

Executive Summary

Introduction and Environmental Assessment Context

Overview of the Project

TransLink and the City of Surrey are proposing to develop the Surrey-Newton-Guildford Light Rail Transit (LRT) (the Project), which will connect the communities of Newton and Guildford to Surrey City Centre, including Surrey Central SkyTrain Station and the SkyTrain Expo Line. Construction and commissioning are anticipated to take three to five years and the operation phase will continue for more than 30 years.

The Project is a proposed 10.5 km long LRT line to be built and operated along 104 Avenue between 152 Street in Guildford and City Parkway, along City Parkway between 104 Avenue and 102 Avenue, along 102 Avenue between City Parkway and King George Boulevard, and along King George Boulevard between 102 Avenue and Newton Exchange near 71 Avenue and 136b Street. The Project is in an urban area that includes some densely-populated residential neighborhoods, commercial districts, businesses, and medical, recreational, and educational facilities. The Project will be built primarily along the center of the existing roadways, at grade, with a guideway width of up to 7.9 m. There are eleven proposed stops along the Project Alignment. Once operational, the Project will be fully integrated with existing TransLink systems and protocols.

The Project is designed to address current and forecasted transportation challenges in the area, including population and employment growth, traffic corridor congestion, sustainable transportation targets, and access to transit. The Project is expected to result in a net decrease in vehicle traffic and increase in transit use.

The Project does not trigger an environmental assessment under the *Canadian Environmental Assessment Act 2012* or the *British Columbia Environmental Assessment Act*, based on size thresholds of the proposed project. However, TransLink undertook an Environmental and Socio-economic Review (ESR), and followed a similar evaluation structure as the formal environmental assessment process, including scoping, development of a Terms of Reference, baseline research, engagement and consultation, comprehensive reporting of findings for applicable environmental and socio-economic aspects, and development of mitigation and management measures.

The review of potential effects of Project construction and operations was conducted based on the information requirements identified in the Terms of Reference. The Project Review Elements were supported by First Nations communities, stakeholder and public interests.

Project activities include the following:

- For construction:
 - Property acquisition
 - Site preparation (e.g., clearing, grading, and set up of temporary facilities) and utility relocation
 - Roadworks, including: construction of guideway, system structures (e.g., substations, power and communication lines), exchanges and stops, excavation
 - Construction of an operation and maintenance building
 - Vehicle traffic (e.g., road use and construction traffic)
 - Management and disposal of waste and excavated materials
 - Commissioning and startup
- For operation:
 - Train operation, including wayside and power
 - Train and track maintenance, administration, transit police
 - Train function (e.g., change in roadways and intersection functions)

First Nations and Public Engagement

TransLink and the City of Surrey have involved First Nations, affected stakeholders and members of the public in ongoing planning for the Project. Early engagement on initial concepts started in 2012; however, engagement for the Project, as currently proposed, has been underway since 2016, focusing on the preferred route and technology through Project-specific design work and the ESR. Input from these groups has been incorporated into the Terms of Reference for the ESR, ongoing Project design, and development of mitigation measures. Engagement will also take place on the ESR and throughout the construction phase. Ongoing engagement during the construction phase will focus on comprehensive community liaison and public communications, a business liaison program to promote and support local businesses, and a public education program to prepare drivers, cyclists and pedestrians for changing road conditions and prepare transit customers for the integration of LRT into the transit network.

First Nations Engagement Activities

The First Nation engagement program has focused on early and frequent consultation with those First Nations identified as having an interest in the Project. TransLink has worked to establish and maintain open and transparent relationships with the identified First Nations in a manner that facilitates effective and meaningful engagement. This has included the sharing of Project-related information throughout the project planning phase, while at the same time, working to resolve any issues raised by participating First Nations in a meaningful and timely manner.

Engagement activities to-date have included both formal correspondence intended to consistently provide up to date Project-related information, ongoing face to face meetings with participating First Nations as well as the sharing of key ESR documents including the draft terms of reference, draft ESR review elements and technical data reports for First Nations review and comment. TransLink has, and will continue to, provide direct responses and feedback to participating First Nations in relation to their comments and issues raised. Key interests and concerns have and will continue to be considered in the development and refinement of Project-related mitigation measures set out in the ESR as appropriate, throughout the Project design phase.

Public Engagement Activities

Public engagement activities involved residents and general members of the public, business organizations and associations, property and real estate developers, community organizations and associations, environmental organizations, first responders, municipal and provincial government agencies, public school and post-secondary education institutions, social service agencies, and transportation-related organizations.

Primary engagement activities to-date have included one-on-one meetings, stakeholder workshops, public open houses, the Project website, email correspondence, online engagement, small group meetings (as required) and Project updates to subscribers. Also, one-to-one meetings were held with first responders to establish procedures to be implemented during construction.

Key interests and concerns raised during public engagement align with the Review Elements included in the ESR; these issues and concerns have been addressed in design of the Project and in the ESR. Mitigation measures to maintain communication will be described in the Communications Plan; a Community Liaison/Construction Program, Business Liaison Program, and Public Education Program will also be developed.

Summary of Effects and Mitigation Measures

The Environmental and Socio-economic Review report of the Surrey Newton Guildford Line Project has been prepared for TransLink to inform engagement with First Nations, Stakeholders, and the General Public, and to provide information and recommendations to guide procurement, delivery, and operations of the Project. Mitigation measures identified in this report, are recommendations for consideration only; and are not intended to form commitments by TransLink, Project contractors, or any third party, in regards to design, construction, and operation of the Project

The following section summarizes effects and mitigation for each Review Element. A Review Element is defined as the various environmental and socio-economic aspects addressed in the review. The following Review Elements were identified through scoping and engagement for the Project:

- Traffic and Transportation
- Housing, residential Properties and Commercial Businesses
- Community and Emergency Services
- Archaeological and Heritage Resources
- Fisheries and Aquatic Resources
- Vegetation and Wildlife Resources
- Noise
- Vibration
- Air Quality and Greenhouse Gases
- Contaminated Sites and Demolition and Excavated Materials
- Electric and Magnetic Fields
- Accidents, Malfunctions and Natural Hazards.

Recommended measures for construction and operation provided in each section below are based on typical best practices for construction and operation in Metro Vancouver and British Columbia. The Construction Environmental Management Plan and Operation Environmental Management Plan describe performance objectives for detailed Environmental Management Plans to be prepared by the Construction Contractor and the Operation Contractor. The Construction Contractor and Operation Contractor will be responsible for meeting performance objectives as appropriate to their means and methods.

Traffic and Transportation

The Traffic and Transportation ESR section addresses how the Project may affect vehicle traffic, other transportation systems, and pedestrian and cyclist mobility. Baseline information was obtained from public sources (e.g., Statistics Canada), public feedback and engagement summaries, interviews with key stakeholders and key personnel involved in recent rapid transit projects in the Lower Mainland, technical studies prepared for the Project, and a review of studies from similar rapid transit projects.

Project construction is expected to disrupt traffic flow (access, travel time, traffic circulation, movement, and volumes) near and along the Alignment and in adjacent neighbourhoods. Construction has the potential to affect pedestrians and road users (e.g., personal, commercial, and emergency vehicles) and cyclists. During construction, traffic delays are anticipated due to temporary lane closures and construction activities. However, it is anticipated that such delays will be managed through implementation of the Traffic Management Plan.

The operation of LRT vehicles may affect traffic and transportation through change in transit ridership, traffic volume (mode shift from car users to transit) and access, and through improved travel times (LRT vehicles will be less affected by future increases in roadway congestion). An Operational Traffic and Maintenance Plan will be in place to address traffic changes (e.g., no access across Alignment except at designated crossings, potential designated U-turn intersections, access to some properties). During operation, the Project will deliver long-term benefits through improved transit services and travel times, pedestrian and cyclist mobility, and traffic safety.

Key mitigation measures recommended for construction to manage traffic and transportation are a Public Education and Safety Campaign (to communicate changes in existing roads and travel ways) and a Traffic Management Plan (includes a Traffic Control Plan, Incident Management Plan, Public Information Plan, and Implementation Plan). Construction may be sequenced block by block as feasible to limit the duration and extent of potential disruptions.

Housing, Residential Properties, and Commercial Businesses

The Housing, Residential Properties, and Commercial Businesses ESR section addresses how Project construction and operation may affect access and use of properties and contribute to property development patterns. As with Traffic and Transportation, baseline information was obtained from public sources, feedback and engagement, experience from recent rapid transit projects in the Lower Mainland, Project technical studies and studies from other LRT projects.

Project activities have the potential to directly and adversely interact with housing, residential properties, and commercial businesses through property acquisition (mainly at intersections and LRT stops) and through temporary changes in access and use during construction. The Project's

presence and operation also has the potential to have both positive and adverse effects on residential and commercial development and property values through real and perceived development potential, improved access to public transit, and perceptions about property values near the Alignment. During operation, the Project is anticipated to deliver long-term benefits through induced development, improved connectivity, and increased access to transit.

Potential Project effects during construction include temporary effects on housing and residences and on access to commercial businesses; some residential properties and commercial businesses will be permanently affected by land acquisition. Key mitigation measures include communicating changes prior to and during construction, as well as implementing the Traffic Management Plan, a property acquisition program, a Community Liaison Plan and a Business Liaison Plan.

Community and Emergency Services

The Community and Emergency Services ESR section addresses how Project construction and operation may affect access for emergency service providers, public safety, and access to community amenities. As with Traffic and Transportation, baseline information was obtained from public sources, feedback and engagement, experience from recent rapid transit projects in the Lower Mainland, Project technical studies and studies from other LRT projects.

Project construction will involve a range of traffic management measures, including lane closures, detours and other access restrictions, that may affect emergency vehicle access (emergency medical services, fire rescue, and police), community amenities, and public safety where these activities occur near emergency response routes, hospitals, fire halls, schools and other community infrastructure. Mitigation measures to reduce potential Project effects during construction include a Traffic Management Plan, an Incident Management Plan and Project design requirements such as restoring normal traffic operations by modifying work plans and activities, where feasible. The Traffic Management Plan will specifically consider access requirements for areas of high potential use (e.g., hospital, care homes, homeless shelters, shopping centres), regional disaster response routes, schools, and parks. Project design will include specifications for lighting and use of space to improve safety and security targeted at decreasing crime incident rates during operation. Transit Police will also be present during operation. During operation, an Operation Environmental Management Plan will be in place.

Potential Project effects include temporary increases in access to community and emergency services during construction, which are anticipated to be managed through implementation of mitigation measures. During operation, the Project will deliver long-term benefits through improved connectivity and access to emergency services.

Archaeological and Heritage Resources

The Archaeological and Heritage Resources ESR section addresses two potential effects of the Project: alterations to archaeological site contents or context and areas with archaeological potential; and alterations to heritage buildings, landscapes or other sites of heritage value. The ESR was informed by an Archaeological Overview Assessment (AOA). The AOA was prepared in accordance with the provincial Archaeology Branch guidelines and included desktop research and a preliminary field reconnaissance.

The AOA found that, within 100 m of the Alignment, there are no archaeological sites listed on the Archaeology Branch's Remote Access to Archaeological Data web application. However, there are areas along the Alignment identified as having high potential for archaeological finds (near three creeks and at the peat deposits to be excavated near Central Parkway). There are also two properties listed on the City of Surrey's Community Heritage Register located near, but not on, the Alignment.

Any activities involving ground disturbance have the potential to affect archaeological sites, if and where they are present. Alterations to sites of heritage value may also occur, depending on the identified heritage values and the nature of proposed development. Minimizing adverse effects to archaeological resources includes avoiding, or if that is not possible, mitigating impacts to archaeological and heritage sites identified during the archaeological assessments, in accordance with the BC *Heritage Conservation Act* and Provincial standards and guidance. During construction, a Chance Find Procedure will be implemented, in case potential archaeological and heritage resources are encountered. TransLink will retain qualified professionals to undertake targeted archaeological field studies (e.g., an archaeological impact assessment) to assess or monitor ground-altering developments within areas evaluated as having high archaeological potential. With mitigation measures as identified in the ESR, the potential for adverse Project effects to archaeological and heritage resources are anticipated to be low.

Fisheries and Aquatic Resources

The Fisheries and Aquatic Resources ESR section addresses two potential effects of the Project: change in fish habitat and change in fish health or mortality. The Project has the potential to interact with three watercourses (Bear Creek, Quibble Creek and tributaries, and Bon Accord Creek). These creeks provide fish habitat (including spawning and rearing habitat) for numerous fish species including trout and Pacific salmon species (*Oncorhynchus* spp.). Baseline information was compiled from a combination of existing reports and field surveys.

Project construction activities that could affect instream and riparian habitat include culvert extensions under King George Boulevard and 104 Avenue, new or replacement watercourse crossings, and widening King George Boulevard parallel to Quibble Creek. During construction and operation, there is potential to introduce deleterious substances, including sediment, into watercourses, which could adversely affect fish health or result in mortality. Mitigation measures include avoidance through Project design (routing, scheduling, equipment selection) and measures as identified in the Construction Environmental Management Plan. These measures include avoiding working in or near fish habitat where feasible; avoiding alteration to stream flows; adhering to regionally-specified windows of least risk; isolating work areas and salvaging fish prior to instream works; implementing the Sediment and Erosion Control Plan, spill response

procedures, limiting removal of riparian vegetation, site restoration and other best available management practices.

Project effects on fisheries and aquatic resources are anticipated to be mainly due to road widening and culvert upgrades, with permanent loss of approximately 2% of the existing riparian habitat and less than 1% of instream habitat. The loss of fish habitat is considered minimal given the context of the Project (primarily within the limits of previously-developed urban roadway) and the proposed mitigation measures. The Project also has the potential to enhance fish access to upstream habitat and maintain fish habitat in the Project area, through culvert replacements and site and channel revegetation and restoration.

Vegetation and Wildlife Resources

The Vegetation and Wildlife Resources ESR section addresses four potential effects: effects on vegetation and wildlife species of management concern (i.e., species at risk and invasive species); change in abundance of ecological communities or abundance and quality of wildlife habitat; change in quantity, quality, or connectivity of green space (i.e., Green Infrastructure Network and forest canopy cover); and injury or mortality of wildlife. Baseline information was compiled from existing reports, aerial photographs, and field surveys.

No occurrences of plant species at risk were identified within the Review Area (100 m of the Project centreline), including in the primary green spaces (e.g., Bear Creek Park). Similarly, no occurrences of focal wildlife species at risk (Pacific water shrew (*Sorex bendirii*) and Oregon forestsnail (*Allogona townsendiana*)) were identified, although some areas of Bear Creek Park and Quibble Creek outside the Project Alignment have low or moderately suitable habitat. One provincially Blue-listed black cottonwood/Sitka willow ecological community was identified within 100 m of the centerline along Quibble Creek, and there is a negligible overlap with the Project (6 m² out of 1.2 ha within the entire Review Area).

Three plant species considered noxious under the BC *Weed Control Act* (Japanese knotweed (*Fallopia japonica*), perennial sow-thistle (*Sonchus arvensis*), and Canada thistle (*Cirsium arvense*)) were identified in the Review Area.

Clearing of up to 2.75 ha of forest canopy cover will affect vegetation and wildlife directly (through habitat loss) and indirectly (through potential introduction of invasive species and alteration of habitat connectivity). Traffic and infrastructure presence have the potential to increase the risk of injury or mortality of wildlife during construction and operation. Mitigation measures recommended in the ESR include avoiding sensitive periods (e.g., migratory bird breeding period) during clearing; identifying species of management concern during surveys prior to site preparation activities; avoiding or limiting clearing extent within identified sensitive areas; and following the City of Surrey's Tree Protection Bylaw to develop a tree inventory and site restoration planning to guide tree replacement.

A Vegetation Management and Site Restoration Plan and a Wildlife Management Plan will be developed to avoid or minimize effects on plants or protected species, wildlife, or wildlife habitat features during construction and address invasive species management. Project effects on vegetation and wildlife have been primarily avoided through location of the Alignment within an existing highly urbanized corridor and multilane road, with limited overlap with vegetated areas.

Noise

The Noise Review Element addresses how Project-related change in noise levels may affect sensitive receptors. Project activities have the potential to affect ambient noise levels during construction and operation.

Predicted noise levels were compared to relevant municipal bylaws (City of Surrey Noise By-Law No. 7044), provincial policy (Ministry of Transportation and Infrastructure 2016), and federal (Health Canada 2017) guidance on noise management. The assessment focused on 49 representative above-ground noise-sensitive receptors (including residential dwellings, schools, and hospital) within 300 m of the Alignment and around the LRT stops. Baseline noise levels over a 24-hour period on a weekday were monitored at 10 locations along the planned guideway and indicated levels typical of a busy urban environment, with road traffic being the dominant noise source.

Noise associated with construction activities and operation (train movements) was modelled to estimate the minimum buffer distances from the edge of construction to where noise effects from construction activities would meet the Health Canada Mitigation Noise Level (MNL) threshold of 72 dB, which applies to urban residential areas. Recommended mitigation measures to reduce Project effects are listed in the ESR and will be finalized as Project design progresses in a Noise and Vibration Management Plan. Measures include, for example, defining allowable hours of work, public notification procedures, requirements for equipment selection and maintenance, timing of noisy work, establishing noise threshold levels and adhering to TransLink's existing noise specifications during operations. Considering the context of the Project (occurring primarily within the limits of previously-developed urban roadways), the potential Project effects on existing noise levels are anticipated to be managed through suitable mitigation measures. During construction, the predicted buffer distance to meet the Health Canada MNL varies from 10 m to 20 m, depending on the activity. During operation, a nominal increase of less than 1 dB L_{dn} was predicted.

Vibration

The Vibration ESR section addresses how Project-related vibration may affect sensitive receptors. Project construction and operation activities are expected to generate vibrations and there is concern that these vibrations could result in damage to nearby buildings and infrastructure, interference with sensitive equipment, or annoyance to humans.

Baseline information was obtained from vibration monitoring at 12 locations along the Alignment considered to be representative of the local environment (including three locations at Surrey Memorial Hospital) and this monitoring showed that vibration levels along the Alignment are typical of an urban residential and commercial land use.

Construction (site preparation and guideway construction) and operation (train movements) vibration levels were estimated along the Alignment. Results were compared with levels at nearby sensitive receptors and with applicable thresholds established with reference to building industry standards. Proposed mitigation measures are outlined in a Vibration Management Plan and include design measures to reduce vibration effects, monitoring protocol, notification procedures, issues management, and restrictions on hours of construction. Pre-and post-construction surveys of structures along the Alignment have been proposed to document condition of the structures.

During construction, vibration effects are anticipated to be similar to those experienced during major road construction, and generally near active construction. Vibration levels are estimated to be below disturbance thresholds for most buildings within the Review Area, given that most of the buildings are located more than 13 m from construction activity and thus not likely to experience damage related to construction-induced vibration. It is recommended that buildings potentially susceptible to vibration damage (i.e., the 22 buildings partially located within 13 m of construction activity) be monitored for vibration effects during construction. Occupants of buildings within 48 to 80 m of construction activity may be disturbed by vibration from vibratory rollers, depending on building type and occupancy. Buildings within these distances will be identified and evaluated in more detail closer to the time of construction as part of the Noise and Vibration Management Plan. Sensitive equipment located at the Surrey Memorial Hospital may experience transient vibrations greater than baseline values; this location should be monitored closely during construction and consideration given for mitigation measures if necessary. As well, processes to address concerns of residents located near the Alignment through public communications processes are identified as part of Project planning.

During operation, LRT-induced vibration levels are estimated to be below thresholds for disturbance, with the two potential exceptions. First, 13 buildings are located within 11 m of the track, which is within the threshold of disturbance for the category “residences and buildings where people normally sleep.” While most of these buildings are expected to be for commercial rather than residential use, the occupancy type needs to be verified as part of vibration management planning. Second, the Royal Canadian Mounted Police Station, located at 10395 148 Street), is within the 27 m threshold of disturbance for buildings housing sensitive equipment; however, no sensitive equipment has been identified at this location. Surrey Memorial Hospital, identified as a building potentially housing sensitive equipment, is approximately 80 m from the Alignment, indicating that interference is unlikely.

Where exceedances of vibration thresholds could occur, vibration-reducing mitigation measures can be applied to lower these levels and to limit the likelihood of annoyance and complaints made by vibration-sensitive receptors.

Air Quality and Greenhouse Gases

The Air Quality and Greenhouse Gases (GHG) ESR section addresses two potential effects of the Project: change in the ambient concentrations of common air contaminants and emissions of GHGs during construction and operation. Air emissions from Project activities were quantified relative to local and regional emissions data publicly reported for the City of Surrey and Metro Vancouver, compared to Metro Vancouver’s Ambient Air Quality Objectives, and assessed relative to existing conditions.

Project activities that could change air quality and GHG emissions include the use of heavy equipment and vehicles during construction and the operation of electric-powered trains and associated power consumption during operations. Performance objectives to reduce project effects on air quality and GHG will be described in the Air Quality and Greenhouse Gas Management Plan. Recommended mitigation measures include best available management practices to control and reduce air and fugitive dust emissions from Project construction and an adaptive monitoring program.

During construction, potential mitigated Project effects are a predicted small increase of 0.04 to 2.83% in individual common air contaminant emissions and a small increase (0.74% CO_{2e}) in GHG emissions on an annual basis for the City of Surrey. With mitigation, potential Project effects on existing air quality and GHG emissions during construction are estimated to be negligible, considering the context of the Project, primarily within the limits of previously-developed urban roadway and recommended mitigation measures.

During operation, the potential mitigated project effects are a predicted decrease in common air contaminant emissions of 0.03 to 1.22% and in GHG emissions of 0.32%. The Project air emissions during operations are anticipated to decrease with operation of electric-powered LRT replacing diesel powered public transit and mode shift from private vehicles compared to existing conditions.

Contaminated Sites and Materials Management

The Contaminated Sites and Excavated Materials ESR section addresses two potential effects of the Project: release of contaminants from contaminated soils or water and potential for dust generation and sedimentation from storage and handling of materials during construction. Baseline information was obtained from a desktop review of publicly available information on known and suspected contaminated sites.

Project construction activities are likely to intersect known and suspected contaminated sites and will generate clean and contaminated excavated materials and demolition waste that will need to be handled, removed, and disposed of in accordance with Provincial requirements. Recommended mitigation measures include best available management practices and site-specific environmental work plans for excavation and demolition which are described in the Contaminated Sites and Excavated Material ESR. Material will be disposed of in a manner that meets requirements of the BC *Environmental Management Act*, Contaminated Sites Regulation, and Hazardous Waste Regulation, as well as City of Surrey and Metro Vancouver Bylaws, and the BC *Workers Compensation Act*. Planning and management for this aspect of construction will be described in the Contaminated Sites and Materials Management Plan.

Electric and Magnetic Fields

The Electric and Magnetic Fields (EMF) ESR section addresses how change in EMF from the Project could result in electro-magnetic interference and potential human health effects, based on literature review and other similar projects. Quantifying EMFs in an urban environment is complex due to the ubiquity of EMFs in urban areas; sources include the Earth's EMF, computers, smartphone, road vehicles, powerlines and household appliances.

During construction, Project-related vehicles that produce EMFs will not contribute to an appreciable change in EMF levels beyond those that typically occur along a city road with normal volumes of vehicle traffic and, therefore, are unlikely to change EMF levels.

During operation, the electrical system, infrastructure, and trains will generate EMFs along the Project Alignment. Project EMFs from these sources should be mitigated according to manufacturers' standards for EMF and interference and be consistent with other similar TransLink projects. Project EMFs along the Alignment are not expected to have acute effects to people because the Project will produce non-ionizing, low frequency, and low intensity EMFs that are

below the acute exposure reference levels. Project EMFs along the Alignment and inside the train are not expected to interfere with the function of personal electronic devices (e.g., cell phones and laptops) and medical/health devices (e.g., pacemakers and electric wheelchairs). Project EMFs at the Operations and Maintenance Facility are expected to be near background levels outside of the perimeter fencing and beyond 10 m from the traction-power substations.

Health Canada and the World Health Organization does not identify any long-term health effects from exposure to low frequency, and low intensity EMFs such as those that would be produced by the Project.

Accidents, Malfunctions, and Natural Hazards

Safety and security of the public is a core value for TransLink. During an accident or malfunction, public safety may be at risk. Accidents and malfunctions were considered for scenarios caused by equipment malfunction or failure, human error, and natural events. Six scenarios (fire, spills, loss of power, derailment, earthquakes, and extreme weather events) were developed to review potential outcomes and demonstrate that the Project has appropriate equipment and procedures in place to prevent and respond to major events. The assessments were conducted primarily in the context of public safety to mitigate the risk of injury to workers and passengers and considered the potential risk of a scenario occurring. Probable or worst-case scenarios were developed, preventative and response measures described, implications for public safety and the other Review Elements were discussed, and risk (likelihood and consequence) described.

Considering the preventative measures to mitigate the likelihood of these events and response measures to reduce the potential effect of these scenarios, the risk to public safety is low for most scenarios. The scenario with the greatest risk to public safety is a spill scenario such as a collision between a train and a vehicle carrying flammable material; such a collision can be caused by human error or factors beyond TransLink's control. The Project is designed with mitigation measures intended to reduce the likelihood of any of the scenarios occurring, and response measures to reduce risk to public safety and effects to the other Review Elements if any of the scenarios occur. These mitigation and response measures will be effective in protecting public safety and in limiting most types of effects to the other Review Elements.

Recommended Mitigation Measures

Table A summarizes key mitigation and management measures to address potential effects on environmental and socio-economic elements. It is recommended that these measures, and other measures identified in elsewhere in this report, be considered for implementation during Project design, construction, and operation.

Table A: Summary of Project Environmental Review Recommendations

1.0 General Environmental Management Recommendations		
1.1	The Project should comply with all applicable permits, approvals and authorizations, and environmental best available management practices (BAMPs).	All Phases
1.2	<p>The Project should develop, implement and maintain Environmental Management Plans for construction and operation to demonstrate how the project will:</p> <ul style="list-style-type: none"> • be carried out to avoid and mitigate negative effects in accordance with contract specifications; • employ industry standard practices; • be updated as required to address new legislation, project scope or environmental conditions, no less than annually; and • comply with all applicable legislation and approval conditions. 	All Phases
1.3	<p>The Project Construction Environmental Management Plan (“Construction EMP”) should provide contractors and on-site workers with procedures and requirements for meeting the terms and conditions of permits, approvals and authorizations and carrying out on-site activities according to accepted Best Available Management Practices (BAMPs). The Construction EMP should clearly identify and define roles, responsibilities and reporting relationships for the Construction Contractor’s Environmental Monitor, Environmental Manager and Project Manager for addressing environmental concerns and issues as may arise during construction. The Construction EMP component plans should include:</p> <ul style="list-style-type: none"> • Air Quality and Greenhouse Gas Management Plan • Archaeological Monitoring Plan • Communications Plan • Construction Schedule • Construction and Demolition Waste Management Plan • Contaminated Sites and Materials Management Plan • Contractor Environmental Awareness and Education Plan • Fisheries and Aquatics Management Plan • Hazardous Materials Management Plan • Noise and Vibration Management Plan • Sediment and Erosion Control Water Quality Management Plan • Spill Prevention, Fuel Management and Emergency Response Plan • Traffic Management Plan • Vegetation Management and Site Restoration Plan • Wildlife Management Plan 	Pre-construction Construction
2.0 Environmental Planning During Construction Recommendations		
2.1	The Project should undertake environmental monitoring and reporting for project construction in accordance with the provisions of this Construction EMP, the Project Agreement and regulatory permits, approvals and authorizations.	Construction
2.2	<p>The Construction Contractor’s Environmental Monitor should be responsible for monitoring adherence to specified environmental measures set out in the Construction EMP throughout project construction including, but not be limited to:</p> <ul style="list-style-type: none"> • monitoring adherence to relevant legislation, the Construction EMP, the Contractor Agreement, and terms and conditions of permits, approvals and authorizations. • providing on-site compliance monitoring in accordance with the Contractor’s Construction EMP and Contractor’s Quality Management Plan. • directing the Contractor’s team in implementing the Construction EMP. • providing on-site environmental protection and awareness training to the Contractor personnel. • liaising with the Owner’s Environmental Manager, engineering field staff and regulators. • issuing “stop work” orders to the Contractor in the event that any Contractor activities have the potential to cause or are causing environmental degradation. • submitting monitoring records to the Owner and Relevant Authorities, as required. 	Construction
3.0 Public Engagement and Information Distribution Recommendations		
3.1	The Project should involve affected local communities and other stakeholders within an open and interactive consultation process.	Design Construction
3.2	The Project should implement a complaint tracking and response mechanism for the project.	Construction
3.3	The Project should establish a Business Liaison Committee for addressing business community concerns a Community Liaison Committee for addressing local community concerns.	Construction
3.4	The Project should increase awareness of the project, describe how feedback from the public and potentially-affected stakeholders has informed project design, environmental management plans, and mitigation measures, and provide safety education for both LRT users and other road users	Design Construction
3.5	The Project should implement a Public Education and Safety Campaign to increase awareness of the project and what the public should expect when train testing and operation begin. This campaign should outline procedures for stakeholders (e.g., residents, businesses, emergency services, and institutions) to safely interact with and use the LRT system.	Operations
3.6	The Project should shall track, document and address public complaints in a timely manner and promptly communicate this information to the Owner	Construction

4.0 Operations Environmental Management Recommendations		
4.1	<p>The Project should require that an Operations Environmental Management Plan (Operations EMP) is developed during the latter stage of construction but prior to commencement of revenue service. The Operations EMP will clearly identify and define roles, responsibilities and reporting relationships for the Operator’s Environmental Manager and Project Manager for addressing all environmental issues pertaining to Surrey Newton Guildford Line operations and maintenance.</p> <p>The Contractor should develop, implement and maintain as required by the Owner an Operations Environmental Management Plan (“Operations EMP”) that will:</p> <ul style="list-style-type: none"> • be carried out to avoid and mitigate negative effects according to contract specifications; • employ best industry standard practices; • comply with relevant legislation and Project requirements; • component plans of the Operations EMP, to be developed as necessary and appropriate, may include: <ul style="list-style-type: none"> • Air Quality and Dust Control Management Plan; • Fuel, Chemicals and Materials Storage and Handling Management Plan; • Health and Safety Management Plan; • Noise and Vibration Management Plan; • Surface Erosion Prevention and Sediment Control Plan; • Solid and Liquid Waste Management Plan; • Snow and Ice Management Plan; • Water and Sediment Quality Management Plan; • Storm Water Management Plan; and • Spill Containment and Emergency Response Plan 	Operations Maintenance
4.2	The Operator should operate the project in accordance with the terms and conditions of permits, approvals and authorizations and monitor compliance with relevant permits, approvals and authorizations and the Operations EMP.	Operations Maintenance
5.0 First Nations Recommendations		
5.1	The Project should involve First Nations within an open and interactive consultation process	All Phases
6.0 Archaeological and Heritage Resources Recommendations		
6.1	The Project should mitigate impacts to archaeological and heritage sites (if any) identified during the archaeological assessments for the project in accordance within the Heritage Conservation Act, provincial guidance and best practices for archaeological and heritage resource3s. Specific measures should be determined in discussion with regulators, First Nations and landowners	All Phases
7.0 Traffic and Transportation Recommendations		
7.1	The Project should require that business, communities, pedestrian and cycling considerations are addressed in the project’s traffic management.	All Phases
7.2	To maintain safe and efficient goods and traffic movement (including vehicular, cyclist, pedestrian, and transit), well-connected street networks, and access to residential and non-residential properties, community amenities, and emergency services, the Construction Contractor should sequence construction block by block, as feasible, to minimize the duration and extent of potential disruption to traffic and access.	Construction
7.3	<p>The Construction Contractor should develop, implement and update as required by the Owner, a Traffic Management Plan to mitigate the potential impacts of construction on motor vehicle traffic, public transit riders, cyclists and pedestrians, and emergency services providers. The Traffic Management Plan shall be in accordance with project requirements and shall have the following sub-component plans:</p> <ul style="list-style-type: none"> • Traffic Control Plan • Incident Management Plan • Public Information Plan • Implementation Plan. 	Construction
8.0 Housing, Residential Properties, and Commercial Businesses Recommendations		
8.1	The Project should be designed, constructed and operated with care and attention provided to land use, site context, and urban design; to transportation and traffic considerations; and to emergency service requirement providers to minimize and mitigate negative effects.	All Phases
8.2	<p>The Project should develop and implement a Residential and Commercial Property Access Plan prior to project operation that includes procedures to address Project-related traffic and changes in residential and commercial property access for:</p> <ul style="list-style-type: none"> • alternate routes to areas with restricted left turns or other physical access restrictions • availability of on-street parking, access to residential and commercial properties, and access to public institutions and spaces • special access plans for properties adjacent to side-running LRT • cyclist and pedestrian access to provide safe and accessible pedestrian crossings and reduce or limit detours to the bike route 	Operations

9.0 Community and Emergency Services Recommendations		
9.1	The Construction Contractor should incorporate design features as required by the Owner to address community and emergency service requirements into design for all phases of construction staging and in the final Project design including the following: <ul style="list-style-type: none"> • Crosswalks, including access adjacent to schools • Changes to emergency services access • Application of <i>Crime Prevention Through Environmental Design</i>. 	Design Construction
10.0 Fisheries and Aquatic Habitat Recommendations		
10.1	The Project should develop and implement CEMP component plans, including the Fisheries and Aquatics Management Plan, in accordance with permits, legislation, authorizations and Best Available Management Practices (BAMPs) for all instream and riparian habitat.	Construction
10.2	The Construction Contractor should adhere to the terms and conditions of this TPER, the Contractor Agreement, the Construction EMP and any applicable permits, approvals and authorizations related to protect and maintain fisheries and aquatic resources and habitat function.	Design Construction
10.3	The Construction Contractor should conduct all project construction works in compliance with applicable environmental requirements and BAMPs, with particular attention to construction practices that: <ul style="list-style-type: none"> • minimize the introduction of deleterious substances, pursuant to Section 36(3) of the federal Fisheries Act, into fish-bearing waters. • contain appropriate measures for management of water quality during construction in accordance with applicable water quality guidelines and objectives. 	Construction
11.0 Vegetation and Wildlife Recommendations		
11.1	The Construction Contractor should conduct land-based construction works for the project in compliance with applicable legislation, environmental requirements and BAMPs, with particular attention to protection and retention of vegetation, management of invasive species and species at risk, management of sites during construction, site restoration in accordance with Project targets, and landscaping requirements in accordance with Project and regulatory requirements.	Construction
11.2	The Project should adhere to the City of Surrey’s "Surrey Tree Protection Bylaw, 2006 No. 16100" including limiting the number of protected trees for removal, requirements for cutting, removal and damage of trees, protection of Significant Trees, and vegetation management within Environmentally Sensitive Areas and associated reporting.	Design Construction
12.0 Air Quality, Noise and Vibration Recommendations		
12.1	The Project should take measures to reasonably minimize or manage adverse project effects related to air quality, greenhouse gases, noise, dust and vibration in accordance with regulatory requirements and BAMPs.	Design Construction
12.2	The Project should develop and implement a Noise and Vibration Management Plan that describes the criteria and standards that will be applied in determining the necessity for, and implementation of, noise attenuation mitigation measures. The Noise and Vibration Management Plan should describe how impacts will be avoided as feasible through measures to schedule noisy/high vibration construction activities. Should work be required outside hours of work specified in the City of Surrey noise bylaw, construction activity noise as measured 15m from the noise source and combined with the existing ambient noise, should not exceed identified thresholds for continuous and non-continuous noise.	Construction
12.3	LRT noise levels during operation should not exceed identified thresholds, as measured 15m away from operating LRT.	Design
13.0 Management of Contaminated Sites, Soils and Other Materials Recommendations		
13.1	The Construction Contractor should assess and dispose of any contaminated soil, excavated material, hazardous materials or contaminated groundwater in accordance with applicable laws, including Environmental Management Act.	Construction
14.0 Electric and Magnetic Fields (EMF) Recommendations		
14.1	The Project should require that EMF does not create radio interference or health impacts	All Phases
15.0 Public Safety Recommendations		
15.1	The Project should be designed, constructed and operated to minimize adverse impacts to public safety that could otherwise result from an accident or malfunction.	All Phases
15.2	The Project should be designed, constructed and operated in a manner that protects public safety, facilitates emergency response and addresses the potential environment adverse effects on the project including: <ul style="list-style-type: none"> • The Contractor should design and construct the project to applicable and current seismic standards. • Construct and operate the project in accordance with Emergency Response Plan, and an Emergency Response Plan prepared in accordance with WorkSafe BC requirements. • Operated as per the requirements of the Project’s BC Safety Authority Permit. 	All Phases
15.3	The Project should design and implement public safety measures described in the terms and conditions of the Contractor Agreement, codes and standards, this TPER, the Construction EMP, the Operation EMP and applicable permits, approvals and authorizations that relate to the avoidance and mitigation of impacts due to accidents and malfunctions.	All Phases

Summary and Conclusions

The 10.5 km long SNG LRT Project is proposed to be built and operated in a populated and traffic congested urban environment in Surrey, at grade on existing roadways mainly along King George Boulevard and 104 Avenue. Construction and commissioning are anticipated to take three to five years and to be sequenced block by block as feasible to limit the duration and extent of potential disruptions. Operation is scheduled to continue for more than 30 years. Potential effects of the Project on environmental and socio-economic Review Elements were assessed and mitigation measures described that will be used to manage potential effects.

Effects were assessed for the following Review Elements: Housing, Residential Properties and Commercial Businesses; Traffic; Community and Emergency Services; Archaeological and Heritage Resources; Fisheries and Aquatic Resources; Vegetation and Wildlife Resources; Noise; Vibration; Air Quality and Greenhouse Gases; Contaminated Sites and Demolition and Excavated Material Management; Electric and Magnetic Fields; and Accidents and Malfunctions.

Mitigation measures developed for the Project include communications plans, a Construction Environmental Management Plan, Traffic Management Plan, Business Liaison Plan, Operation and Maintenance Plan, Noise and Vibration Management Plan, Project-specific measures, and adherence to legislated requirements and design standards.

Project-related effects will be typical of common large roadway construction projects. Even with mitigation measures in place, construction will result in temporary changes in traffic flow and accessibility to businesses, residences, and community and emergency services in localized areas as construction proceeds along the Alignment. With the implementation of mitigation measures designed to effectively integrate the Project into the existing built environment, these effects are anticipated to be managed to acceptable levels.

Over the long-term, the Project will result in benefits for transit users, pedestrians, and cyclists, primarily through reduced traffic volumes, and improvements in time savings, transit system connections, mobility and traffic safety by reducing over-reliance on personal vehicles and providing accessible transportation that links community infrastructure and services within this area of the City of Surrey. Change in traffic and transportation during operation is anticipated to be positive as area users become familiar with the system and shift modes from personal vehicles to LRT.