TRANSPORTATION PLANNERS AND ENGINEERS

Harbourside Waterfront Rezoning
Transportation Assessment

Prepared for

Concert Properties Ltd.

Date

October 2013

Prepared by

Bunt & Associates

Project No.

4025.32

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EXHIBITS

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EXECUTIVE SUMMARY

1. Introduction

Concert Properties has applied to the City of North Vancouver to rezone the 4 southernmost parcels of land at Harbourside Business Park (Harbourside). A successful OCP Amendment in June 2012 permitted the broadening of land uses on these sites to include residential with an increase in density and height. Current zoning allows for up to 530,000 sq. ft. of commercial floor space and based on current travel patterns could generate up to 800 vehicle trips additional trips.

For this rezoning application, transportation was identified as one of the key matters for detailed consideration and this Transportation Study has been developed based on the City of North Vancouver's guidance. The study network is shown at **Exhibit ES1.**

2. Existing Conditions

The main point of vehicle access to Harbourside is at the Fell Avenue overpass. It accommodates around 85% of all Harbourside's vehicle movements at peak times, while Bewicke Avenue is a secondary access route with 15% of vehicle movements.

Vehicle movements to and from Harbourside are currently imbalanced due to the employment-focused uses with a 70% / 30% directional split at each of the peak times and this puts added pressure on the street system. This imbalance also affects transit provision at Harbourside, which operates in a single direction in the weekday morning (in) and afternoon (out) peak times and not outside these peak periods.

Travel behaviour for the existing uses (excluding the Automall) at Harbourside shows that 68% of employee movements are auto driver. Transit use represents 20% of movements, of which it is estimated that 10% walk to Marine Drive (which forms part of the Frequent Transit Network in Metro Vancouver). The Automall and Bodwell School have transportation characteristics particular to those uses with the Automall, for example, being heavily auto dependent.

Peak-hour time periods for vehicle movements at Harbourside are between 8am and 9am in the morning and 4:30pm and 5:30pm in the afternoon weekdays. Vehicle movements observed on the study network between 2010 and 2012 were broadly similar with no vehicle growth observed on the 1st Street and Marine Drive corridors.

At the Bewicke Avenue rail crossing vehicle delays are typically once per day for the peak periods and signal and barrier control system was identified from a North Shore Study for this location (conducted on behalf of Port Metro Vancouver). Concert and the City of North Vancouver have met with CN to develop measures that would allow the rail crossing to remain functional for serving the Harbourside community's needs.

3. .Walking, Cycling and Transit

Accessibility to Harbourside is steadily improving and indeed since 2010 when Bunt conducted its study work to support the OCP, the following changes have or are soon to be completed:

- The Mackay Avenue pedestrian-bicycle bridge - **opened**;
- A new dedicated transit service to Harbourside - **implemented**;
- Bewicke Avenue upgraded to a greenway (Copping to Bewicke Park) – **implemented**; and,
- Mosquito Creek pathway upgrade - **currently progressing with adjacent development plans**.

At Harbourside, the new Mackay overbridge accommodates around 40% to 50% of all pedestrian volumes at peak times and 50% to 60% of cyclists. Fell Avenue's (two sidewalks) represent 15% to 20% of all pedestrian flows and 15% to 20% of cycling movements, while Bewicke Avenue (which has limited sidewalk provision between Copping Street and 2nd Avenue) accommodates 15% of pedestrians and 15% to 20% of cyclists. Upgrading the Copping Street to 2nd Avenue section of Bewicke Avenue is being proposed as a community amenity, including safety improvements to the rail crossing and pedestrian improvements to the Mosquito Creek Bridge.

Additional community amenities are being proposed through the rezoning application to further improve accessibility to Harbourside with changes to pedestrian and cycle networks; TDM measures; and, providing more supporting local amenities.

4. Development Plan

The development plan is to increase the floor to space ratio (FSR) of the 4 parcels from 1.0 to 2.2. This will accommodate new office space at around 215,000sqft (19,980 m^2) of gross floor area (GFA), retail at around 45,000sqft (4,180 m^2) of GFA, approximately 850 residential units (with 110 rental units), and a hotel with 100 beds. It is expected to be incrementally developed over 15-years, resulting in a gradual increase in vehicle movements over that time (and which can be monitored).

The rezoning master plan is shown at **Exhibit ES2** and provides a high-level representation of the building footprints, and the proposed street layout and pedestrian / cycle connections. More detailed plans will be prepared as the design moves toward the Development Permit stage.

A prime focus for the street design is to create a pedestrian-focused street environment, where street space is shared more equally through maximizing the public realm. It will involve blurring the boundaries between different user groups, slowing street vehicles down, and encouraging eye contact with all users.

Strong synergies are expected through the new residential and retail (local services, cafes / restaurants, food, etc.) uses planned, while complementing with the existing and future office / light industrial activities. Overall, they are expected to lower and better balance transportation demands at Harbourside.

A new multi-modal internal "mews" street (east-west) will be introduced within the block structure and this will intersect with the new north-south streets and pedestrian / bicycle corridors. The street structure will maximize permeability, while serving as connections to parking and loading.

Harbourside Place is proposed to operate one-way (in a clockwise direction) on the section south of the new east-west mews (including a short section of Fell Avenue) and along the waterfront. This arrangement will allow direct access to the waterfront from Fell Avenue; create a simple circulatory system (predominant right-turns); maximize public realm; and, allow for the development of a compact and convivial street environment.

Transit waiting zones will be positioned close to activities (e.g. café), have wifi access, covered waiting area, and more generally be a prominent design with complementary surface materials and signage, although this would be revised should future transit run along First Avenue

A new segregated waterfront Spirit Trail route will be developed (6-metres wide) along the development site's waterfront frontage and at the east interface, a new 4-metre wide shared section would connect with the greenway developed by the City on Bewicke Avenue. Concert is proposing to complete the Copping Street to West 2nd Bewicke section (west side), including the new railway crossing controls (barrier, lights, advanced signing, measures to discourage walking alongside tracks), and a pedestrian bridge crossing at Mosquito Creek (west side).

Concert is also committed to working with Squamish First Nation and the City of North Vancouver to complete the Spirit Trail connection along the waterfront to Lonsdale Quay from Harbourside.

An emergency access plan has also been developed with the North Shore Emergency Response Unit. The plan has identified a number of measures that can be introduced to allow access for emergency services during extreme circumstances where both access points (Bewicke Avenue and Fell Avenue) may not be available for responders, along with route various options and facilities to evacuate existing and new employees and residents.

5. Parking and Loading

Street parking within Harbourside is currently close to capacity (circa 95%) during the working week mid-day period, while on-site parking has a lower utilization rate at around 55%, perhaps reflective of inflexible and / or less intensive use for certain buildings, or that same employer is charging for parking. Around one-quarter of the car drivers interviewed in the employee survey said they parked on-street.

Concert is planning to accommodate all its future parking demands within the development boundaries and the planned parking rates for each of the uses is presented below:

- Office at 2.5 to 2.7 spaces per 100 m^2 of GFA;

- Market residential at 1.3 per space per unit (inclusive of 0.1 visitor space per unit) and rental housing at 0.7 spaces per unit (inclusive of 0.1 visitor space per unit) and both supported with car-sharing vehicles;
- Commercial retail parking at 3 spaces per 100 m^2 of GFA; and,
- Hotel is proposed at 0.7 spaces per bed and includes provision for complementary and supporting uses.

Residential and retail 'peak' parking periods are expected to be in the evening and at weekends, and as such, outside the current existing weekday peak demand periods (i.e. 10am to 4pm). Innovative strategies will be developed at the Development Permit stage for shared or unbundled parking, car-sharing, charging stations for EV vehicles, and time-restricted parking measures.

In short-term, supplementary parking is planned adjacent to the Lions Gate School (50) spaces, at 850 Harbourside Drive (32 spaces), and at the BMW dealership (45 spaces).

Street parking supply will primarily be increased with the introduction of new internal "mews" streets planned and this is expected to increase the overall supply of visitor parking in the order of 50 spaces within the master plan area. Its use will essentially function like a laneway (i.e. shared street), but extra width will be provided for parking and pedestrian zones and more generally it will be a generous and comfortable environment for all users. This will be reflected in the materials and landscaping employed.

The City of North Vancouver is planning in the future to implement a 2-hour time limit for the majority of street parking at Harbourside. Concert will work with the City to implement changes that would increase the turnover of street visitor parking, with for example having a 1-hour time-limit and / or pay parking at high turnover locations (i.e. Dog Park / Kings Mill Walk, retail frontages, Mews, etc.). Such changes would be introduced following consultation with relevant groups. On-site public parking would be managed by an experienced operator and is expected to have a longer minimum stay period (compared to street parking) and could be subject to charging.

Bicycle parking provision will be consistent with the City of North Vancouver's bylaw requirement, while its location and design will follow best-practice.

Off-street loading is planned to serve retail, office, residential, and hotel uses from the mews and opportunities will be explored to share loading areas given the expected differing demand profiles. Design for loading will be covered at the Development Permit stage, but the Functional Design (being developed in parallel with this report) will demonstrate that the street design can accommodate these movements along with the City's fire truck requirements.

6. TDM

The employee survey commissioned as part of this transportation assessment supported the potential for successfully introducing Transportation Demand Management (TDM) measures at Harbourside. The

results indicated that 50% of employees are located on the North Shore; 8% within reasonable walking distance; and, 22% within reasonable cycling distance. Transit represents 20% of the current movements and with the high trip origins on the North Shore (50%) and the City of Vancouver (25%); it confirms the potential for successfully improving this mode.

A TDM strategy is being developed in consultation with TransLink's Strategic Planning and Travel Smart representatives together with on-going consultations with local bus operators. Through the TDM strategy, Concert is committed to the following measures that will form part of the community amenity contributions:

- Providing support for a new 231 bus service running along First Street, and operating between Lonsdale Quay and Park Royal Mall, but with the fall-back option (if unsuccessful) of a private shuttle service to augment the existing #231 service, with timing dependent on further discussions with the City and TransLink along with Concert's budget allocation;
- Provide 5 public car share vehicles (including start-up costs and dedicated spaces), and placed in publically accessible locations;
- Work with TransLink's Travel Smart to develop a user-friendly and safe interface for people to ride-share;
- Review opportunities to subsidize transit for employees and residents, but will be dependent on the funding required for the improved transit; and,
- Appoint a Travel Coordinator, provide funding to Travel Smart, and establish a monitoring program.

Concert has been working closely with TransLink's Strategic Planning group to introduce improved transit in the local area and these efforts will continue through the planning process.

The ferry service has not been included as a TDM measure, where previous work from TransLink suggests that the feasibility of such a service is not cost-effective.

Marketing is critical to the success of the TDM strategy and Concert will continue to work closely with Travel Smart to maximize opportunities to improve travel choices at Harbourside with the focus on lowering the number of single-occupant vehicle trips.

7. Trip Generation

Compact mixed-use development patterns typically generate lower vehicle movements when compared to similar spatially separated land use patterns. However, to ensure a robust assessment, the trip rates adopted for the rezoning essentially will follow the ITE rates, which are typically based on low-density / single-use / open surface parking suburban models.

Trip distributions were developed for each land use, with employment / hotel based on existing Harbourside vehicle patterns; residential using TransLink's Travel Diary survey; and, commercial / retail from the Retail Study's trade areas. At full build-out of the development plan, it could generate up to 600 vehicle movement in the morning peak-hour and 850 in the afternoon peak-hour periods; however, these figures are based on suburban land-use patterns (where the vast majority of people drive).

With the planned local commercial activities, less intense peak period demands from residential (e.g. around less 70% to 80% than the equivalent to office rate per 100sqm), improvements to walking / cycling / transit infrastructure, along with the Transportation Demand Management measures, will all be supportive of lowering new vehicle movements. Indeed, it is estimated that new vehicle movements could be closer to 500 in the morning peak-hour and 700 in the afternoon peak-hour periods.

During the weekday afternoon peak-hour (the critical time period), about 280 to 350 new vehicle movements could be added to the current exiting (predominant) volume flow on Fell Avenue, which is equivalent to around 5 to 6 vehicles per minute. This magnitude of change is lower than what the current zoning could generate

New vehicle movements will incrementally be added over time with the phased build-out plan, and a review process of actual demands will be undertaken to provide a clearer understanding on the trip generation for each of the land-uses.

8. Operational Capacity Analysis

The City of North of Vancouver provided a traffic model to analyse the existing and future operational conditions on the study network, and whether changes are required to better manage vehicle flows. All the traffic signals on the study network are currently coordinated and the integrity of this is maintained in the analysis.

Future projections take into consideration background traffic growth, committed developments in the local area along with the rezoning development plan (using ITE trip rates). No adjustments were made for Transportation Demand Management measures or improved accessibility to the area and, as a result, the assessment is considered to be very conservative.

The potential need for intersection changes, based on existing demands, traffic growth, and new development movements, are summarized in **Table 1.**

Table 1: Identified Potential Intersection Changes with Capacity Issues

Intersection	Mitigation	Trigger Point		
		Existing	Background Growth	Development
Fell/ Marine	Northbound approach is repainted to left, through and through-right laning, section of parking is restricted (between 3pm-6pm) on north leg to accomodate two receiving lanes	No	Yes	-
Fell / 1st	Interim measure to restrict southbound left movements(afternoon peak) and add right-turn bay northbound based on monitoring	No	No	Reviewed through monitoring
Fell/ Automall	New traffic light within the existing street geometry	Yes	-	-
Westview / Larson	Phasing change	No	Yes	
Bewicke / Marine / Keith	Ban northbound left-turn (Bewicke) and remark lanes to through and right	No	Yes	-
Fell / Harbourside	Potential future traffic light	No	No	Reviewed through monitoring

Delays for trucks and buses along Marine Drive will be minimized with the planned intersection changes and they are generally not expected to increase crosswalk distances materially, and in some cases, the pedestrian environment will be improved through new signals, while the geometry of the lane changes is expected to operate satisfactorily with the expected design vehicle demands.

A monitoring plan for the Harbourside area will assist with assessing whether the observed future vehicle movements are consistent with the study's projections and identify whether further changes are required to manage these demands.

9. Multi-Modal Analysis

The multi-modal analysis assessed the performance of the street network connections from the development plan to the 1st / 2nd Street corridor (essentially a 400metre walk distance) for pedestrian and cycling activity along with future projections of transit use.

New sidewalks within the master plan are expected to have sufficient capacity when compared with locations that share similar attributes (i.e. commercial / retail frontages). Outside the master plan, the existing connections along Fell Avenue and Bewicke Avenue (including Gostick Place and Copping Street) are expected to accommodate future demands, while the planned upgrade to Bewicke Avenue would operate satisfactorily.

Bicycle lanes along 1st Avenue are projected to operate with a satisfactory level of service, while the 'sharrow' (shared bicycle/vehicle lane) marking on the greenway at Harbourside Drive would perform satisfactory.

Bus patronage on the #231 service, existing or new options, is expected to increase based on the projection of the current demand profile with the increase in new floor area, and taking into consideration less people walking to Marine Drive.

10. Conclusion

A comprehensive Transportation Assessment has been developed for the Harbourside Waterfront rezoning application to better understand existing demands and how future ones can be managed through improvements to walking, cycling, vehicle infrastructure, and Transportation Demand Management measures, while a monitoring plan will provide future opportunities to review.

Vehicle projections for the rezoning are based on conservative estimates and with the expected influence of TDM measures, mix of uses and improved accessibility, it is strongly expected that future vehicle projections at Harbourside should be much lower than that projected and the existing external street network would be able to handle future volume changes satisfactorily and which can be monitored as the development plan progresses.

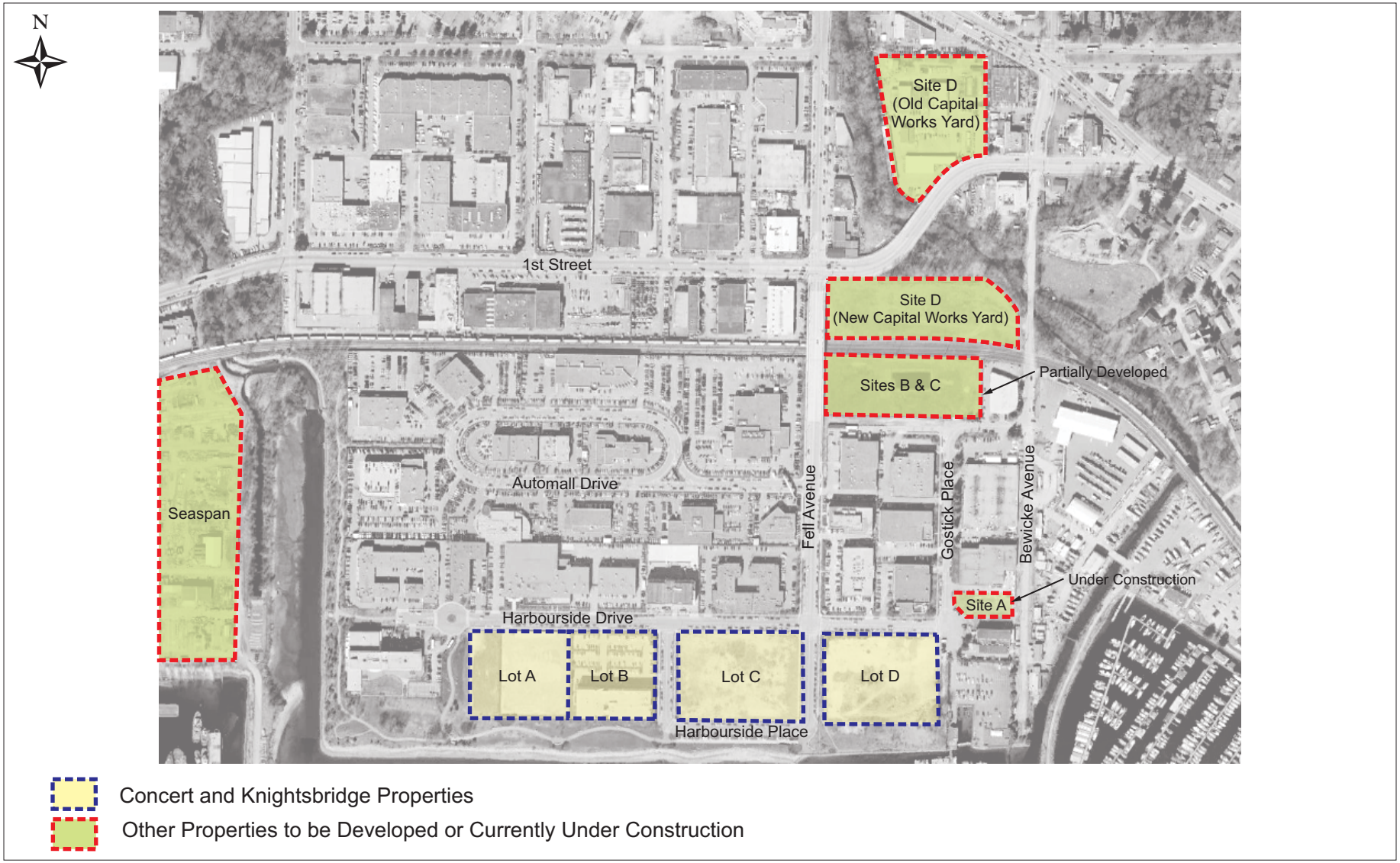

Exhibit ES1

Site Locations

Harbourside Rezoning, North Vancouver, BC
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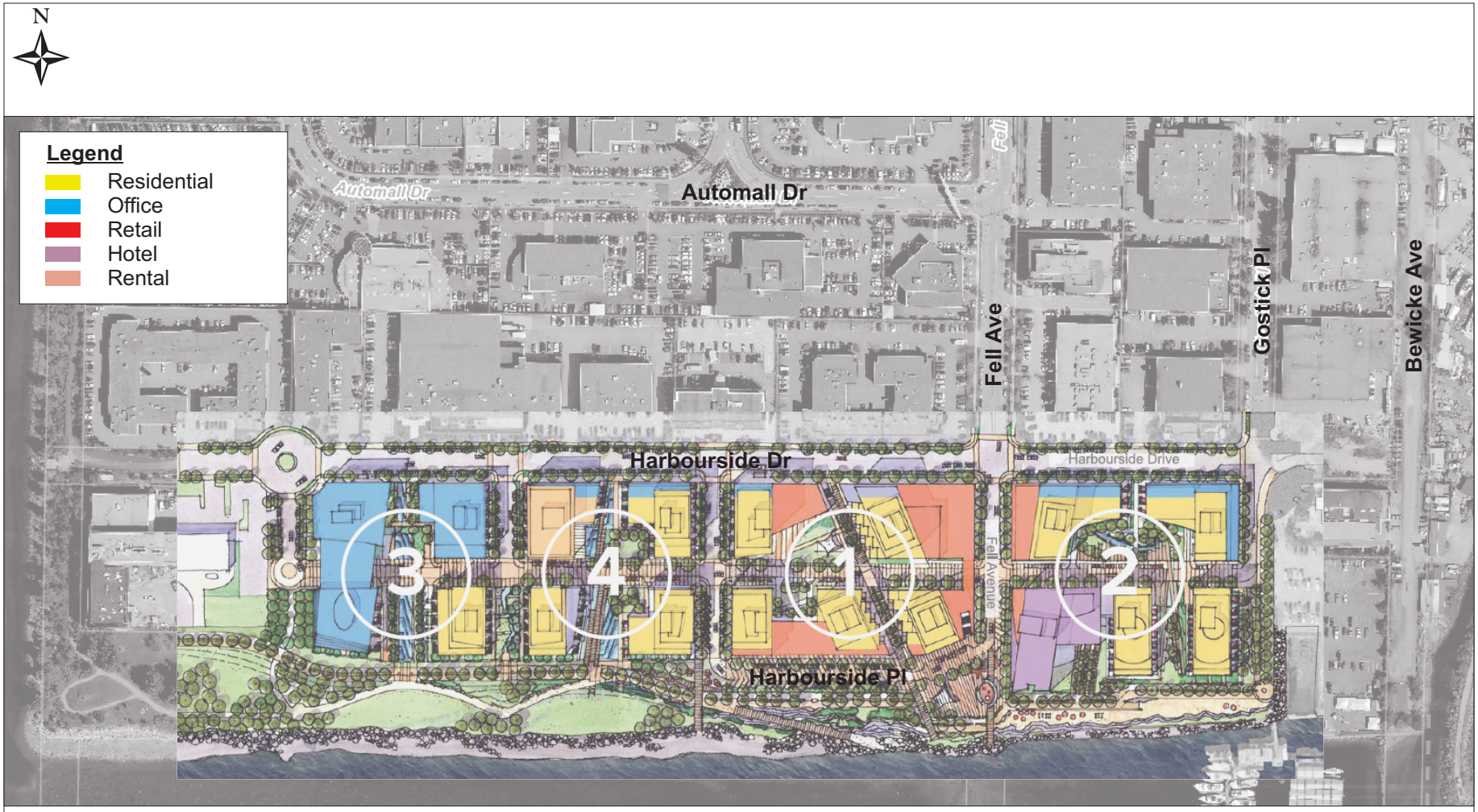

Exhibit ES2
Development Plan Phasing

Harbourside Rezoning, North Vancouver, BC
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1. INTRODUCTION

1.1 Introduction

Concert Properties has applied to the City of North Vancouver to rezone the 4 southernmost parcels of land along the waterfront section of the Harbourside Business Park (Harbourside) to permit the development of a compact mixed-use community. Bunt and Associates has been retained by Concert to provide transportation guidance in support of the development plan.

The development sites, collectively known as Harbourside Waterfront, are shown in the context of the surrounding area at **Exhibit 1.1.**

A successful OCP Amendment in June 2012 permitted the broadening of land uses on these sites to include residential with an increase in density and height. Bunt prepared the Transportation Assessment in May 2010 to support the OCP Amendment and it identified areas where transportation improvements should be focused at the Rezoning stage.

Particular focus was made to the ability of Fell Avenue to accommodate future demands and secondary access at Bewicke Avenue, along with improvements to the local street network, i.e. 1st Street, Marine Drive, etc., along with the railway crossing and the Mosquito Creek bridge structure (no sidewalk) at Bewicke Avenue. Delays along Marine Drive were also considered important for further review and in particular for truck traffic.

Accessibility of Harbourside by walking, cycling and transit also required further work at rezoning in order to better understand how future transportation patterns can lead to lower single-occupant vehicle trips. Strong influences are expected to come in the form of: (a) new supportive local amenities and developing a pedestrian-friendly compact urban form; (b) improvements to walking, cycling, and transit infrastructure; and, (c) implementing Transportation Demand Management (TDM) measures (enhanced transit, car-share, etc.).

The Transportation Assessment identified planning and managing parking supply at Harbourside as an important consideration, especially with the current pressures observed on-street. The rezoning Transportation Assessment will consider the expected demand and supply from the development plan, changes to the configuration and supply of publically accessible parking within the master plan area; and, options for innovative parking management techniques.

The report will articulate a coherent path for infrastructure implementation consistent with the scale and timing of new master plan, along with future monitoring of transportation demands in the area to assess whether the accessibility objectives have been achieved. Its purpose is to provide a framework in moving toward the necessary planning agreements and should not be regarded as a 'definitive' document as it needs to weigh different influences on how decisions are made while other matters will require more detailed work as the design progresses and outside parties are consulted.

1.2 Study Principles

Outlined below are the key guiding objectives for the study work:

- Review changes to vehicle flows on the local streets since the OCP Transportation Assessment in 2010 along with predicted influences from other new developments in the local area;
- Ensure the development plan layout integrates with the pedestrian, cycling and transit corridors (existing and planned) and how these reach out to the surrounding areas;
- Articulate the existing travel patterns within Harbourside and how these can be influenced with the new development plan;
- Ensure new street design and connections are consistent with the objectives of creating an intimate and convivial environment;
- Develop a TDM strategy to positively influence travel behaviour for existing and future employees and visitors, along with new residents;
- Set out a parking strategy to address existing challenges and one which is consistent with the TDM strategy to lower single-occupant vehicle trips;
- Review the operational performance of the street network and highlight changes to improve vehicle flow without undermining the pedestrian and cycling environment; and,
- Set out the basic features of a monitoring program to assess future changes in travel patterns with respect to the TDM plan and the benefits of mixed use compact developments.

The study has been developed based on the Terms of Reference, included at **Appendix A**, covering the key work tasks discussed with the City of North Vancouver.

1.3 Report Layout

Based on our proposed scope of work laid out in the Terms of Reference, and our understanding of previous studies and policies for the study area, the report will proceed with the following sections:

- Section 2 – Existing Conditions
- Section 3 – Site Accessibility by Walking, Cycling, and Transit
- Section 4 – Development Plan;
- Section 5 – Parking and Loading;
- Section 6 – Transportation Demand Management;
- Section 7 – Trip Generation and Distribution;
- Section 8 – Operational Capacity Assessment;
- Section 9 – Multi-modal Analysis

- Section 10 – Summary and Recommendations.

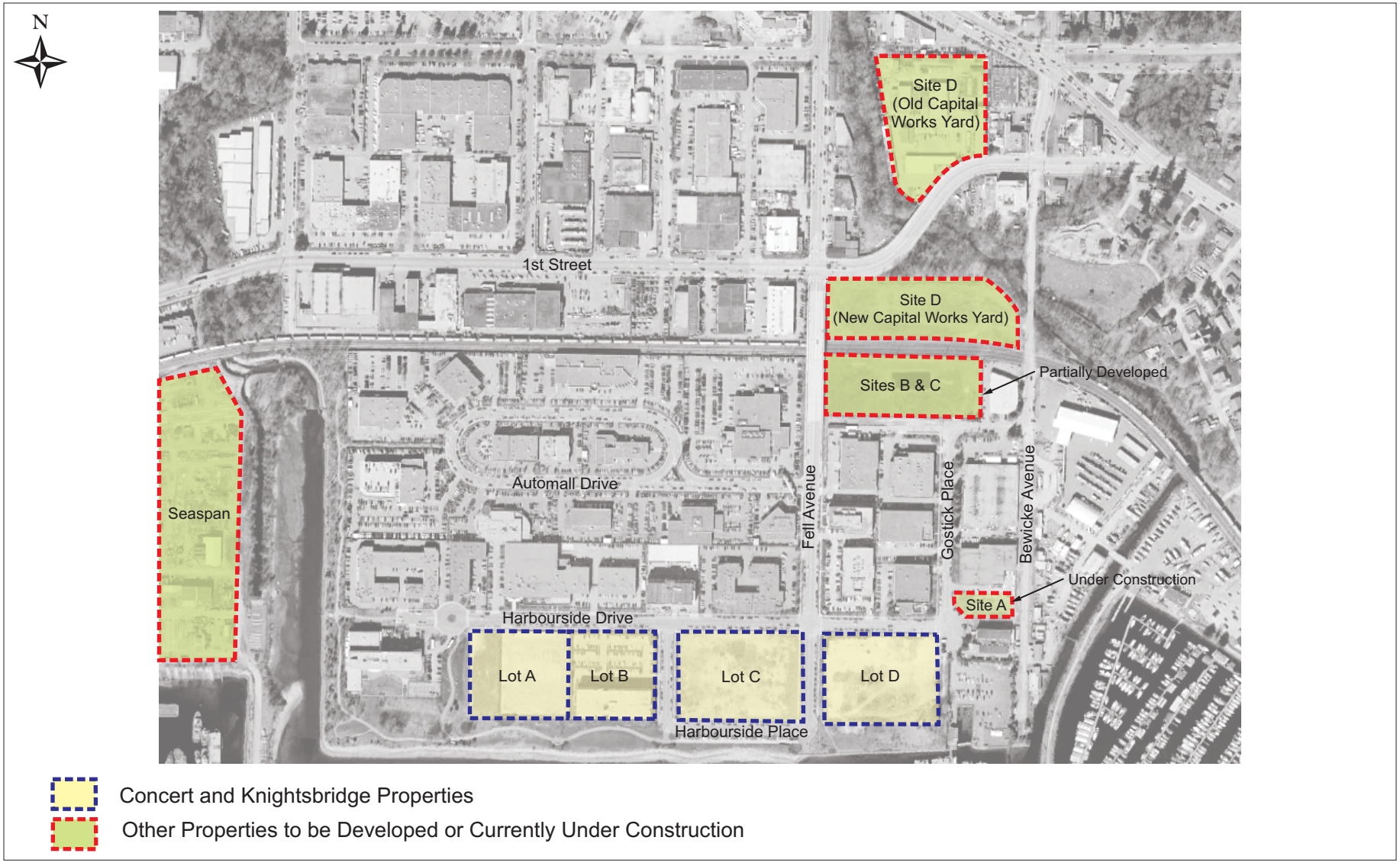

Exhibit 1.1

Site Locations

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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2. EXISTING CONDITIONS

2.1 Introduction

The rezoning application covers four parcels which are shown in the context of the surrounding street network at **Exhibit 2.1a**. Streets fronting the parcels consist of Harbourside Place, Harbourside Drive and Fell Avenue along with Gostick Place which connects at the eastern portion.

Land uses within Harbourside are predominantly employment-related with a mix of light industrial and office together with the North Shore Automall. Smaller scale uses include Bodwell High School; Lions Gate Christian Academy (temporary location); and, local services (dentist, gym, cafés, daycare, etc.) which bring a bit of diversity to the community.

Employment levels are in the range of 1,500 to 1,800 people at Harbourside and this strongly influences current travel patterns, i.e. with predominant in-flows in the morning and out-flows in the evening, while transit is limited to the peak weekday periods. These patterns provide important context for understanding the influences of the rezoning application for the remaining parcels of land at Harbourside.

This section focuses on the existing intersection controls and travel lanes; street network; vehicle movements; and travel behaviours. In the following section, pedestrian and cycling connections along with transit routes are covered.

2.2 Data Collection

Transportation data was collected to support the OCP amendment in 2010 and this data provides the basis for the rezoning Transportation Assessment. To understand changes on the network since then, repeat counts were made at the intersections of 1st Street / Fell Avenue, Marine Drive / Fell Avenue and 1st Street / Mackay Avenue. As well, tube counts at Bewicke Avenue and Fell Avenue were repeated.

Additional counts locations on Larson Road at Bewicke Avenue and Westview Drive were performed to reflect the expanded study network from the OCP assessment. A summary of all data collection locations are shown in **Table 2.1** and the study network is highlighted at **Exhibit 2.1b**.

Table 2.1: Transportation Data Collected

Survey Type and Location	Date
Intersection Traffic Count	
Fell Avenue & Larson Road	April 2010 (Source CNV)
Bewicke Avenue & Larson Road	September 2012
Larson Road & Westview Drive	September 2012
Fell Avenue & Automall Drive	April 2010
1st Street at Fell Avenue	September 2012
Fell at 3rd Avenue	June 2010
Marine Drive at Fell Avenue	September 2012
Fell Avenue & Harbourside Drive	May 2010 (Source CNV)
Harbourside Place / Harbourside Drive	January 2013
Bewicke Avenue & 2nd Street	April 2010 and September 2012
Marine Drive / Keith Road / Bewicke Avenue	April, 2010 (Source CNV)
2nd Street & 3rd Street	April, 2010
1st Street & Mackay Road	April 2010 and September 2012
Screen line Survey	
Fell Avenue, between Automall Drive & Harbourside Drive	April 2010
Bewicke Avenue, between 2nd Street & Copping Street	April 2010
Tube Count	
Fell Avenue (between 1st St & Automall Dr)	April/May 2010 & September 2012
Bewicke Avenue, between 2nd Street & Copping Street	April / May 2010 & September 2012
Parking Occupancy Survey	
Harbourside area (See Exhibit 2.3)	April 2010
Rail Crossing Survey	
Bewicke Avenue, between 2nd Street & Copping Street	June 2010 & January 2013
Questionnaire Survey	
Harbourside Employees	September 2012

Results from the intersection surveys were used to rebalance the 2010 data collected so that all flows in the traffic model are based on the 2012 levels. A summary of the difference between the 2010 and 2012 vehicle flows are presented in **Table 2.2** for the PM period, which is the highest volume period on the study network.

Table 2.2: Comparison between 2010 and 2012 Intersection Counts (PM)

Travel Mode	2010	2012
Marine / Fell	3400	3382
Mackay / 1st	1795	1731
1st / Fell	2703	2542
Fell Avenue overpass	1230	1176

Evidently, volumes are broadly similar with only a slight difference at the 1st Street and Fell Avenue intersection. The volumes observed at this intersection in 2012 are higher than those imbedded within the City of North Vancouver model but are consistent with the tube count undertaken at the Fell overpass. It therefore confirms the suitability of using the 2010 counts as part of the baseline data.

Existing vehicle volumes are summarized in **Exhibits 2.2a and 2.2b**.

The parking occupancy survey covered both street and on-site demands (periods 7am to 9am, 11am to 2pm, and 3pm to 6pm) within Harbourside with the full extent of the survey and time restrictions presented at **Exhibit 2.3**. This is reviewed in Section 5 of the report as a preamble to the parking plan for the rezoning application.

A questionnaire survey, included at **Appendix B**, was conducted with a number of local businesses at Harbourside in order to better understand the travel and parking patterns of employees, and to provide greater detail than the previous survey conducted in 2010. Key parameters and assumptions for the survey are presented below and further details can be found in the appendix:

- One-time survey of a random, representative sample of building occupants was conducted on-site by an independent, professional opinion research firm (Mustel Group);
- The survey was designed to establish commuter transportation choices when traveling to the site and to gauge the potential uptake of sustainable transportation methods if they were made available;
- Survey data was collected 25th to 27th September, 2012, between 10am and 4pm. Commuting behaviour and transportation choices were recorded among regular, full-time occupants of the Harbourside Business Park (see Appendix for map of buildings included in the survey);

- The data collection period was chosen specifically as regular travel is less likely to be impacted by extreme weather conditions and no observed holidays occur during that particular week;
- The survey recorded commute origin, commute distance and transportation choice, as well as parking location and number of vehicle occupants of those who drove. Respondents were asked which transportation improvement they felt would most be beneficial to the area and ended by asking them to rate the existing transportation options. Finally a name and contact telephone number was recorded for all respondents for verification purposes; and,
- Sampling was 302 people of the 978 occupants with 2 / 3 surveyors per day.

The North Shore Automall was not included in the Questionnaire Survey as the employees and customers are not expected to be materially influenced by TDM measures given the automobile-based nature of these businesses. This is also evident from the travel mode survey discussed later in this section.

Bodwell High School was also not included in the survey as it is not a significant transportation demand source at Harbourside and indeed has its own unique and established transportation characteristics with school bus operation and boarding school component. Mode data was collected for Automall and Bodwell in October 2012 to provide context for the overall transportation demands in the area.

A preliminary review of the questionnaire results is presented in this section and further detailed review is provided in the context of the Transportation Demand Management strategy in **Section 6**.

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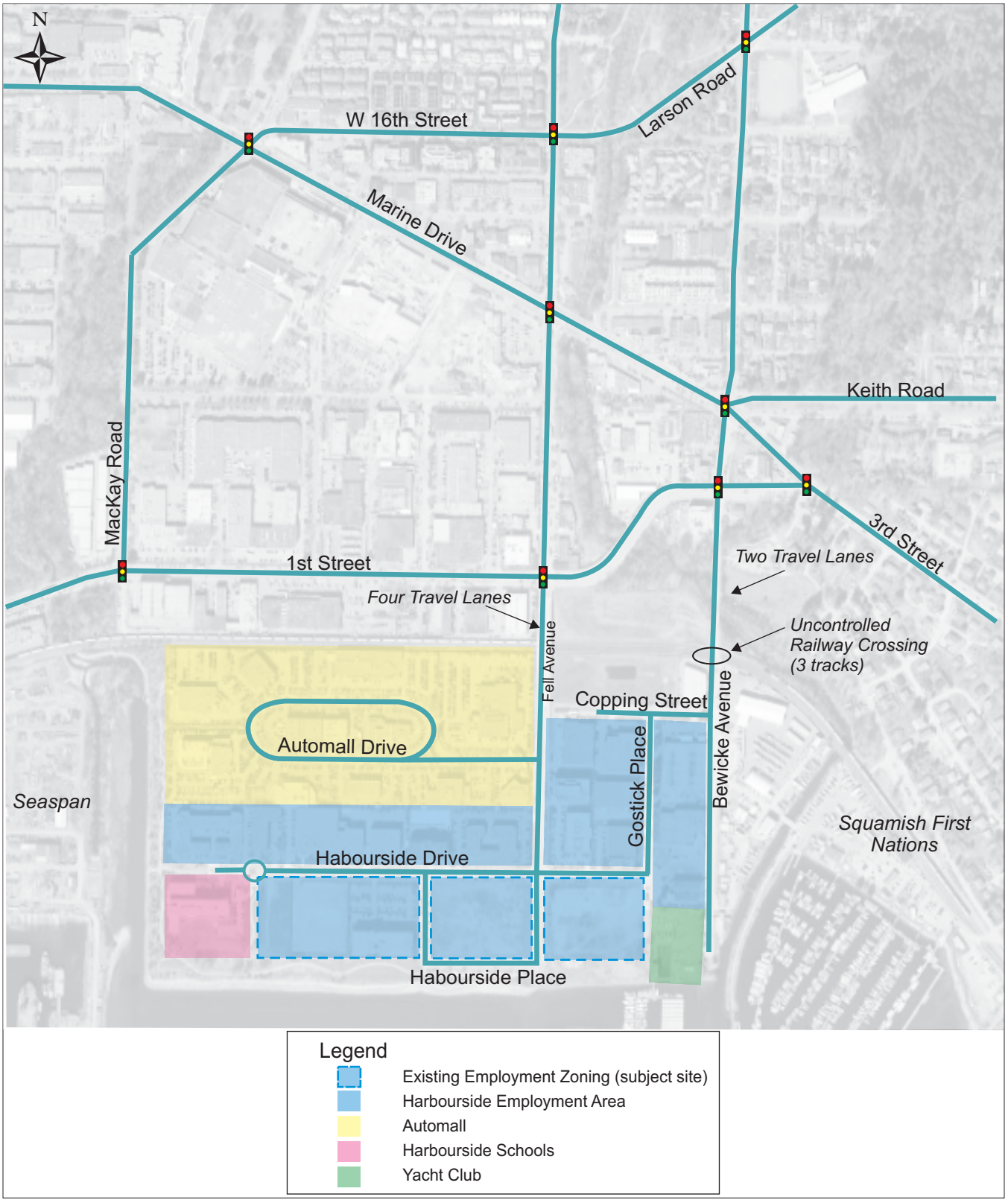

Exhibit 2.1a

Street Network

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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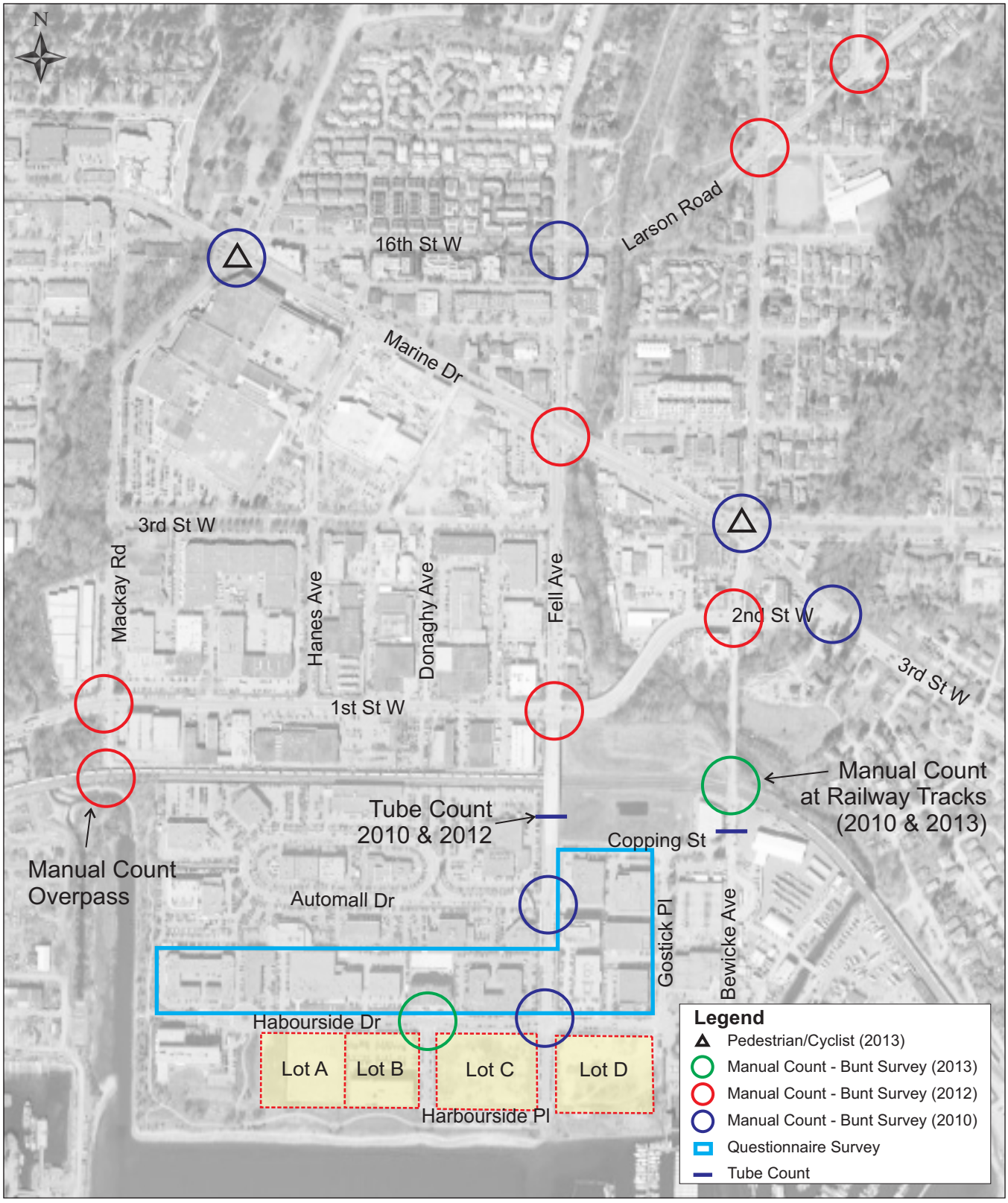

Exhibit 2.1b
Study Area

Harbourside Rezoning, North Vancouver, BC
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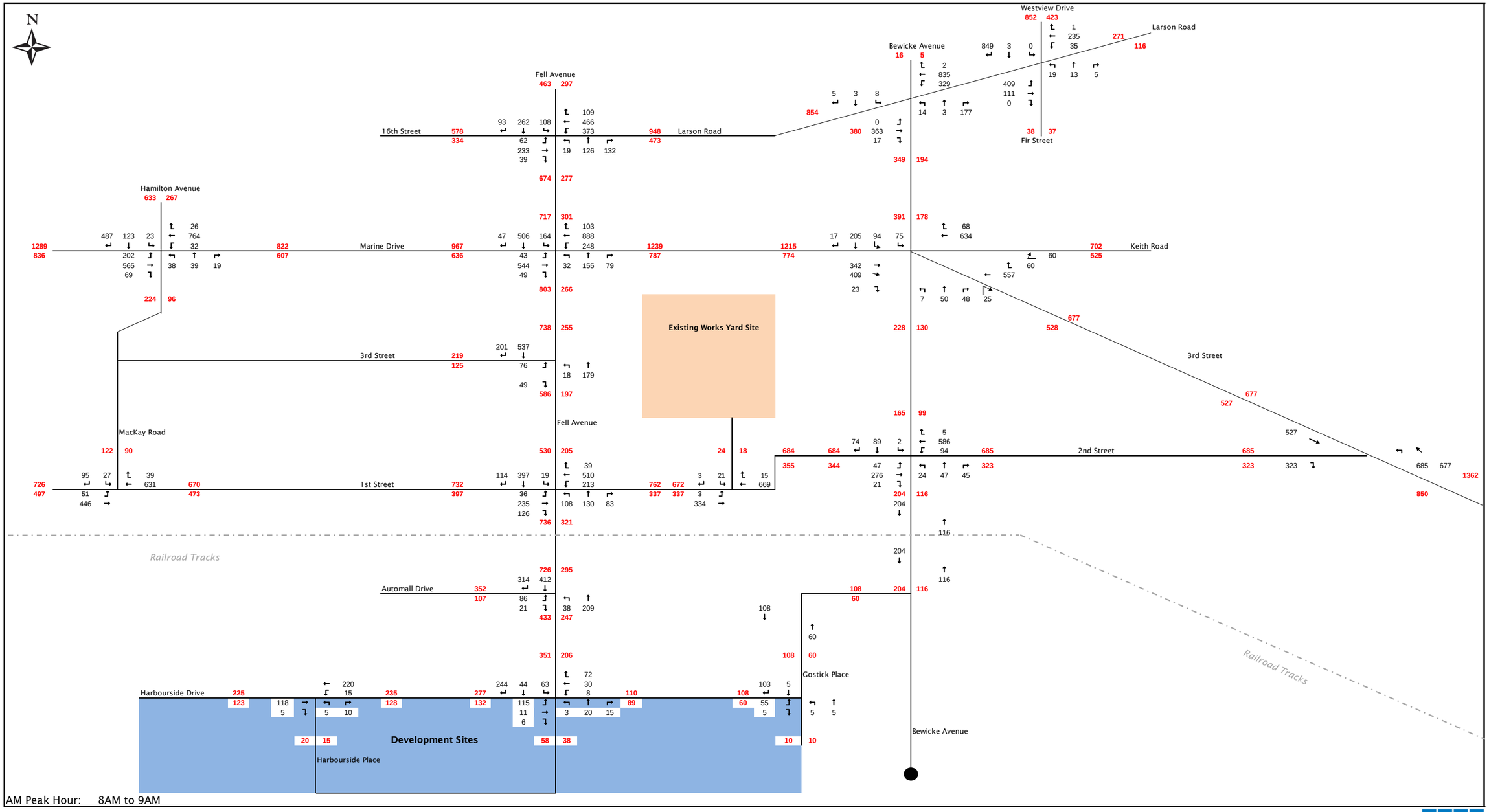

Exhibit 2.2a

2012 Existing Weekday AM Peak Hour Traffic Volumes

Harbourside Rezoning, North Vancouver BC

4025.32 October 2013 NTS

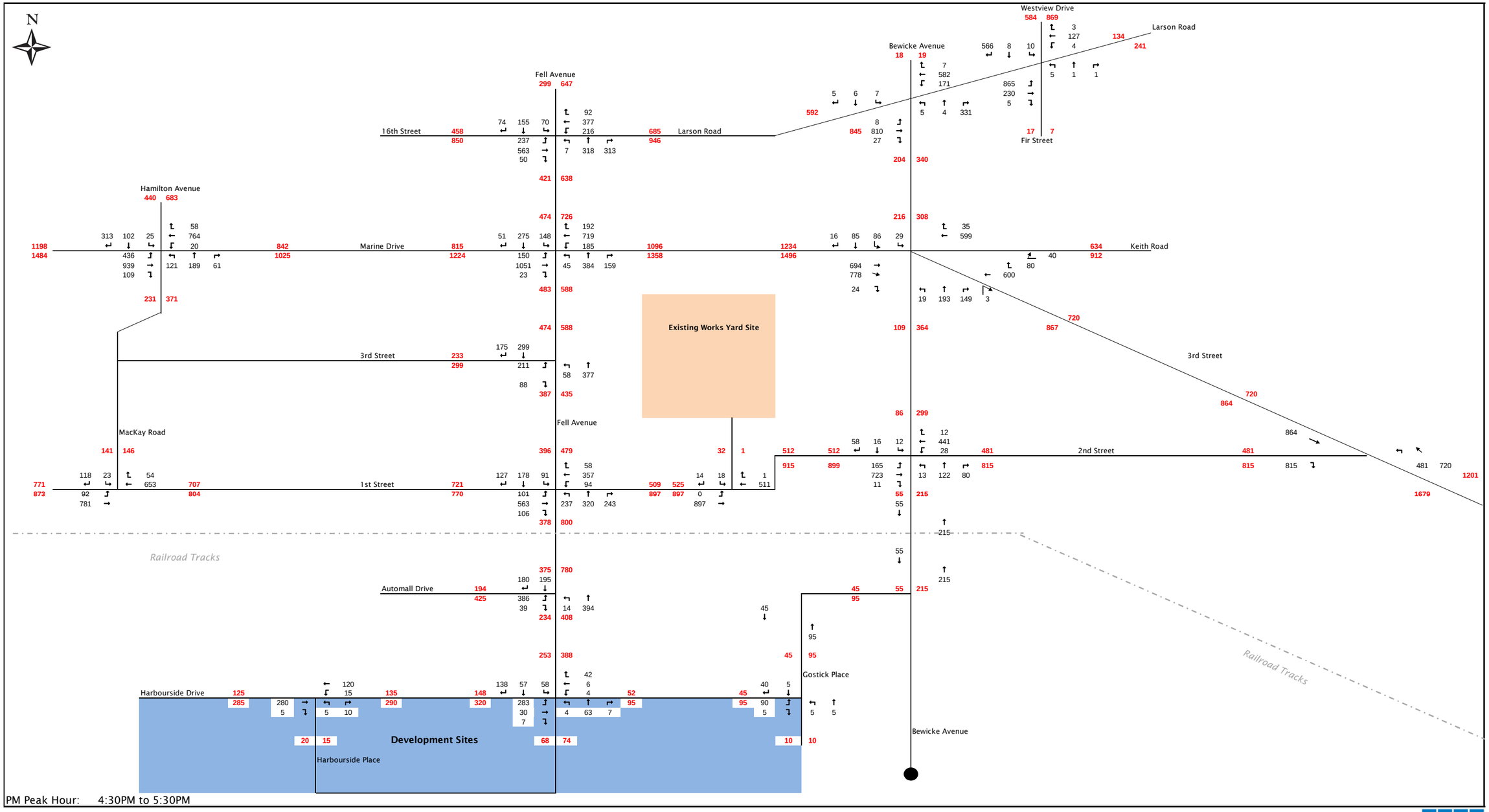

Exhibit 2.2b

2012 Existing Weekday PM Peak Hour Traffic Volumes

Harbourside Rezoning, North Vancouver BC

4025.32 October 2013 NTS

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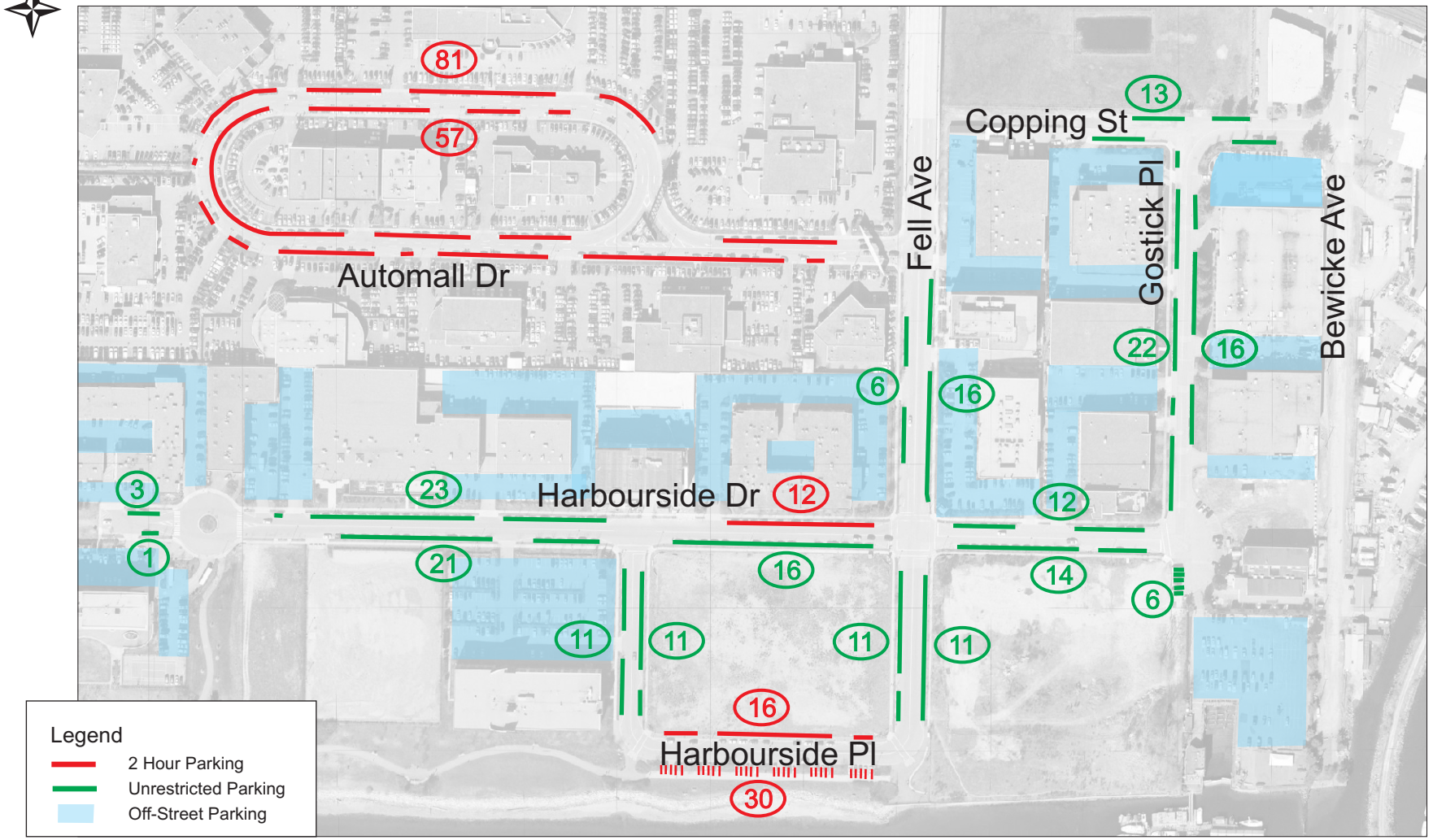

Note: Street parking spaces in circles

Exhibit 2.3

Existing Parking Supply and Control

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2.3 Existing Geometrics and Traffic Control

Overall, the study network covers 13 intersections from Larson Road in the north to Harbourside Drive in the south. Intersection details are summarized in **Table 2.3** and the existing lane configurations at each of these intersections is presented at **Exhibit 2.4**.

Table 2.3: Existing Intersection Traffic Control and Geometry

Intersection	Control Type	Bike Amenities	Pedestrian Amenities
Fell Avenue / Larson Road	Coordinated signalized intersection	Cycle lanes are marked on Larson (east leg)	Pedestrian crossings on all approaches
Fell Avenue / Marine Drive	Coordinated signalized intersection	Cycle lanes are marked on Marine Dr (Fell to Mackay)	Pedestrian crossings on all approaches
Fell Avenue / 1st Street	Coordinated signalized intersection	Cycle lanes are marked on 1st Street	Pedestrian crossings on all approaches
Fell Avenue / Automall Drive	Stop-controlled intersection with Fell Ave priority	Cycle lanes not marked on Fell Avenue or Automall Drive	Pedestrian crossings on the northern & western approaches
Fell Avenue / Harbourside Drive	Four-way stop controlled intersection	No cycle lanes	Pedestrian crossings on all approaches
Harbourside Dr. / Harbourside Place	Minor Stop on Harbourside Place	No cycle lanes	Pedestrian crossings on west and south approaches
Bewicke Avenue / Marine Drive	Coordinated signalized intersection	No cycle lanes, but a bike box on Bewicke north leg	Pedestrian crossings on all approaches except eastbound approach.
Bewicke Avenue / 2nd Street	Coordinated signalized intersection	Cycle lanes are marked on 2nd Street, with a bike box on the south leg	Pedestrian crossings on all approaches
1st Street / Mackay	Coordinated signalized intersection	Cycle lanes are marked on 1st Street and Spirit Trail on south and west legs	Pedestrian crossings on all approaches
West 16 Avenue / Marine Drive	Coordinated signalized intersection	Cycle lanes are marked on Marine Dr	Pedestrian crossings on all approaches except eastbound approach.
Larson Road / Bewicke Avenue	Coordinated signalized intersection	No cycle lanes	Pedestrian crossings on the eastbound and southbound approaches
Larson Road / Westview Drive	Coordinated signalized intersection	No cycle lanes	Pedestrian crossings on the eastbound and southbound approaches
3rd Street / 2nd Street	Coordinated signalized intersection.	2nd Street cycle lanes terminate at intersection. & not marked on 3rd St	Pedestrian crossings on the eastbound and southbound approaches

All the intersections in Table 2.3 have been modelled in Synchro Software (version 6) and the results showing existing operations is presented in Section 8, including all modelling assumptions along with details of Volume over Capacity (v/c) and Levels of Service (LOS).

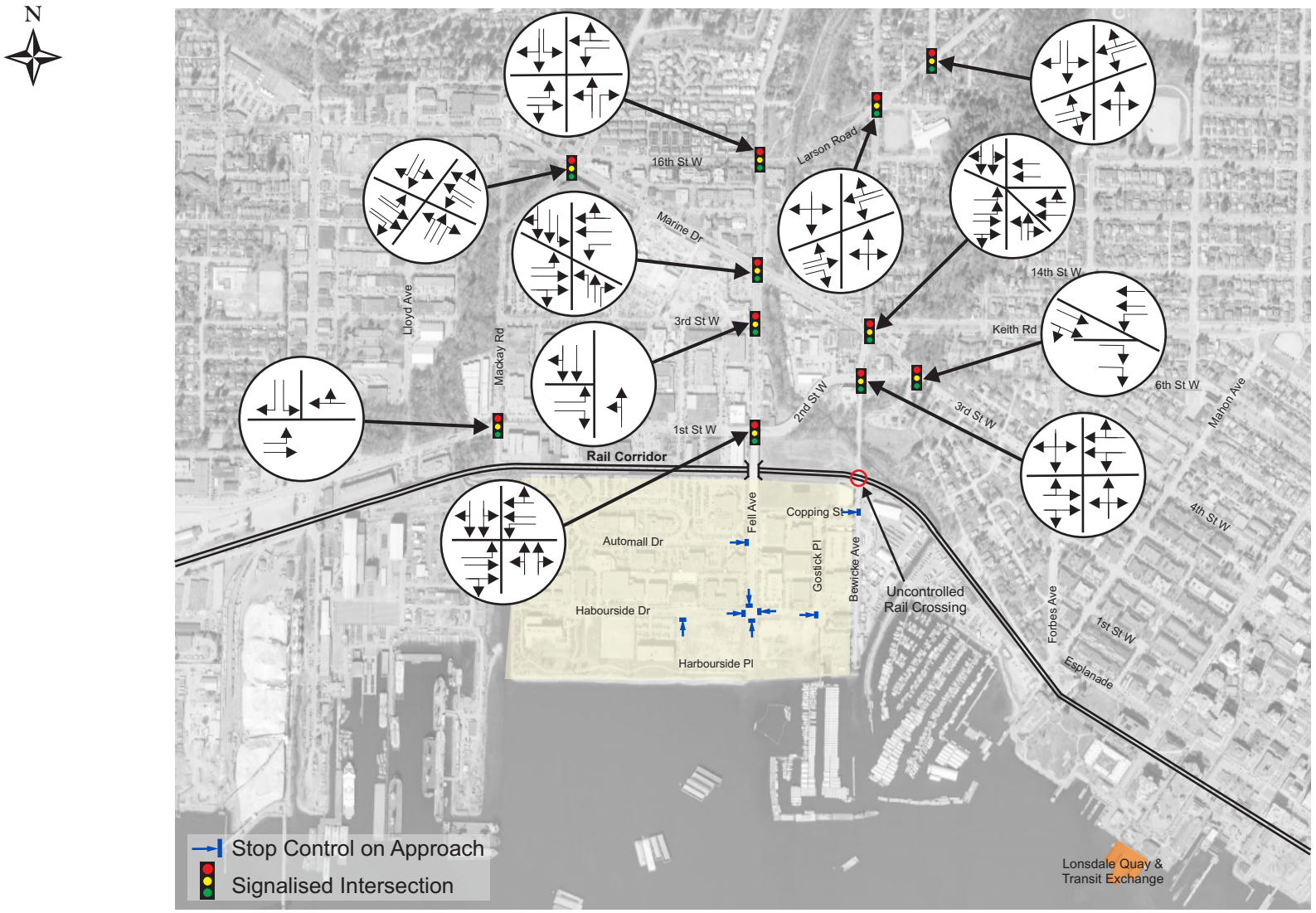

Exhibit 2.4

Existing Intersection Control and Laning Configuration

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2.4 Street Network

Marine Drive and 1st Street are the two main east-west arterial roads crossing through the study area. Marine Drive is typically four lanes together with left-turn lanes and primarily has fronting commercial properties within the study area. A number of bus routes operate on Marine Drive that connect with the Lonsdale Quay Transit Exchange.

The 1st / 2nd Street corridor is typically four lanes through the study network; however, west of Fell Avenue it becomes two travel lanes plus two parking lanes.

Fell Avenue and Bewicke Avenue are the two main north-south corridors connecting Harbourside with the surrounding road network. Fell Avenue provides the primary access to Harbourside from Marine Drive and 1st Street, where there is a four-lane overpass at the rail line crossing. Bewicke Avenue is considered a secondary access route to Harbourside and has two travel lanes (no formal parking) and has an at-grade rail crossing just north of Copping Street.

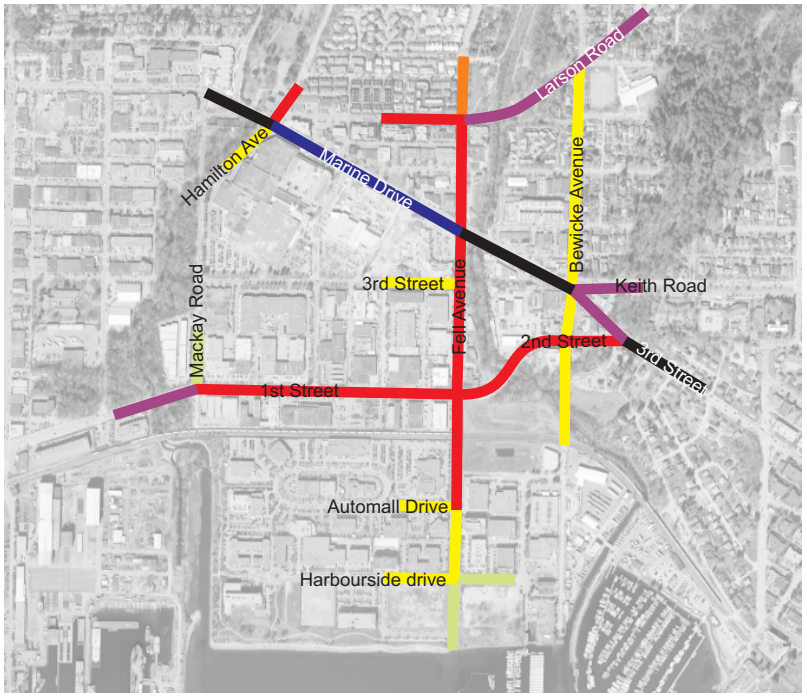
Marine Drive and 3rd Street have the highest vehicle volumes within the Study Area, while Bewicke Avenue, south of 2nd Street, carries around 300 vehicles per hour in the peak periods. **Table 2.4** summarizes the street network classifications and peak-hour volumes and these are also highlighted at **Exhibit 2.5**.

Table 2.4: Street Network Characteristics

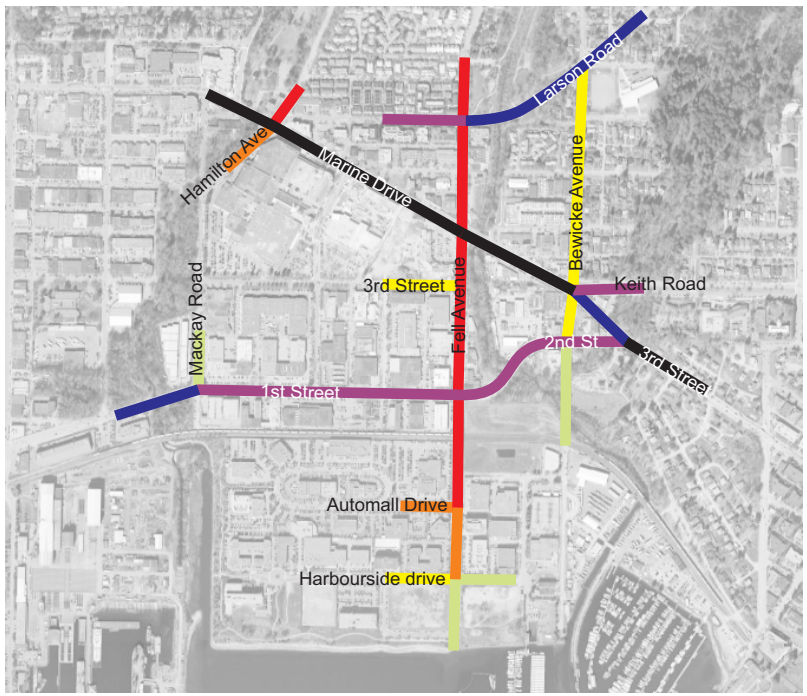
Street	Peak Volume (veh/hr)		Street Classification
	AM Peak Hour	PM Peak Hour	
Marine Drive	1990	2550	Major Arterial
3rd Street	2330	3120	Major Arterial
Larson Road	1420	1630	Major Arterial
1st Street/ 2nd Street	1150	1580	Major Arterial
Fell Ave (1st St to Marine Dr)	950	1230	Major Arterial
Fell Ave (Automall Dr to 1st St)	1150	1180	Collector
Bewicke Avenue	270	320	Collector
Automall Drive	460	620	Local Road
Harbourside Drive	370	470	Local Road

N

AM Peak Hour



PM Peak Hour



Existing Vehicle Volume Ranges

- Greater than 1,800vph
- 1,500 to 1,800vph
- 1,200 to 1,500vph
- 900 to 1,200vph
- 600 to 900vph
- 300 to 600vph
- 0 to 300vph

Exhibit 2.5

Existing Two-Way Vehicle Volumes

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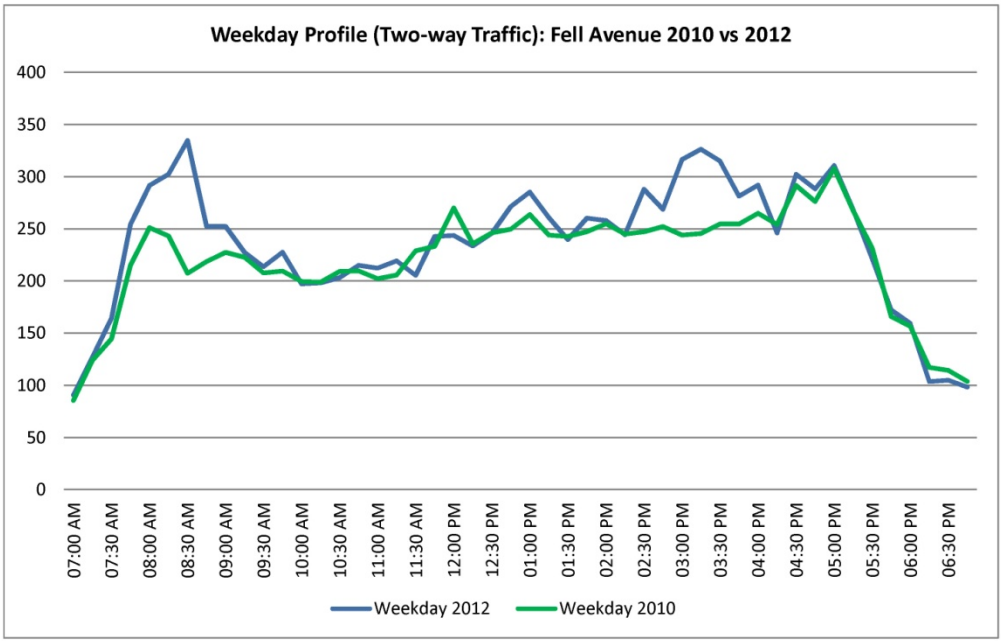
2.5 Harbourside Vehicle Movements

Vehicle flow patterns for Harbourside were reviewed to better understand the existing characteristics with the employment-focused land use patterns occupying the area.

Figure 2.1 highlights the daily profile for Harbourside (Fell Avenue), covering the weekday period based on the 2010 and 2012 tube count surveys. Peak volumes are typically 40% to 50% lower at the weekend and this period was not considered critical to the assessment.

Figure 2.1: Fell Avenue Weekday Vehicle Profile



This graph indicates the morning peak 15-minute period is higher by around 5% when compared to the afternoon peak period in the 2012 survey. This was not the case in the 2010 survey and it would therefore strongly indicate that the Lions Gate Christian Academy has had a material influence (not operational in the 2010 survey) with the spikes at 8:30am and 3:30pm (coincided with the start and finish times at the school).

The school is only temporality located at Harbourside and the future background profile is expected to be similar to that observed in 2010.

Concern has been raised with regard to queuing and delays currently being experienced at the Fell Avenue exit to First Avenue and specifically during the afternoon period. With this being the primary access point for the area, and it avoids potential train delays on Bewicke, it is important to clearly understand the existing challenges.

Outlined at **Figure 2.2** is a 15-minute demand profile for vehicles exiting at the Fell Avenue overbridge to 1st Street and it highlights two distinct periods when demand peaks, i.e., 16:30 to 16:45 and 17:00 to17:15, and this also coincides with the higher level of vehicle queuing observed, presented in **Table 2.5**

Figure 2.2: Northbound Fell Avenue Profile – PM Peak Period

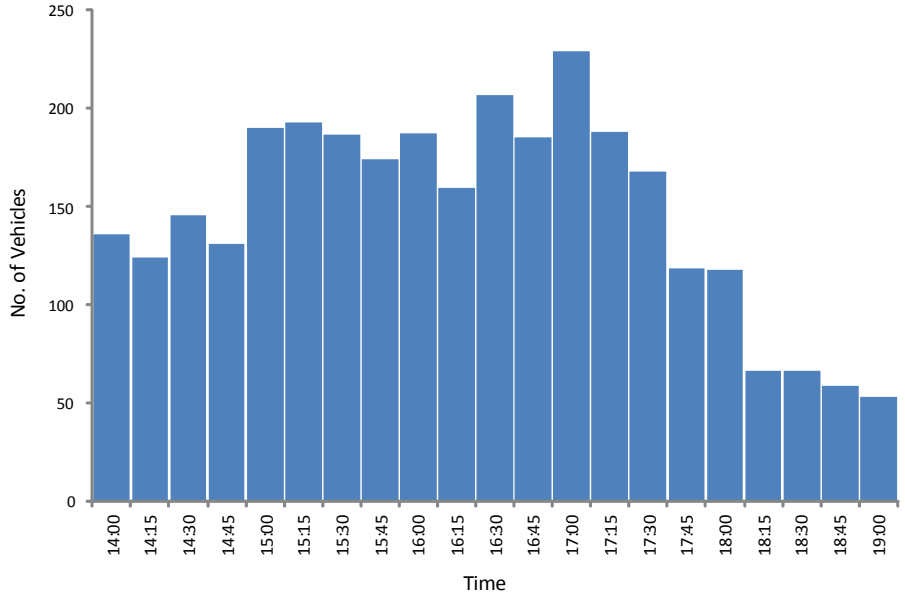


Table 2.5: Queuing Variations (4:30 to 5:30 pm)

Percentile	Left and Through	Right and Through
25%	40m / 5 vehicles	8m / 1 vehicle
50%	40m / 5 vehicles	24m / 3 vehicles
75%	56m / 7 vehicles	40m / 5 vehicles
95%	80m / 10 vehicles	64m / 8 vehicles

Table 2.5 highlights the right / through queue length is generally lower even though it can handle around 70% of all movements in the PM peak-hour (i.e. through and right turns). Site observations indicate that there is a general reluctance for through-vehicle movements to use the right lane given the parking presence on Fell Avenue immediately north of the intersection. A better queue balance could be achieved with this parking restricted in the afternoon peak period, i.e. 3pm to 6pm (discussed in Section 8).

Another observation was that many left-turn movements did not benefit directly from the protected left-turn signal phase as the straight-through movement took advantage of this time period. Compounding the

challenge for left-turn movements is the fact that the opposing left-turn movement is offset (given the four-lane road configuration).

These matters will be important points of reference in reviewing options to improve capacity at the intersection in Section 8.

In terms of the overall influence on the existing movements at Harbourside, **Table 2.6** presents the vehicle data for the 3 identifiable land use components in the critical PM peak period (4:30pm – 5:30pm).

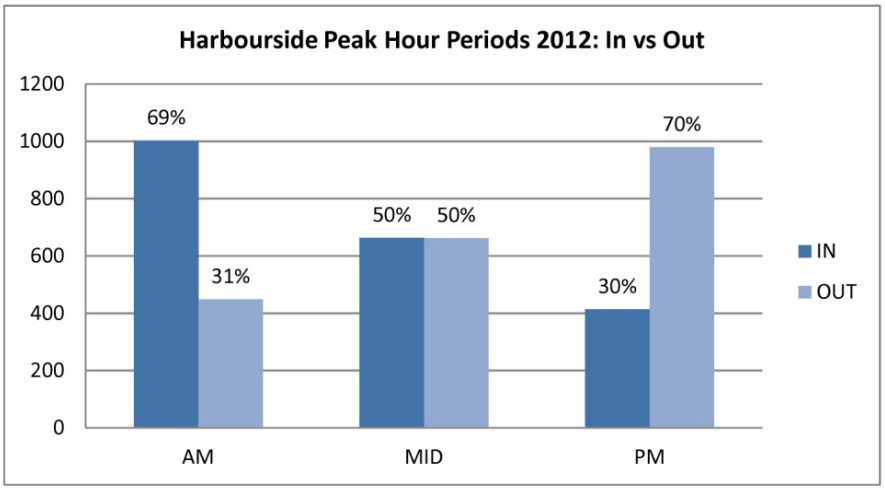
Table 2.6: Land Use Influences at Harbourside

Land use	PM Peak Hour Trips		
	In	Out	Total
Harbourside Area Business	214	535	749
Harbourside Area Schools	23	55	78
Automall	194	425	619

The Automall accounts for just over 40% of all the transportation demands within the Harbourside area, while the schools account for less than 5%. Harbourside businesses form the majority of movements.

Figure 2.3 highlights the difference between in-bound and out-bound flows for Fell Avenue and Bewicke Avenue based on the vehicle movement data collected.

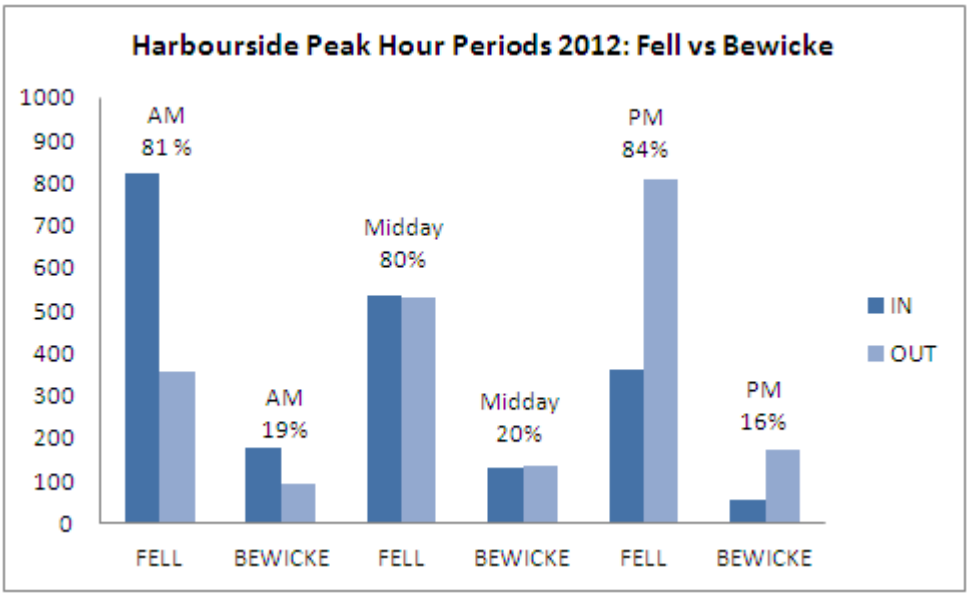
Figure 2.3: Harbourside Peak Hour Flows



It confirms the current imbalance between inbound and outbound flows in the peak-hour periods with a 30%/70% directional split observed in the AM and PM peak-hour periods. This imbalance is reflective of the

employment dominant nature of the area and that introducing other uses should assist with rebalancing these patterns, resulting in a better utilization of the street capacity. The outbound direction in the PM period, shown at **Figure 2.4**, is a key issue as mentioned earlier and in Section 7 of the report it will be covered in detail with respect to the development plan.

Figure 2.4: Vehicle Flow Balance Fell Avenue and Bewicke Avenue



Fell Avenue is the main route of choice, accommodating between 80% and 85% of all Harbourside vehicle movements (depending on the time of day).

Contributory factors to this concentration are likely to do with the fact that the main land uses are located to the west of Fell Avenue (e.g. the Automall which accounts for 40% to 45% of all movements at Harbourside), and that the connection to Bewicke Avenue is circuitous with stop controls at Gostick Place, Copping Street, and Bewicke Avenue. The at-grade railway crossing also contributes to this pattern, where there is the potential of delay due to train movements.

2.6 Travel Behaviour

Travel behaviour surveys were undertaken in 2010 (June) and 2012 (September and October) to understand the existing travel characteristics of the Harbourside area. The 2010 survey was a basic cordon survey and counted vehicles (and occupants) along with pedestrian and cycle movements at Bewicke Avenue (Copping Street) and Fell Avenue (Automall Drive).

For the rezoning application, it was considered important to not only update the previous work but provide more details on travel behaviour through a Questionnaire Survey of existing employees as this will

provide insight on future employee movements as part of the proposed development plan, and it will also assist with understanding the expectations for the residential component.

Mustel Group was commissioned to undertake the questionnaire survey of existing employees and details of the survey and methodology were covered earlier and are included with their report at Appendix B. A summary of the travel mode split is provided in **Table 2.6**.

Table 2.6: Harbourside Area Travel Mode Splits 2010 and 2012 Comparison

Travel Mode	2012 Employee Survey	2010 Cordon Survey
Driver of a vehicle	68%	71%
Passenger in a vehicle	4%	12%
Pedestrian / Cycle	8%	5-11%
Transit	20%	6-12%
Total	**100%**	**100%**

The driver proportion is broadly comparable between the two surveys; however, other parts of the survey show important differences.

Auto passenger is lower in the 2012 survey and this is partly reflective of the fact that the cordon survey included students being dropped-off at Bodwell High School.

The transit proportion is higher in the employee questionnaire and provides a better level of accuracy than the cordon survey, which did not fully track transit trips to / from Marine Drive (many trips identified in the walk mode). Indeed, a follow-up pedestrian questionnaire survey (January 2013) highlighted that around 60% of the people walking to / from Harbourside accessed transit on Marine Drive and this would account for some of the difference in that mode. It could also be influenced by the change in transit service operations in December 2011 (see next section).

Other aspects of the questionnaire survey are highlighted below:

- 50% of employees live on the North Shore and 18% are from downtown Vancouver;
- Around 50% are within 10 kilometres, which is potential cycling distance based on experience; and,
- Accessibility rating at Harbourside was voted at 4.3 out of 10, suggesting a neutral to slightly negative rating.

Bodwell High School was not included in the survey as it is not a significant transportation demand source at Harbourside and has its own unique and established transportation characteristics with the school bus

operations and boarding school component. Automall was also not included in the study because of its heavily auto-based nature and where TDM measures are expected to have little impact.

However, mode data was collected for these land uses in October 2012 to provide context for the overall transportation demands in the area. Results of the surveys are summarized in **Table 2.7**.

Table 2.7: Harbourside Area Travel Mode Splits 2012 (all Uses)

Travel Mode	2012 Employee Survey	Automall	Bodwell High School
Driver of a vehicle	68%	86%	19%
Passenger in a vehicle	4%	6%	26%
Pedestrian / Cycle	8%	5/6%	19%
Transit	20%	2/3%	48%

It confirms that the Automall and Bodwell School have their own unique travel characteristics and are not expected to be representative of the general travel characteristics within the Harbourside Area or those projected for the development plan.

Questionnaire Survey results are reviewed further in the context of the Transportation Demand Management strategy set out in Section 6.

2.7 Bewicke Avenue Rail Crossing

Bewicke Avenue Rail crossing (CN) is located around 60-metres north of Copping Street and around 30-metres from the access to the new City Works Yard site. It is uncontrolled with three rail tracks at the road crossing (to accommodate the shunting of rail cars).

During the survey, over three days in June 2010, typically one train crossed Bewicke Avenue during the morning and afternoon peak-hour periods. Crossing times ranged from 1min to 1min and 50seconds for through trains, while twice during the survey trains were recorded stopping on Bewicke Avenue. On one occasion this was for up to 7minutes and 34seconds (resulting in vehicles turning round and leaving the queue).

A further survey was conducted over two days in January 2013 (7am-10am and 3pm-6pm) to provide further context of the existing demands. One train crossed Bewicke Avenue during the morning peak-hour (8:00am-9:00am) over the two surveys days with a crossing time of 39 seconds, and no trains were observed crossing in the afternoon peak-hour. Outside the peak-hour periods, one train was observed at 9.24 am on the first day (crossing time - 50 seconds) and another at 9:47am on the second day (crossing time 9 minutes and 56 seconds).

These observations indicate less usage than the previous survey, but it does highlight the length of time that can occur with a train operating in the railcar siding area.

Port Metro Vancouver requested AECOM to prepare a "Road / Rail At-Grade Crossing North Shore Assessment Report" (February 2011) for the 17 rail / road crossings on the North Shore. At the Bewicke Avenue crossing, it recommended the installation of flashing lights, gates, and pavement markings at an estimated cost of $510k. No funding sources were identified.

Canadian National (CN) expressed concerns on the safety challenges it has with this rail crossing and in particular with respect to trespassing and visibility for train drivers' approaching from the east to the crossing given the rail track curvature. Concert and the City of North Vancouver have met with CN to work on measures that would allow the crossing to still function for serving the Harbourside community.

Indeed, Concert is committed (as part of their community amenity contribution for the development plan, covered further in Section 4 and 8) to introduce a barrier control and lights along with an integrated signing strategy to advise drivers' (and cyclists) in advance that a train is passing. This will reduce frustration and u-turn movements and increase the use of Bewicke Avenue as a viable, secondary route to Harbourside (currently used by only 15% of all vehicles to / from Harbourside at peak times).

Other benefits with the barrier control and lights will be safety for all street users in controlling movements when the line is operational, while it could avoid the necessity for train whistles, which are common at many uncontrolled crossings. Part of the change will also involve features to discourage trespassing along the railway track through barriers or signage. The timing of measures will be determined through the relevant planning and community amenity agreements and linked to phasing / build-out.

2.8 Summary

A review of the existing conditions confirms the following:

- The vehicles flows collected on the study network between 2010 and 2012 are broadly similar and do not suggest a trend of vehicle growth;
- Vehicle movement in / out profile at Harbourside confirms a 70%/30% imbalance in the morning and afternoon peak-hour periods while temporarily-located Lions Gate Christian School will not be an influence after this summer;
- Bewicke Avenue is generally underused with only 15% of Harbourside vehicle movements using it compared to Fell Avenue;
- Detailed analysis of the study network intersections will be undertaken in Section 8 of the report;

- The questionnaire survey provided further clarity on the travel behaviour at Harbourside and in particular highlighting a 20% proportion of transit usage (not including Bodwell High School and the Automall which have their own unique travel characteristics); and,
- The railway crossing use at the peak periods varies significantly where the 2010 survey showed one movement in each of the peak periods, while the most recent survey in 2013 highlighted only one movement in total in the peak period over the two days observed.

3. WALKING, CYCLING & TRANSIT CONNECTIONS

This section presents the existing and future conditions for accessing Harbourside by walking, cycling, and transit.

3.1 Introduction

In 2008, the City of North Vancouver developed a Transportation Plan with a more progressive sustainable approach than the one developed some 15 years prior. It was prepared to:

> *"serve as a 'road-map' for the next decade and beyond and to help it achieve many of the long-term goals and objectives outlined in the OCP".*

One of the long-term goals established is to reduce greenhouse gas emissions. Emphasis is placed on transportation alternatives to the car, including walking, cycling, and transit. Specific sections of the Plan cover walking, cycling and transit, and maps show the existing and long term routes.

Through the consultation process for the OCP amendment, the following key issues for active modes were raised in connection with the Harbourside area:

- Transit service limited;
- Spirit Trail connection to Lonsdale closed through the Marina / Boat yard; and,
- Lack of a pedestrian path on Bewicke Avenue, including the new bridge structure at Mosquito Creek, and no barrier control arms at the at-grade rail crossing.

Interpretation of the current Pedestrian, Cyclist and Transit maps for the area are reproduced at **Exhibits 3.1, 3.2** and **3.3**, and these are discussed in detail in the following paragraphs. **Exhibit 3.4** illustrates the pedestrian amenities for the area.

In Section 9 of the report, a multi-modal assessment is presented that reviews the existing and future operations of the pedestrian and bicycle network in the Harbourside area.

3.2 Walking and Cycling

Pedestrian and bicycle access for Harbourside is at Fell Avenue, Bewicke Avenue, and Mackay (via the new pedestrian / bicycle overpass). In an east-west direction, through Harbourside, there are currently no off-street pedestrian or cyclist waterfront trail connections available at Mackay Creek (in the west) and Mosquito Creek (in the east).

An inventory of all pedestrian and bicycle connections has been prepared and this is included at **Exhibit 3.5**. It covers up to Marine Drive to recognize the location of the Frequent Transit Network (FTN) bus corridor.

It confirms sidewalks are present on both sides of Harbourside Drive, Harbourside Place and Fell Avenue within the Harbourside area, while Gostick Place (west side) and Copping Street (south side) has 1 sidewalk.

Bewicke Avenue has limited dedicated provision for pedestrians, including no sidewalk on the Mosquito Creek bridge (introduced in 2010 to replace the previous wood structure), and there are only short sections of (informal) sidewalk area along the west side between Copping Street and 2nd Avenue. Future sidewalk provision opportunity exist on the west side of Bewicke Avenue with the setback for the works yard (completed 2012) and park area immediately to the north of the creek

Bicycle lanes are present along the 1st and 2nd Street corridor and on the section of Marine Drive around Fell Avenue and westwards. Harbourside Drive (Greenway) has shared travel lane bicycle markings (sharrows) and the Spirit Trail / Kings Mill Walk off-street section continues from 1st Street (pedestrian / cycle shared section) over the new Mackay overbridge, and along the east side of the Creek (still shared) and then along the waterfront (segregated), and goes as far as Fell Avenue in the Harbourside area.

Bewicke Avenue has no identified bicycle facilities other than the advance stop lines at 2nd Avenue, but it is a low-volume route with around 300 vehicles per hour in the peak-hour periods. This street access to Harbourside provides a reasonable connection to Harbourside from the north /east direction given the relatively flat grade and lower use by vehicles (i.e. when compared to Fell Avenue).

A multi-modal analysis in Section 9 will review the operational characteristics of the existing street sections in Harbourside for pedestrians and cyclists.

Presented at **Exhibits 3.6** and **3.7** are existing pedestrian and cycling volumes in the study area and these counts were conducted as part of the intersection surveys in 2010 and 2012 (see Table 2.1) and the year of survey has been coloured coded on the diagrams.

Table 3.1 summarizes the pedestrian volumes on study network for the peak-hour morning and afternoon periods.

Table 3.1: Peak-Hour Pedestrian Volume Summary (8am to 9am / 4:30pm to 5:30pm)

Intersection	North Leg	West Leg	South Leg	East Leg
Fell Avenue / Marine Drive	29/65	89/125	22 /62	No crossing
Fell Avenue / 1st Street	8/8	45/48	1/20	4/8
Fell Avenue / Automall Drive	10/10	78/45	37/14	No crossing
Fell Avenue / Harbourside Drive	14/17	17 /15	6 / 4	1 /8
Harbourside Dr. / Harbourside Place	No crossing	5/7	19/9	1/0
Bewicke Avenue / Marine Drive	5/13	No Crossing	23/32	27/14 (Keith Rd) 32/29 (3rd St W)
Bewicke Avenue / 2nd Street	7/9	0 / 9	15 / 29	10 / 32
1st Street / Mackay	9/13	20/35	No crossing	8/38
West 16 / Marine Drive	11/24	No crossing	23/58	29/116
Fell Avenue / Larson	5/15	17 /44	14 / 12	9 / 19
Larson / Bewicke Avenue	33/15	4/2	47/19	27/11
Larson / Westview Dr	7/7	2/0	32/7	2/5
3rd Street / 2nd Street	25/13	17/36	No crossing	No crossing

Pedestrian volumes are generally low (maximum 2 per minute) in the Harbourside area, while higher volumes are observed along the Marine Drive corridor and these are likely influenced by the FTN route.

Specific to Harbourside, the following table summarizes the volume of pedestrians using the three current points of access.

Table 3.2: Harbourside Hourly Pedestrian Summary

Connection	Morning (8am to 9am)	Evening (4:30pm to 5:30pm)
Spirit Trail Overpass	45	80
Fell Avenue	80	55
Bewicke Avenue	20	20
Totals	145	155

The new MacKay overpass and Fell Avenue connections accommodate around 45-80 pedestrian movements in the peak-hour periods, while Bewicke Avenue is lower at 20 movements (per hour). Mackay may have a higher level of use in the evening period given the higher propensity for recreational movements at that time. On whether the MacKay overpass has influenced vehicle flows to / from Harbourside is difficult to extrapolate, especially given the demands of the Lions Gate Academy, which was not present in the 2010 survey, and / or increasing recreational users attracted by the new connection.

Additionally, the increased pedestrian activity on the Fell overpass in the morning could be the influenced by the schools, particularly as it is a more direct route to access the Frequent Transit Network along Marine Drive (see comment later that 60% of those observed walking to / from Harbourside accessed transit on Marine Drive).

Table 3.3 summarizes the cyclist volumes on study network for the peak-hour morning and afternoon periods.

Table 3.3: Hourly Cycling Volume Summary (8am to 9am and 4:30pm to 5:30pm)

Intersection	North Leg	West Leg	South Leg	East Leg
Fell Avenue / Marine Drive	11/17	33/41	15/9	45/65
Fell Avenue & 1st Street	7/9	59/76	8/7	62/76
Fell Avenue & Automall Drive	9/6	½	9/6	N/A
Fell Avenue & Harbourside Drive	6/7	8/7	2/1	8/6
Harbourside Dr. at Harbourside Place	N/A	8/2	0/0	3/5
Bewicke Avenue & Marine Drive	0/2	13/25	0-5/0-5	15/16 (Keith Rd) 6/11 (3rd St W)
Bewicke Avenue & 2nd Street	12/20	49/63	10/20	47/61
1st Street and Mackay	14/15	81/126	N/A	63/93
West 16 at Marine Drive	11/8	24/28	3/9	16/24
Fell Avenue / Larson	6/8	12/8	9/8	17/13
Larson and Bewicke Avenue	1/2	17/8	4/6	16/12
Larson and Westview Drive	6/4	6/13	1/2	16/9
3rd Street & 2nd Street	17/22	40/58	39/42	N/A

Clearly, the 1st/2nd/ 3rd Street corridor has the highest bicycle volume in the study area with around 60 to 80 movements at Fell Avenue and this increases at the Mackay / Spirit Trail connection with around 80 to 130 movements (higher level observed in the PM peak-hour).

The following table, **Table 3.4**, summarizes the volume of cyclists using the three current points of access.

Table 3.4: Harbourside Hourly Cycling Summary

Connection	Morning (8am to 9am)	Evening (4:30pm to 5:30pm)
Mackay Overpass	20	40
Fell Avenue	10	10
Bewicke Avenue	10	20
Totals	40	60

Mackay overpass has the highest level of use of the three existing Harbourside connections and is equivalent to 60% of all movement to / from the area. Bewicke has a higher usage than Fell in the PM period and equal in the AM, likely a result of the relatively flat topography (vehicle flow is 85%/15% in favour of Fell).

3.3 Planned Changes to Greenways

The following summarizes the identified future changes to the greenway routes in the immediate area and in particular for the Spirit Trail and Bewicke Avenue.

3.3.1 Spirit Trail and Kings Mill Walk

This trail runs through Harbourside with the Kings Mill Walk (and dog park) along the waterfront, while the Greenway (for bikes) is located on Harbourside Drive. At the west end, the trail runs parallel with Mackay Creek, crosses the CN railway to 1st Street via the new pedestrian overpass, and then continues as a shared pathway along the north side of 1st Street. A new traffic signal has been introduced at Mackay and 1st Street to provide a controlled crossing point.

At the east side of Harbourside, the Spirit Trail is closed at the boat yard site, where discussions are on-going between the City and Squamish First Nation to resolve this matter. One of the key issues is how to accommodate trail users within an active boat works yard facility (security and conflicts). Design options would need to be considered to address these concerns, but with it open, a direct, safe, and scenic access to Lonsdale Quay (SeaBus, Buses, local amenities, etc.) would be available.

For pedestrians it would be 15-18 minute walk, or cyclists a 5 to 6-minute cycle, to Lonsdale, and is expected to be a strong influence on improving accessibility to the Harbourside area. Concert recognizes the importance of the connection to Lonsdale Quay and is committed to working with the City and Squamish First Nation to progress the waterfront route alignment.

A temporary route is being considered by the City along Bewicke Avenue, West 2nd Street and 3Rd Street until the preferred waterfront route is resolved (identified on Exhibits 3.1 and 3.2).

With the development plan at 22 Gostick Place, a new connection is being provided on the south side of the building to allow pedestrian / bicycle access between Gostick Place / Harbourside Drive and Bewicke Avenue. Pavement markings will be provided by the City on the Gostick Place side to guide cyclists to the Harbourside Greenway. It will also connect to the new waterfront Spirit Trail section that is being undertaken by Concert starting on the west side of the Yacht Club, where there is an existing right-of-way (see next section).

3.3.2 Bewicke Avenue Greenway

The City of North Vancouver has upgraded Bewicke Avenue (Copping Street to Bewicke Park) to a Greenway standard and an indicative layout of the design is shown at **Exhibit 3.8.** North of Copping Street, there is no formal continuous sidewalk, including at the new bridge for Mosquito Creek but provision has been made on the west side for a future extension to accommodate one. Additionally, the existing at-grade rail crossing at Bewicke Avenue is currently uncontrolled for vehicles and other street users.

Upgrading the Bewicke Avenue greenway between Copping Street to West 2nd Street is included as part of Concert's community amenity contribution and this is covered further in the following section.

3.3.1 Mosquito Creek

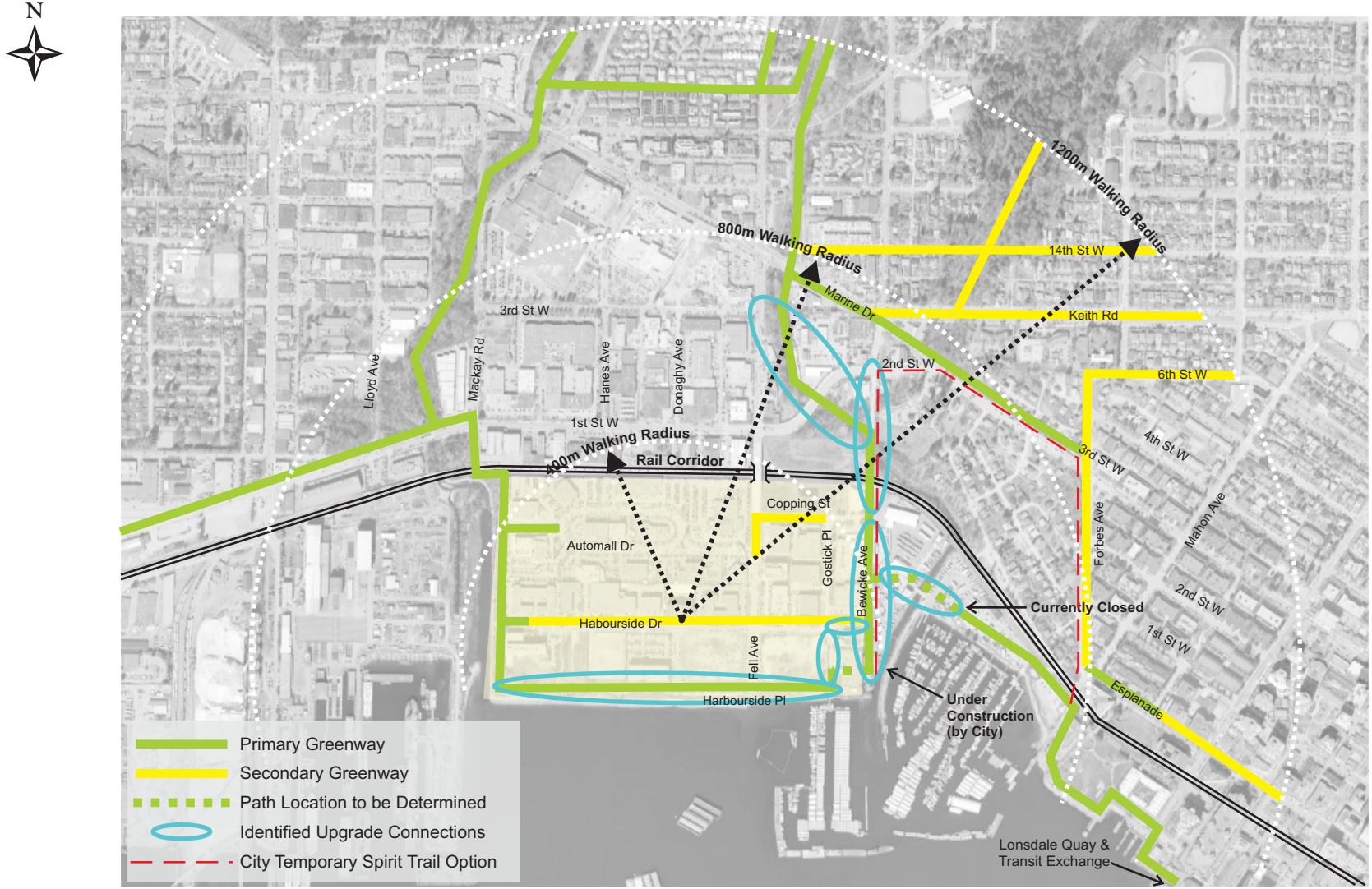
A pathway currently runs along the north / east side of Mosquito Creek and is planned to be upgraded as part of the relocation of the City's new Works Yard site. It will include a new stairwell from the path to the 1st / 2nd Street overpass structure.

On the section from 1st / 2nd Street to Marine Drive, much of the path's length would have overlooking buildings from the new residential planned (at the current Works Yard site) and this should improve comfort / security.

3.3.1 Connection to Seaspan at Mackay Creek

Discussions are ongoing between Concert and Seaspan regarding the potential for a connection between the Seaspan lands (in the District of North Vancouver) and Harbourside via a pedestrian bridge across Mackay Creek. Given the fact that the Seaspan site is a high security area, the pedestrian bridge would only be for use by Seaspan employees to access the Spirit Trail and / or amenities at Harbourside (i.e. it would not be publically accessible).

The Seaspan pedestrian crossing would require consultation with regulatory bodies, including BERC and the District, and as such, is not included as part of this rezoning application. Concert will continue to work with Seaspan and may, if they wish, pursue the connection in the future as part of a separate application.



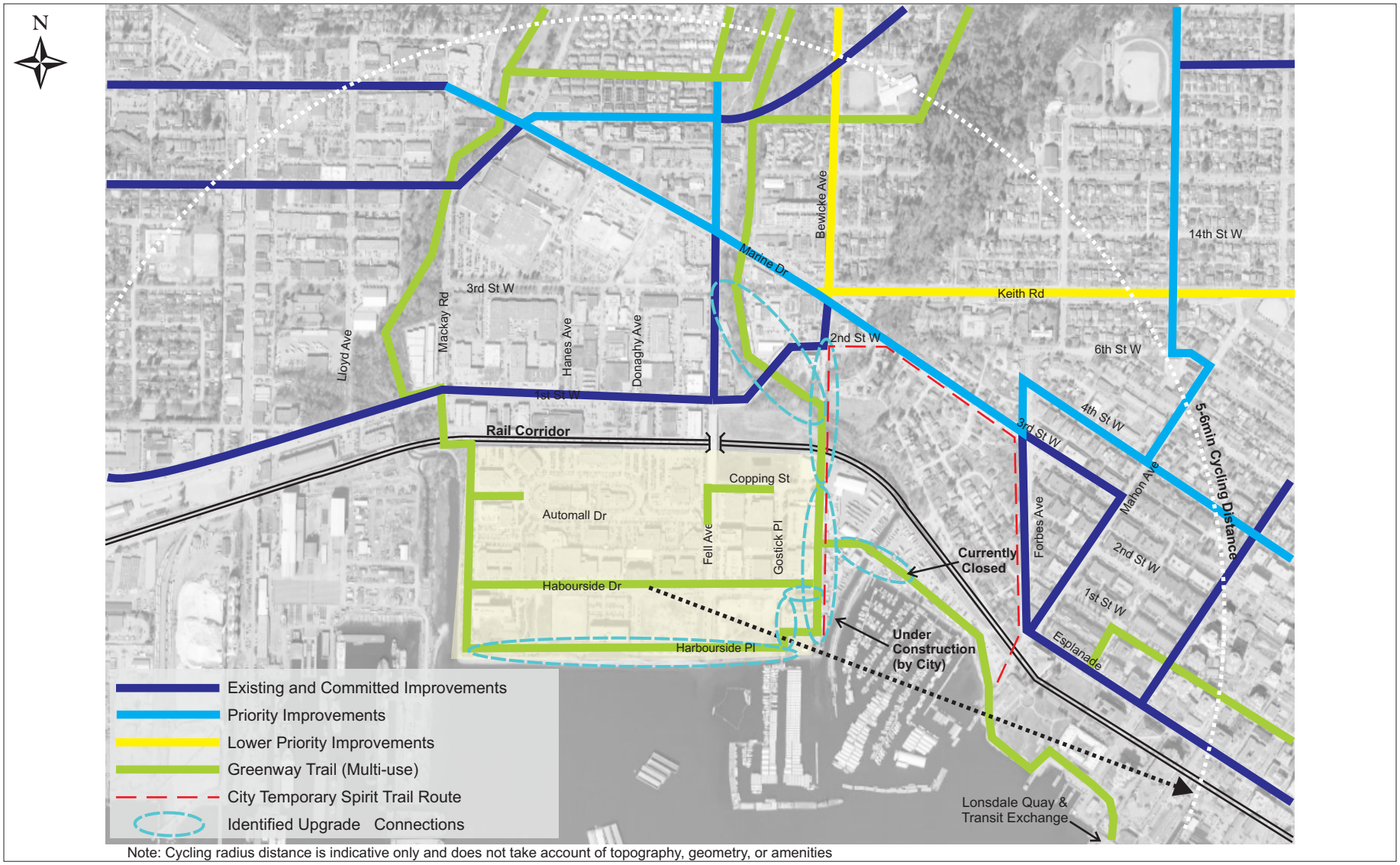
Note: Walking radius distances are indicative only and do not take account of topography, geometry or amenities

Exhibit 3.1

Existing Pedestrian Routes

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

bunt & associates



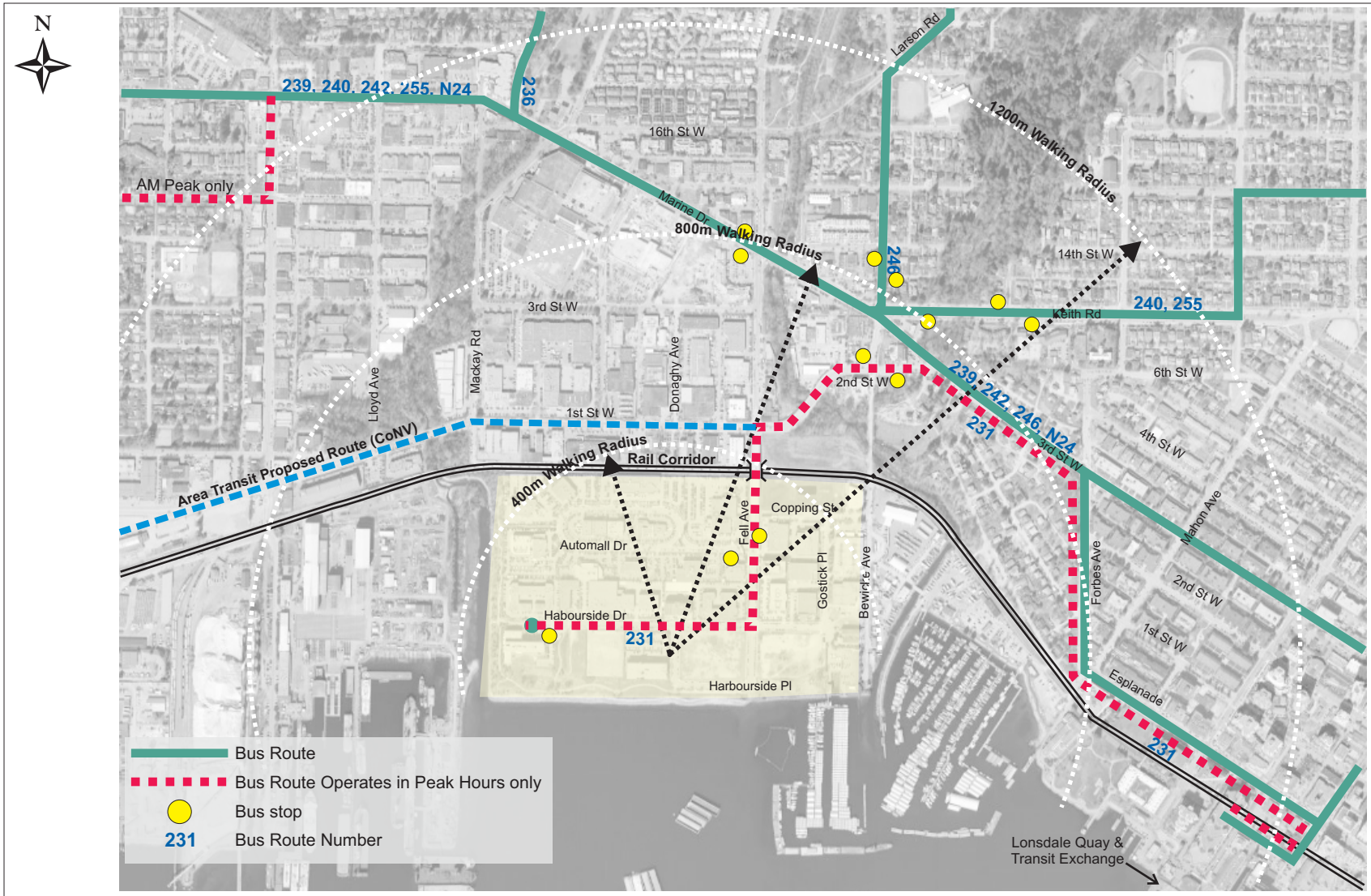
Note: Cycling radius distance is indicative only and does not take account of topography, geometry, or amenities

Exhibit 3.2

Existing Cycle Routes

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

bunt & associates



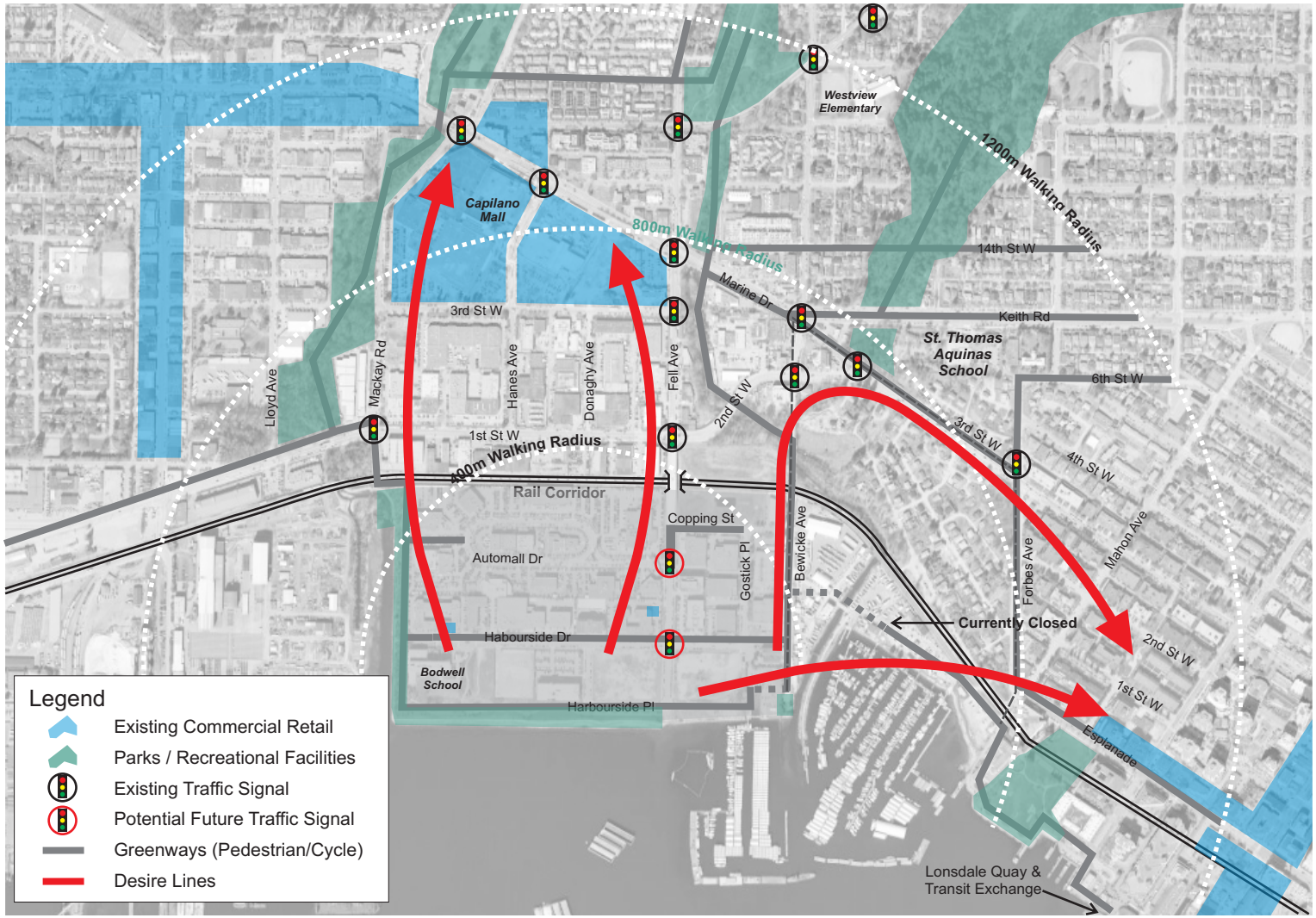
Note: Walking radius distances are indicative only and do not take account of topography, geometry, or amenities

Exhibit 3.3

Existing Transit Routes

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

bunt & associates



Note: Walking radius distances are indicative only and do not take account of topography, geometry or amenities

Exhibit 3.4

Existing Pedestrian Amenities

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

bunt & associates

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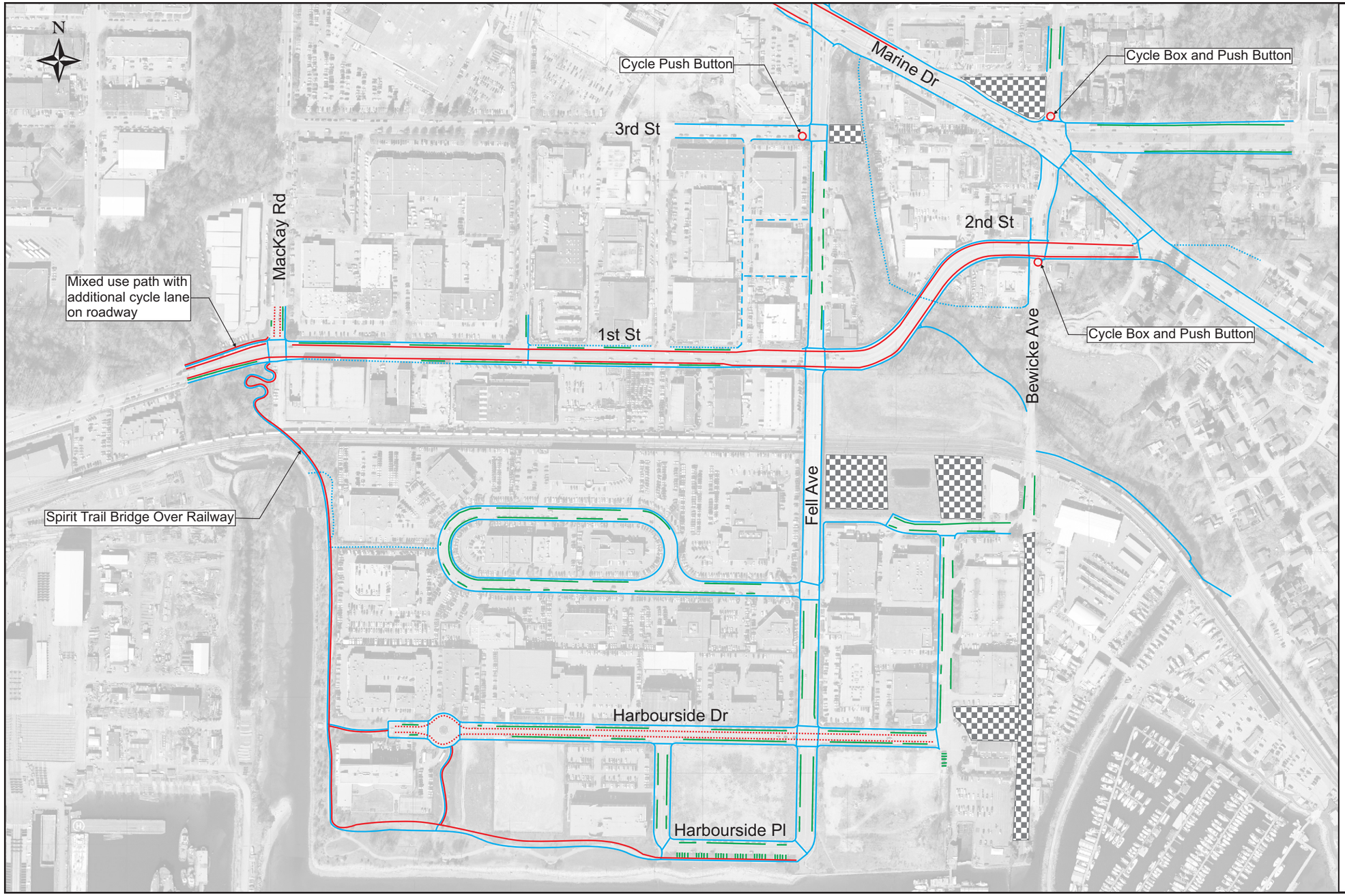

Legend

- Sidewalk (Paved) (indicates painted crosswalk at road crossings)
- Pathway (Unpaved)
- Pedestrian Connection via laneway
- Cycle Lane
- Shared lane (Sharrows)
- Parking Permitted
- Area Under Construction at time of inventory, future frontage treatment unknown.

Exhibit 3.5

Existing Pedestrian and Cycle Facilities

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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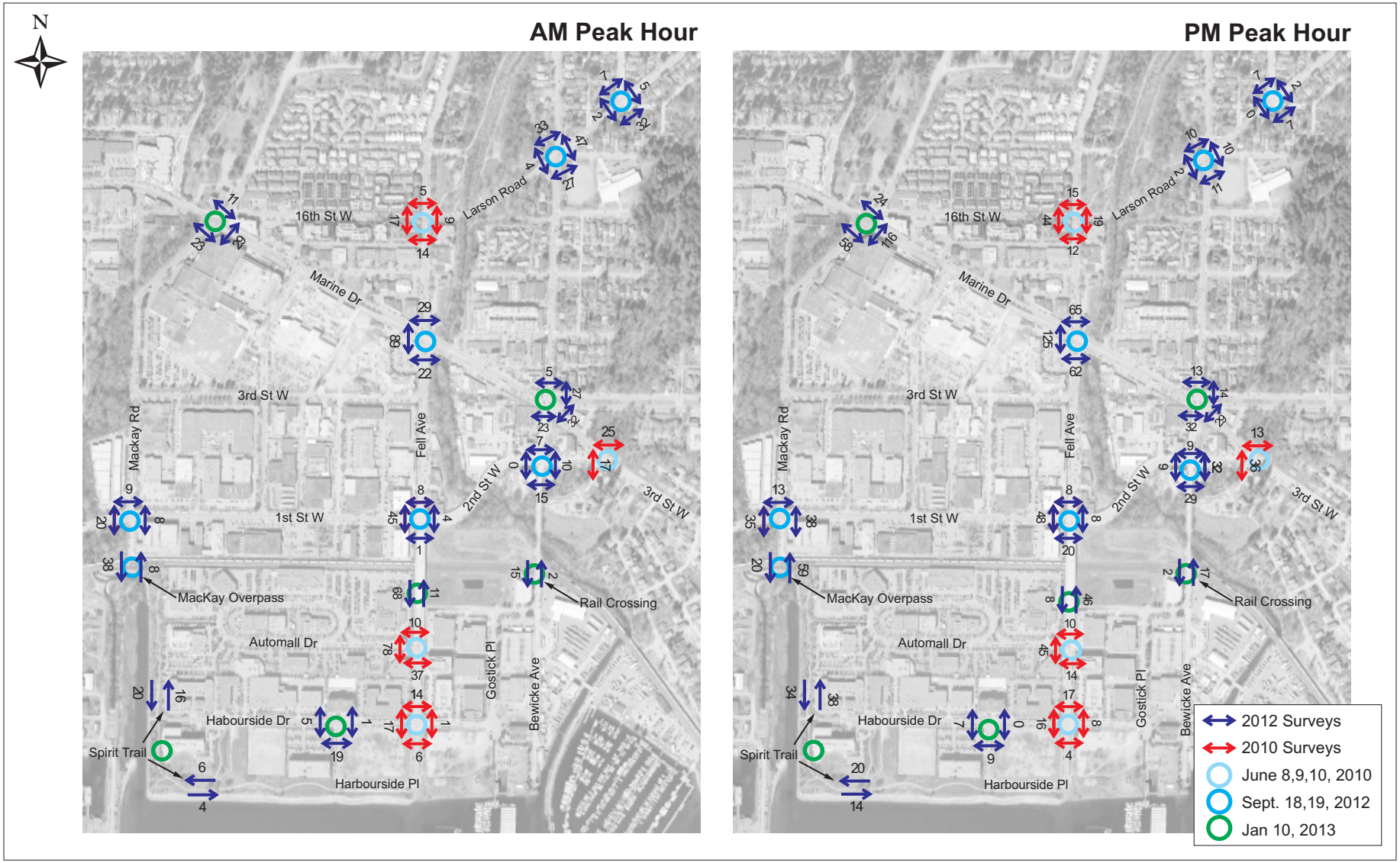

Exhibit 3.6

Existing Pedestrian Volumes

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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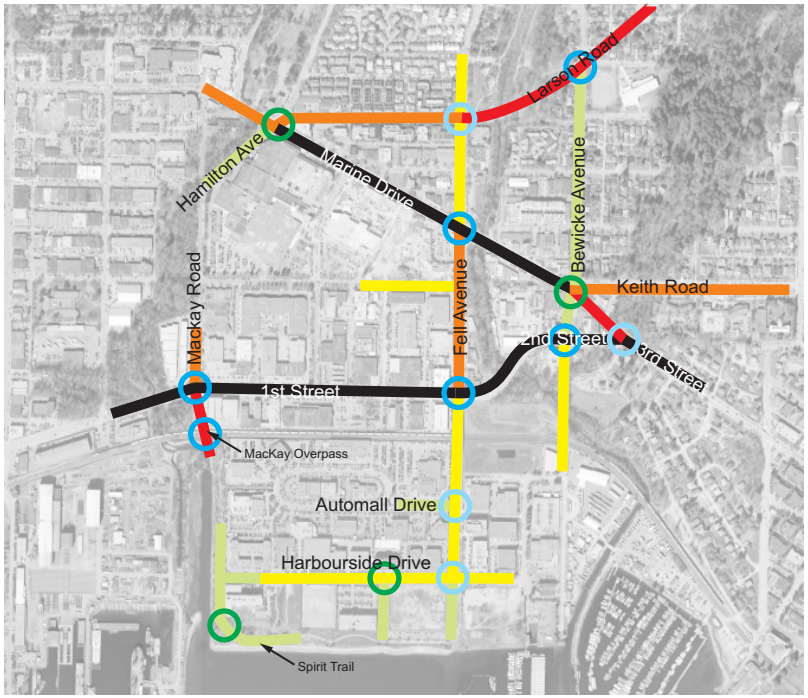
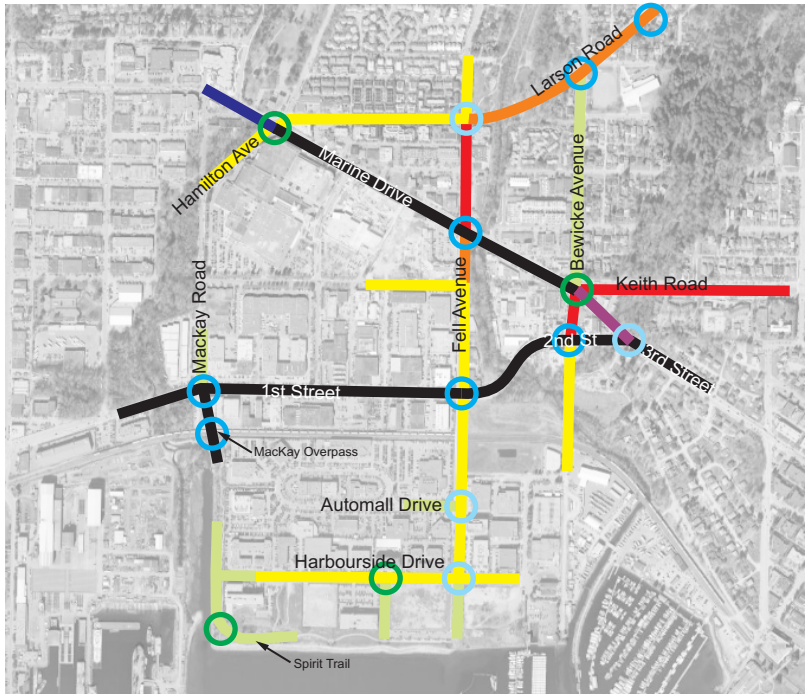
AM Peak Hour



PM Peak Hour



Existing Cyclist Volume Ranges

- Greater than 30 cph
- 26 to 30cph
- 21 to 25cph
- 16 to 20cph
- 11 to 15cph
- 6 to 10cph
- 0 to 5cph

- June 8,9,10, 2010
- Sept. 18,19, 2012
- Jan 10, 2013

*Note: the number of cyclists is likely higher during summer months (i.e. along the Spirit Trail)

Exhibit 3.7

Existing Cyclist Volumes

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

bunt & associates

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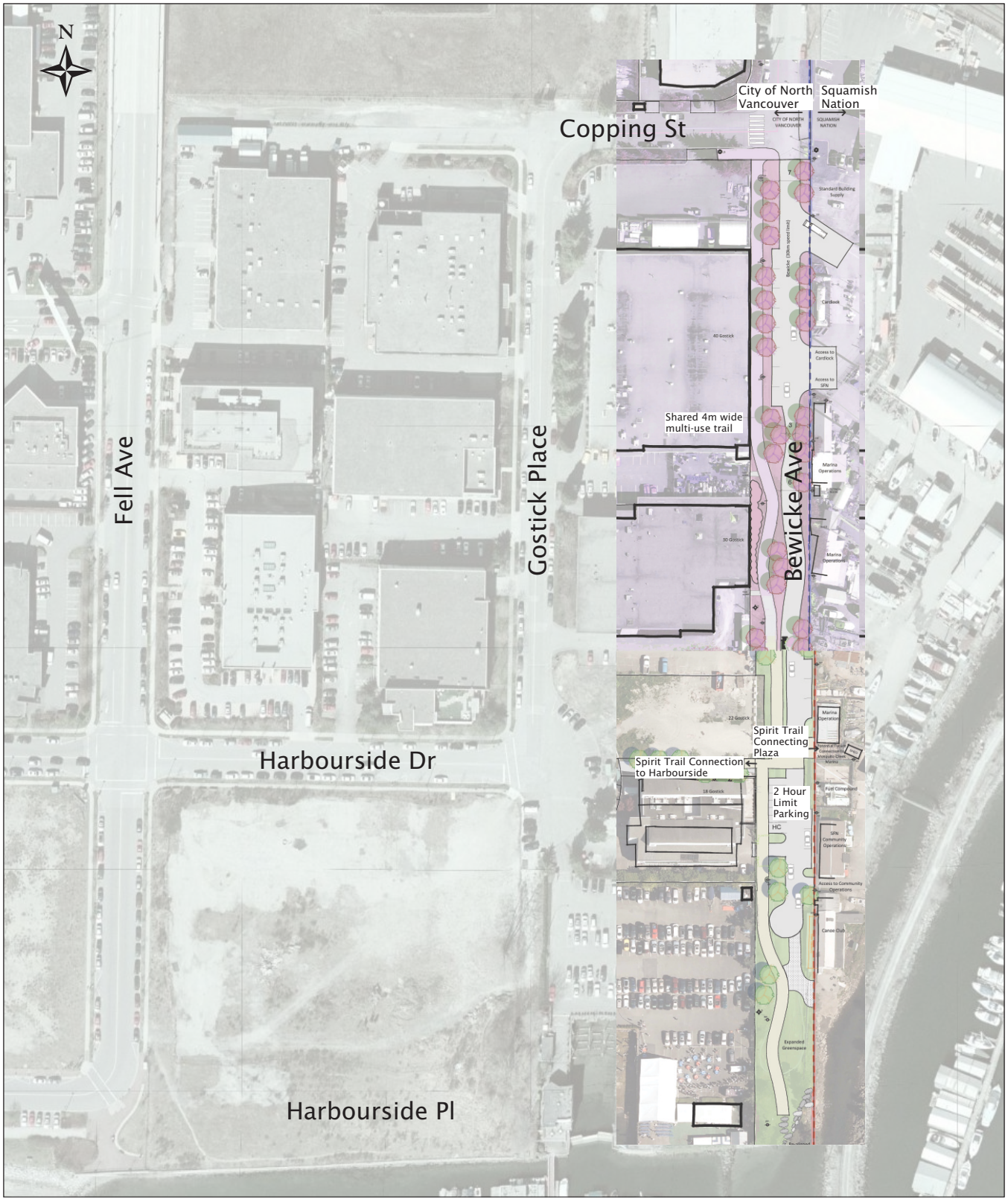

Exhibit 3.8

Bewicke Greenway City Plan

Harbourside Rezoning, Vancouver, BC
4025.32 October 2013 Scale NTS

bunt & associates

3.4 Transit

The following provides a review of current transit access for Harbourside and in Section 6 consideration is given to changes as part of the Transportation Demand Management strategy.

Direct transit access to Harbourside is currently provided by a peak-period bus service, route #231, and which connects with Lonsdale Quay (journey time 8/9 minutes). Time periods of operation cover the morning and afternoon peak periods only and are highlighted at **Table 3.5**.

Table 3.5: Existing Transit Service to Harbourside

Route	Direction	Time Period	Frequency
231	Inbound (to Harbourside from Lonsdale Quay)	7:30am – 8:30am*	15 minutes
231	Outbound (from Harbourside to Lonsdale Quay)	3:30pm – 5:45pm	30 minutes

Note – a single bus service operates in the westbound direction during the afternoon peak leaving Lonsdale Quay at around 4:30pm.

This service was introduced in December 2011, where previously, the connection was from the diversion (to Harbourside) of the Lonsdale Quay to Grouse Mountain service (#236). The #236 forms part of TransLink's Frequent Transit Network (FTN) on Marine Drive and provides regular service throughout the day and into the evening. A short rerouting of this service could occur along Fell Avenue and 1st / 2nd Avenue to improve access to Harbourside while minimizing operational delays. TranslInk has advised that this option would not be pursued at this stage.

A North Shore Area Transit Plan was prepared by TransLink in 2000, with a new peak hour service identified for the Pemberton/Fell area running along West 1st Avenue. This service has not been implemented to date, but one of the options being developed with the City and TransLink, as part of the master plan, is the introduction of a new #231service on this corridor, running between Lonsdale Quay and Park Royal. Walking distance to this route option from the site is expected to range between 450 metres to 650 metres (depending on parcel location), above the desired 400-metre guidance, but as is evident below for the Marine Drive corridor, passengers are will willing to walk a longer distance to access a better / more regular service. This is an important trade-off in developing a sustainable future transit service.

Within a 1000 to 1300-metres walk of Harbourside is the Marine Drive FTN corridor with the services highlighted in **Table 3.6**. In January 2013, Bunt surveyed walkers in the weekday peak period times (8am to 10am and 4pm to 6pm) along Fell and Bewicke Avenue to better understand the level of pedestrian activity at Harbourside associated with transit on the Marine Drive corridor.

On Fell Avenue, during the morning peak hour period, 67% (44 of 66) of pedestrians' interview walked to / from transit on Marine Drive, while during the evening peak-hour period it was 71% (27 of 38). Similarly, a pedestrian intercept survey along Bewicke Avenue showed that 20% (2 of 10) in the morning and 15% (2 of

13) in the evening peak periods were accessing transit along Marine. The lower walk transit-related volume on Bewicke Avenue is probably due to fact that Fell Avenue provides a more direct connection to / from the Marine Drive corridor for people in Harbourside.

Overall, this data confirms that the transit routes along Marine Drive are important connection for the Harbourside businesses, and this is reflected in part of the 20% modal split observed in the Mustell employee survey.

Table 3.6: Existing Local Transit Service

Route		Operating Times		Service Headways (minutes)			
#	Name	Start	End	AM Period	Mid-day Period	PM Period	Evening Period
239	Capilano College / Park Royal	5:24 am	1:43 am	10-12	8-10	10	15
240	15th Street / Vancouver	5:30 am	12:55 am	10-15	15	10-15	15-30
241	Vancouver / Upper Lonsdale *(Northbound)*	4:06 pm	7:29 pm			15	
241	Vancouver / Upper Lonsdale *(Southbound)*	7:00 am	8:36 am	10	--	--	--
255	Lynn Valley Centre / Dundarave	6:56 am	7:49 pm	30	30	15-30	30
236	Grouse Mtn. / Lonsdale Quay *(Southbound)*	6:15 am	12:45 am	15-30	15	15	30-60
236	Grouse Mtn. / Lonsdale Quay *(Northbound)*	6:10 am	12:10 am	15-30	15	15	60

3.5 Summary

Accessibility to Harbourside is steadily improving. Since 2010, when Bunt conducted its study work to support the OCP amendment application, the following changes have or are soon to be completed:

- The Mackay overpass pedestrian-bicycle bridge - opened;
- A new dedicated transit service to Harbourside - implemented;
- Bewicke Avenue upgraded to a greenway (Copping to Bewicke Park) –implemented; and,

- Mosquito Creek pathway upgraded - with the old City Works Yard development currently coming forward.

Concert is proposing to further improve accessibility at Harbourside as part of their community amenity contribution, and this will be set out in subsequent sections, including the TDM plan in Section 6.

4. DEVELOPMENT PLAN

4.1 Introduction

Following a successful application by Concert to amend the City of North Vancouver's Official Community Plan designation for the four southernmost waterfront parcels at the Harbourside Business Park (Harbourside), Concert has now applied for rezoning.

The rezoning application is to amend the zoning designation to allow for the introduction of residential, which can support other commercial uses, including general retail, cafes, restaurants, local services, etc.; while retaining the level of employment floor space that would be built under the current zoning. This change can be achieved through increasing the allowable FSR from 1.0 to 2.2 (inclusive of 0.15 FSR of bonus market rental density), an increase in permitted building heights, and accommodating parking underground.

New street fronting commercial uses are expected to be a positive addition in contrast to the existing typical suburban form at Harbourside with buildings set-back from the street edge to accommodate parking (which generates the auto-oriented feel of the area).

The development plan is presented at **Exhibit 4.1** in the context of the planned local street treatments and land uses planned. Retail uses are focused on Fell Avenue and Harbourside Place frontages (indicated red) and street treatments will reflect the higher demands in terms of pedestrian space.

The master plan layout, as indicated in this report, presents the key concepts planned and a functional design plan is being prepared in parallel to cover the more detailed aspects of the design. It is expected that these plans will continue to evolve toward the development permit applications for each parcel. As well, building design including details of ramp access and parking layouts, have not been presented for rezoning but will be at the development permit stage.

This section will articulate the key design objectives of the development plan from a transportation perspective. It will first summarize the design principles before focusing on the development content, expected travel characteristics, street design, and pedestrian / cycling treatments and emergency vehicle access.

Parking and truck loading are covered in the following section, while **Section 6** features the Transportation Demand Management strategy.

4.2 Design Principles

One of the overriding objectives of the development plan is to provide a better mix / balance of land uses at Harbourside. The approach will better support existing and new commercial activities (retail, local services, cafes / restaurants, leisure activities, etc.), along with generating a wider demand base for transit

(i.e. throughout the day). A prime focus for the design is to develop street space that is shared more equally through a pedestrian-focused design. Outlined below are the key design principles:

- Expand the range of land uses to create a more self-contained community with less reliance on auto use;
- Improve environment for transit passengers on Harbourside Drive should the 231 service continue or equivalent;
- Develop street oriented retail uses to enhance the walking experience to one that is engaging and attractive along with new connections and pedestrian-only zones;
- Develop a design where pedestrians, cyclists, and transit users are prioritized ahead of private vehicle movements;
- Adopt development parking levels consistent with the future sustainability objectives for the community and locate within enclosed structures; and,
- Support the accessibility of the master plan with transportation demand management measures, maximizing opportunities for transportation choice and lowering vehicle demands.

Future travel behaviour at Harbourside is expected to be strongly influenced by the approach to density, diversity, and design. These principles are presented below in the context of the development plan.

Density: the development density is expected to provide a critical mass to support the mix of uses planned, through maximizing the number of people within walking distance of each element, along with increasing use of the bus service (which operates weekday peak periods only). It also provides support to develop Transportation Demand Management measures and allow on-site parking located in enclosed areas (as opposed to the current surface areas);

Diversity (mix of uses): the development plan is expected to encourage a mix of retail, small grocery, restaurants / cafes and local service uses to support the community (existing and new). It will help to create a more balanced community in terms of a place to live, work, and shop, and where the transportation demand profile is more balanced and spread throughout the day.

Design for urban form: this plays a pivotal role in creating a dynamic and flexible transportation system for the master plan with the following key features:

- Creating an engaging and safe environment for people to walk, with buildings fronting and overlooking sidewalks and walkways - 'eyes on the street' - especially for the evening and weekend periods;
- Develop a cycle-friendly environment to complement and enhance the existing greenway connections; and,

- Create new locations for bus stops that complement the surrounding uses and tie in with the public realm.

With the application of these high-level design principles, it is expected to facilitate appreciably higher levels of walking, cycling, and transit trips than what is currently observed at Harbourside.

4.3 Development Content

A rezoning application proposes the development of four sites, shown at Exhibit 4.1, and **Table 4.1** summarises the estimated breakdown of floor areas along with details of hotel beds, residential unit numbers, etc.

Table 4.1: Proposed Development Content

Land use	GFA sq.ft	Comment
Office GFA	215,000	Potential synergy with Seaspan
Retail	45,000	Small size shops, restaurants, cafes, etc. expected up to 300m^2 GFA each
Market Residential	715,000	Estimate equivalent to about 740 Units
Rental Residential	80,000	Estimate equivalent to about 110 Units
Hotel	110,000	Approximately 100 beds
Total GFA	1,165,000	

Evidently, the development plan would broaden out the number of uses at Harbourside and this will be assessed in terms of new vehicle movements in **Section 7** of the report. The development could take around 10 to 15-years (perhaps longer) for the market to absorb and this will be an important consideration with the timing of new transportation improvements.

Development phasing has been set out in **Table 4.2** (understood at this stage) and is illustrated in Exhibit 4.1. The actual sequencing will be subject to change, with the strongest influence being changing market conditions.

Table 4.2: Proposed Development Phasing

Phase: Location	Land Uses (GFA sq. ft.)			
	Employment (Office)	Residential	Retail	Hotel
Phase 1: Lot C	59,000	185,000	40,000	0
Phase 2: Lot D	12,000	240,000	5,000	110,000
Phase 3: Lot A	140,000	115,000	0	0
Phase 4: Lot B	4,000	255,000	0	0
Totals	215,000	795,000	45,000	110,000

Note: See Exhibit 4.1 for Parcel Locations

One of the aims is to introduce retail as early as possible to support the community, evident from the phasing, while residential would be spread across all 4 phases.

4.4 Transportation Pattern Changes Expected

Even though overall vehicle movements are projected to increase at Harbourside, the development will, however, bring a number of positive transportation benefits to the area:

- Increase the number of people within walking distance of existing and future commercial activities, reducing trip distances by encouraging walking and cycling activities;
- Create activity outside the workday to improve general security and comfort, which will be particularly beneficial for the adjacent Kings Mill Walk (Spirit Trail);
- Be a catalyst for innovative TDM measures such as car-share, transit improvements, ride share, etc. (covered in Section 6); and,
- Allow a better balance of in / out vehicle flows at Harbourside (currently imbalanced at a 70%/30% split), where residential, for example, has the reverse peak flow pattern while retail is closer to a 50%/50% split (see Section 7 for more details).

4.5 Street Design

Harbourside Drive and Harbourside Place are planned to be enhanced from their current 'industrial street' form to one that is more in keeping with a mixed-use community, and particularly with a focus on pedestrian activities. The master plan street network is shown at **Exhibit 4.2,** based on the preliminary functional design and it also highlights future intersection controls.

One of the key features is to make the waterfront portion of Harbourside Place one-way (clockwise) along with a short section of Fell Avenue (south of the east-west mews) to create a more compact / intimate street structure along the waterfront. Originally it was planned to make the whole loop section one-way (i.e. from Harbourside Drive), but it was considered important for the mews that drivers' had direct access to Fell Avenue (in both directions) without relying upon solely Harbourside Drive for exiting.

Harbourside Place's intersection with Harbourside Drive remains in the current location and will offset the existing driveway (pair) on the opposite side (to the east) by 25 to 30metres. With the dominant flow to the east and little or no cross movements, this is not expected to be a design issue. A new mews / street section is planned between Parcels A / B and there is an existing driveway, on the opposite side, located 20 metres to the west. Similar to Harbourside Place, this proximity is not expected to be an issue with the dominant vehicle flow going to the east.

Moreover, TAC (Transportation Association of Canada) advises that on collector or local roads, 'driveways on opposite sides of the road is not necessary a design consideration'.

Harbourside Drive is planned to retain parallel parking along the south side of the street and this will allow for a generous public realm and allow extra width for cyclists on the roadway, discussed under Pedestrians and Cyclists.

Integration features and design will be included in the Functional Plan and will meet TransLink's design requirements with regard to bus turning movements and passenger waiting areas. An improvement to transit operations at Harbourside is covered under Transportation Demand Management in Section 6.

With permeability as a key design theme for the design, an internal "Mews" street will be developed across the entire mid-block of the four development sites, creating a continuous east-west thoroughfare between Bodwell High School and Gostick Place. It will provide additional surface parking, access to underground parking structures, primary building lobbies, and loading zones. A series of north-south connections in the form of streets and pedestrian corridors / links will further complement the permeability of the development plan.

Summarized in **Table 4.3** are the proposed street cross sections proposed for the master plan and these will be subject to further review as the design develops and be reflected in the Functional Design Plan, which will supersede this report.

Table 4.3: Proposed Street Sections (all dimensions metres [m] for master plan area)

Street	Section	Sidewalks	Travel Lanes	Parking Lanes
Fell Avenue (two-way)	Harbourside Dr to mews.	2 x 3m plus setback (varies)	2 x 3.5m	2 x 2.5m
Fell Avenue (one-way)	Mews to waterfront	2 x 2.8m plus setback (varies)	1 x 4.5m	1 x 2.4m & 1 x 5.6m (45 degree)
Harbourside Place	East – West section	2.6m north side plus set back (varies)	1 x 4.5m	1 x 5.6m (45 degree) & 1 x 2.5m
Harbourside Place (two-way)	Harbourside Drive to mews	2 x 2m	2 x 3.3m	2 x 2.5m
Harbourside Place (one-way)	Mews to waterfront	2.4m plus setback & 1.8m	1 x 4.5m	1 x 2.4 & 1 x 5.5m (45 degree)
Harbourside Drive	All sections	Southside 1.9m plus 1.2m setback & 1.5m boulevard	2 x 4.3m and around 4.9m at bus stops	2 x 2.4m & 1x 5.6m (45 degree)
Internals Mews	East – West section	2 x 2m & defined materials and street furniture	2 x 3m	1 x 2.4m (one side only)
Gostick Place extension	Harbourside Drive to mews	1 x 2m	2 x 3m	None
New Road / Mews	Harbourside Drive to mews	1 x 2.0m & 1 x 3m	2 x 3.3m	2 x 2.5m

All streets within the master plan will be dimensioned to meet the needs of emergency vehicles, truck servicing, and parking (angled or parallel), including a review with a transit vehicle, fire truck and Single Unit 9 truck movements. The City has indicated that the street design should consider a WB-15 truck but none of the loading spaces planned (see Table 5.6) can accommodate such a vehicle type, and moreover small commercial units, office use, and residential are all generally supported with smaller commercial vehicle activities and the planned design reinforces this position.

Moreover, Harbourside currently suffers from excessive roadway widths due to the previous industrial planning standards and one of the prime objectives of the new master plan is to redress this previous planning approach so as to create a pedestrian-friendly design.

The functional design will be developed further along with the building design and the purpose of showing at this stage is to articulate how the site plan can function and provide sufficient confidence going forward to the Development Permit (DP) applications.

Intersection designs are also considered on the Functional Design Plan, and Exhibit 4.2 highlights the expected control at each of the intersections within the master plan area.

The function of Fell Avenue (north of Harbourside Drive) is considered in Section 8 of the report in the context of the expected changes in vehicle movements with the development plan.

Harbourside Drive is expected to continue as a local road to support access for storefront office and retail fronting the street, while the planned Mews (east-west) through the site is expected to absorb a good part of the new vehicle demand from the development. Fell Avenue (south of Harbourside Drive) and Harbourside Place will essentially cater for access to street parking while on-site parking is accessed from the Mews.

A reconfiguration of the intersection at Gostick Place and Harbourside Drive is planned with the extension of Gostick Place on the eastern boundary of the master plan to link-up with the Mews, as highlighted at Exhibit 4.2. This arrangement takes into consideration access to the yacht club and local businesses while maintaining as much as possible a standard 4-way stop control configuration at Harbourside Drive and Gostick Place. This design will need to be developed further in consultation with adjacent property owners at the time of the DP for Parcel D.

Planned changes to the master plan external intersections are covered in Section 8 of the report in the context of the projected new vehicle demands.

4.6 Pedestrians and Cyclists

Pedestrian and cycle routes for the development plan are highlighted at **Exhibit 4.3**, along with how they extend out to the surrounding area.

A key focus for the master plan is a permeable block structure with an intimate and close-nit street structure, focused on prioritizing pedestrian movements and catering for cyclists of different abilities. The north-south and east-west connections through the block structure provide a variety of spaces to walk or cycle, including streets, mews and pedestrian /cycle corridors. It will mean that all points of the development can be accessed without the need to use Fell Avenue or Harbourside Drive.

Internal Mews will be characterised with slow moving vehicles and this will be achieved through a shared street environment with no priority afforded to a particular user. Supporting the approach will be pavement materials, bollards, landscaping, and street lighting.

The waterfront trail provides a safe and comfortable route for recreational cyclists and will also be suitable for less-experienced and slower moving users, for example, it is expected to be the preferred route for cycling to Bodwell High School.

The existing walk / cycle section of the waterfront trail between Bodwell High School and Harbourside Place is a 6-metre wide separated path (but will be constructed at the new FCL in the future), and will be extended to the east boundary of the master plan. The trail will then continue northward as a shared 4-metre wide pedestrian / bicycle path alongside the Gostick Place extension proposed and connect to the section of the CNV planned Spirit Trail, running between Gostick Place and Bewicke Avenue.

Trail users can continue along Bewicke Avenue, which will be fully upgraded to a Greenway up to 2nd Avenue, or potentially, in the future, they could connect through the Squamish First Nation land to Lonsdale Quay. Concert is committed to working with the Squamish First Nation and the City to develop a safe alignment that respects the existing boat yard operations and provides a direct connection to Lonsdale Quay.

Mosquito Creek path (located on the north/east side of the creek) can also be accessed from Bewicke Avenue, and provides a connection to Marine Drive (close to Fell Avenue).

On the west side of Harbourside, the Spirit Trail continues along the east side of Mackay Creek to the new bridge overpass leading to 1st Avenue.

The Harbourside Drive Greenway is still expected to be used by more experienced cyclists, including commuters, who typically prefer to travel at higher speeds. Supporting this cycling group will be to enhance the existing sharrow markings facility along with having 2 x 4.3 metre travel lanes. Sharrow marking are expected to be on a green background as highlighted opposite to reinforce the message

Harbourside Drive is still expected to have a low vehicle speed environment given its local access nature (cul-de-sac), contributing to a comfortable place for cyclists. Sidewalk build-outs are planned at Fell Avenue and Harbourside Place intersections to reduce crossing distances for pedestrians on Harbourside Drive. More detailed consideration of how cyclist's access buildings will be covered at the Development Permit (DP) Stage.

On Bewicke Avenue (Copping Street to West 2nd), a new greenway treatment is planned as part of Concert's community amenity contribution associated with the development plan. It is expected to form a separate sidewalk / bicycle connection, located on the west side of the street, together with appropriate pavement materials for bicycle and pedestrian shared use.

At the Mosquito Bridge, pedestrian (cycle) arm will be provided (west side) as part of the greenway design in accordance with the current bridge upgrade design. Public realm improvements, including landscape features and lighting, will be integral within the design

At the Bewicke at-grade rail crossing, the developer is committed to introducing barrier control and lights along with an integrated signing strategy to advise drivers' (and cyclists) in advance that a train is passing. This would reduce frustration and u-turn movements and increase the use of Bewicke Avenue as a viable,

secondary route to Harbourside (currently used by only 15% of all vehicles to / from Harbourside at peak times). Other benefits with the barrier control and lights will be safety for all street users in controlling movements when the line is operational, while it could avoid the necessity for train whistles, which are common at many uncontrolled crossings.

In addition, measures will be developed to discourage trespassing, through barriers or signage, along the railway and ensure the railway crossing is clear when a train is approaching. It will also be important to monitor the situation as the development builds out and this can be done through the agreement principles set out in Section 8 of the report.

The timing of these measures will be determined through the relevant planning and community amenity agreements and linked to the phasing / build-out.

4.7 Emergency Access

Emergency access for Harbourside has been reviewed with the North Shore Emergency Response Unit. This exercise identified a number of key features that would be required to accommodate certain emergency requirements such as chemical spills, earthquakes, and fire response. **Exhibit 4.4** highlights the key aspects of the plan and following describes them:

- Location for a helicopter landing area;
- Should Bewicke Avenue and Fell Avenue both be closed, a potential alternative emergency access could be through the Squamish First Nation site;
- The beach could be used for water access if that is necessary;
- Need for emergency or low-level lighting along the Mackay section of the Kings Mill Walk (but challenges could come from fisheries with lighting along the creek);
- At the foot of the Mackay overpass within Harbourside, there is sufficient room to accommodate a large passenger vehicle turning (5.5-metres long) and in part by using the existing pathway between the Kings Mill Walk and Automall Drive;
- The pathway Kings Mill Walk to Automall Drive could be widened as part of the measures suggested (i.e. provide 4-metre clear width route within the existing 6-metre right-of-way). This pathway could be used for vehicles exiting should a circulatory option be considered rather than turning vehicles around; and,
- Gator vehicles, or similar, could located in Harbourside for moving people across the pedestrian / bicycle overpass at Mackay (there is sufficient width to do so).

The North Shore Emergency Response Unit will prepare a formal response to the plan and details will be covered in the relevant planning agreements.

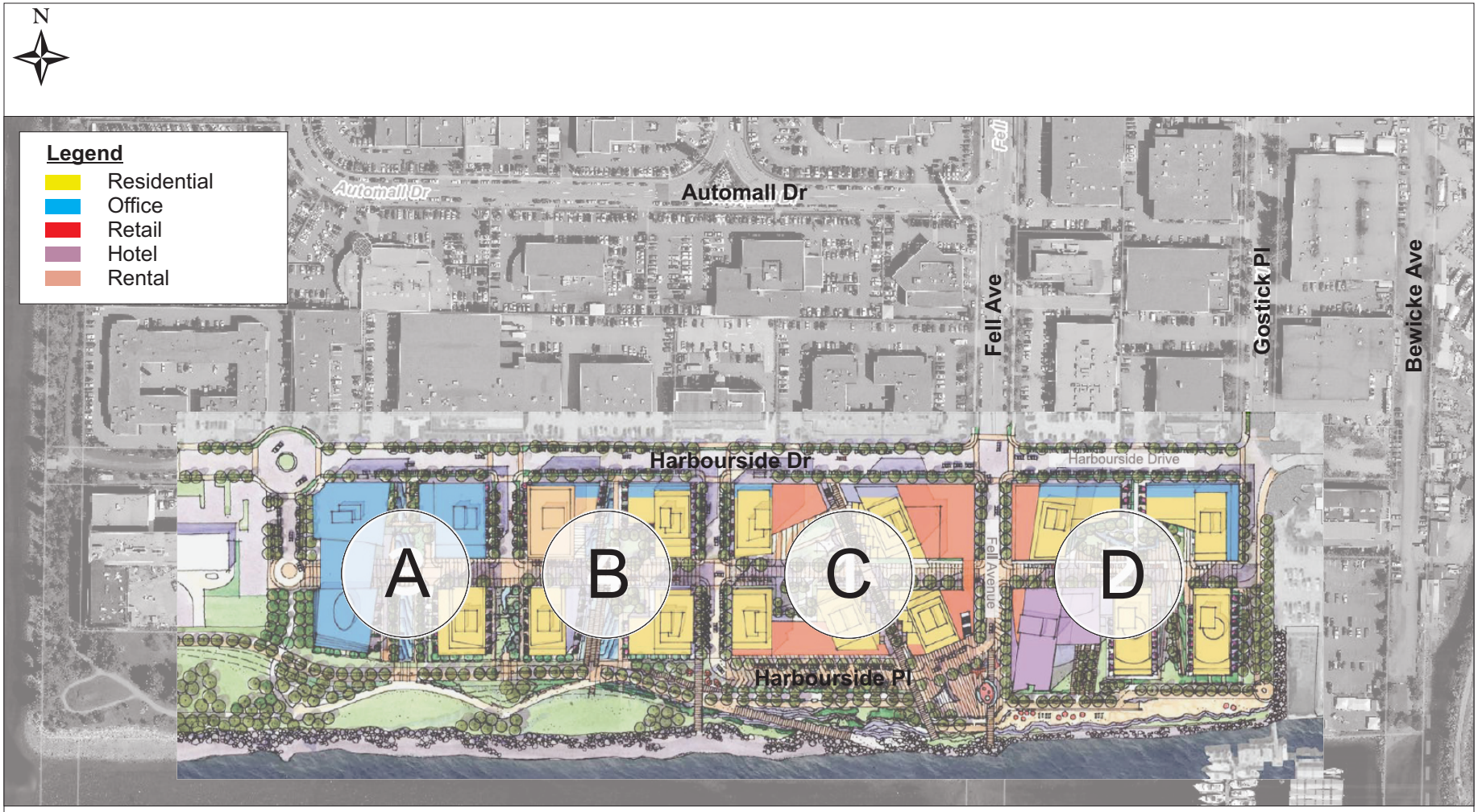

Exhibit 4.1

Development Plan Phasing

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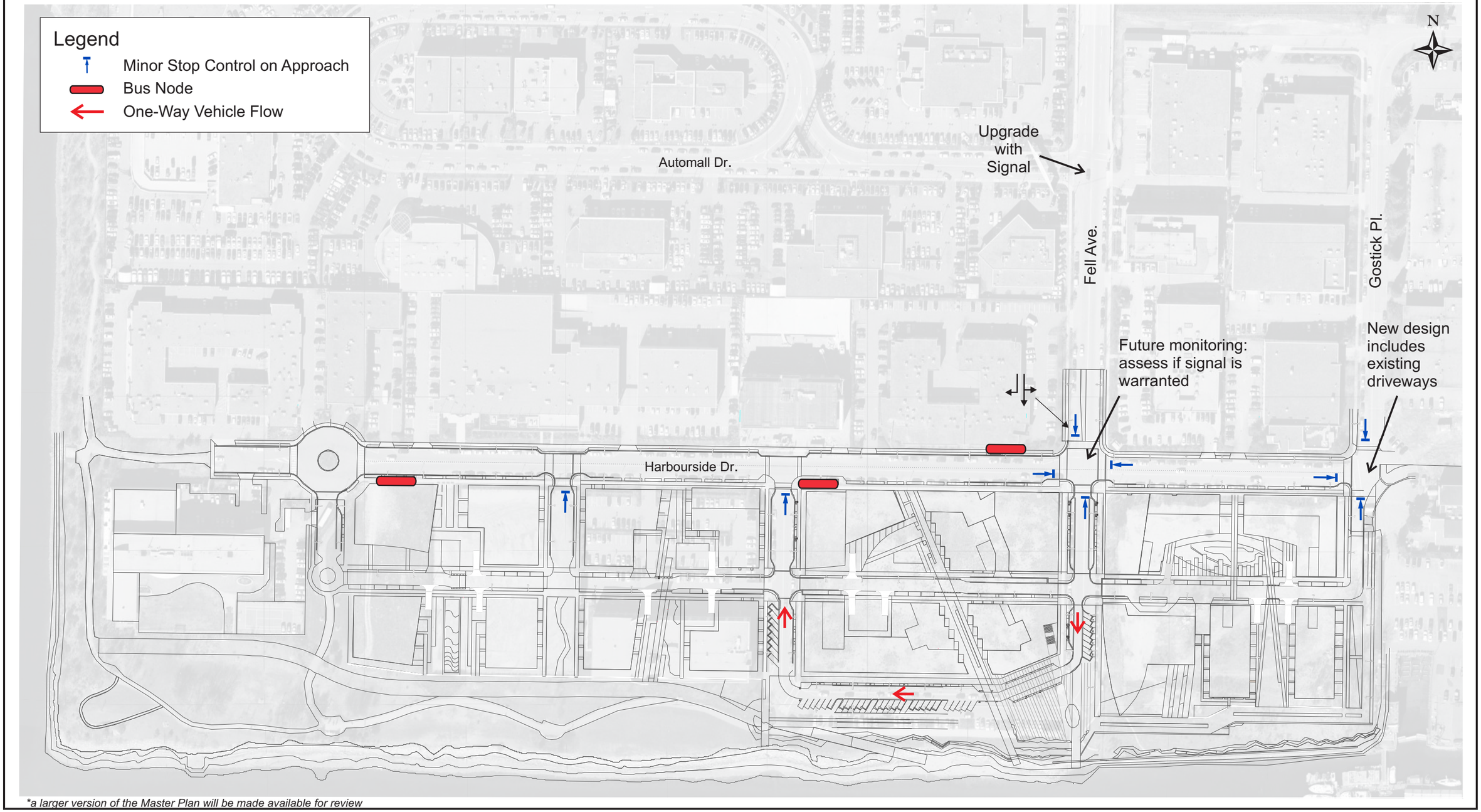

*a larger version of the Master Plan will be made available for review

Exhibit 4.2

Master Plan Street Layout & Connections

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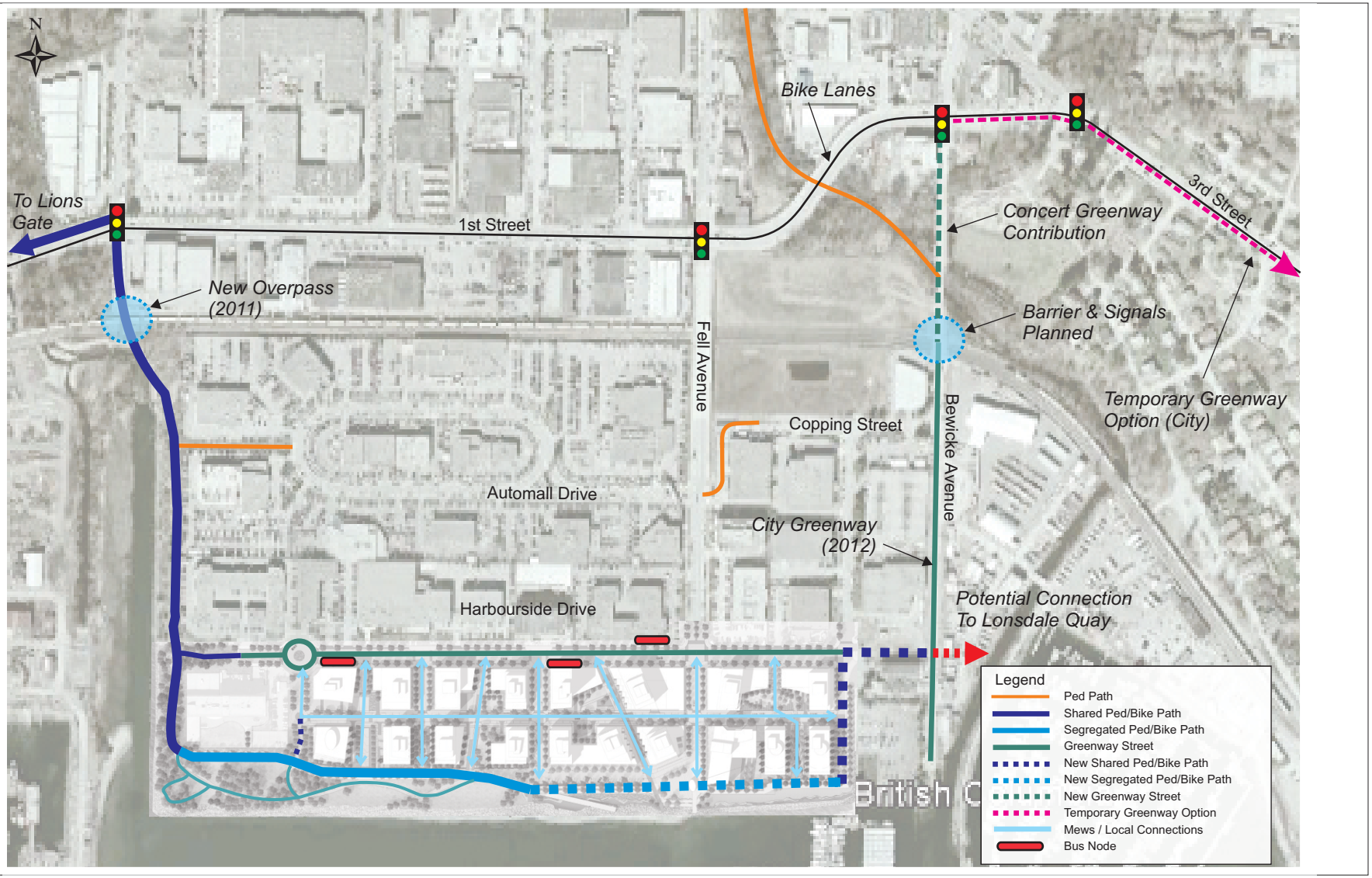

Exhibit 4.3

Site Plan - Pedestrian and Bicycle Connections

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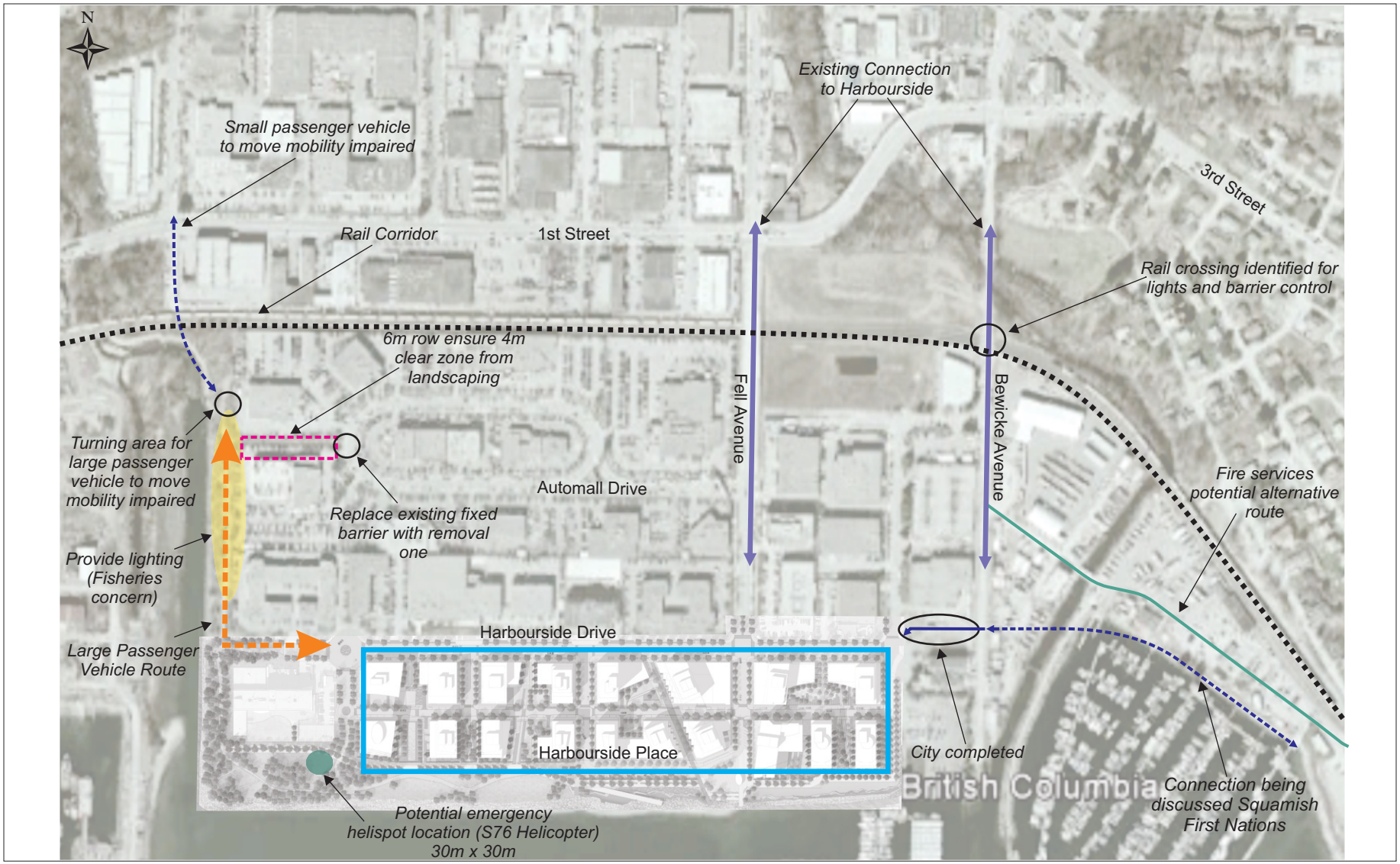

Exhibit 4.4

Emergency Access

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5. PARKING AND LOADING REVIEW

Parking forms an integral part of the overall transportation strategy for Harbourside and in particular to find the necessary balance between allowing sufficient supply to meet basic needs, while recognizing the TDM measures to lower single-occupant auto use. The starting point for this exercise is to understand existing conditions before developing options that can meet expected future demands, including that of bicycle and truck loading needs.

The section covers the general principles of approach for the master plan rezoning, and more specific details in respect to design and management of parking and loading arrangements will be covered at the Development Permit Stage, once each building design is developed.

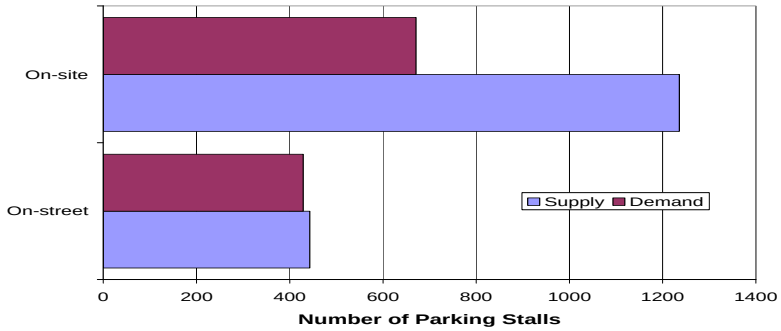
5.1 Street Conditions

Parking supply and time restrictions within Harbourside were surveyed in April 2010 (and rechecked 2013) and the details are presented previously in Exhibit 2.3. **Table 5.1**summarizes the supply and peak parking demand periods for the study area and this is shown graphically at **Exhibit 5.1** and in **Figure 5.1**.

Table 5.1: Existing Parking Supply and Demands

Location	Supply	Peak Occupancy	Comment
On-site	1240	54% (11:30am)	Excluding Automall
Street	409	97% (1:30pm)	196 assigned to 2-hour parking only - majority located at Automall Drive & Harbourside Place

Figure 5.1: Existing Parking Supply and Demand



Clearly, there is a current imbalance between street and on-site demand. The Questionnaire Survey (2012) highlighted that around 30% of employees' surveyed (who drive) parked on-street. It is likely certain employers have insufficient, or inflexible / driver allocation, or charge for parking and this is reflected in the imbalance. More recent spot surveys in October 2013 confirm that this level of parking imbalance is still present.

Coupled with this, observation surveys suggest the Automall has some level of influence on parking demands along Fell Avenue Harbourside Place, and Harbourside Drive as an overflow area and is estimated to account for up to 30-35% of parking demand. In response, BMW is currently expanding its site capacity for storing vehicles while other opportunities are expected to be developed to assist with accommodating the Automall needs.

Like vehicle patterns at Harbourside, the street parking demand is heavily influenced by the employee-based nature of the area, where demand falls away appreciably in the evening and weekend periods. The only exception is around Harbourside Place, where the demands from the Kings Mill Walk continue into the evening period (dog walkers, joggers, etc).

Concert has suggested options to the City (car-sharing vehicles, maximizing street parking opportunities, temporary off-street locations, etc.) that better manages existing demands in the short-term and until the accessibility of the area is improved as the development plan is built-out along with other improvements to accessibility of the area (e.g. Spirit Trail connection opened to Lonsdale Quay) .

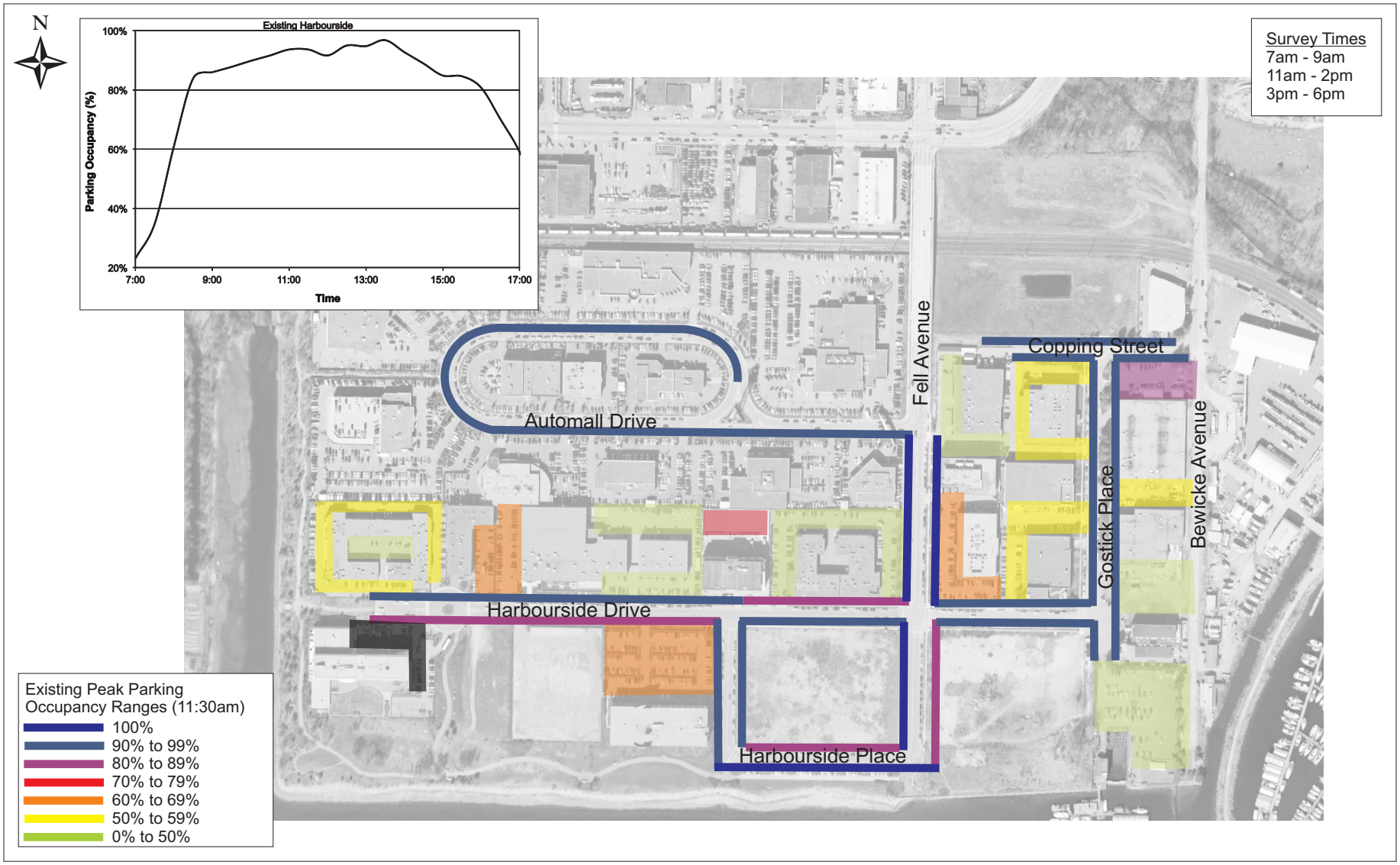


Exhibit 5.1

Peak Parking Occupancy (April 29, 2010)

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5.2 Bylaw Rates

Presented in **Table 5.2** are the parking supply rates covering the local area zoning along with City-wide rates for the new land uses planned within Harbourside.

Table 5.2: Parking Supply Rates from the City of North Vancouver Zoning By-law

Location / Use	Bylaw Zone	Parking supply rate
Existing Uses		
955 Harbourside Dr	CD-428	1 Stall per 67 m^2, and not less than 64 stalls
828, 890, 930, 998 Harbourside Dr	CD-360	1 Stall per 50 m^2
889 Harbourside Dr	CD-359	1 Stall per 67 m^2
850 Harbourside Dr	CD-534	1 Stall per 50 m^2
New uses		
Restaurant	CD-359	1 space per 18.5m^2 integral with other uses
Retail	CD-359	1 per 46.45 m^2
Market Residential	CD-359	1.3 spaces per unit plus 0.1 visitor
Rental Residential	CD-359	0.70 spaces per unit plus 0.1 visitor
Office	CD-359	1 per 46.45 m^2
Hotel	CD-359	No specific standard – use 1 per 46.45 m^2

5.3 Development Parking

Highlighted at **Exhibit 5.2** is the preliminary parking layout for the master plan, showing indicative access locations for parking structures along with the style of street parking proposed at the interfaces with the development sites. The plan covers the general principles of approach, where the detail with respect to ramp design, controls, charging, sight lines, etc., will be articulated at the Development Permit stage.

Street parking supply will be supplemented with the rezoning plan through the provision of increased street frontage areas on the new street mews and north-south streets, along with angle parking in key locations. This is expected to increase the overall supply in the order of 45 spaces and will be prioritized as visitor parking through the application of appropriate time-limit periods, discussed later under parking management.

An application for a temporary car park on site adjacent to the Lion Gate School is in place to provide 50 or so parking spaces to support the businesses in the immediate area and provide relief to street parking

so that it is prioritized for visitors and park users. Additional parking is also planned at 850 Harbourside Drive (32 spaces) and at the BMW dealership (43 spaces).

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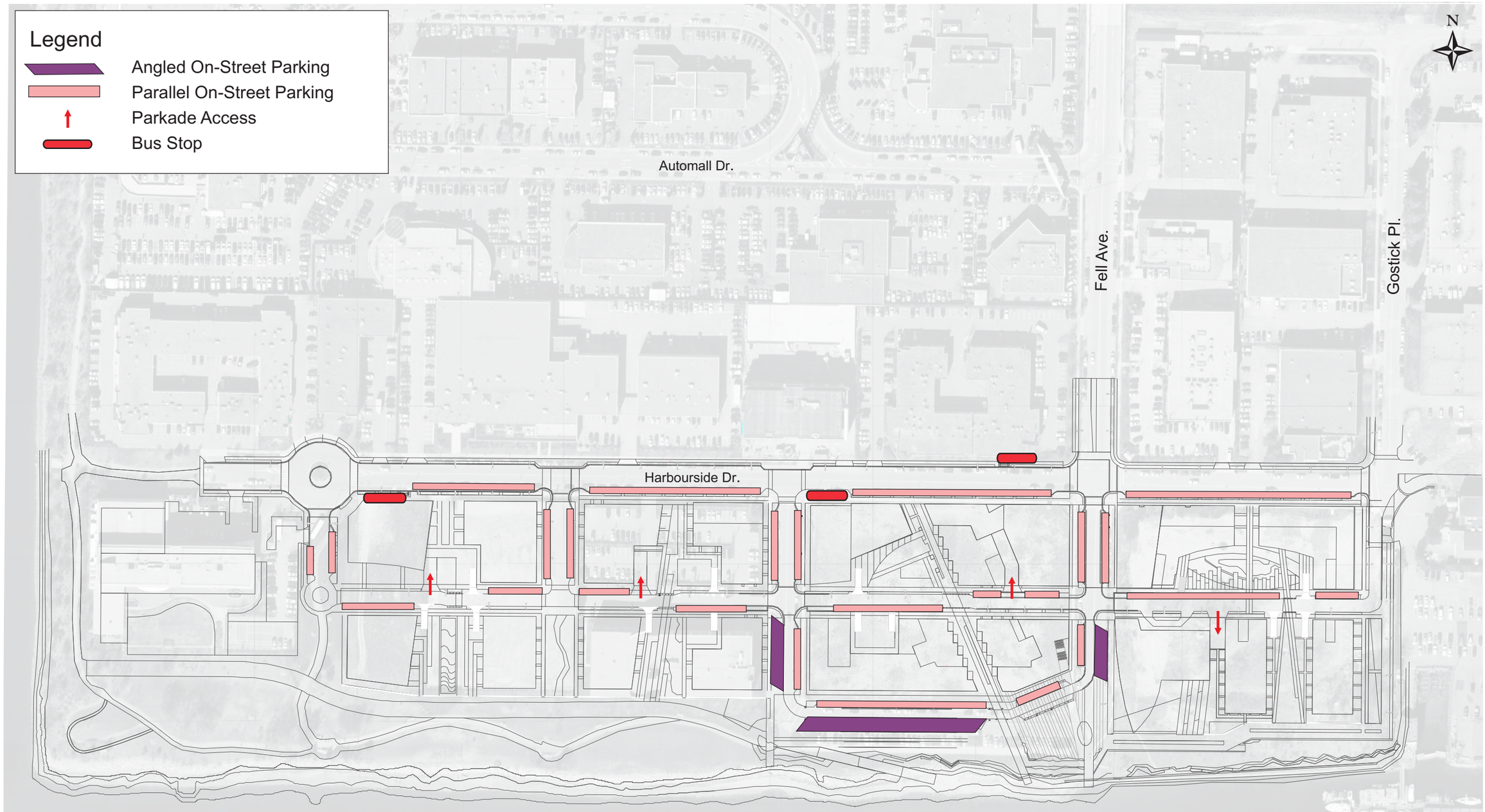

Exhibit 5.2

Harbourside Parking Plan

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Please note vehicle trip generation for the development is not based on parking numbers but on floor area or unit numbers, and therefore the additional supply will not be materially relevant to the change in vehicle movements at the peak periods.

5.3.1 Office / Employee

A number of the occupiers of the existing commercial office businesses probably have employee densities up to 3 to 4 employees per 100sqm (typical industry standard). At 1 parking space per 2 employees (bylaw), it would roughly indicate 50% of the staff would be non-car drivers' for the supply to work, but the employee Questionnaire Survey indicates the proportion closer to 70%. Further, around 30% of car drivers' interviewed indicated they parked on-street.

This review strongly indicates a higher parking rate is required for employment uses and is reflected in the proposed rate of **2.5 to 2.7 spaces per 100 m² GFA**. This would be equivalent to a mode split at around 60% to 65% vehicle drivers', lower than the current proportion at 68%. Equally important, the new development plans will meet all expected demands on site and avoid the current imbalances being observed nearby.

5.3.2 Residential

Parking proposed for the market residential is consistent with patterns observed in other parts of Metro Vancouver, where typically rates allowed are around 1 to 1.2 spaces per unit. At Harbourside, it is proposed at **1.3 per space per unit (inclusive of 0.1 visitor space per unit)** and meets the bylaw standard in overall numbers.

The rate is also within the expected demands for site's located outside the FTN, set out in the Metro Vancouver Apartment Parking Study (May 2012). This report shows parking demands for such locations range between 1.1 and 1.25 spaces per Dwelling Unit (Table 24).

Visitor demand in the same report indicates peak use lower than 0.1 space per unit, and this is consistent with the work undertaken by Bunt & Associates at Metrotown and Burnaby Mountain, and which have been included at **Appendix C**.

Additional visitor demand, if necessary, could be met on-street, especially during the low-demand evening or weekend periods, or in the communal off-street commercial locations planned.

Rental housing is planned at **0.7 spaces per unit**, inclusive of 0.1 visitor spaces per unit, and this is below the City requirement of 0.75 spaces per unit and could result in shortfall of around 6 spaces (with the number units planned). Even if this adds extra demand to the street parking, it would only occur in the evening and weekend periods when there is significantly less demand, while the plan also provides additional street parking (45 spaces). Once the form of rental housing is known in terms of unit size,

targeted groups, etc.; the parking rate can be developed further and this would include the opportunity for shared parking

Car-sharing will form an integral part of the residential parking strategy with a minimum of 1 vehicle per 180 residential units planned, with vehicles situated in publically accessible locations for wider community use (see Section 6).

5.3.3 Retail and Restaurant

Commercial parking will be publically accessible at **3 spaces per 100 m² GFA**. It covers a general mix of restaurant / café and speciality retail uses, and can be refined further as the development plan progresses. Parking for the commercial is likely to be charged and this will ensure it is utilized for purposes intended and that it generates a reasonable level of turnover (i.e. 30 to 60 minutes average), which is important for retailers.

Supplementing the on-site supply will be additional street supply through a combination of using angle parking and increasing the street frontage area (new internal mews street for example).

5.3.1 Hotel

Parking for the hotel is proposed at **0.7 spaces per room**, which includes provision for complementary and supporting uses, typical for a hotel. The City of North Vancouver has no specific rate for this use to make a comparison.

5.3.1 Summary

Presented in **Table 5.3** as an indication of the expected parking provision for each phase / lot, based on the current phasing plan (see previous section) and parking rates outlined above. The majority of on-site parking is expected to be located under buildings, although there is expected to be small pockets of surface parking for short-term use.

Table 5.3: Proposed Parking Supply (per lot)

Phase / Lot	Employment (Office)	Residential	Retail	Hotel
Phase 1 Lot C	134	243	125	0
Phase 2 Lot D	25	313	23	70
Phase 3 Lot A	324	151	0	0
Phase 4 Lot B	8	283	0	0
Totals	**491**	**991**	**148**	**70**

Note: See Exhibit 4.1 for Parcel Locations

At each Development Permit application, the parking layouts will be set out along with the design of the access. It will be articulated in the context of the bylaw requirements and will also show, through the construction management plan, on how parking demand can be accommodated at each phase / lot without adding pressure to the street system.

It will be prudent to review the rates as the community matures and accessibility improves, and this can done through the monitoring agreements.

5.4 Innovative Strategies

One of the key benefits of mixed-used developments is the opportunity for shared parking. Peak parking demand for residential, for example, typically occurs overnight, while the office peaks during the weekday day time. This is articulated in **Table 5.4**, and includes commercial / retail and entertainment uses, and highlights that much of new demand will be outside the current peak periods

Table 5.4: Utilization Factors for Different Uses – Shared Parking Opportunities

Time Period	Proportion of Use			
	General Office	Residential Visitor[(1)]	Commercial	Entertainment
Weekday daytime	100%	20%	80% / 90%	40%
Saturday daytime	20%	50%	100%	80%
Evening Period	5%	100%	80%	100%

Source: Victoria Transportation Policy Institute; and [(1)] Bunt's MetroTown Surveys

Other specific strategies to manage demands include charging employee parking (already occurs at 889 Harbourside Drive), unbundling, and car-share vehicles along with the Transportation Demand Management measures set out in the next section.

Parking strategies will be developed in detail at the Development Permit stage for each lot to ensure they are not over-supplied and will continually be monitored throughout the build-out of the development rezoning.

5.5 Street Parking Management

Planning for the master plan is aimed at accommodating all expected demands on-site, while additional street parking is planned to maximize opportunities for improving the existing visitor parking situation (with around 45 spaces).

Concert will also investigate opportunities to support the City of North Vancouver to implement a system that can better manage the existing parking demands within the local area and, in particular, ensure that

street parking is available for visitor use only. This would be incorporated as part of the new street design being developed and specific details for management and operation will be covered at the Develop Permit stage.

Limiting street parking to a 2-hour period will be self-regulating to ensure it is used by visitors and not employees, who tend to park all-day (it would too much hassle in constantly moving vehicles). In fact, anecdotal feedback from certain employers, through the public consultation process, did highlight that with the City's proposal to enforce a 2-hour limit, that some of the employees indicated they would park on-site (parking is charged by some employers). This charging is indeed one of the reasons why on-site parking is underutilized, as highlighted at Figure 5.1.

Concert has made commitments to supplement the parking supply for full-time employees until accessibility to the area is improved, including the introduction of temporary parking stalls (50) and car-share vehicles (5). These details will be progressed further as part of the rezoning application.

All weekday daytime street parking is expected to be controlled by 2-hour limit (maximum) in the future to ensure that it is available for visitor use and turnover is maximized for the benefit of all.

Once Parcel C is complete (see Exhibit 4.1), street pay-parking for the weekday day-time period (9am to 6pm on weekdays) is proposed on street sections where commercial frontage is present, and a higher turnover of parking would be desirable, and that the time-limit could be reduced to 1-hour. The time-limit along all new mews sections is expected to be 2-hours.

Street pay parking would only be introduced following consultation with local businesses and visitors to the waterfront park, and in particular their willingness to accept this arrangement to ensure parking is prioritized for visitor use and proper enforcement is undertaken.

Funding revenue for the pay parking could be used to support the enforcement by the City, of not only the new pay parking sections, but also in the Harbourside Area as a whole, where a 2-hour limit is planned to be introduced.

All non-residential off-street parking is anticipated to have some form of charging and this would be developed with the future tenants. Commercial parking, located in Parcel C, would be available for all visitors to the area and would be signed as a public car park.

This public parking supply could be supplemented with residential visitor parking and office parking within Parcel C (outside business hours weekday 8am to 6pm) and this would be articulated through internal signage. The time limit for visitor parking is expected to be extended to 3-hours (depending on tenant requirements) and parking charges would be lower than street parking (should that go ahead). Concert would engage an established management company to regulate the parking.

More generally, pay parking would better manage demands; encourage more walking, cycling, and transit trips to the area; support enforcement; and, provide a revenue stream to the City.

Non-compliance of the City's vehicle idling bylaw can be enforced through the parking management officers (funded through the pay parking).

5.6 Bicycle Parking

Rates for bicycle parking are presented in **Table 5.5** for each of the uses planned.

Table 5.5: Bicycle Parking Rates (City of North Vancouver Bylaw)

Land Use	Class A (enclosed)	Class B (street located)
Residential	A minimum of 1.5 spaces for every unit.	A minimum of 6 spaces for any development containing a minimum of 20 units
Employment	1 per 250 m^2 GFA	A minimum of 6 spaces per 1000 m^2 GFA
Commercial	1 per 250 m^2 GFA	A minimum of 6 spaces per 1000 m^2 GFA

5.7 Loading

The City of North Vancouver loading bylaw only directly applies to industrial and commercial use buildings, and at essentially 1 space per building. The master plan will comply with this requirement and Concert is also planning loading for other uses and these are presented at Table 5.6

Table 5.6: Proposed Loading Rates (without reduction for sharing)

Land Use	Source	Number of Loading Bays
Commercial	City of North Vancouver	1 per 1393.5 sq m (9.2m by 2.8m)
Office	Concert	1 per 7500 sq m (5.5m by 3 m) and 1 per 5000 sq m (9.2m by 2.8m)
Residential	Concert	1 per building (9.2m by 2.8m)

Loading for the planned uses will be accessed from the mews, where loading areas will be developed within each land parcel. These loading spaces are consistent with accommodating a SU9 truck and this is reflected in the street design.

5.8 Summary

Parking demand at Harbourside currently generates pressure on the street system. It is therefore proposed to provide parking rates for each use that do not add pressure, while at the same time being consistent

with the overall objective to lower single-occupant vehicle use. Proactive parking demand opportunities will be explored such as charging, car-sharing, unbundling, etc.

Street time-limited parking enforcement is expected to cover all of Harbourside Place, Fell Avenue, Copping Street and Gostick Place.

Additional parking is planned to support the existing demands, including 850 Harbourside Drive, BMW dealership and Lions Gate School.

Planned on-site commercial parking is expected to be charged, while street pay-parking could be introduced in the future on sections close to the waterfront (but only after public consultation). It will better regulate parking use and support the enforcement.

Bicycle parking rates and design will meet best-practice in terms of access and design..

With mixed used development, opportunities to share loading spaces exist and these will be explored as the plan develops.

6. TRANSPORTATION DEMAND MANAGEMENT

6.1 Introduction

This section presents the outline of the Transportation Demand Management plan for the rezoning master plan application. It will complement improvements to the local area with respect to walking, cycling and transit together with the benefits generated through providing a broader mix of uses in meeting existing and future needs of the community.

Projected vehicle volumes in the next section assume no reduction for TDM measures and as a consequence all capacity infrastructure is based on this premise. Any benefits that are derived from TDM will be an added benefit to capacity operations and, as has been outlined before, it is not prudent to provide estimates of vehicle reductions for TDM measures as there is little supporting data.

Details will be refined further through the planning agreements and the purpose of this section is to provide context and rationale to progress to the next stage of development, where for example, the strategy for improving transit is still being discussed with TransLink.

6.2 Existing Travel Patterns

The existing travel mode split for Harbourside is presented in **Table 6.1** and it confirms that single-occupant trips represent 68% of employee trips, while transit is the next biggest proportion at 20%.

Table 6.1: Harbourside Travel Mode Splits

Travel Mode	2012 Employee Survey	Automall	Bodwell School
Driver of a vehicle	68%	86%	19%
Passenger in a vehicle	4%	6%	26%
Pedestrian / Cycle	8%	5/6%	19%
Transit	20%	2/3%	48%

Bodwell High School already has favourable travel patterns and is a small contributor to overall demands in the community and especially in the peak-hour afternoon period. Unsurprisingly, the Automall is heavily focused on vehicle movements and this is unlikely to change materially given the nature of the business, where purchase or use of vehicles forms part of the incentive package for many employers, while customers are basically purchasing or getting cars' serviced.

Harbourside employees are expected to be most influenced with Transportation Demand Management measures given their daily routine patterns. Indeed, they are already demonstrating transit plays an important part of current travel patterns and this group is the focus for the following paragraphs.

Table 6.2 summarizes the origin of employee trips.

Table 6.2: Origin of Employee Trips

Origin	
North Vancouver	44%
Downtown Vancouver	18%
Other Vancouver	9%
West Vancouver	6%
Burnaby / New Westminster	6%
Coquitlam / Port Moody	5%
Richmond	4%
Surrey	4%
Other	2%

North Shore is well-represented at around 50% of all trips to Harbourside and it highlights the local nature of the employees. Downtown Vancouver is also an important origin of trips, and together with other parts of Vancouver, the City represents around 25% of all trips. Other, more distant areas, contribute the remaining 25% or so trips.

Table 6.3 highlights the approximate employee trip distances to/from Harbourside.

Table 6.3: Employee Trip Distance

Distance Travelled	Mode	Threshold for Mode
Less than 2km	7%	Potential Walking
2 to 5 km	22%	Potential Cycling
5 to 10km	23%	Potential Cycling / Transit / Car Only
10 to 20km	6%	Transit / Car Only
Greater than 20km	21%	Transit / Car Only
Coquitlam / Port Moody	5%	Transit / Car Only

Overall, there is the potential for 30% of trips to be walking or bicycling with the current patterns, while at present the proportion is only 8%. These groups should be prime area of focus for the TDM plan.

In contrast, ride-sharing opportunities lower the closer employees live to where they work as the economies of shared travel diminish.

6.3 Transportation Demand Management Options

This section reviews the following TDM options:

- Transit;
- Car-Sharing;
- Ferry Service;
- Ride sharing;
- Bicycle Initiatives;
- Transit Pass Subsidy;
- Management, Promotion and Monitoring Program; and,
- Parking and Management.

Each option is described in the context of the development plan and future demands in the following paragraphs.

6.4 Transit

6.4.1 Existing Condition

Direct transit access for Harbourside is currently provided by route #231, which only covers the morning and afternoon peak periods as highlighted in **Table 6.4**. This service changed in December 2011 where previously the connection was provided with the diversion (to Harbourside) of the Lonsdale Quay to Grouse Mountain service (#236).

Table 6.4: Existing Transit Service to Harbourside

Route	Direction	Time Period	Frequency
231	Inbound (to Harbourside from Lonsdale Quay)	7:30am – 8:30am*	15 minutes
231	Outbound (from Harbourside to Lonsdale Quay)	3:30pm – 5:45pm	30 minutes

Note – a single bus service operates in the westbound direction during the afternoon peak leaving Lonsdale Quay at around 4:30pm.

Currently around 20% of employees at Harbourside use transit with 18% of these taking the bus, including around 40% walking to Marine Drive, while 8% of them also take the Seabus. This information provides an important platform in targeting an improved connection to Lonsdale Quay.

6.4.1 Options to Augmented Service

With the limited existing service, the focus here is to augment the transit service with the following options:

- Provide funding to TransLink to expand #231 route; or,
- Introduce a private shuttle to augment the existing service.

Preference is for Option 1 and initial feedback from TransLink indicates that opportunities exist to develop this option. However, Option 2 will form a back-up option where local private opportunities have been canvassed and showed a willingness to operate the service.

Using TransLink as the service provider will provide consistency and transparency with existing operations where the bus departure point would be located in the existing Lonsdale Exchange. It is unlikely that a private operator could be located in the exchange and would therefore need to be located at an adjacent publically accessible location.

Concert and the City of North Vancouver have been working closely with TransLink to develop an expanded version of the 231 service which currently connects to Harbourside. The preferred option at this stage is to extend this service to Park Royal, running along 1st Street close to the site, and connecting with other residential and commercial uses on this corridor, which are currently not directly served, including Seaspan.

Potential bus stop locations are indicated at **Exhibit 6.1** on 1st Street and would be positioned at MacKay (connected with the overpass), Fell Avenue, and Bewicke Avenue. Walking distance to bus stops are expected to be 450 to 650 metres, depending on the parcel location, but this needs to be traded off against achieving a more sustainable bus route that serves the wider community. Observations from Harbourside already confirm people are willing to walk a longer distance to Marine Drive to access better transit.

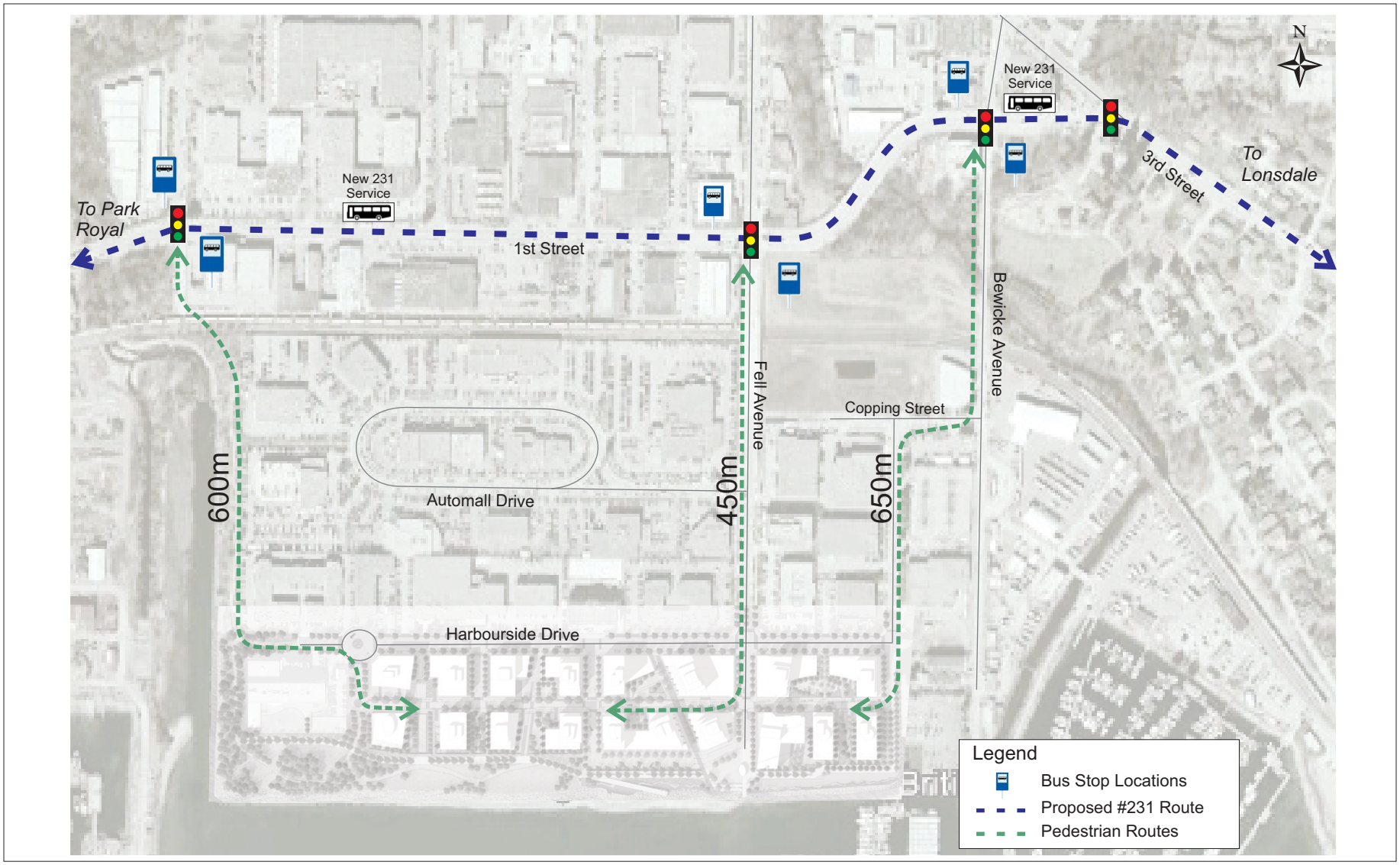

Exhibit 6.1

Proposed #231 Route & Bus Stop Locations (Walking Distance)

Harbourside Rezoning, North Vancouver, BC
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TransLink has indicated that 2 new buses would be required to implement the #231 expanded service along with the supporting infrastructure such as bus stops.

With the fall-back option, it is important to recognize that privately operated shuttle bus services in Metro Vancouver have been introduced by other developers / companies, including the following two examples:

- Best Buy Headquarters at Glenn Lions Parkway, Burnaby (employee connection to MetroTown SkyTrain Station; and,
- Telus Headquarters at Kingsway, Burnaby

These proactive initiatives highlight the commitment taken by other private companies to move employees in a more sustainable manner.

6.4.2 Strategy

Current transit ridership at Harbourside is around 120 to 140 movements (20% of total employee movements) during the periods of operation, where around 10% of employees currently walk to Marine Drive. Current demand within Harbourside is in one direction with service #231 only being inbound during morning and outbound in the evening.

Concert will continue discussions with the City and TransLink to move forward the enhanced #231 service and indications at this stage show that there is a strong possibility of success. But should the preferred option not proceed then the private shuttle, or TransLink variation, will be developed based on the criteria presented in **Table 6.5**.

Table 6.5: Harbourside Bus Option (should TransLink preferred option fall through)

Item	Criteria
Operation Period	This is under discussion with the City and will be established through the development service agreement.
Bus Type	Standard bus or similar
Operation Consistency	Supplement existing bus operation (which would continue) but with the possibility of being two-way (currently one-way)
Contract	Time period dependent on funding, and operations would still need approval by TransLink
Peak Frequency	15-minute (7am-9am; and 4pm-6pm)
Off-Peak Frequency	30-minute (9am-4pm)
Fare	Dependent on arrangement with TransLink or private operator
Number of buses	2 buses for peak periods (including existing TransLink bus), and 1 bus off-peak
Route Distance	2.6-kilometres
Bus Stops	Harbourside Drive (three locations); Fell Ave/Automall Dr; 2nd Avenue, Esplanade, and Lonsdale Quay.
Travel Time	Approximately 9-minutes with stops on route (or 7-minutes with stops only at Harbourside)
Routing	Follow existing #231 service route, i.e. Fell/West 2nd/3rd/Forbes-Esplanade/Lonsdale/Bus Loop
Schedule Coordination	Linked with Seabus Arrival
New Infrastructure	New Bus Waiting Facilities at Harbourside Drive

Concert is committed to providing enhanced transit upon further discussions with TransLink, the City and Concert's budget allocation.

6.5 Car-Share vehicles

Modo car-sharing co-op (Phil Baudin, Executive Director) has indicated the company's interest in locating vehicles at Harbourside. An estimated cost breakdown is set out below:

- $25,000 Vehicle (including vehicle conversion – locking and tracking system)
- $5,000 Start-up Cost

The intention is for employees and residents to subscribe to the car-sharing program. A subscription would also entitle members' with a 15% discount on transit passes, thereby increasing demand for transit.

Vehicles would be located in publicly accessible locations and be available to all residents and employees at Harbourside (and other areas) who are registered members' of the Modo Car-Share program.

Employees typically use vehicles during the daytime while residential use is more concentrated in the evening and at weekend periods. With the types of occupations currently at Harbourside (e.g. professional firms), it is assumed that the car-share vehicles would be well subscribed.

One car-share vehicle is planned for every 180 residential dwelling units and altogether five vehicles for the 850 units proposed. Vehicle introduction would be phased with the residential build-out, with the first vehicle provided after the first unit is occupied and one vehicle thereafter for each 180 units.

Concert is committed to providing five car-share vehicles, start-up costs and dedicated, publically accessible on-site parking stalls.

6.6 Ferry Service

One opportunity that has been proposed is for Harbourside to take advantage of its frontage with the waterfront through the introduction of a ferry service that could either connect close to Lonsdale Quay or downtown Vancouver.

In 2003-2004, TransLink undertook the Vancouver Harbour Passenger Marine Study, a feasibility study on potential new regional passenger marine services. The general findings from the study confirmed that marine passenger service is a highly costly endeavour and typically only cost-effective when serving terminals of significant population and development. It is unclear that demand would be robust enough to warrant both existing Seabus and introduction of a new ferry service to Harbourside.

There are also regulatory challenges with operating on the Burrard Inlet, given the high level of commercial activity. Therefore for the purpose of the study, the ferry has not been included as a TDM measure.

6.7 Ride-sharing

The existing system available for ride sharing is the Jack Bell program and the development plan could be linked to this system. Presently ride-sharing proportion is low for employees at Harbourside and TransLink has advised that with the number of employees living close to the Harbourside area (i.e. North Shore and the City of Vancouver), the opportunities for this measure could be limited. It is however relatively low-cost and can be monitored.

This aspect of the TDM strategy would be linked with the Travel Smart program, which provides suggestions on how ride-sharing initiatives can be developed. It could be managed through the TDM coordinator.

Concert will work with TransLink's Travel Smart to develop a user-friendly and safe interface for people to ride-share.

6.8 Transit Pass Subsidy

In addition to the transit pass subsidies available through the TransLink employee program or through car-share membership, Concert will review opportunities to expand the discounts available along with extending the groups participating.

The program however, will need to be balanced with the cost of subsidizing transit to the community, which is a key priority.

Concert is dedicated to investigating opportunities to extend transit pass subsidies.

6.9 Parking Management

Important to the success of the TDM initiatives is ensuring parking provision and management is consistent with the objectives of lower auto use at Harbourside. Parking was covered in the previous section with the aim to adopt levels consistent with the planned TDM initiatives; proactive measures to lower demand; and, review rates further as the community matures.

Concert is committed to working with the City in developing parking management plan to lower demands and prioritize street parking for visitor use.

6.10 Management, Marketing, and Monitoring

Management and marketing is critical to the success of the TDM plan and Concert has been liaising with TransLink's Smart Travel group to develop a framework for maximizing opportunities positively in changing travel behaviour and making people aware of the options available.

Concert intends to use a (Transportation Demand Management) TDM Coordinator, who will be responsible for the following:

- Securing start-up and annual operational funding for the TDM program elements;
- Overseeing all aspects of: TDM planning, program implementation, operations and management, evaluation of effectiveness, and ongoing monitoring;
- Liaise directly with Travel Smart and coordinated promotion events within the budget made available to Travel Smart to assist with the TDM plan;

- Responding to transportation/parking problems and complaints identified by residents and employees, the City of North Vancouver and other businesses at Harbourside;
- Coordinating with city-wide or regional TDM programs, travel service providers, and related transportation agencies (City of North Vancouver, Go Green, TransLink, Coast Mountain Bus, etc.). and,
- Establishing a line of communication with the City of North Vancouver, including a reporting structure

Typically the TDM Coordinator's first step is to understand existing travel characteristics in the local area. Information can be collected through a combination of surveys, interviews and traffic/parking demand counts. Once this data is analyzed, the coordinator will be able to define baseline values for the following transit-related characteristics:

- Mode split to auto modes (Single-Occupant Vehicle (SOV), High-Occupant Vehicle (carpool or vanpool), Transit, Walking and Cycling;
- Average auto occupancy;
- Peak hour vehicle trip generation;
- Peak parking demand; and,
- On-site parking vs. off-site parking.

Once this information is known for the base condition, the coordinator would establish targets for lowering auto use, related to these characteristics.

All existing and new employees along with residents would be given a welcome booklet with a Multi-Modal Access Guide (or Transportation Access Guide) which is a document or set of documents that provide concise, customized information on how to access a particular destination by various travel modes. Particular focus would be given to sustainable modes such as walking, cycling, and transit.

The guide will be distributed to all residents and employees that move in, and made available at a kiosk or bulletin board within each building. Potential contents of the guide would include:

- A map of the area showing local amenities and activities, the closest transit bus routes/stops, and cycling and walking routes to key destinations;
- Information about transit service frequency, fares, first and last runs, plus phone numbers and web addresses for transit service providers and taxi companies;
- Details on how long it takes to walk from transit stops and other locations near the site;

- Access arrangements for people with disabilities;
- Carpool program hotline number; and,
- Car Share/bike program policies.

Different versions of the multi-modal access guide may be required in order to address the different needs of users. It will include a link to a website dedicated for Harbourside marketing and also be coordinated with TransLink's Travel Smart program. It will make clear the objectives of the strategy, how to access the measures available, and have a feedback / comment window.

Visits would be arranged through Travel Smart to the local businesses to educate them on the opportunities available together with the importance of lowering auto use (less stress, health, environmental goals, etc.).

The Travel Coordinator will also have responsibilities under the monitoring program and this is outlined at the end of Section 7.

More regular information could be collected on transit usage (from TransLink, car-share operator, etc.), while surveys of transportation movements at Fell Avenue and Bewicke Avenue, for example, could be collected more regularly. The City would be able to contact and meet with the Travel Coordinator at their convenience for updates and feedback.

All details for the monitoring agreement will be covered in the relevant planning agreements and linked with the vehicle operational review set out in Section8. It would advise on whether the plan should be refocused or if further improvements on walking, cycling, and transit connections are needed.

Concert properties is committed to the management, funding, and monitoring of the TDM plan, including the appointment of a Travel Coordinator.

6.11 Summary

The following table summarizes the key TDM measures planned and expected introduction period.

Table 6.7: TDM Measure Commitments and Anticipated Timing

Item	
Transit	Enhanced transit under discussion with TransLink and City with the introduction to be determined.
Car-sharing	Introduced with residential build-out at 1 per 180 units with the first car introduced with the first unit occupied
Ride-sharing	Introduced with the occupation of the first building in Phase 1
Transit Subsidy	Dependent on the resources required for the transit subsidy and would also be linked to the employee program and car-share vehicle introduction.
Parking Management	Work with the City to develop measures to lower demand and prioritize street parking for short-term / visitor use, and will start with the completion of the first building
Travel Smart	Funding contribution for materials used in the Travel Smart program.
Management, Marketing Monitoring TDM Coordinator	Introduced with the occupation of the first building in Phase 1.

More specific details will be covered in other planning documents as the development plan progresses.

7. VEHICLE TRIP GENERATION AND DISTRIBUTION

7.1 Introduction

Higher density / mixed use developments inherently generate lower vehicles demands compared to predominantly spatially separated land-use patterns. It is important to understand these influences in the context of the expected vehicle trip projections at Harbourside.

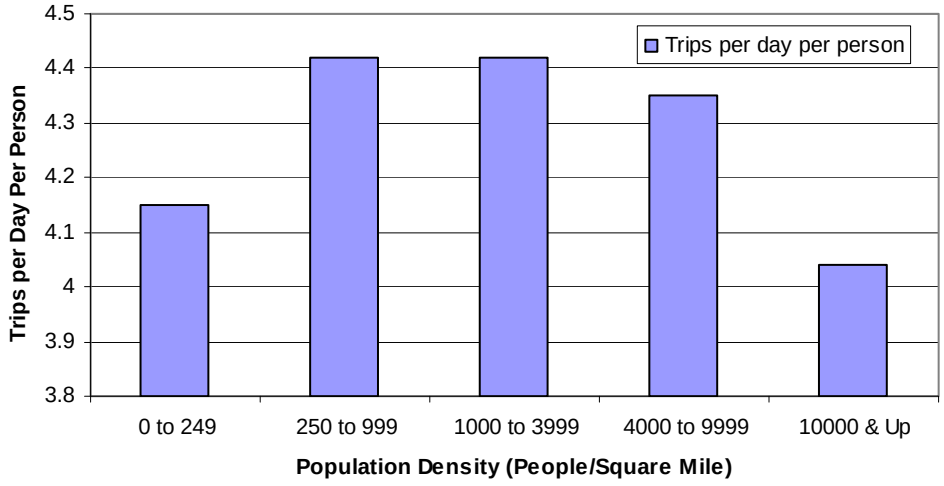
Vehicle trip rates developed in this section cover each of the planned uses: residential, retail, employment, and hotel uses, together with the associated trip distribution patterns. Section 9 will project pedestrian, bicycle, and transit trips along with assessing their influence on the transportation system.

7.2 Influences on Vehicle Trips

The following reviews research work relating to the influence of a mixed-use and higher-density land use patterns. Its purpose is to provide context in the application of vehicle trip rates and, in particular, to show that they are typically lower in higher density, mixed use developments.

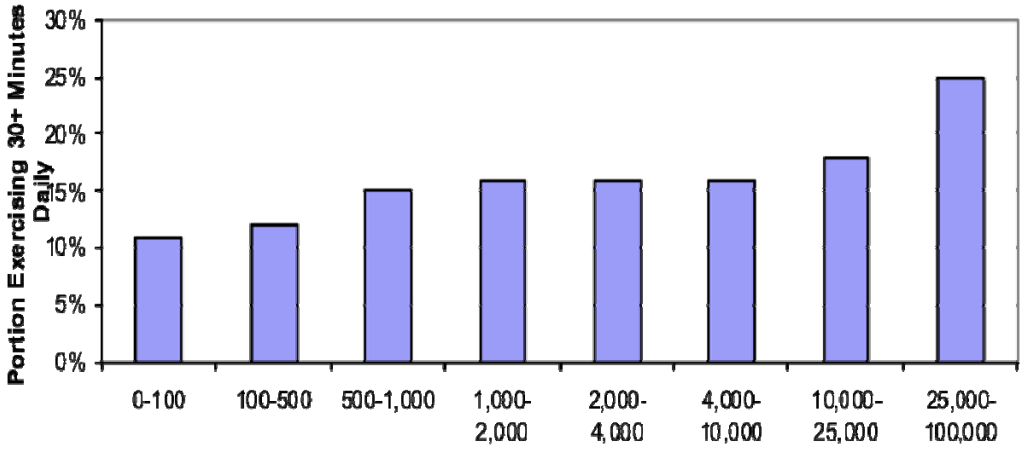
Catherine L. Ross et al conducted a study using National Personal Transportation Survey data from 1995. **Figure 7.1** shows how the number of trips per person reduces (with the exception of the lowest density) with increasing population density. At the highest density, there are 10% fewer trips made per person compared to the 1,000 to 3,999-population density range.

Figure 7.1 Person Trips by Population Density



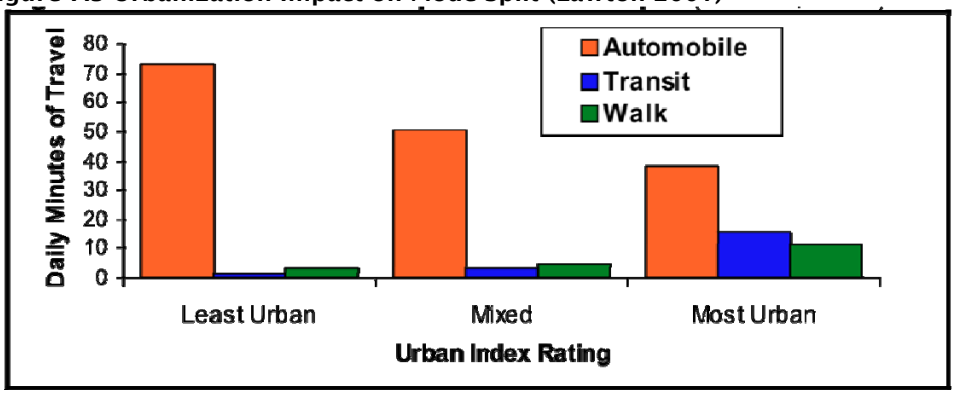
William Gehling produced a graph, shown at **Figure 7.2**, highlighting how higher population density increases walking and cycling activity.

Figure 7.2 Portion of Population Walking & Cycling 30+ minutes Daily (NHTS William Gehling)



Influence of density and urban design was explored by Lawton, and he showed how auto use reduces by around 30% between 'least' and 'most' urban locations.

Figure 7.3 Urbanization Impact on Mode Split (Lawton 2001)



The link between travel choice and density is also highlighted in a study by Dunphy, Robert T. and Kimberly Fisher titled, "Transportation, Congestion, and Density: New Insights" Transportation Research Board 1552 (1996. 89-96) [US]. It shows for residential densities of between 10,000 and 50,000 people per square mile, 50% of all trips were non-automobile.

Table 7.1 is from the Victoria Transport Policy Institute TDM Encyclopaedia (May 2005). It highlights the influence of location on transit and rideshare participation and in particular how single-occupant vehicle use reduces as transit and urban form become more prevalent. Again, it reinforces the trend of increasing density and lower levels of private automobile use.

Table 7.1: Modal Split by Location (Comsis 1993)

Type	Low Density Suburb	Activity Centre	Regional CBD / Corridor
Single Occupant Vehicle	85%	66%	41%
Transit	7%	16%	30%
Rideshare	8%	18%	29%

Harbourside parcels are expected to have: (a) an equivalent to an overall population density 10,000 / 15,000 people per square mile; (b) fall within the mixed / most urban design category; and (c) be between an activity centre and CBD. With this, it is anticipated that 58% to 65% auto use would be a reasonable target, compared to current auto use levels closer to 70%. This would provide a good reference point for the monitoring program set out at the end of the next section.

Trip rates developed in the following paragraphs **do not take into consideration these influences** and, as such, are expected to be very conservative. This is discussed further at the end of the section.

7.3 Vehicle Trip Rate Review

Trip generation rates were assessed for new residential, office, commercial retail, and hotel uses and the following paragraphs set out the approach to derive each of the rates.

Table 7.2 provides a summary of the trip generation rates for the school (Bodwell High School) and commercial land uses on Harbourside Drive, west of Fell Avenue. This is taken from the OCP study to assess the expected demands for commercial uses.

Table 7.2: Existing Trip Generation Rates for the School and Commercial Land Uses

Land Use	Unit	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
School	Trips per student	0.20	0.10	0.30	0.06	0.07	0.13
Commercial	Trips per 1000 ft^2	0.70	0.24	0.94	0.54	0.97	1.51

Trip generation rates for the school covers the network peak-hours (recorded between 7 and 9 am and in the afternoon rate between 4 and 6 pm). While the morning street peak-hour coincides with the school peak, the afternoon peak-hour is outside of the school peak hours, resulting in a low trip generation rate for that period.

The ITE rate for a Business Park was found to be 1.43 trips per 1000 sq. ft. in the morning peak-hour and 1.29 trips per 1000 sq. ft. in the afternoon peak-hour. The morning ITE rate is higher than the existing commercial trip rate of 0.94 per 1000 sq. ft., probably reflective of the number of local services and commercial uses captured in the survey along with the Questionnaire Survey showing two-thirds of employees driving compared to ITE at typically 90%. This strongly suggests a lower trip level on the future commercial component at Harbourside.

Table 7.3 shows the vehicle flows generated with the rates from Table 7.2.

Table 7.3: Existing Trips Generated by Bodwell High School and Commercial Uses on Harbourside Drive (Source: 2010 survey)

Land Use	Size	AM Peak Hour (vph)			PM Peak Hour (vph)		
		In	Out	Total	In	Out	Total
School (Bodwell)	370 Students	75	36	111	23	25	48
Commercial	355,000 sq. ft. GFA	250	85	335	191	345	536
Total		325	121	446	214	370	584

Residential vehicle trips were based on a combination of local data and ITE Trip generational manual rates. Summarised in **Table 7.4** are several ITE categories of residential buildings that were presented in the 2010 OCP study for Harbourside. The first two categories are not expected to be relevant as they do not specifically cover high-rise buildings (defined as over 3 stories), while category #220 only covers only rental.

Categories #221 and #222 specifically cover high-rise and are therefore consistent with the development plan building form, although the sample count is lower.

Table 7.4: Trip Generation Rates for Residential Land Uses from ITE (trips per unit)

Source - Land Use	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE – Apartment (Rental) (#220)*	0.10	0.41	0.51	0.40	0.22	0.62
ITE – Low-rise Apartment (#221)*	0.10	0.36	0.46	0.38	0.20	0.58
ITE – High-rise Apartment (#222)	0.08	0.22	0.30	0.21	0.14	0.35
ITE – High-rise Condo/Townhouse (#232)	0.06	0.28	0.34	0.25	0.13	0.38
ITE Condo / Townhouse – (#230)*	0.07	0.37	0.44	0.35	0.17	0.52

*categories are not applicable for high-rise private / senior housing planned

ITE rates are; however, based on suburban land use patterns where typically 90 to 95% of transportation movements are auto-related. Indeed the ITE manual recommends, where possible, local rates be used recognizing the characteristics of the location (access to transit, amenities, employment, etc.) and social behaviour.

Presented in **Table 7.5** are a selected number of residential development sites that share similar characteristics to Harbourside with respect to accessibility and high-rise development form. Sites reviewed also contain sizeable cross section of units to provide a good representative sample. **Table 7.6** summarizes the vehicle trips at each of the sites referred to in Table 7.5.

Table 7.5: Surveyed Residential Sites – Key Characteristics

Site	Units	Density	Local Facilities	Transit Nearby
Woodcroft North Vancouver	1,222	Medium to high density	Limited within 800 metres	2 buses per hour
Quayside Drive, New Westminster	1,344	Medium to high density	Local facilities around 800 to 1000 metres	None but SkyTrain is 1200-metres away.
Quilchena Park Vancouver	680	Medium to high density	Local shops around 600 to 800 metres	2 buses per hour
Riverport Drive	280	Medium Density	Local facilities nearby but highway oriented	5 buses per hour
West Fraserlands, Vancouver	1140	Medium Density	Some recreational facilities – local shops > 1200 metres	4 buses per hour on Marine Drive
West Royal Towers	171	Medium to high density	Local facilities nearby but highway oriented	10 buses per hour

Table 7.6: Trip Generation Rates for Residential Land Uses from Bunt Surveys (trips per unit)

Location	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Woodcroft North Vancouver	0.05	0.18	0.23	0.17	0.08	0.25
Quayside Drive, New Westminster	0.12	0.23	0.35	0.28	0.20	0.48
Quilchena Park Vancouver	-	-	-	0.	0.0	0.41
Riverport Drive	-	-	-	0.20	0.08	0.28
West Fraserlands, Vancouver	0.06	0.28	0.34	0.24	0.14	0.38
West Royal Towers. West Vancouver	-	-	-	0.19	0.10	0.29
Average	0.08	0.25	0.33	0.20	0.12	0.32

On average, the vehicle trip rates from the surveys are generally comparable with the ITE categories #222 and #232 and, as such, are supportive of a robust level to use for Harbourside. Also, none of the rates presented have a known direct influence from TDM.

The City of North Vancouver suggested a blended rate between the locally collected data and the ITE Category #221 and this would equate to 0.34 vehicle trips per unit in the morning peak-hour and 0.42 in the afternoon peak-hour. No adjustment has been for the rental housing, which has a parking supply rate around 35%/40% lower than the market housing given this category is not specifically covered in the ITE Manual.

Additionally, the City of North Vancouver requested a higher rate for residential be used based on the Category #230 of the ITE Manual. This has been done as a 'Sensitivity Test' in the following section at the key entrance intersections to Harbourside and is expected to generate **85 additional trips** above that projected in the tables below. Again, this category covers a range of building types, including low-rise which is not reflective of the development plan.

ITE Category for Hotel (#310) has been applied for this particular use. Retail has been based on a hybrid of Speciality Retail (#826) and Quality Restaurant (#951) rates and is consistent with the planned parking ratio at 3 spaces per 100sqm.

7.4 Vehicle Trip Generation

New vehicle movements are presented in **Tables 7.7 and 7.8** for the morning and afternoon weekday peak-hour periods.

Table 7.7: Projected Vehicle Trips AM Peak-Hour

Component	Unit Reference	Rate	In	Out	Vehicle Trips		
					In	Out	Total
Employment (per 1,000sq.ft)	215,000 GFA	0.94	0.70	0.24	151	52	203
Retail (per 1,000sq.ft)	45,000 GFA	0.75	0.46	0.29	21	13	34
Market / Rental Residential	850 units	0.34	0.07	0.24	58	231	289
Hotel	100 beds	0.56	0.34	0.22	34	22	56
Totals	-	-	-	-	**449**	**142**	**591**

Table 7.8: Projected Vehicle Trips PM Peak-Hour

Component	Unit Reference	Rate	In	Out	Vehicle Trips		
					In	Out	Total
Employment (per 1,000sq.ft)	215,000 GFA	1.51	0.54	0.97	116	209	325
Retail (per 1,000sq.ft)	45,000 GFA	3.91	1.72	2.19	47	61	108
Market / Rental Residential	850 units	0.42	0.27	0.15	232	125	357
Hotel	100 beds	0.59	0.31	0.28	31	28	59
Totals	-	-	-	-	**426**	**423**	**849**

Altogether the rezoning plan is expected to generate around 600 vehicle movements in the morning peak-hour and 900 in the afternoon peak-hour periods. These flow movements are quantified in more detail later in this section after the influence of internal movements and trip distribution.

Set out in **Table 7.9** is a summary of the projected vehicle trips by phasing and it shows that increases are incremental and will provide opportunities for review through the planned monitoring program.

Table 7.9: Accumulative Vehicle Trips (per hour) by Phase

	AM Trips			PM Trips		
	In	Out	Total	In	Out	Total
Phase 1	68	73	141	123	138	261
Phase 2	129	165	295	238	227	465
Phase 3	235	231	466	345	380	725
Phase 4	259	314	573	426	422	849

7.5 Committed Developments

A number of developments in the local area are expected to influence capacity operations on the study network, and the City of North Vancouver has helped to identify the sites summarized in **Table 7.10**.

Table 7.10: Committed Development Vehicle Movements

Location	In AM/PM	Out AM/PM	Total AM/PM	Source
Existing Works Yard	30/116	120/64	150/180	Bunt Report 2011
New Works Yard	18/1	24/32	42/33	Bunt Report 2011
Gostick Place	12/9	4/16	16/26	OCP Bunt 2010
Bewicke / Copping	91/13	13/96	104/109	OCP Bunt 2010
Seaspan	151/139	161/209	312/348	Seaspan Report

Vehicle movements from these developments are included as part of the operational assessment in the following section.

7.6 Multi-modal Review

Estimates for future walking, cycling and transit trips is presented in Section 9 of the report and are based on the methodology used for the Mountain Equipment Co-op report (dated March 2011). Unfortunately, there is limited data available to make projections on person trips for each land use, while the mode split data is limited and would be unsuitable to extrapolate for sites like Harbourside, and where new uses are planned.

The monitoring agreement (Section 8) will provide a more accurate of measurements of mode split for the planned uses which can be reviewed in future DP applications.

7.7 Trip Distribution & Assignment

Trip distribution patterns have been developed for each of the planned main uses, i.e. employment (including hotel), residential, and commercial.

Residential patterns are based on the TransLink Trip Diary Survey 2008 (data provided by the City), which identified origin and destination for residential-based trips in the local area. This analysis is presented in **Table 7.11** and the assignment of movements has been based on the expected desired lines to the destination zones.

Table 7.11: Residential Trips using 2008 Trip Diary

Destination	Proportion	Comment
City North Vancouver	21.0%	21% east
District of North Vancouver	23.1%	17% Highway 1, 6.1% east%
Vancouver	25.2%	20.2% Lions Gate Bridge; 5% Highway 1
West Vancouver	7.0%	7.0 % west
Burnaby / Surrey / New Westminster / Coquitlam	19.3%	19.3% Highway 1
Richmond / Delta / White Rock	1.7%	1.0% Lions Gate Bridge; 0.7% Highway 1
Other	2.7%	2.7% Highway 1
Total	**100%**	

Commercial retail vehicle trip distribution is based on the Colliers International Retail Study projections, with Trade Area proportions presented in **Table 7.12** and highlighted at **Figure 7.4**.

Table 7.12: Commercial Trips based on 2018 Projection Retail Study

Origin	Proportion	Comment
Primary Trade Area (south of 1st /2nd)	36%	No external trips
Secondary Trade Area (local employment and residential area	30%	Trips generated mainly to the west of Fell
Tertiary Trade Area (10-minute drive)	34%	Trips split 40% north, 40% east and
Total	**100%**	

This confirms that just over one-third of retail demand is expected to originate within Harbourside, including the Automall, with the remaining proportion external.

Figure 7.4: Trade Areas

Employment and hotel movements are expected to follow similar patterns to the existing Harbourside flows.

Assignment proportions for all land uses on the study network are summarized in **Table 7.13**, while supporting information is included at **Appendix D.**

Table 7.13: Assignment Proportion Summary for the Study Network

To/From	Employment	Residential	Retail
3rd Street (east)	30%	24%	30%
Keith Road (east)	17%	10%	15%
Larson Road (east)	10%	5%	10%
1st Street (west)	19%	13%	8%
Marine Drive (west)	4%	30%	12%
Westview (north)	13%	15%	25%
Fell Avenue (north)	7%	3%	0%

Table 7.14 summarizes the pass-by / internal capture associated with only the commercial aspect of the development plan. No account has been made for people working and living within the community, which is one of the key tenants for promoting mixed used developments.

Table 7.14: Summary of Internal and Pass-by Trips for Retail

Location	Reduction	Comment
Harbourside Area (south of 1st / 2nd)	36%	Derived from the retail study and no discount has been made for lowering external trips
1st Avenue	10%	Conservative estimate where ITE allows up to 40%

The 36% reduction in this table was derived from the retail study which highlighted that this proportion of customers for the new commercial facilities would originate from within the Harbourside Area (referred to as the Primary Trade Area). Further, no account has been of the potential reductions of existing vehicle trips at Fell Avenue, or Bewicke Avenue, with people leaving the community currently to access similar amenities in other parts of the local area.

The Institute of Transportation Engineers advises that people combine their work commute or other trip purposes with a visit to commercial activities and especially in the weekday peak periods. First Street is an east-west commuter route and it would be reasonable to assume a proportion of the new commercial trips would originate from that corridor. Indeed, 10% is at the low end of what ITE suggests for such trip diversions in peak periods and hence provides a conservative estimate.

7.8 Influences of Transportation Demand Management

After reviewing research work in North America, there is no definitive work that clearly outlines the benefits of particular Transportation Demand Management (TDM) measures.

Moreover, TDM has really only taken a hold in North America over the past five years and many of the developments where it has been introduced are probably not mature enough to review the results. Controls sites would also be needed in nearby buildings to remove external influences such as existing transit, proximity to local services, and accessibility to walking and cycling routes.

For the purposes of this report, no specific reductions have been made for the operational analysis in the next section and will provide a 'robust' approach to the assessment. The monitoring exercise, set out in the following section, will provide the framework for assessing the influence of TDM at Harbourside along with the projections made in this report.

With that being said, the following table (**Table 7.15**) provides a sensitivity test of the potential of small changes in mode split for existing and future occupants and visitors at Harbourside.

Table 7.15: Sensitivity with Lower Driver Proportion

Position	Single vehicle Occupant Proportion	Current Uses (excluding Automall)	New Uses	Combined
Existing	68%	980	860	N/A
Modest Target	62% (-6%)	-60	-50	-110
Progressive Target	58% (-10%)	-100	-85	-185

The table highlights that vehicle projections could be lower by around 110 to 185 vehicle movements than what this report indicates with a lowering of single-occupant vehicle proportion. It could be achieved with a combination of TDM measures; synergies with the new compact urban form and mix of uses; and, improvements to pedestrian and cycle connections.

7.9 Summary

Compact mixed use development patterns typically generate lower vehicle movements when compared to spatially separated land use patterns (of similar floor area). With vehicle trip projections used for this rezoning generally following ITE rates for each land-uses, the projections are expected to be 'very conservative'.

Figure 7.5 highlights the trip projections for the existing zoning and what is currently planned for the critical afternoon peak-hour period. It highlights that the overall vehicle volumes from Harbourside are broadly similar between the existing zoning and current plan while the critical exiting vehicle volumes are significantly lower with the current plan.

Moreover, it shows the benefits of mixed use developments in balancing new demands rather than the current employee-dominated patterns.

Figure 7.5: Summary of Vehicle Projections

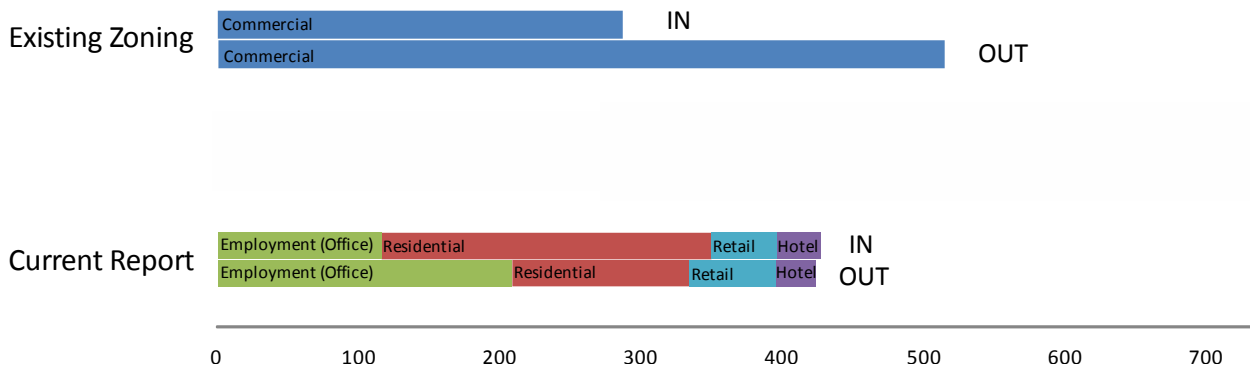
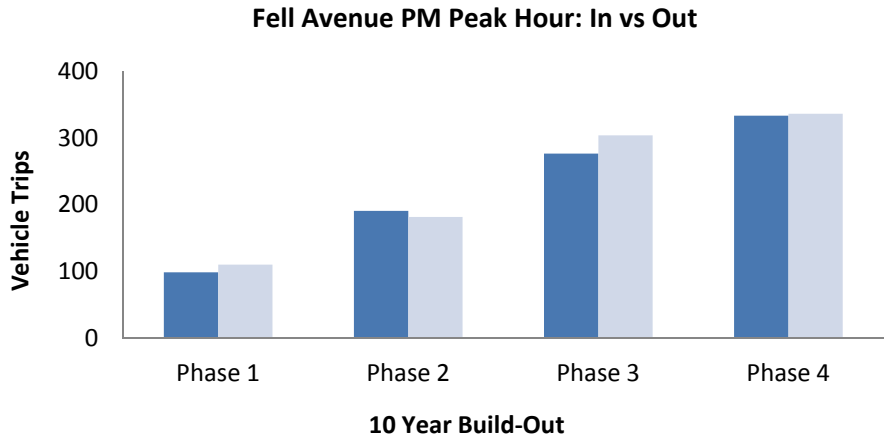


Figure 7.6 summarizes the external trips for Harbourside taking into consideration the localized benefits of the commercial retail and residential. The figure shows new vehicle movements (compounded) that are projected to use Fell Avenue for each stage of the development, each stage and separated between inbound and outbound vehicle trips for the critical PM peak-hour. Benefits of residential vehicle movements external to Harbourside are not considered to be significantly material.

Figure 7.6: Additional Movements at Fell Avenue (Compounded)



At full build-out, the development plan could add around 350 vehicle movements to the exiting volume on Fell Avenue at the afternoon peak-hour, which is equivalent to around 6 vehicles per minute. With the TDM measures, synergy of uses, and improved accessibility, it could lower at 280 vehicle movements or 5 vehicles per minute (taken from Table 7.15 with respect to the Sensitivity Test).

The following section will set out a monitoring program for the development plan's influence on the study network as it progresses, and will inform whether changes to the street system proposed in Section 8 are necessary or not.

8. OPERATIONAL CAPACITY ANALYSIS

8.1 Introduction

This section of the report presents the operational performance of the study network with future vehicle growth, committed developments, and the Harbourside rezoning plan. It will articulate what changes are required to the study network as a result of the development plan's rezoning along with the trigger points from the existing demands and vehicle growth (including committed developments).

The focus for this assessment is to support the full build-out of the master plan and the timing of the planned mitigation measures are not expected to be triggered by individual development phases, and especially given the strong influence of vehicle traffic growth and other committed developments.

Consideration is also given to the influence of a sensitivity test for a higher residential vehicle trip rate; a review of safety in the context of the mitigation measures planned; the function of Fell Avenue; and, an assessment of vehicle delays along Marine Drive (including for trucks and buses) in the context of the planned mitigation measures.

At the end of the section, an outline of the planned monitoring plan is set out and the details will be further developed and confirmed through the relevant planning agreements.

8.2 Vehicle Flow Diagrams

Flow diagrams were produced to cover each step of the analysis and all of the diagrams are included at **Appendix E**. A brief summary of the key steps are presented below for each of the study time periods:

- Existing weekday AM and PM peak-hour vehicle flows from surveys (see Section 2);
- Vehicle growth applied at 1% per year (compounded) for the design years 2012 and 2024 (excluding existing Harbourside movements);
- Committed Development flows presented for works yard sites (existing and new) and other developments identified by the City added to network, including Seaspan;
- New development flows are shown individually for each of the planned uses (residential, office, hotel, and retail);
- Development flows for each phase are also presented (see Section 4 for phasing);
- Internal trip capture and pass-by trips accounted for the assessment (for retail use only); and,
- Total development movements are presented with the background movements and committed developments added.

8.3 Percentage Change on the Study Network

Before presenting the operational analysis, it is important to first understand the percentage change in new vehicle movements with the development plan in place. It provides context to the capacity assessment and in particular whether mitigation measures are required with the respect to the new development plan's movements, or from traffic growth / committed developments.

Total vehicle volumes are illustrated at **Exhibits 8.1a/b** and **Table 8.1** summarizes the percentage change in vehicle movement at each study intersection.

Table 8.1: Percentage Development Change in Vehicle Movements per. Intersection

Intersection	AM Background Volume	AM Site Volume	AM Percentage Change	PM Background Volume	PM Site Volume	PM Percentage Change
Fell Ave & 1st St	2243	461	**21%**	2709	673	**25%**
Fell Ave & Automall Dr	1091	461	**42%**	1225	673	**55%**
Fell Ave & Harbourside Dr	641	524	**82%**	716	785	**110%**
Harbourside Dr & Harbourside Pl	373	368	**99%**	435	494	**114%**
Bewicke Ave & 2nd St	1562	226	**14%**	1989	324	**16%**
Fell Ave & 3rd St	1265	255	**20%**	1431	394	**28%**
Bewicke Ave & Marine Dr / Keith Rd	3059	124	4%	3900	198	5%
2nd St & Marine Dr	2544	156	6%	3294	226	7%
Fell Ave & Marine Dr	3264	263	8%	3848	401	10%
Fell Ave & West 16th St	2279	117	5%	2786	162	6%
Westview Dr & Larson Rd	1902	128	7%	2075	174	8%
Bewicke Ave & Larson Rd	1987	131	7%	2229	176	8%
West 16th St & Marine Dr	2707	100	4%	3563	151	4%
MacKay Rd & 1st Ave	1500	93	6%	1941	131	7%

Internal intersections within Harbourside exhibit the highest percentage change in new vehicle movements and their treatment will form part of the rezoning street design.

Fell at 1st Avenue shows an increase of around 670 vehicle movements in the PM peak-hour (or 25% increase), but around 70% of these new trips are in-bound where predominant current flow is out-bound at 70%.

Bewicke Avenue at 2nd Street shows an increase of around 320 movements with around half of these movements accessing the Fell Avenue access from 2nd Street, while the other half use Bewicke Avenue.

Outside the 1st / 2nd Street corridor, the percentage change is less than 10% and this will be an important consideration when reviewing the operational analysis at each intersection.

8.4 Capacity Analysis Preamble

Vehicle capacity analysis was carried out using Synchro Software (version 6) and the results are summarized in the tables provided in this section. Output tables will summarize Volume to Capacity (V/C) ratios and the delay-based vehicle indicator 'Level of Service' (LOS); ranging from ideal 'A' condition, with minimal delay, through to LOS 'F', 'over-saturated' condition.

For un-signalized, intersections the movement with the worst LOS output will be included in the table. As Synchro only reports overall intersection V/C and LOS for signalized intersections (as per HCM procedures), the overall traffic operations at these intersections cannot be reported.

Furthermore, 95th percentile queue lengths will only be reported for movements that experience storage capacity overflow.

Main notes for each table summary is presented below:

- "√" indicates that the 95th percentile queue lengths for a movement at an intersection can be accommodated within the available storage capacity, "X" indicates that the storage capacity is exceeded.
- **Bolded** results indicate values not meeting acceptable criteria.
- "N" = Northbound; "S" = Southbound; "E" = Eastbound; "W" = Westbound; "L" = Left; "T" = Through; "R" = Right".

The City of North Vancouver provided the Synchro traffic model for the study area and the assessment has been based on the parameters embedded in that model. Mitigation measures for improving operations will highlight whether there has been changes to the model parameters, otherwise it should be taken as unchanged from what the City provided.

Traffic signal intersections on the study area are coordinated and, as such, the cycle lengths have not been adjusted, and currently operate at 68 seconds (am) and 88 seconds (pm). In future scenarios, the analysis is optimized for the coordinated network's signal offsets and splits (but this will not affect the cycle length).

Analysis table have been grouped into Harbourside, Marine Drive, and Larson areas / corridors for ease of reference in summarizing the Synchro output. Detailed Synchro outputs for all movements and periods of assessment can be found at **Appendix F**.

8.5 Existing 2012 Conditions

A summary of 2012 existing vehicle capacity operations is presented in **Tables 8.2a, 8.2b & 8.2c**, covering Harbourside first before reviewing the external network areas. It also presented graphically at **Exhibit 8.2**.

Table 8.2a: 2012 Capacity Operations - Harbourside

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Fell Ave & 1st St	Overall	0.43	B	-	0.62	C	-
	EB TR	0.23	A	√	0.54	B	√
	WB L	0.34	A	√	0.31	A	√
	NB LTR	0.53	C	√	0.82	C	√
	SB LTR	0.65	B	√	0.55	B	√
Fell Ave & Automall Dr (unsignalized)	Overall	-	-	-	-	-	-
	EB L	0.22	C	√	0.87	**F**	√
	NB L	0.04	A	√	0.01	A	√
	SB R	0.18	A	√	0.11	A	√
Fell Ave & Harbourside Dr (4 way Stop)	Overall	-	A	-	-	B	-
	EB LTR	-	A	√	-	B	√
	WB LTR	-	A	√	-	A	√
	SB LT	-	A	√	-	A	√
Harbourside Dr & Harbourside Pl (unsignalized)	Overall	-	-	-	-	-	-
	EB T	0.07	A	√	0.17	A	√
	WB T	0.01	A	√	0.01	A	√
	NB LR	0.02	A	√	0.02	B	√
Bewicke Ave & 2nd St	Overall	0.32	A	-	0.51	B	-
	EB LTR	0.16	A	√	0.48	A	√
	WB LTR	0.31	A	√	0.22	A	√
	NB LTR	0.38	C	√	0.63	D	√
	SB R	0.05	D	√	0.04	**F**	√
Fell Ave & 3rd St	Overall	0.29	C	-	0.43	B	-
	EB L	0.10	B	√	0.31	B	√
	NB LT	0.28	B	√	0.53	C	√
	SB TR	0.49	C	√	0.24	A	√
MacKay Rd & 1st Ave	Overall	0.47	B	-	0.51	B	-
	EB L	0.24	B	√	0.27	A	√
	WB TR	0.72	B	√	0.60	B	√
	SB LR	0.11	B	√	0.13	C	√

With existing operations, the only local intersection that exhibits potential capacity issues is at Automall Drive and Fell Avenue in the afternoon peak-hour.

Tables 8.2b and 8.2c confirms that there are no operational issues identified on the Marine Drive or Larson Road corridors in the morning peak-hour period, while in the afternoon issues are identified at West 16th Street / Marine Drive, and Fell Avenue / Marine Drive.

Table 8.2b: 2012 Capacity Operations – Marine Drive Intersections

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Bewicke Ave & Marine Dr / Keith Rd	Overall	0.71	B	-	0.85	C	-
	EB T	0.37	B	√	0.87	C	√
	WB TR	0.77	C	√	0.80	D	√
	NB TR	0.39	C	√	0.88	D	√
	SB L	0.73	C	√	0.62	C	√
	NWB LT	0.64	C	√	0.83	D	√
2nd St & Marine Dr	Overall	0.61	B	-	0.58	A	-
	EB R	0.21	B	√	0.43	A	√
	NB L	0.86	C	√	0.48	B	√
	SB TR	0.36	A	√	0.74	B	√
Fell Ave & Marine Dr	Overall	0.69	B	-	**0.92**	C	-
	EB TR	0.57	C	√	0.82	B	√
	WB L	0.73	B	√	0.73	C	√
	NB	0.30 (L)	C	√	**0.96 (T)**	**F**	**X**
	SB LTR	0.69	C	√	0.66	C	√
West 16th St & Marine Dr	Overall	0.62	B	-	0.84	C	-
	EB L	0.56	B	√	**0.99**	**F**	**X**
	WB TR	0.58	A	√	0.86	C	√
	NB L	0.15	C	√	0.45	C	√
	SB	0.84 (R)	D	√	0.47 (LT)	C	√

Table 8.2c: 2012 Capacity Operations – Larson Road Intersections

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Fell Ave & West 16th St	Overall	0.62	B	-	0.73	C	-
	EB L	0.18	B	√	0.46	B	**X**
	WB L	0.59	A	√	0.51	C	**X**
	NB	0.09 (R)	E	√	0.70 (LT)	C	√
	SB	0.72 (TR)	C	√	0.49 (L)	C	√
Westview Dr & Larson Rd	Overall	0.70	B	-	0.76	B	-
	EB L	0.43	B	**X**	0.81	B	**X**
	WB TR	0.56	C	√	0.19	B	√
	NB LTR	0.38	C	√	0.11	D	√
	SB R	0.79	B	**X**	0.37	B	√
Bewicke Ave & Larson Rd	Overall	0.67	B	-	0.77	C	-
	EB T	0.45	A	√	0.82	C	√
	WB L	0.50	A	√	0.65	C	√
	NB LTR	0.62	C	√	0.68	C	√
	SB LTR	0.04	C	√	0.04	C	√

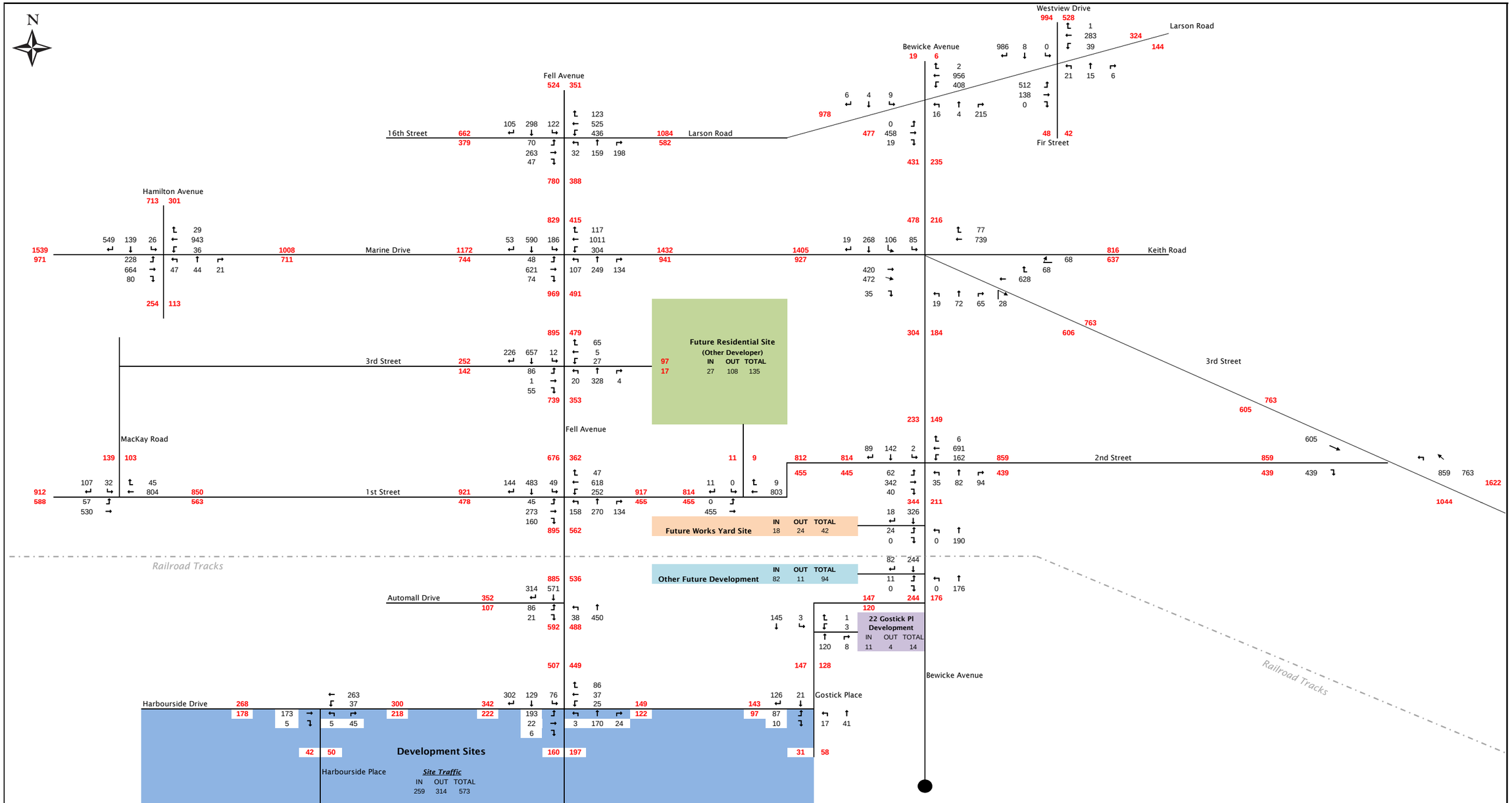
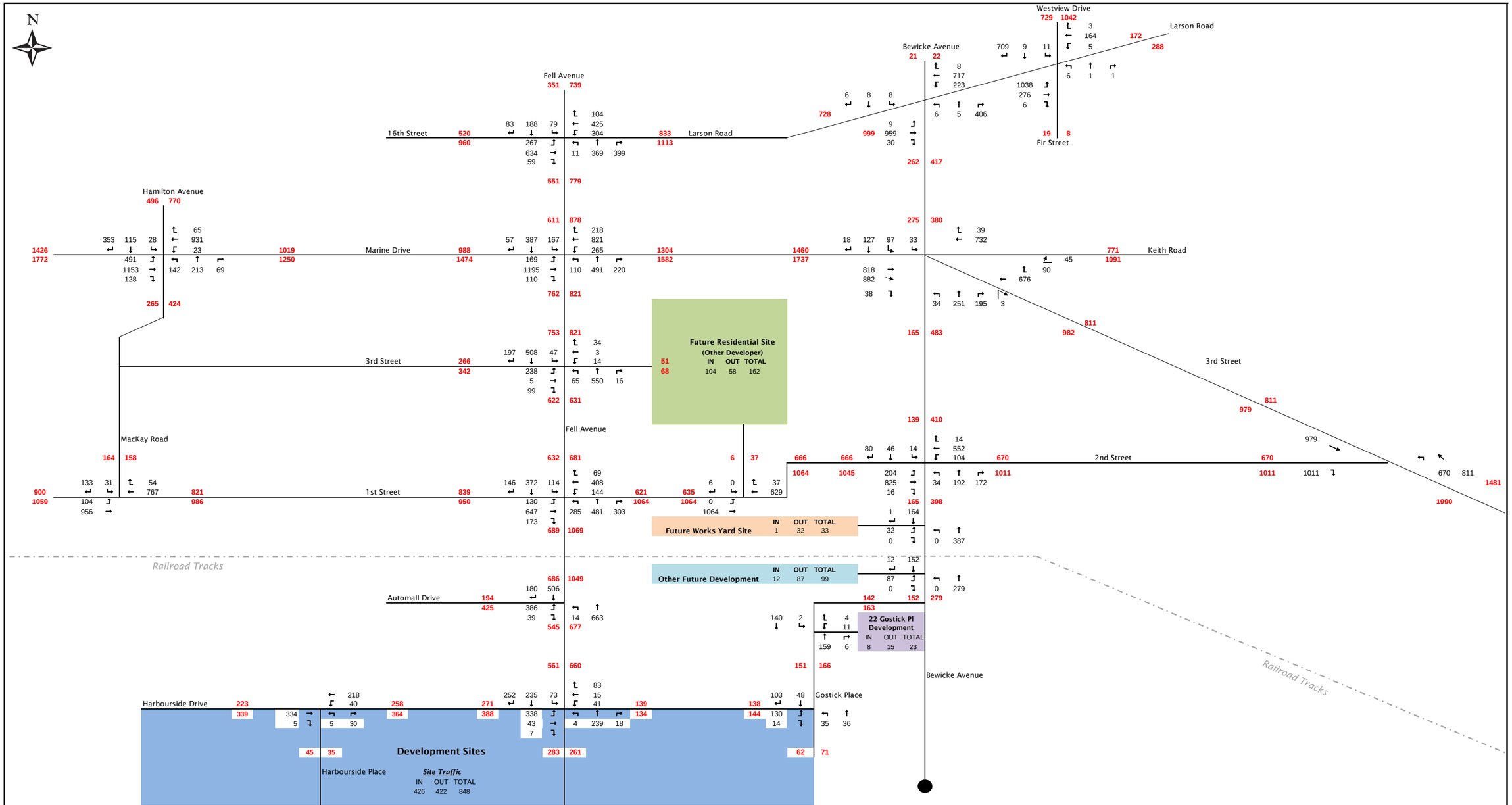


Exhibit 8.1a

2024 Weekday AM Peak Hour Total Traffic Volumes (without TDM)

Harbourside Rezoning, North Vancouver BC

4025.32 October 2013 NTS



PM Peak Hour: 4:30PM to 5:30PM

Exhibit 8.1b

2024 Weekday PM Peak Hour Total Traffic Volumes (without TDM)

Harbourside Rezoning, North Vancouver BC

4025.32 October 2013 NTS

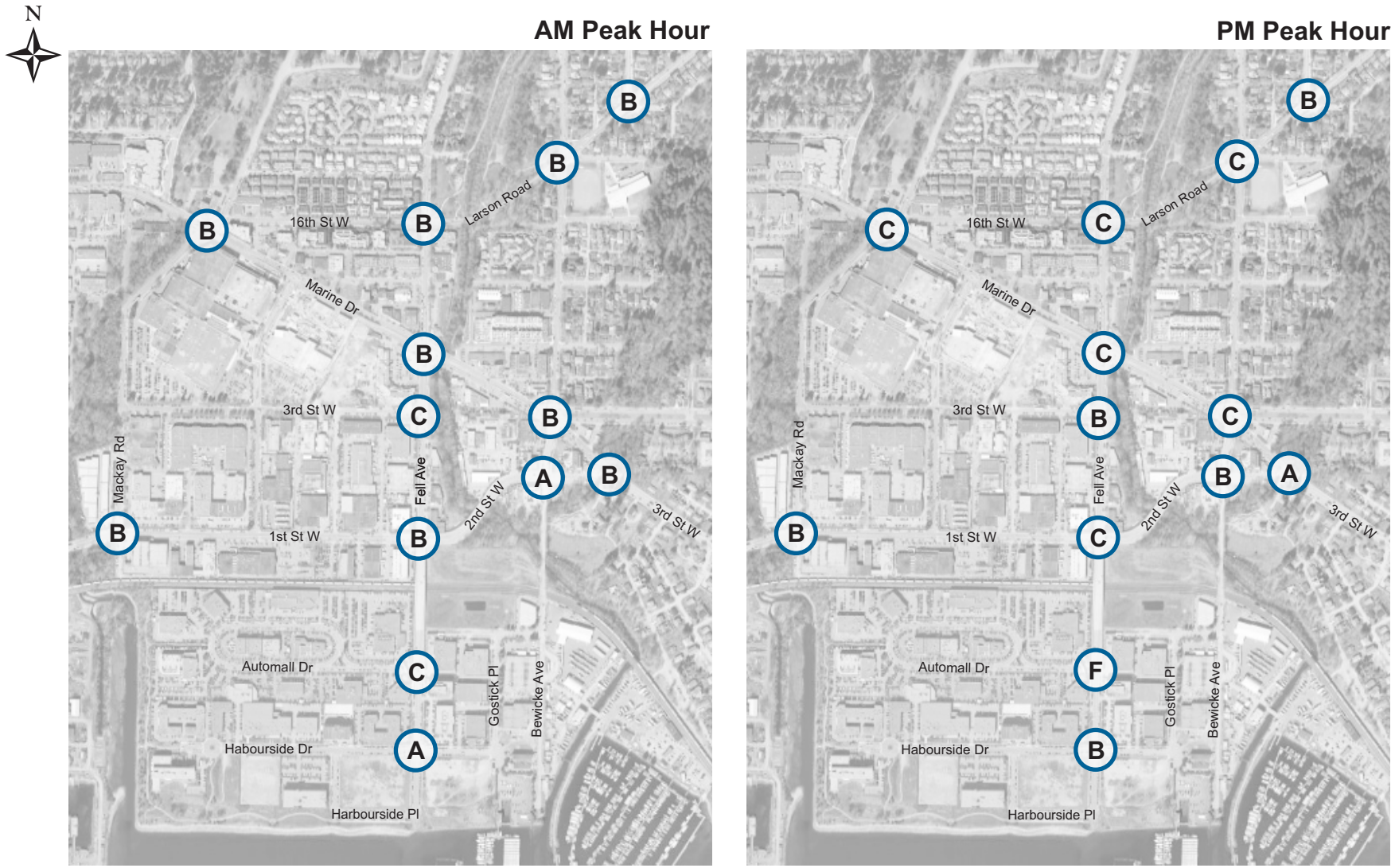


Exhibit 8.2

Level of Service - 2012 Existing Traffic Flows

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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8.6 2024 Flows (1% growth per year) but without the Development Flows

A summary of 2024 Background vehicle capacity operations is summarized in **Tables 8.3a, 8.3b & 8.3c** and presented graphically at **Exhibit 8.3**.

Table 8.3a: 2024 Background without Development Capacity Operations - Harbourside Area

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Fell Ave & 1st St	Overall	0.48	B	-	0.67	B	-
	EB TR	0.26	C	√	0.63	B	√
	WB L	0.38	A	√	0.36	A	√
	NB LTR	0.51	C	√	0.83	C	√
	SB LTR	0.69	B	√	0.63	C	√
Fell Ave & Automall Dr (unsignalized)	Overall	-	-	-	-	-	-
	EB L	0.22	C	√	**0.90**	**F**	√
	NB L	0.04	A	√	0.01	B	√
	SB R	0.18	A	√	0.11	A	√
Fell Ave & Harbourside Dr (4 way Stop)	Overall	-	A	-	-	B	-
	EB LTR	-	A	√	-	A	√
	WB LTR	-	A	√	-	A	√
	SB LT	-	A	√	-	A	√
Harbourside Dr & Harbourside Pl (unsignalized)	Overall	-	-	-	-	-	-
	EB T	0.07	A	√	0.17	A	√
	WB T	0.01	A	√	0.01	A	√
	NB LR	0.02	A	√	0.02	B	√
Bewicke Ave & 2nd St	Overall	0.42	A	-	0.64	B	-
	EB LTR	0.19	A	√	0.60	A	√
	WB LTR	0.41	A	√	0.29	A	√
	NB LTR	0.44	C	√	0.75	D	√
	SB R	0.05	D	√	0.05	D	√
Fell Ave & 3rd St	Overall	0.31	B	-	0.47	B	-
	EB L	0.11	B	√	0.75	D	√
	NB LT	0.30	B	√	0.40	A	√
	SB TR	0.53	B	√	0.20	A	√
MacKay Rd & 1st Ave	Overall	0.55	C	-	0.59	B	-
	EB L	0.48	C	√	0.31	A	√
	WB TR	0.87	C	√	0.63	A	√
	SB LR	0.12	B	√	0.16	C	√

Again, the only intersection with operational challenges is at Fell Avenue and Automall Drive.

Table 8.3b: 2024 Background without Development Capacity Operations – Marine Drive Intersections

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Bewicke Ave & Marine Dr / Keith Rd	Overall	0.80	C	-	**0.98**	**E**	-
	EB T	0.42	B	√	**0.97**	D	√
	WB TR	0.85	C	√	**0.91**	D	√
	NB TR	0.42	C	√	**1.00**	**F**	√
	SB L	0.80	D	√	0.77	D	√
	NWB LT	0.75	C	√	**1.00**	**F**	√
2nd St & Marine Dr	Overall	0.72	B	-	0.67	A	-
	EB R	0.18	A	√	0.57	B	√
	NB L	0.77	B	√	0.65	C	√
	SB TR	0.61	C	√	0.69	A	√
Fell Ave & Marine Dr	Overall	0.83	B	-	0.89	D	-
	EB TR	0.67	C	√	**0.97**	D	√
	WB L	**0.92**	D	√	**0.91**	D	√
	NB	0.29 (L)	B	√	**0.96 (T)**	**E**	**X**
	SB LTR	0.80	C	√	**0.93**	C	√
West 16th St & Marine Dr	Overall	0.84	C	-	**0.98**	**E**	-
	EB L	0.83	D	√	**<1.0**	**F**	**X**
	WB TR	0.77	A	√	**0.98**	E	√
	NB L	0.13	B	√	0.52	C	√
	SB	**0.94 (R)**	E	√	0.53 (LT)	B	√

Clearly the application of traffic growth results in operational issues at the Marine Drive / Keith Road / Bewicke Avenue and Bewicke Avenue / Larson Road locations in addition to the two previously identified intersections for the 2012 assessment. It confirms that should vehicle traffic growth occur then the City would need to deal with these operational issues, irrespective of the Harbourside rezoning development plan progressing.

Table 8.3c: 2024 Background without Development Capacity Operations – Larson Road Intersections

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Fell Ave & West 16th St	Overall	0.70	B	-	0.81	C	-
	EB L	0.24	B	√	0.52	B	**X**
	WB L	0.68	A	√	0.77	C	**X**
	NB	0.10 (R)	D	√	0.82 (LT)	C	√
	SB	0.77 (TR)	C	√	0.77 (L)	E	√
Westview Dr & Larson Rd	Overall	0.77	**F**	-	0.80	A	-
	EB L	0.57	B	**X**	0.85	A	**X**
	WB TR	0.36	B	√	0.58	D	√
	NB LTR	0.34	C	√	0.14	D	√
	SB R	**<1.0**	**F**	**X**	0.46	A	√
Bewicke Ave & Larson Rd	Overall	0.74	B	-	0.88	C	-
	EB T	0.59	B	√	**0.94**	C	√
	WB L	0.65	A	√	0.69	C	**X**
	NB LTR	0.60	C	√	0.78	B	√
	SB LTR	0.04	C	√	0.06	C	√

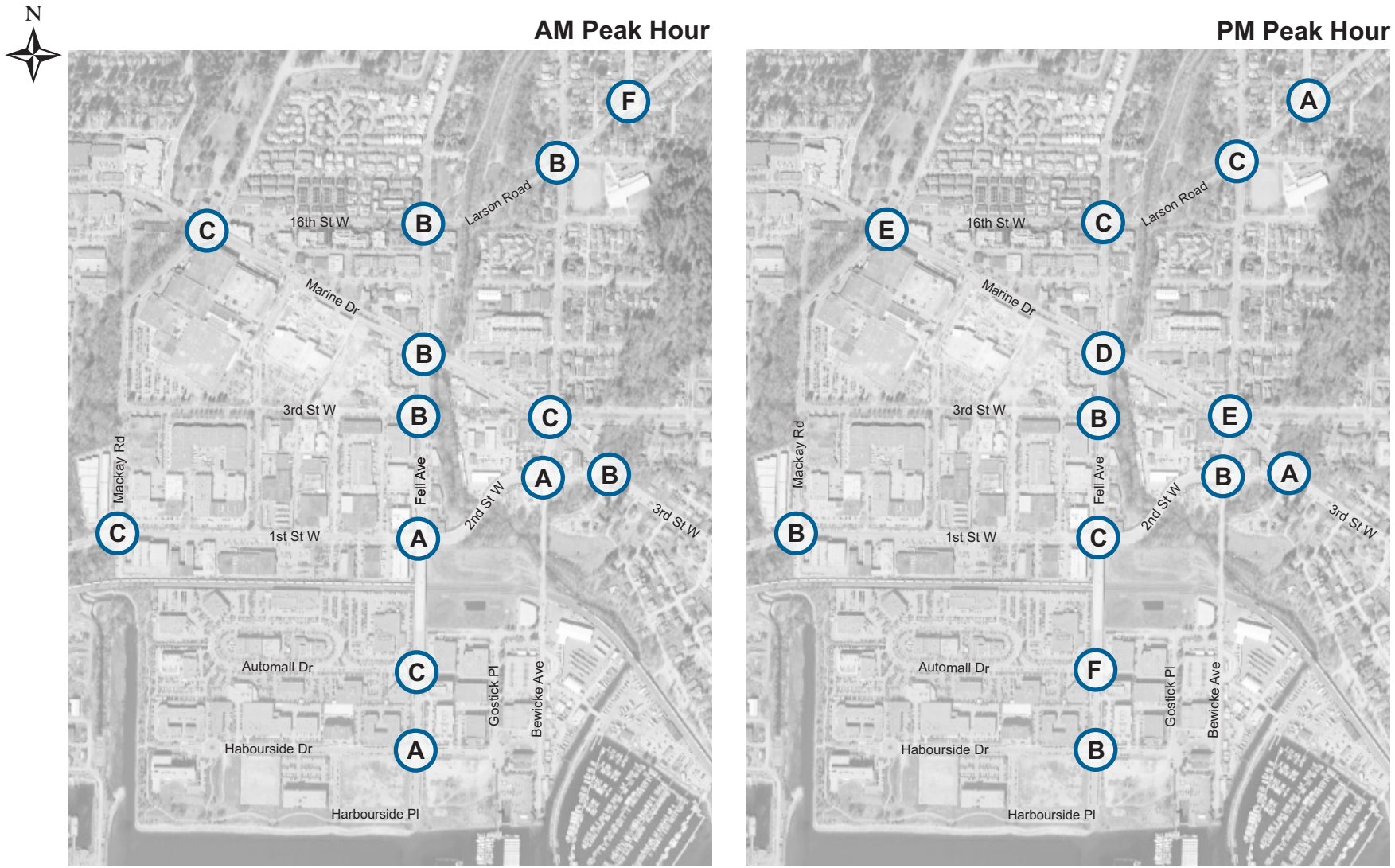

Exhibit 8.3

Level of Service - 2024 Background Traffic Flows

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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8.7 2024 Flows (1% growth per year) with the Development Plan

A summary of 2024 Total Traffic operations, with the development plan, is summarized in **Tables 8.4a, 8.4b & 8.4c** and graphically presented at **Exhibit 8.4**.

Table 8.4a: 2024 Total with Development Capacity Operations - Harbourside Area

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Fell Ave & 1st St	Overall	0.63	B	-	**0.91**	D	-
	EB TR	0.30	D	√	**0.90**	C	√
	WB L	0.52	A	√	0.73	D	√
	NB LTR	0.81	C	√	**0.96**	D	√
	SB LTR	0.69	A	√	**0.93**	D	√
Fell Ave & Automall Dr (unsignalized)	Overall	-	-	-	-	-	-
	EB L	0.41	D	√	**<1.0**	**F**	**X**
	NB L	0.05	A	√	0.02	A	√
	SB R	0.18	A	√	0.11	A	√
Fell Ave & Harbourside Dr (4 way Stop)	Overall	-	B	-	-	C	-
	EB LTR	-	B	√	-	D	√
	WB LTR	-	B	√	-	B	√
	NB LTR		B	√		C	√
	SB LT	-	B	√	-	C	√
Harbourside Dr & Harbourside Pl (unsignalized)	Overall	-	-	-	-	-	-
	EB T	0.11	A	√	0.24	A	√
	WB T	0.00	A	√	0.00	A	√
	NB LR	0.24	B	√	0.35	B	√
Bewicke Ave & 2nd St	Overall	0.48	B	-	0.75	B	-
	EB LTR	0.24	A	√	0.72	A	√
	WB LTR	0.46	A	√	0.46	A	√
	NB LTR	0.55	C	√	0.83	D	√
	SB R	0.06	D	√	0.05	D	√
Fell Ave & 3rd St	Overall	0.34	B	-	0.58	B	-
	EB L	0.11	B	√	0.42	C	√
	NB LT	0.48	B	√	0.68	B	√
	SB TR	0.59	B	√	0.35	A	√
MacKay Rd & 1st Ave	Overall	0.59	C	-	0.62	B	-
	EB L	0.54	C	√	0.31	A	√
	WB TR	0.92	C	√	0.64	B	√
	SB LR	0.12	B	√	0.18	C	√

With the development in place, the existing operational challenges at the Fell Avenue and Automall Drive would be exacerbated and it would be prudent at an early point to introduce a new traffic light. Fell Avenue at 1st Street would still operate within a reasonable level of capacity, although the volume to capacity ratio is expected to increase to 0.91 (overall) from 0.71 before.

Fell Avenue at Harbourside Drive is expected to operate within capacity, however it can be monitored in the future to assess whether there is the need for a traffic signal. Having Fell Avenue operate as two-way north of mews will allow for a more balanced distribution of vehicle movements at this node and put less pressure on the left-turn movement on Harbourside Drive to Fell Avenue (west to north) in the afternoon peak-hour.

Table 8.4b: 2024 Total with Development Capacity Operations – Marine Drive Intersections

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Bewicke Ave & Marine Dr / Keith Rd	Overall	0.82	C	-	**<1.0**	**F**	-
	EB T	0.44	B	√	**<1.0**	**F**	√
	WB TR	0.87	C	√	**0.97**	E	√
	NB TR	0.50	C	√	**<1.0**	**F**	√
	SB L	0.84	D	√	0.77	D	√
	NWB LT	0.76	C	√	**1.00**	**F**	√
2nd St & Marine Dr	Overall	0.75	B	-	0.73	A	-
	EB R	0.22	A	√	0.56	B	√
	NB L	0.84	B	√	0.70	B	√
	SB TR	0.58	C	√	0.78	A	√
Fell Ave & Marine Dr	Overall	**0.95**	D	-	**<1.0**	**F**	-
	EB TR	0.69	C	√	**<1.0**	**F**	√
	WB L	**<1.0**	**F**	√	**<1.0**	**F**	√
	NB	0.65 (L)	C	√	**<1.0 (T)**	**F**	**X**
	SB LTR	0.83	C	√	**0.94**	C	√
West 16th St & Marine Dr	Overall	0.84	C	-	**0.99**	**F**	-
	EB L	0.83	D	√	**<1.0**	**F**	**X**
	WB TR	0.82	B	√	**<1.0**	**F**	√
	NB L	0.16	B	√	0.53	C	√
	SB	**0.94 (R)**	E	√	0.55 (LT)	D	√

Table 8.4c: 2024 Total with Development Capacity Operations – Larson Road Intersections

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Fell Ave & West 16th St	Overall	0.74	B	-	0.82	B	-
	EB L	0.25	B	√	0.57	C	**X**
	WB L	0.73	A	√	0.85	C	**X**
	NB	0.13 (R)	D	√	0.84 (LT)	C	√
	SB	0.79 (TR)	C	√	0.82 (L)	**F**	√
Westview Dr & Larson Rd	Overall	0.83	**F**	-	0.86	D	-
	EB L	0.63	A	**X**	0.85	A	**X**
	WB TR	0.37	B	√	**<1.0**	**F**	√
	NB LTR	0.34	C	√	0.14	D	√
	SB R	**<1.0**	**F**	**X**	0.51	A	√
Bewicke Ave & Larson Rd	Overall	0.77	B	-	0.93	D	-
	EB T	0.75	C	√	**<1.0**	**F**	√
	WB L	0.70	A	√	0.80	D	**X**
	NB LTR	0.65	C	√	0.77	B	√
	SB LTR	0.04	C	√	0.05	C	√

The Larson Road's intersections at Westview Drive and Bewicke Avenue are expected to be over capacity with the development plan projections along with the application of traffic growth and committed developments in addition to those intersections highlighted already in Tables 8.3b and 8.3c. In Table 8.7 a mitigation measure is proposed to improve vehicle flow at the Westview Drive and Larson intersection.

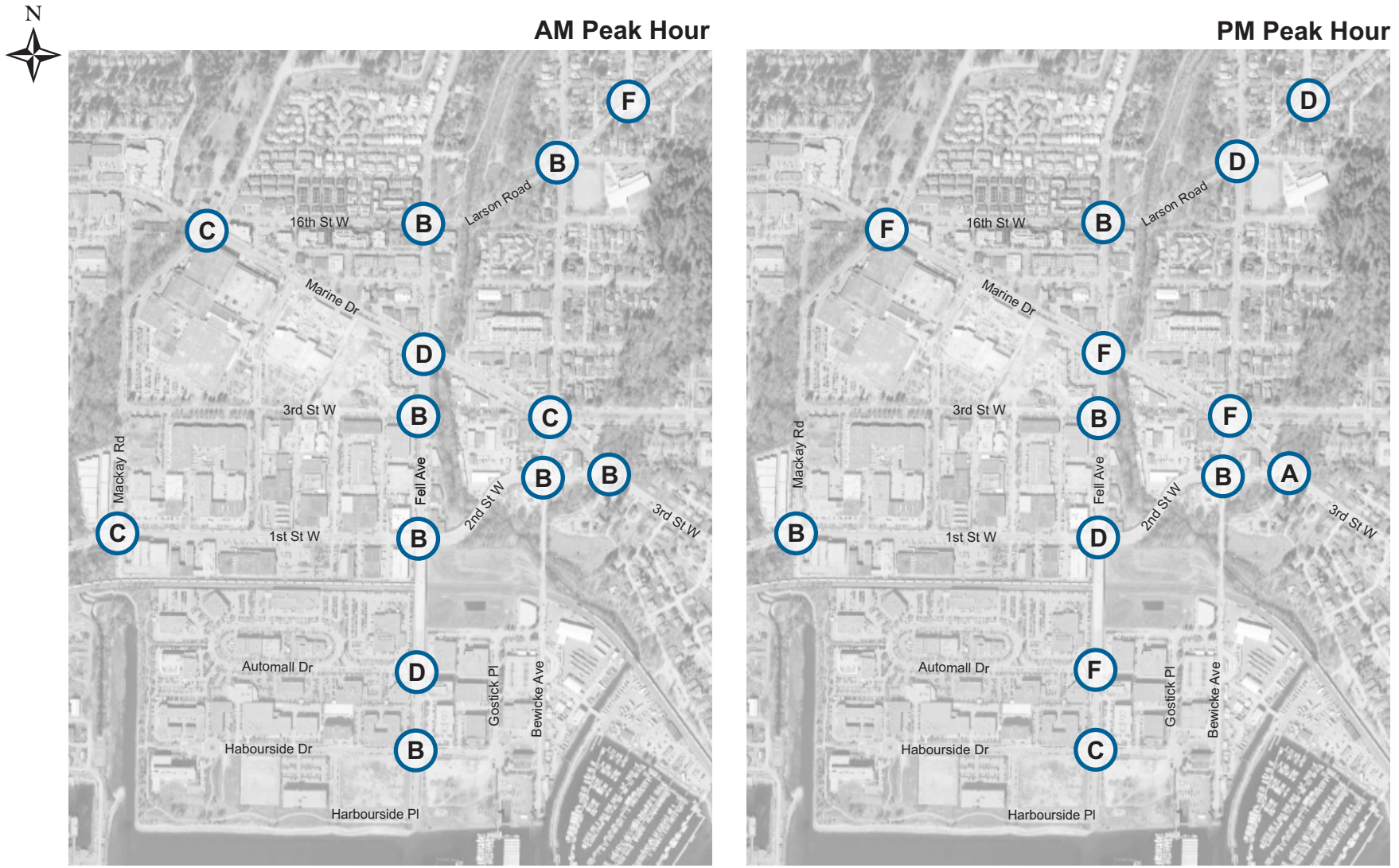

Exhibit 8.4

Level of Service - 2024 Total Traffic Flows

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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8.8 Residential Sensitivity Test

The City of North Vancouver requested consideration be given to the residential rate for the ITE category #230, and this has been done as a 'sensitivity test' as the land use is not consistent with the planned form of residential use at Harbourside. Further, the ITE category #230 is appreciably higher than local observations from sites that share similar characteristics.

The focus for this exercise is at the Fell Avenue / 1st Street and Bewicke Avenue / 2nd Avenue intersections as these are the two main points of access for Harbourside and, as such, most sensitive to the development vehicle changes. Results from the test are presented in the context the proposed rate in **Table 8.5**.

Table 8.5: Residential Sensitivity Test

Intersection		AM Peak Hour			PM Peak Hour		
		Int. V/C	Int. LOS	Overall Int. Delay (sec)	Int. V/C	Int. LOS	Overall Int. Delay (sec)
Fell Ave & 1st St	Proposed Rate	0.81	B	16.6	0.87	C	34.1
	Sensitivity Test	0.85	B	17.5	0.90	D	41.8
Bewicke Ave & 2nd St	Proposed Rate	0.48	A	7.2	0.75	B	17.5
	Sensitivity Test	0.49	A	7.5	0.76	B	17.7

Clearly, the sensitivity test indicates the higher rate would only have a modest influence on operations and this can reviewed in the monitoring study.

8.9 Mitigation Measures

Proposed mitigation measures on the study network are either triggered by existing demands, traffic growth (including committed developments), or by the development plan.

Before covering mitigation measures on the study network intersections, it is important first to focus on the intersection at 1st Street and Fell Avenue as this is the main point of concern expressed by the community. Twp proposed mitigation measures have been developed to accommodate the new demands

in the afternoon peak-hour period (morning period is not an issue) and in particular on the Fell Avenue over bridge. Measures reviewed are summarized below:

- Restricting the left-turn southbound movement on Fell Avenue to First Avenue in the afternoon peak period (only); and,
- Widening the bridge structure on the east side (Works Yard) to accommodate a right-turn lane and allow the straight ahead / middle lane to run more freely.

These changes are shown at **Exhibit 8.5** and would form part of the monitoring agreement (outlined at the end of this section), and an operational summary is presented in **Table 8.6** based on retaining as close as possible the balance of green time allocated to the east-west movements (priority to the City) and north-south movements.

Table 8.6: 1st & Fell Intersection Review - Total 2024 PM Balanced Green Time (1-2 seconds)

Movement	PM Peak Hour								
	Existing Laning			Banned SBL			New NBR Lane		
	V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Overall	**0.91**	D	-	0.89	C	-	0.78	C	-
EB TR	**0.90**	C	√	0.84	C	77	0.74	C	76
WB L	0.73	D	√	0.80	D	29	0.64	B	20
NB LT	**0.96** (LTR)	D	√	0.94 (LTR)	D	89	**0.80***	C	65
NB R	-	-	-	-	-	-	0.28	B	24
SB LTR	**0.93**	D	√	0.45 (TR)	B	22	0.85	D	70

The banned southbound lane (SBL) is expected to provide significant benefits but it is acknowledged that this would only be a temporary measure. The City preference is expected to be the widening of the south-leg for a new NB right-turn lane and modelling for this indicates no operational issues. Further work has been done to better model the northbound left-turn movement and the following provides an overview on what has been undertaken.

In practice vehicles typically make a left-turn movement (approx. 1 to 2 per cycle) at the end of the protected/permissive phase and this is known as an 'intergreen discharge'. HCM 2000 calculations do not

account for this and therefore a test model was run to get a better understanding of the NB left-turn approach operation. With the intergreen discharge, the approach is expected to have 40 less vehicle movements than the model suggests, or equivalent to 1 vehicle per cycle (i.e. 40 cycles per hour for an 88 second cycle length). The result shows the v/c ratio on the NB left-turn movement reducing to 0.80 (from 0.97). The intersection will therefore not exceed the 0.90 v/c ratio threshold during the afternoon peak hour and this result could improve even further with a small shift in the allocation of green time at the intersection from the east / west approaches. In sum, the intersection will operate well within capacity with an overall v/c ratio of 0.78.

The City of North Vancouver has suggested consideration be given to the widening of the north leg of the 1st Street and Fell Avenue intersection, but the results of the widening on the south-leg show that no further capacity measures are required for accommodating the development plan.

On the west leg of the intersection, the City has suggested extending the two through travel lanes to Donaghy Avenue and this can be achieved within the existing curb to curb width on the basis that the cross section at the stop line is acceptable downstream. This change can be included as part of the bus infrastructure measures and is likely to also have a modest benefit to capacity.

Mitigation measures for the study area are summarized in **Table 8.7**.

Table 8.7: Summary of Mitigation Measures Planned

Intersection	Mitigation	Trigger Point		
		Existing	Background Growth	Development
Fell/ Marine	Northbound approach is repainted to left, through and through-right laning, section of parking is restricted (between 3pm-6pm) on north leg to accomodate two receiving lanes	No	Yes	-
Fell / 1st	Interim measure to restrict southbound left movements(afternoon peak) and add right-turn bay northbound based on monitoring	No	No	Reviewed through monitoring
Fell/ Automall	New traffic light within the existing street geometry	Yes	-	-
Westview / Larson	Phasing change	No	Yes	
Bewicke / Marine / Keith	Ban northbound left-turn (Bewicke) and remark lanes to through and right	No	Yes	-
Fell / Harbourside	Potential future traffic light	No	No	Reviewed through monitoring

The operational review with the application of these mitigation measures is presented at **Table 8.8.**

Table 8.8: Results of the Mitigation Measures on Operations, 2024 Total Traffic Flows

Intersection	Movement	AM Peak Hour			PM Peak Hour		
		V/C	LOS	95th Percentile Queue (m)	V/C	LOS	95th Percentile Queue (m)
Fell Ave & Marine Dr	Overall	0.87	C	-	**0.96**	D	-
	EB TR	0.81	C	√	**0.99**	D	√
	WB L	**0.92**	D	√	**0.96**	E	√
	NB TR	0.34	B	√	**0.95**	E	√
	SB LTR	0.87	C	√	**0.94**	D	√
Fell Ave & Automall Dr	Overall	0.42	A	-	0.67	B	-
	EBL	0.46	C	√	0..63	C	√
Westview Dr & Larson Rd	Overall	0.84	B	-	0.83	A	-
	SB R	0.92	C	√	0.61	A	√
	WB TR	0.63	C	√	0.42	C	√
Bewicke Ave & Marine Dr / Keith Rd	Overall	0.80	C	-	0.84	D	-
	EB T	0.44	B	√	0.88	C	√
	WB TR	0.87	C	√	0.84	D	√
	NB R	0.33	C	√	0.67	D	√
	SB L	0.81	D	√	0.71	B	√
	NWB L	0.73	C	√	**0.98**	**F**	√

Exhibit 8.6 illustrates these results graphically and the following provides a review of the expected timing of these measures.

Automall Drive at Fell Avenue traffic light would benefit the existing operations and, as such, would not be triggered by the future scenarios. A proposed layout is presented at **Exhibit 8.7** and can be accommodated within the existing curb layout, which was recently amended with new curb build-outs.

The Fell Avenue at Marine Drive change suggested at **Exhibit 8.8** can be accommodated under the development plan given the importance of this corridor for the accessibility to the area. The City of North Vancouver recently introduced a similar change to the north leg on Fell Avenue and it proposed to do

likewise on the south leg. It can be accommodated through amending the existing pavement markings, modifying curbs, and may need alterations to the traffic signal configuration (i.e. changing the EBL from permissive to permissive-protected and allow lead/lag; optimize signal offsets and splits).

Additionally, the City requested consideration to the north leg of this intersection being widened from 4 to 5 travel lanes (including 3 southbound). But the available Right-of-Way is only 20-metres and therefore would only leave around 2 to 2.25 metres for sidewalk and landscaping on each side. Further it would increase the crosswalk distance along the Frequent Transit Corridor, which is not considered desirable.

Moreover, the capacity at this intersection is impacted as much by the application of traffic growth and other development plans, including the new residential on the adjacent former works yard. Removing this background traffic indicates that with the development plan's new movements along with the mitigation measure proposed on the south leg, it would operate with an overall LOS of C and v/c at 0.87 in the afternoon peak-hour (the morning period is not an issue). Indeed, the only movement with a v/c over 0.93 is the westbound left-turn movement and even here the LOS is D. In essence, the proposed mitigation measure more or less offsets the development's impact.

At Bewicke Avenue and Marine Drive, it is suggested that the low volume left-turn movement (19 vehicles in the am and 34 vehicles pm - 2024) from Bewicke Avenue (south) to Marine Drive (west) could be banned, freeing-up the left-turn lane for straight-ahead movements, while the curb lane would be allocated for right-turn movements. Banned left-turn movements could either be diverted via West 14th (not favoured by the City) or by undertaking a right-turn movement to Marine Drive and then right-turn back to West 2ndAvenue.

These changes are reviewed in the context of pedestrians, cycling, and intersection geometry later in the section.

8.10 Review of Transit & Truck Delays on Marine Drive at Fell and Keith / Bewicke

At the City of North Vancouver's ITC meeting along with TransLink's feedback at the OCP, it was identified that the development plan should aim to minimize delays to bus and truck movement along Marine Drive and the following covers this in the context of the planned mitigation measures.

Table 8.9 presents an operational delay review at the intersections on Marine Drive at Fell Avenue and Keith / Bewicke Avenue for the design Year 2024, where the development plan is projected to add around 5% new movements. It covers scenarios without and with development flows plus mitigation measures outlined earlier for these intersections.

Table 8.9: Operational Delay Review on Marine Drive

Location	Scenario	Overall Int. Delay (s)	Overall LOS	Delay at Marine Drive Approaches (s)	Delay at Keith Road Approaches (s)
Fell Ave & Marine Dr	2024 Background PM without development (no mitigation)	36.5	D	40.9 (EB) 24.3 (WB)	N/A
	2024 Total PM with development (with suggested mitigations)	43.7	D	51.5 (EB) 29 (WB)	N/A
Bewicke Ave & Marine Dr & Keith Rd	2024 Background PM without development (no mitigation)	57.5	E	32.4 (EB) 92.6 (NWB)	32.4 (EB) 50.7 (WB)
	2024 Total PM with development (with suggested mitigations)	36.5	D	18.1 (EB) 80.6 (NWB)	18.1 (EB) 37.6 (WB)

Evidently, the mitigation measure planned at Bewicke Avenue / Marine Drive / Keith Road offset the influence of the new development flows in terms of delays through the intersection, and which includes bus and truck movements. Delays at the Marine Drive / Fell Avenue intersection are partly offset, but the overall delay is less than that observed at Marine / Bewicke / Keith while it operates with a LOS of 'D'.

8.11 Fell Avenue Function

With the rezoning plan in place along with other development influences, the City of North Vancouver requested that consideration be given to the function of Fell Avenue between Harbourside Drive and Marine Drive.

Table 8.10 summarizes the existing and projected vehicle volumes along Fell Avenue along with the current travel lane configurations.

Table 8.10: Fell Avenue Functional Review

Street Section	Design-ated Users	Class-ification	Travel Lanes	Curb to Curb width	Existing		Future	
					AM	PM	AM	PM
Marine to 3rd	Bike	Arterial	4	15 to 16.5 metres	1070	1070	1410	1525
3rd to 1st	Bike	Arterial	2 + 2 parking	13.5 metres	790	875	1050	1245
1st to Automall	Bus	Local	4	15.5 metres	1060	1180	1485	1750
Automall to Harbourside	Bus	Local	2 + 2 parking	2 + 15.5metres	680	660	1110	1235

Vehicle volumes are expected to increase on all sections of Fell Avenue with the projected build-out of the rezoning plan along with the committed developments (summarized in the previous section), including the residential development plan at the existing Works Yard (which is accessed primarily at 3rd Street and Fell Avenue).

Projected volumes on the 2-lane section between Harbourside Drive and Automall Drive are expected to be broadly similar to that currently observed on the 2-lane section between 1st Avenue and 3rd Avenue. The highest volumes are observed on the 4-lane sections (Automall Drive to 1st Avenue and 3rd Avenue to Marine Drive) but on a per lane basis they are lower than the two other sections reviewed.

Typically operational capacity (per lane) in urban areas is 600 to 800 vehicles per hour, and this would indicate the current laning is adequate for the projected volumes.

Fell Avenue is designated as a Arterial Route between 1st Avenue and Marine Drive while the sections south are not currently designated. Similar to Bewicke Avenue, Copping to 2nd Avenue, the section of Fell Avenue between Harbourside Drive and 1st Avenue could be designated as 'Collector' with respect to the number of business it serves.

Fell Avenue is identified as an existing bike route between 1st and Marine Drive but has no designated facilities. With the new Mackay Creek overbridge and the planned Greenway treatments on Bewicke Avenue, consideration should be given to removing this designation from the OCP and identifying the two adjacent parallel routes.

Fell Avenue is a bus route between 1st and Harbourside Drive and there is sufficient lane width available, i.e. 3.7 metres, to accommodate buses.

8.12 Safety Review

The following table summarizes the planned mitigation measures for intersections on the study network in the context of their influence pedestrians, cyclist and, intersection geometry. It provides a high-level review at this stage of the design process to identify key considerations and a more detailed assessment can be undertaken at the design stage.

Table 8.11: Mitigation Measure Safety Review

Intersection	Mitigation	Pedestrians	Cyclists	Vehicle Geometry
Fell / Marine	Lane marking change within existing the existing roadway	Crosswalk distances and cycle length remain unchanged	Marine Drive bike lanes unaffected	Lane alignment satisfactory and turning radii unaffected
Fell / 1st	Widening of south leg to 5 lanes	Cycle length remains unchanged but the widening on this leg will increase the crossing time; offset partly by the potential local widening on the east sidewalk on Fell	Bike lanes on 1st unaffected and there is sufficient width on the southbound lane (5m) to allow a vehicle to pass a cyclist.	Corner radii at the southwest corner improved and lane alignment satisfactory
Fell / Automall	New traffic light	Potential increased waiting delays (to cross), but would be offset with controlled crossing points	Planned controlled environment would benefit cyclists	Laning unchanged
Westview / Larson	Phasing change	Crosswalk distances and cycle length remain unchanged	No expected influence on cycling movements	Laning unchanged
Bewicke / Marine / Keith	Lane marking change within existing the existing roadway	Crosswalk distances and cycle length remain unchanged	Add bike box to complement the north leg	No expected alignment issues and turning radii remain unaffected
Fell / Harbourside	Corner build-outs on the south east and west corridors and potentially a future signal and one-way south leg	Crosswalk distances reduced and potential for future controlled movements	Planned controlled environment would benefit cyclists	No alignment issues and overall turning movements reduced with one-way section
Harbourside Drive / Harbourside Place	Corner build outs on the south side to complement the existing north side build-out	Reduced crosswalk distances	Travel lane width of 4 metres at build-outs will provide sufficient comfort for cyclists	No alignment issues and the build-outs will assist with visibility on the south-leg

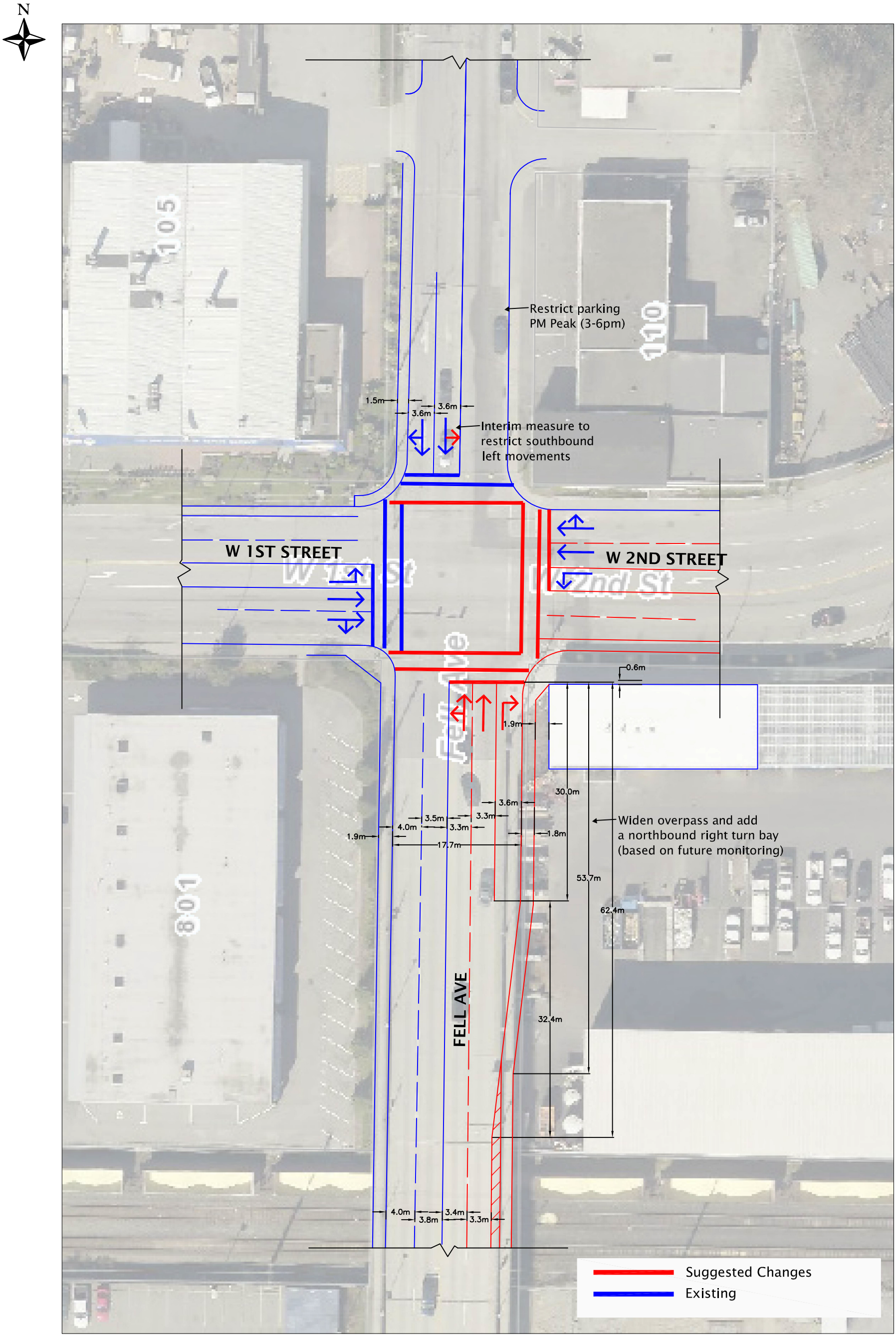

Exhibit 8.5

Suggested Intersection Changes - Fell Avenue & 1st Street

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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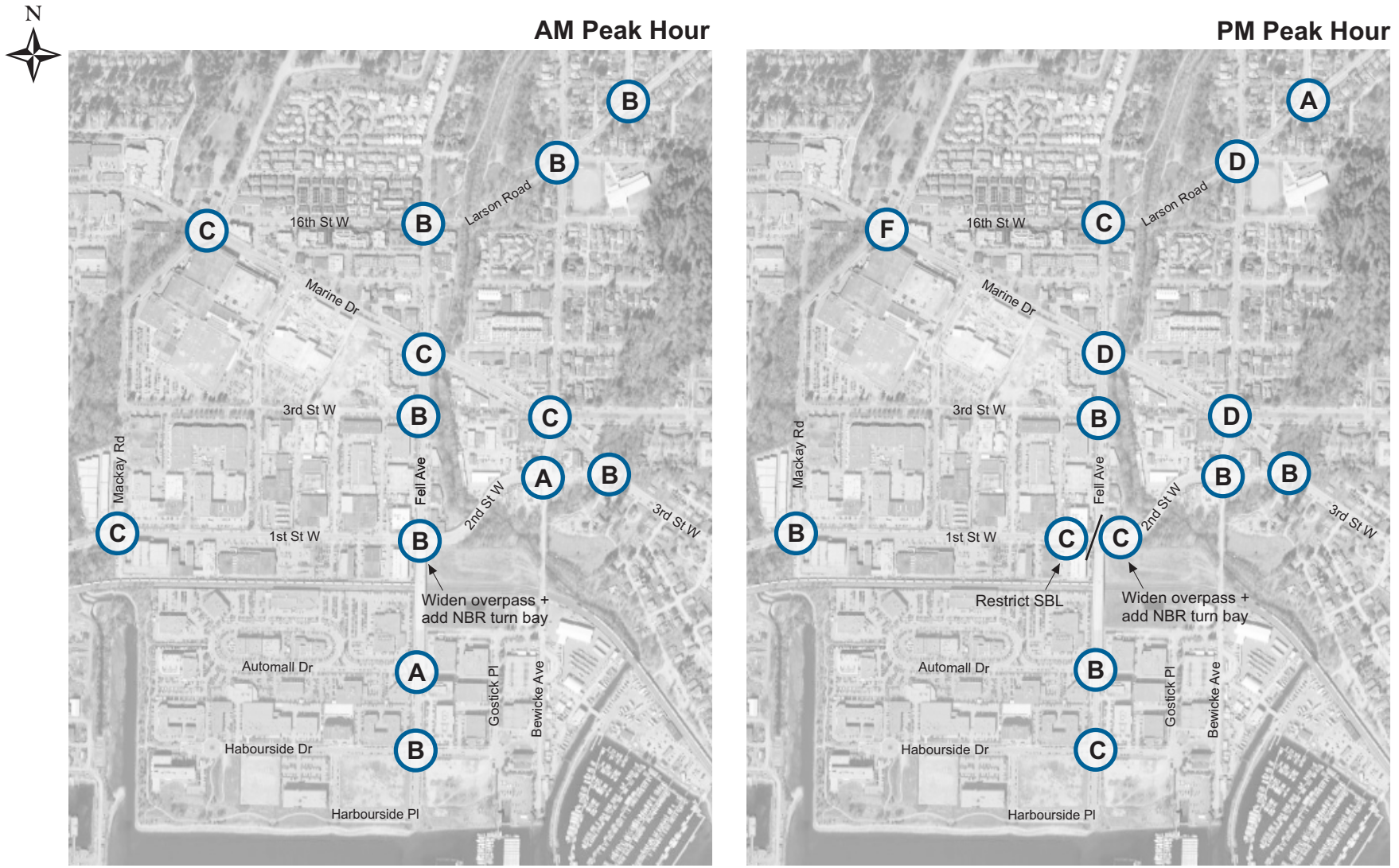

Exhibit 8.6

Level of Service - 2024 Total Traffic Flows (with suggested changes)

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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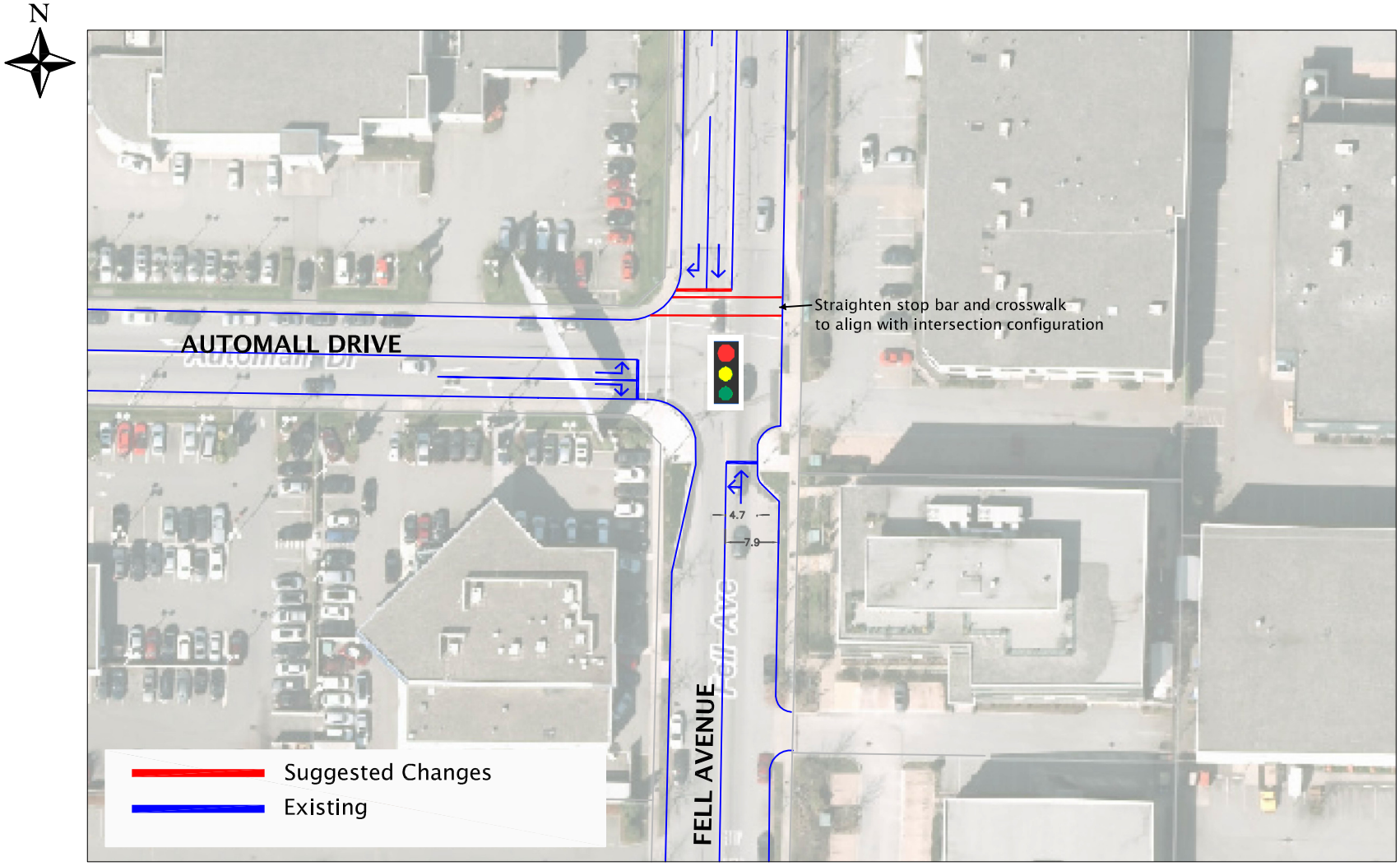

Exhibit 8.7

Suggested New Signal Intersection - Fell Avenue & Automall Drive

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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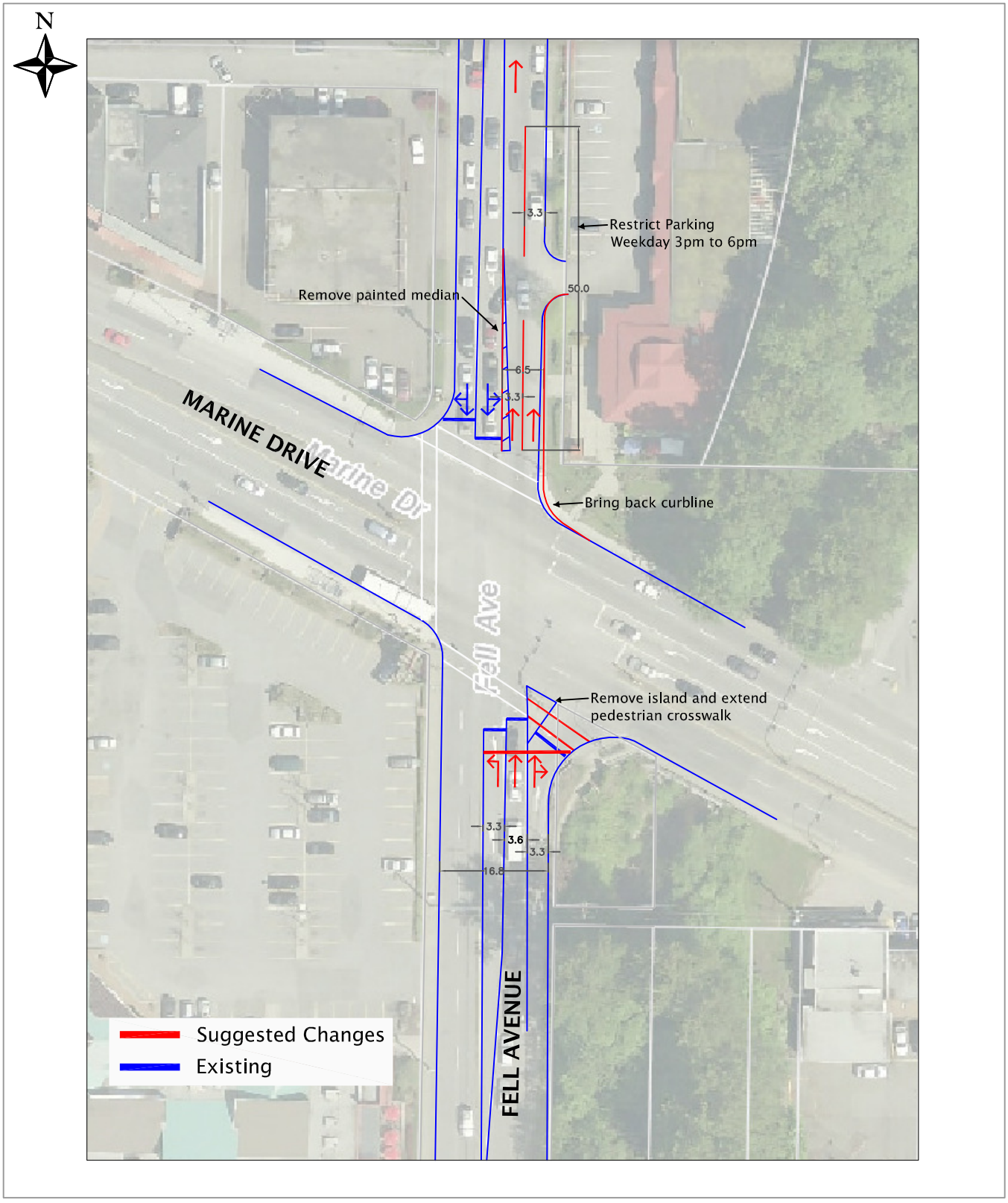

Exhibit 8.8

Suggested Intersection Change - Fell Avenue & Marine Drive

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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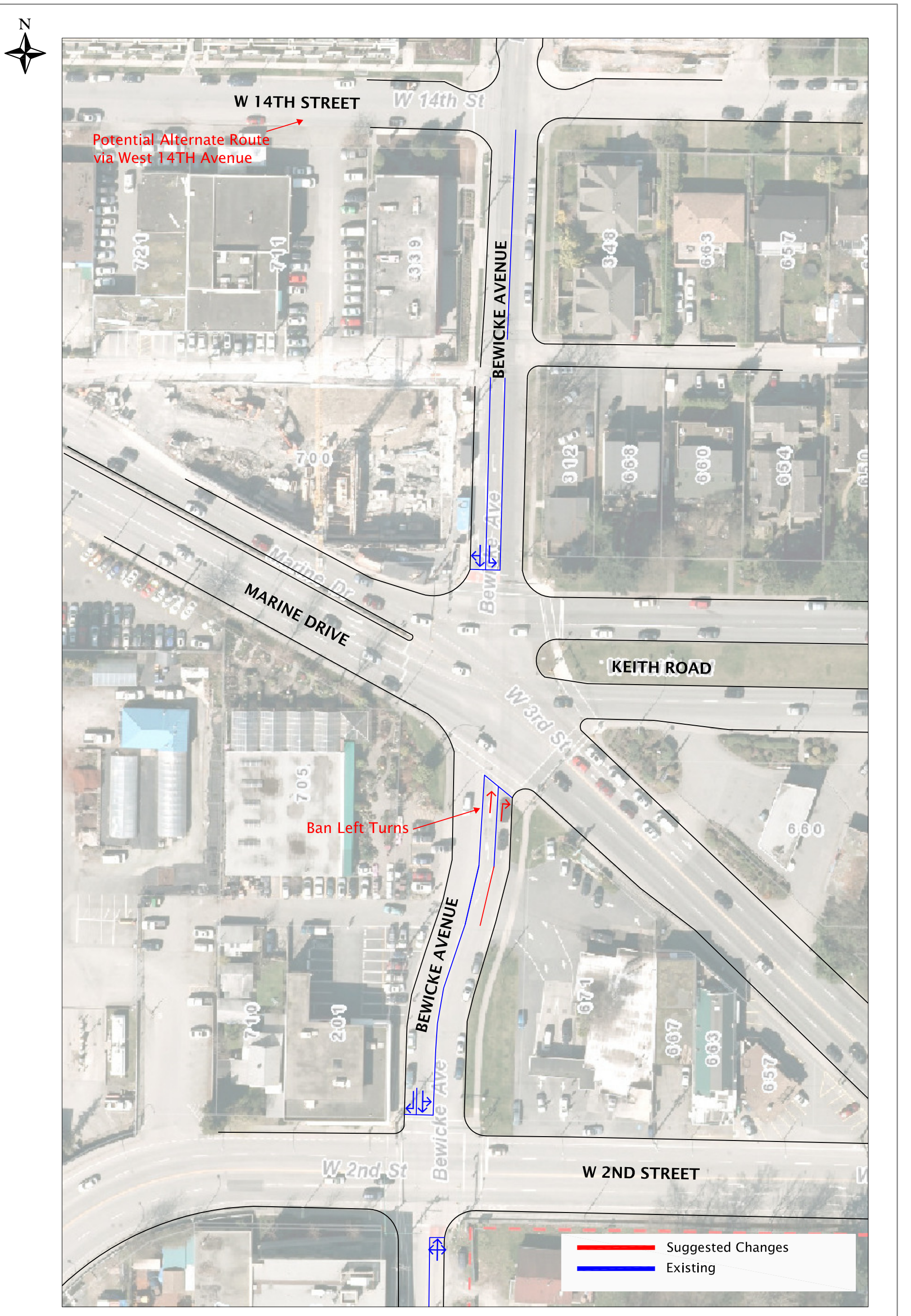

Exhibit 8.9

Suggested Intersection Change - Beewicke Avenue / Marine Drive / Keith Road

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

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8.13 Transportation Monitoring Plan

Consistent with other master plan projects developed over extended periods of time, Harbourside is expected over a 10 to 15-year period. It is therefore prudent to review the transportation projections made at the Rezoning Stage, as the development builds out to assess whether further mitigation measures are necessary or if the proposed measures need refocused.

The study area for the assessment is planned for the Harbourside area, where the development plan has the most immediate impact (i.e. over 10% change in vehicle volumes), and where majority of concerns have been expressed with regard to street operations.

Covered earlier in Section 6 was the Travel Coordinator responsibilities and part of these will include keeping a database of information to share with the City of North Vancouver. It will allow the City to have access to regular updates (perhaps every 6 months depending on build-out progress) relating to existing and new travel patterns (by mode), ride-sharing participation, and parking use (street and off-street) through the collection of local counts. Transit use would be obtained from TransLink and supported with travel data collected from local businesses (i.e. email surveys).

This information will chart the progress of the development plan and allow the City is clearly understand the influence this has on new vehicle movements and parking demand.

In addition to the regular travel coordinator data collection, a more comprehensive set of surveys are planned at three milestones during build-out (by an approved Transportation Consultant) and these will agreed with the City; likely based on the development proportion completed, i.e. at one-quarter, one-half, and three quarters build-out. This metric is considered the best proxy given the timeline and phasing are both expected to change given market conditions.

Survey details are expected to cover the following items:

- Intersection transportation counts on Fell Avenue at Harbourside Drive, Automall Drive, and 1st Avenue (weekday 7am to 10am and 3pm to 6pm);
- Intersection count at Harbourside Drive and Harbourside Place (weekday 7am to 10am and 3pm to 6pm);
- Counts on Bewicke Avenue at the railway crossing and the 2nd Avenue intersection(weekday 7am to 10am and 3pm to 6pm);
- Street parking survey count (weekday 9am to 6pm) to cover all streets within Harbourside along with onsite parking for the development plan (completed at that point);
- Review of safety at the Bewicke rail crossing, including whether people are walking alongside the rail tracks;

- Questionnaire Survey for new office employees and residents, covering vehicle use and ownership, travel mode, use of TDM measures, etc. (over a weekday);
- Review and assess TransLink's bus ridership data for #231 and compare with baseline before the first building is beneficially occupied; and,
- Preparation of a summary report, showing observed results in the context of the projections (based on trip rates from the rezoning report) and identify whether the thresholds outlined below have been triggered and hence more detailed work is required.

Trigger points for further detailed capacity analysis at Harbourside along with the potential mitigation measures area are to be based on:

- Reaching 720 new vehicle movements per hour (around 15% discount to 850 in Table 7.8) in the critical afternoon peak hour; and,
- 90% or more parking utilization on the combination of Harbourside Drive, Fell Avenue (south of Automall drive), Gostick Place and Harbourside Place for a period of 1-hour, or onsite. This threshold is realistic operations and consistent with the guidelines for application of theoretical capacity in car park design..

The applied discount for vehicle trips provides a safety bridge to allow sufficient time for review. Should the triggers be reached then detailed analysis would include: intersection operational modelling and mitigation measures; new Transportation Demand Management measures, improvements to parking management or supply, etc.

Trigger points are not appropriate for each phase of development as the report is based on the whole master plan along with the infrastructure planned to support it as set out in this document.

Information would be provided through the Travel Coordinator, who would be the point of contact for the City in obtaining feedback and supplementary information on the efforts of the TDM plan's implementation.

8.14 Summary

This section has identified the following mitigation measures on the study network:

- Fell Avenue and Marine Drive – lane changes
- Fell Avenue and 1st Avenue – widening and lane change
- Fell Avenue and Automall Drive – new traffic light
- Bewicke Avenue at Marine Drive and Keith – restricted turn and lane change

- Fell at Avenue Harbourside Drive – review future need for a traffic light
- Westview at Larson – Phasing Change

A safety overview identifies that the intersection mitigations are not expected to result with safety issues for pedestrians, cyclists, and vehicle movements.

Delays on Marine Drive, including for buses or trucks, can be mitigated with the planned changes and this would offset much of the new development movements (over a 10-year period).

Fell Avenue is recommended to be removed as a designated route (unmarked) for cyclists given the two lower volume / parallel routes options available on Bewicke and Mackay, while the section between 1st Avenue and Harbourside Drive should be designated as a 'collector'.

A monitoring plan has been developed for Harbourside that will provide opportunities to review the projections in this report and advise if further changes are required to manage future demands.

9. MULTI-MODAL ANALYSIS

9.1 Introduction

This section of the report undertakes the multi-modal analysis for the rezoning application employing the NCHRP Report 616 and HCM 2010 procedures for assessing bicycle and pedestrian LOS as required by the City of North Vancouver's Terms of Reference.

The review focuses on the external connections to the master plan within Harbourside and is equivalent to a 400 / 500 metre walk distance. Future year growth projection is based on the same methodology used in the Mountain Equipment Co-op report (dated March 2011, City of North Vancouver), where the overall new floor area is factored-up against the existing at Harbourside components, for future demands.

With the new street design planned for the master plan, the review is more focused on best practices in urban design and especially in the context of creating a pedestrian-oriented design where pedestrians and cyclists share street space more equitably.

Transit projections are also considered in this section using the base data collected from TransLink and local surveys.

9.2 Background

Bicycle and pedestrian Level of Service (LOS) are based on the NCHRP Report 128 and 616 Multi-modal Levels of Service (MMLOS) for Urban Streets: Users Guide (Richard Dowling / TRB) methodology published in November 2009 and updated in January 2010. The Report 616 methodology has been integrated into the new 2010 Highway Capacity Manual in assessing comparative LOS for different modes. Bunt has created a spreadsheet that allows these calculations to be made in a consistent manner.

The methodology predicts level of service for both auto and non-auto modes on urban streets based upon user feedback and "normalizes" LOS across modes. Quality of service is defined as:

> "An indicator of the traveling public's perceived degree of satisfaction with the travelling experience provided by the urban street under prevailing demand and operation conditions. Quality of service is a selfish measure. It considers only the perspective of the traveler or the prospective traveler. It does not take into account how many people will actually use the facility or how expensive it is to the agency and the general public to provide the facility. It does not consider environmental concerns or collision rates.
>
> Quality of service is therefore only one of several factors that must be taken into account in good design and planning practice. It is NOT the be all and end all of design or planning. Planning and design must take into account additional factors like capacity utilization, accessibility, safety, cost-effectiveness, the effect on the environment, and each agency's goals and objectives.

> Level of service results must be evaluated in the context of other planning and design considerations. Level of service .F, by itself, does NOT mean that there is a problem that the agency must fix. Similarly, level of service .A, by itself, does NOT mean that there are no problems"
>
> Source (*2009; NCHRP Multimodal Level of Service Analysis for Urban Streets: Users Guide; R. Dowling; p.2-3*)

In addition this methodology is not considered appropriate for local (or residential) streets with low volume / speed and where pedestrian (and cyclists) form part of the shared street space. Survey data collected in the development of this tool is more focused on higher volume streets, where consideration for pedestrian and bicycle facilities is needed to improve the comfort level for those users.

All these points are important considerations when reviewing the analysis in this section and making conclusions.

Parameters used in the assessment for both the pedestrian and cyclist LOS are presented in the following **Table 9.1.**

Table 9.1: Parameters Used In NCHRP Report 616 to Calculate Pedestrian and Cyclist LOS

Road layout and Geometry	Traffic Information	Pedestrian Information
Vehicle speed	% of right turning vehicles	Pedestrian speed
Distance between intersections	% of left turning vehicles	Pedestrian volume
Crossing distance at intersections	Peak hour factor	Pedestrian delay
Pavement conditions	Cross street volume	Cycle length
Control type (e.g. Signals)	Number of lanes on cross street	Green time
Area type (e.g. Suburban)	% of heavy vehicles	
Road Cross - section Dimensions	Average Annual Daily Traffic Flow	
	% of block with on-street parking	
	Number of driveways on block	

This table does take into consideration gradients and railway crossings which are two important matters for Harbourside, along with environmental factors (buildings, parking lots, scenery, etc.). Also, it does not take account accessibility requirements for mobility impaired people.

Overall pedestrian LOS for urban streets is based on a combination of pedestrian density and non-density factors with the overall pedestrian LOS found by taking the worse of the density LOS and non-density LOS. It considers pedestrian space and pedestrian flow rate, while the non-density LOS includes the segment LOS, the intersection LOS and a roadway crossing difficulty factor.

Each side of the street and each block are considered separately. Below is a summary of the different components that make up the overall pedestrian LOS:

- Pedestrian Density LOS – is a measure of space, measured in square feet per person, and flow rate, measured in people per minute per foot;
- Pedestrian Segment LOS – is determined by the perceived separation between pedestrians and vehicle traffic. While higher traffic speeds and traffic volumes reduce the perceived separation, physical barriers such as parked cars help to increase the perceived separation;
- Pedestrian Intersection LOS - is analyzed for signalized intersections only and is a measure of the conflict between vehicles and pedestrians crossing the road. The intersection LOS is worse when there are higher vehicle turning volumes, more lanes to cross and longer signal cycle times resulting in greater pedestrian delay; and,
- Roadway Crossing Difficulty Factor – this measures the difficulty of crossing the street between two intersections.

Table 9.2 illustrates typical operational capacity of sidewalks associated with pedestrian flows.

Table 9.2: Parameters Used In NCHRP Report 616 to Calculate Sidewalk Capacity

Minimum sidewalk space per person (sq. m./person)	LOS Score
5.5	A
3.7	B
2.2	C
1.4	D
0.8	E
0	F

The procedure to determine bicycle LOS is simpler and the assessment reviews just the intersection LOS and the directional segment LOS. Intersection and segment bicycle LOS are combined in a formula which also includes a factor related to the number of driveways encountered per block.

Both the pedestrian and cyclist LOS is calculated as a number (unit-less) where the number range relates to a LOS category. The same number range and LOS is used for both pedestrians and cyclists, and these are provided in **Table 9.3**. As shown, the number range for each letter is small and therefore sensitive to minor changes, so the score is reported with the LOS for completeness.

Table 9.3: Pedestrian and Cyclist LOS Numerical Equivalents

Level of Service	Numerical Score
A	≤ 2.00
B	> 2.00 and ≤ 2 .75
C	> 2.75 and ≤ 3.50
D	> 3.50 and ≤ 4.25
E	> 4.25 and ≤ 5.00
F	> 5.00

Source: NCHRP Report 616: Multimodal Level of service Analysis for Urban Streets

9.3 Multi-modal Projections for External Trips

The non-auto mode splits is assumed to remain the same with the proposed development and this position is conservative given the ITE trips rates that have been applied, which are essentially 90% auto based compared to Harbourside at around 68% for the employment use.

The growth factor is based upon the projected increase in gross floor area (similar to the Mountain Equipment Co-op project). This is presented in **Table 9.4** and represents a **67%** increase over the existing Harbourside Area floor area (excluding Automall).

Table 9.4: Floor Area Growth 2024 (build-out)

Harbourside	Gross Floor Area (sq. ft.)
Existing	630,000
Proposed	1,165,000
Adopt 10% addition to be conservative	1,280,000
Total	1,910,000
Growth Rate	**1.67**

This growth factor is only applied to the external projections to the master plan area. Within the master plan, a more 'qualitative' assessment is produced as the projected demands are expected to more complex and especially with the urban design and retail influences.

9.4 Multi-Modal Analysis

The analysis has been separated into two categories based on the pedestrian and cycling data available:

1. **External Links**: covers urban streets within Harbourside that connect to 1st Street / 2nd Street, including Fell Avenue, Bewicke Avenue, Copping Street and Gostick Place and includes the growth factor in Table 9.5.

2. **Master Plan**: covers streets within the master plan, including Harbourside Place, Fell Avenue, and Harbourside Drive. This assessment is focused on good design practice for pedestrian and bicycle movements on slower moving streets.

Exhibit 9.1 illustrates the intersections and segments included in this multi-modal analysis, identifying cross-section locations corresponding to the existing/future level of service output tables.

S:\PROJECTS\4025-32 Harbourside Rezoning\Deliverables\Draft Reports\August 2013 Update\Graphics

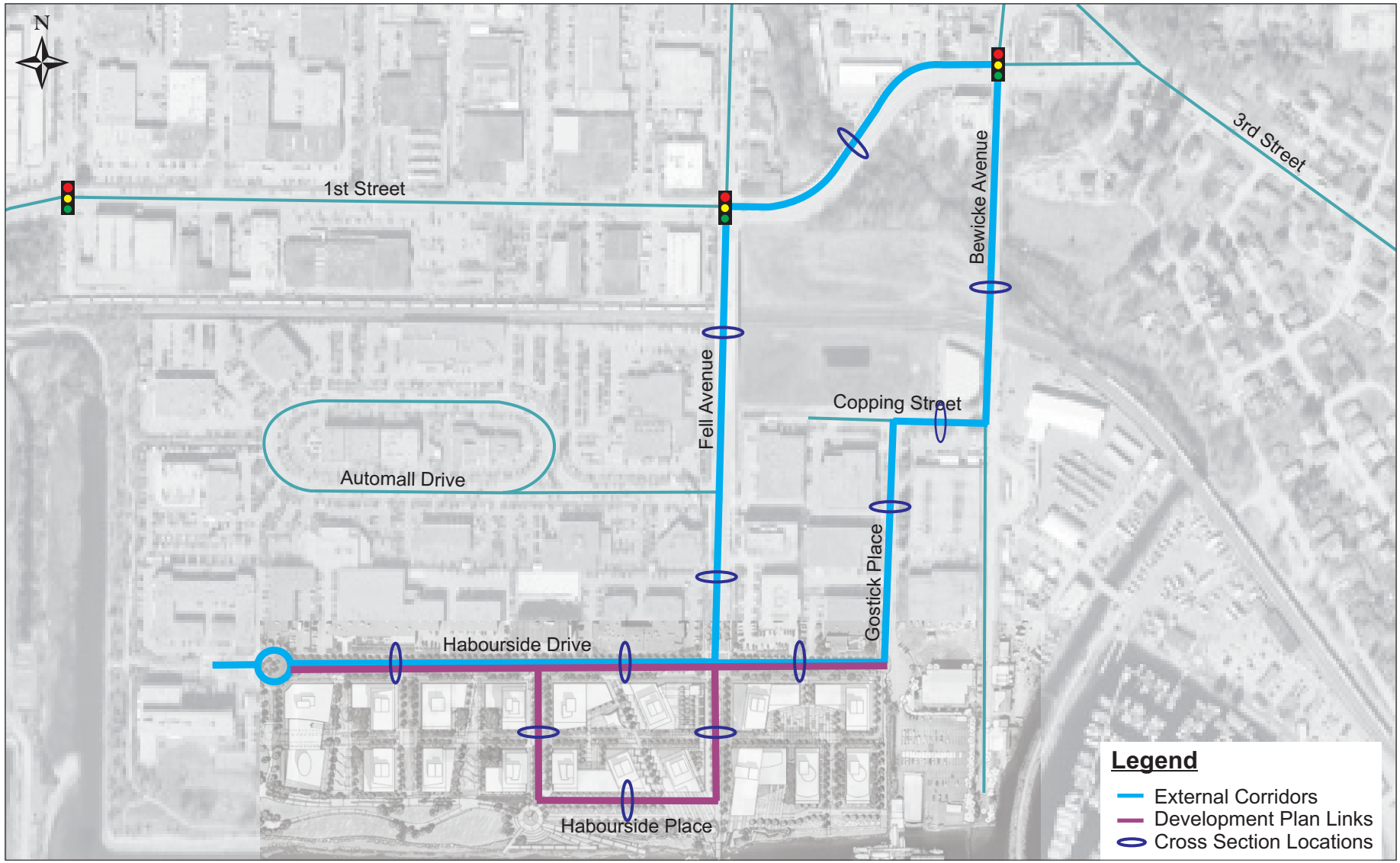

Exhibit 9.1

Multi-Modal Cross Sections

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

bunt & associates

Tables 9.5a and **9.5b** summarize the existing and projected volume for pedestrians and cyclists based on the growth rate established in Table 9.4. The analysis is focused on the afternoon peak-hour as this is the busiest time period for Harbourside, where vehicle volumes have a strong influence on the assessment in comparison to pedestrian and bicycle volumes. Transit projections are covered later in the section.

Table 9.5a: Pedestrian Volumes (existing & projected 2024)

Segment	Southbound / Westbound Pedestrian Flow (per peak hour)		Northbound / Eastbound Pedestrian Flow (per peak hour)	
	Existing	Future Projection	Existing	Future Projection
Fell Avenue Corridor (North - South)				
1st St to Automall Dr	45	75	5	10
Automall Dr to Harbourside Dr	80	135	5	10
Bewicke Avenue Corridor (North - South)				
2nd to Copping St	10	20	35	75
Copping Street (east - west)	5	10	20	35
Gostick Pl (north - south)	5	10	20	35
1st / 2nd Street Corridor (East - West)				
Fell Ave to Bewicke Ave	15	25	15	25
Bewicke Ave to 3rd St W	15	25	15	25
Harbourside Drive Corridor (East -West)				
Roundabout to Harbourside Pl	10	20	10	20
Harbourside Pl to Fell Ave	10	20	20	35
Fell Ave to Gostick Pl	20	35	5	10

Please note this is a high level exercise based on projecting existing patterns, and it is therefore likely that there could be significant variability's in the data, especially where the existing volumes are low.

Table 9.5b: Cycling Volumes (existing & projected 2024)

Segment	North - South / East - West Bicycle Flow (per peak hour)	
	Existing	Future Projection
Fell Avenue Corridor (North - South)		
1st St to Automall Dr	10	17
Automall Dr to Harbourside Dr	5	8
Bewicke Avenue Corridor (North - South)		
2nd to Copping St	20	33
Copping Street (east - west)	20	33
Gostick Pl (north - south)	10	17
1st / 2nd Street Corridor (East - West)		
Fell Ave to Bewicke Ave	75	125
Bewicke Ave to 3rd St W	65	109
Harbourside Drive Corridor (East -West)		
Roundabout to Harbourside Pl	5	8
Harbourside Pl to Fell Ave	10	17
Fell Ave to Gostick Pl	5	8

Table 9.6a summarizes the existing and future street cross sections, while **Table 9.6b** summarizes the street sections for the development plan. Street sections in the master plan show a minimum geometry for sidewalk widths to provide a robust assessment, and where additional width in reality would be available through building set-backs.

Table 9.6a: Road Geometry, External Links (existing & future 2024)

Corridor	Section	Existing			Future		
		Sidewalks	Travel Lanes	Parking Lanes	Sidewalks	Travel Lanes	Parking Lanes
Fell Avenue (North - South)	1st Street to Automall Drive	1.5m (both sides)	4 x 3.8m	None	No Change	No Change	No Change
	Automall Drive to Harbourside Drive	1.5m (both sides)	2 x 4.5m	1 x 2.5m	No Change	No Change	No Change
Bewicke Avenue (North -South)	2nd Street to Copping Street	Partial 1.7m (west side)	2 x 3.5m	None	3.5m shared bike / ped (east side)	No Change	No Change
	Copping Street (East -West) b/w Bewicke and Gostick	2.0m (south side)	2 x 3.0m	1 x 2.5m	No Change	No Change	No Change
	Gostick Place (North - South) b/w Copping and Harbourside Dr.	1.8m (west side)	2 x 3.4m	2 x 2.5m	No Change	No Change	No Change
1st / 2nd Street (East - West)	Fell Avenue to Bewicke Avenue	2.0m (both sides)	4 x 3.2m	None	No Change	No Change	No Change
	Bewicke Ave to 3rd Street W	2.0m (both sides)	4 x 3.2m	None	No Change	No Change	No Change
Harbourside Drive	All Sections	1.5m (both sides)	2 x 3.5m	2 x 2.5m	Southside (1.9m lower and 2m upper) & north side 1.5m	2 x 3.5m with 4m at bus stops	2 x 2.5m

Table 9.6b: Development Plan Geometry (Selected Locations)

Street	Section	Sidewalks	Travel Lanes	Parking Lanes
Fell Avenue	Harbourside Dr to Harbourside Pl.	2.0m (minimum)	2 x 3.5m	2 x 2.5 m
Harbourside Place	East – West section	2.6m north side plus set back (varies)	1 x 4.5m	1 x 5.6m (45 degree) & 1 x 2.5m
Harbourside Place (two-way)	Harbourside Drive to mews	2 x 2m	2 x 3.3m	2 x 2.5m
Harbourside Place (one-way)	Mews to waterfront	2.4m plus setback & 1.8m	1 x 4.5m	1 x 2.4 & 1 x 5.5m (45 degree)
Harbourside Drive	All sections	Southside 1.9m plus 1.2m setback & 1.5m boulevard	2 x 4.3m and around 4.9m at bus stops	2 x 2.4m & 1x 5.6m (45 degree)

9.5 Existing External Pedestrian & Cycling Conditions

The following presents the existing operational conditions for the external part of the study network and it highlights key issues and responses. **Table 9.7a** presents the review of the pedestrian network**.**

Table 9.7a: 2012 PM Peak Hour Background Pedestrian LOS

Segment	Southbound / Westbound					Northbound / Eastbound				
	Int. LOS	Seg. LOS	Space LOS	Flow LOS	Overall LOS & Score	Int. LOS	Seg. LOS	Space LOS	Flow LOS	Overall LOS & Score
Fell Avenue Corridor (North - South)										
1st St to Automall Dr	F	C	A	A	**C 3.36**	F	D	A	A	**D 3.70**
Automall Dr to Harbourside Dr	-	B	C	A	**C 2.75**	-	B	A	A	**B 2.28**
Bewicke Avenue Corridor (North - South)										
2nd to Copping St	F	A	A	A	**B 2.62**	F	C	-	-	**n/a**
Copping Street (east - west)	-	B	-	-	**n/a**	-	A	A	A	**A 1.8**
Gostick Pl (north - south)	-	A	A	A	**A 1.72**	-	B	-	-	**n/a**
1st / 2nd Street Corridor (East - West)										
Fell Ave to Bewicke Ave	F	C	A	A	**D 4.08**	F	D	A	A	**D 4.15**
Bewicke Ave to 3rd St W	C	B	A	A	**C 3.43**	C	D	A	A	**D 3.76**
Harbourside Drive Corridor (East -West)										
Roundabout to Harbourside Pl	-	A	A	A	**A 1.82**	-	C	A	A	**B 2.00**
Harbourside Pl to Fell Ave	-	A	A	A	**A 1.80**	-	B	A	A	**A 1.88**
Fell Ave to Gostick Pl	-	A	A	A	**A 1.77**	-	B	A	A	**A 1.89**

Key outcomes from this review are:

- Fell Avenue at 1st Street, Bewicke at 2nd Street indicate a LOS of 'F' at the intersections, this is triggered by vehicle volumes and number of travel lanes to cross; and,
- Bewicke (Copping to 2nd) is not considered as part of the review as there is no continuous facility for pedestrians and also this will be considered as part of the improvements.

Table 9.7b reports the findings from the bicycle LOS analysis. It should be noted that the NCHRP Report 616 methodology for calculating bicycle LOS makes achieving a LOS 'A' extremely difficult to attain on shared streets and that LOS 'C' or 'D' is considered generally acceptable and that a field visit should form part of the review.

Table 9.7b: 2012 PM Peak Hour Background Cyclist LOS

Segment	Southbound / Westbound			Northbound / Eastbound		
	Int. LOS	Seg. LOS	Overall LOS & Score	Int. LOS	Seg. LOS	Overall LOS & Score
Fell Avenue Corridor (North - South)						
1st St to Automall Dr	D	B	**C 2.77**	E	B	**C 3.26**
Automall Dr to Harbourside Dr	E	B	**C 3.41**	E	B	**D 3.89**
Bewicke Avenue Corridor (North - South)						
2nd to Copping St	B	A	**A 1.28**	E	B	**C 3.30**
Copping Street (east - west)	C	B	**C 2.80**	C	A	**B 2.16**
Gostick Pl (north - south)	D	B	**E 4.27**	D	B	**C 2.96**
1st / 2nd Street Corridor (East - West)						
Fell Ave to Bewicke Ave	D	B	**B 2.54**	D	A	**B 2.45**
Bewicke Ave to 3rd St W	C	B	**C 2.92**	D	A	**B 2.33**
Harbourside Drive Corridor (East -West)						
Roundabout to Harbourside Pl	D	B	**C 3.03**	D	B	**C 3.10**
Harbourside Pl to Fell Ave	D	C	**C 3.15**	D	B	**B 2.54**
Fell Ave to Gostick Pl	D	B	**E 4.47**	D	B	**B 2.63**

Key outcomes from this review are:

- Gostick Place indicates a LOS of 'E' and would require further review, and,
- All remaining overall Levels of Service are D or less.

9.6 Future Pedestrian & Cycling Conditions

This exercise is now undertaken for the future conditions and includes the following planned changes to the network:

- New traffic signal at Automall Drive and Fell Avenue;
- New greenway between Copping Street and 2nd Street.

Table 9.8a presents the pedestrian review for the external links.

Table 9.8a: 2024 PM Peak Hour Background Pedestrian LOS

Segment	Southbound / Westbound					Northbound / Eastbound				
	Int. LOS	Seg. LOS	Space LOS	Flow LOS	Overall LOS & Score	Int. LOS	Seg. LOS	Space LOS	Flow LOS	Overall LOS & Score
Fell Avenue Corridor (North - South)										
1st St to Automall Dr	F	D	B	A	**E 4.95**	F	E	A	A	**F > 5.0**
Automall Dr to Harbourside Dr	C	B	D	A	**D 3.50**	A	C	A	A	**C 3.23**
Bewicke Avenue Corridor (North - South)										
2nd to Copping St	F	B	-	-	**n/a**	F	B	B	A	**B 2.74**
Copping Street (east - west)	-	B	-	-	**n/a**	-	A	C	A	**C 2.75**
Gostick Pl (north - south)	-	A	A	A	**A 1.72**	-	B	-	-	**n/a**
1st / 2nd Street Corridor (East - West)										
Fell Ave to Bewicke Ave	F	D	A	A	**E 4.91**	F	D	A	A	**E 4.99**
Bewicke Ave to 3rd St W	D	C	A	A	**D 4.03**	D	E	A	A	**E 4.68**
Harbourside Drive Corridor (East -West)										
Roundabout to Harbourside Pl	-	A	A	A	**A 1.83**	-	C	A	A	**A 1.99**
Harbourside Pl to Fell Ave	-	A	A	A	**A 1.77**	-	B	A	A	**A 1.87**
Fell Ave to Gostick Pl	D	A	A	A	**B 2.27**	E	B	A	A	**B 2.70**

Key outcomes from this review are:

- Fell Avenue (1st to Automall Drive) again shows a high level of service and this is heavily influenced by vehicle volume and the number of travel lanes at 1st Street (5);
- Bewicke Avenue greenway improves the pedestrian environment along this corridor and is reflected with a lower LOS, and,
- 1st Street / 2nd Street corridor continues to show a high LOS and is influenced by vehicle volumes and number of crossing travel lanes; however this section is not on the desire lines for Harbourside.

Table 9.8b: 2024 PM Peak Hour Total Cycling LOS

Segment	Southbound / Westbound			Northbound / Eastbound		
	Int. LOS	Seg. LOS	Overall LOS & Score	Int. LOS	Seg. LOS	Overall LOS & Score
Fell Avenue Corridor (North - South)						
1st St to Automall Dr	E	B	C 3.01	E	B	D 3.53
Automall Dr to Harbourside Dr	F	B	D 3.87	C	B	C 2.81
Bewicke Avenue Corridor (North – South)						
2nd to Copping St	D	A	B 2.69	B	A	A 1.76
Copping Street (east - west)	C	C	C 3.27	C	B	B 2.33
Gostick Pl (north - south)	A	B	D 3.81	B	B	B 2.72
1st / 2nd Street Corridor (East - West)						
Fell Ave to Bewicke Ave	D	B	B 2.60	D	A	B 2.56
Bewicke Ave to 3rd St W	C	B	C 3.00	D	A	B 2.41
Harbourside Drive Corridor (East -West)						
Roundabout to Harbourside Pl	D	B	C 3.06	D	B	C 3.12
Harbourside Pl to Fell Ave	C	B	C 3.09	D	B	B 2.46
Fell Ave to Gostick Pl	C	B	E 4.49	D	B	B 2.60

Key outcomes from this review are:

- Harbourside Drive corridor generally is satisfactory for cyclists with the only exception at Gostick Place (similar to the existing situation) and its layout is under review (Functional Design);
- Fell Avenue (Harbourside to Automall Drive) exhibits a high LOS but it is not a designated bike route and especially with the parallel options available at Bewicke and Mackay.

Overall the review has only identified potential areas for further review at Gostick Place / Harbourside Drive, while the changes planned at Automall Drive / Fell Avenue and Bewicke Avenue (Copping to 2nd Avenue) should improve the environment for these user groups.

9.7 Master Plan Pedestrian Review

Master plan street sections are expected to have significantly different demands in the future and in particular with the retail uses planned at street level. There is no practical way to evaluate these street sections other than undertake a more qualitative review. **Table 9.9** provides an indication of the Levels of Service based on the sidewalk width provided.

Table 9.9: 2024 Master Plan: Sidewalks and LOS Pedestrian Volumes (per hr.)

Segment	Minimum Width Planned	LOS C	LOS D
Southside of Harbourside Drive Corridor (East -West)			
Roundabout to Harbourside Pl	1.9	140-250	250-390
Harbourside Pl to Fell Ave	1.9	95-160	160-265
Fell Ave to Gostick Pl	1.9	100-155	155-255
Waterfront Street Sections			
Fell Leg	2.3	60-95	95-150
Harbourside Place South Leg	2.7	115-185	185-300
Harbourside Place West Leg	2.0	60-95	95-150

Evidently the planned minimum widths can accommodate high pedestrian volumes at a LOS of D. On sections of Fell Avenue (north of mews), Harbourside Drive, and Harbourside Place (north of mews) there is an additional pedestrian area at the upper level serving the commercial access points and this would further add to capacity.

Table 9.10 summarizes existing conditions and multi-modal analysis results from a previous Bunt study at 1250 Lonsdale Avenue (dated July 2011) and it highlights sidewalk width, LOS, and volumes found on another commercial frontage in the City which provides some context for Harbourside.

Table 9.10: Lonsdale Avenue and West 13th Street Projected Pedestrian Volumes

Segment	Peak Pedestrian Volume	Sidewalk Width	Space LOS
Lonsdale at West 13th	200	2.1m	A
West 13th at Lonsdale	100	3.3m	A

Table 9.11 provides a review of commercial streets with a wide range of sidewalk widths and volumes on street sections generally regarded as being comfortable and animated spaces.

Table 9.11: Review of Commercial Streets and Sidewalk Widths

Location	Segment	Direction	Peak Pedestrian Volume	Sidewalk Width
1	Arbutus St at West Broadway	N-S	150	2.0-2.5m
	West Broadway at Arbutus St	E-W	550	2.7m
2	Arbutus St at West 4th Ave	N-S	110	1.8m
	West 4th Ave at Arbutus St	E-W	270	2.0m
3	Main St at 12th Ave	N-S	165	1.8m
4	Commercial Dr at East 1st Ave	N-S	550	1.8-2.0m
	East 1st Ave at Commercial Dr	E-W	250	1.8-2.0m
5	Cypress St at Cornwall Ave	N-S	150	1.5-1.8m
	Cornwall Ave at Cypress St	E-W	220	1.8-2.5m

Pedestrian volumes on the master plan streets are difficult to assess, but this exercise should provide comfort that the minimum widths planned are sufficient for the master plan to function successfully.

9.8 Transit Service

This part of the multi-modal assessment reviews the transit demand in the Harbourside area and takes into consideration data obtained from TransLink's own survey data.

Table 9.12: TransLink Existing Data for #231 and estimate of Harbourside Trips

Time	Services	Direction	No. of Stops	Total Avg Boardings per trip	Estimated for Harbourside %	Estimated for Harbourside Riders
7 to 8am	2	West	4 /1	34	90%	61
8 to 9am	3	West	4 /1	20	90%	54
4pm to 5pm	2	East	4 /1	32	90%	58
5pm to 6pm	2	East	4 / 1	19	90%	34

Current patronage load factor on the #231 service is around 30% to 40% during the times of operation and this may be due to the limited periods of operation.

Bunt conducted intercept surveys of pedestrian movements on Bewicke Avenue and Fell Avenue and found that a significant proportion of the walk trips to / from Harbourside were associated with transit use on Marine Drive. This information is presented in **Table 9.13** along with a summary of the demands from the #231 service.

Table 9.13: Summary of Existing Harbourside Transit Trips

Bus Service	7 to 9am (inbound)	Percentage (%)	4 to 6pm (outbound)	Percentage (%)
#231	115	60%	92	63%
Marine Drive Routes	77	40%	55	37%
Total	192	100%	147	100%

The table indicates that around 40% of the bus trips recorded at Harbourside access services on Marine Drive, which is around 1000 to 1200 metres away.

Projections for new transit trips have been based on the same factor used earlier for the external pedestrian and bicycle trips (i.e. 1.67). This is presented in **Table 9.14** for the #231 and Marine Drive routes, but it has been assumed that a higher proportion could use the improved service at Harbourside with a conservative 10% redistribution.

Table 9.14 Projected 2024 Harbourside Transit Trips (per peak direction)

Bus Service	7 to 9am (inbound)	Percentage (%)	4 to 6pm (outbound)	Percentage (%)
#231	205	64%	163	66%
Marine Drive Routes	116	36%	83	34%
Total	321	100%	245	100%

At 4 buses per hour during these periods and with the improved service, it indicates a load factor per bus (per peak direction) of 35 to 50 passengers for the #231 service with full build-out of the master plan. This exercise provides a broad-brush estimate based on the methodology applied and a reference point for the monitoring study (in previous section).

A further breakdown has been made below in **Table 9.15** for the development phasing and which will provide an indication of what could be expected as the master plan is developed out over the next 10-years.

Table 9.15: Projected (Peak Directional) Demand with Phasing (15-minute headway)

Year	Development complete	Percentage of Master Plan Complete	#231 AM inbound / PM outbound	Marine Drive Routes inbound / outbound
2014	Phase 1	24%	49 /39	28 / 20
2017	Phase 2	32%	115 /91	65 / 46
2019	Phase 3	22%	160 / 127	90 / 65
2024	Phase 4	22%	205 / 163	116 / 83

These projections will provide a baseline for the monitoring program in reviewing the future demands for transit during the peak periods. There is insufficient data to project demand outside these peak periods as there is no baseline data available.

9.9 Summary

This multi-modal review provides a very high-level assessment of pedestrian and cyclist operational characteristics but should not replace local experience and judgement along with good design practice. It has highlighted that the existing and future street networks, subject to minor reviews, would be adequate for the expected future demands. Transit projections made will provide a benchmark for the monitoring program.

10. SUMMARY

Concert has applied to the City of North Vancouver to rezone 4 parcels of land along the waterfront section of the Harbourside Business Park. The master plan is to create a new compact, mixed-use block design with a permeable network of routes for pedestrians, cyclists, and vehicles. Residential and employment uses planned will complement the new commercial uses (retail, local services, cafes / restaurants, etc.) along with maximizing synergies with existing employment and school use.

The development plan for the 4 parcels of land is proposed to consist of 215,000 sq.ft GFA of office, 45,000 sq.ft GFA retail, 850 residential units (740 market and 110 rental), and a 100 bed hotel. Build-out of these uses is expected in phases and could cover a span of 10-years.

Harbourside currently generates around 1,380 vehicle in the morning peak-hour (8am to 9am) and 1,450 vehicles in the evening peak-hour (16:30pm to 17:30pm). Of these movements, the Automall contributes around 40% to 45%. With two points of vehicle access to Harbourside, the Fell Avenue overpass is the most dominant one with 85% of all movements, while Bewicke Avenue is used by only 15% of all movements.

The employment focus of the existing uses at Harbourside is reflective with the 70% / 30% split of flows at each of the peak periods, and the fact that transit can only be supported at weekday peak times and in one direction. Travel behaviour indicates that 68% of employees drive, 20% use transit, and the remainder are split between walking / cycling (at 8%) and passengers' of vehicles (at 4%).

A number of changes have been introduced to Harbourside to improve accessibility: new pedestrian / bicycle overpass at Mackay; dedicated bus service (December 2011); greenway on Bewicke Avenue, while sections along Mosquito Creek are expected to be upgraded with adjacent development plans. The waterfront Spirit Trail to Lonsdale Quay is currently closed and discussions are ongoing with the Squamish First Nation to open it up through the boat yard area.

A new main east-west street mews will be introduced to improve permeability and provide access to parking and loading activities. It will be intersected north-south with a combination of streets, mews, and pedestrian connections. Harbourside Place is planned to be one-way (clockwise), together with a short section of Fell Avenue, south of the main east-west mews.

Pedestrians will benefit with the new permeable block structure along with the new connections provided through the waterfront area. A compact street design is planned to minimize pedestrian crossing distances and reduce vehicle speeds and complement the new urban form with higher level of pedestrian activity than what is currently observed.

A new segregated Spirit Trail route will be developed (6-metres wide) along the site's frontages and at the eastern interface of the plan, a 4-metre shared section would connect with the greenway being developed on Bewicke Avenue. Concert is proposing to complete the Copping Street to West 2nd Street section of the Greenway, including a new barrier and lights at the railway crossing (along with advanced warning signs)

and the pedestrian/cycle bridge crossing at Mosquito Creek, as part of their community amenity contribution.

Concert is also committed to working with Squamish First Nation and the City of North Vancouver to open up a Waterfront Spirit Trail to Lonsdale Quay from Harbourside.

Emergency access plan has been developed with the North Shore Emergency Response Unit and it has identified a number of measures that can be introduced to allow access for emergency services (in addition to Bewicke Avenue and Fell Avenue) along with route options and facilities to evacuate employees and residents.

Parking for office is proposed at 2.5 to 2.7 spaces per 100sqm GFA; retail at 3 spaces per 100sqm; market residential at 1.3 spaces per unit and 0.7 space per unit rental (both inclusive of 0.1 visitor); and, 0.7 spaces per bed for the hotel. Proactive strategies for parking such as charging, shared use, and car-sharing will be considered at the Development Permit stage.

A 2-hour limit parking at Harbourside is expected to enforced in the future including on the streets within the master plan, while a 1-hour limit could be introduced in higher activity locations and / or charging could be introduced (i.e. next to retail and waterfront frontages). The development plan will also add to the street parking supply through the new street sections, while the commercial parking will be publically accessible. Concert will work with the City on a parking management strategy that prioritzes street parking for visitor use only.

Bicycle parking will comply with the City of North Vancouver's bylaw and truck servicing will meet the expected demands and will be accessed from the mews where the design will covered at the DP stage.

Transportation Demand Management plan strategy will support the development plan and a summary of the measures is presented in **Table 10.1**.

Table 10.1: TDM Measure and Anticipated Timing

Item	
Transit	Enhanced transit under discussion with TransLink and City with the introduction to be determined.
Car-sharing	Introduced with residential build-out at 1 per 180 units with the first car introduced with the first unit occupied
Ride-sharing	Introduced with the occupation of the first building in Phase 1
Transit Subsidy	Dependent on the resources required for the transit subsidy and would also be linked to the employee program and car-share vehicle introduction.
Parking Management	Work with the City to develop measures to lower demand and prioritize street parking for short-term / visitor use, and will start with the completion of the first building
Travel Smart	Funding contribution for materials used in the Travel Smart program.
Management, Marketing Monitoring TDM Coordinator	Introduced with the occupation of the first building in Phase 1.

New external vehicle movements to / from Harbourside are projected at up to 600 in the morning peak-hour and 850 in the afternoon peak-hour. These are essentially based on ITE Trip Rates, which typically cover low-density / single-use suburban sites and are therefore expected to be on the high side.

In reality projections could be lower by 10% to 15%, reflecting the compact urban form / mix of uses and Transportation Demand Management strategy planned, while the increases would be incremental and more balanced as shown at **Figure 10.1**.

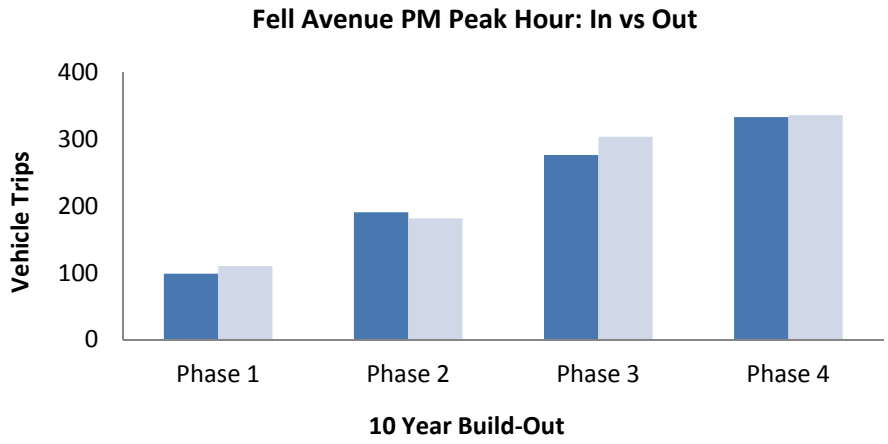

Figure 10.1: Additional Movements at Fell Avenue (Compounded)

The City of North Vancouver's traffic model covering the study street network was used to assess existing and projected vehicle movements with the development plan, and **Table 10.2** presents the planned mitigation measures.

Table 10.2: Mitigation Measures Planned

Intersection	Mitigation	Trigger Point		
		Existing	Background Growth	Development
Fell/ Marine	Northbound approach is repainted to left, through and through-right laning, section of parking is restricted (between 3pm-6pm) on north leg to accomodate two receiving lanes	No	Yes	-
Fell / 1st	Interim measure to restrict southbound left movements(afternoon peak) and add right-turn bay northbound based on monitoring	No	No	Reviewed through monitoring
Fell/ Automall	New traffic light within the existing street geometry	Yes	-	-
Westview / Larson	Phasing change	No	Yes	
Bewicke / Marine / Keith	Ban northbound left-turn (Bewicke) and remark lanes to through and right	No	Yes	-
Fell / Harbourside	Potential future traffic light	No	No	Reviewed through monitoring

The locations of these suggested changes are shown at **Exhibit 10.1**.

The planned monitoring program will reassess the projections made in this report at future points in time and whether the changes identified in this report are required or whether new ones are required.

New sidewalks within the master plan are expected to have sufficient capacity when compared with other locations that share similar attributes (i.e. commercial / retail frontages). Outside the master plan, the existing connections along Fell Avenue and Bewicke Avenue (including Gostick Place and Copping Street) are expected to accommodate future demands (subject to minor review), while the planned upgrade to Bewicke Avenue would operate satisfactorily.

Bus patronage projections on the #231 service are expected to increase based on the current demand profile projected with the increase in new floor area and taking into consideration less people walking to Marine Drive.

In conclusion, this report has provided a comprehensive review of the expected transportation demands at Harbourside in the context of the development rezoning plan and has identified changes to pedestrian, bicycle, transit, and vehicle infrastructure to manage both existing and new demands along with developing a parking strategy to deal with existing street peak demand.

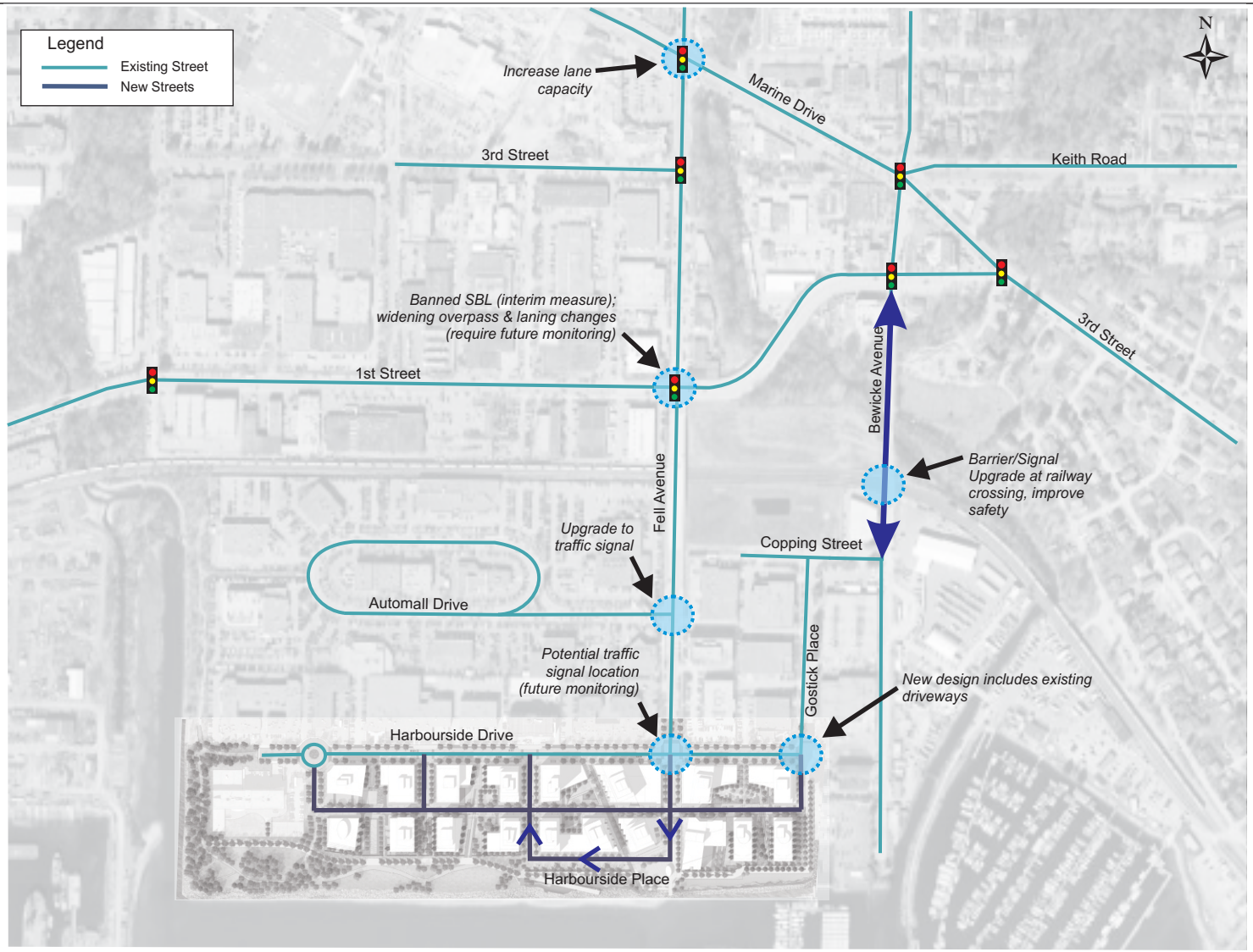

Exhibit 10.1

Identified Changes to Street Network

Harbourside Rezoning, North Vancouver, BC
4025.32 October 2013 Scale NTS

bunt & associates