



SQUAMISH DOWNTOWN TRUCK ROUTE STUDY

Final Report
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1 INTRODUCTION

The District of Squamish is a growing community and an economic hub. The current population of 17,500 people is the result of almost 15% growth between 2006 and 2011¹. Rapid population growth is expected to continue, with plans to increase density in the Downtown core, and especially along Logger's Lane and Oceanfront areas. Port and industrial activities in Squamish provide jobs for residents and support the local and regional economies. Squamish Terminals handles between 800,000 MT and 1,000,000 MT of cargo each year – that is up to \$1 Billion in economic value of goods annually. Squamish Terminals and the Squamish Rail Yards (the rail yards) are important economic generators. Efficient, reliable, and safe connections between these two facilities and to Highway 99 will support the continued growth of the local and regional economy. A truck route that is planned and designed to respond to the community's needs will ensure that the goals of economic prosperity and community liveability are viable throughout Squamish.

The District currently has three main Commercial Transportation Routes on municipal roadways as identified by the Traffic Bylaw and illustrated in **Figure 1-1**.

Downtown Route – Cleveland Avenue from Highway 99 to Buckley Avenue/Hunter Place, Loggers Lane to Vancouver Street, Vancouver Street to Third Avenue.

Industrial Route – Industrial Way to Queens Way to Government Road. This route terminates on Government Road south of the rail yards. Government Road becomes an unpaved rural roadway after the terminus of the Commercial Transportation Route.

Airport Route – Squamish Valley Road serves as the truck route in the vicinity of Squamish Airport providing



Figure 1-1: Existing Truck Route

¹ <http://squamish.ca/discover-squamish/about-squamish>

connection to Highway 99 in northern Squamish region.

A Downtown Truck Route study in Downtown Squamish was one of the key recommendations identified in the District's 2031 Multi-Modal Transportation Plan, adopted by District Council in 2011. Based on this recommendation, the District of Squamish retained Urban Systems to undertake a Downtown Truck Route Study to ensure a safe and efficient downtown truck route that can support rising port activities, while balancing the needs of the growing Squamish community.

A truck route is a defined commercial transportation route on which commercial vehicles defined by bylaw must travel. If the destination is not on a truck route, the trucks must use the shortest route between a truck route and the destination. Truck transportation is important for economic development of Squamish as many businesses rely on this mode. In Squamish, much of the industry, and in particular, Squamish Terminals, is located south of the downtown and therefore the trucks must travel through downtown to make connection with Highway 99. A proper accommodation of trucks through downtown can improve productivity for businesses relying on truck transportation, provide opportunity to better manage safety concerns and emissions, and aids to future economic development.

Truck routes generally require additional consideration to pavement structures, maintenance requirements, design vehicles, geometric design, etc. However, accommodating trucks, particularly in downtown areas, requires balance between different modes because the intersections are typically closely spaced, more congested and the volumes of pedestrians and cyclists are higher. The current truck route in Squamish is Loggers Lane, which runs in the north-south direction adjacent to Mamquam Blind Channel. Since there currently aren't many residential or commercial frontages onto the street, this makes the street an ideal location. However, there are already operational challenges being faced by trucks under existing conditions and more residential and commercial developments are proposed in the future along this roadway. This study seeks to identify the best option for a truck route to the south end of Downtown that accommodates anticipated development.

TRUCKS IN SQUAMISH

According to the District of Squamish's Traffic Bylaw (Bylaw No. 2220, 2012), a commercial vehicle is defined as:

- any motor vehicle bearing a commercial licence plate; or
- a casket wagon, limousine, hearse, motor bus, tow vehicle, road building machine, taxi, or a tractor; or
- any combination of truck, truck tractor, semi-trailer and commercial trailer; or
- other vehicles as specified by regulation of the Lieutenant Governor in Council pursuant to the Commercial Transport Act, including, without limitation, an inter-city bus, a commercial dolly, permanently mounted crane or other equipment, a loader, or a scraper.

A heavy commercial vehicle weighing more than 15,000 kilograms (gross vehicle weight (GVW)) on any highway within the District must drive on a commercial transportation route using the most direct route from a permitted highway and from the point of delivery. It is noted that many other municipalities in the region classify trucks as 10,000 GVW.

1.1 STUDY OBJECTIVES

The objective of this study is to identify efficient, reliable, and safe connections between Highway 99 and Squamish Terminals, Squamish Rail Yards, Downtown Construction, and Downtown Commercial areas. The study objective can be further broken down to tasks as listed below:

- Review possibilities for Downtown Truck Routes and finalize a short list of options;
- Identify improvements required to implement, maximize efficiency, safety, and reliability of each option;
- Compare options based on an agreed-upon evaluation framework; and
- Recommend an option(s) for further development and funding by the District and other partners.

Each of the objectives noted above was guided by an overarching principle that truck routes should provide efficient service to industrial and restricted industrial land uses in Squamish while balancing the needs of the community. The Downtown Truck Route recommended by the Study should seek to address the following needs:

- Mitigate capacity constraints due to growth of traffic, residential development, and goods movement within the District's boundaries.
- Reduce the negative impacts of truck traffic on quality of life.
- Reduce congestion on municipal roads and intersections between municipal roads and Highway 99.
- Result in a benefit-cost analysis of proposed improvements to truck routes and / or potential new road connections to ensure good return on investment of public funds.
- Improve the reliability of the truck network by reducing the negative impacts of congestion on truck and trade movements. This includes improving reliability throughout the summer season, when traffic volumes and resulting congestion on Highway 99 are higher than the remainder of the year.

1.2 STUDY PROCESS

The study area is limited to the Downtown only and although it is noted that a large number of industrial activities occur outside of the Downtown area, this study focuses only on the impacts on the Downtown road network. The recommendations for Downtown Truck Routes were developed over a two-phase process, as summarized below.

Phase 1: Public Engagement, Background Review, and Data Gathering included reviewing background reports and available data, reviewing demographic trends, and developing a data collection program. Phase 1 also included the first round of engagement that focused on listening with the intent to understand and incorporating the aspirations, goals, and needs of the stakeholders related to the truck route options. As part of this exercise, a stakeholder roundtable meeting and Public Open House event was conducted and a group of broader stakeholders were also consulted. Within this phase, the draft evaluation criteria and potential options were developed and there were two check-ins with Council to update them on status and draft findings were also completed.

Phase 2: Scenario Development, Evaluation, and Public Input involved identifying improvements required for each route to facilitate efficient and safe truck movements by undertaking technical reviews of each option and considering the input provided by Squamish residents and stakeholder groups. The technical review included traffic, environmental, archaeological, geological, and structural assessments. A second round of public and stakeholder consultations was completed to determine the preferred solutions.

1.3 COMMUNICATIONS AND CONSULTATION

Community involvement was critical in the consideration of future downtown truck route options. A range of communications and consultation approaches were used throughout the process to engage community stakeholders and residents, as described below.

A project webpage was developed on the District's website to provide the information regarding the Downtown Truck Route Study and on-going progress. The information boards presented at public open houses as well as online surveys were made available on this webpage.

Surveys were made available on-line and through hardcopy for all residents, businesses and stakeholders to complete during both public consultation periods in the months of May and November. The first survey focused on understanding the issues and concerns of Squamish residents related to the Downtown Truck Route Study. Once the options were identified, the second survey helped to collect feedback on them. In total, 188 surveys were submitted during Phase 1 and 25 surveys were submitted during Phase 2. The questionnaire and results of the surveys are attached in **Appendix A**.

Open House #1 was held on May 18, 2016 at the Squamish Seniors Activity Centre. Approximately 60 people attended the event and engaged with the project team. The event included display boards that summarized the available information and key questions related to the study, the evaluation criteria, and potential options. A survey was distributed at the event and the summary of feedback was considered as part of the options evaluation.

Open House #2 was held on November 16, 2016 at the Squamish Seniors Activity Centre. Approximately 37 people attended the event and 12 attendees completed the survey that was distributed to collect feedback on the recommendations. The results of technical evaluation and

proposed recommendations were displayed on boards at this event. The merits and demerits of each option were summarized on separate boards and an evaluation summary table comparing all options were presented to the attendees.

Core Stakeholders Meetings were held on two separate occasions. This group was selected by the District, which included businesses, associations, and community groups, as well as agencies with significant data/information to share or decision-making ability that may impact the success of one or more options. Core stakeholders included the following organizations:

- Squamish Terminals
- Squamish Forestry (Sea to Sky District - Ministry of Forests, Lands & Natural Resources)
- CN Rail
- Squamish River Watershed Society
- Squamish Estuary Management Committee
- Sleeman Brewery (via BC Trucking Association)
- Squamish Environment Society
- Downtown Business Improvement Association/ Squamish Historical Society

The first meeting for Core Stakeholders was held on May 18, 2016 and focused on understanding the aspirations, goals, and needs of the stakeholders related to the truck route options. The stakeholders were provided with a summary of key information and each attendee was given the opportunity to speak on key topics relevant to their needs and concerns.

The second meeting was held on November 16, 2016 where the stakeholders were presented with a summary of results of the technical analysis and proposed recommendations. The results and findings were discussed with the group and feedback received from the stakeholders were incorporated in the final recommendations.

Broader Stakeholders Meetings were held through spring and summer of 2016. This group was identified by the District, which included land owners / developers, agencies, and organizations that may have competing schedules or required individual discussions.

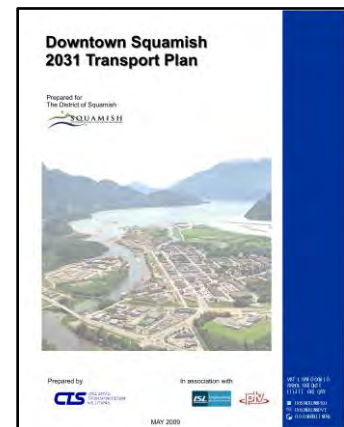
2 REVIEW OF PREVIOUS STUDIES

The District of Squamish has conducted numerous transportation studies to ensure provision of “a balanced transportation system that encourages transit, cycling, pedestrian and other modes of travel throughout the municipality”. Two transportation studies in particular were completed to review the District’s long-term transportation needs that would support the District’s Official Community Plan (OCP) – the Downtown 2031 Transport Plan (CTS, 2009) and the District-Wide Multi Modal Study (Opus, 2011). The two studies in particular were used as the sources for information in this study. The following sections provide an overview of background documents referenced.

2.1 DOWNTOWN SQUAMISH 2031 TRANSPORT PLAN (CTS, 2009)

In 2009, Creative Transportation Solution Ltd. (CTS) in association with ISL Engineering & Land Services Ltd. and PTV America developed a multi-modal transportation plan for Downtown Squamish. The study particularly focused on projecting traffic volumes in 2031 based on the population growth and future land use changes as well as employment projections. Based on these projected volumes, several recommendations were made to define the future Downtown transportation network.

The findings and recommendations from the study are summarized below.



Key Findings

- **Employment for Squamish-based residents is expected to increase by 40%** between the year 2006 (8,335 jobs) and the year 2031 (11,700 jobs). As the population of Squamish is projected to more than double in 2031, with a larger population but smaller percentage of jobs, most Squamish based population is anticipated to either not be employed or have a job located outside of Squamish. If this trend of turning Squamish into a “bedroom community” continues, it will have significant impacts on the future transportation network requirement for Squamish as the majority of travel demand will be between the various neighbourhoods of Squamish and Highway 99. As well, this would conflict with Smart Growth principles which encourages the development of good jobs close to home for future residents.

- **The current transportation plan for Squamish identified two future major transportation roadways into downtown Squamish.** The “Seventh Avenue Connector”, which we refer to as “Western Route” in this study, would be located on the west side of downtown Squamish along the railway corridor and link both downtown and Squamish Terminals to the south with the Squamish Rail Yards and Business Park to the north, as well as provide an indirect connection to Highway 99 along Government Road. The second corridor in the transportation plan is a new crossing of the Mamquam Blind Channel which would link downtown Squamish with Highway 99 to the east.
- **Two potential crossings over Mamquam Blind Channel were identified:** The Pemberton Bridge crossing was recommended for the 2031 horizon. The Westminster Bridge Crossing was recommended to be protected for as a longer term consideration.
- **Western Route** was identified and recommended to be protected for as a potential future connection.
- **Summer Friday afternoon peak hour experiences peak traffic demand** and therefore this peak hour was selected as the design hour to develop the updated transport plan for Downtown Squamish.
- **The use of either a car or truck to enter and exit downtown Squamish is overwhelmingly the preferred transport** for the majority of the almost 40,000 persons observed as 92.7% used this mode in the summer and 90.4% in the winter. Public transport, which for most urban communities is the next most viable and effective mode of transport for moving people, is clearly not well used in Squamish at only 1.5% in the summer and 3.8% in the winter.

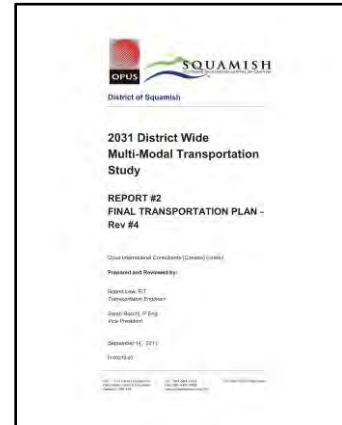
Key Recommendations

- **The District of Squamish should aim to reduce the auto trips from 92.7% to 75%, while increasing the other modes** as follows.
 - Increase transit trips from 1.5% to 10%
 - Increase motorcycle trips from 0.7% to 1%
 - Increase bicycle trips from 1.6% to 5%
 - Increase walk trips from 3.4% to 7%
 - Increase other trips such as ferry from 0.1% to 2%
- **By the year 2031, and in conjunction with the transport mode targets, the District of Squamish is expected to increase the number of expected locally based jobs** from 8,310 to 11,915 (+43%) and scale back the number of expected residential units from 8,800 to 7,480 homes (-10%) in order to reduce the demand for additional transportation infrastructure by providing a more sustainable balance between population and local jobs.
- **The District of Squamish should complete a District-wide Transportation Plan** and the findings of the Downtown and District-wide Plans should be integrated into the Official Community Plan.

2.2 2031 DISTRICT-WIDE MULTI-MODAL STUDY (OPUS, 2011)

The 2031 District-Wide Multi-Modal Study, completed by Opus International Consultants in 2011, included the future transportation needs of all the communities in Squamish. The study looked at the regional transportation network and the local transportation network separately while also including commercial transport.

The findings and recommendations from the study are summarized below.



Key Findings

- **July and August are the peak months for traffic volumes.** In fact, summer travel demand is 24% higher than winter. Friday, Saturday, and Sunday see the highest traffic volumes due to recreational traffic on Highway 99 and summer afternoon peak hour continues to be the dominant hour of week.
- **Squamish is heavily reliant on automobiles to enter and exit downtown Squamish.** The mode split for auto was found to be 92.7% in the summer and 90.4% in the winter.
- **The left turn movement at Cleveland Avenue/Highway 99 intersection was found to experience significant delays in summer afternoon peak hour.** All other key intersections in downtown Squamish were found to be operating at good levels of service and had varying amounts of spare capacity to accommodate additional traffic volume growth.
- **A 130% increase in traffic volumes were expected by the year 2031.** The transportation model projected approximately 12,000 vehicles per hour by the year 2031.
- In addition to the alternate downtown access at Pemberton Avenue, an additional Mamquam River Crossing will not be required unless the District's population reaches 50,000.
- Due attention should be given to connectivity of the inter-modal port, rail facilities, industrial lands generally, resource extraction based industries and outlying destinations.
- An origin/destination phone survey conducted in 2011 indicated each household had vehicle ownership rate of 2.15.

Key Recommendations

- **Set transport mode targets for the year 2031** to reduce the auto trips from 92.7% to 75%.

- **Explore evaluation of truck routes through the Downtown** primarily focusing on the connection to the Squamish Terminals.
- **Complete a Downtown Entrance Study** in the near term to reconcile issues such as community gateway, emergency access, and multi-modal network needs.
- **Request that BC MoTI commit to not changing signal timing on any of the Highway intersections in Squamish without consultation** and further that an ongoing dialogue be established between the District and BC MoTI on how a level of balance may be reached between regional and local traffic demands that accomplishes the goals of both parties.

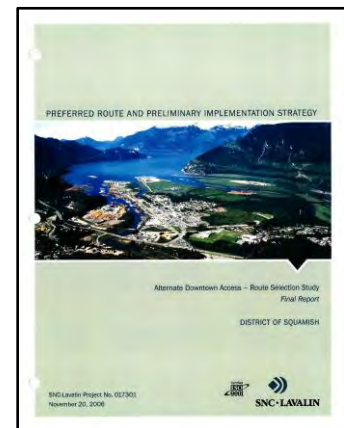
2.3 ALTERNATE DOWNTOWN ACCESS – ROUTE SELECTION STUDY (SNC LAVALIN, 2006)

A Route Selection study was conducted by SNC-Lavalin in 2006 for an alternate downtown access from Highway 99 to Downtown Squamish. The purpose of the study was to identify a suitable connection and treatment at Highway 99, to compare the route options across the Mamquam Blind Channel, and to recommend a preferred route for the alternate downtown access.

The findings and recommendations from the study are summarized below.

Key Findings

- **Pemberton Avenue, Winnipeg Street, and Westminster Street were chosen as appropriate routes connecting Downtown Squamish to Highway 99 at Clarke Drive.** An overpass structure over the CNR mainline would be required to connect to Clarke Drive at Highway 99 regardless of which option is chosen.
- **Tunnel and low level movable bridge options were not considered feasible** and not explored as part of the study.
- **Westminster Street was selected as the preferred route** for the alternate downtown access.
- **The traffic analysis suggested that an at-grade intersection at Clarke Drive would be adequate** to accommodate future traffic in 2026 horizon.



Key Recommendations

- **Update the Transportation Master Plan for downtown Squamish** to ensure proper integration of the alternate downtown access to the existing road network in the area.
- **Consult with Navigable Waters Protection Division regarding the navigation clearance over the Mamquam Blind Channel** (including a detailed navigation study of the channel to verify its existing usage by marine vessels and floatplanes). At the time of the study, Transport Canada were consulted and the Pemberton Avenue Crossing was the most preferable option.
- **Consult with the Squamish First Nation regarding the route alignment** across the newly acquired Squamish Nation land.

2.4 OTHER RELEVANT STUDIES

The findings and recommendations from the following studies are also referenced in this study.

- ***District of Squamish Active Transportation Plan***, September 2016, Urban Systems Ltd.
- ***Squamish Retail, Commercial and Industrial Trade, Investment and Marketing Strategy***, March 2005, Vann Struth Consulting Group.
- ***Squamish Oceanfront Development Transportation Assessment***, January 2012, Bunt & Associates
- ***Skwelwil'em Squamish Estuary Wildlife Management Area***, August 2007, Lower Mainland Region Environmental Stewardship Division.
- ***Coastal Flood Hazard Mitigation Strategy and Flood Protection Options***, October 2015, Kerr Wood Leidel.
- ***District of Squamish integrated Flood Hazard Management Plan***, February 2015, Kerr Wood Leidel.
- ***Mamquam Blind Channel – Main Street Crossing***, November 2005, Brook Development Planning Inc.
- ***Growth Management Study***, July 2005, Urbanics Consultants Ltd.
- ***Squamish Estuary Management Plan***, 1999, District of Squamish.

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3 WHERE ARE WE TODAY AND WHAT'S PLANNED?

This section of the report highlights and examines existing transportation conditions in Downtown Squamish as well as some of the broader context for planning the transportation system in the area.

The transportation initiatives of the District of Squamish are a result of careful planning and policy processes that not only respect the community's vision for how it wants to manage growth and development, but are also reflective of regional planning goals.

3.1 ROADWAY NETWORK

Squamish's downtown road network is generally comprised of local and collector roads. Cleveland Avenue provides access into the Downtown from Highway 99, which provides connection to larger Squamish communities. CN railway track runs through the Downtown parallel to Buckley Avenue crossing Cleveland Avenue and over Mamquam Blind Channel. Due to the railway alignment, Downtown can only be accessed via railway crossings. The current crossing at Cleveland Avenue is at-grade and therefore affects the traffic flow to and from the Downtown. BC Transit provides bus service to the Downtown via routes that travel along Cleveland Avenue, Main Street, Second Avenue, Victoria Street, Third Avenue, Pemberton Avenue, and Buckley Avenue.

Figure 3-1 highlights the current road network, classifications and traffic controls.

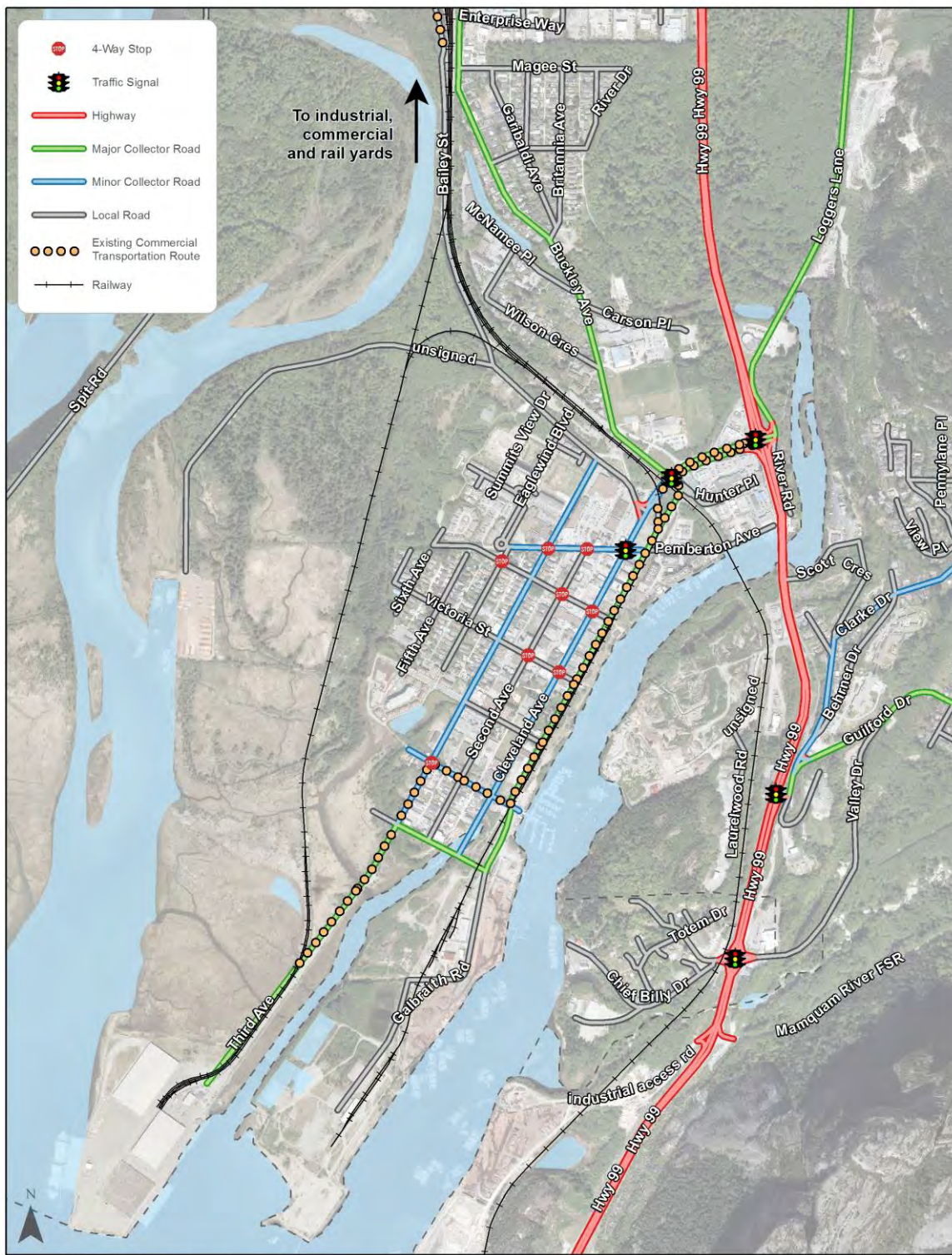


Figure 3-1: Existing Road Classification and Traffic Controls

The following roadways are the major roadways in Downtown related to truck transportation.

Highway 99: Highway 99 is a four-lane provincial highway that connects Squamish to Lower Mainland to the south and Whistler to the north. Currently, the access in and out of Downtown Squamish is only available via Cleveland Avenue. A future signalized intersection is planned at Clarke Drive with a new development, which may provide connection to crossing opportunities of the Mamquam Blind Channel.

Cleveland Avenue: Cleveland Avenue is a four-lane roadway classified as major collector north of Bailey Street that connects with Highway 99 to the downtown business core. It transitions to a two-lane collector road between Buckley Avenue and Vancouver Street. Cleveland Avenue serves as the primary access to/from the Highway and also connects commercial vehicles travelling on Loggers Lane to/from the industrial areas in the south. Within the Downtown, Cleveland Avenue is one of the major transit routes with bus stops located on east side of the street. There are several store frontages on both sides of the street and parking is allowed on both sides of the road.

Loggers Lane: Loggers Lane is a two-lane collector roadway in downtown Squamish that intersects with Buckley Avenue/Hunter Place to the north and Vancouver Street to the south. The roadway transitions south of Vancouver Street to Galbraith Avenue which provides access to the Garibaldi Forest Products log sort. There are several commercial businesses located on the west side of Loggers Lane. BC Rail train tracks run adjacent to Loggers Lane on the east side.

Galbraith Ave: Galbraith Avenue is a two-lane local roadway that begins at the termination of Loggers Lane south of Vancouver Street. The roadway currently ends at Cattermole Slough Log sorting located on the east side and several industrial operations located on the west side. A potential crossing over Cattermole Slough could connect this roadway with Third Avenue on the west side.

Bailey Street: Bailey Street is a two-lane local roadway extends as Government Road beyond Downtown paralleling rail tracks and serves as part of the industrial/commercial connection. The street is currently unpaved starting at the Downtown limits travelling towards Government Road to British Columbia Railway (BCR) North Yards site.

Buckley Avenue: Buckley Avenue is a two-lane major collector roadway that runs in the north-south direction and currently provides connection between Downtown and northern Squamish communities. It also serves as the transit route from/to Downtown.

Pemberton Avenue: Pemberton Avenue is a two-lane collector roadway that provides vital east-west connection in Downtown with access to stores in shopping mall and industrial companies located east of Cleveland Ave. Parking is allowed along most of the roadway.

Third Avenue: Third Avenue is a two-lane collector roadway intersects with Bailey Street and goes through downtown Squamish ending at Squamish Terminals. It is the only access to Squamish Terminals and a potential barge load out facility. There are residential buildings as well as several commercial/industrial businesses located on both sides of the street south of Pemberton Avenue.

Vancouver Street: Vancouver Street is a two-lane local roadway that runs in the east-west direction and intersects Third Avenue to the west and Loggers Lane to the east. It serves as a critical route to Squamish Terminals, Galbraith Avenue Log Sort, and Squamish Yacht Club.

3.2 TRAVEL CHARACTERISTICS

In order to identify the truck routes, an understanding of the current travel characteristics of not only the trucks but also general traffic throughout the Downtown and further is required. Key facts about the current travel characteristics include:

Mode Share: Based on the 2011 National household Survey conducted by Statistics Canada, approximately 87% of all trips to work in Squamish are made by auto trips. Although active modes such as walking, cycling, and transit account for only 13% of all trips, they have been on the rise since 2001.

Trip Distribution: The majority of the trips in and out of Downtown, which include both general and truck traffic, are destined to and from Highway 99. The trucks leaving Squamish Terminals travel on Third Avenue passing through a single-lane bridge continuing on to Vancouver Street. At Vancouver Street, trucks make the right turn to travel on Loggers Lane which eventually connects to Cleveland Avenue just south of Buckley Avenue. Similarly, the trucks from the log sort in Squamish Oceanfront Peninsula travel north-south on Loggers Lane without having to turn into any other street besides Cleveland Avenue.

3.3 LAND USE

The most significant factor affecting how people travel is the proximity of where people live to where they work, shop, and play. The type, scale and mixture of land uses along with the densities of those uses, will largely determine how far, and consequently what mode of transportation, people will use to get to their destinations. The closer people are to their desired destination, the more opportunities there are for them to use sustainable modes of transportation, such as walking, cycling, or taking transit. This is especially true for the Downtown area.

Current commercial destinations are primarily located on the north side of the Downtown while industrial destinations are to the south. The majority of industrial use, however, is located outside of the Downtown to the north in the Business Park.

Figure 3-2 illustrates the current land use as well as the major truck destinations within Downtown Squamish. The major truck destinations for commercial vehicles in Squamish include:

- Squamish Terminals
- Squamish Business Park
- CN Rail Terminal
- Squamish Oceanfront Peninsula
- Downtown Business District
- Site “B”

Of the major truck destinations, trucks destined to and from Squamish Terminals travel the farthest to connect with the Highway and/or Business Park. There is also currently a log sort located in Squamish Oceanfront Peninsula that contributes to truck traffic in Downtown Squamish.

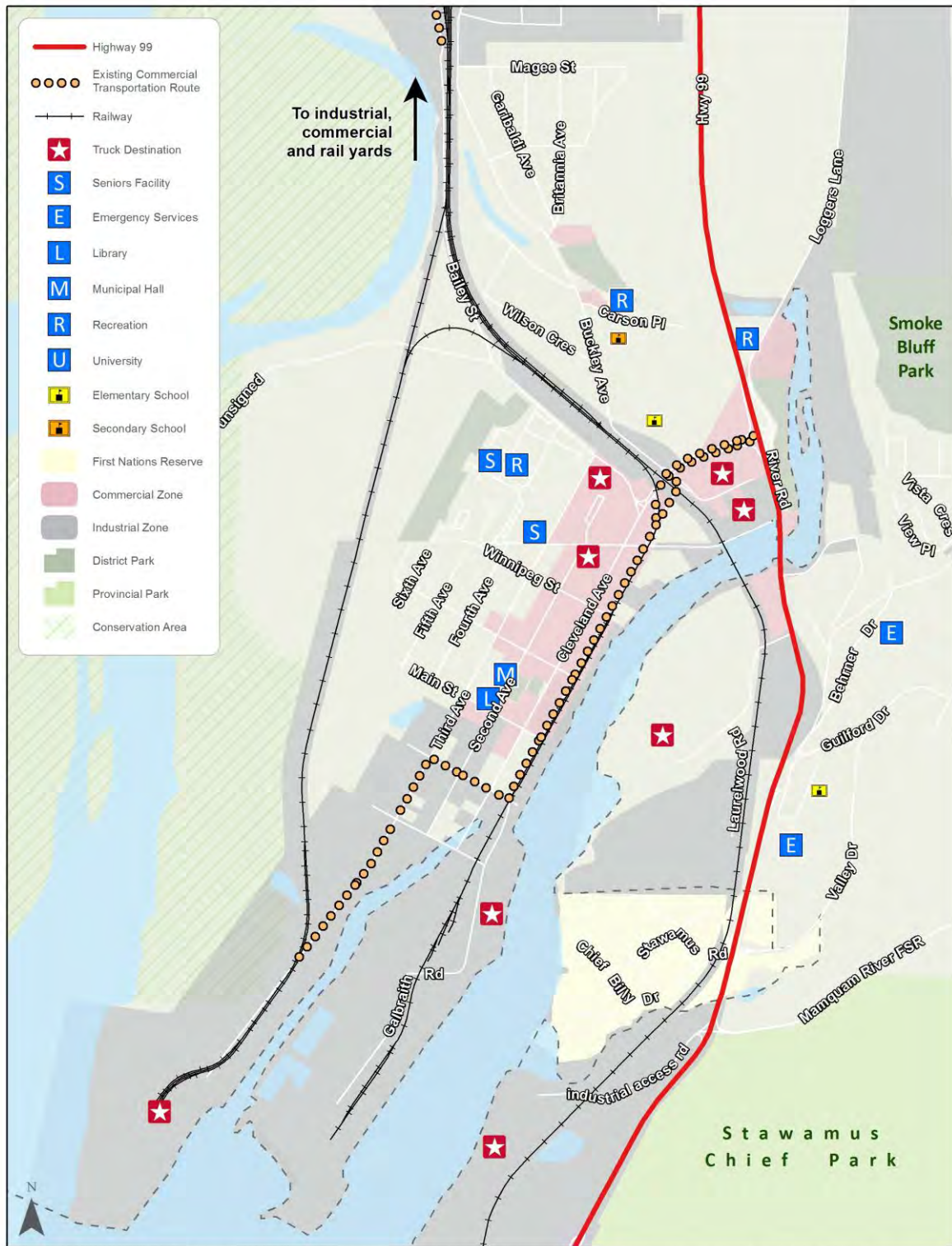


Figure 3-2: Land Use and Truck Destination Map

3.4 MAJOR PROPOSED DEVELOPMENTS

There are numerous developments currently planned in downtown Squamish. Majority of these developments are residential in nature. However, there are two major developments anticipated in Squamish that have significant implications on traffic in the future: Oceanfront Development and Waterfront Landing. The locations of these developments are shown in **Figure 3-3**.

Oceanfront Development: The Squamish Oceanfront Development Corporation (SODC) is planning to develop 1,136 residential dwelling units and 79,280 sq. m commercial space within parcels covered by their lands in Squamish Oceanfront Peninsula. Bunt & Associates completed a Transportation Impact Assessment (TIA) in 2012 to provide guidance on the level of infrastructure needed to support the development plan. The major network changes anticipated due to this development is a signalized intersection at Vancouver Street/Cleveland Avenue and a bridge crossing over Cattermole Slough. Due to the high number of residential units, a secondary emergency access was anticipated as part of the TIA for the Squamish Oceanfront Peninsula. The bridge connection would also help meeting the long-term transportation needs of this development while improving the circulation as well safety.

Waterfront Landing: The proposed development on Waterfront Landing is primarily residential and expected to include 800 - 965 residential units and moderate commercial use. Although the development plan is still being finalized, the access to the development has been identified to be provided via the Clarke Drive intersection south of Cleveland Avenue. As the development is primarily residential, some of this residential traffic is expected to be destined for Downtown Squamish. A pedestrian bridge over Mamquam Blind Channel is currently being proposed as part of the development. This would help in reducing the number of vehicular trips between this development and Downtown but without a direct vehicular connection, the development is expected to add more traffic on the Cleveland Avenue/Highway 99 intersection. A TIA was completed by SNC Lavalin in 2006 estimating the traffic volumes based on the older development plan. The plan identified the possibility of a vehicular crossing of the Mamquam Blind Channel at Pemberton Ave. As the intensity of the development have changed significantly since the last study was completed, an update to the analysis is required to assess the impacts of this development on the transportation network.

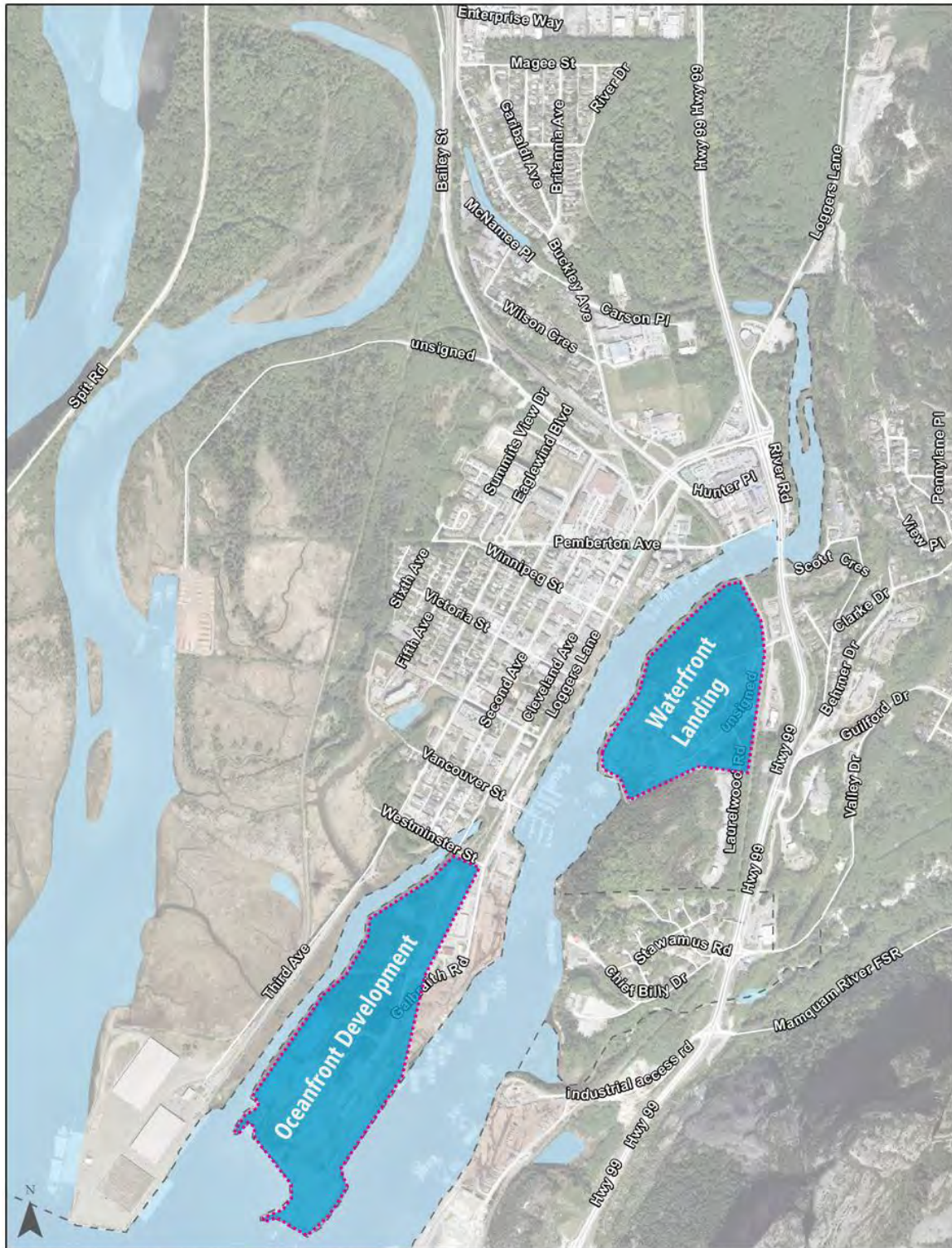


Figure 3-3: Oceanfront Development and Waterfront Landing

4 TRANSPORTATION ASSESSMENT

This section provides an overview of the current characteristics of Squamish’s transportation network and highlights key issues to be addressed in assigning truck routes.

The transportation assessment is structured to present general facts and observations and the key issues and opportunities for the road network, intersection geometry and traffic operations relating to truck traffic as well as general traffic. The input from Public Open House as well as the Stakeholder meetings are also included for consideration as they are the primary users of the infrastructure.

4.1 ROADWAY NETWORK

The roadway network supports mobility for all modes of travel including general purpose traffic, goods movement, transit, walking, and cycling. In many Canadian communities, vehicles are often given preferential treatment on the roadway network, sometimes at the expense of walking, cycling, or even transit operations. Squamish has a high auto modal split when compared to other travel modes, however Squamish has made concerted efforts to improve the comfort, quality, and amount of facilities for walking, cycling and transit.

4.1.1 FACTS AND OBSERVATIONS

Road Classifications: Table 4-1 shows the road classification of some of the major roadways in Downtown Squamish and current daily traffic volumes. The 2016 daily traffic volumes are shown in Figure 4-1. The Downtown Transportation Plan identified proposed classifications, however it is expected that they would need to be reassessed in future based on the future traffic volumes as well as the function of the roadway.

Table 4-1: Road Classification and Daily Traffic Volumes

Roadway	Classification	Existing Daily Traffic Volumes
Cleveland Avenue	Collector Roadway	18,120 vpd
Loggers Lane	Major Collector Roadway	1,690 vpd
Third Avenue	Collector Roadway	1,900 vpd
Pemberton Avenue	Collector Roadway	5,800 vpd
Bailey Street	Local Roadway	6,500 vpd

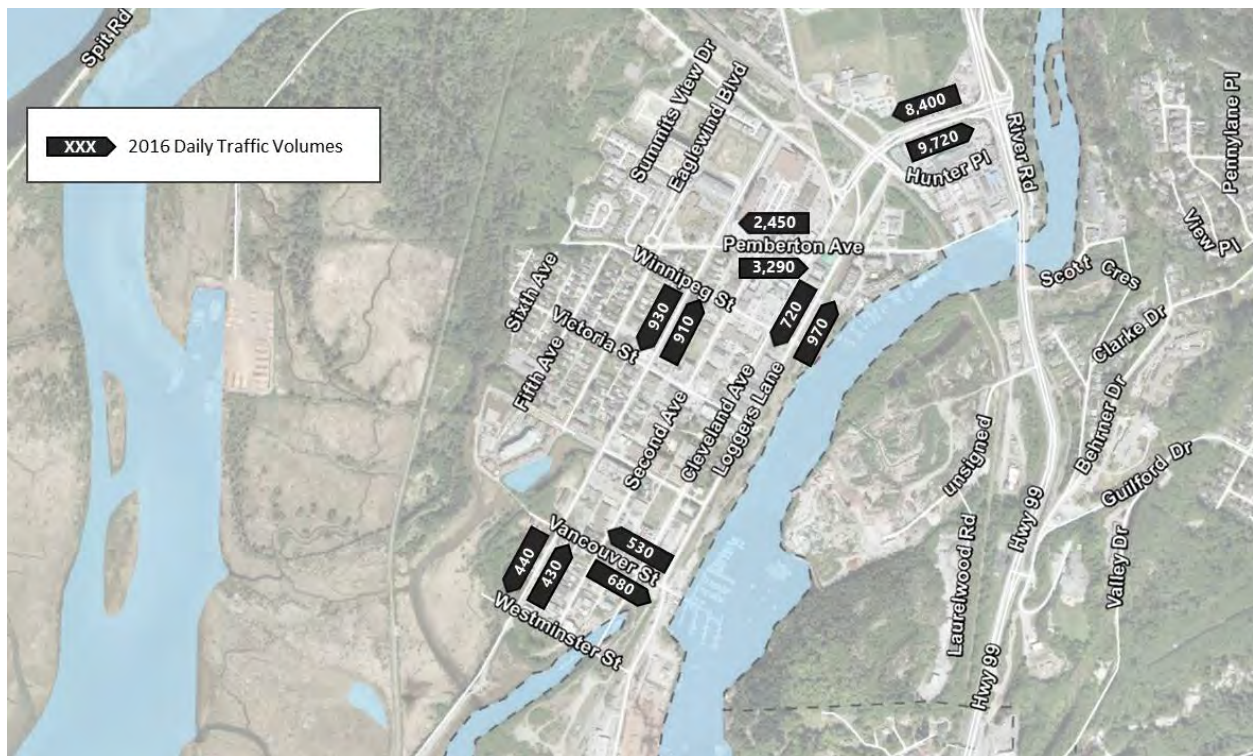


Figure 4-1: 2016 Daily Traffic Volumes

Traffic Volumes: Manual intersection counts were available for major Downtown intersections as part of previous studies. In order to assess the exiting traffic conditions, traffic counts were conducted in May at the following intersections.

- Third Avenue/Bailey Street
- Third Avenue/Vancouver Street
- Third Avenue/Winnipeg Street
- Cleveland Avenue/Bailey Street
- Cleveland Avenue/Buckley Avenue
- Loggers Lane/Loggers Lane

Daily traffic tube counts were also conducted at the following locations:

- Third Avenue between Pemberton Avenue and Winnipeg Street
- Third Avenue south of Vancouver Street
- Cleveland Avenue north of Buckley Avenue
- Loggers Lane between Main Street and Victoria Street
- Pemberton Avenue between Cleveland Avenue and Second Avenue
- Vancouver Street between Loggers Lane and Cleveland Avenue

The existing 2016 afternoon peak hour traffic volumes are shown in **Figure 4-2**. **Figure 4-3** shows the truck volumes during the same peak hour and **Figure 4-4** shows the highest hourly truck volumes, which was observed to occur in the morning. The peak periods for trucks travelling within Downtown were found to be between 11 AM and 1 PM. However, the general traffic volumes during this period were found to be much lower than the afternoon peak period. Between 300 to 500 trucks daily were observed on Cleveland Avenue between Buckley Avenue and Highway 99 daily while between 50 to 100 trucks travel on Loggers Lane daily. The resulting truck percentages on existing streets is observed to be between 2% to 4% on Cleveland Avenue and 4% to 7% on Loggers Lane. It is noted that typical truck percentages observed in other communities are between 3% to 5% on major roads and between 7% to 10% on truck routes. Referencing total vehicles observed on Loggers Lane and Cleveland Avenue (1690vpd and 18,120vpd, respectively), the absolute number and percentage of trucks observed in downtown Squamish is relatively low in comparison. These observations reflect typical conditions, however, and it is noted that higher truck volumes on Loggers Lane have been recorded during special shipping activities at Squamish Terminals. Typical daily vehicle profiles on some of the major roads are shown in **Figure 4-5** through **Figure 4-8**.

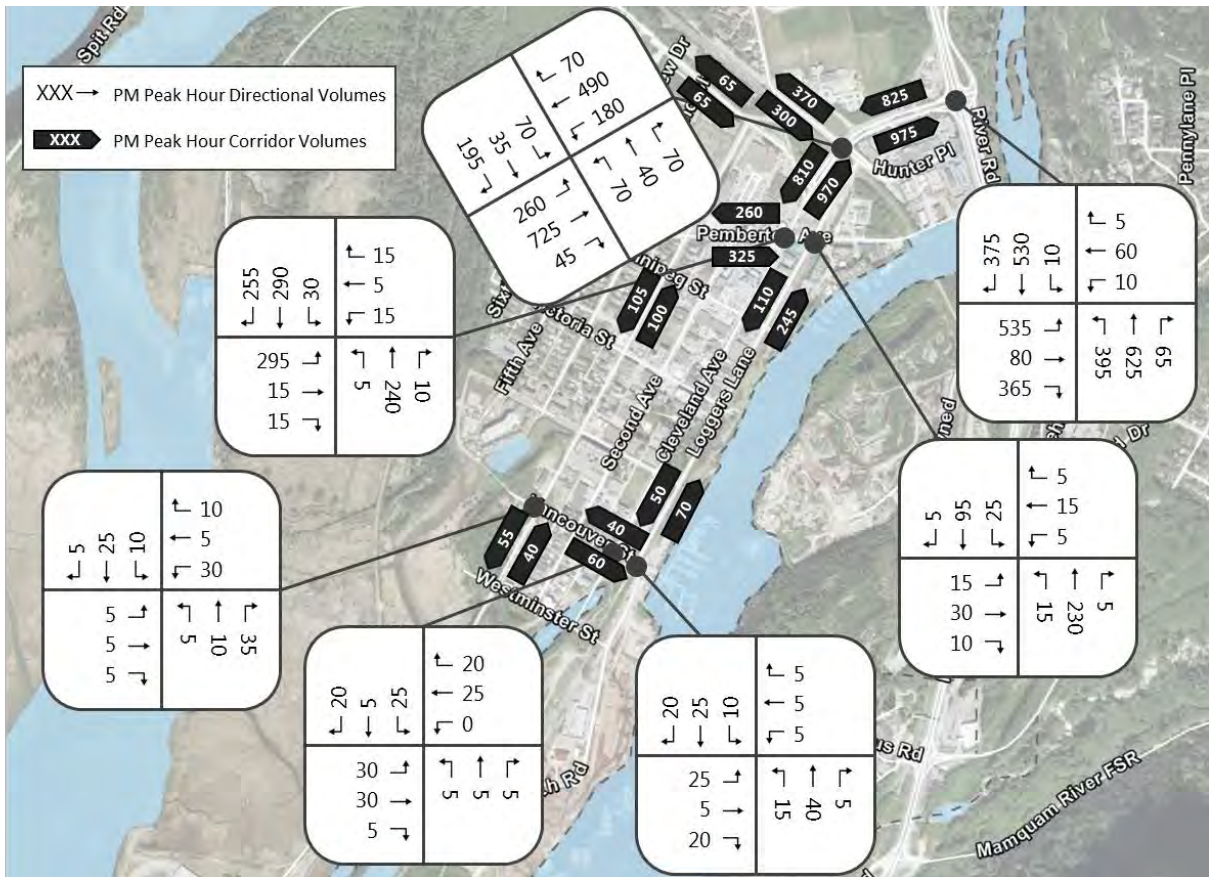


Figure 4-2: 2016 PM Peak Intersection Movement Counts

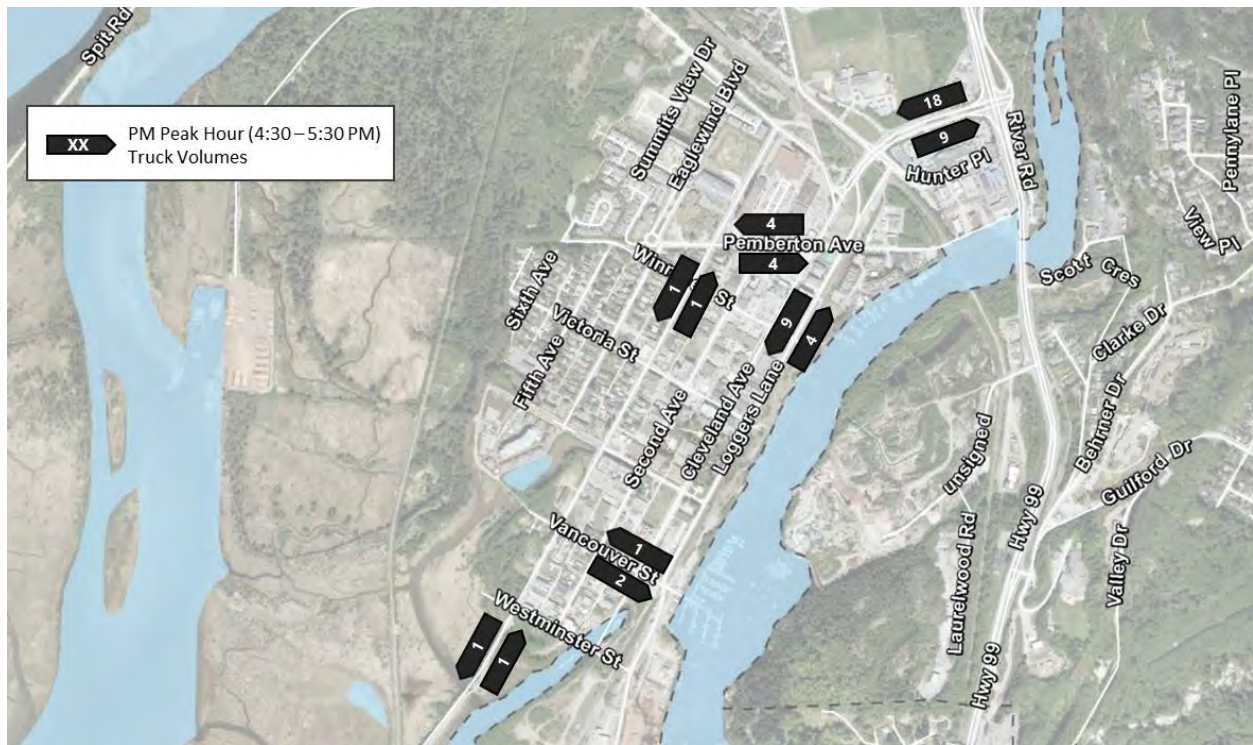


Figure 4-3: PM Peak Hour Truck Volumes

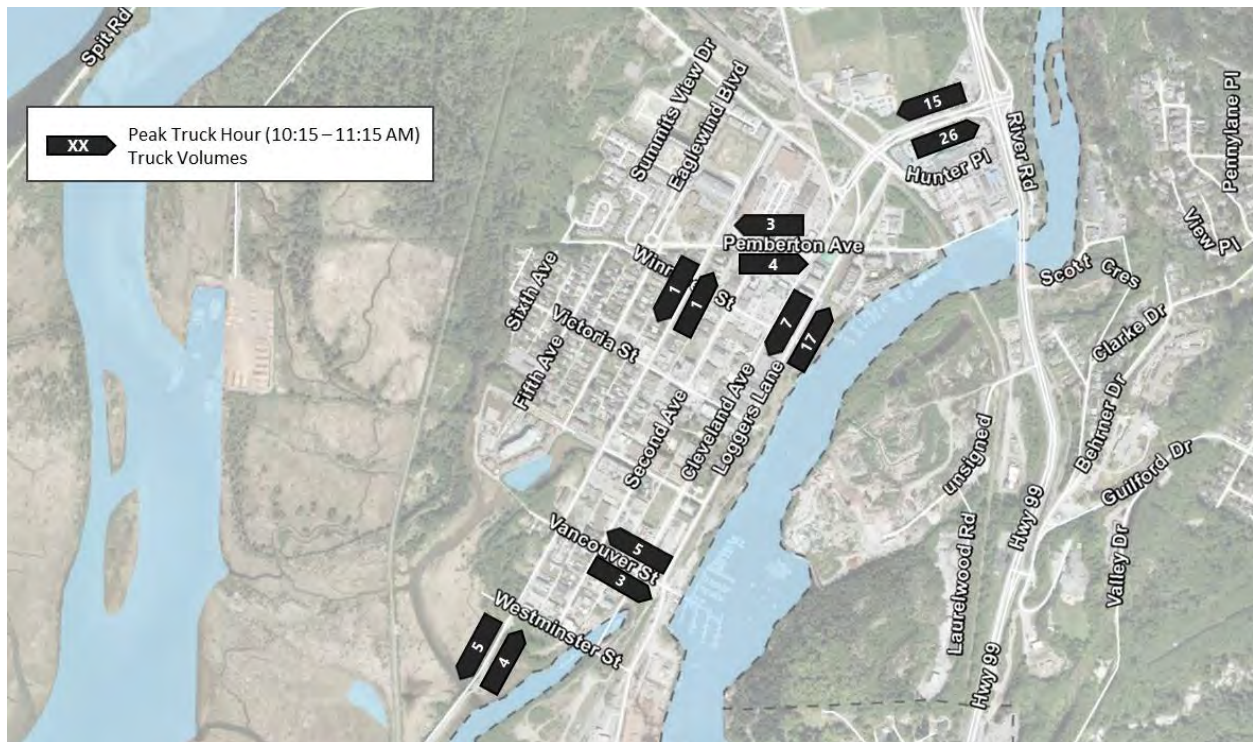


Figure 4-4: Truck Peak Hour Truck Volumes

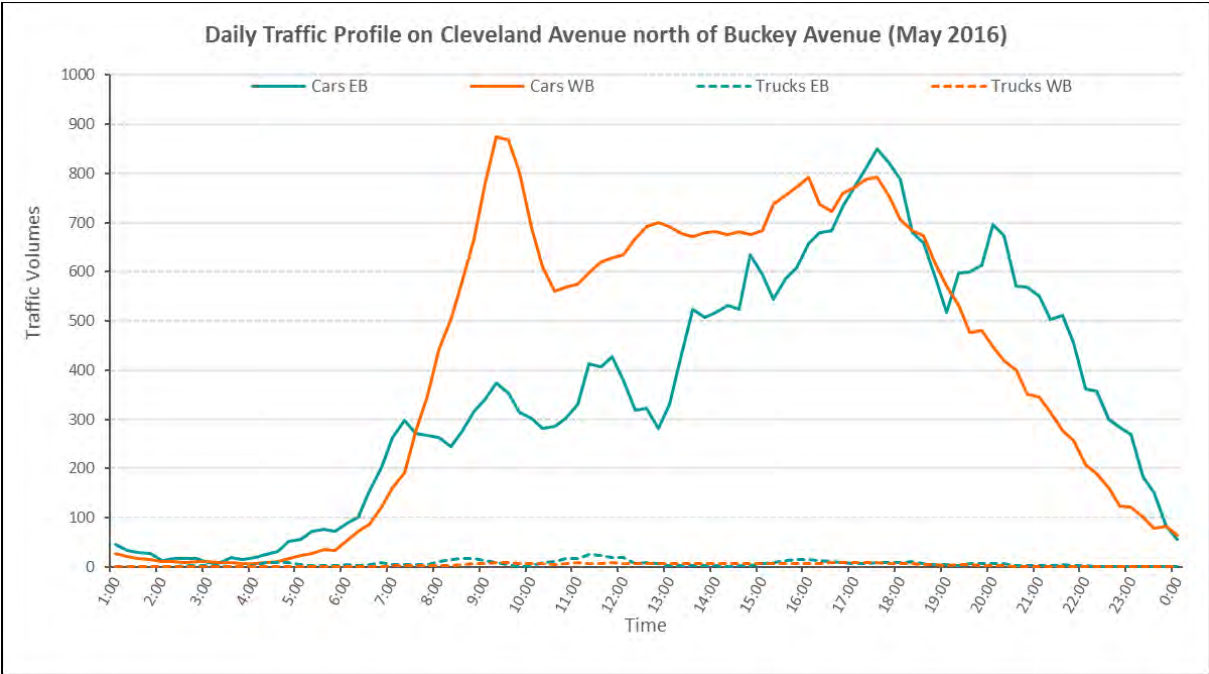


Figure 4-5: Daily Traffic Profile on Cleveland Avenue north of Buckley Street

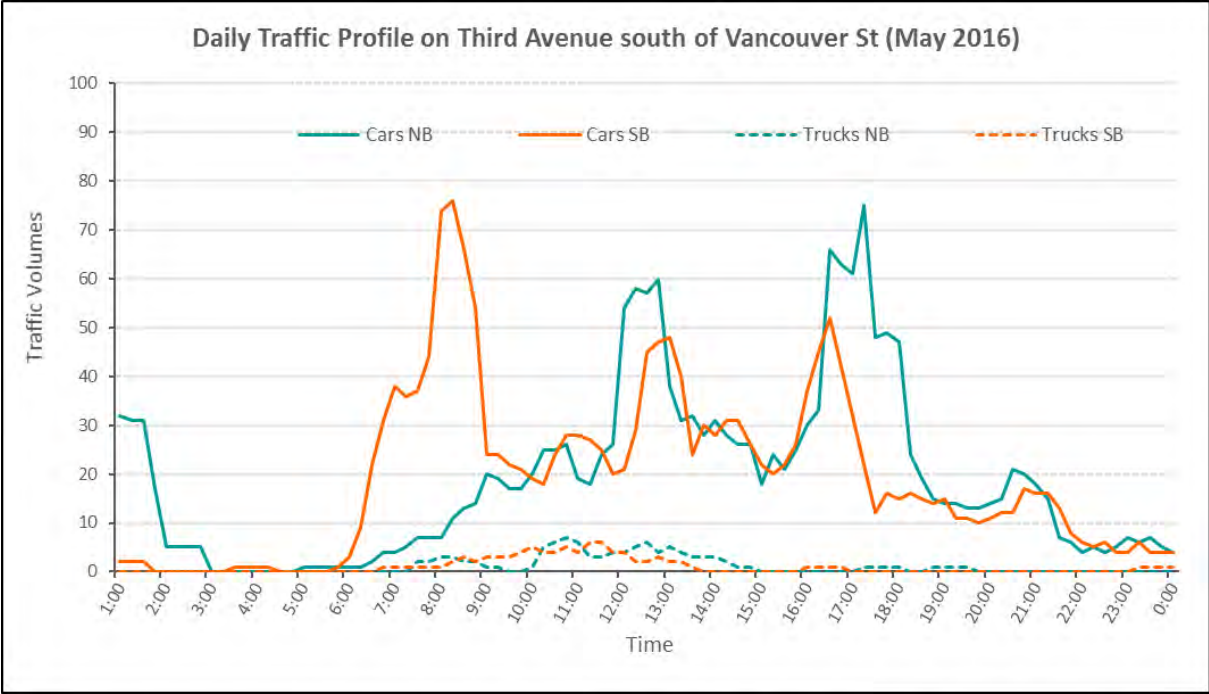


Figure 4-6: Daily Traffic Profile on Third Avenue south of Vancouver Street

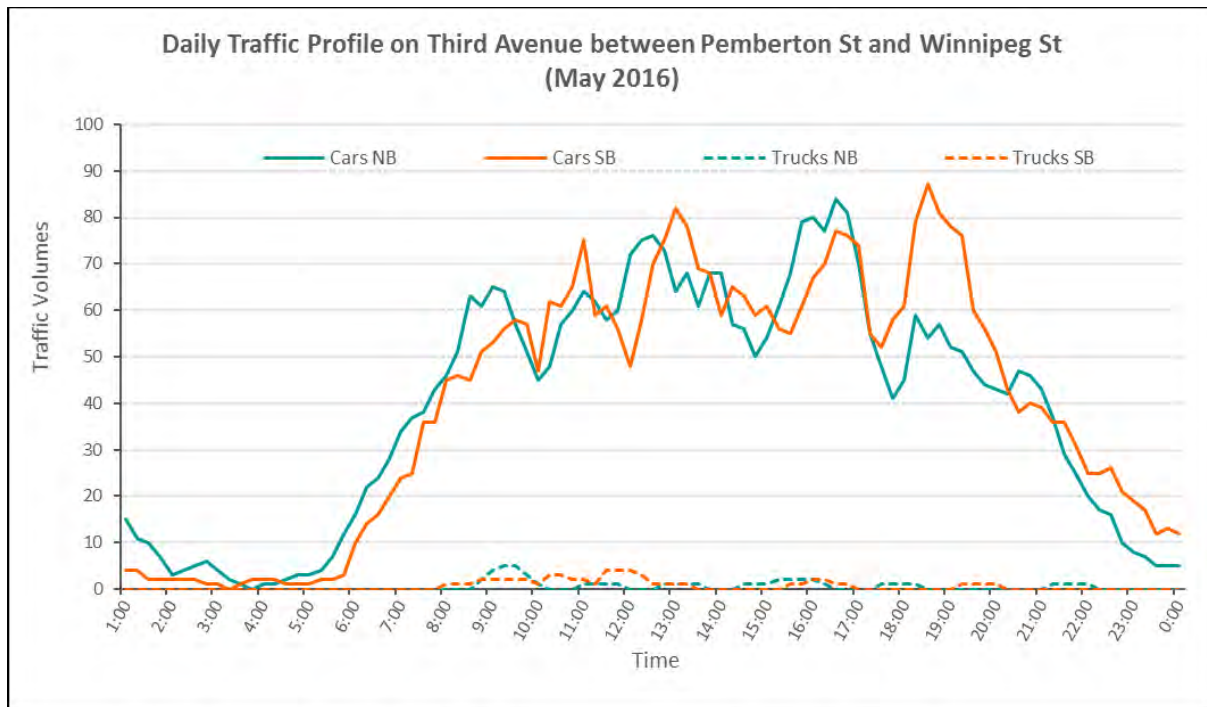


Figure 4-7: Daily Traffic Profile on Third Avenue between Pemberton Avenue and Winnipeg Street

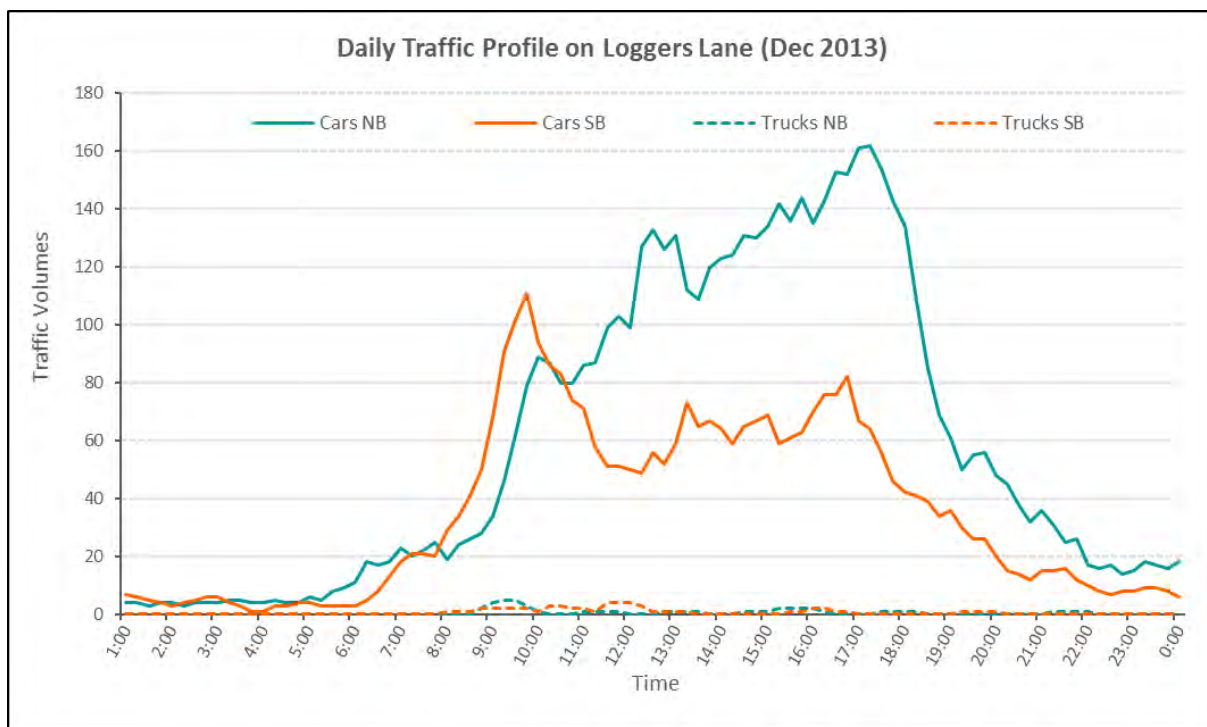


Figure 4-8: Daily Traffic Profile on Loggers Lane

Speed Limits: The posted speed limits within the Downtown area do not exceed 50 km/hr. There are however several segments near parks and school that are posted as 30 km/hr zone. One such location along the existing truck route is shown in **Figure 4-9**.



Figure 4-9: 30 km/hr Speed Limit along Existing Truck Route

4.1.2 WHAT THE DISTRICT HAS HEARD

Aspirations: Respondents from the Public Open House and online survey provided the following suggestions related to the road network.

- Consider using rail tracks
- No truck routes near schools
- Most direct route from the highway to downtown

The attendees that participated in the stakeholder meetings provided the following suggestions regarding the road network.

- Ultimately, take the truck route outside of Downtown
- Efficiency – no restriction on hours of operations
- Loggers Lane development plans will fully consider safety issues arising from truck routes

Issues and concerns: Respondents from the Public Open House and online survey indicated the following issues and concerns related to the road network.

- Trucks conflict with children and seniors

- Narrow streets (road right-of-ways)
- No truck route through residential areas
- No truck routes through estuary

The attendees that participated in the stakeholder meetings indicated the following issues and concerns regarding the road network.

- Current site constraints on existing routes (turning movements, parking, conflicts with other users)
- Site B truck traffic capacity needs to increase by 60-75% to handle a relocation of the GFP/Galbraith Ave facility

4.1.3 KEY ISSUES AND CHALLENGES

Since there is only one access in and out of Downtown Squamish, the intersection of Cleveland Avenue/Highway 99 is critical for overall traffic operation in Squamish as well as the Sea-to-Sky Highway. Additionally, the at-grade railway crossing just south of Buckley Avenue already causes delays due to the long wait and traffic volumes are expected grow in the future.

There are also several proposed active transportation projects that could change the residents travel behaviour. There are proposed bicycle lanes on Third Avenue and Pemberton Avenue. Pemberton Avenue also serves as a pedestrian friendly corridor and as such routing trucks through this corridor would cause be in conflict with this plan. There is also a long-term bikeway proposed along Loggers Lane, however it is recognized this would require additional ROW.

4.2 INTERSECTION GEOMETRY

Intersection geometry design requires a balance between the needs of passenger vehicles, commercial vehicles, pedestrians, and cyclists. There are multiple factors affecting the movement of a truck through an intersection such as curb radii, road widths, medians, and channelized turn lanes. The following six intersections were recognized to be challenged in their current configurations and reviewed.

- Third Avenue and Vancouver Street
- Loggers Lane and Pemberton Avenue
- Loggers Lane and Vancouver Street
- Third Avenue and Bailey Street
- Third Street and Pemberton Avenue
- Cleveland Avenue and Bailey Street

4.2.1 FACTS AND OBSERVATIONS

- **Existing Right-of-Way (ROW):** The existing right of way width on Loggers Lane is narrow (approximately 11 metres). The lanes are wide (4.2 metres to 4.4 metres). Where geometric improvements may be required at intersections to accommodate truck movements, more ROW is needed to accommodate trucks on existing route. Existing cross-sections for Loggers Lane and Third Avenue are attached in **Appendix B**.
- **Truck Turning Movements:** Based on the truck turning analysis, the existing geometries at key intersections in the study area were found to be constrained and in some cases require trucks to cross over the centre-line and/or track over the curb/roadside. Existing geometric conditions along major roadways in Downtown areas are challenged to accommodate trucks and those with oversize and overweight loads are seen as particularly problematic. Existing truck turning templates are included in **Appendix C**.

4.2.2 WHAT THE DISTRICT HAS HEARD

Issues and concerns: Respondents at the Public Open House and online survey noted the following issues and concerns regarding traffic and safety impacts.

- Senior population along north end of Third Street
- No controlled crossings on Third Avenue
- Noise and dust issues on Third Avenue with no preventative action.
- Respect natural environment and enjoyment of estuary
- No truck route through Third Avenue as it is the most residentially dense area.

4.2.3 KEY ISSUES AND CHALLENGES

The roadway design to accommodate a large volume of trucks is often in contrast with the roadway design prioritizing other road users. As trucks require larger turning radiuses at the intersection, the design demands for wider intersections. This in turn can create challenging environments for pedestrians causing significant barriers to walking. Wide road crossings are particularly difficult for persons with disabilities and the elderly. Wide streets also tend to encourage motorists to speed and not stop for pedestrians who are waiting to cross the street. Meanwhile, stop and go operation is a hindrance to trucks; therefore, a route with minimal stops is desired.

4.3 TRAFFIC OPERATIONS

Traffic analysis for Downtown intersections were previously completed in both Downtown Transport Plan and Multi Modal Transportation Plan. Using updated traffic counts, the traffic models were reconstructed using Synchro 8 to evaluate the level of service (LOS) within the Downtown.

4.3.1 FACTS AND OBSERVATIONS

The overall performance of an urban roadway is typically measured by the delays experienced at major intersections, also referred to as Level of Service (LOS). The LOS assigned to a signalized intersection can range between A and F. LOS A through C generally indicated that the intersection experiences very few delays during the peak hour whereas LOS F suggests the delays are significant (greater than 60 seconds/vehicle) and the intersection is failing. For planning purposes, signalized intersections LOS D or better are generally acceptable, with no left turn movement operating below LOS E. For unsignalized intersections, LOS E or better is generally accepted.

Existing Conditions

The results of the afternoon peak period Synchro assessment under existing horizon are illustrated in **Figure 4-10**.

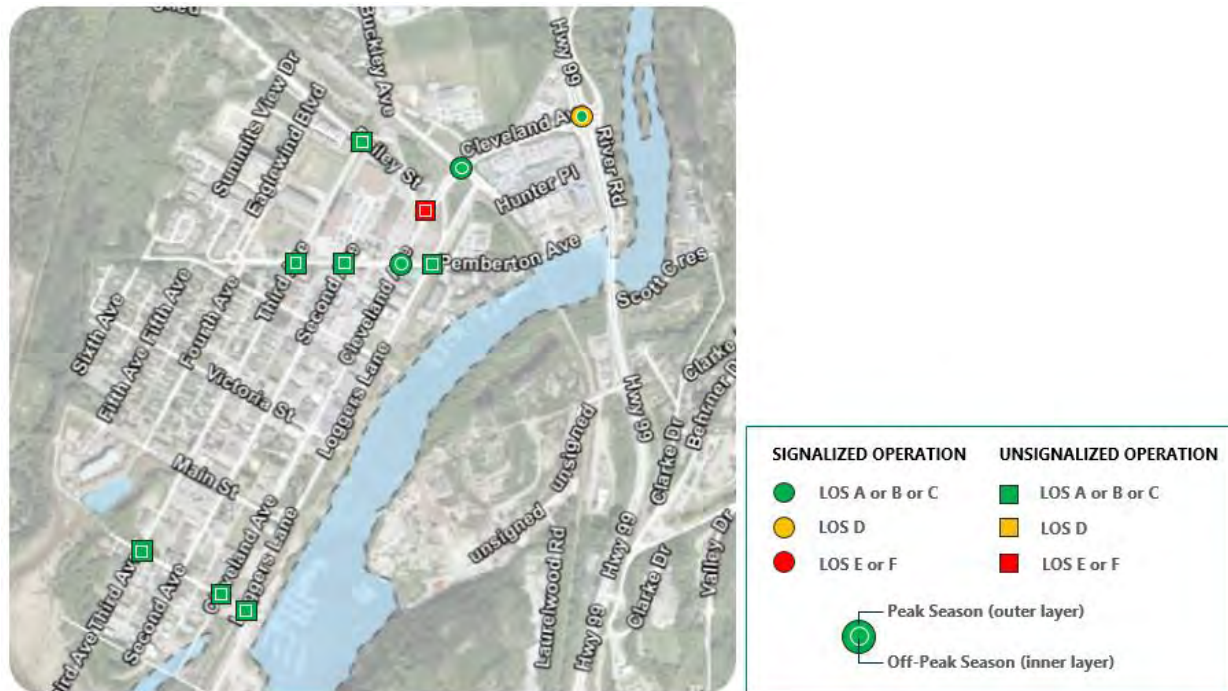


Figure 4-10: Existing Traffic Conditions (Typical PM and Summer Peak)

All intersections currently operate at a LOS C or better in typical afternoon peak hour with exception to the intersection of Bailey Street and Cleveland Avenue. This intersection is currently unsignalized and vehicles turning left onto Cleveland Avenue experience delays while waiting for gaps to turn. This is typical of a stop-controlled intersection where the major corridor (Cleveland Avenue) experiences around 1,800 vehicles during the peak period. Delays at this intersection makes it difficult for residents along Bailey Street to access Cleveland Avenue. As more residential developments are developed along Bailey Street, the traffic demand at this intersection is expected to increase. Though the existing volumes are not high enough to warrant signalization, this could change in the future. Traffic volumes should be monitored at this intersection to determine the installation of traffic signal or should be modified to a right-in/right-out access only. The peak-season analysis indicates poor level of service at the intersection of Cleveland Avenue/Highway 99 intersection resulting in a LOS D for the intersection overall, with some individual movements showing LOS E and F. The northbound left turn movement at this intersection in particular experiences significant delays and queues even with the provision of two left turn lanes.

Future Conditions

The population in Squamish is expected to increase to 33,100 by the year 2031 according to the Growth Management Strategy. Traffic projections have been estimated with this assumption and analysed under various scenarios. These scenarios included reduced auto mode split and increased alternative modes usage. In this study, a steady traffic growth with no changes in auto mode was

assumed for conservative results. **Figure 4-11** summarizes the traffic conditions within Downtown in the 2031 horizon during the typical and summer PM peak hour.

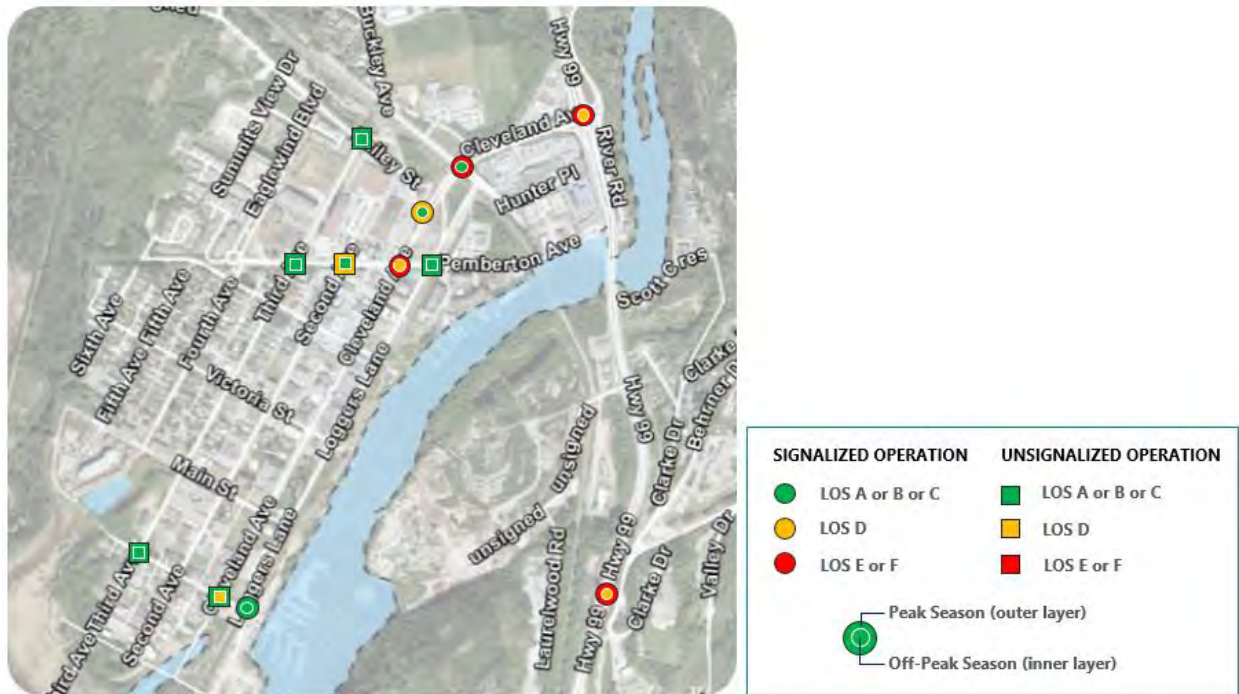


Figure 4-11: Future Traffic Conditions (Typical PM and Summer Peak)

Several intersections are expected to operate with worsened conditions in the future with the assumed increase in traffic. The intersection of Bailey Street/Cleveland Avenue, Buckley Avenue/Cleveland Avenue, Highway 99/Cleveland Avenue are particularly expected to operate with significant delays. The intersections of Bailey Street/Cleveland Avenue and Vancouver Street/loggers Lane were assumed to be signalized in the future horizon for this analysis.

Based on the currently available forecast data, analyses in this study, as well as previous studies, have identified capacity and performance issues at Cleveland Avenue/Highway 99. At-grade intersection improvements as well as signal timing improvements alone are not sufficient to accommodate future traffic volumes. As identified in previous studies, a secondary Downtown access connecting to Clarke Drive/Highway 99 to alleviate the traffic volumes along Cleveland Avenue between Pemberton Avenue and Highway 99.

4.3.2 WHAT THE DISTRICT HAS HEARD

Aspirations: Respondents at the Public Open House and online survey provided the following suggestions regarding traffic and safety.

- Consider direct route away from community

- Reduce impact to residential area and schools
- Service downtown as well as Squamish Terminals
- Truck routes must be integrated into overall traffic plan

The attendees that participated in the stakeholder meetings indicated the following issues and concerns regarding traffic and safety.

- No increased traffic along transportation corridor or Swan Slough
- Efficient movement of trucks
- Account for growth
- Make light at Cleveland Ave and Highway 99 longer to allow downtown exit

Issues and concerns: Respondents from the Public Open House and online survey indicated the following issues and concerns related to traffic and safety.

- Senior population along north end of Third Street
- No controlled crossings on Third Avenue
- Noise and Dust issues on existing street with no preventative action
- Respect natural environment and enjoyment of estuary
- No truck route through Third Avenue as it is the most residentially dense area

The attendees that participated in the stakeholder meetings indicated the following issues and concerns regarding traffic and safety.

- Future traffic volumes – increased competition for space with trucks
- Short traffic light on Cleveland Ave at Highway 99
- Traffic Congestion

4.3.3 KEY ISSUES AND CHALLENGES

There is a need to review the future roadway network operations to ensure that traffic growth can be accommodated. Traffic growth forecasts show an average of approximately 3% growth in traffic volumes per year in Squamish. The major intersection of Cleveland Avenue/Highway 99 would experience significant congestion issues in absence of further intersection improvements. Most of the intersections located on north side of Downtown would face increased delays and congestions in the future. A second access to Downtown would help alleviate the congestion from this intersection as traffic balance between the two intersections on the highway at Cleveland Avenue and Clarke Drive.

Moreover, with population growth in the District as well as improved pedestrian and cycling facilities, the number of pedestrians and cyclists is expected to rise. These would pose further conflict with truck movements.

Although outside of Downtown, the intersection of Highway 99/Industrial Access Road (to/from Site B industrial area) immediately south of Stawamus River has been identified for safety concerns due to the intersection geometry and uncontrolled operation. Large volumes of trucks are reported to use the intersection to access Site B industrial area. The District is currently working with ICBC and the Ministry of Transportation and Infrastructure (MOTI) on a traffic operational safety review of this intersection. Improvements to this intersection would help the intersection to process higher volumes of trucks safely and in turn support the relocation of the current log sort of Garibaldi Forest Products. As a result, less trucks would be travelling along Loggers Lane.



Figure 4-12: Highway 99/Industrial Access Road Intersection

5 OTHER CONSIDERATIONS

Other crucial elements taken into account in order to assess the route options were social, community, environmental and archaeological impacts.

5.1 SOCIAL/COMMUNITY IMPACTS

Truck routes are necessary to provide goods and services as well as support local economic resilience. The local businesses and industry rely on these routes for efficient business operation. However, a truck route can be disruptive to a neighbourhood. Truck traffic can contribute to noise and emissions and trucks require a different approach to urban design.

5.1.1 FACTS AND OBSERVATIONS

Local Businesses: Squamish Terminals is a significant employer and relies heavily on truck transportation. The commercial businesses and construction sites in Downtown also require truck transportation to deliver essential goods and services.

5.1.2 WHAT THE DISTRICT HAS HEARD

Aspirations: Respondents from the Public Open House and online survey provided the following suggestions regarding community impacts.

- Consider direct route away from community
- Reduce impact to residential area and schools
- Service downtown as well as Squamish Terminals
- Truck routes must be integrated into overall traffic plan

The participants at the stakeholder meetings provided the following suggestions regarding community impacts.

- Liveability: Minimize conflicts with pedestrians and cyclists. Allow for good active transportation routes
- Seek balance between truck traffic and active modes along Loggers Lane
- Use of Western Route to remove trucks from downtown

- Routes to Highway 99 makes more sense for all community – commuters, downtown, and Squamish Terminals
- There need not be any conflict with a truck route

Issues and concerns: Respondents from the Public Open House and online survey indicated the following issues and concerns regarding community impacts.

- Senior population along north end of Third Street
- No controlled crossings on Third Avenue
- Noise and Dust issues on existing street with no preventative action
- Respect natural environment and enjoyment of estuary
- No truck route through Third Avenue as it is the most residentially dense area

The participants at the stakeholder meetings indicated the following issues and concerns regarding community impacts.

- The current truck route separates existing commercial/residential part of the Downtown from the Oceanfront
- Truck routes placed on pedestrian/cycling route or Safe Routes to School is problematic
- Dust issues arising from unpaved Bailey Street to Government Road is a current concern resulting in increasing neighbourhood complaints

5.1.3 KEY ISSUES AND CHALLENGES

Options that consider a crossing over the Mamquam Blind Channel are going to have visual impacts. Due to the vertical clearance restrictions required by the Navigable Waters Act, these crossings are expected to be very high – upwards of 20-25m high for the Westminster alignment. This ultimately impacts the view for residents on both sides of the bridge and could cause the ‘barrier’ effect on the communities. Depending on the location of the crossing, property expropriation would be required to accommodate the footprint of the bridge landing as well as impacts to the urban environment with some potential community displacement.

5.2 ENVIRONMENTAL/ARCHAEOLOGICAL IMPACTS

The District of Squamish has adopted many goals on environmental sustainability. The OCP and Estuary Management Plan indicate several goals towards transportation, buildings, waste, and energy alternatives. The community and stakeholders have also identified environmental and archaeological impacts as two of the priorities in the selection of truck routes. The results of environmental review

and archaeological overview assessment (AOA) conducted to evaluate the impacts of each option are included in **Appendix E**.

5.2.1 FACTS AND OBSERVATIONS

Environmental: The Coastal Flood Hazard Mitigation Strategy and Flood Protection Option Study states that much of Downtown Squamish is currently at risk of inundation from a coastal flood event with a return period of less than 200 years. Several options to protect the contiguous flood area were recommended in the study, one of which was the Western Route alignment. This option was contingent on the use of an existing 60 metre wide transportation corridor designated in the Squamish Estuary Management Plan. The corridor would be aligned with the existing railway corridor west of Downtown Squamish linking Squamish Terminals with the Business Park to the north. However, it has been identified that this option presents significant costs and environmental impacts to the estuary and would only be contemplated if a dedicated truck route were to be built there.

Environmental review has also identified sensitive areas within and around the Mamquam Blind Channel as well as the Cattermole Slough.

Archaeological: Archaeological review of the area identified that although there are no known archaeological sites in conflict, there are areas of moderate and high potential for the presence of unidentified archaeological sites are present in the project area.

5.2.2 WHAT THE DISTRICT HAS HEARD

Aspirations: Respondents from the Public Open House and online survey provided the following suggestions regarding environmental and archaeological impacts.

- Use trains on existing rail route; not as polluting as trucks
- Reduce impact to estuary
- Consider relocating Squamish Terminals to Watt point

The participants at the stakeholder meetings provided the following suggestions regarding environmental and archaeological impacts.

- Acknowledge trade-offs that took place in 1999 related to Squamish Estuary Management Plan (SEMP) Transportation corridor
- Maintain estuary habitat along transportation corridor
- A truck route that does not fragment estuary habitat
- Maintain natural habitat and ecological values on transportation corridor

- A habitat compensation arrangement can be devised to address potential intrusion into slough from needed Bailey Street to Government Road upgrade
- Natural capital valuation/ Blue Carson Values on Transportation corridor

Issues and concerns: Respondents from the Public Open House and online survey indicated the following issues and concerns regarding environmental and archaeological impacts.

- Don't want to lose rich estuary habitat
- Don't want to lose natural flood control
- Interference with existing trails and adverse effects on estuary

The participants at the stakeholder meetings indicated the following issues and concerns regarding environmental and archaeological impacts.

- SEMP (1999) is out of date
- District of Squamish is not recognising the value of estuary
- Increasing risk of spills/contamination incidents in natural environment/estuary
- Estuary habitat may be impacted by a dike upgrade and/or truck road; however, the estuary itself is changing
- Upgrading Bailey Street to Government Road access route to BCR Yards and Railway Heritage Park might involve some "disturbance at Slough"
- Estuary impact to service one industry – only Squamish Terminals to rail yards
- Noise pollution impacts to bird biodiversity in estuary
- Improve air quality; reduce stormwater runoff into stream

5.2.3 KEY ISSUES AND CHALLENGES

Squamish Estuary is a highly productive ecosystem that acts as critical flood mechanism. It is also identified as a conservation area. The Western Route would encompass a large footprint in the estuary affecting the existing ecosystem. Although this corridor benefits the industry by providing direct connection from Downtown to the Business Park, there are limited benefits to general traffic. The transportation corridor would also require additional railway crossings along the corridor, which is undesirable for CN Railway.

6 TRUCK ROUTE OPTIONS

The Multi-Modal Transportation Plan identified three potential routes through the Downtown (including the existing route). Additional options for crossing the Mamquam Blind Channel were also included, with reference to past studies. Truck Route Options reviewed are highlighted in **Figure 6-1**, below.

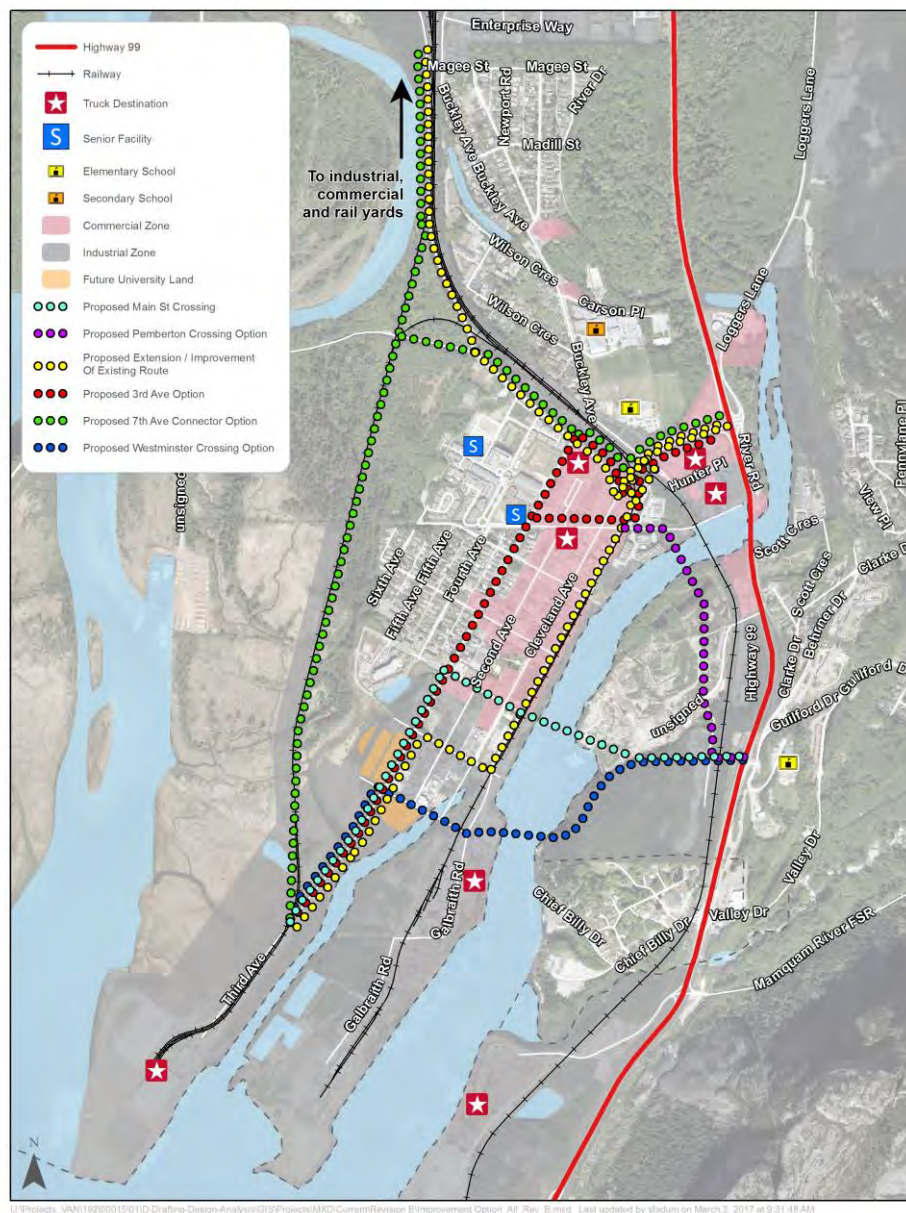


Figure 6-1: Proposed Downtown Truck Route Options

Option 1: Loggers Lane. Maintain the Existing Downtown Route with extension to connect with Government Road.

- Increasing conflicts between truck movements and residential uses are anticipated along Logger's Lane.
- It will be increasingly difficult to provide efficient truck movement, while also delivering the high quality public realm envisioned by the District along this route.
- Growing commercial vehicle volumes along with growth in private vehicles due to residential development are expected to increase delays, especially during summer months.
- With Highway 99 as the only viable connection between the Business Park and Squamish Terminals, commercial vehicles will increasingly be delayed by local and recreational traffic.
- The potential future connection to Government Road along Bailey Street presents challenges due to road conditions, challenging geometry, existing turn restrictions, and access issues.

Option 2 - Third Avenue to Bailey Street with extension to connect with Government Road and connection via Pemberton Avenue to Cleveland Avenue.

- The existing Commercial Vehicle Route includes Third Avenue from Vancouver Street to Squamish Terminals.
- Third Avenue continues from Vancouver Street to a full movement intersection at Bailey Street.
- On Third Avenue, trucks could be expected to conflict with residential and commercial retail land uses, including seniors' homes and a popular route to schools.
- Third Avenue is being considered as a potential bicycle route through the Active Transportation Plan. Cycling routes and truck routes are difficult to implement on the same corridor. If the two are co-located, additional consideration would need to be given to design elements that would mitigate conflict and improve comfort for drivers and cyclists.

Option 3 – Western Route connecting south end of Third Avenue to Government Road with possible connection to Cleveland Avenue via Pemberton Avenue or Bailey Road.

-
- Source: Coastal Flood Hazard Mitigation
- Map 3-10-17

provided for coastal flood protection works at Reach 2. The Seventh Avenue Connector Option sea dike is shown in green in Figure 6-2.

Option 4 - Mamquam Blind Channel Crossing connecting to Highway 99 in the Clarke Drive area via a bridge connection at Westminster Street, Main Street or Pemberton Avenue.

- The Westminster Street Bridge Crossing was included in the 2031 Downtown Transportation Plan (2009); the plan recommended protecting a right-of-way for future development. At the time of development of that plan, stakeholders expressed some concern about the development of a road along this alignment.
- The Pemberton Avenue Crossing was one of the three crossings shortlisted for evaluation in the Alternative Downtown Access – Route Selection Study. The Westminster Street Crossing was selected as most favourable option for the alternate downtown access in this study.
- Mamquam Blind Channel is a navigable waterway with active recreational and industrial marine traffic. Any crossing over the channel will be required to maintain navigable clearance and Transport Canada will be a key stakeholder in the consideration of this option.

- There is a high cost associated with building a new channel crossing, new roadway, and a new railway crossing associated with this option.

6.1 OPTION EVALUATION

Preliminary option evaluation criteria were developed with consideration to standard Multiple Account Evaluations set by provincial and federal business casing guidelines. With input from the public, stakeholders, District, and Council, a project specific evaluation criteria was established for this study. This evaluation included the following criteria:

- **Travel Time:** The travel time assessments were based on the traffic operational analysis carried out using the 2031 traffic volumes. For each option, a PM peak analysis was carried out and travel time from Squamish Terminals to the highway were estimated. Squamish Terminal was chosen as the starting destination since it is the farthest truck destination from the highway.
- **Community:** This account evaluates the potential impacts of each option on the community. These are generally qualitative measures but are considered in combination with the more quantifiable economic indicators. Factors that are typically considered include:
 - Noise, Visual and Pollution Impacts – exposure and magnitude;
 - Community Displacement – Land Acquisition; and
 - Community Severance – the barrier effect of roadways on pedestrian traffic.

When evaluating competing options, these factors are usually considered using a single qualitative measure of low, moderate or high impact, with low being the most favourable and high being the least favourable.

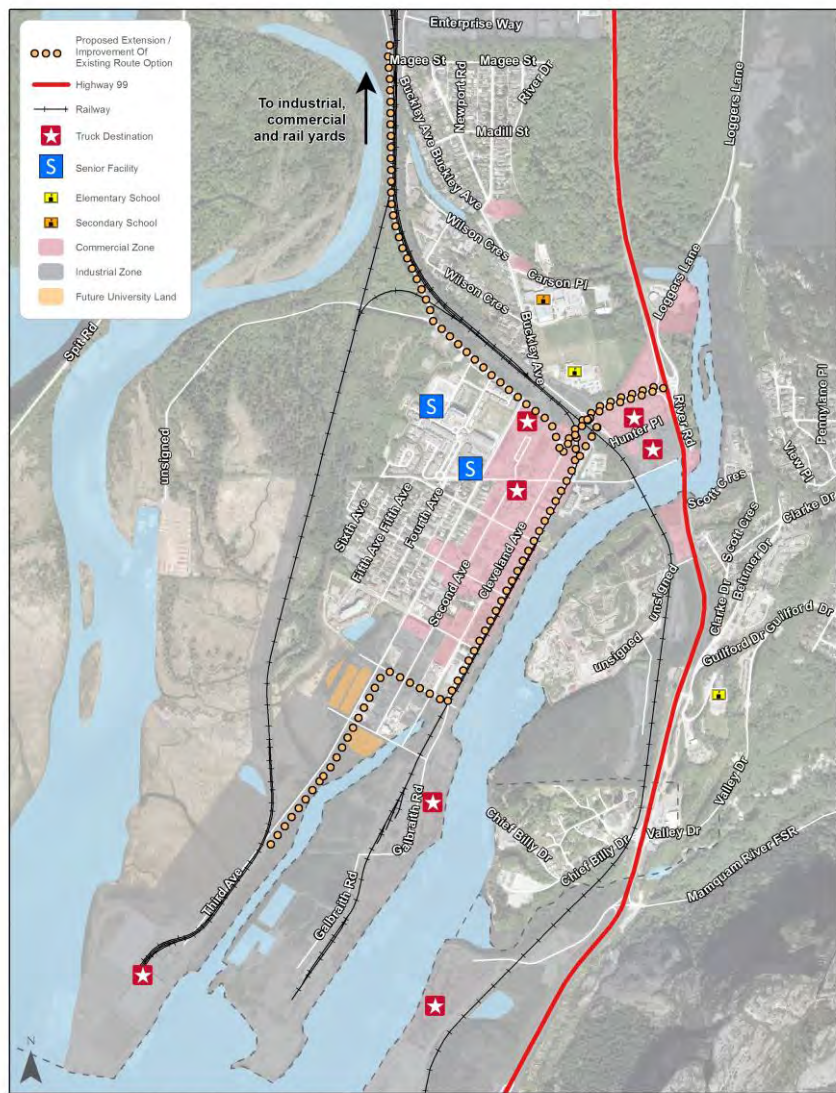
- **Health:** The health account considers the emissions output from the trucks and proximity of residential areas to the truck routes. This account was in response to a Council specific request.
- **Environmental:** The environmental account is intended to identify any significant environmental impacts resulting from the proposed options. This is not intended to replace an environmental assessment, if required, but only as a qualitative measure of potential impact. An environmental review was conducted by Hatfield to compare the truck route options under consideration. The study is included in **Appendix D**. Thurber Engineering also completed a geotechnical desktop review of the proposed options. The geotechnical review is attached in **Appendix D**.
- **Archaeological:** An archaeological overview assessment (AOA) was undertaken out by Amec Foster Wheeler Environment & Infrastructure and included in **Appendix D**.
- **Cost:** Order of magnitude cost estimates were prepared for each option, referencing previously completed designs and cost estimates where available. Estimates were updated where necessary to incorporate revised design considerations that were identified as part of this study.

- **Alignment with multiple District priorities:** The options were also evaluated for whether they align with District's other priorities identified in the planning documents such as the Official Community Plan, Downtown Transportation Plan, and Active Transportation plan.

6.2 OPTION 1 – LOGGERS LANE

The Loggers Lane option would include retaining the current route with the improvements along the route such as widening the corridor, enforcing no parking, and widening corner radii at existing intersections identified in the previous sections. In particular, the intersection of Third Avenue and Vancouver Street will require widening on the south and east approach to better accommodate the northbound right turning and westbound left turning truck movements. Similarly, the intersection of Loggers Lane and Vancouver Street will require widening on the north and west approach to better accommodate the eastbound left turning and southbound right turning truck movements.

However, this option alone does not address key constraints including capacity at Cleveland Avenue and Highway 99.



- **Travel Time:** Under Loggers Lane option, the trucks travelling from Squamish Terminals would have to route through the unsignalized intersections of Third Avenue/Vancouver Street and Loggers Lane/Vancouver Street.
- **Community:** Since the trucks are already travelling on Loggers Lane, there are less perceived impacts or changes in impacts to the community due to this option. However, if additional ROW

can be acquired from BC Rail to widen the corridor, the design of proposed new residential developments on the east side of Loggers Lane will be impacted. Some of the current applications envision Loggers Lane with parking pockets and separated bike lanes. These features will need to be considered further for feasibility with this option.

- **Health:** Trucks are already travelling along this route, thus the health impacts due to a change in emission levels are expected to be low.
- **Environmental:** As this route option is already contained in an urban area, no significant environmental impacts are expected due to this option.
- **Archaeological:** No documented archaeological sites are located within or immediately adjacent to the route alignment. Ethnographic accounts identify a traditional use site on the route alignment near the Squamish docks at Vancouver Street and Loggers Lane. The Squamish Forest District archaeological potential model displays a small area of moderate potential along Cleveland Avenue, between Buckley Avenue and Highway 99. However, the route alignment is situated in an area that has been profoundly modified by urban development, including road and railway construction, and industrial and residential land use. As such, the proposed route alignment is considered to have low-to-moderate potential for unidentified archaeological sites.
- **Cost:** This option is expected to be the lowest cost to implement. Order of magnitude cost estimates for improving Loggers Lane are \$3M-\$5M, which includes intersection improvements and some spot treatments for crossings. The estimate also includes an allowance for additional pedestrian/cycling facilities, but may be done as part of development. Should the Bailey Street connection also be completed, and additional \$3M-\$5M could be expected depending on road rehabilitation requirements and extents. No land acquisition costs are included in the estimates.
- **Alignment with multiple District priorities:** Loggers Lane is identified as major bicycle and pedestrian routes within Downtown Squamish. There are residential developments planned along the east side of this roadway, which would further necessitate needs for better active transportation infrastructure along this corridor. It is noted that Loggers Lane will likely be required to accommodate trucks in the short to medium term for the construction of the Oceanfront area.

Table 6-1 summarizes the benefits and issues/constraints associated with this option.

Table 6-1: Benefits, Issues, and Constrains Summary for Loggers Lane Option

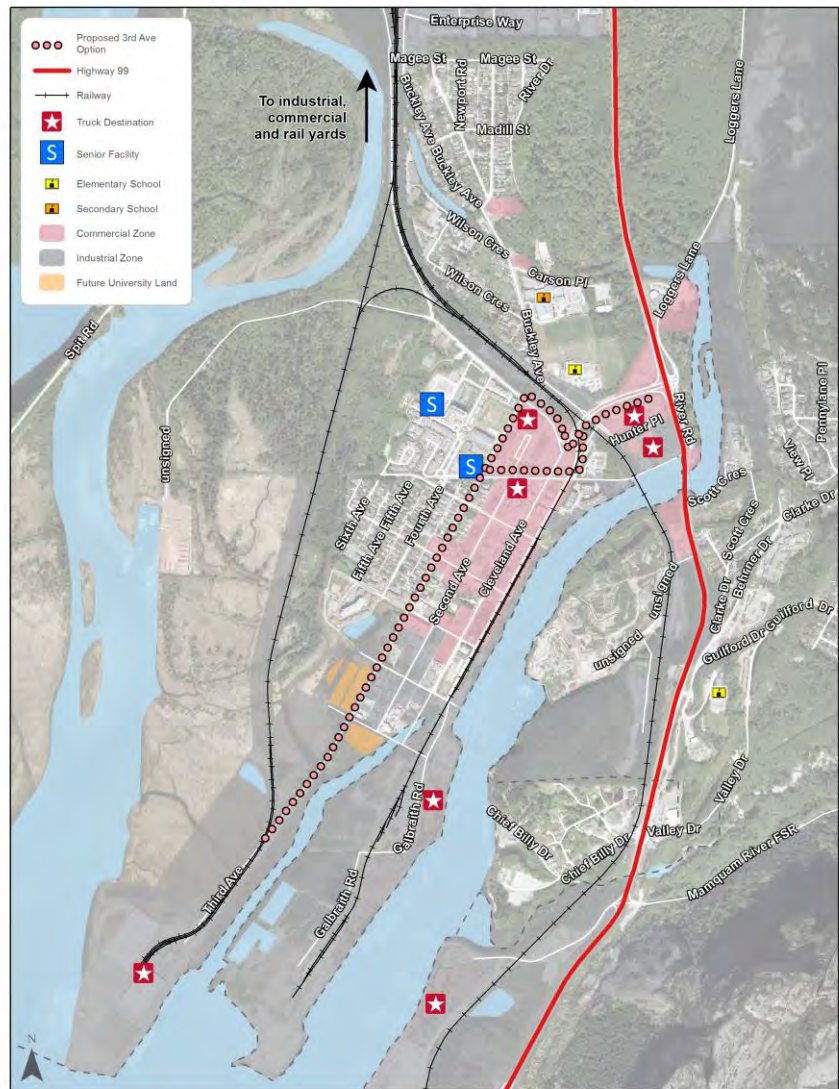
Benefits	Issues and Constraints
<ul style="list-style-type: none"> • Maintaining existing route with improved geometry for truck movements would require low cost to implement • Impact to environment would be minimal • Impact to community would be minimal 	<ul style="list-style-type: none"> • Does not address capacity issues - Unless network improvements are implemented in Downtown Squamish, trucks will experience the same delays as general traffic • Noise issues for existing and future developments along Loggers Lane

Option 1 is recommended for the short-term based on the benefits identified and continued needed through the short-medium term in serving industry needs as well as construction in the downtown area.

6.3 OPTION 2 – THIRD AVENUE

The Third Avenue option includes reconfiguring the Third Avenue corridor to accommodate trucks through a residential and business area. In order to develop a truck route along Third Avenue, the corridor would require widening with removal of on-street parking. The intersections where trucks are expected to turn, such as Third Avenue and Pemberton Avenue as well as Pemberton Avenue and Cleveland Avenue, would also require widening to accommodate truck turning.

- Travel Time:** The travel time under this option is comparable to the travel time for trucks using Loggers Lane. However, the connection from Loggers lane to Cleveland Avenue is more direct whereas the trucks would have to travel on the busy Pemberton Avenue corridor through the Downtown.
- Community:** The Third Avenue corridor includes residential and commercial development on both sides of the street. Most of these developments were built without the anticipation of trucks running along Third Avenue corridor. As such, the homeowners and businesses along this corridor would be susceptible to truck noises if this option were to be chosen. Additionally, there is heavy presence of seniors along this corridor on the north side of Pemberton Avenue. Routing trucks through the intersections used by seniors would cause additional conflict especially at the crossings.



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- **Health:** The emission from trucks travelling along the corridor is insignificant compared to the emissions emitted by general traffic already travelling on this corridor.
- **Environmental:** No significant environmental impacts are expected due to this option.
- **Archaeological:** No documented archaeological sites are located within or immediately adjacent to the route alignment. The Squamish Forest District archaeological potential model for the route alignment displays an area with moderate potential along Cleveland Avenue, between Buckley Avenue and Highway 99. Like the Loggers Lane route however, Third Avenue alignment is situated in an area that has been profoundly modified by urban development, including road construction, and industrial and residential land use. As such, the proposed route alignment is considered to have low-to-moderate potential for unidentified archaeological site.
- **Cost:** The cost associated with this option includes changes to the corridor as well as some intersections improvements. Third Avenue currently has a narrow ROW with parking allowed on both sides of the road. There are utility lines running east-west along the corridor that may pose clearance issues for some trucks. The cross section of the roadway would require changes to accommodate trucks, however, there are currently adequate ROWs to implement these changes. As the road is not currently a truck route, it may also require additional improvements to the pavement structure. The order of magnitude costs for this option are approximately \$7M-\$10M. The estimate includes intersection improvements, road rehabilitation, and installation of traffic signals. No land acquisition costs are included in the estimate.
- **Alignment with multiple District priorities:** Third Avenue is identified as a major bicycle and pedestrian route within Downtown Squamish. In the short term, improvements in pedestrian and bicycle facilities are recommended along this corridor. Upon implementation of these improvements, this corridor would serve as an important north-south connection within Downtown Squamish for pedestrians and cyclists alike.

Table 6-2 summarizes the benefits and issues/constraints associated with this option.

Table 6-2: Benefits, Issues, and Constrains Summary for Third Avenue Option

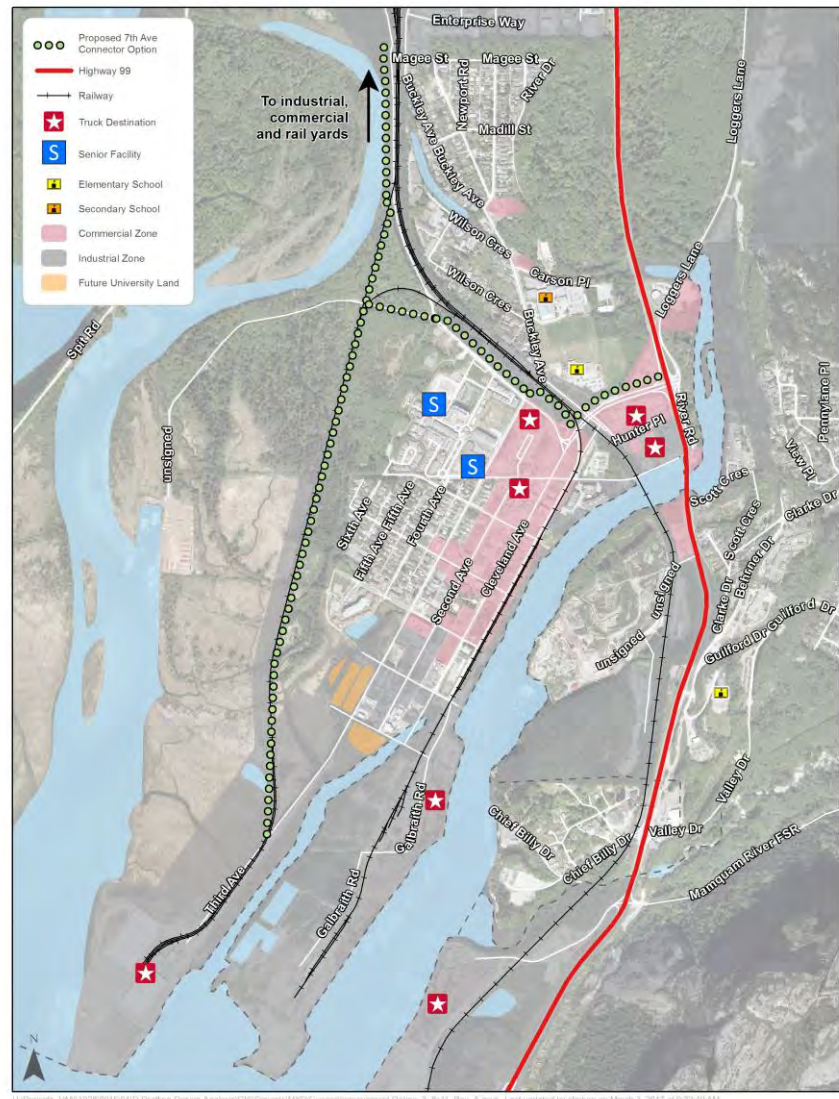
Benefits	Issues and Constraints
<ul style="list-style-type: none"> • Improvements to Third Avenue corridor may be lower cost to implement • Impact to environment would be minimal 	<ul style="list-style-type: none"> • Does not address capacity issues - The travel time on Third Avenue would be similar as Loggers Lane • Noise issues for existing developments along Third Avenue • Conflicts with recommended bicycle route. • Popular route to schools • Improving the corridor to accommodate trucks would result in conflict with other road users especially with the presence of seniors crossing Third Avenue to access shopping and services

Option 2 is not recommended for future consideration due to the issues and constraints identified.

6.4 OPTION 3 – WESTERN ROUTE

The Western Route, previously labelled as “Seventh Avenue Connector” has been referred to by some people as the estuary route. This option utilizes a potential dike alignment to construct a new transportation corridor. This corridor would only be used by truck traffic, redirecting many of the trucks travelling from south of Downtown towards Highway 99.

- Travel Time:** The Western Route would be open to truck traffic exclusively. This eliminates conflicts with all other road users and allows the trucks to travel with minimal to no stops. However, there are two possible connections to the north on this route: one via Bailey Street to Cleveland Avenue, another via Bailey Street to Government Road. Once on Bailey Street, trucks would still have to travel through the residential areas until reaching Cleveland Avenue and subsequently turn left on to connect to the highway. This would require a redesign of Bailey Street/Cleveland Avenue intersection. Either route will be more circuitous for the trucks resulting in longer travel time than the previous two options.
- Community:** The majority of the developments south of Bailey Street would be free of truck-related issues with development of this option. However, the residential developments located



on either side of Bailey Street would be impacted if trucks were allowed to connect to Cleveland Avenue via Bailey Street.

- **Health:** Since the trucks would be mostly travelling along the transportation corridor, Downtown residents would be less exposed to the emissions.
- **Environmental:** The transportation corridor would add footprint to the recommended dike requirements causing further impacts to the estuary. Significant environmental impacts are expected due to the construction of this corridor.
- **Archaeological:** No documented archaeological sites are located within or immediately adjacent to the route alignment. Four known archaeological sites within 10 km of the route alignment are situated in similar settings along the Squamish River. Ethnographic accounts identify a traditional use site of undetermined location within Squamish estuary. The route alignment is situated in an area that has been affected by railway construction, but has otherwise not been impacted by residential or industrial activities and is mostly intact. As a result, the proposed route alignment is considered to have moderate-to-high potential for unidentified archaeological sites.
- **Cost:** Due to the construction of new infrastructure, there are significant cost implications with this option. However, since the construction of a new dike is contingent on the construction of the transportation corridor, the combined cost of construction for a dike and transportation corridor could be reduced. The current recommended dike alignment does not follow this route. Previous order of magnitude cost estimates for this option have ranged from \$35M to \$50M, depending on if the road was completed by itself, or if it was completed as a dike. It is noted that the District no longer favours the integration of this road with a dike, however. The cost estimates prepared generally assume construction of approximately 3km of length for the Western Route (Seventh Avenue connector), allowances for added rail crossings, improvements to Bailey Street and an allowance for intersection improvements. Proximity to the rail line and associated impacts due to settlements is also a concern and not specifically incorporated in the estimate. Land acquisition costs are not included in the estimate.
- **Alignment with multiple District priorities:** A transportation corridor as identified in this option would only serve truck traffic. This option does not aid in alleviating traffic issues in Downtown, and the District no longer views this option as being paired with a future dike. As such, this option does not align with any other District's priorities other than limiting trucks out of Downtown.

Table 6-3 summarizes the benefits and issues/constraints associated with this option.

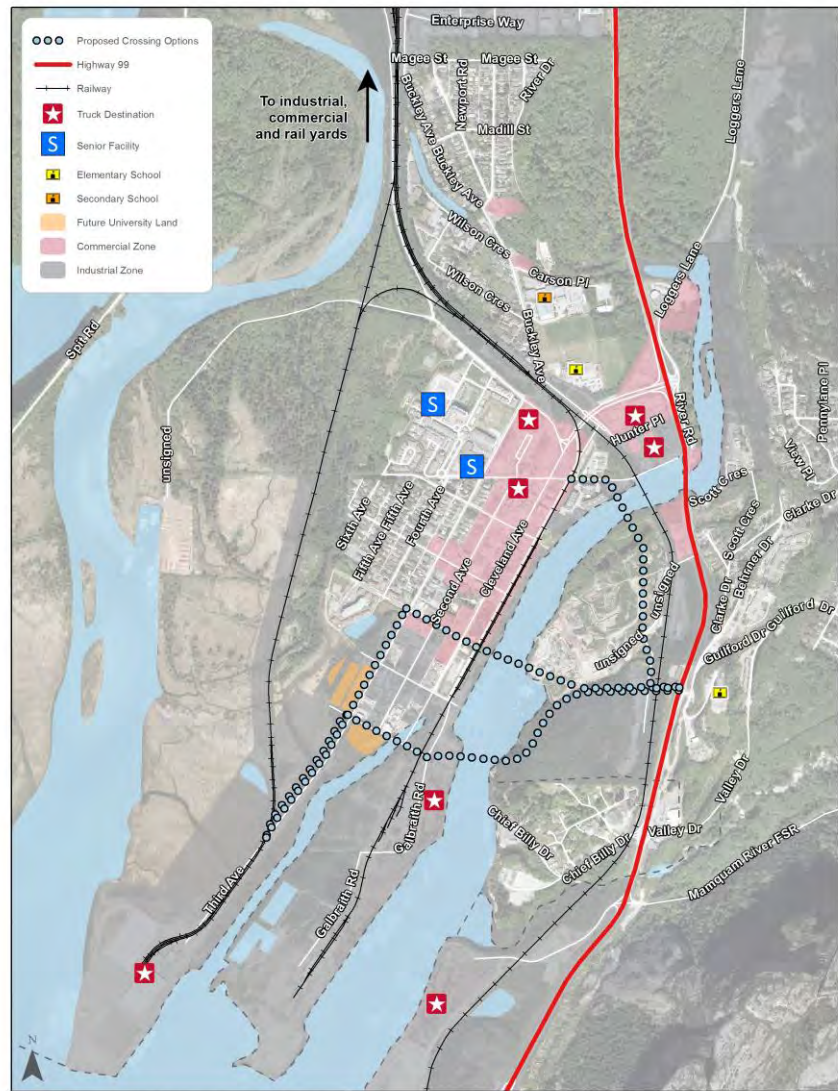
Table 6-3: Benefits, Issues, and Constrains Summary for Option 3 – Western Route Option

Benefits	Issues and Constraints
<ul style="list-style-type: none"> • Completely avoids the Downtown area • Provides more direct connection to rail yards • Reduced conflict with other road users • Potential synergy with a new downtown dike 	<ul style="list-style-type: none"> • Require land acquisition • Requires additional rail crossings • Additional footprint on proposed dike requirements • Longer travel path for trucks that are destined to Highway 99 • Environmental impacts due to construction of new infrastructure • Is no longer anticipated to be completed as part of a dike

Option 3 is not recommended for future consideration due to the issues and constraints identified above.

6.5 OPTION 4 – MAMQUAM BLIND CHANNEL CROSSINGS

The three additional options are contingent on new crossings over Mamquam Blind Channel. Traffic analyses carried out in this study and in previous studies have confirmed the need for a secondary access into Downtown to accommodate the future traffic volumes. The crossings would connect the existing roadways in Downtown to future roadways on the east side of the Blind Channel and eventually connect at Clarke Drive/Highway 99 intersection. Since these connections would bypass several Downtown intersections expected to experience capacity issues, they would be suitable for future truck routes. The crossing locations evaluated in this study are: Westminster Street, Main Street, and Pemberton Avenue. These options have higher cost implications, however, provide much needed mobility improvements for general traffic in the future. Each have been identified in past studies, but were reviewed again as part of this study.



6.5.1 OPTION 4A – WESTMINSTER STREET CROSSING

Westminster Street is a proposed roadway south of Vancouver Street which would run in east-west direction. A bridge over Mamquam Blind Channel would connect the Westminster Street ROW on the east side to the First Nations land on the west side.

- **Travel Time:** From Squamish Terminals, this option would provide the fastest travel time to the highway as it bypasses most Downtown intersections.
- **Community:** Most of the impacts of this option would be on the Oceanfront Development and Waterfront Landing. As the future transportation network is planned on the east side of Mamquam Blind Channel, the future roadways could be built to accommodate trucks along this route. Noise levels should be assessed to confirm if any sound attenuations measures are required. It is noted this overpass location would also be the highest option over the Mamquam Blind Channel. As such the landing of the overpass would be expected to have some additional community impact.
- **Health:** The overall health benefits due to moving the trucks away from the busy Downtown areas to a corridor with low traffic volumes result in less health impacts.
- **Environmental:** There would be some environmental impacts due to the construction of new bridge, however, initial reviews have shown that there are minimal impacts to wildlife.
- **Archaeological:** No documented archaeological sites are located within or immediately adjacent to the route alignment area. One known archaeological site is located within 500 m of the route alignment on Stawamus IR 24. The Squamish Forest District archaeological potential model for the route alignment display an area of high potential on the east side of Mamquam blind Channel from north of Chief Billy Drive to the edge of the bluffs at the north side of Stawamus IR 24. The model also displays an area of moderate potential on the east side of Mamquam Blind Channel from undeveloped lands on Stawamus IR 24 to Highway 99 at Clark Drive. Ethnographic accounts identify two traditional use sites on the route alignment on Stawamus IR 24. As such, the proposed route alignment is considered to have moderate-to-high potential for unidentified archaeological sites.
- **Cost:** The order of magnitude cost for this option is \$65M–\$75M (referencing and updating from the cost estimate previously completed by SNC, 2006). It is noted that the previous design, for which the estimate was referenced, was for a 13.2m high clearance to structure. The current navigable water requirements may be upwards of 25m which requires a higher structure, extended approach ramps and higher cost. The cost estimate assumes an at-grade intersection at Clarke Dr, overpass over the rail line, road connector (including significant rock cut (upwards of 27m in previous design)), bridge structure over the Mamquam Blind Channel, bridge structure over the Cattermole Slough, approach ramps and various road improvements. Land acquisition costs are not included in the estimate.

- **Alignment with multiple District priorities:** The Westminster Street crossing was identified for future consideration in the Downtown Squamish Transport Plan (CTS, 2009). A crossing over Mamquam Blind Channel that connects Downtown Squamish to Highway 99 at Clark Drive would provide a secondary access to Downtown. As traffic in Downtown is expected to be a major issue in the long term, this connection would help alleviate traffic congestion problems at Downtown intersections. Westminster Street Crossing in particular would route truck traffic away from Loggers Lane. This would allow implementation of robust active transportation infrastructure along Loggers Lane. As such, this option is expected to help District achieve multiple priorities in the long term.

Table 6-4 summarizes the benefits and issues/constraints associated with this option.

Table 6-4: Benefits, Issues, and Constrains Summary for Option 4A - Westminster Street Crossing

Benefits	Issues and Constraints
<ul style="list-style-type: none"> • Avoids downtown area • Provides second access for vehicles to downtown • Allows emergency vehicles access if the rail crossing at Cleveland Avenue is blocked • Provides grade separation of rail • Reduced conflict with other road users in Downtown 	<ul style="list-style-type: none"> • Requires property/agreements with Squamish First Nation and/or Waterfront development • Impact on future development lands in the Oceanfront area • Visual, community, environmental, and archeological impacts

Option 4A is recommended for future consideration in the long term based on its connection to industry and benefits as a secondary access from Highway 99 to Downtown.

6.5.2 OPTION 4B – MAIN STREET CROSSING

The Main Street crossing would be located centrally in Downtown Squamish. As such, traffic is expected to travel from both north and south of Main Street. The trends in traffic movements is expected to change drastically due the location of this crossing. The trucks would remain a small portion of the traffic and face conflicts with other road users.

- **Travel Time:** Due to the proximity of this crossing from residential and other commercial businesses, a large amount of existing traffic in and out of Downtown are expected to reroute through this connection. As such, a moderate level of congestion is expected at the intersections connecting Main Street to the bridge. The travel time would thus be slower than the Westminster crossing option.
- **Community:** This option would have major impacts to the developments located near Loggers Lane/Main Street intersection. The bridge footprint would require a significant expropriation as the grade requirements of the bridge would require a landing west of Loggers Lane. As the future transportation network is planned on the east side of the Blind Channel, the future roadways could be built to accommodate trucks along this route. Noise levels should be assessed to confirm if any sound attenuations measures are required. It is noted that a crossing at this location would likely not be as high as the crossing at Westminster Highway, but would have additional community impacts on the landings of the structure.
- **Health:** The overall health benefits due to moving the trucks away from the busy Downtown areas to a corridor with low traffic volumes result in less health impacts.
- **Environmental:** There would be some environmental impacts due to the construction of new bridge, however, initial reviews have shown that there are minimal impacts to wildlife.
- **Archaeological:** No documented archaeological sites are located within or immediately adjacent to the route alignment area. One known archaeological site is located within 500 m of the route alignment on Stawamus IR 24. The Squamish Forest District archaeological potential model for the route alignment display an area of moderate potential on the east side of Mamquam Blind Channel from undeveloped lands on Stawamus IR 24 to Highway 99 at Clark Drive. Ethnographic accounts identify two traditional use sites on the route alignment on Stawamus IR 24. As such, the proposed route alignment is considered to have moderate-to-high potential for unidentified archaeological sites.
- **Cost:** The order of magnitude cost for this option is \$40-50M. (The estimated cost was derived referencing estimated cost estimates already established for the Westminster Crossing and Pemberton Crossing). The cost estimate assumes an at-grade intersection at Clarke Dr, overpass over the rail line, road connections, bridge structure over Mamquam Blind Channel, approach ramps and various road improvements. Land acquisition costs are not included in the estimate, however it is noted that this option would require additional property acquisitions in the downtown on Main Street between Loggers Lane and Third Avenue.

- **Alignment with multiple District priorities:** Similar to Westminster Crossing, this option would also help alleviate traffic congestion problems at Downtown intersections. Although Main Street crossing is situated north of Westminster Street alignment, the truck traffic would still be routed away from most of the Loggers Lane corridor. The Main Street crossing was not carried as a recommendation in the Downtown Squamish Transport Plan (CTS, 2009), but its implementation would assist in providing a secondary option to downtown for motor vehicles, pedestrians and cyclists. Therefore, this option is expected to help District achieve multiple priorities in the long term.

Table 6-5 summarizes the benefits and issues/constraints associated with this option.

Table 6-5: Benefits, Issues, and Constrains Summary for Option 4B – Main Street Crossing

Benefits	Issues and Constraints
<ul style="list-style-type: none"> • Avoids downtown area • Provides second access for vehicles to downtown • Allows emergency vehicles access if the rail crossing at Cleveland Avenue is blocked • Provides grade separation of rail • Reduced conflict with other road users in Downtown 	<ul style="list-style-type: none"> • Requires property/agreements with Squamish First Nation and/or Waterfront development • Impact on downtown development areas with approach/ramp structures • Visual, community, environmental, and archeological impacts

Option 4B is not recommended for future consideration due to the issues and constraints identified.

6.5.3 OPTION 4C – PEMBERTON AVENUE CROSSING

Pemberton Avenue crossing would connect Pemberton Avenue on the west side of the Blind Channel to Laurelwood Road on the east side. The improvements suggested for Loggers Lane option would still be required as the new section of the route only starts past the Loggers Lane/Pemberton Avenue intersection. Since Laurelwood Road runs outside of the Waterfront Landing development, there's opportunity to build the roadway to arterial standard with provision for trucks. This would also provide businesses with a new route to transport oversize loads.

- **Travel Time:** The travel time savings with this options only starts past Pemberton Avenue. The new route via crossing over the Blind Channel helps to avoid the congested section of Cleveland Avenue between Buckley Avenue and Highway 99. This route would also reduce the amount of tight turns and stops at intersections. Since the trucks still have to travel along Loggers Lane to Pemberton Avenue, the travel time is expected to be higher than the other two crossing options.
- **Community:** This option relies on the existing Loggers Lane truck route. As such, new developments on the east side of Loggers Lane would be susceptible to the impacts. The developments on either side of Laurelwood Drive would also be impacted. It is noted that this would be the lowest height of the three locations identified and would have reduced impacts on landings as compared to Main Street and Westminster Street options.
- **Health:** The overall health benefits is neutral as most of the route would still use the existing Loggers Lane corridor.
- **Environmental:** There would be some environmental impacts due to the construction of new bridge, however, initial reviews have shown that there are minimal impacts to wildlife.
- **Archaeological:** No documented archaeological sites are located within or immediately adjacent to the route alignment area. One known archaeological site is located within 500 m of the route alignment on Stawamus IR 24. The Squamish Forest District archaeological potential model for the route alignment display an area of moderate potential on the east side of Mamquam Blind Channel from undeveloped lands on Stawamus IR 24 to Highway 99 at Clark Drive. As such, the proposed route alignment is considered to have moderate-to-high potential for unidentified archaeological sites.
- **Cost:** The order of magnitude cost for this option is \$25–30M (referencing and updating from the cost estimate previously completed by SNC, 2006). The cost estimate assumes an at-grade intersection at Clarke Dr, overpass over the rail line, road connector, low level bridge structure over the Mamquam Blind Channel, bridge, approach ramps and other associated road improvements. The design assumed at-grade intersection at Clarke Dr, road connector, structure over Mamquam Blind Channel, structure over Cattermole Slough, approaches and road improvements.
- **Alignment with multiple District priorities:** The Pemberton Avenue crossing was recommended for the 2031 horizon in the Downtown Squamish Transport Plan (CTS, 2009),

noted in the Multi-Modal Transportation Plan (OPUS, 2011), and has been recently referenced as part of the Waterfront development concepts. The crossing at this location allows trucks to divert away from the busy Downtown intersections to the north. However, unlike the two other Mamquam Blind Channel crossings discussed above, this option would not reduce the number of trucks using the Loggers Lane corridor. Implementation of active transportation infrastructure along Loggers Lane also requires some additional consideration in the long term with this option. Overall, this option aligns with multiple district priorities.

Table 6-6 summarizes the benefits and issues/constraints associated with this option.

Table 6-6: Benefits, Issues, and Constrains Summary for Option 4C - Pemberton Avenue Crossing

Benefits	Issues and Constraints
<ul style="list-style-type: none"> • Provides second access for vehicles to downtown • Allows emergency vehicles access if the rail crossing at Cleveland Avenue is blocked • Provides grade separation of rail 	<ul style="list-style-type: none"> • Requires property/agreements with Waterfront development • Visual, community, environmental, and archeological impacts

Option 4C is recommended for future consideration in the medium-long term based on its likely connection to and requirement of future development.

6.6 EVALUATION SUMMARY

An evaluation for all options were carried out by assessing the merits and demerits in each criterion discussed in the previous section. Evaluations were completed as a relative measure between options. It is noted that no specific weighting was applied to any criteria and therefore the comparison between the options were not based on an average score. **Figure 6-3**, below, summarizes the completed evaluation matrix including summary recommendations to each option. Recommendations are further described in **Section 7** of this report.

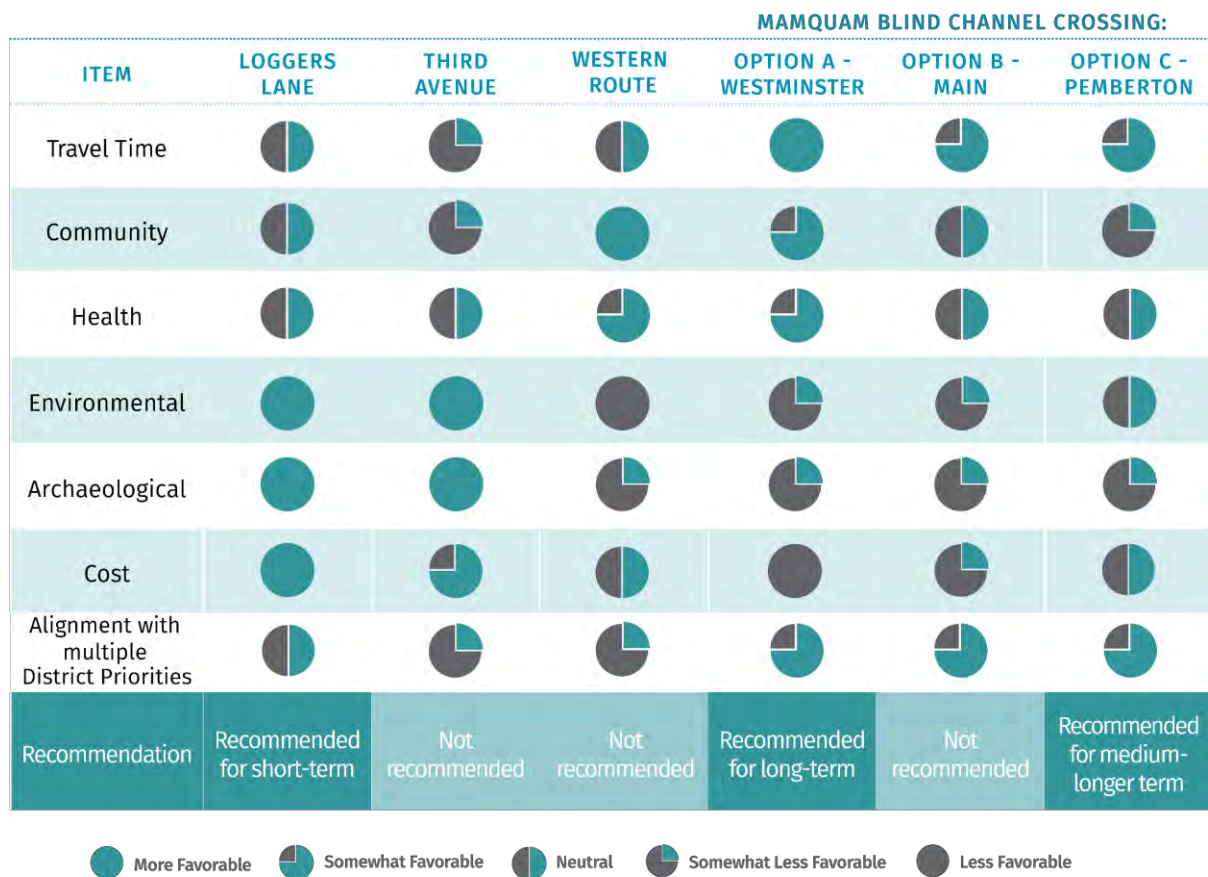
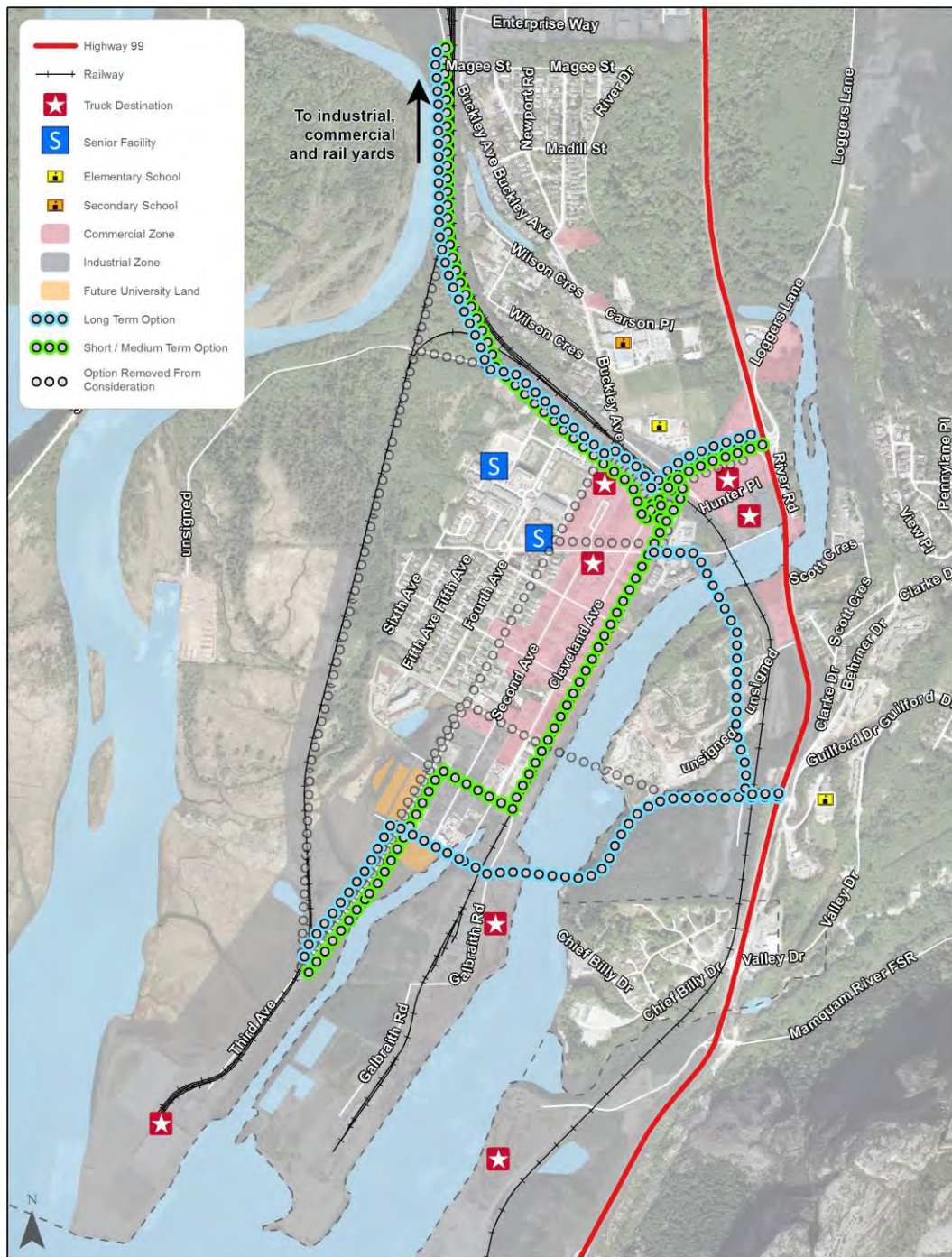


Figure 6-3: Proposed Downtown Truck Route Options

Figure 6-4 illustrates all the Downtown truck route options considered as part of this study and highlights the recommended short term and medium to long term truck routes.



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Figure 6-4: Recommended Short Term and Long Term Truck Routes

6.7 PUBLIC FEEDBACK

A second Public Open House was held in November 16, 2016 to present and seek feedback on the results of technical evaluation and proposed recommendations. As part of the open house, an online survey was also available for interested parties to provide comments related to issues and concerns with the routes that are recommended as part of short-term and long-term solutions. A detailed summary of the survey is presented in Appendix A.

The major findings from the survey are discussed below.

- 80% of the respondents found the evaluation matrix provided to help assess the options were suitable.
- Majority of the respondents agreed with the evaluation presented for Loggers Lane (83%), Third Avenue (64%), Westminster Street (70%), and Main Street (72%). 55% of the respondents agreed with the evaluation presented for Western Route. Only 47% of the respondents agreed with the evaluation presented for Pemberton Avenue. The disagreement lied in the evaluation for community criteria.
- Respondents felt that the evaluation for impacts in community were subjective. One community isn't more important than the other community.
- Respondents were largely supportive of the recommended short, medium, and long term options. Community is supportive of bridge options for long term solution but concerned about the cost implications of these options.

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7 RECOMMENDATION SUMMARY

The recommended truck routes are classified as short, medium, or long term. The short-term option can be implemented in the near future and requires few improvements when compared to the medium and long term options. The medium and long term options take into account the future growth and changing travel patterns and therefore require major infrastructure upgrades. The following sections identify the specific recommendations to the various terms.

7.1 SHORT-TERM RECOMMENDATIONS

Loggers Lane is recommended in the short-term to continue serving as a truck route in downtown Squamish connecting to Cleveland Avenue and ultimately to Highway 99. The following additional considerations are noted with this recommendation:

- Conduct further preliminary and detailed design of improvements for the following intersections and prioritize improvement funding for the following intersections:
 - Third Avenue/Vancouver Street
 - Loggers Lane/Vancouver Street
- Consider restricting parking along and directly off Loggers lane.
- Consider widening of Loggers Lane to expand the street section and to better accommodate pedestrians and cyclists by acquiring BC Rail ROW running adjacent to Loggers Lane.
- Review the quality of pedestrian and cycling facilities, particularly the crossings.
- Ensure pavement quality is appropriate for the truck loads along the route.
- Confirm the appropriateness of posted speed limits. Review the speed limits if Loggers Lane is widened or pedestrian activities increase along Loggers Lane.
- Maintain east-west stop controlled operations at unsignalized intersections to allow free-flow operation for the north-south traffic.
- Notify the developers currently planning to develop along Loggers Lane to consider provision of noise mitigation measures on the planned development.
- Collaborate with the Ministry to improve the operation at Cleveland Avenue/Highway 99.
- Support intersection improvements at Highway 99/Industrial Access Road to help facilitate relocation of the Garibaldi Forest Products log sort.

7.2 MEDIUM- AND LONG-TERM RECOMMENDATIONS

A future crossing of the Mamquam Blind Channel has been previously recommended at Pemberton Avenue in past studies. This crossing may be expected in the medium to long term to provide a secondary road connection into the downtown, a connection and access for the Waterfront development, and ultimately is recommended to be utilized as a truck route. This route would connect Loggers Lane to Highway 99 via a new east-west connection at Clarke Drive. This would encourage more trucks to utilize the new Highway 99 and Clarke Drive intersection, thereby reducing the number of trucks using the Highway 99 and Cleveland Avenue intersection.

The other long-term option remains the Westminster crossing. As noted in other past studies, this secondary connection to the downtown was identified as a requirement of traffic growth to provide alternate connection options to the downtown and to reduce overall road network delays.

Overall, the medium and longer term options identified in this study are made possible through other previously recommended initiatives and requirements. Each option is expected to require further discussion and agreements with multiple agencies and stakeholders.

The following other considerations are noted as part of the medium and long-term recommendations proposed:

- Review and consider restricting parking along the future truck route.
- Consider provision of noise mitigation measures on the residential development along the route.
- Work with the development community to ensure developments fronting the truck route are designed accordingly.
- Update / review previously completed analysis and design on the Mamquam Blind Channel crossings including design, navigable waters considerations, land agreements, geotechnical requirements, environmental impacts, archaeological studies and other considerations to confirm feasibilities.

7.2.1 REGULATORY APPROVALS

The following legislations are expected to apply to the recommended long term options and will need further review and assessment in planning for these future facilities.

- Navigation Protection Act
- Fisheries Act
- Species at Risk Act
- Environmental Management Act, Contaminated Sites Regulation
- Heritage Conservation Act
- Land Act
- Water Sustainability Act
- Wildlife Act

7.3 ADVANCEMENT IN TECHNOLOGY

There are several advancements in technology of goods movement that could affect the way future decisions are made regarding truck routes in urban settings.

Electric trucks are reported to outperform diesel trucks in urban delivery routes with frequent stops. A study² published in the journal *Environmental Science and Technology* stated that electric trucks in such urban settings are 20 percent less expensive than diesel-fuelled trucks and reduces greenhouse gas emission by roughly 50 percent. Another study³ found that electric trucks produce significantly less noise under 50 km/h speed regimes compared to internal combustion engine trucks. More research and development are currently underway to produce all-electric freight vehicles. If the electric trucks were to replace conventional diesel trucks, it would help mitigate concerns over health and noise issues related to diesel-fuelled trucks currently driving through residential areas in the Downtown.

Self-driving vehicles, including trucks, are currently undergoing progressive development. Driverless trucks are expected to be safer and cheaper than their human controlled counterparts. These and other technologies may work to improve how goods movements are handled in communities and to the extent they need to be accommodated and mitigated along identified truck routes.

² "Electric Urban Delivery Trucks: Energy Use, Greenhouse Gas Emissions, and Cost Effectiveness", Dong-Yeon Lee, Valerie M. Thomas and Marilyn A. Brown, June 20, 2013.

³ "Noise emission assessment of a hybrid electric mid-size truck", M.A. Pallas, R. Chatagnon, J. Lelong, 20 September, 2013.

7.4 FURTHER STUDIES

In order to incorporate truck routes with the future Downtown transportation infrastructure, it is recommended that the District conduct further studies addressing the following topics:

- **Future Traffic Demands:** With the changes recognized for future development planned in Squamish, it is essential to update previous traffic forecast models to determine the local and regional transportation network needs. Of particular importance is the Cleveland Avenue and Highway 99 intersection, whose operation is expected to worsen as more developments progress in the District.
- **Modal Shift for trips within Squamish:** The majority of trips in Downtown Squamish are currently made by motor vehicles. This is partly due to the lack of frequent transit service and limited pedestrian and cycle infrastructure. As the District implements the recommendations provided in the Active Transportation Plan, changes resulting from the implementation should be monitored.
- **Need for a Secondary Downtown Access and/or Gateway:** Although the study carried out in 2007 established the need for a secondary downtown access, the nature and intensity of expected future development have been changing since. Initiatives taken to improve active transportation facilities as well as transit service could help shift people away from auto mode which could contribute to the lower traffic demand in downtown. It should be confirmed whether the secondary downtown access is vital to accommodate the future growth anticipated in Downtown.

APPENDIX A

Public Survey Questionnaire and Results

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Downtown Truck Route Study

Thanks you for your interest in the Downtown Truck Route Study. The Study will work towards a safe and efficient downtown truck route that can support rising port activities, while balancing the needs of the growing Squamish community.

Over the next five months, the District will explore potential future downtown truck routes. The District is currently in the data collection and problem definition stage of the project. Through initial public consultation, the project team is hoping to develop a greater understanding of the issues, opportunities, and challenges, as well as community's aspirations and goals as they apply to truck routes. Four (4) possibilities have been identified through previous work and are the starting point for consideration through this study; however, the District is also seeking input on what other possibilities should be explored. Each possible future truck route will have varying degrees of social, environmental, technical and economic impacts to be considered and evaluated further.

Community involvement will be a key component in the development of a future downtown truck route. This survey will allow the District to better understand the issues and concerns of Squamish residents related to the Downtown Truck Route Study.

We appreciate your time to complete this survey. For more information about the Downtown Truck Route Study visit: squamish.ca/yourgovernment/projects-and-initiatives/truckroute.

Please submit your completed survey by June 1, 2016.



Downtown Truck Route Survey

1. In general, how do you see current conditions of trucks travelling in downtown Squamish
Consider the following: Are trucks using designated routes? Are there safety issues? Are trucks able to navigate the streets well?

2. What do you see as the most important issues to be considered when selecting a new truck route(s) in downtown Squamish?

Please rank the issues/concerns list below in order of priority, with 1 being your top priority and 5 being your last priority.

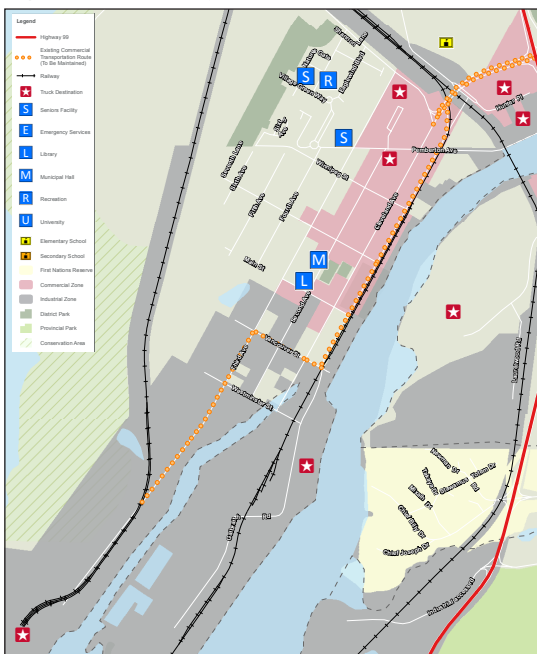
ISSUE OR CONCERN	PRIORITY
Consideration of people in nearby properties	
Impact on environmentally sensitive areas	
Traffic safety of heavy/industrial traffic	
Increased traffic volumes	
Other	

Please provide any comments to help explain your priorities.

3. When it comes to trucking in Squamish, what issues have you experienced in the downtown?

Please use the map below to identify specific locations where the issue(s) exists. Consider traffic issues, neighbourhood issues, environmental issues, and compliance issues.

Figure 1: Issues Map



Comments:

[illegible]

Downtown Truck Route Survey

4. Many factors will influence the development and assessment of a future truck route. These include the environment, economy, safety and mobility, and community quality of life. Please share your concerns and aspirations related to trucks in each of these categories.

Issue or Concern	Concerns	Aspirations
Environment		
Economy		
Safety & Mobility		
Quality of Life		

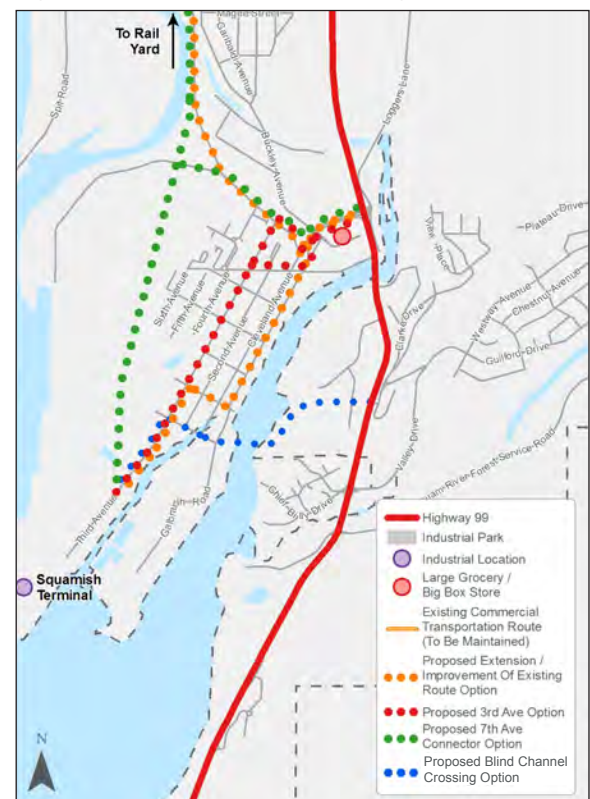
5. The District has identified four (4) possible options through past studies. The four possibilities are illustrated on the map to the right. These options are a starting point for the identification of a future route; however, the District is seeking input on other routes that should be considered.

Are there any other routes that you believe should be considered through the Downtown Truck Route Study?

Please use the map at the end of the survey to sketch additional routes and provide a brief description below.

[illegible]

Figure 2: Possible truck routes being considered



6. Please provide any comments on specific issues or concerns you may have about Option 1: Loggers Lane.

Downtown Truck Route Survey

7. Please provide any comments on specific issues or concerns you may have about Option 2: 3rd Avenue.

8. Please provide any comments on specific issues or concerns you may have about Option 3: 7th Avenue Connector.

9. Please provide any comments on specific issues or concerns you may have about Option 4: Blind Channel Crossing.

10. Please provide any comments on specific issues or concerns you may have about Option 5: Your Option

ABOUT YOU

11. Please indicate if you are:

- | | |
|--|--|
| <input type="checkbox"/> A Squamish resident | <input type="checkbox"/> An industry representative (i.e. terminals, port, etc.) |
| <input type="checkbox"/> A Squamish business owner | <input type="checkbox"/> A truck driver transporting goods in Squamish |
| <input type="checkbox"/> A provincial, federal, or municipal government employee | <input type="checkbox"/> Other (please specify) |

12. What is your postal code?

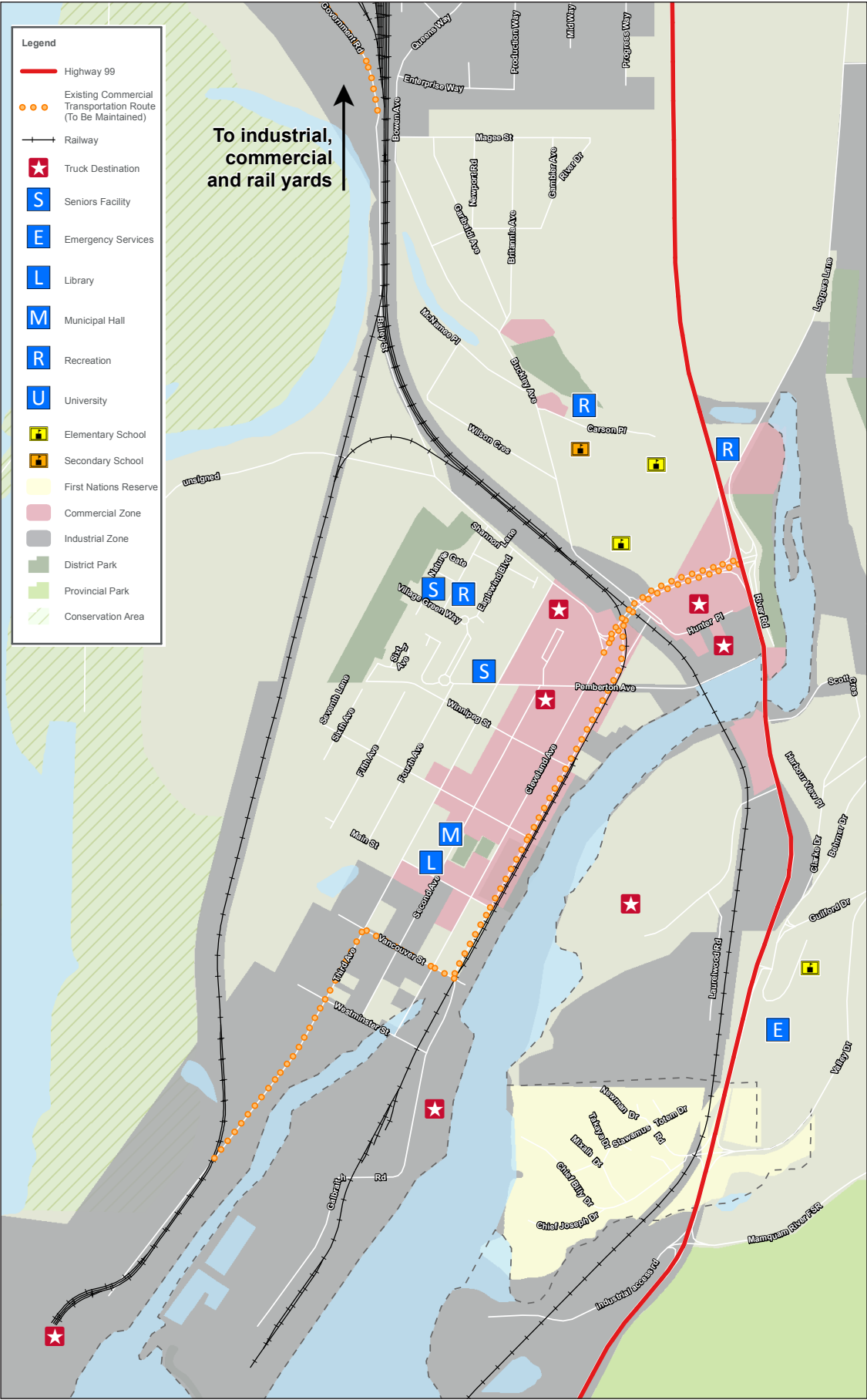
Please provide your contact information if you would like to receive additional information about this project.

Name: _____ Email: _____

Thank you for taking the time to complete this survey. Completed surveys can be handed in at the open house, emailed to lprincic@squamish.ca or mailed to:

**ATTN: Laura Princic
37955 Second Avenue
P.O. Box 310
Squamish, B.C. V8B0A3**

Figure 3: Other truck routes to consider



Squamish Downtown Truck Route Study | Survey Summary

JULY 2016: DRAFT

In May, 2016 the District of Squamish distributed a survey to residents and key stakeholder groups as part of the consultation process for the Downtown Truck Route Study. The survey was available both online through the District's website and hardcopy. In total, 188 surveys were submitted - 37 hardcopies and 151 online submissions.

The following is a summary of the input provided by those interested in the Downtown Truck Route Study. The input will be used to help inform the evaluation framework criteria as the study advances further.

QUESTION 1: In general, how do you see current conditions of trucks travelling in downtown Squamish?

Respondents were first asked to describe from their perspective the current state of trucking in downtown Squamish. 140 responses were provided to this question. Many respondents were unaware of specific issues or conditions related to truck travel in downtown Squamish. Others were concerned about the impact of future development along Loggers Lanes and mixing residential/commercial activity with transport vehicles. Respondents also flagged the intersection of Cleveland Avenue and Loggers Lane as difficult for trucks to navigate.

Responses were categorized into themes, with the top 10 themes highlighted in Table 1 below.

Table 1: Current Condition of Trucks

Theme	# of Mentions
Do not notice truck traffic or issues with trucks	30
Safety concerns when passing through residential/commercial areas	23
Concerns about future development on Loggers Lane	23
Issues with trucks on Cleveland Avenue	16
Current route is adequate	14
Navigating narrow streets is difficult for trucks	12
Trucks have difficulty navigating certain turns	12
Poor driver behavior (e.g. speeding, distracted driving)	10
Not all trucks use the designated routes	6
Concerns about train tracks	5

QUESTION 2: What do you see as the most important issues to be considered when selecting a new truck route(s) in downtown Squamish?

Respondents were then provided a list of four issues/concerns and asked to rank them in order of priority. Of those who provided a response to this question, 46% ranked 'impact on environmentally sensitive areas' as their top priority. 'Increased traffic volumes' was ranked the least important, with 39% of those who answered this question, listing this issue as their fourth or fifth priority.

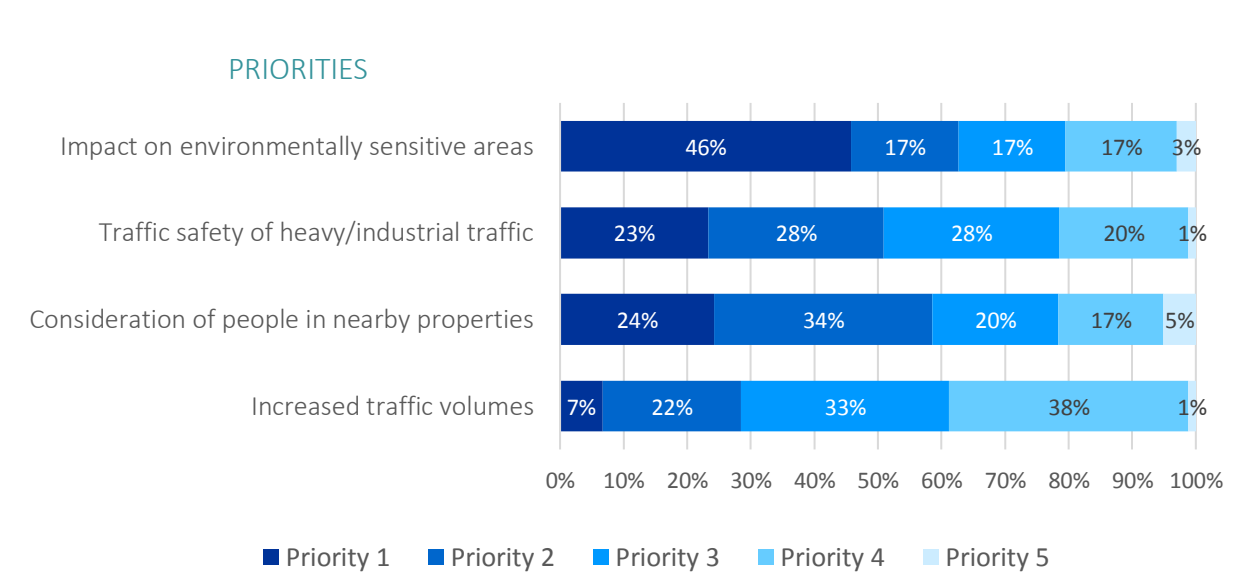


Figure 1: Priorities

As a follow-up to this question, respondents were asked to provide comments to help explain their priorities. 85 comments were provided by respondents and subsequently grouped into themes. The main themes are listed in Table 2.

Table 2: Truck Route Priorities

Theme	# of Mentions
Protect the environment/estuary first	32
People/Neighbourhoods should come first	27
Safety is top priority	10
Consider all equally	9
Concern for increasing traffic volumes	6
Restrict trucking in general downtown or during peak hours	5
Trucks should have own route	4

QUESTION 3: When it comes to trucking in Squamish, what issues have you experienced in the downtown?

Survey participants were then asked to identify specific issues they have experiences when it comes to trucking in Squamish. More than 130 comments were provided. While many respondents indicated having no issues, others had concerns related to the safety of residents with increased residential development along Loggers Lane. Noise and air pollution was also a top concern among respondents. Cleveland Avenue was again identified as an issues. Respondents indicated the street is being used by trucks (intentionally and unintentionally) and creates congestion when turning on and off of Loggers Lane from Cleveland. Bailey Street was also identified as an issue with trucks parking along the gravel shoulder overnight.

Responses were categorized into themes, with the top 10 themes highlighted in Table 3 below.

Table 3: Downtown Trucking Issues

Theme	# of Mentions
No concerns - have not experienced issues	42
Safety concerns from increased residential activity along Loggers Lane	25
Noise and air pollution concerns	23
Loggers Lane is too congested and narrow	16
Visibility and turning radius at certain intersection	13
Poor driver behavior (speeding, districted driving, ignoring stop signs)	12
Issues with trucks using Cleveland	8
Parking issues along Loggers Lane	7
Issues with trucks using 3 rd Avenue	5
Tie: Trucks stopping along Loggers Lane to make deliveries	4
Tie: Issues from train tracks	4

QUESTION 4: Please share your aspirations and concerns related to trucks the following categories:

- Environment
- Economy
- Safety and Mobility
- Quality of Life

Four key guiding principles were used to guide feedback around aspirations and concerns related to trucks. The following is an overview of the prominent themes that emerged from each category.

Environment

Aspiration

The estuary and the desire to protect the area were key themes that emerged from the comments provided, as shown in Table 4.

Table 4: Environment Aspirations

Theme	# of Mentions
Protect the estuary	32
Minimize environmental impact	16
Control / reduce emissions	14
Eliminate trucks from downtown	8
Make environment top priority	6
Use existing infrastructure	5
Balance needs of both	3
Ensure efficiency	2

Concerns

Damage to sensitive areas, like the estuary, and pollution were key themes that emerged from the concerns provided, as shown in Table 5.

Table 5: Environment Concerns

Theme	# of Mentions
Damage to sensitive areas	42
Pollution and spills	29
Noise	16
Ensure minimal impact	10
Wildlife	10
Overuse of roadways	4
Environment should come first	4
Dust	4
Potential for collisions	3
Visual impacts	2

Impact on residential neighbourhoods	2
Don't give in to business / industry	2

Economy

Aspiration

A desire to support industry and grow a healthy local economy were key themes that emerged from the aspirations provided, as shown in Table 6.

Table 6: Economy Aspirations

Theme	# of Mentions
Supports industry	15
Healthy local economy	10
Dedicate route for trucks away from development	11
Ensure an efficient truck route	9
Ensure needs/aspirations are balanced	6
Maintains employment	4
Environment should come first	4
Explore alternative industries to support local economy	3
Minimize impacts on tourism	2
Ensure user pays	2

Concerns

Negative impacts on local businesses, the Squamish economy and the experience / atmosphere downtown were common concerns among respondents, as shown in Table 7Table 10.

Table 7: Economy Concerns

Theme	# of Mentions
Impact on local businesses and economy	20
Impacts on downtown experience	8
Ability to meet demands - trucks are needed	5
Impacts on tourism	4
Cost of a new route	3
Should not outweigh environment	3
Impact on roadways	3
Pollution concerns	2
Improve planning and decision making	2
Ensure minimal impacts	2

Safety and Mobility

Aspiration

The desire to separate trucks from neighbourhoods (people) and support safety and mobility as a top priority were two key themes that emerged from the aspirations provided, as shown in Table 8.

Table 8: Safety and Mobility Aspirations

Theme	# of Mentions
Separate trucks from pedestrians (away from residential/local businesses)	18
Safety and mobility is a top priority	16
Ensure truck route is efficient and reliable (e.g. no parking, wide lanes)	10
Manage issues through design and regulations	8
Increase enforcement	7
Reduce congestion	7
Maintain/Improve walkability and bikeability	6
Maintain current route	3
Reduce or eliminate accidents	3

Concerns

Negative impacts on Squamish residents and active transportation opportunities were common concerns among respondents, as shown in Table 9Table 10.

Table 9: Safety and Mobility Concerns

Theme	# of Mentions
Impacts on residents and residential areas	19
Impact on active transportation (limits mobility downtown)	17
Safety around schools and parks	10
Increased congestion	7
Truck driver behavior	5
Concerns about collisions	4
Trucks on unsuitable roadways	3
Top priority - High concern	3
Impacts from development	2
Maintain current route	2

Quality of Life

Aspiration

Noise pollution and separating trucks from neighbourhoods (people) were common aspirations among respondents, as shown in Table 10.

Table 10: Quality of Life Aspirations

Theme	# of Mentions
-------	---------------

Reduce noise pollution	23
Separate people/homes from trucks	19
Reduce air pollution/emissions	13
Reduce congestion	5
Protect the estuary	4
Trucking is important for Squamish economy	4
Maintain current quality of life	3
Safety	3
Improve access to downtown/waterfront	3
Ensure sustainability of route	2
Promote active transportation	2

Concerns

Negative impacts from air and noise pollution, as well as impacts to the livability of the downtown area were key themes that emerged from the concerns provided, as shown in Table 11.

Table 11: Quality of Life Concerns

Theme	# of Mentions
Impacts from air pollution	21
Noise pollution	17
Impact on livability of downtown	11
Separate trucks from residential areas	11
Increased congestion	8
Impacts on active transportation	6
Important to find balance	3
Impact on local employment and businesses	2
Dust	2
Loss of recreational activities	2
Need to innovate / think outside the box	2

QUESTION 5: Are there any other routes that you believe should be considered through the Downtown Truck Route Study?

Respondents were asked to suggest alternative truck routes to the four options presented for discussion. While the majority of respondents simply indicated their preference for one or more of the options, a number of alternative were suggested for consideration. The responses were categorized into themes with the top themes outlined in Table 12.

Table 12: Top themes for consideration of alternative routes

Theme	# of Mentions
Preference for Option 4	31
Preference for Option 3	7
Preference to maintain Loggers Lane	6
Use another mode of transport (e.g. rail)	6
Convert the rail line to be dual purpose	5
Remove all trucks from downtown	4
Remove Option 3	3
Prefer a variation on Option 4*	3
Need more options	2
Move the port (Squamish Terminals) to Watts Point	2
Remove Option 2	2
Combination of Option 1 and 2	2
All options are already identified	1
Preference for Option 2	1
Use the spit road	1
Minimize delays for trucks	1
Consider two one-way routes	1
Build a tunnel under the river	1

*Prefer a variation on option 4:

- 5. Similar to option 4 but more to the south
- The Mamquam blind channel crossing option seems to be the only route that meets the town needs, and could be adjusted slightly depending. One example would be to make the crossing by filling in the Mamquam Blind as a crossing and opening up the Cattermole slough as the new access channel for boats.
- I would like to have the DOS explore the opportunity to cross the Mamquam Blind Channel from the Nexen Beach lands across to Site B and up through to Highway 99.

Other examples provided:

- I would like to explore route across from Pemberton Avenue to the former Sawmill Site (Waterfront Landing) to provide a potential alternate route from the downtown to Highway 99.
- Northbound Hwy 99, left on finch, right on government, past heritage railway museum, 7Th Ave connector

QUESTION 6: Please provide any comments on specific issues or concerns you may have about the four options presented. In addition, if you have suggested an alternative truck route please provide any comments about your option (Option 5).

Respondents were asked to provide comments on the four options presented as well as any alternative route they may have suggested in question 5. Comments were specific to each option, however the environment and impacts on Squamish residents were common concerns throughout.

Option 1:

Loggers Lane

Many respondents suggested that with future residential development planned for Loggers Lane, the current route is no longer be suitable for the long-term. On the other hand, a selection of respondents also felt that Loggers Lane should be maintained as the preferred truck route. In total 120 comments were provided with the key themes shown in Table 13.

Table 13: Option 1 Comments and Concerns

Theme	# of Mentions
With development and density, Loggers Lane is not a long-term option	40
Loggers Lane should be maintained as Squamish's truck route	23
Quality of life impacts on those living downtown (eaglewind, seniors, etc.)	15
Concerns for function, efficiency and reliability (too much congestion)	15
Concerns for safety	11
Congestion on Cleveland Avenue	9
Parks and trucks don't mix	8
Too narrow	6
Required a re-design to accommodate all modes	6
Concerns for the environment and sustainability	4
Congestion from rail traffic	4
Fewest issues or concerns with this options	4
Consider an overpass or underpass for active transportation access	3
Protect the estuary	2
Would be the second choice	2

Option 2:

3rd Avenue

The majority of the comments provided for Option 2 centered on concerns for the safety and quality of life of residents living along 3rd Avenue or in close proximity. In total 122 comments were provided with the key themes identified shown in Table 14.

Table 14: Option 2 Comments and Concerns

Theme	# of Mentions
Concerns for safety of residents in area (seniors, kits, etc.)	88
Noise concerns	10
Congestion concerns	10
Impact on active transportation initiatives	8
Trucks should be kept out of the downtown area	8
Roadway not suitable for truck traffic (design, condition, etc.)	6
Air quality concerns	6
Best option presented	4
Concerns for impact on downtown businesses	3
Ok but restrict the number of trucks per day	2

Option 3:

7th Avenue Connector

The environment and need to protect the estuary was a top priority and concern of those who provided commentary on option 3. Impacts to neighbouring residential areas and wildlife were also identified as themes. In total 123 comments were provided with the key themes identified shown in Table 15.

Table 15: Option 3 Comments and Concerns

Theme	# of Mentions
Environmental concerns - Need to protect estuary	64
Concern for impact on nearby residential areas	13
Preferred option if environmental concerns and regulations are addressed	13
Run route along or over existing rail line	13
Support for option - best option	10
Concern for wildlife	5
Second choice of the options presented	5
Noise concerns	4
Safest route - Least impact on Squamish residents	4
Congestion along the highway	3
Concern for recreation activities	3
Too expensive	2

Option 4:

Blind Channel Crossing

The majority of those who provided a comment related to option 4, recommended the Blind Channel Crossing was the best option of those presented. Many suggested a new bridge crossing would also benefit the broader Squamish community and visitors, providing a secondary access point in and out of

the downtown core. On the other hand, concerns were also raised about the unknown cost of building a bridge and the impacts a crossing would have on marine vessels and First Nations. In total 129 comments were provided with the key themes identified shown in Table 16.

Table 16: Option 4 Comments and Concerns

Theme	# of Mentions
Best option with least amount of impacts	72
Concerned about costs	25
Creates second access to downtown and waterfront	22
Would reduce congestion and improve safety downtown	12
Concerns about marine vessels	10
Congestion and safety concerns along Highway 99	8
Concerns about environmental impacts	8
Concerns about impact of rail crossings	5
Too close to residential	5
Concerns about First Nations rights	4
Concern for sightlines	4
Need more information	4
Not feasible	3

Option 5:

Your Options

A handful of respondents suggested alternatives to the four options presented as shown in Table 17.

Table 17: Option 5 Comments and Concerns

Theme	# of Mentions
Consider moving Squamish Terminals	4
Consider moving the rail tracks	2
No trucks downtown	2
Consider alternative option over Blind Channel	2
Consider regulating truck traffic along Loggers Lane	2
Maintain Loggers Lane	2
Consider using rail instead of trucks	2

RESPONDENTS SURVEY DEMOGRAPHICS:

To complete the survey, respondents were asked to indicate if they are:

- A Squamish resident
- A Squamish business owner
- A provincial, federal, or municipal government employee
- An industry representative
- A truck driver transporting goods in Squamish
- Other

As shown in Figure 2, nearly all of those who participated in this survey identified themselves as a Squamish resident.

Who we heard from

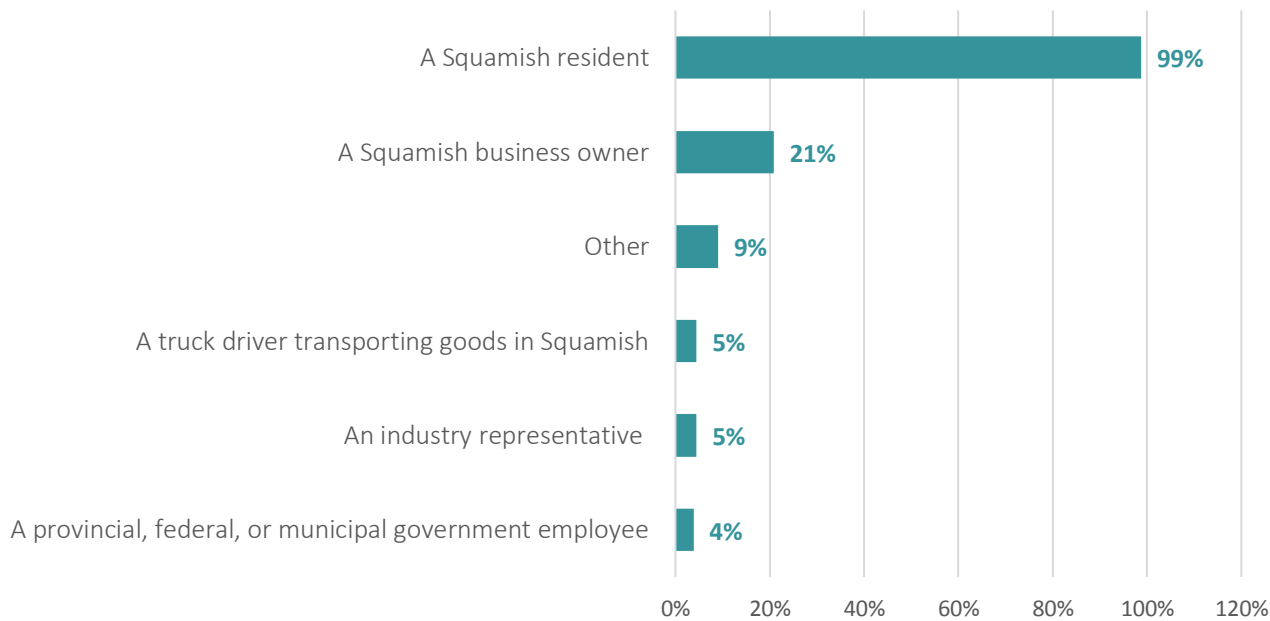


Figure 2: Who We Heard From

Postal Code Data

Participants were also asked to provide their postal code. The images shown in Figure 3 highlight where respondents live.

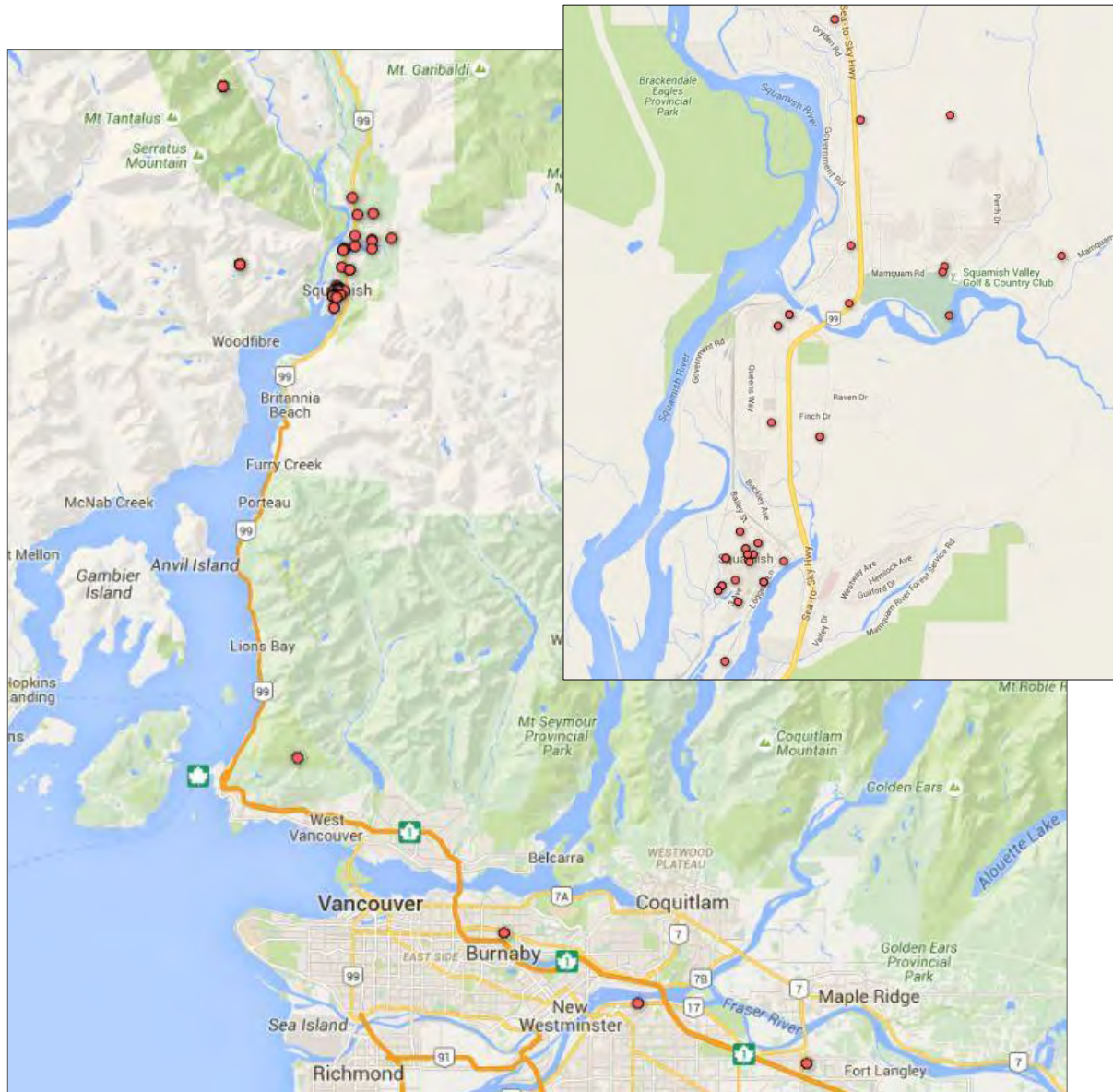


Figure 3: Where Respondents Live

Downtown Truck Route Study

Thank you for your interest in the Downtown Truck Route Study. Through this study, the District is working towards identifying a safe and efficient downtown truck route that can support rising truck activity, including Squamish Terminals, while balancing the needs of the growing Squamish community.

In May, 2016, the project team held a number of consultation sessions with stakeholder groups and the public. Through these sessions, the District heard valuable feedback on four options being considered as possible downtown truck routes. Over the past six months, the project team has worked to evaluate the options presented in May using technical analysis and consideration for the input provided by Squamish residents and various stakeholder groups.

Entering the final phase of the Study process, short- and long-term recommendations have been identified. The District is now looking for feedback on these recommendations before being presented to District Council later this Fall.

We appreciate your time to complete this survey. For more information about the Downtown Truck Route Study visit: squamish.ca/yourgovernment/projects-and-initiatives/truckroute.

Please submit your completed survey by **November 30, 2016**.

Completed surveys can be handed in at the open house, emailed to lpincip@squamish.ca or mailed to: ATTN: Laura Princip
37955 Second Avenue
P.O. Box 310
Squamish, B.C. V8B0A3

OPTIONS OVERVIEW

●●● **Option 1 | Loggers Lane** (existing route) maintains the existing truck route along Loggers' Lane, joining it to the business park and rail yards via Bailey Street. This option will include some improvements to existing roads.

●●● **Option 2 | Third Avenue** relocates the truck route to 3rd Avenue with a connection to Highway 99 via Pemberton Avenue, Bailey Street, and Cleveland Avenue. This option includes some improvements to existing roads.

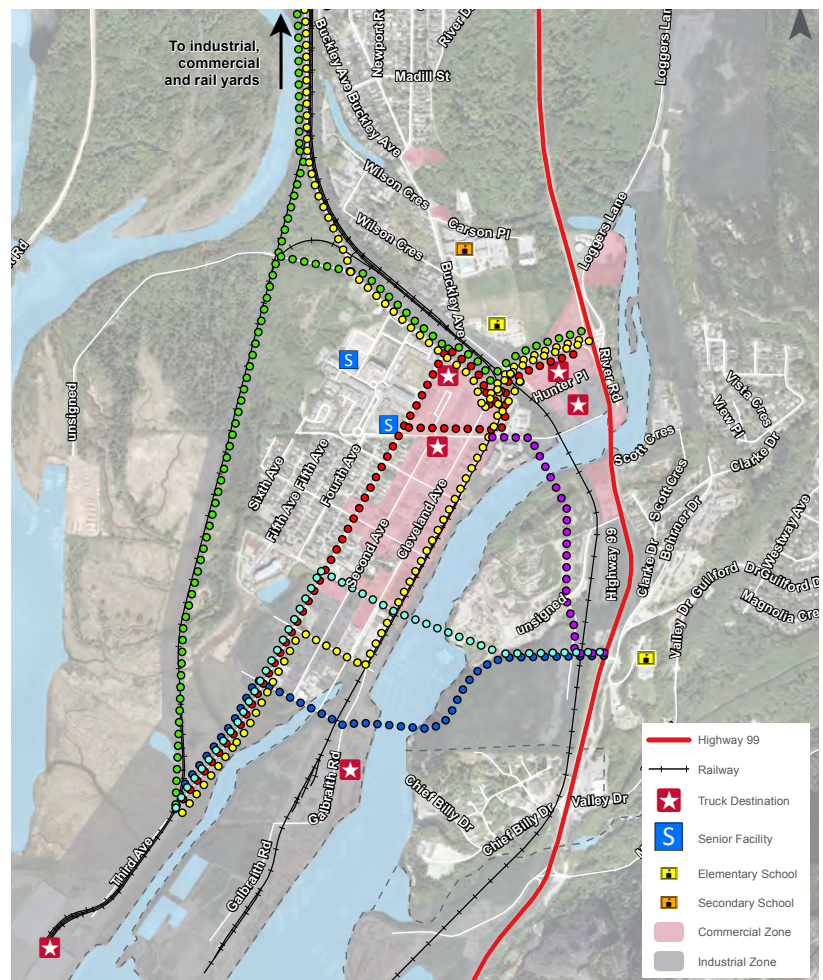
●●● **Option 3 | 7th Avenue** is a new road along the 7th Avenue Alignment, which will align with the transportation corridor identified in the Skwelwil'em Squamish Estuary WMA Management Plan and would be co-located with the proposed sea dyke.

●●● **Option 4 | Mamquam Bridge Crossing** is a new crossing of the Blind Channel with a new connection to Highway 99 at Clarke Drive. There are three potential crossing locations:

●●● **Option 4A: Westminster Street** is an extension of Westminster Street to the east connecting to Highway 99 at Clarke Drive. The truck route would be a combination of Third Avenue and Westminster Street.

●●● **Option 4B: Main Street** is an extension of Main Street to the east connecting to Highway 99 at Clarke Drive. The truck route would be a combination of Third Avenue and Main Street.

●●● **Option 4C: Pemberton Avenue** is an extension of Pemberton Avenue to the east connecting to Highway 99 at Clarke Drive. The truck route would be a combination of Loggers Lane or Third Avenue and Pemberton Avenue.



Downtown Truck Route Survey

Candidates Option Summary

ITEM	LOGGERS LANE	THIRD AVENUE	7 TH AVENUE	OPTION A - WESTMINSTER	OPTION B - MAIN	OPTION C - PEMBERTON
Travel Time						
Community						
Health						
Environmental						
Archaeological						
Cost						
Recommendation	Recommended (short-term)	Not recommended	Recommended (long-term)	Recommended (long-term)	Not recommended	Recommended (medium- longer term)

More Favorable
 Somewhat Favorable
 Neutral
 Somewhat Less Favorable
 Less Favorable

1. An evaluation matrix has been provided to help assess the options presented. Do you feel these are suitable?

☐ Yes ☐ No

2. Do you agree with the evaluations presented for each option? Please provide any comments to explain your answers.

Option 1 - Loggers Lane: ☐ Yes ☐ No _____

Option 2 - Third Avenue: ☐ Yes ☐ No _____

Option 3 - 7th Avenue: ☐ Yes ☐ No _____

Option 4A - Westminster Street: ☐ Yes ☐ No _____

Option 4B - Main Street: ☐ Yes ☐ No _____

Option 4C - Pemberton Avenue: ☐ Yes ☐ No _____

3. Do you agree with the recommendations presented for each option? Please provide any comments to explain your answers.

Option 1 - Loggers Lane: ☐ Yes ☐ No _____

Option 2 - Third Avenue: ☐ Yes ☐ No _____

Option 3 - 7th Avenue: ☐ Yes ☐ No _____

Option 4A - Westminster Street: ☐ Yes ☐ No _____

Option 4B - Main Street: ☐ Yes ☐ No _____

Option 4C - Pemberton Avenue: ☐ Yes ☐ No _____

4. Do you have any other comments or feedback on the options, evaluations or recommendations presented for each option?

5. Please indicate if you are:

- ☐ A Squamish resident
 ☐ An industry representative (i.e. terminals, port, etc.)
- ☐ A Squamish business owner
 ☐ A truck driver transporting goods in Squamish
- ☐ A provincial, federal, or municipal government employee
 ☐ Other (please specify)

6. What is your postal code? _____

Squamish Downtown Truck Route Study | Survey 2 Summary

NOVEMBER 2016

QUESTION 1: An evaluation matrix has been provided to help assess the options presented. Do you feel these are suitable?

Response	Count	Percentage
Yes	16	80%
No	4	20%
Total Responses	20	

QUESTION 2: Do you agree with the evaluations presented for each option? Please provide any comments to explain your answers.

Options	Yes	No	Total Responses
Option 1 - Loggers Lane	19 (82.6%)	4 (17.4%)	23
Option 2 - Third Avenue	14 (63.6%)	8 (36.4%)	22
Option 3 - 7th Avenue	11 (55.0%)	9 (45.0%)	20
Option 4A - Westminster Street	16 (69.6%)	7 (30.4%)	23
Option 4B - Main Street	13 (72.2%)	5 (27.8%)	18
Option 4C - Pemberton Avenue	9 (47.4%)	10 (52.6%)	19

Response	Comments
1	Given the final scores of the various options it would appear that a weighting has been applied to each item that has not been indicated. The community impacts only appear to measure impacts from where people sleep, not where they live. The community impacts associated with the 7th Ave connector impact where the community of Squamish spends a great deal of time outdoors. The health item does not seem to understand that we all share the same air-shed, and environment. For example, BC Ferries vessels are one of the largest point sources of air-borne particulate pollution in the Squamish valley, and yet would likely score well in this study for health. Travel time is vague, and is difficult to properly assess given the absence of information. I also could not answer yes or no to more than one option per answer; a glitch in the survey.
2	Clarke Drive is a good idea. Trucks can stay off main downtown intersection
3	There is not enough information provided for me to make a proper evaluation. As an example Options 1 and 3 both have a neutral cost evaluation but #3 will cost more to construct.
4	Has too many environmental concerns and safety concerns regarding children crossing to school. (Option4) Need a 2nd Access into downtown to sustain long-term growth and development.
5	Traffic issues they key. Design can resolve all issues except NIMBYs. Incredible costs for Option 4.

6	Option 1: short-term Option 2: Residential not suitable Option 3: Long-term Option 4A: High budget - not preferred Option 4B: High budget - not preferred
7	Option 1, 2, 4C: People concerns Option 3: WMA concerns
8	Option 1: Widen corners, the best option Option 3: Need to define costs Option 4C: Needs to be done
9	Option 3: Much more environmentally sensitive that valued assessed. Doesn't provide an exit for downtown.
10	Option 3: Community will be affected by screwing up our most utilized nature connection.
11	Option 4A: This crossing will profoundly change the neighbourhood at the end of 2nd Avenue
12	Option 4A: Community and health = Somewhat less favorable Option 4C: Environmental = Somewhat less favorable
13	Option 3: The environment sacrifice would be better for neighbourhoods Option 4A: Study undervalues our community + health Option 4C: Why is one community (Pemberton) more important than my community (2nd Avenue)?
14	Option 3: The environment sacrifice would help other areas Option 4A: Study undervalues my community and health Option 4C: Overvalued community, why is it more important than my community
15	Option 1: As trucks would travel by condos Option 2: As trucks would travel by condos Option 3: Destruction and negative effect on estuary Option 4A: Quick scan - effects on environment Option 4B: Too many residential buildings Option 4C: Too many condos
16	Option 1: To date handling up to 250 trucks/day Option 2: Can only work if new rail crossing option Option 3: Dependent on rail and terminal demands Option 4A: Site B a better alternative long-term Option 4B: Future demand - Site B better plan
17	Option 3: I like that trucks are out of the way
18	Option 4ABC: I would rank more favorable because it allows emergency vehicles access If the rail crossing is blocked
19	Option 1: Short-term Option 2: Disrupts people Option 3: Not in estuary lands Option 4A: Least disruptive and easy access to Nexen Option 4B: Not good to people living around Option 4C: Has to cross downtown to Nexen and terminal
20	Option 2: "health" should be 'somewhat less favorable' Option 3: I am not in favor of this option. Option 4A: Good for diverting traffic away from Cleveland Avenue and Highway 99

QUESTION 3: Do you agree with the recommendations presented for each option? Please provide any comments to explain your answers.

Options	Yes	No	Total Responses
Option 1 - Loggers Lane	17 (73.9%)	6 (26.1%)	23
Option 2 - Third Avenue	12 (66.7%)	6 (33.3%)	18
Option 3 - 7th Avenue	11 (61.1%)	7 (38.9%)	18
Option 4A - Westminster Street	13 (65.0%)	7 (35.0%)	20
Option 4B - Main Street	12 (70.6%)	5 (29.4%)	17
Option 4C - Pemberton Avenue	14 (73.7%)	5 (26.3%)	19

Response	Comments
1	Please see comments above, but I would add that the Loggers Lane option 1 should be recommended as good for short to medium term. Again, what is meant by short, medium and long term would be useful. The 7th Avenue connector should never be recommended.
2	The computer is not allowing me to make choices for each option. I am in favour of a combination of Options 1 and 4c for both short and long term. I am particularly opposed to Option 3.
3	Not sure I agree with truck number estimates for Loggers Lane
4	Not in favor of truck route through residential + high pedestrian traffic concerning children. Option 4 is the best option for long-term growth.
5	7th Avenue along Bailey probably trucks preference - huge problem with all new development.
6	Option 1: short-term Option 2: Residential not suitable Option 3: Long-term Option 4A: High budget - not preferred Option 4B: High budget - not preferred
7	Option 1: Based on number of trucks, this is the best Option 3: Huge costs - who pays? Option 4C: Benefits all of Squamish
8	Option 3: Not an option. Community is more favorable. Estuary, animal movement, etc. very important.
9	Option 3: Estuary is sacred and should not be recommended.
10	Option 4A: As a resident impacted directly, I firmly oppose this option.
11	Option 3: Too much disturbance - not recommended Option 4C: Why is one community (Pemberton) more important than my community (2nd Avenue)?
12	Option 4A: Not a great option - not recommended. Too much disturbance
13	Option 1: Too many condos Option 2: Residential Option 3: Would destroy the estuary - wetlands Option 4A: Least harmful - quick access Option 4B: Residential Option 4C: Condos - residential

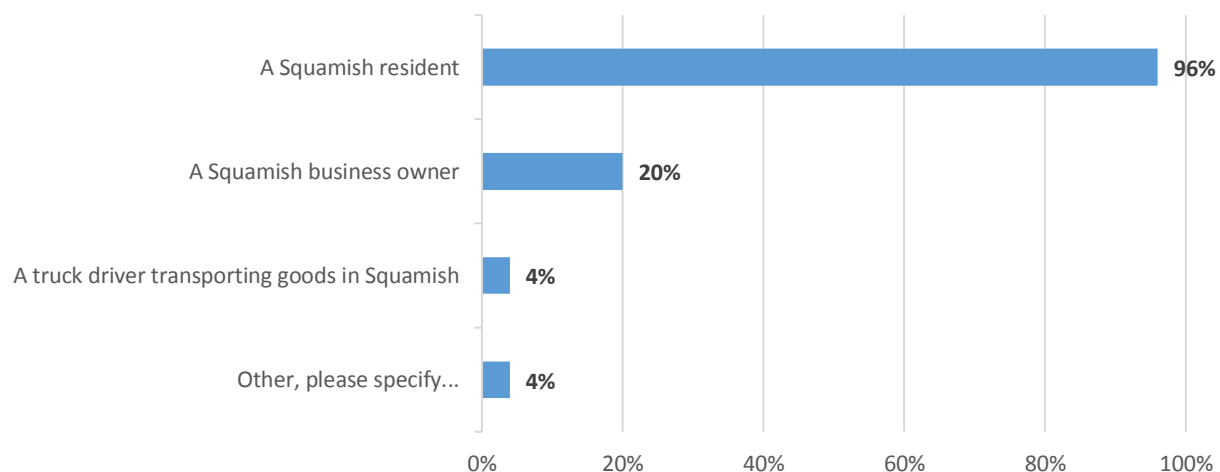
14	Option 1: Logging trucks - short-term Option 2: Too close to residential Option 3: always planned - long-term/rail/oriented Option 4A: Very costly and limited/no rail benefit Option 4B: Costly and wrong location Option 4C: Bad for future of town
15	Option 3: Should not be recommended Option 4A: Should be short- to medium-term Option 4C: Should not be recommended
16	Option 1: Short-term - while building 4A Option 2: Too many people live here Option 3: Leave the estuary alone Option 4A: The best - fast access - not disruptive Option 4B: Many people live there Option 4C: Crossing all downtown to reach Nexen

QUESTION 4: Do you have any other comments or feedback on the options, evaluations or recommendations presented for each option?

Response	Comments
1	I will mention again that this study has not addressed, or is willfully not addressing the oceanfront lands and the access issues with the pending development of them. In addition it is relying on woefully outdated rationale for the establishment of a future 7th Avenue connector to access employment lands along the waterfront. Since the establishment of this future connector, the rationale for it has almost completely evaporated due to the changed land uses in the downtown areas of Squamish. For these reasons, I consider this study to be of limited value. At best, the study design has simply neglected to consider a wide range of very important factors that must be considered, at worst, it is willfully negligent of these issues in search of a pre-determined outcome.
2	We need to consider long-term solutions for extensive growth and development.
3	New proposal on Waterfront Landing - particularly movement of pedestrians and kids to school. Make huge difference on the Pemberton option.
4	Rail from Industrial Park
5	7th Avenue is very costly and only benefits 10 trucks/day. Utilize Loggers Lane and add the Pemberton Avenue bridge.
6	Westminster is the best crossing. Still need to improve all streets which are too narrow at present.
7	The estuary is sacred. High density areas, like downtown will continue to be, must have areas of wilderness accessible by foot/bike to maintain a healthy community.
8	Option 3 should not have been an option because of its effects on the estuary, which is our community's most delicate and closest connection to nature.
9	Option 3 would be a great option if the environmental issues could be mitigated. Pemberton Avenue provides a second highway access which is badly needed with minimal impact on existing communities.
10	I agree that the logger's Lane is currently the best option and agree the Pemberton crossing is the best option to pursue in the future.

11	To bring a bridge and road into Westminster Street would cut our small downtown in half. We need our trails to flow through the waterfronts, the drive down Loggers Lane is negligible anyways. Also would be happy to have New Westminster Avenue crossing pedestrian only!
12	Adopt Option A for easy access to all lands involved (i.e. Nexen, Terminal, downtown by-passing traffic lights at 99 x eleve land)
13	Main trucking demands continues to change. Rail and terminal capacity of regional and federal importance. More back-up storage and land choices crucial for future trade demands bound to happen. Site B crucial for the future.
14	The traffic delays caused by the Cleveland rail crossing being blocked are unacceptable in terms of emergency response and the back-ups are already causing hazards at the Hwy 99/Cleveland intersection.
15	Build Option 4A as it provides safe, easy, quick access to the Nexen lands and Terminal facility. Do not consider 7th Avenue as it would essentially destroy the estuary habitat.
16	My first choice: Have a loading/unloading station at the former BCR industrial land. Cargo would be loaded/unloaded from trucks to trains (or from trains to trucks). With this system, trucks would not even have to go out to the port. Also, it would not be as costly as some of the other options.

SURVEY RESPONDENT DEMOGRAPHICS:



APPENDIX B

Existing and Proposed Cross Sections

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Client/Project

ISSUED FOR
DISCUSSION

AUG 9, 2016

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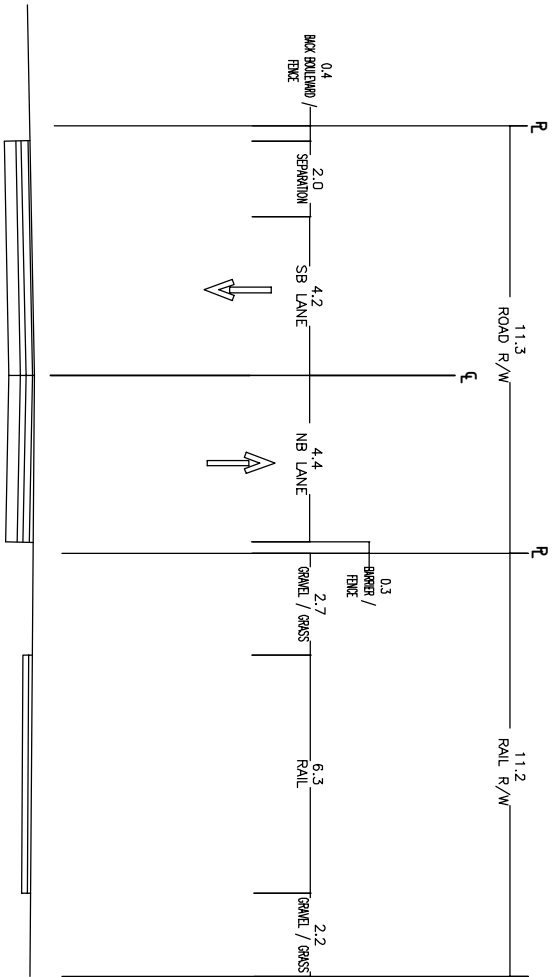
SQUAMISH TRUCK ROUTE STUDY

Scale Date Figure

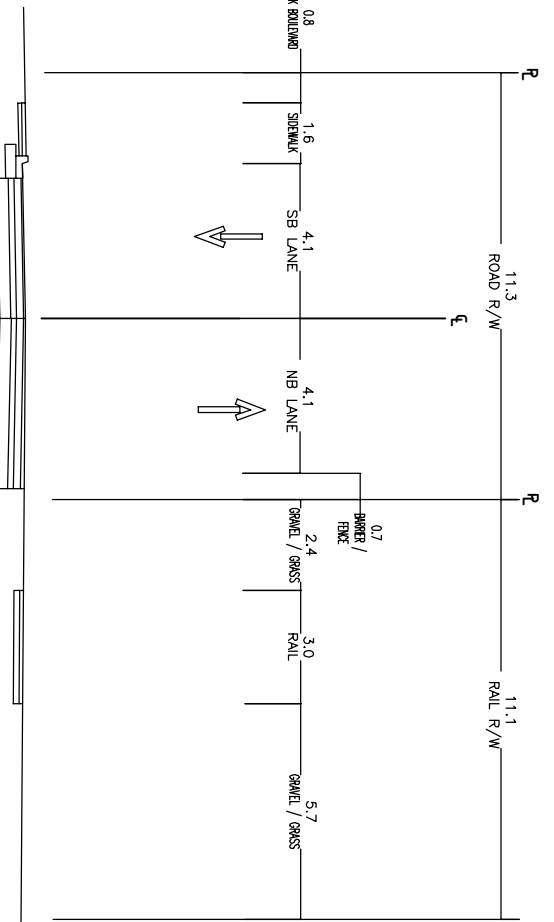
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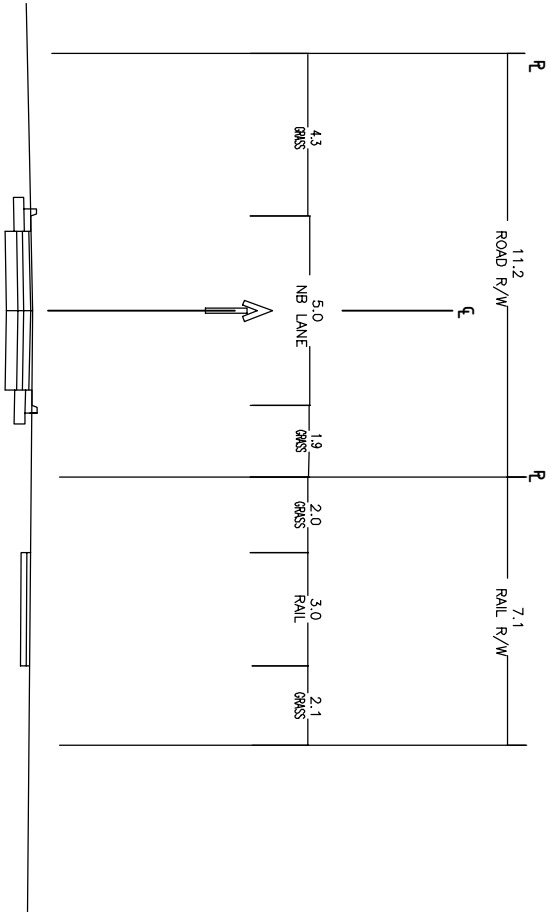
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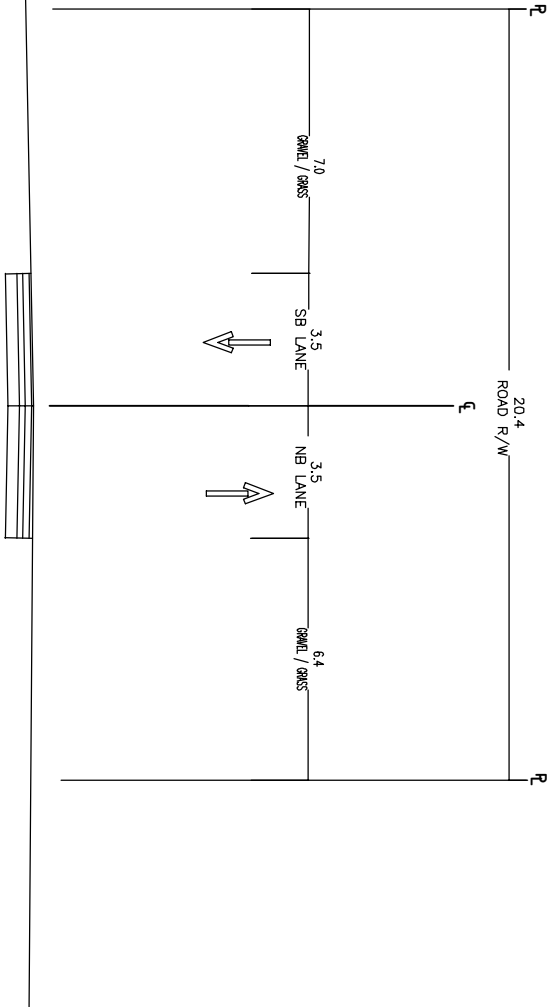
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SECTION A1



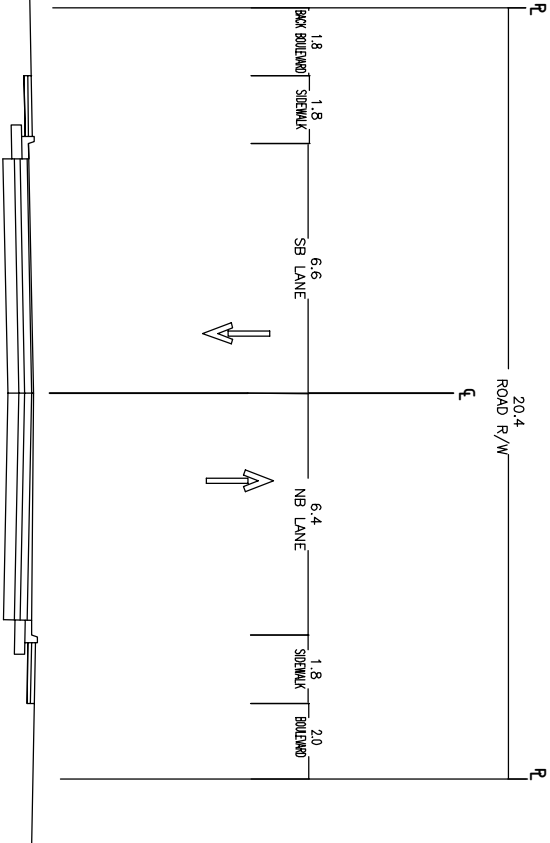
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SECTION A2



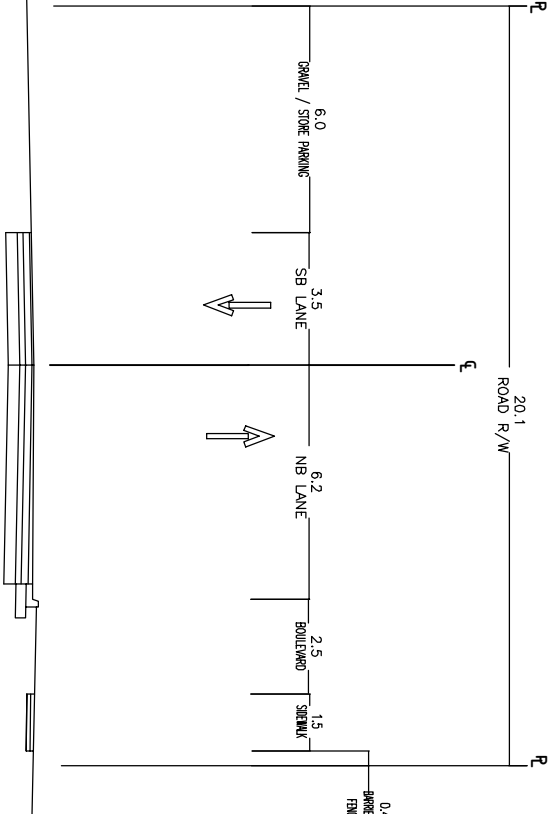
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SECTION A3



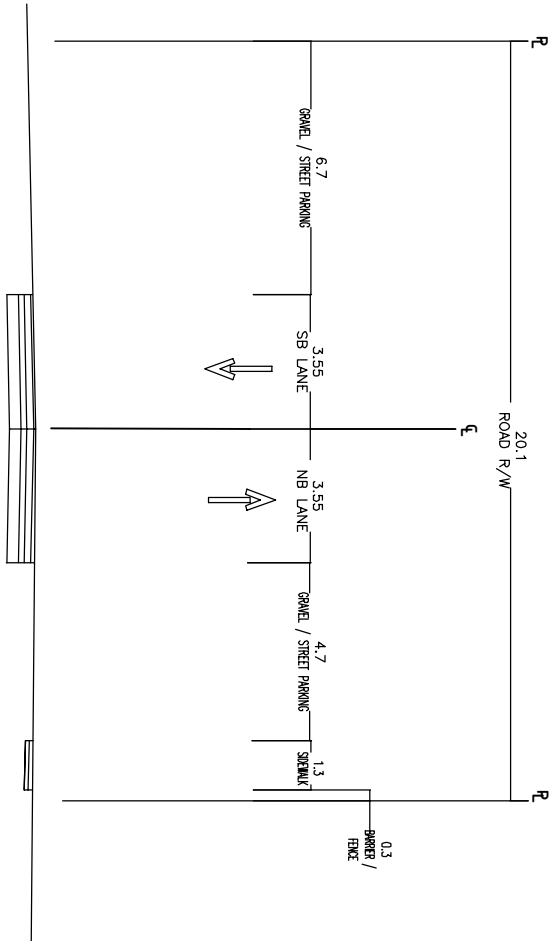
TYPICAL SECTION - THIRD AVENUE
SECTION B1



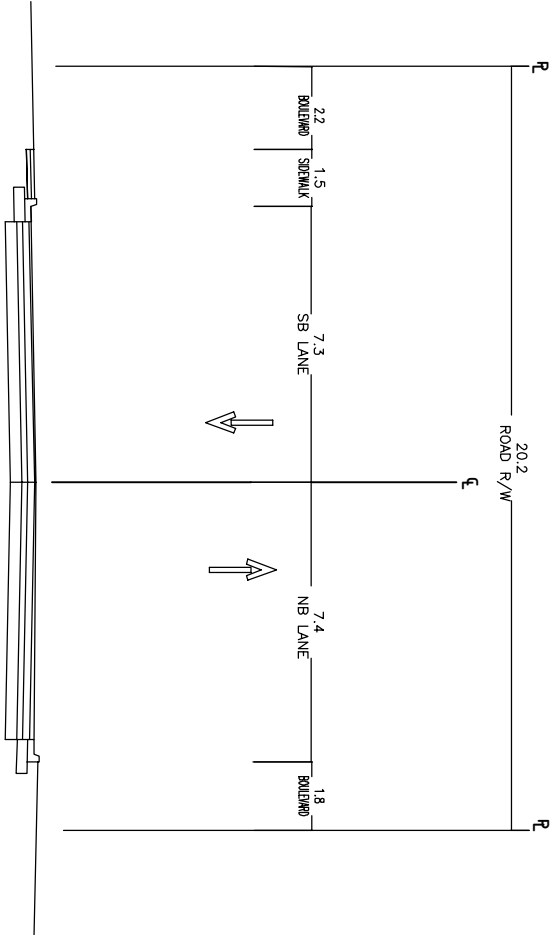
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SECTION B2



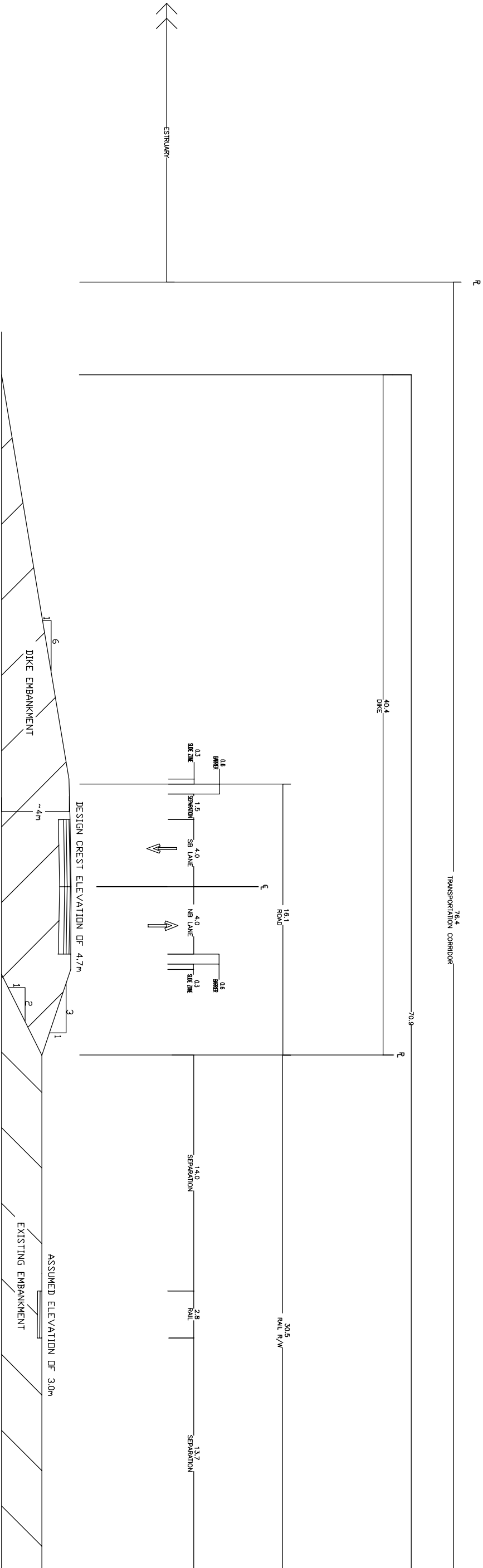
TYPICAL SECTION - THIRD AVENUE
SECTION B3



TYPICAL SECTION - THIRD AVENUE
SECTION B4



TYPICAL SECTION - THIRD AVENUE
SECTION B5



PROPOSED SECTION - SEVENTH AVENUE

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APPENDIX C

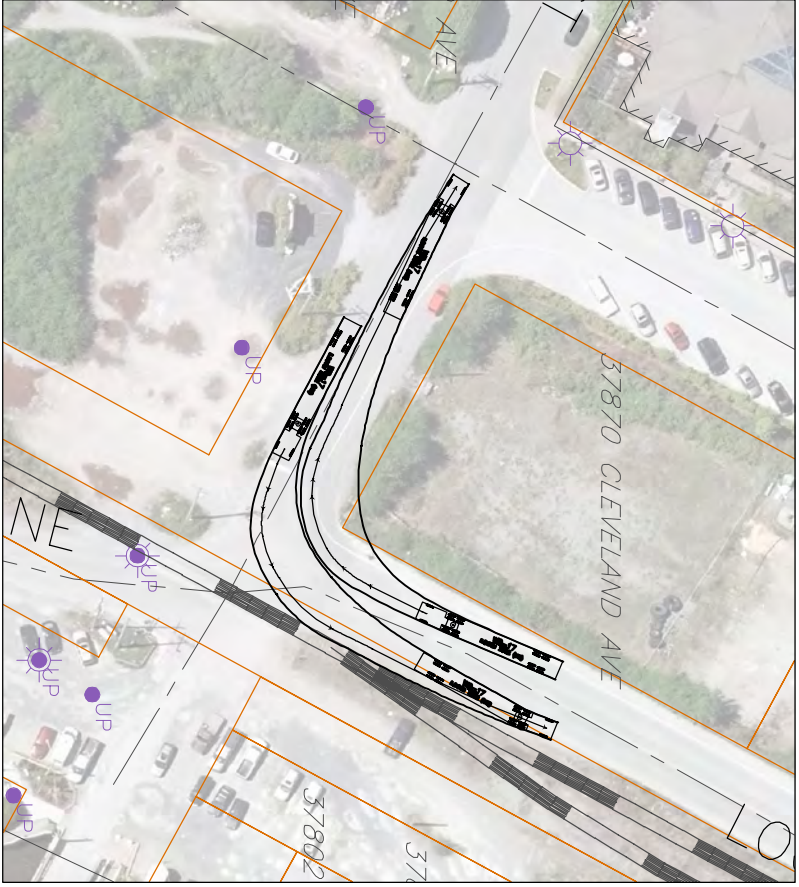
Truck Turning Movements

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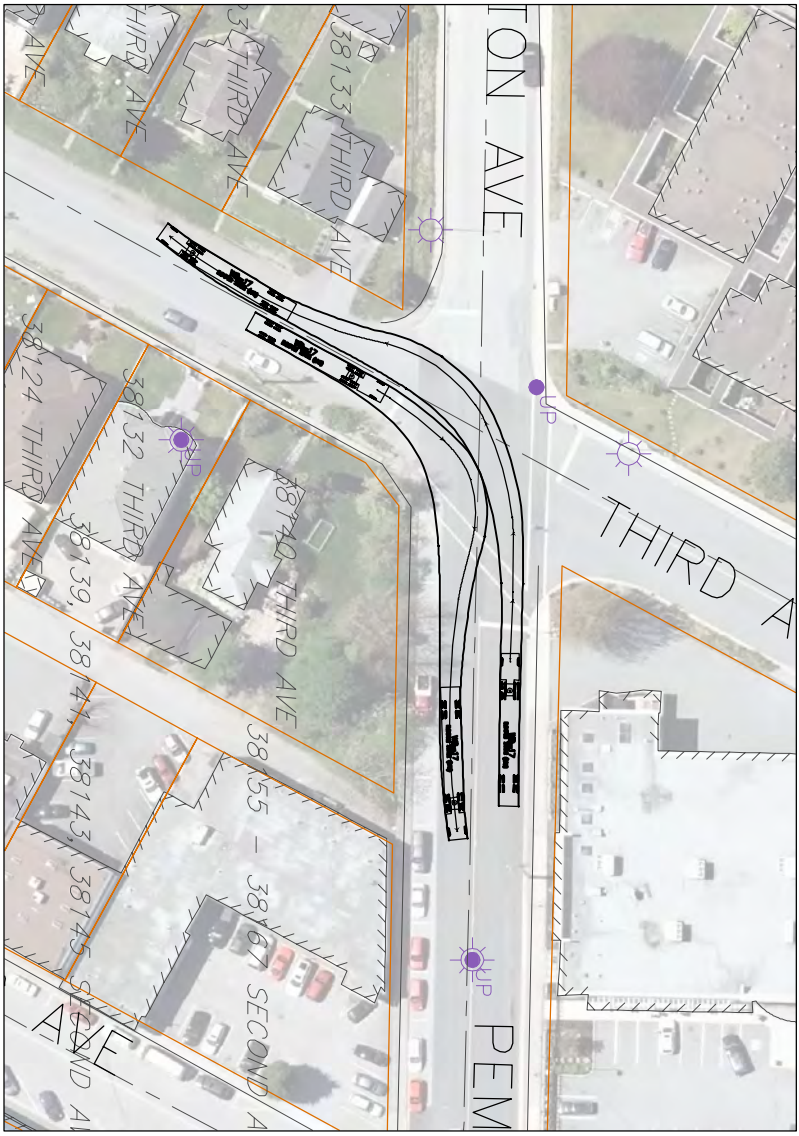
THIRD AVENUE AND VANCOUVER STREET



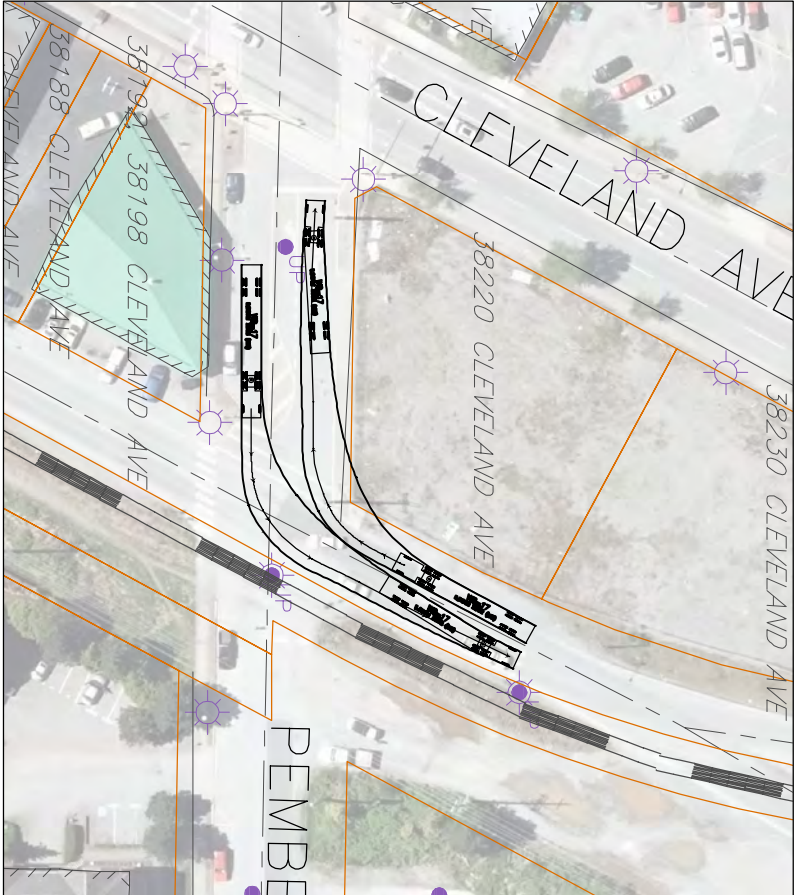
LOGGERS LANE AND VANCOUVER STREET



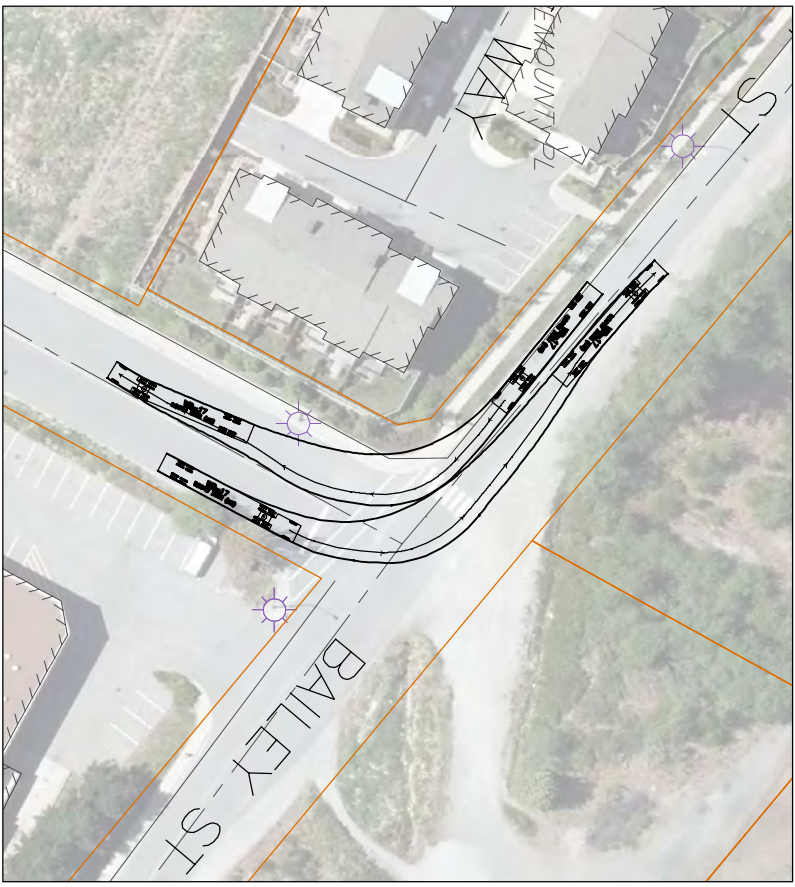
THIRD AVENUE AND PEMBERTON AVENUE



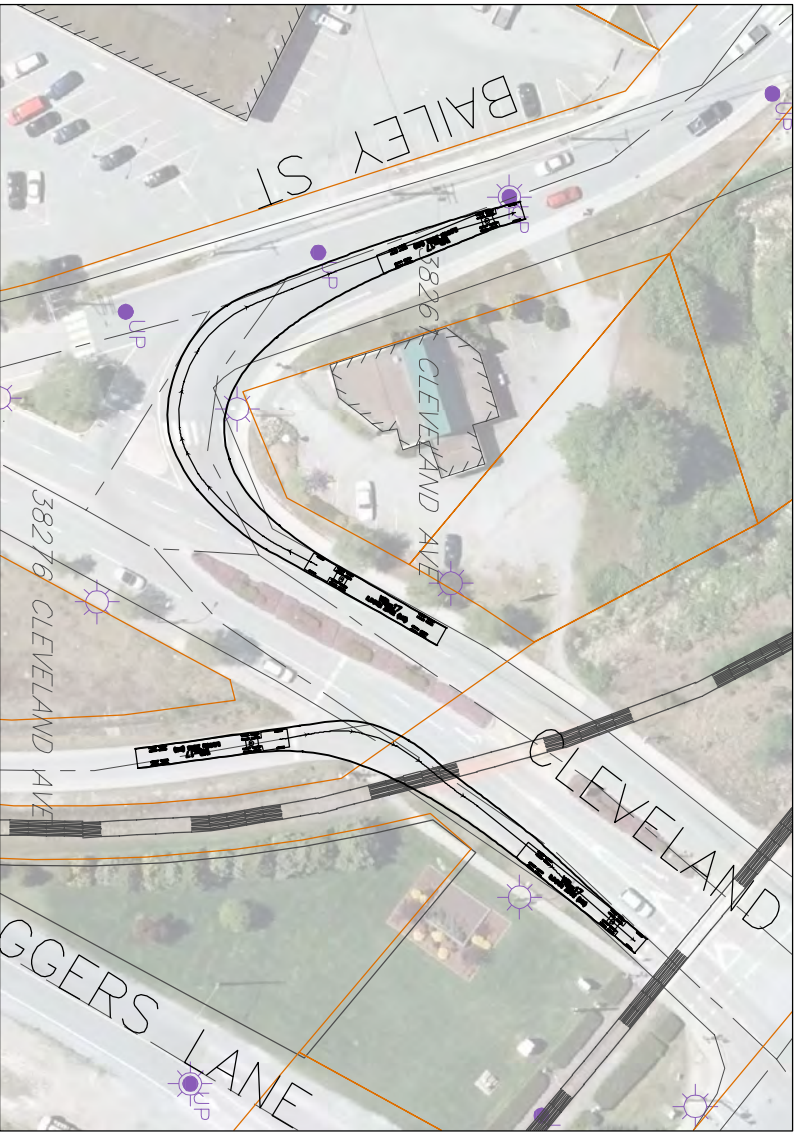
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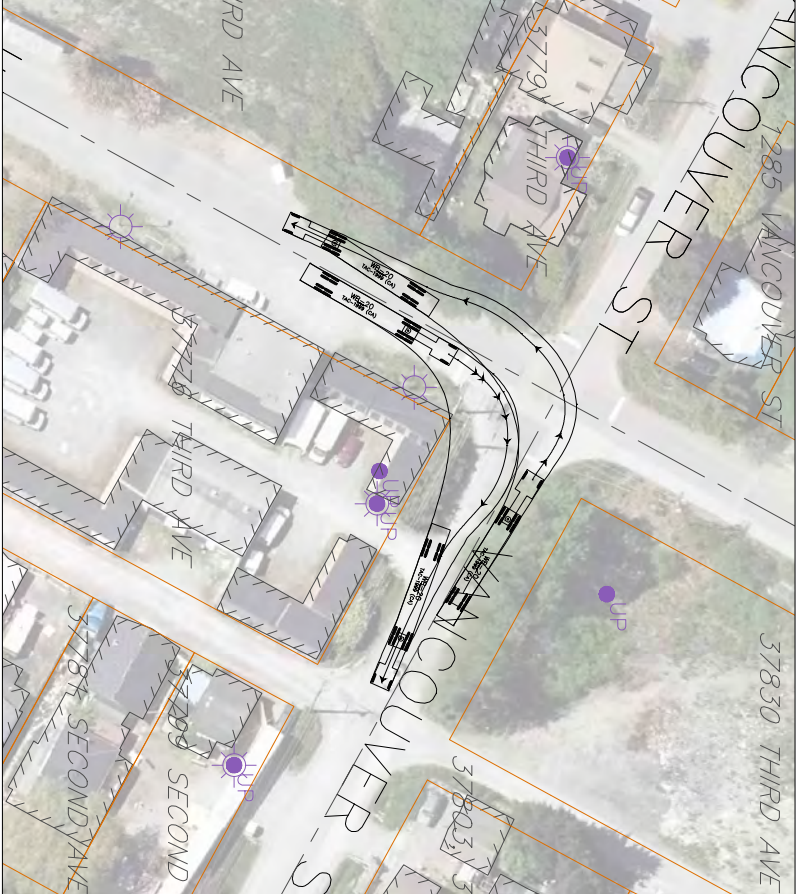
THIRD AVENUE AND BAILEY STREET



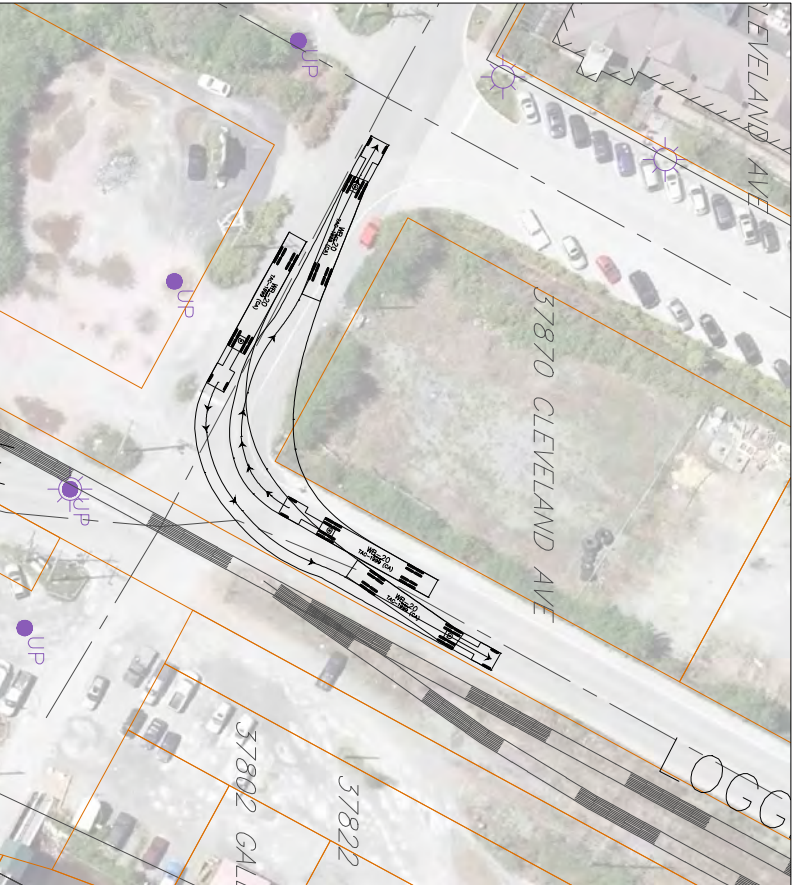
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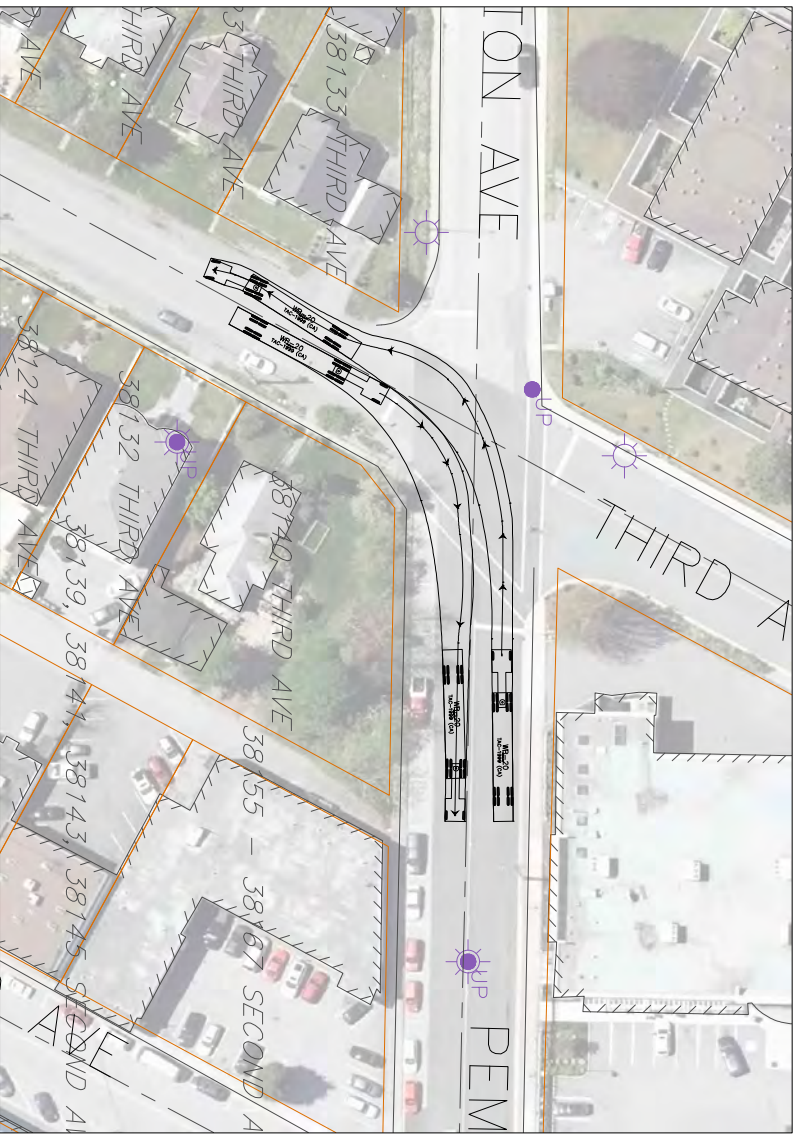
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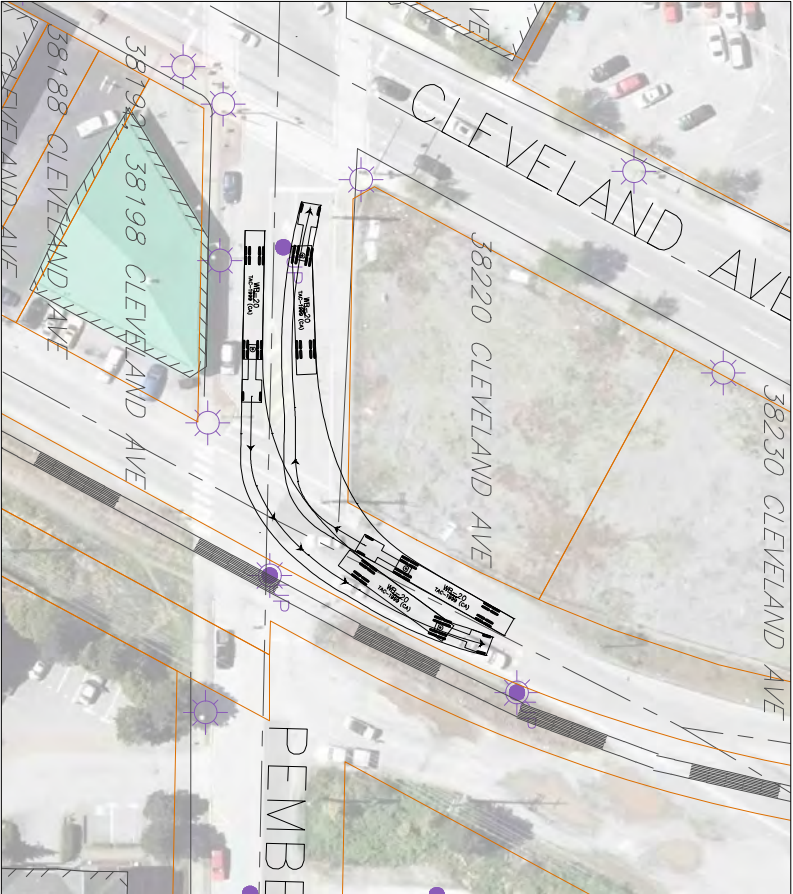
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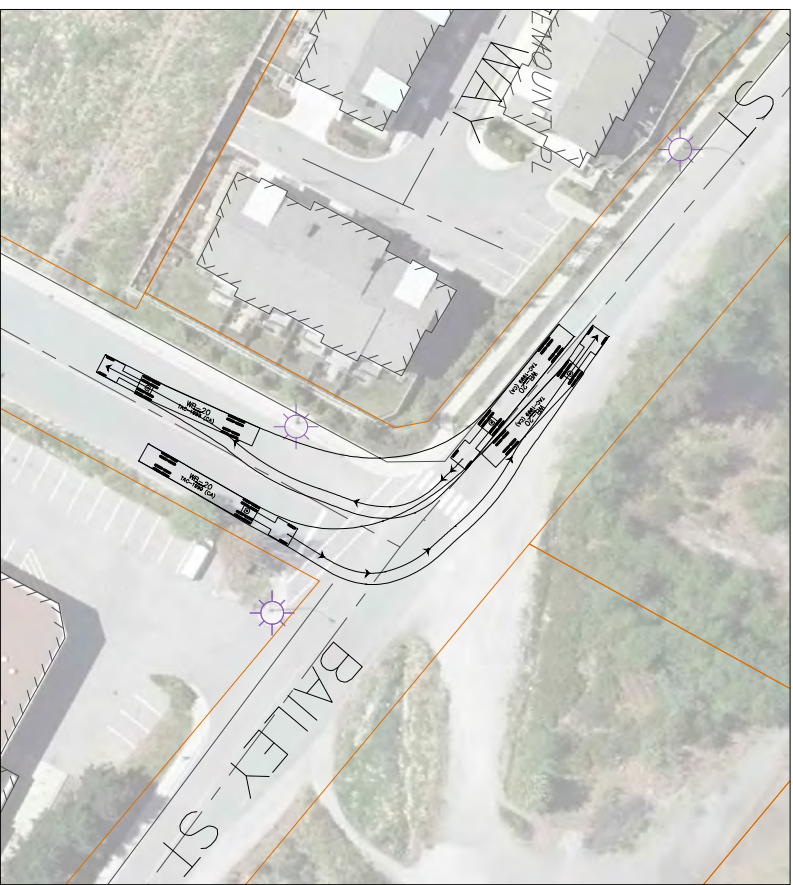
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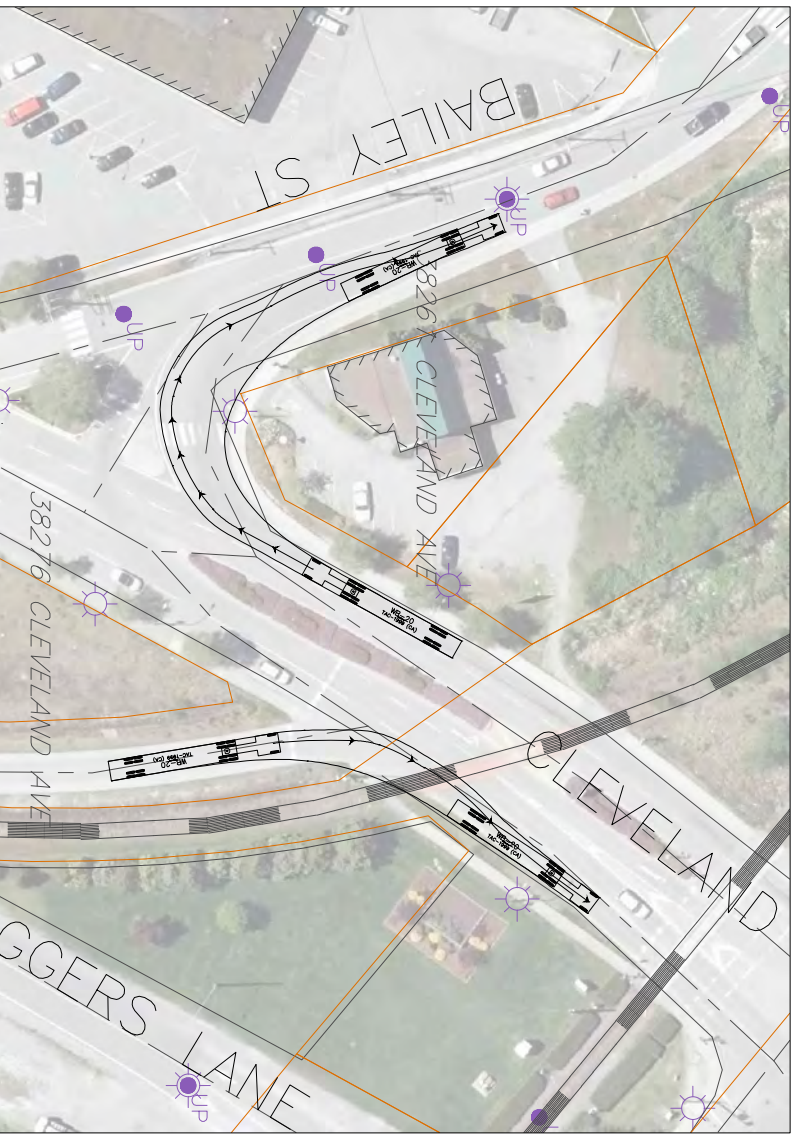
LOGGERS LANE AND PEMBERTON AVENUE



THIRD AVENUE AND BAILEY STREET



LOGGERS LANE AND BAILEY STREET



APPENDIX D

Technical Review Reports

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DOWNTOWN TRUCK ROUTE STUDY, SQUAMISH BC

ARCHAEOLOGICAL OVERVIEW ASSESSMENT

Downtown Truck Route Study Squamish, BC

Archaeological Overview Assessment

August 2016

Submitted to:
Urban Systems Ltd.
Suite 550-1090 Homer Street
Vancouver, BC V6B 2W9

Submitted by:
Amec Foster Wheeler Environment & Infrastructure
a division of Amec Foster Wheeler Americas Limited
Suite 600-4445 Lougheed Highway,
Burnaby, BC V5C 0E4

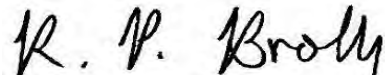
Amec Foster Wheeler Project No.: VE16403

Prepared by:



Christopher Verral
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Reviewed by:



Richard Brolly
Senior Archaeologist

IMPORTANT NOTICE

This report was prepared exclusively for Urban Systems Ltd. by Amec Foster Wheeler Environment & Infrastructure, a division of Amec Foster Wheeler Americas Limited. The quality of information, conclusions and estimates contained herein are consistent with the level of effort involved in Amec Foster Wheeler services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used only by Urban Systems Ltd., subject to the terms and conditions of its contract with Amec Foster Wheeler. Any use of, or reliance on, this report by any third party is at that party's sole risk.

CREDITS

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All personnel are affiliated with Amec Foster Wheeler Environment & Infrastructure.

EXECUTIVE SUMMARY

An Archaeological Overview Report (AOA) was conducted by Amec Foster Wheeler Environment & Infrastructure for the Squamish Downtown Truck Route Study (the Project) in Squamish, BC, for Urban Systems Ltd. on behalf of the District of Squamish. The AOA did not require a Permit issued under the *Heritage Conservation Act* or any First Nations Permits.

The results of this AOA indicate there are no known archaeological sites in conflict with the Project, but that areas of moderate and high potential for the presence of unidentified archaeological sites are present in the Project area.

The core results of the AOA are as follows:

- Eleven (11) documented archaeological sites are located within 5 km of the Project;
- Sixteen (16) documented archaeological sites are located within 10 km of the Project;
- The potential for unidentified archaeological sites to occur within the Project area varies from **low to high**; and
- Based on the types and distribution of previously recorded sites nearby, the following site types are the most likely to be present: surface and subsurface lithic scatters, cultural depressions, CMTs, and human burials.

Extension / Improvement of Existing Routes – Summary

Based on the results and conclusions in this report, the following recommendations are provided for the proposed route alignment:

- No further archaeological work is recommended for the proposed route alignment: (1) along Third Avenue; (2) along Bailey Street from Government Road to Cleveland Avenue; and, (3) along Cleveland Avenue from Bailey Street to Buckley Avenue. These lands have been assessed as having low archaeological potential;
- An Archaeological Impact Assessment (AIA) is recommended for the proposed route alignment: (1) along Logger's Lane from Vancouver Street to Buckley Avenue; (2) along Cleveland Avenue between Buckley Avenue and Highway 99; and, (3) along Government Road from Bailey Street to the CN Rail yard. These lands have been assessed as having moderate archaeological potential; and
 - The AIA should include monitoring by a qualified archaeologist of all construction activities that require removal of native sediments outside the prism of established municipal thoroughfares and should be conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation.

Third Avenue Option – Summary

Based on the results and conclusions in this report, the following recommendations are provided for the proposed route alignment:

- No further archaeological work is recommended for the proposed route alignment: (1) along Third Avenue; (2) along Bailey Street from Third Avenue to Cleveland Avenue; (3) along Cleveland Avenue from Bailey Street to Buckley Avenue; and, (4) along Pemberton Avenue. These lands have been assessed as having low archaeological potential;
- An AIA is recommended for the proposed route alignment: (1) along Cleveland Avenue between Buckley Avenue and Highway 99. These lands have been assessed as having moderate archaeological potential; and
 - The AIA should include monitoring, by a qualified archaeologist, of all construction activities that require removal of native sediments outside the prism of established municipal thoroughfares and should be conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation.

7th Avenue Connector Option – Summary

Based on the results and conclusions in this report, the following recommendations are provided for the proposed route alignment:

- No further archaeological work is recommended for the proposed route alignment: (1) along Bailey Street from Third Avenue to Cleveland Avenue; and, (2) Cleveland Avenue from Bailey Street to Buckley Avenue. These lands have been assessed as having low archaeological potential;
- An AIA is recommended for the proposed route alignment: (1) through the Squamish River estuary from Third Avenue to Government Road. These lands have been assessed as having high archaeological potential;
 - The AIA should include a systematic walking survey and a subsurface testing program conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation;
- An AIA is recommended for the proposed route alignment: (1) along Government Road to the CN Rail yard; (2) along Bailey Street from the CN Rail line crossing to Third Avenue; and (2) along Cleveland Avenue between Buckley Avenue and Highway 99. These lands have been assessed as having moderate archaeological potential;
 - The AIA should include monitoring, by a qualified archaeologist, of all construction activities that require removal of native sediments outside the prism of established municipal thoroughfares and should be conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation.

Westminster Crossing Option – Summary

Based on the results and conclusions in this report, the following recommendations are provided for the proposed route alignment:

- No further archaeological work is recommended for the proposed route alignment: (1) along Third Avenue; and, (2) along Main Street from Third Avenue to Logger's Lane. These lands have been assessed as having low archaeological potential;

- An AIA is recommended for the proposed route alignment: (1) through Stawamus IR 24 to Clarke Drive at Highway 99. These lands have been assessed as having high archaeological potential;
 - The AIA should include a systematic walking survey and a subsurface testing program conducted under a Heritage Inspection Permit issued by the Archaeology Branch and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation;
- An AIA is recommended for the proposed route alignment: (1) along Westminster Street from Third Avenue to the Mamquam Blind Channel; and, (2) along Main Street from Logger's Lane to the Mamquam Blind Channel. These lands have been assessed as having moderate archaeological potential; and
 - The AIA should include monitoring, by a qualified archaeologist, of all construction activities that require removal of native sediments outside the prism of established municipal thoroughfares and should be conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation.

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1 INTRODUCTION

This report describes the results of an Archaeological Overview Assessment (AOA) undertaken by Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) at the request of Urban Systems Ltd. for the District of Squamish Downtown Truck Route Study (the Project) in Squamish, British Columbia (BC). The District of Squamish is located on the west coast of British Columbia, approximately 60 km north of Vancouver, connected to Vancouver by the Sea-to-Sky Highway (Highway 99) (Figure 1).

The objective of the AOA was to identify lands that have the potential to contain archaeological resources along each of four proposed truck routes.

1.1 Protection of Heritage Resources

In BC, most archaeological sites are attributable to settlement and resource use by First Nations' people, and if they pre-date AD 1846, are automatically protected from damage, desecration, alteration, or excavation by the Heritage Conservation Act (Government of BC 1996). Some sites are protected through designation as "Provincial Heritage Sites" under section 9 of the Act, or through automatic protection under section 13 by virtue of particular historic or archaeological values. Sites automatically protected under section 13 include:

- Archaeological sites occupied or used before AD 1846;
- Rock art with historical or archaeological value;
- Burial places with historical or archaeological value;
- Heritage shipwrecks or aircraft wrecks; and
- Archaeological sites of unknown age, with a reasonable possibility of having been occupied or used before AD 1846.

Protected sites may be located on public or private land, and may not be altered (changed in any manner) without a permit issued under sections 12 or 14 of the *Act*. Additionally, archaeological sites of Aboriginal origin may be subject to interpretations of the Supreme Court of Canada decision in *Delgamuukw vs. British Columbia* (1997), regarding the fiduciary responsibility of provincial governments for protecting cultural heritage.

2 PROPOSED PROJECT

The District of Squamish is undertaking a study of proposed commercial vehicle routes between the existing marine terminal (Squamish Terminals) and the CN Rail yard and industrial lands (Squamish Industrial Park) within the District's boundaries. The Project consists of four proposed route options proposed route options to accommodate commercial vehicle traffic through downtown Squamish.

Options include both upgrades to existing roads and construction of new roads and a sea dike. Each of the proposed options has been presented and evaluated for archaeological potential in this report.

The proposed routes are as follows:

- **Extension / Improvement of Existing Route Option:** This route alignment includes upgrades to existing roads: (1) Third Avenue from Squamish Terminals to Vancouver Street; (2) Vancouver Street from Third Avenue to Logger's Lane; (3) Logger's Lane from Vancouver Street to Buckley Avenue; (4) Cleveland Avenue from Bailey Street to Highway 99; and (5) Bailey Street from Cleveland Avenue to Government Road.
- **Third Avenue Option:** This route alignment includes upgrades to existing roads: (1) Third Avenue from Squamish Terminals to Bailey Street; (2) Bailey Street from Third Avenue to Cleveland Avenue; (3) Pemberton Avenue from Third Avenue to Logger's Lane; and (4) Cleveland Avenue from Bailey Street to Highway 99.
- **7th Avenue Connector Option:** This route alignment includes a mix of upgrades to existing roads and construction of a new road: (1) across the Squamish estuary from Third Avenue to Government Road; (2) Bailey Street from the CN Rail crossing to Cleveland Avenue; and (3) Cleveland Avenue from Bailey Street to Highway 99. This route alignment would require construction of a sea dike along the route through the Squamish estuary; and
- **Westminster Crossing Option:** This route alignment includes a mix of upgrades to existing roads and construction of new road: (1) Third Avenue from Squamish Terminals to either Westminster Street or Main Street; (2) Westminster Street from Third Avenue to Galbraith Avenue; or, (3) Main Street from Third Avenue to Logger's Lane; and (4) through Stawamus Indian Reserve (IR) 24 to Highway 99 at Clark Drive. This route alignment would require construction of a new bridge across the Mamquam Blind Channel at either Westminster Street or Main Street.

Specific impacts, including width and depth of any ground disturbance, associated with each option have yet to be determined. For the purposes of evaluating archaeological potential, anticipated impacts for proposed routes are assumed to be as follows:

- **Extension / Improvement of Existing Route Option:** a 20 m wide corridor for road upgrades along Third Avenue, Vancouver Street, Loggers Lane, Bailey Street, and Cleveland Avenue.
- **Third Avenue Option:** a 20 m wide corridor for road upgrades along Third Avenue, Bailey Street, Pemberton Avenue, and Cleveland Avenue.
- **7th Avenue Connector Option:** (1) a 20 m wide corridor for road upgrades along Bailey Street and Cleveland Avenue; and, (2) a 50 m wide corridor for new road and sea dike construction through the Squamish estuary and along Government Road.
- **Westminster Crossing Option:** (1) a 20 m wide corridor for road upgrades along Third Avenue and Main Street; and, (2) a 30 m wide corridor for new road and bridge construction along Westminster Street and through undeveloped land on Stawamus IR 24 to Highway 99 at Clark Drive.

3 STUDY AREA

3.1 Biophysical Background

The Project area is located in the District of Squamish at the head Howe Sound. The modern landscape at the head of Howe Sound is the result of retreating glacial ice and moving water. It is underlain by Holocene alluvial sediment deposited by the Squamish and Mamquam Rivers as well as glaciofluvial and glaciomarine deposits. The area is within the Southern Pacific Ranges ecosection of the Pacific Ranges Ecoregion, characterized by steep mountains formed by glacial action (Demarchi 2011), and within the Eastern Variant of the Dry Maritime Coastal Western Hemlock (CWHdm) biogeoclimatic subzone, characterized by forest of Western Hemlock, Western Red Cedar, and Douglas-fir (Pojar et al. 1991). Much of the forest along the valleys and lower slopes have been subject to generations of logging, along with urban development (Meidinger and Pojar 1991; Ministry of Forests 1994).

A summary of the geomorphological development of the area is provided by Friele (1995). In this area, deglaciation began approximately 10,000 years ago. Meltwater from deglaciation created a complex of terraces and delta landforms around upper Howe Sound. Montane settings in the area deglaciated by 9,300 years ago.

For most of the past 9000 years, the head of Howe Sound was located further north of its modern shoreline. The Squamish River delta has developed over this time: until 3000 years ago the head of Howe Sound stood near the modern Squamish River-Cheakamus River confluence; by 1500 years ago, the delta had built down the sound to a point about 1 km below the modern Squamish River-Mamquam River confluence; and by 1000 years ago, the delta stood at a point just north of Stawamus Indian Reserve (IR) 24 (Friele 1995).

Before the Squamish River extended its delta downstream, the Mamquam and Stawamus Rivers flowed directly into upper Howe Sound. The advancing Squamish River delta formed a barrier to the westward expansion of the Mamquam delta, forcing the river to flow into the sound via a channel parallel to the Squamish River. The modern course of the Mamquam River was established in 1921 when the river changed course during a significant flooding event, creating the Mamquam Blind Channel (Armitage 1997).

The Stawamus River, south of the Squamish delta, formed its own delta independent of the main river and its tributaries. Post-glaciation sea levels reached their modern levels around 2250 years ago, but beach formation on the Stawamus delta was hindered until 900 years ago when this location became protected by the Squamish delta's southward expansion.

3.2 Ethnographic Background

The Project area is located within the traditional territories of the Squamish Nation (Skwwu'mish7u'lh) and Tsleil-Waututh Nation.

The Squamish Nation is a linguistically and culturally distinct group within the Central Coast Salish family (Barnett 1955; Bouchard and Kennedy 1986; Suttles 1990). Their asserted traditional territory includes Burrard Inlet, all of Howe Sound and the Sunshine Coast to Roberts Creek, the Squamish River drainage including the Cheekye and Cheakamus Rivers, and the lower reaches of the Elaho River Valley.

The Tsleil-Waututh Nation are descendants of a Halkomelem group that lived around Burrard Inlet and Indian Arm (Suttles 1990). Their asserted traditional territory includes Burrard Inlet, all of Howe Sound, the Squamish River drainage and the Cheakamus River drainage to Mount Garibaldi.

Traditional Coast Salish culture was characterized by a semi-sedentary lifestyle dependent on fishing, gathering, and hunting for subsistence. The primary socio-economic unit of Coast Salish society was the house group, each consisting of one or more extended families occupying a single house. Each house group owned its house, rights to resource procurement sites, and ritual property including ancestral names, legends, songs, and dances. Rights to these properties were acquired through inheritance and were normally held by the most important members of the household.

Coast Salish villages usually comprised one or more houses. Leadership was provided by the most respected family heads in the village. Each village was linked through ties of marriage and kinship with other villages to form a widespread inter-village network without distinct boundaries. Marriages arranged between socially equal families in different villages helped to establish a co-operative system for resource procurement, including shared access to specific resource locations and shared labour.

Traditional population and settlement were contingent upon the availability and distribution of seasonal resources. The most important of these resources included: salmon and eulachon runs in the Squamish River and tributary streams and rivers as far south as Burrard Inlet; resident fish in rivers, lakes, and sloughs; waterfowl, including ducks, geese, and swans in sloughs and wetlands; wide-ranging game animals, such as deer, elk, mountain goat, and bear; small game and fur-bearing mammals, including beaver, muskrat, otter, and mink, from aquatic settings along sloughs and in wetlands; and plant resources, including redcedar and yellow-cedar trees for timber and bark, other coniferous trees for firewood and medicinal purposes, choke cherries, huckleberries, and blueberries, among others, aquatic plants, such as cranberries and wapato which were used for food, and cattails, used for mat-weaving, and medicinal and root crops in forested and alpine montane environments (Turner 1975, 1979).

Traditional forest use by the Squamish Nation is recorded in the ethnohistoric literature in the form of place names. Place names and discussion of their meanings inform our understanding of earlier uses of the land.

Bouchard and Kennedy (1986) identify the following traditional places in close proximity to the Project area in Squamish:

- *ske'áw* ("beaver"), a low, rocky hill on the west side of Highway 99 opposite the Stawamus Chief Mountain;
- *st'ámes* (no translation), a village site on the Stawamus Indian Reserve (IR) #24, Borden Number DkRs-6
- *xwúekw* ("where they hand the heads of their enemies"), a canoe landing site at the north side of the Squamish dock on Mamquam Blind Channel;
- *smu7k* ("drop from rear end"), a defensive site on the east side of Mamquam Blind Channel, north of the village site #136;

- *k'iyaxenáych* ("fence along the site"), a former fortified village site at the south side of Mamquam Blind Channel where the Highway 99 bridge crosses it;
- *kw'kwinstn* ("cause to hit on chest"), a culturally modified tree associated with fortified village site #141;
- *skwelwílem* (no translation), possible village or seasonal camp site on the east side of the Squamish River main channel in an uncertain location.

3.2 Archaeological Background

An archaeological site is a location containing physical evidence of past human activity in the form of artifacts or cultural features. Artifacts are human-made or modified objects, such as stone and bone tools, ceremonial objects, and fire-altered rocks. Cultural features are modifications to the landscape or objects that cannot be moved without altering them, such as burials, culturally modified trees (CMTs), rock art, cabins and structures, trails and roads, and the remains of industrial activities.

The Project area is situated within the Northwest Coast Culture Area, which encompasses the west coast of North America from southeastern Alaska to southern Oregon (Ames and Maschner 1999; Matson and Coupland 1995). Archaeologists have defined a sequence of pre-Contact cultures in this area, based on site investigations in Howe Sound and Burrard Inlet, the Fraser Valley, the east coast of Vancouver Island and southern Gulf Islands, and in Whatcom County and the San Juan Islands in Washington State. Recent summaries of regional prehistory are provided by Ames and Maschner (1999), Matson and Coupland (1995), Mitchell (1990), and Moss (2011). Based on diagnostic artifact types and technologies, as well as inferred economic, social and other cultural traits, five distinct cultural periods have been identified (Mitchell 1990):

- Lithic or Old Cordilleran (ca. 8,500 - 5,000 years Before Present (BP));
- Charles (ca. 6,500 - 3,200 BP);
- Locarno Beach (ca. 3,200 - 2,400 BP);
- Marpole (ca. 2,400 - 1,600 BP); and
- Strait of Georgia (ca. 1,600 - 200 BP).

The first substantive archaeological work in the Squamish Valley began in 1974, when site surveys by the provincial Archaeological Sites Advisory Board included impact assessments for highway upgrading projects in the Mamquam-Cheekye locality by Kautz and Routley (1974). No archaeological sites were identified along these highway corridors. The first large-scale inventory of archaeological sites in Squamish core territory occurred the following year, when Winram (1975) surveyed the shoreline and islands of Howe Sound. Approximately 70 sites were located, most of which were described as shell middens.

Additional small-scale impact assessments for proposed developments continued in Squamish through the latter half of the 1970s and into the 1980s. These included: assessments for highway construction projects along the Cheakamus River (May and Lucs 1976; Duff and Brolly 1978; Melcombe 1979; Apland 1980a; Bussey 1982) and assessments for highways, transmission lines, and other developments in the Squamish Valley (Duff and Brolly 1978; Melcombe 1979; Apland 1980b; Friesen 1980).

Site inventory-level surveys of this area were conducted on behalf of the Squamish Nation in the 1990s by Arcas Consulting Archeologists (1998a). Arcas (e.g. 1998b, 1998c, 1998d, 1998e, 2000, 2002, and 2003) have conducted numerous assessments for proposed forestry developments in the Squamish Forest District. Reimer has conducted several site surveys and excavations in the Squamish Valley, with a particular focus on alpine and subalpine environments (e.g. Reimer 2000, 2004, 2011).

Compared to the Burrard Inlet-Fraser Delta area, relatively few sites in this region have been investigated in detail by archaeologists. Between 1991 and 1999, Arcas conducted excavations at several sites on behalf of the Squamish Nation, including: the traditional village of *st'ámes* (DkRs-6) on the Stawamus Indian Reserve (IR) #24 in 1991, 1993, and 1994; a traditional resource-processing camp called *upeníwa* (DkRt-2) near Brackendale in 1992; an alpine hunting camp (DkRr-1) near Columnar Peak in Garibaldi Provincial Park; and an upland camp in a rock shelter (EaRu-5) beside the Elaho River in 1999 (Arcas 1998a). Additional excavations were conducted among the islands and shores of Howe Sound further south in Squamish Nation territory (Arcas 1998b). Reimer (2004) discovered and investigated rock shelter sites in the upper Squamish River-Elaho River valley, including additional excavations at site EaRu-5. A general archaeological overview for the Squamish Forest District was prepared by Millennia Research in 1997.

Typical sites that might appear in the Project area specifically, and in the Howe Sound region generally, can include one or more of the following:

- **Middens**, most often situated near marine shorelines, are deposits of mollusc shell, fire-altered rocks, charcoal, and faunal remains (butchered animal bones), representing the locations of village sites or resource harvesting camps.
- **Artifact scatters** are clusters of, most commonly, stone artifacts, including expedient or formed tools and the waste products of tool manufacture (debitage). Most artifact scatters represent transitory use of the landscape, and are often associated with the exploitation of particular resources.
- **Burial places** are locations where First Nation communities interred their dead, commonly within village middens but also throughout their territories. In more recent pre—contact times, the dead were interred above ground at special locations such as bedrock overhangs or earthen mounds.
- **Rock art sites** are locations of non-portable Aboriginal art, either painted on stone (pictographs) or pecked into stone (petroglyphs). Rock art sites are typically found on bedrock outcrops or large boulders, often along steep shorelines or at locations of strong spiritual significance to First Nations' people.
- **Rock shelter sites**, typically found around or bedrock outcrops or large boulders, are locations where a rock formation or boulder provided a naturally sheltered space for a resource harvesting camp or temporary habitation.
- **Fish traps/weirs** are found on river bars or in creeks and streams supporting runs of sea-run salmonids and other fishes.

- **Wetsites** are found in permanently saturated or waterlogged locations, which allow preservation of organic materials (including wooden artifacts) that would otherwise decay rapidly.
- **Forest utilization sites** consist of one or more CMTs, which are trees that have been intentionally altered by First Nations' people. There are two basic types of coastal CMTs: bark-stripped trees and Aboriginally-logged trees (Archaeology Branch 2001). The former result from collecting bark, whereas the latter were produced during timber harvesting. Aboriginally-logged trees can be divided into different types, including: logged stumps of various kinds, standing test-hole trees, plank-stripped trees, plank-stripped logs, and canoe blanks. The majority of CMTs occur within 500 m of the coastline or a major watercourse and in old-growth forest stands containing straight-grained cedar trees.
- **Historical sites** are Post-Contact remains, including artifacts, structures, and features usually associated with Euro-Canadian or Asian-Canadian settlement and land use.

3.2 Historic Background

The first Europeans to enter the waters of Howe Sound were under the command of Captain George Vancouver, aboard the ships the HMS *Discovery* and *Chatham*, in June 1792. In addition to naming and mapping various features of Howe Sound, Vancouver's crew also met and traded with the Squamish Nation. Over the next 50 years, few Europeans visited Howe Sound, and then only to trade (Armitage 1997). However, by 1856, Europeans started exploring the Squamish River in search of gold.

In 1858, Governor Douglas sent an exploration party up the Squamish River to find an easier route to the Cariboo Gold Fields. By the 1860s, the development of this route, the Pemberton Trail from Squamish north to Pemberton, facilitated European expansion into the area. From the 1870s onward, logging and mining activities dominated the landscape in the Squamish-Garibaldi area. Only scattered settlers set up homesteads, the first of whom were a group of Norwegians (Armitage 1997).

Increased industrial activities and the need to get resources (e.g., lumber or minerals) to market, along with increased homesteading activities, lead to the creation of the townsite of Squamish. In 1906, the Pacific Great Eastern Railway was incorporated, with the line proceeding north from Squamish (at that time known as Newport) along the general route of the Pemberton Trail. By 1972, the railway was operating under the name BC Rail, which is now operated by Canadian National Railway.

The expansion of the logging and mining industries lead to the development of the Squamish area as it is today. Construction of the Sea-to-Sky Highway (Highway 99), paralleling the route of the Pemberton Trail, has led to continuing residential and commercial growth along its corridor (Armitage 1997; Town 2000).

4 METHODS

To assist with the management of archaeological sites, the Archaeology Branch of the BC Ministry of Forests, Lands and Natural Resource Operations (Archaeology Branch) issued the *Archaeological Impact Assessment Guidelines* (Archaeology Branch 1998). According to the *Guidelines*, the purpose of an Archaeological Overview Assessment (AOA) is to:

- Identify lands that have the potential to contain archaeological resources, within the Project development area;
- identify potential conflicts between documented archaeological resources and the proposed development; and
- Recommend additional studies or other measures to identify and evaluate archaeological resources, if required.

“Archaeological potential” is defined as the capability of a landscape for having supported the kinds of traditional activities in the past that would have resulted in the formation and preservation of archaeological sites. Potential ratings do not predict the probability of sites, but rather identify lands that should be examined by archaeologists in advance of development projects. Some kinds of traditional activities did not result in the formation of physical remains and such activities usually cannot be considered in the context of an assessment of archaeological potential.

No fieldwork was conducted for this AOA and neither a Heritage Inspection Permit nor First Nation Permits were required for the current stage of the Project. Possible later archaeological studies, such as an Archaeological Impact Assessment (AIA), will require a Heritage Inspection Permit as defined in the *Heritage Conservation Act* (Government of BC, 1996) and First Nations Permits (Squamish Archaeological Investigation Permit and Tsleil-Waututh Cultural Heritage Investigation Permit) issued by those communities for archaeological work within their respective areas of traditional interest.

This AOA included:

- Background research, including a review of historic, ethnographic, and archaeological literature describing prior research in the Squamish area;
- A search of the Provincial Heritage Register maintained by the Archaeology Branch, for recorded archaeological and historical sites in the vicinity of the Project;
- A review of aerial and satellite imagery of the Project area for information on land use and landscape integrity;
- A review of biological, topographical, geological, and hydrological information for the Project area; and
- Preparation of this report on the results of the AOA.

Recommendations for additional work were prepared for each of the proposed route options based on the results of the desktop research and the assessed potential of each route. An assessment of archaeological resource potential is based on a consideration of the locations of documented archaeological sites, ethnographic and historic information, and topographical and biophysical characteristics that favourably influence the distribution of archaeological sites.

Because archaeological site locations are often correlated with particular micro-environmental attributes, the presence or absence of these variables can be used to identify lands with greater or lesser archaeological potential. The environmental variables considered for the AOA included:

- Modern vegetation/forest cover;
- Proximity to documented archaeological resources;

- Presence of traditional resources (e.g., stone suitable for flaking, economic plants);
- Proximity to aquatic features (e.g., streams, wetlands, open water);
- Aspect (i.e., wind or solar exposure based on direction of slope);
- Current understanding of traditional resource use and settlement by Aboriginal people;
- Environmental settings of documented archaeological sites in the area; and
- Integrity of the modern landscape as a reflection of historic land use practices.

5 RESULTS

5.1 Documentary Research

Documentary research included a review of ethnographic and archaeological literature. Information pertaining to the ethnographic and pre-contact land use is described in Section **Error! eference source not found..** Information pertaining to biophysical, geomorphological, and hydrological information is presented in Section **Error! Reference source not found..**

5.2 Archaeological Resources

The results of this AOA indicate that there are no previously documented archaeological sites in conflict with the Project; however, a search of the RAAD database revealed a range of cultural and archaeological site types, including shell middens, rock shelters, artifact scatters, and human burials, located near the Project area, in the river valley and at higher elevations:

- One (1) archaeological site within 500 m of the Project area;
- Eleven (11) archaeological sites located within 5 km of the Project area; and
- Sixteen (16) archaeological sites located within 10 km of the Project area.

The 11 archaeological sites present within 5 km of the Project area are shown on Figure 1 and the 16 archaeological sites present within 10 km of the Project area are summarized in Table 1 below.

Table 1. Known Archaeological Sites within 10 km of Study Area

Borden Number	Site Type	Setting	Site Visits	Comments	Distance & Direction from Project
DkRs-6	Shell midden	East side of Mamquam Blind Channel	1990, 1991, 1994	<i>st'ámes</i> traditional village, located on Stawamus IR 24. Numerous artifacts recovered.	440m southeast
DkRs-16	Rock shelter with surface lithics	Forested east slope of Stawamus Chief	2012	Surface lithics recovered from two rock shelter features.	1.8 km east
DkRs-20	Surface lithics	Within cleared BC Hydro transmission line right-of-way	2001, 2015	Single projectile point located on a transmission tower pad.	1.8 km northeast
DkRs-2	Precontact surface lithics	On a trail on Squamish Chief	1967	Single artifact located on a trail. No details provided in Provincial Register. Exact location undetermined.	1.9 km south-southeast

Borden Number	Site Type	Setting	Site Visits	Comments	Distance & Direction from Project
DkRs-19	Subsurface lithics and faunal remains	Low bedrock bluff above a terrace	2014	Diffuse site with lithics scattered across a wide area.	2.1 km east
DkRs-5	Historical cemetery	Eastern bank of the Squamish River	1991	Fenced graveyard on a rocky point north of Yekwaupsum IR 19.	2.3 km north
DkRs-10	Rock shelter with surface lithics and fauna	At the foot of granite bluff	1995	Site is adjacent to Shannon Creek Forest Service Road.	2.8 km southeast
DkRs-9	Surface lithics	Residential property in Garibaldi Highlands	1993	Single basalt maul located on private property.	3.2 km northeast
DjRt-7	Surface lithics	Northeast of Watts Point	1975	No details provided in Provincial Register	3.8 km south
DkRs-17	Subsurface lithics	Northeast bank of the Stawamus River	2014	Site is directly adjacent to the Stawamus River.	3.9 km east
DkRs-18	Rock shelter with subsurface lithics and fauna	Steep slope along the Stawamus River Valley	2014	Granite boulder with protected overhang.	4.5 km east
DjRt-10	Pictograph	In Browning Lake Provincial Park	2003	<i>Sts'its'a7in</i> pictograph site on a granite bluff.	6.0 km southwest
DkRs-12	Surface lithics	Terrace overlooking Brackendale-Squamish Slough	1998	Lithics eroding from cut bank. Site disturbed by land leveling.	6.3 km north
DkRs-4	Historical cemetery	Eastern bank of the Squamish River	1991	Multiple human burials eroding out of the bank of the Squamish River	6.6 km north
DkRs-8	Culturally modified trees	Eastern bank of the Cheakamus River	1996, 1998	Stand of CMTs in Block G of Woodlot 27. Partially logged.	6.7 km north
DkRt-3	Historical cemetery	East bank of the Squamish River	1990	Marked graves located within the Poquiosin and Skamain IR 13.	7.3 km north

5.3 Archaeological Potential

An archaeological potential model for the Project area is displayed in RAAD which highlights lands of moderate and high potential.

Areas of modeled high and moderate archaeological potential along proposed route alignment options are shown on Figures 2-5, and summarized here:

- High potential modeled along the proposed **Westminster Crossing Option**, on the east side of Mamquam Blind Channel from north of Chief Billy Drive to the edge of the bluffs at the north side of Stawamus IR 24;
- Moderate potential modeled along the proposed **Westminster Crossing Option**, on the east side of Mamquam Blind Channel through undeveloped lands on Stawamus IR 24 to Highway 99 at Clark Drive; and
- Moderate potential modeled along the proposed **Extension/Improvement of Existing Routes Option**, the **Third Avenue Option**, and the **7th Avenue Connector Option** along Cleveland Drive, between Buckley Avenue and Highway 99.

5.4 Historic Landscape Integrity

Aerial photography of the area was reviewed and shows continuous residential and industrial development throughout the study area. The results of the aerial photograph review are summarized below:

Table 2. Aerial Photo Review Results

Date	Flight	Frames	Altitude	Observations
1949 (Photo 1)	BC 811	25	High	<ul style="list-style-type: none"> ▪ Study area is a mix of rural and residential properties, cleared fields, and wooded areas. ▪ Cleveland Avenue, and Pemberton Avenue right-of-ways have been built on their modern alignments. ▪ Loggers Lane right-of-way has been built on its modern alignment between Pemberton Avenue and Vancouver Street. ▪ Rail line adjacent to Logger's Lane has been built on its modern alignment. ▪ Bailey Street has not been built. ▪ Third Avenue has not been built. ▪ CN Rail line west of townsite has not been built. ▪ Galbraith Avenue has not been built. ▪ No development visible along 7th Avenue connector option. ▪ Westminster Crossing option is wooded. ▪ North-south trending creek west of Squamish adjacent to 7th Ave Connector option appears to be in its original alignment. ▪ No clearing or development along east-west trending ridge on east side of Mamquam Blind Channel on Westminster Crossing option.
1957 (Photo 2)	BC 2350	11	High	<ul style="list-style-type: none"> ▪ Third Avenue built on modern alignment between Pemberton Avenue and Main Street and south of Vancouver Street. ▪ Wooded areas along Westminster Crossing option on west side of Mamquam Blind Channel have been cleared for industrial use. ▪ Squamish Shipping Terminal and Third Avenue extension to terminal not built. ▪ Additional residential development throughout study area.
1967	BC 5226	176	High	<ul style="list-style-type: none"> ▪ Galbraith Avenue has been built on its modern alignment. ▪ Bailey Street right-of-way has been built on its modern alignment. ▪ Third Avenue has been extended from Pemberton Avenue to south of Vancouver Street.

Date	Flight	Frames	Altitude	Observations
				<ul style="list-style-type: none"> Highway 99 has been built on its modern alignment. Additional clearing and development of residential and industrial structures throughout study area.
1973 (Photo 3)	BC 7558	57	Very High	<ul style="list-style-type: none"> Third Avenue has been extended to its modern alignment from Pemberton Avenue to the Squamish Shipping Terminal. Squamish River backchannel adjacent to Third Avenue redirected under Third Avenue and bridge installed in modern location. Squamish Shipping Terminal has been built in its modern location. CN Rail line west of Squamish, trending north from Shipping Terminal has been built in its modern alignment. Continued clearing and development of residential and industrial structures throughout study area.
1981	BC 81017	79, 161	High	<ul style="list-style-type: none"> Continued clearing and development of residential and industrial structures throughout study area. No significant changes along proposed route options.
1994	BC 94122	94	Very High	<ul style="list-style-type: none"> Continued clearing and development of residential and industrial structures throughout study area. No significant changes along proposed route options.
2005 (Photo 4)	BC 5025	207	High	<ul style="list-style-type: none"> Continued clearing and development of residential and industrial structures throughout study area. No significant changes along proposed route options.

6 EVALUATION AND DISCUSSION

The results of this AOA indicate that the Project area contains no known archaeological sites, but that there are areas of moderate and high potential for the presence of undocumented archaeological sites along the proposed route options. The AOA results for each route option are detailed in Section 6.1 through 6.4 below.

6.1 Extension / Improvement of Existing Routes Option

Based on the findings of the desktop review, the proposed route alignment is considered to have **low-to-moderate potential** for unidentified archaeological sites, based on the following:

- The route alignment is situated within 100 m of the Mamquam Blind Channel (the previous course of the Mamquam River), within 100 m of distributary channels of the Squamish estuary, and within 1 km of the Squamish River main channel;
- No documented archaeological sites are located within or immediately adjacent to the route alignment;
- The Squamish Forest District potential model for the route alignment displays the one polygon of modeled moderate potential along Cleveland Avenue, between Buckley Avenue and Highway 99;
- Ethnographic accounts identify a traditional use site on the route alignment near the Squamish docks at Vancouver Street and Logger's Lane;

- The route alignment is situated in an area that has been profoundly modified by urban development, including road and railway construction, and industrial and residential land use.

6.2 Third Avenue Option

Based on the results and conclusions above, the proposed route alignment is considered to have **low-to-moderate potential** for unidentified archaeological sites, based on the following:

- The route alignment is situated within 400 m of the Mamquam Blind Channel, within 100 m of distributary channels of the Squamish estuary, and within 1 km of the Squamish River main channel;
- No documented archaeological sites are located within or immediately adjacent to the route alignment;
- The Squamish Forest District potential model for the route alignment displays the one polygon of modeled moderate potential along Cleveland Avenue, between Buckley Avenue and Highway 99;
- The route alignment is situated in an area that has been profoundly modified by urban development, including road construction, and industrial and residential land use.

6.3 7th Avenue Connector Option

Based on the results and conclusions above, the proposed route alignment is considered to have **moderate-to-high potential** for unidentified archaeological sites, based on the following:

- The route alignment is situated within 500 m of the Mamquam Blind Channel, within 100 m of distributary channels of the Squamish estuary, and within 1 km of the Squamish River main channel;
- No documented archaeological sites are located within or immediately adjacent to the route alignment;
- Four known archaeological sites within 10 km of the route alignment are situated in similar settings along the Squamish River;
- The Squamish Forest District potential model for the route alignment displays the one polygon of modeled moderate potential along Cleveland Avenue, between Buckley Avenue and Highway 99;
- Ethnographic accounts identify a traditional use site of undetermined location within Squamish estuary;
- The route alignment is situated in an area that has been affected by railway construction, but has otherwise not been impacted by residential or industrial activities and is mostly intact.

6.4 Westminster Crossing Option

Based on the results and conclusions above, the proposed route alignment is considered to have **moderate-to-high potential** for unidentified archaeological sites, based on the following:

- The route alignment crosses the Mamquam Blind, is within 100 m of distributary channels of the Squamish estuary, and within 1 km of the Squamish River main channel;
- No documented archaeological sites are located within or immediately adjacent to the route alignment area;
- One known archaeological is located within 500 m of the route alignment on Stawamus IR 24;
- The Squamish Forest District potential model for the route alignment displays the one polygon of modeled high potential on the east side of Mamquam Blind Channel from north of Chief Billy Drive to the edge of the bluffs at the north side of Stawamus IR 24;
- The Squamish Forest District potential model for the route alignment displays the one polygon of modeled moderate potential on the east side of Mamquam Blind Channel from undeveloped lands on Stawamus IR 24 to Highway 99 at Clark Drive;
- Ethnographic accounts identify two traditional use sites on the route alignment on Stawamus IR 24;
- The route alignment west of Mamquam Blind Channel is situated in an area that has been profoundly modified by urban development, including road and rail construction, and industrial and residential land use.;
- The route alignment east of Mamquam Blind Channel is situated in an area that remains largely intact.

7 RECOMMENDATIONS

The review of the proposed alignments of the four route options shows that there are archaeological concerns associated with each of the proposed routes. Recommendations for each route option are detailed in Section 7.1 through 7.4 below.

7.1 Extension / Improvement of Existing Routes Option

Based on the results of this study, the following recommendations are provided for the proposed route alignment:

- No further archaeological work is recommended for the proposed route alignment: (1) along Third Avenue; (2) along Bailey Street from Government Road to Cleveland Avenue; and, (3) along Cleveland Avenue from Bailey Street to Buckley Avenue. These lands have been assessed as having low archaeological potential;
- An Archaeological Impact Assessment (AIA) is recommended for the proposed route alignment: (1) along Logger's Lane from Vancouver Street to Buckley Avenue; (2) along Cleveland Avenue between Buckley Avenue and Highway 99; and, (3) along Government Road from Bailey Street to the CN Rail yard. These lands have been assessed as having moderate archaeological potential; and
 - The AIA should involve concurrent monitoring by a qualified archaeologist of construction activities that require removal of native sediments outside the prism of established municipal thoroughfares and should be conducted under a

Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation.

7.2 Third Avenue Option

Based on the results of this study, the following recommendations are provided for the proposed route alignment:

- No further archaeological work is recommended for the proposed route alignment: (1) along Third Avenue; (2) along Bailey Street from Third Avenue to Cleveland Avenue; (3) along Cleveland Avenue from Bailey Street to Buckley Avenue; and, (4) along Pemberton Avenue. These lands have been assessed as having low archaeological potential;
- An AIA is recommended for the proposed route alignment: (1) along Cleveland Avenue between Buckley Avenue and Highway 99. These lands have been assessed as having moderate archaeological potential; and
 - The AIA should include monitoring, by a qualified archaeologist, of construction activities that require removal of native sediments outside the prism of established municipal thoroughfares and should be conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation.

7.3 7th Avenue Connector Option

Based on the results of this study, the following recommendations are provided for the proposed route alignment:

- No further archaeological work is recommended for the proposed route alignment: (1) along Bailey Street from Third Avenue to Cleveland Avenue; and, (2) Cleveland Avenue from Bailey Street to Buckley Avenue. These lands have been assessed as having low archaeological potential;
- An AIA is recommended for the proposed route alignment: (1) through the Squamish River estuary from Third Avenue to Government Road. These lands have been assessed as having high archaeological potential;
 - The AIA should involve a systematic pedestrian survey and subsurface testing program conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation;
- An AIA is recommended for the proposed route alignment: (1) along Government Road to the CN Rail yard; (2) along Bailey Street from the CN Rail line crossing to Third Avenue; and (2) along Cleveland Avenue between Buckley Avenue and Highway 99. These lands have been assessed as having moderate archaeological potential;
 - The AIA should involve concurrent monitoring, by a qualified archaeologist, of construction activities that require removal of native sediments outside the prism of established municipal thoroughfares and should be conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation.

7.4 Westminster Crossing Option

Based on the results of this study, the following recommendations are provided for the proposed route alignment:

- No further archaeological work is recommended for the proposed route alignment: (1) along Third Avenue; and, (2) along Main Street from Third Avenue to Logger's Lane. These lands have been assessed as having low archaeological potential;
- An AIA is recommended for the proposed route alignment: (1) through Stawamus IR 24 to Clarke Drive at Highway 99. These lands have been assessed as having high archaeological potential;
 - The AIA should involve a systematic pedestrian survey and subsurface testing program conducted under a Heritage Inspection Permit issued by the Archaeology Branch and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation;
- An AIA is recommended for the proposed route alignment: (1) along Westminster Street from Third Avenue to the Mamquam Blind Channel; and, (2) along Main Street from Logger's Lane to the Mamquam Blind Channel. These lands have been assessed as having moderate archaeological potential; and
 - The AIA should involve concurrent monitoring, by a qualified archaeologist, of construction activities that require removal of native sediments outside the prism of established municipal thoroughfares and should be conducted under a Heritage Inspection Permit issued by the Archaeology Branch, and archaeological permits issued by the Squamish Nation and the Tsleil-Waututh Nation.

8 LIMITATIONS AND CLOSURE

This Technical Memorandum was prepared by Amec Foster Wheeler for the exclusive use of Urban Systems Ltd. and the District of Squamish. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in Amec Foster Wheeler services and based on: (i) information available at the time of preparation, (ii) data supplied by outside sources, and (iii) the assumptions, conditions, and qualifications set forth in this document.

This document is intended to be used by Urban Systems Ltd. and the District of Squamish for its purposes only, subject to the terms and conditions of its contract with Amec Foster Wheeler. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

The study was not designed to address issues of potential traditional Aboriginal use of the proposed development location, and this letter was written without prejudice to Aboriginal rights and title.

We appreciate the opportunity to conduct this desktop archaeological review for Urban Systems Ltd. Please contact us if you have any questions about the work completed for this study or the recommendations we have made.

9 REFERENCES

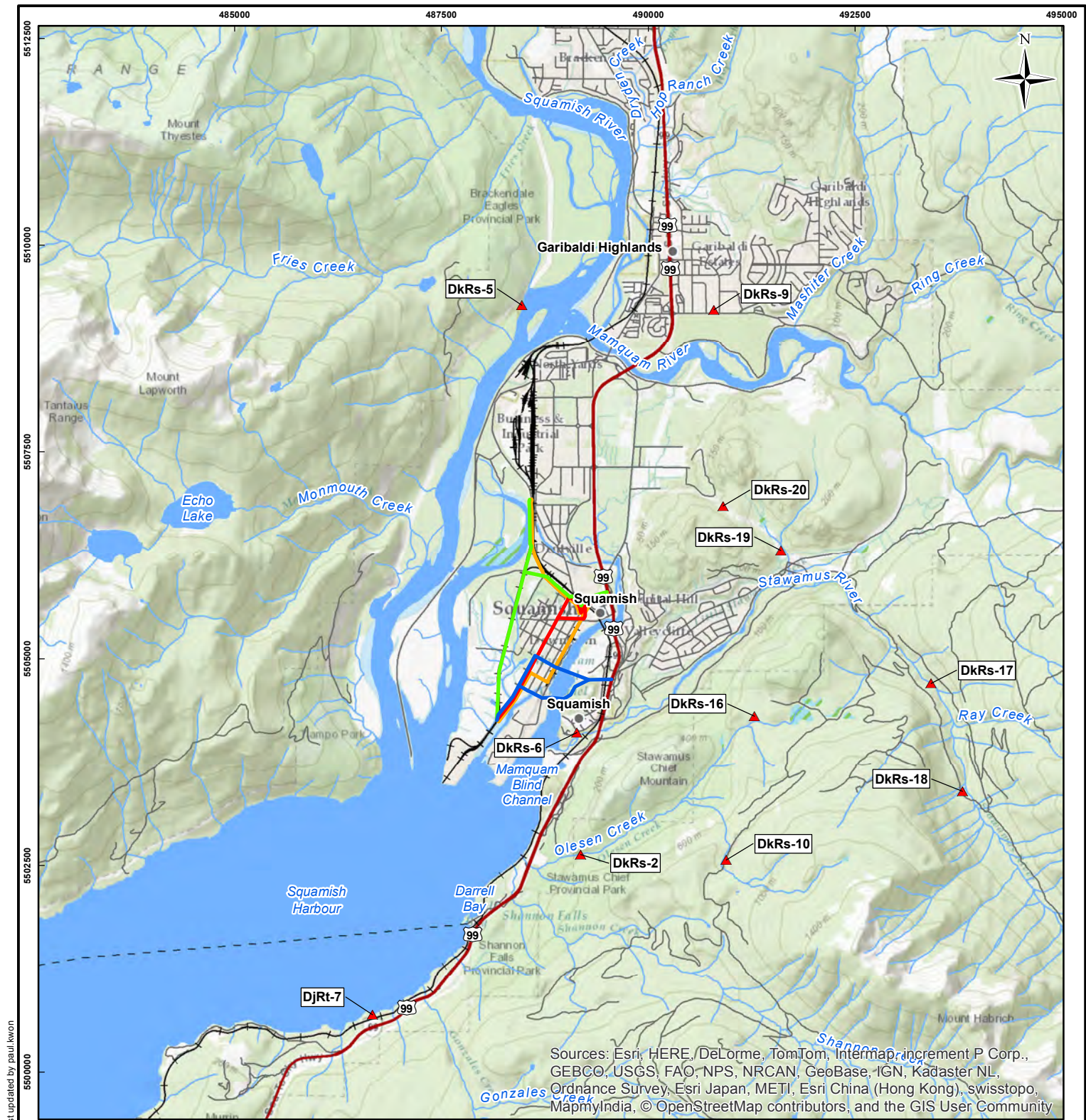
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Figures

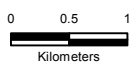




Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Legend

- ▲ Previously Recorded Archaeological Site
- Populated Place
- Railway
- Highway
- Road
- Ferry Route
- Watercourse
- Waterbody
- Wetland
- Extension Improvement of Existing Route Option
- Third Ave Option
- 7th Ave Connector Option
- Westminster Crossing Option



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 MFLNRO - Archaeology Branch
 Archaeological Sites RAAD
 (Remote Access to Archaeological Data)

CLIENT:

Urban Systems

PROJECT:

Squamish Downtown Truck Route Study

TITLE:

Downtown Truck Route Study Overview

DATE:

August 17, 2016

SCALE:

1:65,000

Figure 1

GIS FILE:

Figure1_Overview

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wheeler

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NAD 1983 UTM Zone 10N

JOB No:

VE16403

ANALYST:

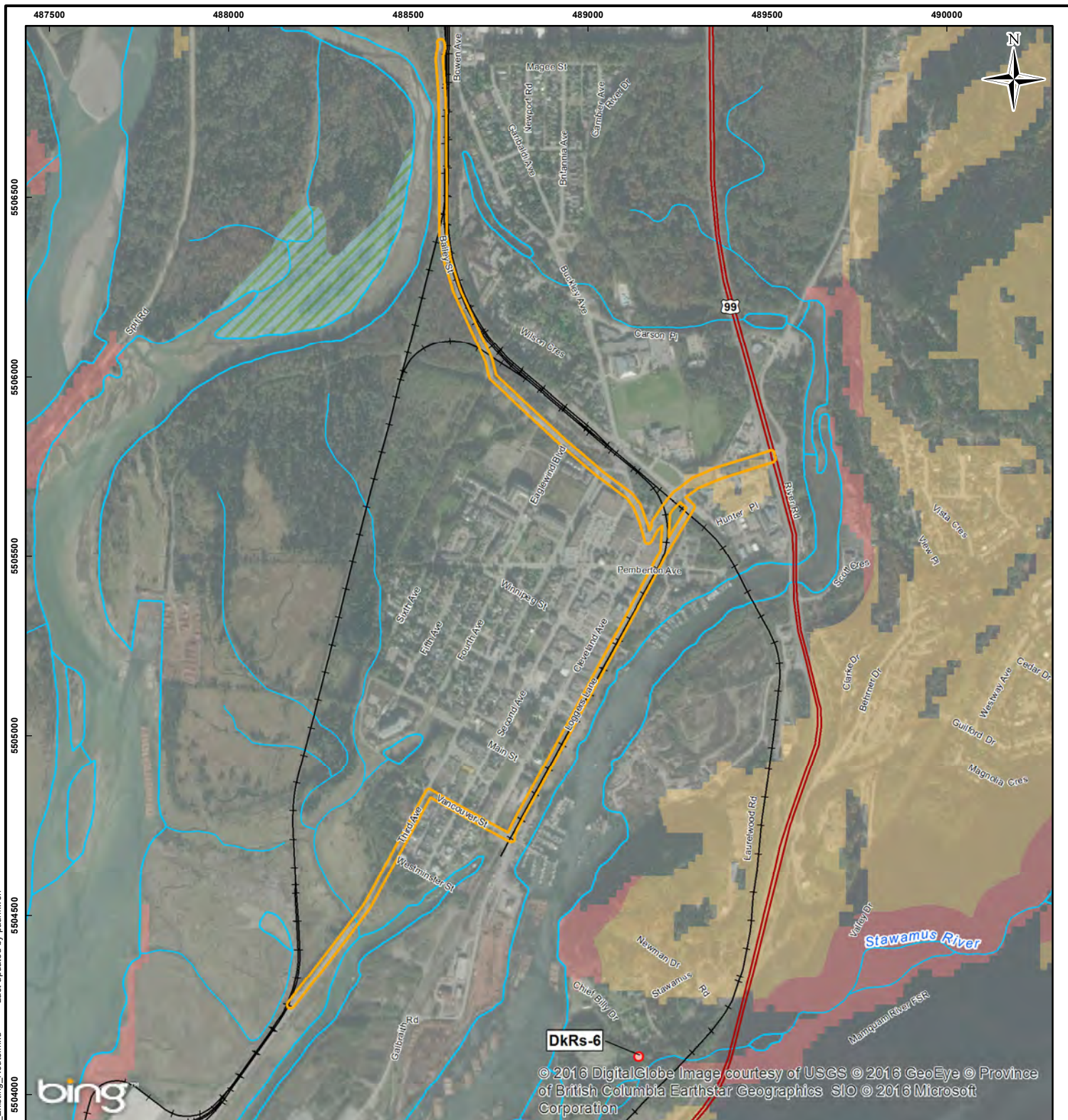
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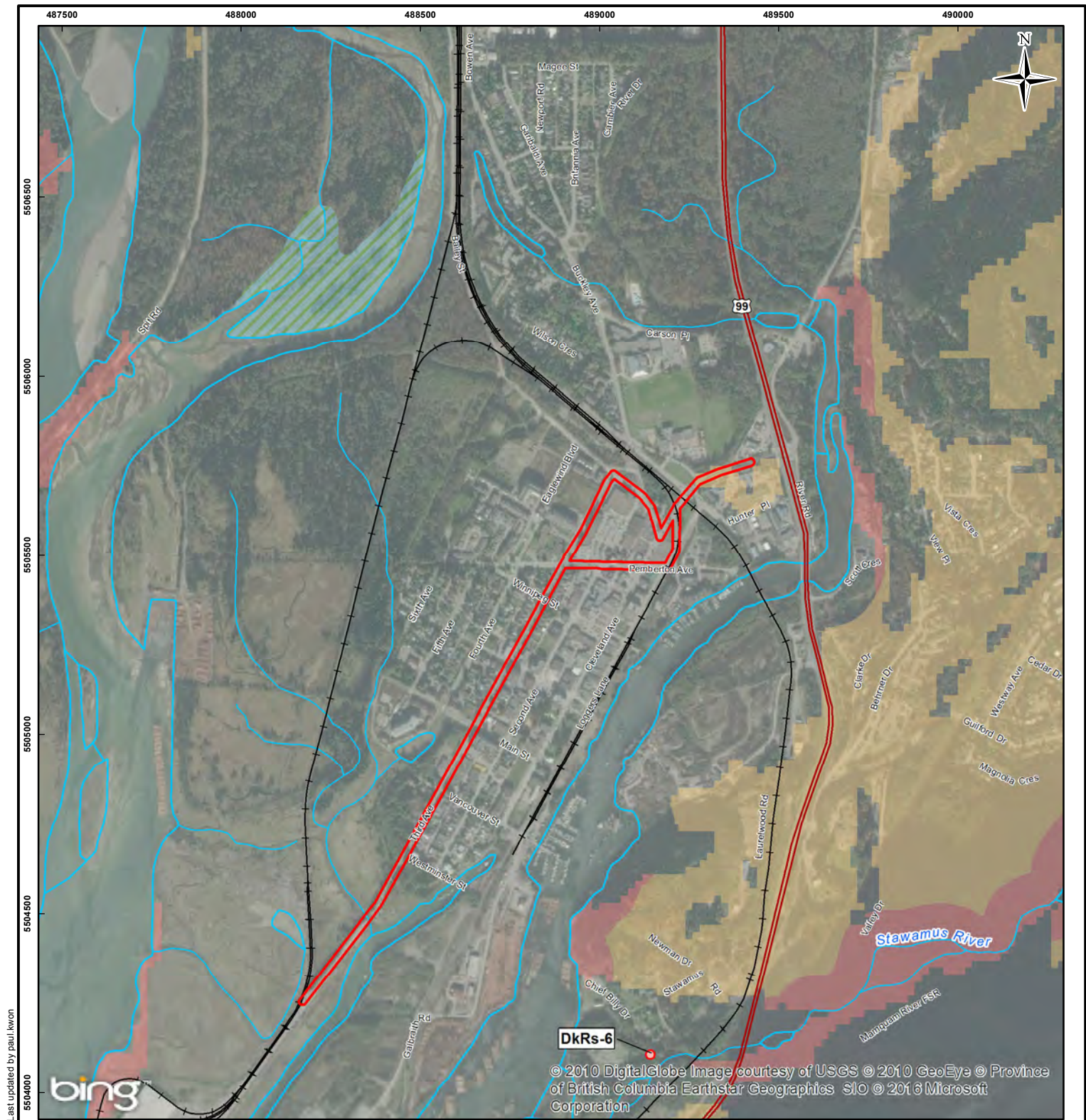
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- Watercourse
- Waterbody
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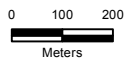
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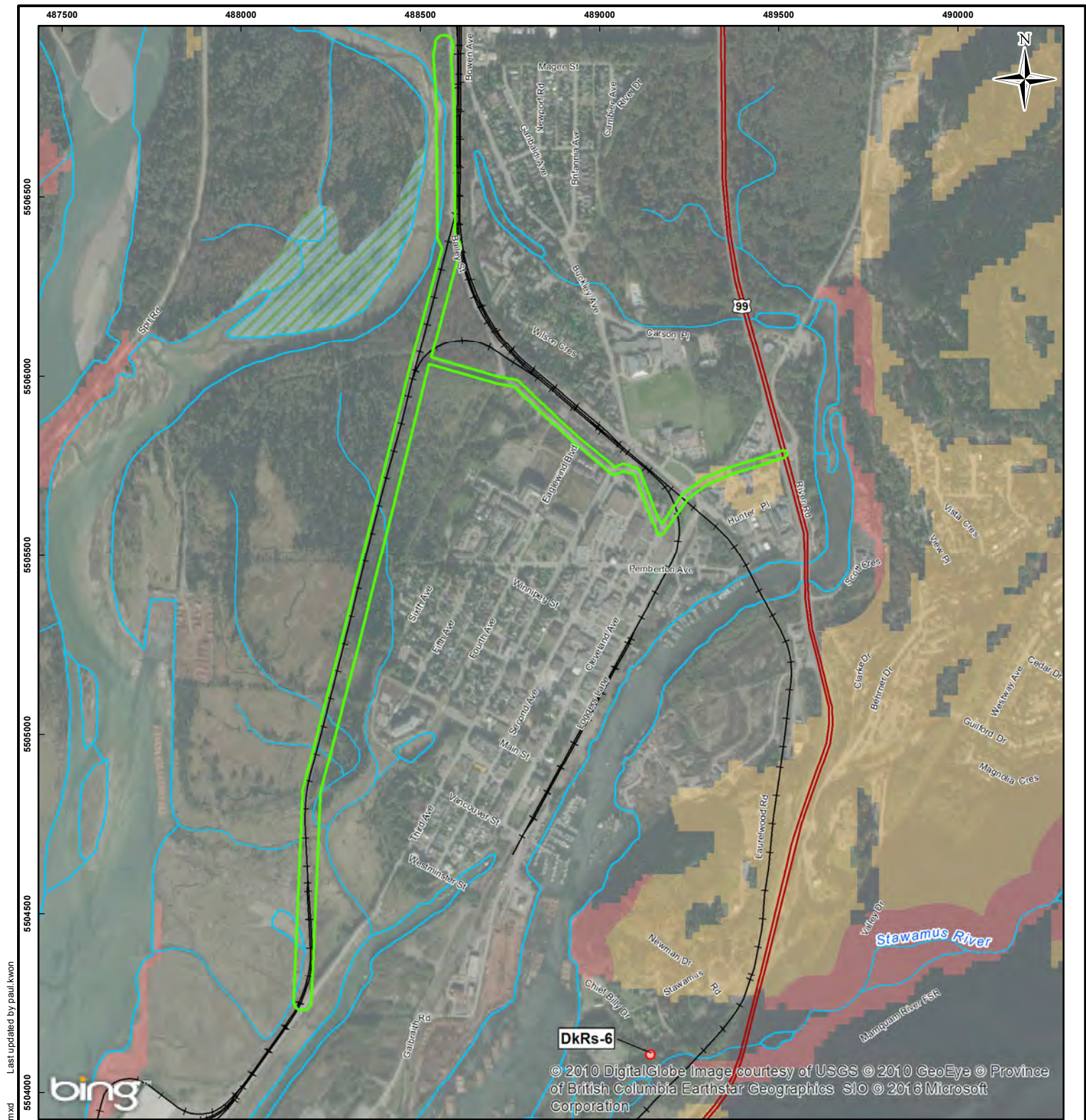
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- High
- Moderate
- Potential Route Option**
- Third Avenue
- Highway
- Railway
- Watercourse
- Waterbody
- Wetland



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PROJECT:				Squamish Downtown Truck Route Study			
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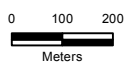





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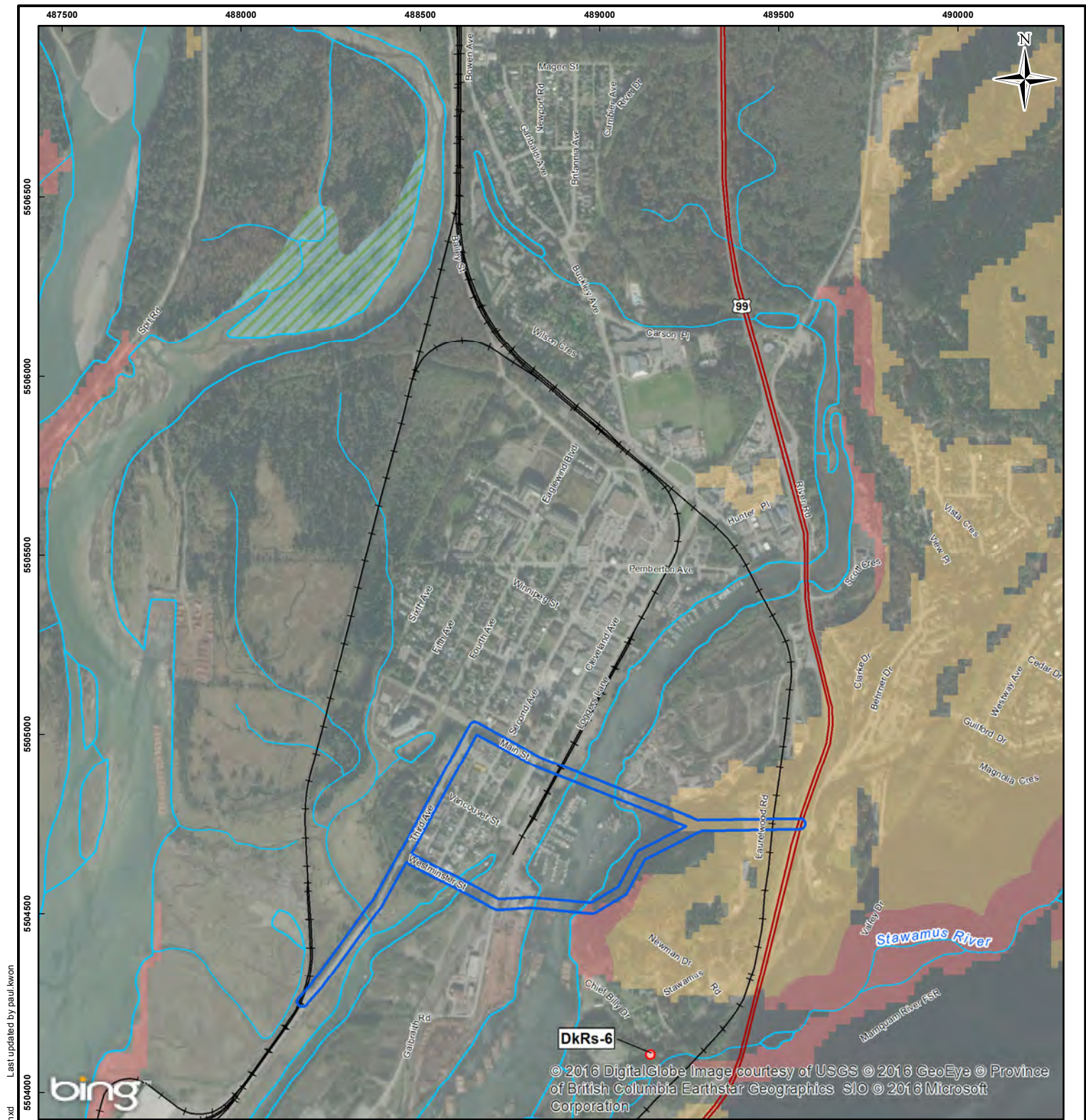
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- Watercourse
- Waterbody
- Wetland



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Urban Systems					
PROJECT:					
Squamish Downtown Truck Route Study					
TITLE:					
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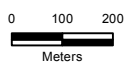




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Legend

- Previously Recorded Archaeological Site
- Archaeology Potential
 - High
 - Moderate
- Potential Route Option
 - Westminster Crossing
- Highway
- Railway
- Watercourse
- Waterbody
- Wetland



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CLIENT:			
Urban Systems			
PROJECT:			
Squamish Downtown Truck Route			
TITLE:			
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Photographs





Photo 1. Air Photo, Squamish, 1949



Photo 2. Air Photo, Squamish, 1957



Photo 3. Air Photo, Squamish, 1973



Photo 4. Air Photo, Squamish, 2005

Date: October 12, 2016 HCP Ref No.: 7861
From: John Villamere, P. Eng., Senior Environmental Engineer
To: Jayson Walker, P. Eng., Transportation Engineer, Urban Systems Ltd.
Subject: Environmental Input to District of Squamish Truck Route Study

1.0 INTRODUCTION

This environmental review has been undertaken in order to compare four options under consideration for the Squamish Truck Route. This environmental review is not an environmental assessment but does undertake to identify environmental and community issues that will require more analysis for the option (or options) that advance to the next phase of assessment. The environmental review is undertaken on the basis of:

1. biophysical resource values; and
2. community / neighbourhood considerations.

Two of the options are discussed on the basis of community / neighbourhood considerations. The other two options are compared primarily on the basis of biophysical resource values, i.e., potential impacts to environmentally sensitive areas are the main criteria. Field investigations were outside the scope of the assignment but would be an important component of future studies for the option(s) selected for further study.

A three point impact rating system of Low, Moderate and High is used for comparative purposes whereby a High rating indicates highly valued resources at risk.

2.0 EVALUATION OF OPTIONS

Option 1: Loggers Lane

Loggers Lane is the existing truck route and is located in an area of commercial development with some residential properties also present. Improvements would include widening of Loggers Lane by removing the rail line that runs along the east side of Loggers Lane. This rail line is not in service. Biophysical resource impacts are minimal. There is the potential to encounter contaminated soils during the removal of the rail line and this would require further investigation. Since Loggers Lane is already the truck route, from a community / neighbourhood perspective, the changes are minor.

Biophysical Environmental Impact Rating: Low (minimal resources and impacts)

Community / Neighbourhood Impact Rating: Low (benchmark, existing truck route with improvements)

Regulatory Agency Permitting Risks: Low

Option 2: 3rd Avenue

With this option, truck traffic will pass along 3rd Avenue, through a residential area which includes a seniors' home. This street is currently not exposed to truck traffic. With truck traffic re-routed to 3rd Avenue, residents of the neighbourhood will likely be concerned about noise, air quality and health. Biophysical (habitat) impacts associated with this option are minimal.

Biophysical Environmental Impact Rating: Low (minimal resources and impacts)

Community / Neighbourhood Impact Rating: Moderate (based on concerns of residents along 3rd Avenue)

Regulatory Agency Permitting Risks: Low

Option 3: 7th Avenue Connector

The 7th Avenue Connector has been referred to by some people as the *estuary* route. The 1999 Squamish Estuary Management Plan (SEMP) states that a 60 meter wide transportation corridor for future combined road and rail transportation infrastructure has been established, suggesting a location along the east side of the existing track that leads to the Squamish Terminals. The SEMP suggests that infrastructure will be built when needed and regulatory processes (e.g., acquiring a DFO Authorization) will be followed with respect to mitigating impacts and compensating for (i.e., offsetting) unavoidable impacts.

Because this truck route option is being considered in association with a flood control dike (a joint project undertaking), if developed, the combined dike and road are expected to be located on the west side of the rail line in order to include the rail line within the area protected by the dike. The west side of the dike is also suggested because the Nature Trust holdings along the east side of the track near Main Street are protected from development in perpetuity. For the purposes of this analysis, it is assumed that re-locating the infrastructure to the west side of the track is compliant with the broad intent of the SEMP.

The width of the combined road and dike as currently estimated is expected to be about 40 to 50 m. The length of new road and dike from where it intersects 3rd Avenue near the marine terminals (i.e., south end) to its connection at Bailey Street in the north is about 2.2 km. The combined dike and road location is currently a highly rated greenbelt and the features and values are described in the Environmentally Sensitive Areas presentation on the District of Squamish WebMap. The District of Squamish has very effectively mapped and described the environmental features and values along each side of the rail line in this area. Features of the estuary in this area include marshes, mudflats, meadows, wetlands, riparian areas, ponds, streams and forested lands, most of which are highly rated. In addition, this area provides important recreational resource opportunities for the Squamish community.

Based on the analysis to date, it appears from an environmental perspective, that a west side alignment may be preferred over an east side alignment. However, in either case, impacts to the greenbelt adjacent to the rail line are significant. The fact that the road (hence the truck route) would only happen if the dike is located in the same location has served to keep this option in contention. The combined dike and road footprint would be about 80,000 to 100,000 square meters (about 8 to 10 ha). If this option proceeds to the next round of analysis, it will require significant environmental study efforts to determine the extent of the impacts to terrestrial, aquatic and wetland habitats, to wildlife, fish, species at risk, etc. and to determine the mitigation and offsets / compensation that could be implemented to address impacts.

The following points are worth noting:

- if the District of Squamish determine that the required dike is going to be located along the rail line, then this truck route option warrants further analysis;
- based on limited analysis but noting habitat features and land tenure, it appears that an option immediately west of the tracks is preferred to an option along the east side of the tracks; and
- it will also be necessary to widen the 0.4 km road that links Bailey Street to the rail line and this widening will also result in greenbelt impacts and neighbourhood concerns regarding increased truck traffic on Bailey Street.

Biophysical Environmental Impact Rating: High (significant estuarine greenbelt impacts)

Community / Neighbourhood Impact Rating: High (public concerns related to impacts to the estuary, recreational values and re-routing trucks along Bailey Street to access the 7th Avenue Connector)

Regulatory Permitting Risks: High (DFO and FLNRO approvals likely required, mitigating impacts and developing habitat offsets will be challenging)

Option 4: Blind Channel Crossings

Eelgrass beds are an important environmental feature in Blind Channel. Programs are currently in place to manage and monitor these eelgrass beds. Pier placement in the channel would impact the eelgrass beds and would result in a DFO project review. Developing habitat offsets will be a challenge. Hence, it is assumed for the purposes of this review, that Blind Channel crossing options include a clear span bridge crossing of Blind Channel, i.e., all piers will be located above the high water mark, and that construction activities in Blind Channel can be undertaken in a manner that impacts to the marine environment including the eelgrass beds are manageable, i.e., minor and short-term. Shading impacts of the structure require further analysis but are not likely a major concern due to the height of the bridge for the Westminster and Main Crossings.

For both the Westminster Crossing option and the Main Crossing option, the clear span bridge will have to meet Transport Canada Navigation Protection Act (NPA) requirements for vertical clearance (height) and width of the navigation channel. Because of NPA vertical clearance criteria (i.e., about 25 m above high water), this bridge is expected to be a very noticeable, new feature on the landscape. The vertical clearance of the bridge will be such that the bridge is expected to be visible from most parts of the downtown Squamish area. For the Pemberton Crossing, the bridge profile will be much lower, i.e., about 5 m above high water and it will be adjacent to the existing rail bridge, hence less noticeable.

The Westminster Crossing of Blind Channel begins on the west side at or near Vancouver Street and would have a likely east side landing site on the steep banked, wooded area between the Waterfront Landing property and the Stawamus Indian Reserve. This wooded area is described in the District of Squamish's WebMap as primarily young forest with part of it being primarily coniferous and part of it being primarily broadleaf (deciduous). On the east side, consideration would also need to be given to possible community impacts to the Stawamus Indian Reserve. On the west side of Blind Channel, a new bridge would result in neighbourhood changes that would require investigation that is beyond the scope of this assignment.

The Main Crossing of Blind Channel follows generally along the Main Street alignment, connecting to the Waterfront Landing property on the east side of Blind Channel. On the east side of Blind Channel, it will have minimal biophysical impacts noting that the Waterfront Landing site is already heavily impacted by previous industrial operations. As stated above for the Westminster Crossing, on the west side of Blind Channel, a new bridge would result in significant neighbourhood changes that would require investigation that is beyond the scope of this assignment.

The Pemberton Crossing is an extension of Pemberton Avenue on the west side of Blind Channel connecting to Highway 99 on the east side of Blind Channel near Clarke Drive. As previously stated, the bridge crossing of Blind Channel would be located adjacent to the rail bridge and have about a 5 m clearance above high water. It would be much less visually intrusive than the other Blind Channel options. On both the east and west side of Blind Channel, the alignment is located in disturbed ecosystems as noted on the District of Squamish's WebMap. The one exception is a small pond and wetland located between 50 and 150 m east of Blind Channel which could be impacted.

Westminster Crossing (Vancouver Street Corridor)

Biophysical Environmental Impact Rating: Moderate (impacts to greenbelt on the east side of Blind Channel, assuming a clear span bridge crossing of Blind Channel)

Community / Neighbourhood Impact Rating: High (significant changes in downtown Squamish requiring further analysis)

Regulatory Permitting Risks: High (acquiring Transport Canada and DFO approvals could be challenging)

Main Crossing (Main Street Corridor)

Biophysical Environmental Impact Rating: Low to Moderate (based on the highly disturbed nature of the Waterfront Landing property and assuming a clear span bridge crossing of Blind Channel)

Community / Neighbourhood Impact Rating: High (significant changes in downtown Squamish requiring further analysis, impacts to proposed Waterfront Landing subdivision plans)

Regulatory Permitting Risks: High (acquiring Transport Canada and DFO approvals could be challenging)

Pemberton Crossing (Pemberton Street Corridor)

Biophysical Environmental Impact Rating: Low to Moderate (based on the highly disturbed nature of the lands along this alignment and assuming a clear span bridge crossing of Blind Channel)

Community / Neighbourhood Impact Rating: Moderate (rating will be driven by the roadway connection between Pemberton Avenue and the marine terminals when selected)

Regulatory Permitting Risks: Moderate (acquiring Transport Canada and DFO approvals would be less challenging than for the other two Blind Channel crossing options)

3.0 LEGISLATION POTENTIALLY APPLYING TO THE TRUCK ROUTE PROJECT

The following legislation will potentially apply to the project. Some legislation may apply to one or more options but not all the options and this is noted.

Navigation Protection Act (Transport Canada) because Option 4 will cause temporary and permanent obstruction of navigation in Blind Channel

Fisheries Act anticipating that DFO determines, for Options 3 and 4, that the project could cause serious harm to fish

Species at Risk Act if Options 3 and 4 impact SARA listed species and result in salvage and relocation of SARA listed species

Environmental Management Act, Contaminated Sites Regulation if soils disturbed during construction contain contaminants that exceed standards (applicable to Option 4 Waterfront Landing area, a former industrial site and Option 1 along the abandoned rail line)

Heritage Conservation Act if an Archaeology Branch permit is required to investigate possible sites and /or to disturb known sites

Land Act if right-of-way is required on crown lands

Water Sustainability Act for changes in and about a stream (applies to Option 3 and possibly Option 4)

Wildlife Act if salvage and relocation of wildlife including relocating nests of designated bird species is required (applies to Option 3 and Option 4)

4.0 CONCLUSIONS

Comprehensive environmental assessment studies will be needed if Options 3 or 4 are pursued to the next level of analysis. The District of Squamish biological resource information provided on the District's WebMap is comprehensive and informative and is a good starting point for the baseline studies. Compensation for unavoidable impacts (finding offsets) will likely be challenging. Minimizing the project footprint will be very important.

Option 1 is the existing truck route and widening appears to be feasible with minimal impacts. Improvements to 3rd Avenue to enable its use as a truck route will create neighbourhood concerns. Hence, the rationale and justification for moving the truck route from one neighbourhood street (Loggers Lane) to another (3rd Avenue) will have to be clearly established.

August 29, 2016

File: 12044

Urban Systems Ltd.
550 - 1090 Homer Street
Vancouver, BC
V6B 2W9

Attention: Mark Downing, P.Eng.

**DOWNTOWN TRUCK ROUTE STUDY
SQUAMISH, BC**

Dear Mark:

As requested, Thurber Engineering Ltd. (Thurber) has completed a geotechnical desktop review of the proposed truck route options through the Squamish downtown. This letter describes the results of our desktop review, identified geotechnical issues and includes recommendations for future geotechnical investigation required to complete the next stages of the project.

It is a condition of this letter that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

1. INTRODUCTION

We understand that the District of Squamish (District) is planning on upgrading their existing downtown truck route along Logger's Lane to the District's current road standards. However, due to the increase in high-density residential buildings in the downtown area, as well as the projected enhancement of public seaside amenities, pedestrian and vehicle traffic is expected to increase significantly along Logger's Lane.

The District has outlined four potential future downtown truck routes:

- Logger's Lane (existing)
- 3rd Avenue
- 7th Avenue Connector / Sea Dike
- Westminster Street Bridge crossing the Blind Channel and connecting Highway 99 in the Clarke Drive area.

The potential truck routes have, to varying degrees, significant social, environmental, technical and economical impacts.

2. DESKTOP REVIEW

We completed a desktop study that included review of publically available surficial geology maps and of our existing project files for test hole data near the potential truck routes.



2.1 Surficial Geology Maps

Available surficial geology maps from the Geological Survey of Canada (GSC) and the Department of Mines and Technical Surveys of Canada indicate that the project area is underlain by fluvial sands with varying amounts of silt and gravel.

The surficial geology maps were only available in small-scale so differentiating the mapped boundaries was difficult, although the mapped zones within the project area are similar. The attached Figure 1 presents the general surficial geology for the area.

2.2 Subsurface Information From Thurber Files

A total of 13 projects were identified within close proximity to the downtown truck route options where we had previously completed a geotechnical investigation (test pits, test holes or cone penetration tests (CPT)). The 13 projects provided 14 distinct areas with test hole information as shown on Figure 1. A generalized description of the soil profile encountered at 14 areas is provided in the table below.

Table 1. Summary of General Soil Profiles

Map Symbol	Generalized Soil Profile		Soil Unit Thickness	
A	Western Profile		Eastern Profile	
	Granular Fill	1 m	Silty Sand	6 m
	Soft Silt	2.5 m	Gravelly Sand	1.5 m
	Soft Sandy Silt	1 m	Firm silt with some Sand	4.5 m
	Compact Sand	>4.5 m	Firm Sandy Silt	>14 m
B	Granular Fill	1 m		
	Clayey Silt	2 – 3 m		
	Compact Sand	>10 m		
C	Dense Gravelly Sand	1 m		
	Firm Silt	>2 m		
D	Dense Sand and Gravel	0.8 – 1.5 m		
	Compact Sand to Silt and Sand	0.5 – 2 m		
	Loose Silty Sand to Soft Silt	>1 m		
E	Compact Sand to Sand and Gravel (Fill)	1.4 – 3.3 m		
	Soft to Firm Silt	1.3 – 4.6 m		
	Loose to Compact Sand	4 – 12 m		
	Silty Sand to Silt	>15 m		
F	Compact to Dense Sand and Gravel (Fill)	1 – 3 m		
	Silt	2 – 3 m		
	Sand and Gravel	1.5 – 2.5 m		
	Silt	>17 m		

Map Symbol	Generalized Soil Profile	Soil Unit Thickness
G	Granular Fill Soft Silt Sand with Occasional Silty Layers Stiff Silt	1 – 2 m 2 – 4.5 m 23 – 26 m >3 m
H	Granular Fill Silty Sand and Firm Silt Loose to Compact Sand Silty Sand to Sandy Silt	0.5 – 1 m (where present) 2 m 6 – 9 m >3 m
I	Granular Fill Soft to Stiff Silt Sand to Silty Sand	0.5 – 1.5 m 0.5 – 2.5 m >18 m
J	Sandy Silt to Sand (Fill) Sandy Silt Loose to Compact Sand with Occasional Silty Zones	1.5 – 2 m 1 – 2 m (where present) >6 – 8.5 m
K	Granular Fill Soft Silt Sand, Silty Sand and Interlayered Silt and Sand	2 – 5 m 1 – 2.5 m >30 m
L	Compact Sand and Gravel (Fill) Compact Sand with some Gravel Soft to Firm Silt Firm to Stiff Silt Compact Sand	1.5 m 2.5 m 1.5 m 1 m >1 m
M	Sand with some Gravel and Silt Loose Sand with some Silt Loose Sand Soft Silt	3 m 3 m 3 m >5.5 m
N	Dense Sand and Gravel Fill	3 m

2.3 Groundwater

Groundwater is typically encountered between 1 and 3 m depth throughout most of downtown Squamish. The groundwater level will vary seasonally with infiltration, drainage and tide levels.



3. RECOMMENDATIONS

3.1 General Geotechnical Recommendations

3.1.1 Preloading / Settlements

The downtown area of Squamish is located on a fluvial fan. Deposition of sediments in a fluvial environment is variable and can result in highly variable thickness of similar sediment types across short distances. The general description provided in the following paragraphs will need to be supplemented with route specific investigation during conceptual/detailed design.

Based on our desktop review and our experience working in Squamish, there is typically a soft, compressible silt layer at or near the ground surface. Beneath the silt there is loose to compact, sand to silty sand, with occasional silt layers, that significantly varies in thickness. This sand layer can also have occasional silt layers. Beneath the sand is a lower silt layer that is encountered quite deep across most of downtown, although much closer to the surface near the northeast part of downtown in the vicinity of the Blind Channel.

The proposed 3rd Avenue and Extension / Improvement of Existing Route Options follow existing roadways and they are unlikely to have any significant grade changes. The proposed 7th Avenue Connector and Westminster Crossing Options have portions that follow existing roadways but the majority of their alignment is on undeveloped land. As such, there may be significant grade changes that will cause consolidation settlements and, without preloading, differential settlements due to the variable thickness of silt.

Accordingly, we are of the opinion that preloading of the alignment options is not required when the alignment follows existing roadways and when grade changes are small, typically less than 1 m. Preloading will likely be required where the proposed alignments are on undeveloped land or where grade changes are 1 m or greater. The exception to this would be for the Westminster Crossing Option where portions of the alignment east of Blind Channel are likely to be founded upon rock.

3.1.2 Pavement Structure

We did not find any information for existing pavement structure (i.e. thickness of base and subbase gravels) in our existing project files. The District, in the RFP, has suggested that the pavement structure is insufficient along Logger's Lane because they plan to upgrade this truck route to accommodate the additional traffic and to meet their current road standards. Review of Logger's Lane with Google Street View shows some asphalt patch repair and some areas of longitudinal and transverse cracking of the asphalt. Generally, the pavement along Logger's Lane looks to be in moderate condition, with some localized poor condition areas.



It may be possible that the existing pavement structure is sufficient along portions of Logger's Lane. However, it is highly unlikely that the other roads have sufficient pavement structure to handle the design truck traffic.

3.1.3 Site Preparation

Prior to fill placement and road construction, all surficial organic soils and other deleterious material should be stripped to at least 1.5 m beyond the edge of the future roadway or sidewalk. The exposed subgrade should then be proof-rolled with multiple passes of a large, steel, smooth drum vibratory roller to confirm suitable subgrade. Any soft, wet, organic rich or other deleterious materials encountered at the subgrade level should be excavated and replaced with compacted sand and gravel as described below.

We recommend that surcharge fill (temporary) be placed in addition to the embankment preload (permanent) in the early stages of construction but after site stripping, to reduce post-construction settlements. It is likely that surcharge will be required in undeveloped areas or if large grade changes are required, depending on the soil encountered during project specific drilling. The required preload height will depend on the size of embankment and the foundation soils. In general, surcharge could be anticipated to be on the order of 1.5 m high.

Primary consolidation settlement from preload and surcharge will depend on the thickness of the silt beneath the preload. We anticipate that the consolidation period would be on the order of several months after completion of preload and surcharge fill placement. The preload and surcharge should be instrumented with settlement gauges so that the geotechnical engineer can determine when to remove the surcharge.

3.1.4 Soil Liquefaction

The loose to compact sand with varying amounts of silt that is encountered below the upper silt is susceptible to liquefaction during seismic activity. Ground improvement by means of dynamic compaction, rapid impact compaction, vibro-densification or vibro-replacement is expected to be required at bridge abutments not founded upon bedrock. Depending on design requirements for the 7th Avenue Connector / Sea Dike and other routes, ground improvement away from bridge abutments may also be required.

3.2 Specific Truck Route Geotechnical Recommendations

3.2.1 Proposed 7th Avenue Connector Route

The 7th Avenue Connector is proposed in combination with a new sea-dike along the CN Rail tracks. The construction of a large, wide, sea dike to accommodate a truck route will require preloading the dike embankment with the addition of a surcharge prior to construction of the road structure. The construction of the dike / preloading will cause the neighbouring rail tracks to settle,



depending on the setback. Provisions must be included to re-ballast the rail during the preload phase of construction.

If settlements to the rail tracks are unacceptable then the dike/road would have to be setback from the tracks. The setback distance is dependent on the size of the dike and the ground conditions. Our experience suggests that the setback would likely be 1 to 2 times the base width of the dike embankment.

3.2.2 Proposed Westminster Crossing Route

The proposed Westminster Crossing appears to cross areas of bedrock or near surface bedrock for most of the alignment east of Blind Channel. The bedrock is likely to be granitic and very strong which means that rock cut slope design will be based on the bedrock structure. Depending on alignment, significant rock cuts may be required that will require further geotechnical investigation. For conceptual planning purposes, rock cuts may be assumed at 0.25H:1V.

3.3 Blind Channel Crossing Recommendations

3.3.1 Westminster Crossing

Depending on the location of the Westminster Crossing, it is possible that the east bridge abutment can be founded upon bedrock with shallow footings. However, surficial geology mapping suggests that bedrock does not extend to the edge of the channel. As such, piled foundations may be required for both abutments. If piles are required, frictional, steel, pipe piles should be anticipated for abutment foundation. The approach embankments, if not founded on bedrock, should be preloaded to reduce post-construction settlements and differential settlements between the pile supported abutments and the bridge approaches.

3.3.2 Main Crossing

Frictional, steel, pipe piles should be expected for the both abutment foundations. The approach embankments should be preloaded to reduce post-construction settlements and differential settlements between the pile supported abutments and the bridge approaches.

3.3.3 Pemberton Crossing

Frictional, steel, pipe piles should be expected for the both abutment foundations. However, both ends of the Highway 99 bridge crossing of Blind Channel are supported by end-bearing piles on bedrock so it may be possible that the Pemberton Crossing may also be supported by end-bearing piles. The approach embankments should be preloaded to reduce post-construction settlements and differential settlements between the pile supported abutments and the bridge approaches.



4. FUTURE SITE INVESTIGATION

At a minimum, at least one test hole and CPT should be completed at each abutment for the desired crossing of Blind Channel to confirm the expected soil conditions and to provide design input data for pile design. Further, test holes at regular intervals, typically every 200 m, would be required along the chosen alignment to assess the quality of the road structure and if re-use is possible. If the 7th Avenue Connector Option is chosen, test holes at approximately 200 m spacing should be drilled along the alignment in the estuary to obtain detail to help determine sea dike / embankment design.

5. CLOSURE

We trust that this information is sufficient for your needs. Should you require clarification of any item or additional information, please contact us at your convenience.

Yours truly,
Thurber Engineering Ltd.
David Regher, P.Eng.
Review Principal



Christopher Clarke, E.I.T.
Project Engineer

Attachments: Statement of Limitations and Conditions
Site Plan (Dwg. 12044-1)

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

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All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

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5. INTERPRETATION OF THE REPORT

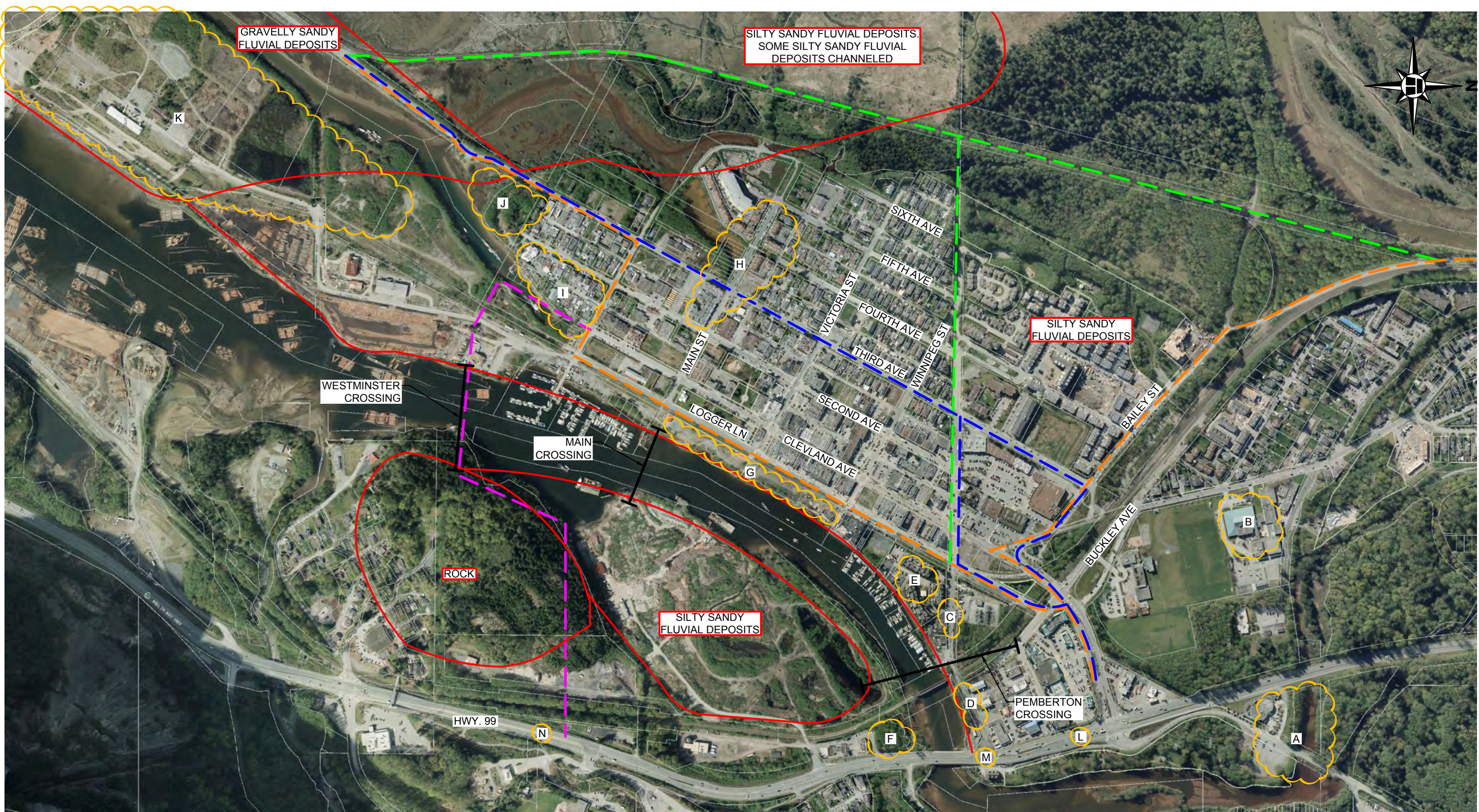
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

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Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

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LEGEND:

- PROPOSED 3RD AVE. OPTION
- PROPOSED 7TH AVE. CONNECTOR OPTION
- PROPOSED WESTMINSTER CROSSING OPTION

- PROPOSED EXTENSION / IMPROVEMENT OF EXISTING ROUTE OPTION
- APPROXIMATE SURFICIAL GEOLOGY BOUNDARY

- AREAS WITH TEST HOLE INFORMATION (TYPICAL SOIL PROFILE PROVIDED IN REPORT)
- POSSIBLE CROSSING OPTION



NOTES:

- BASE PLAN TAKEN FROM THE CITY OF SQUAMISH'S PUBLIC MAP VIEWER.
- SURFICIAL GEOLOGY DESCRIPTIONS' FROM MINES AND TECHNICAL SURVEYS MAP 92 9/11 WEST, SQUAMISH, NEW WESTMINSTER DISTRICT BRITISH COLUMBIA.



THURBER ENGINEERING LTD.

CLIENT

URBAN SYSTEMS LTD.

SITE PLAN

DOWNTOWN TRUCK ROUTE STUDY

SQUAMISH, BC

DESIGNED CC	DRAWN NAK	APPROVED DNR
DATE 29/08/16	SCALE 1:7500	
PROJECT No. 12044	FIG. No. 1	REV. -

