Comox Valley REGIONAL DISTRICT

Staff Report

DATE: June 10, 2020

FILE: 3350-20 /CP 1C 20
3360-20 /RZ 1C 20

TO: Chair and Directors
Electoral Areas Services Committee

FROM: Russell Dyson
Chief Administrative Officer

Supported by Russell Dyson
Chief Administrative Officer

R. Dyson

RE: Official Community Plan and Rezoning Applications – 3L Developments Inc.

Purpose
To introduce Official Community Plan (OCP and Zoning Bylaw amendments proposed by 3L Developments Inc. to develop their lands with 780 housing units (335 single detached units each with provision for a secondary suite, 54 townhouse units and 56 multi-family units), 1,400 square meters of neighbourhood commercial floor area, and 97ha of open space (e.g. park land). The proposal triggers the need for an amendment to the Regional Growth Strategy (RGS).

Recommendation from the Chief Administrative Officer:
THAT the Comox Valley Regional District Board endorse the agency referral list as outlined in Appendix A of staff report dated June 10, 2020, and direct staff to commence the external agency referral process for properties known as:

- That Part of the NW ¼ of Section 10, Township 9, Comox District, Plan 552G, Lying West of Puntledge River, except that part in Plan VIP70188 and EPP24391 (PID 000-866-792);
- The south west ¼ of Section 15, Township 9, Comox District, Plan 552G, except that part shown coloured red on Plan 79 RW and except that part in plan VIP70188 (PID 000-866-814);
- That Part of the north ½ section 14, Township 9, Comox District, Plan 552G lying to the South of the North bank of the Puntledge River (PID 003-922-308);
- That Part of the south east ¼ of section 14, Township 9, Comox District, Plan 552G lying to the west of the east bank of the Puntledge River except those parts in Plans 8304 and 9343 (PID 003-922-391);
- The south west ¼ section of Section 14, Township 9, Comox District, Plan 552G, except that part in Plan 9343 and except that part shown coloured red on Plan 829 R.W. (PID 003-924-033)

as part of a repeal of Bylaw No. 2042, 1998, being the "Rural Comox Valley Official Community Plan Bylaw, 1998" and proposed amendments (File: CP 1C 20; RZ 1C 20) to Bylaw No. 337, being the "Rural Comox Valley Official Community Plan Bylaw No. 337, 2014" and Bylaw No. 520, being the "Rural Comox Valley Zoning Bylaw No. 520, 2019";

AND FINALLY THAT Comox Valley Regional District staff consult with First Nations in accordance with the referrals management program dated September 25, 2012.

Executive Summary

- The subject properties total approximately 201 hectares in area and are designated under two Official Community Plans as Rural Area and Rural Settlement Area/Settlement Expansion

Area, respectively. The majority of the lands are zoned Rural Twenty (RU-20). These designations allow for residential development (single detached units with accessory dwelling units) on parcel sizes of no less than 20 hectares. A small portion is zoned upland resource (UR-40). This zone permits a range of resource uses and one single detached dwelling per lot as an accessory use.

- 3L Developments Inc. is proposing to repeal the existing OCP designation on a portion of the lands (under Bylaw No. 2042, being the "Rural Comox Valley Official Community Plan Bylaw, 1998") and amend the OCP designation on the remaining lands to Settlement Node and Rural Settlement Area (under Bylaw No. 337, being the "Rural Comox Valley Official Community Plan Bylaw No. 337, 2014").
- The applicant is proposing a new settlement node comprising 335 single detached dwelling lots; 335 secondary suites; 54 townhouse units and 56 multi-family units (total of 780 residential units). The proposal includes 1400 square metres of neighbourhood commercial floor area, 97 hectares of open space (proposed as park), and a 10 hectare parcel for K'ómoks First Nation.
- The applicant's proposal triggers the need for an amendment to the Comox Valley Regional Growth Strategy, Bylaw No. 120, being the "Comox Valley Regional District Regional Growth Strategy Bylaw No. 120, 2010", to re-designate the lands from Rural Settlement Area and Settlement Expansion Area to Settlement Node and Rural Settlement Area.
- The RGS states that an amendment to the RGS may be proposed by a member municipality, the Electoral Areas Services Committee, or the Board, including on behalf of an external agency or private land owner. For this reason, the applicant is introducing the proposal to the Electoral Areas Services Committee with an application to amend the OCP and Zoning Bylaws to determine whether the Board will support advancing the proposal to the RGS amendment process.
- The Board can deny the OCP and Zoning applications at this stage; refer the applications to external agencies and First Nations for comment; refer the applications to the Board (Committee of the Whole directors' vote) to consider whether to initiate an amendment to the RGS; or request that the applicant provide additional information about the proposal prior to considering next steps (i.e. pursuant to the Development Approval Information Areas Bylaw).
- Staff recommends referring the applications to external agencies and First Nations for comment such that detailed feedback can be received (including additional information needs).

Prepared by:	Concurrence:	Concurrence:
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Government Partners and Stakeholder Distribution (Upon Agenda Publication)

City of Courtenay	✔
Town of Comox	✔
Village of Cumberland	✔
K'ómoks First Nation	✔

Background/Current Situation

In 2018, the Board initiated an RGS amendment process to review 3L Developments Inc.'s proposal to re-designate the subject lands from "Rural Settlement Area" and "Settlement Expansion Area" to "Settlement Node" in order to develop the lands with 1,100 residential dwelling units and provide lands for public use (i.e. park). The Board adopted a consultation plan to consider the proposal as a standard amendment to the RGS.

A public information meeting was held and over 200 citizens attended. The RGS Steering Committee (i.e. Chief Administrative Officers for the Comox Valley Regional District (CVRD) and each member municipality) recommended, following analysis of the proposal by the RGS Technical Advisory Committee (i.e. CVRD and municipal planning staff), that the Board deny the proposed amendment on the basis of existing and approved housing supply within the core settlement areas (i.e. a new settlement node was not needed to accommodate projected growth). The Board denied the application in October 2018.

In December 2018, the Board amended the implementation section of the RGS to state that an amendment to the RGS may be proposed by a member municipality, the CVRD Electoral Areas Services Committee, or the CVRD Board, including on behalf of an external agency or private land owner. Essentially, any proposed amendment requires a local government to bring it forward for the Board's consideration. No longer can a landowner make an application to amend the RGS directly to the CVRD Board. The idea is that the local government that is most likely affected by the proposed amendment (e.g. the lands are within the local government's planning area jurisdiction) should have an opportunity to consider how any given proposal to amend the RGS impacts the local OCP and zoning.

3L Developments Inc. has therefore submitted an application to the CVRD to amend the Rural OCP and Zoning Bylaw in order to develop a new settlement node comprising 780 residential units (335 single detached dwellings, 335 secondary suites, 54 townhouse units, 56 multi-family units), 1,400 square meters of commercial floor area, 97 hectares of open space (proposed to be park and trails), a "community room and gathering place", and a 10 hectare parcel for K'ómoks First Nation. The applicant has submitted the following studies in support of the application:

- Archaeological Overview Assessment, I.R. Wilson Consultants Ltd., August 2009
- Transportation Assessment, Bunt and Associates Engineering Ltd., October 2009
- Ecology and Wildlife Summary, FishFor Contracting Ltd., December 2009
- Floodplain Assessment, McElhanney Consulting Ltd., July 2018
- Geohazard Assessment, Base Geotechnical Inc., July 2018

The applicant proposes water and sewer systems "to be provided and operated by on-site private utilities". The application package also notes that "storm water (is) to be managed with an integrated storm water management plan". Minimum parcel sizes are not identified (Appendix B). The applicant states "*in responding to comments regarding the previous application, this OCP and rezoning proposal has set out to reduce the development foot print and maximize rural and green space…As a result it has less impact and protects more land".*

Official Community Plan Designations

The majority of the subject properties are designated "Rural" under Bylaw No. 2042 (Rural Official Community Plan, 1998). Note that these are the only lands in the electoral areas that still have a designation under the former OCP. The balance of the subject properties are subject to the current Rural OCP (Bylaw No. 337) and are designated either "Rural Settlement Area" or "Settlement Expansion Area" (Appendix C).

Official Community Plan Bylaw No. 2042

3L Development Inc.'s proposal would require repeal of the "Rural" designation and replacement with a new designation under Bylaw No. 337. The "Rural" designation was intended to encourage land use patterns that minimize urban sprawl, ensure "appropriate and adequate" rural servicing, minimize potential negative impacts on the environment and the productive potential of adjacent resource lands, and support the provision of affordable housing appropriate to its rural setting. Permitted land uses include: residential (i.e. single detached, secondary suites, mobile homes), forestry, agriculture, manufacturing and processing. The minimum parcel size for subdivision (in the absence of public water and/or sewer systems) defaults to the minimum specified in the applicable zone (i.e. Rural Twenty – 20 hectares).

Official Community Plan Bylaw No. 337

The portions of the properties designated under Bylaw No. 337 are "Rural Settlement Area" and "Settlement Expansion Area". The rural settlement area designation allows residential development with parcel sizes ranging between 4 hectares and 20 hectares. The Plan envisions that each new residential lot shall have its own potable water source (well) and its own septic system (with both on-site primary and secondary disposal lands identified). The intent of the rural settlement area is to provide for rural living without causing fragmentation of rural lands or negative impact on working landscapes (e.g. agriculture, silviculture). One of the reasons for the minimum 4 hectare parcel size is to ensure that over the long-term lands proposed for subdivision will be self-sustaining and not require an unplanned extension of public water and sewer services.

The "settlement expansion area" designation was created to identify lands with either the potential for increased density (once incorporated into a municipal area and connected to public water and sewer service) or historically developed lands that will require public servicing given historic densities and related on-site servicing challenges. Until such time as settlement expansion area lands may be incorporated in a municipality and provided with public water and sewer service, the lands have minimal development potential. For example, the OCP states that the minimum parcel size for subdivision is 4ha.

Zoning Bylaw No. 520

All of the lands are subject to Zoning Bylaw No. 520, being the "Rural Comox Valley Zoning Bylaw No. 520", adopted in 2019. The majority of the subject properties are zoned Rural Twenty (RU-20); one portion is zoned Upland Resource (UR-40), including a portion of the land identified by the applicant as K'ómoks First Nation "development lands". The RU-20 zone permits a range of principal uses, including single detached dwellings, agriculture, forestry, sawmills, wood processing, mineral extraction, crushing and screening. The UR-40 zone includes principal uses such as agriculture, silviculture, wood processing, firearm ranges, and mineral extraction, crushing and screening (Appendix D). Surrounding and nearby lands, particularly north of the Puntledge, are similarly zoned for rural density (e.g. on-site services) and land use (including Agricultural Land Reserve lands).

3L Development Inc.'s Proposed OCP Designations and Zoning Amendment

The applicant is proposing to re-designate the lands to "settlement node" and "rural settlement area" under Bylaw No. 337 (i.e. eliminate the settlement expansion area designation entirely) (Appendix B).

Settlement nodes are one of four types of "core settlement areas": this is an electoral area designation that applies to the communities of Union Bay, Saratoga, and Mt. Washington. When the RGS was being developed, these communities were identified as existing settlements that could benefit from full public servicing and, if publically serviced, could have potential to accommodate

additional rural density and uses. The scale and density of the Union Bay and Saratoga settlement nodes in particular was deemed viable to support, in future, provision of public utilities and services such as rural transit and access to elementary schools (and/or sufficient economy of scale to support bussing to schools). They are not contiguous with municipal areas nor are they intended to replicate all of the features and services that are found in a municipal area. New settlement nodes can only be created through an amendment to the RGS.

The applicant characterizes the proposed settlement node as follows:

> *"The Riverwood Settlement Node is an approximate 445 residential unit village. It incorporates a mix of housing forms including single family dwellings with Secondary Suites, Townhouses, Low Rise Apartments. Within this mix, it is contemplated that there will be rental housing, social and assisted housing opportunities. Riverwood will be a compact village scale neighbourhood that will include opportunity for living, recreating, working, playing and growing food. Riverwood is sited to protect the surrounding ecosystems and access to greenway, bikeway and trail systems."*

The applicant's reference to "445 residential units" does not include the potential for 335 secondary suites.

Although the applicant has submitted a concurrent rezoning application, no zoning has been proposed (e.g. permitted uses, minimum parcel size for subdivision). Within the application package it is stated that "*the community facility along with trails, parks and allotment gardens will be provided as community amenities*". Staff note that the Board has adopted a voluntary community amenity policy that would need to be considered if and when the Board considers the proposed zoning amendment. The appropriate time to consider any voluntary offer of community amenities is through the public re-zoning process. The applicant has also stated that a separate development parcel will be given to K'ómoks First Nation but no new OCP designation or zoning is proposed to enable its subdivision from the balance of the lands or development with uses other than what currently exists.

<u>Water, Wastewater and Rainwater Management</u>

As noted elsewhere, 3L Developments Inc. is proposing greenfield development (i.e. a new community) with private water and wastewater utilities owned and operated by a private entity. The properties are not within a local service area. Although the applicant has not yet provided any servicing details, staff note that many private water and wastewater services in BC are challenged in maintaining operations and infrastructure in accordance with provincial utility standards over the long-term. The CVRD has seen several recent examples of private utility operators approaching the CVRD to take over their private systems including Sandwick, King Coho, and Watutco. The Union Bay and Graham Lake Improvement Districts have also requested that the CVRD undertake conversion studies. None of the long term planning for the regional water and sewer systems has included development in this area, which would significantly increase the cost and operational impacts of extending community water and sewer to this location if requested by future residents.

The Board received a report from staff in September 2019 outlining some of the factors to be considered in both supporting development that relies on privately owned and operated community utility systems and factors to be considered when approached by private utility operators with a request to take over service to a community. At present, there are two non-CVRD utility operators serving a population with more than 300 connections in the electoral areas (i.e. Union Bay Improvement District's water service – currently part of a provincially sponsored governance review, and Mt. Washington's water and sewer services). The majority of the private utility systems serve populations with fewer than 15 non-residential connections.

As noted in staff's September 2019 report, there are very few opportunities for the CVRD to influence private utility decisions, despite the CVRD potentially being required to take over those utilities in future. To be clear, the opportunity to consider whether development that relies on private utility servicing should be enabled is the OCP amendment/rezoning stage. There is no opportunity at the subdivision stage or building permit stage.

In respect to rainwater management, the documents provided by the applicant are silent on how the proposed development will manage rainwater (although the application package states that "storm water to be managed with an integrated storm water management plan"). A Rainwater Management Plan will need to be developed that demonstrates how the proposed development will meet the rainwater management policies and objectives of the OCP. Additionally the applicant will have to demonstrate how the proposed development will meet the requirements of the Ministry of Transportation and Infrastructure's TAC BC Supplement, Chapter 1000. The proposed scale of development suggests that some level of community rainwater management infrastructure may be necessary to maintain the natural water balance of the development site. This would likely require either a private utility or the establishment of a local service area to construct, operate and maintain the community infrastructure. Again, staff highlights the concern with the long-term ability of a private utility to sustain this type and scale of infrastructure on behalf of a residential community.

Cultural values

The lands are within the territory of the K'ómoks First Nation. The applicant has provided an archaeological overview assessment, completed by I.R. Wilson Consultants in 2009. Note that it is not attached to this report as it identifies the location of archaeological sites. The author states that the overview assessment is intended to identify and assess heritage resource potential. It is not to be used as a detailed assessment or mitigation plan. If the Board refers this application to external agencies and First Nations for review, there will be an opportunity to undertake more thorough assessment of the lands such that the cultural values of the subject lands can be identified and protected through the rezoning process (i.e. require detailed assessment per the Development Approval Information Area Bylaw).

Multi-modal Transportation

The applicant states that "traffic sustainability measures including walking, cycling, car pooling and car sharing" will be incorporated in the development in accordance with Bunt and Associates' 2009 Transportation Assessment. Note that this report was prepared while the RGS was in preparation and prior to the current OCP but does reference the Comox Valley Sustainability Strategy. The report has not been updated to reflect the proposed number of residential units or commercial floor area, rather is based on a phased construction plan of 60 single detached dwellings in 2012 and 540 single detached dwelling units in 2022. The Bunt assessment proposes ideas to:

1. Encourage walking (i.e. "*Centrally located services (convenience shopping, daycare, etc.) to reduce the need to travel outside the neighbourhood; walkable access to a variety of transportation and community services; traffic calmed streets with (sic) achieve 20-30km/h operating speeds; an extensive, inviting and safe network of sidewalks and trails within the neighbourhood and connecting to destinations outside of the neighbourhood with good lighting, signage and way-finding maps; pedestrian-permeable and/or small development blocks. Approximately half of the development land is dedicated as park land to ensure continued public access to the Puntledge River and Browns River Trail systems and other natural amenities of the area.*")
2. Encourage cycling (e.g. on-street bike lanes, multi-use pathways within the right-of-way or off-street paved multi-use pathways, connections to future cycling network, way-finding, bike racks, charging station for electric bikes and scooters).
3. Provide transit to key destination: No BC Transit service therefore the "*developer could provide a community shuttle van and operating funds for a private transit service*".

4. Encourage car-pooling: "*the developer could include a community amenity space in the central transportation hub that includes a 'Ride Share Board' and/or internet access that would allow residents to match to other residents*".
5. Encourage car sharing: "*the neighbourhood could potentially support two car-share vehicles…it may be that the development is too small or not sufficiently dense to be a good candidate* (for a car share operator to invest)".
6. Discourage excessive parking supply.
7. Eliminate trips: "*high speed internet should form a key requirement for the development and it should be something delivered to each unit at time of purchase*" – the assessment includes this idea in the context of shopping online and working from home as means to eliminate trips.

While the assessment proposes some ideas for reducing the reliance on private vehicles it does not address how a greenfield residential development in a rural area achieves viable multi-modal connectivity or overcomes the challenges of economies of scale required to achieve modal shift. Staff note that many of the ideas suggested within the report are outside of the control of the developer and the CVRD and would instead rely on external agencies to alter rural standards of service provision (or require CVRD service area establishment).

If the Board opts to refer these applications for external agency comment, both the Ministry of Transportation and Infrastructure and BC Transit will be invited to provide detailed comments on the proposal.

Parks, the Environment and Climate Change

The applicant is proposing a voluntary community amenity of dedicated land for public use, including Stotan Falls and the bed of the Puntledge River. As noted previously, the Board has adopted a voluntary community amenity policy that would need to be considered at the rezoning stage (i.e. following an amendment to the RGS to create a new settlement node). The applicant states that "once Riverwood is rezoned, there will be public access to Stotan Falls and River trails".

Lands along the Puntledge River and Browns River (Puntledge Triangle) including Stotan Falls have been identified as a priority acquisition piece in the Rural Comox Valley Parks and Greenways Strategic Plan 2011 – 2030. The large contiguous park size being proposed would address a gap in the current parks and greenways system for larger nature parks that could provide recreation opportunities as well as provide sufficient size to protect wildlife habitat and ecological integrity. As such, the proposed parkland dedication meets the following specific park objective as per the Rural Comox Valley Parks and Greenways Strategic Plan 2011 – 2030:

> Objective 2.2 – *"Secure access to community amenities and special features, such as Stotan Falls, swimming holes, beaches, fossil beds, cultural and historic sites."*

If this proposal proceeds, staff will work with the applicant to refine the terms of the proposed park dedication, including assessment of the geohazard and floodplain considerations within the riverine and terraced systems and will report back to the Board accordingly.

The applicant has provided an "ecology and wildlife summary" prepared in 2009 by FishFor Contracting Ltd. If the rezoning application proceeds, an updated report will be requested per the CVRD's Development Approval Information (DAI) Bylaw.

In addition to the parks and open space policies, the OCP includes climate change policies. Adopted in 2014, the policies are primarily focussed on the reduction of greenhouse gas emissions and include targets for those reductions. Recognizing fossil-fuel burning transportation and home heating as the largest sources of emissions, the OCP directs the majority of rural development to

existing settlement nodes where transit and active transportation infrastructure can be more readily provided. Conversely, the applicant is proposing a new settlement node in order to develop the subject lands. One of the fundamental principles of growth management in respect to mitigating climate change is to direct new development to existing developed areas. Compact development is infill development within existing core settlement areas with existing or planned infrastructure. It is difficult to suggest that greenfield development in the rural area on the fringe of a municipality is anything but urban sprawl that detracts from the ability to make the most efficient use of already developed lands and infrastructure.

The applicant states that through the use of covenants (i.e. private contracts between the CVRD and individual landowners) the dwellings will be required to be constructed to "Built Green" standards. "Built Green" is a third-party, non-profit organization that promotes and certifies energy efficiency in new construction. BC has introduced the "Energy Step Code": these are performance requirements for new construction. The goal is to move BC towards net zero energy readiness by 2032. In the meantime, local governments have the authority to require that new construction meets one or more steps of the Energy Step Code as an alternative to the BC Building Code's prescriptive energy efficiency requirements. Staff do not foresee the need to introduce covenants (which take more local government resources to monitor and enforce than public law such as requirements of the Building Bylaw). Rather, compliance with the Energy Step Code will assure that new buildings are performing as advertised.

Housing and Affordability

The applicant states that the creation of a new settlement node will augment housing supply and therefore contribute to increased housing affordability in the Valley.

> *"We suggest that not all of the capacity for new housing identified in the RGS may be easily or readily developed. One solution to this is to increase the sources of new housing through an additional settlement node so that additional housing is actually produced…As long as the core areas are actually approving sufficient development, the new settlement node would augment the housing produced in the core hopefully with the result working towards a better balance of supply and demand."*

The applicant does not provide any detail on how the proposed housing units will be made affordable. To be clear, "affordable" means that household shelter costs equate to less than 30 per cent of total before-tax household income. Increasingly, however, affordability calculators include consideration of a household's transportation costs. The findings of our housing needs assessment include a strong connection between housing and transportation needs. For example, if a household must have a private vehicle to travel to work/school/services the household's costs increase. Housing location is a key factor in a household's ability to use travel modes other than private vehicles. As the subject properties are not within a BC Transit service area, households will not have the option to swap a vehicle for a transit pass in order to improve household affordability. It is also important to consider the impact of proposed private utilities on household costs and the degree to which this type of servicing impacts the overall affordability of housing. Finally, the property is outside of the Courtenay Fire Protection District: households may experience increased home insurance premiums.

The soon to be completed Regional Housing Needs Assessment identifies the gaps that have been created in our reliance on market housing to achieve true affordability. There is a need for more non-market housing, particularly dedicated rental housing (i.e. purpose built rental).The services that can readily improve household affordability are generally not found in rural areas.

Growth Management

The applicant states that the "*Riverwood Settlement Node is key to the ability of the Comox Valley Regional District to achieve several of its important regional growth management…goals*" and that the proposal is "*consistent with many of the CVRD's growth management policies*". The applicant continues that the proposal "*does not create additional planned settlement areas; rather it simply shifts planned growth from one part of the property to another part*". The applicant suggests that the removal of lands from the future, municipal land base (i.e. settlement expansion area lands) is akin to the creation of a new settlement node in the rural areas.

To be clear, the RGS and both OCPs designate the entirety of the subject properties for rural uses and density (until such time as the settlement expansion area portion may be incorporated into a municipal area). The applicant's proposal does, in fact, alter the growth management scheme for the subject properties as well as the Region as a whole (including proposal of a different future municipal boundary). As noted previously in this report, settlement expansion areas were identified as either having existing residential density that may require public water and sewer servicing in the future to avoid an environmental or health crisis, or because of their potential (once incorporated in a municipality and serviced) to absorb additional density. In the meantime, development in the settlement expansion area lands is limited and change that would increase density, impact or intensity of use is not envisioned (i.e. OCP identifies a minimum 4ha area parcel size for subdivision).

Also noted previously, settlement nodes are not intended to replicate the density and related services found within a municipal area. Creation of a new settlement node within the rural area before the existing settlement nodes or municipalities have reached build-out is not consistent with the growth management objectives of the RGS.

3L Development Inc.'s proposal to "*shift planned growth*" is regionally significant in that investment decisions by private landowners, local government and higher level governments (e.g. land use and infrastructure development) will be affected. Shifting the location for growth potential will also shift or detract from the infrastructure opportunities and needs within existing Core Settlement Areas. These are the same arguments that were presented to the Board in 2018 in the context of 3L Development Inc.'s RGS amendment application. Since the Board last considered a proposed new settlement node, region-specific population, housing and employment data has been collected (through the Regional Housing Needs assessment project in 2019 and 2020) and re-confirms that, on balance the Region is building enough housing for its growth needs. The Region is challenged by a lack of truly affordable housing that the market has not, to date, been able to provide.

Policy Analysis

The *Local Government Act (RSBC, 2015, c. 1)* (LGA) grants the authority to adopt an OCP and Zoning Bylaw and states that any local government that does so must define procedures for amending the bylaws. Bylaw No. 328, being the "Comox Valley Regional District Planning Procedures and Fees Bylaw No. 328, 2014", defines a procedure for amending the Rural OCP and Zoning Bylaw. Further, the LGA requires that a local government consider every application that it receives to amend an OCP or Zoning Bylaw.

This circumstance is unique in that the proposed OCP and zoning amendments trigger the need to amend the RGS. Only the Board is granted the authority through the LGA to initiate an amendment to the RGS (i.e. no requirement to consider an amendment to the RGS). The RGS Bylaw states that an amendment to the bylaw may be proposed by a member municipality, the Electoral Areas Services Committee, or the Board, including on behalf of an external agency or private land owner.

For this reason, the applicant is introducing the proposal to the Electoral Areas Services Committee with an application to amend the OCP and Zoning Bylaws.

Staff has identified the following steps for the Board to take in order to consider the applications made by 3L Developments Inc.. Note that legal counsel has reviewed this process:

1. Landowner applies to the CVRD to amend the Rural OCP (procedures bylaw allows for concurrent zoning bylaw amendment application where desired by the applicant).
2. Electoral Areas Services Committee receives a staff report and makes a recommendation for the CVRD Board (electoral area directors' vote).
3. Board (i.e. electoral area directors' vote) considers the application and identifies next steps which may include referral of the application to external agencies and First Nations, referral of the application to the Board (Committee of the Whole directors' vote) to immediately consider whether to initiate an RGS amendment process, or denial of the application.
4. If the Board (i.e. electoral area directors' vote) refers the application for external review, staff will report back with comments and recommend next steps on the OCP and Zoning Bylaw amendment applications. Recommended next steps may include referral of the proposal to the Committee of the Whole in order to consider whether to recommend to the Board that an RGS amendment should be initiated; or denial of the applications.
5. If the Board opts to initiate an amendment process to the RGS, staff will report back with a recommendation about the type of process to be followed (i.e. standard or minor) and then the process outlined in Appendix E will kick in.

It is important to note that the Board cannot adopt a bylaw that is not consistent with the RGS. This prevents any changes to the Rural OCP or Zoning Bylaw prior to a decision on the RGS designation of the subject lands.

Options

1. Proceed with referral of the application to external agencies and First Nations.
2. Refer the applications directly to the Board to consider whether or not to initiate an amendment to the RGS (Committee of the Whole directors' vote).
3. Request that prior to any further consideration of the applications, the applicant be required to supply additional studies or information (pursuant to Bylaw No. 369, Development Approval Information Area Bylaw, 2015); or
4. Deny the applications.

Staff recommends option one as this provides an opportunity for external feedback on the proposal (including any specific additional information requirements) prior to the potential initiation of an RGS amendment process.

Financial Factors

The applicant has paid the application fees for an OCP and Zoning Bylaw amendment. Fees relating to the required RGS amendment will only be levied if and when the Board initiates an amendment to the RGS.

Legal Factors

This report and its recommendations have been prepared in accordance with the LGA and applicable CVRD Bylaws.

Regional Growth Strategy Implications

The applicant's proposal to amend the OCP designations and zoning of the lands triggers the need for an amendment to the RGS. As noted earlier in this report, the first step in the process is for the electoral area directors to consider, through a public process, how the proposal impacts the intent of

the Rural OCP and zoning. If the electoral area directors, via a board resolution, concur with staff's recommendation to refer the applications externally, staff will report back with external agency and First Nations' feedback as well as provide a recommendation on the applications, including process next steps.

Impacts of this regionally significant proposal relative to the goals of the RGS are highlighted throughout this report. Fulsome review of the RGS implications of the applicant's proposal will be undertaken by the RGS Technical Advisory Committee and RGS Steering Committee if the Board initiates an amendment to the RGS.

Intergovernmental Factors
If the Board opts to refer this application externally for comment, the government agencies and First Nations identified in Appendix A will be consulted and asked to provide feedback on the proposal. Member municipalities and K'ómoks First Nation have been provided with a copy of this report upon agenda publication.

Interdepartmental Involvement
Planning staff is leading the review of this application. Input from other CVRD departments has been integrated into this report and will continue to be collected as the application moves through the review process.

Citizen/Public Relations
Staff recommends that the application be referred to the Area C Advisory Planning Commission. Any further statutory decisions (e.g. bylaw preparation, RGS initiation) will trigger the community consultation components of the LGA (e.g. consultation plan, public hearing).

Attachments: Appendix A – "External Agency and First Nation Referral List"
Appendix B – "3L Development Inc.'s Application"
Appendix C – "OCP designation map"
Appendix D – "RU-20 and UR-40 zoning"
Appendix E – "RGS amendment process"

Agency and First Nations Referral List

The following agencies will receive a referral of the proposal ☒.

First Nations

☒	K'ómoks First Nation	☒	Homalco Indian Band
☒	We Wai Kai First Nation	☒	Wei Wai Kum First Nation of the Kwiakah Treaty Society
☒	Laich-Kwil-Tach Treaty Society		

Provincial Ministries and Agencies

	Agricultural Land Commission		Ministry of Municipal Affairs and Housing
☒	BC Assessment		Ministry of Energy & Mines
	BC Parks	☒	Ministry of Forests, Lands and Natural Resource Operations and Rural Development
☒	Ministry of Environment and Climate Change	☒	Ministry of Transportation and Infrastructure
☒	BC Transit		Ministry of Jobs, Tourism & Skills Training (responsible for Labour)
	Ministry of Agriculture	☒	Ministry of Indigenous Relations and Reconciliation
☒	BC Hydro		

Local Government

☒	Comox (Town of)		Alberni-Clayoquot Regional District
☒	Courtenay (City of)		Strathcona Regional District
☒	Cumberland (Village of)		Regional District of Mount Waddington
	Islands Trust		Regional District of Nanaimo

Other

☒	Advisory Planning Commission C	☒	Vancouver Island Health Authority (Environmental Health)
☒	Advisory Planning Commission B	☒	Advisory Planning Commission A
☒	School District No. 71 (Comox Valley)		

Comox Valley REGIONAL DISTRICT

Planning Application

Property information (Refer to your tax assessment notice or certificate of title.)

Legal description	See Attached.
Civic address	
PID	BC Assessment roll No.

Application type (If more than one application is needed, check the additional applicable boxes.)

Bylaw amendment

☑ Official community plan ☑ Zoning bylaw (i.e., rezoning)

Development permit

☐ Aquatic and Riparian Habitat ☐ Eagle Nest ☐ Blue Heron Nest
☐ Shoreline Protection Devices ☐ Steep Slopes (Hazardous Conditions) ☐ Farm Land Protection
☐ Mt. Washington mixed use development ☐ Union Bay Tourism Highway Commercial ☐ Kensington Comprehensive Development
☐ Commercial and Industrial (Form & Character)

Variance

☐ Development variance permit ☐ Board of variance

Others

☐ Temporary use permit ☐ Site specific amendment to floodplain ☐ Strata conversion
☐ Home occupation, bed and breakfast... ☐ Temporary occup. of additional dwelling ☐ Property information request

Owner information

Name(s) 3L Developments, 0768816 BC Ltd.		Company	
Mailing address Personal Information Removed		City Personal Information Removed	
		Province Personal Information	Postal code Personal Information Removed
Phone(s) Personal Information Removed		Email Personal Information Removed	

Applicant information (If the applicant is not the owner(s), complete this and the agent authorization sections. All communication will be forwarded to the applicant only.)

Name(s) Rob Buchan		Company iPlan	
Mailing address Personal Information Removed		City Personal Information Removed	
		Province Personal Information	Postal code Personal Information Removed
Phone(s) Personal Information Removed		Email Personal Information Removed	

Agent authorization (Complete only if the applicant is not the owner(s).)

I/we, (owner's name) Personal Information Removed

declare that I am/we are the property owner(s) noted on this form, and hereby authorize

(agent's name) Rob Buchan to act as agent in the matter of this/these application(s).

Owner's name 1 Personal Information Removed	Signature Personal Information Removed
Owner's name 2	Signature

All owners shown on the certificate of title must sign. Attach a separate page with additional signatures.

Development proposal (Describe the present and intended uses, and reasons for proposal. Attach additional pages if needed.)

Provincial site profile

Section 40(1) of the *Environmental Management Act* requires a site profile to be completed with an application when the applicant knows, or reasonably should know, that a site has been used or is being used for commercial or industrial purposes. If any activities found in Schedule 2 of the *Contaminated Sites Regulation* apply to the subject property, the applicant is required to complete a site profile. Schedule 2 and the site profile application form are available in the "land remediation" section of the BC Government web site (www.gov.bc.ca), as well as at the Comox Valley Regional District (CVRD). If any of the listed activities in Schedule 2 applies, contact the CVRD. If any of the listed activities in Schedule 2 does not apply, complete the following declaration:

I hereby declare that, based upon my current knowledge of the subject property, no Schedule 2 activities have been carried out.

Signature	Date
Personal Information Removed	03 0820

Notice of collection of personal information

Personal information on this application form is collected for the administration, enforcement and processing of this application. The personal information is collected under the authority of the *Freedom of Information and Protection of Privacy Act* (FIPPA), *Local Government Act* and CVRD bylaws. All documentation, drawings, plans and information submitted in support of this application can be made available for public inspection pursuant to the FIPPA. For questions about the collection of personal information, please contact the corporate legislative officer at 600 Comox Road, Courtenay, BC or at 250-334-6007.

Declaration

I, the undersigned, have attached the required documentation, as noted on the submission checklist, along with the required application fee and hereby agree to submit further information deemed necessary for processing this application. I hereby certify that the documentation and information provided with respect to this application is full and complete[1] and is, to the best of my knowledge, a true statement of the facts related to this application. Lastly, I hereby acknowledge that an incomplete application will not be processed and will be returned to me, and that any fees paid are non-refundable except as noted in the Planning Procedures and Fees Bylaw.

Signature	Date
Personal Information Removed	03 09 2020

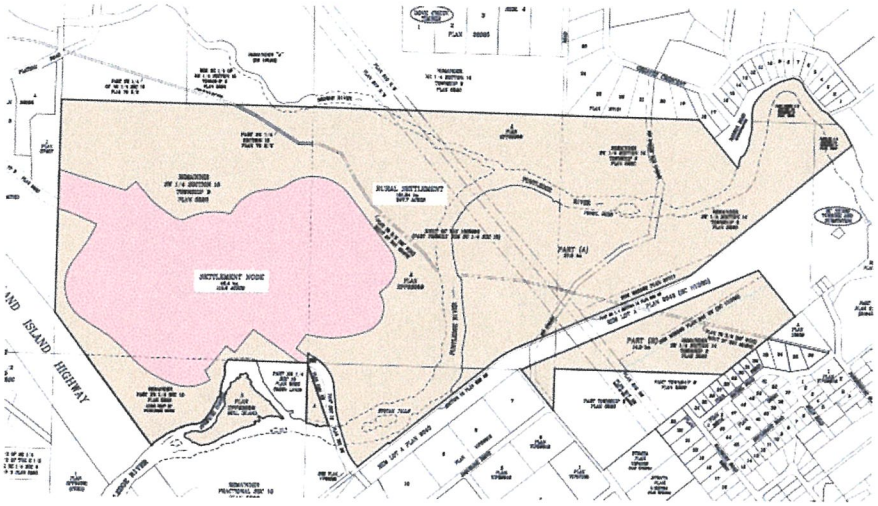
[1] A complete application includes: application form properly filled out and all fees paid; plans and supporting information compiled by applicant into a complete, required set; compliance with existing development agreements on certificates of title and conditions of previous planning approvals; identification of existing easements and rights-of-way. Incomplete applications will not be processed and will be returned.

Office use

PSR	Date received	Received by
	Fee $	Security deposit $
Planning staff	Date assigned	Assigned to

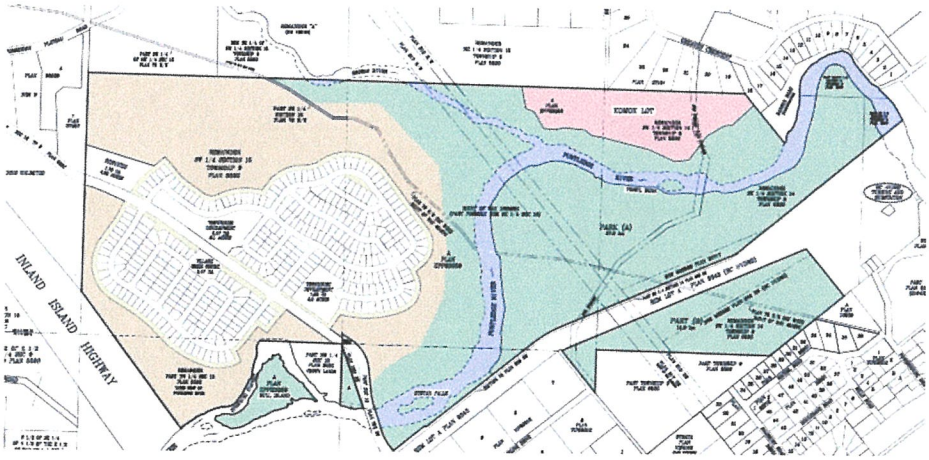
RIVERWOOD
COMOX VALLEY

Request for Regional Growth Strategy Amendment.



And

Application for Official Community Plan, and Rezoning Amendments



March 2020

iPlan Planning and Development Services

RIVERWOOD
COMOX VALLEY

Introduction

Riverwood is an approximately **201 hectare (500 acres)** master planned community in the Comox Valley. The proposed density is reduced from the previous proposed dwelling units to 335 single family lots with Secondary Suites, 54 Townhouses and 56 medium density multifamily housing, with a modest neighbourhood commercial village green centre to meet local demand for retail and to serve as a neighbourhood gathering place.

At build out, Riverwood will consist of 335 single family lots secondary suites, a mix of low (54 units) and medium density (56 units) multifamily housing (with provisions for assisted living and special needs units) and contain 1,400 square

RIVERWOOD
COMOX VALLEY

metres (15,000 square feet) of neighbourhood commercial space in a central village green (see attached land use plan).

Riverwood is committed to dedicating approximately half of the total site area which will place about 97 hectares into public ownership and create a network of public trails. This significant park and trail dedication will include the Puntledge and Brown's River beds and adjacent green belts. Acquisition of these lands are a priority objective in the Comox Valley Regional District's Parks and Greenway Strategy which calls for the acquisition of the Puntledge triangle trail system and Stotan Falls. These dedications would place these important lands with ecological and recreational values into the control and stewardship of the Comox Valley Regional District and enable achieving a number of regional policy goals.

K'omoks First Nation

The Riverwood team is committed to undertaking meaningful consultations with the K'omoks First Nation and will engage as the First Nation wishes. To this end, the proponents have been proactively approaching the First Nation and will continue in this spirit.

RIVERWOOD
COMOX VALLEY

Development Approach

In responding to comments regarding the previous application, this OCP and Rezoning proposal has set out to reduce the development foot print and maximize rural and green space. Accordingly, only 25% of the site is proposed for development. Of the remaining land, 49% is proposed as park land, 21% is proposed as rural settlement land, and a 10 hectare parcel (5%) is identified as a lot proposed for the K'omox First Nation. The proponent is committed to work with and support the Nation in their aspiration for the future use of that parcel. While we have presented a specific proposal, we look forward to discussions that can lead to detail changes recommended through the process.

The proposed development has been designed to protect environmental, recreational and archaeological values and to minimize impacts. Accordingly, a number of professional reports have been prepared for an earlier, larger development proposal. This new, smaller scale proposal reduces the previous development footprint. As a result, it has less impact and protects more land. The relevant assessments include: archaeology, traffic, environmental and ecological, and Geohazard. The development will follow the recommendations in these assessments. In particular, the following will be actioned as the development proceeds:

1) An archaeological review where the development footprint includes areas of moderate to high archaeological potential.
2) Environmental field reviews to determine if there are any western hemlock – western red cedar / deer fern or douglas-fir/ sword fern plant communities on the property and if there are any Broadwhorl Tightcoil slugs on the property.
3) Detailed riparian assessment of the headwaters of stream 13 to ensure no net loss of riparian habitat.
4) Connection to the greenways located to the north and south.
5) Sight line improvements (vegetation removal) and pavement marking improvements in accordance with the Traffic Assessment.
6) Incorporation of traffic sustainability measures including walking, cycling, car pooling, and car sharing per the Bunt Traffic Assessment.

RIVERWOOD
COMOX VALLEY

7) Compliance with the flood plain set back and flood construction levels recommended in the McElhanney Flood Plain Analysis.

Inclusionary, Affordable and Sustainable Housing

The proposed 335 single family dwellings with suites, 110 low and medium density housing units will make a meaningful contribution to the supply of housing in the Comox Valley. Recent reports in the media and from the CVRD highlight the lack of supply as being a contributor to the increasing housing prices and the resulting affordability challenges in the Comox Valley.

Riverwood proposes to have secondary suites included in the zoning bylaw which will enable a significant contribution to the affordable rental housing stock. The advantage of secondary suite housing is that it does not require any government funding and results in affordable housing throughout the development rather than being segregated into pockets of affordable housing. They also function to assist homeowners in paying their personal mortgages and/or supplement household incomes.

Riverwood also proposes to deliver sustainably built housing that meets or exceeds Builtgreen standards. A Section 219 would be registered on title prior to adoption of the rezoning bylaw to ensure that all homes built in Riverwood are certified Builtgreen.

Servicing

The Riverwood Settlement Node will be serviced as follows:

1) Vehicle and bicycle traffic will connect to adjacent public roads.
2) Bicycles and pedestrians will be provided with internal routes and connections to external routes.
3) Hydro Electric service is available and will be used for servicing the development.
4) Sanitary Sewer and water service to be provided and operated by on-site private utilities.
5) Stormwater to be managed with an integrated storm water management plan.

RIVERWOOD
COMOX VALLEY

The Proposed RGS Amendment

It is proposed to remove the Settlement Expansion area in the south east area of the site and replace that designation with Rural Settlement. It is also proposed to remove an area of Rural Settlement in the north west part of the plan and replace it with Settlement Node. These changes essentially relocate planned settlement lands (see attached plan). We propose the following RGS text amendment to accompany the map amendment:

"MG Policy ID-5 – Riverwood Settlement Node

The Riverwood settlement node is an approximate 445 residential unit village. It incorporates a mix of housing forms including single family dwellings with Secondary Suites, Townhouses and Low Rise Apartments. Within this mix, it is contemplated that there will be rental housing, social and assisted housing opportunities. Riverwood will be a compact village scale neighbourhood that will include opportunity for living, recreating, working, playing and growing food. Riverwood is sited to protect the surrounding ecosystems and access to greenway, bikeway, and trail way systems.

Riverwood Settlement Development Policies include:

1) Respond to climate change by requiring all development to meet Builtgreen standards, be solar ready, and provide transit facilities, bicycle facilities, Electric Vehicle charge stations, and trail facilities within the development and linking to the surrounding networks.
2) Ensure a mix of housing forms is provided.
3) Ensure affordable housing is provided.
4) Provide opportunity for Assisted and Special Needs housing.
5) Develop in accordance with an Integrated Storm Water Management Plan.
6) Provide opportunities for growing food in allotment gardens.
7) Develop with measures to mitigate the risk of Interface Fire Hazard.
8) Provide a neighbourhood centre for social gatherings.
9) Provide neighbourhood shopping services."

The rationale for this new Settlement Node is attached as Appendix A.

Development Summary:

1. The Riverwood Plan encompasses approximately 201 hectares.
2. Ecological Values will be protected with significant park land dedication

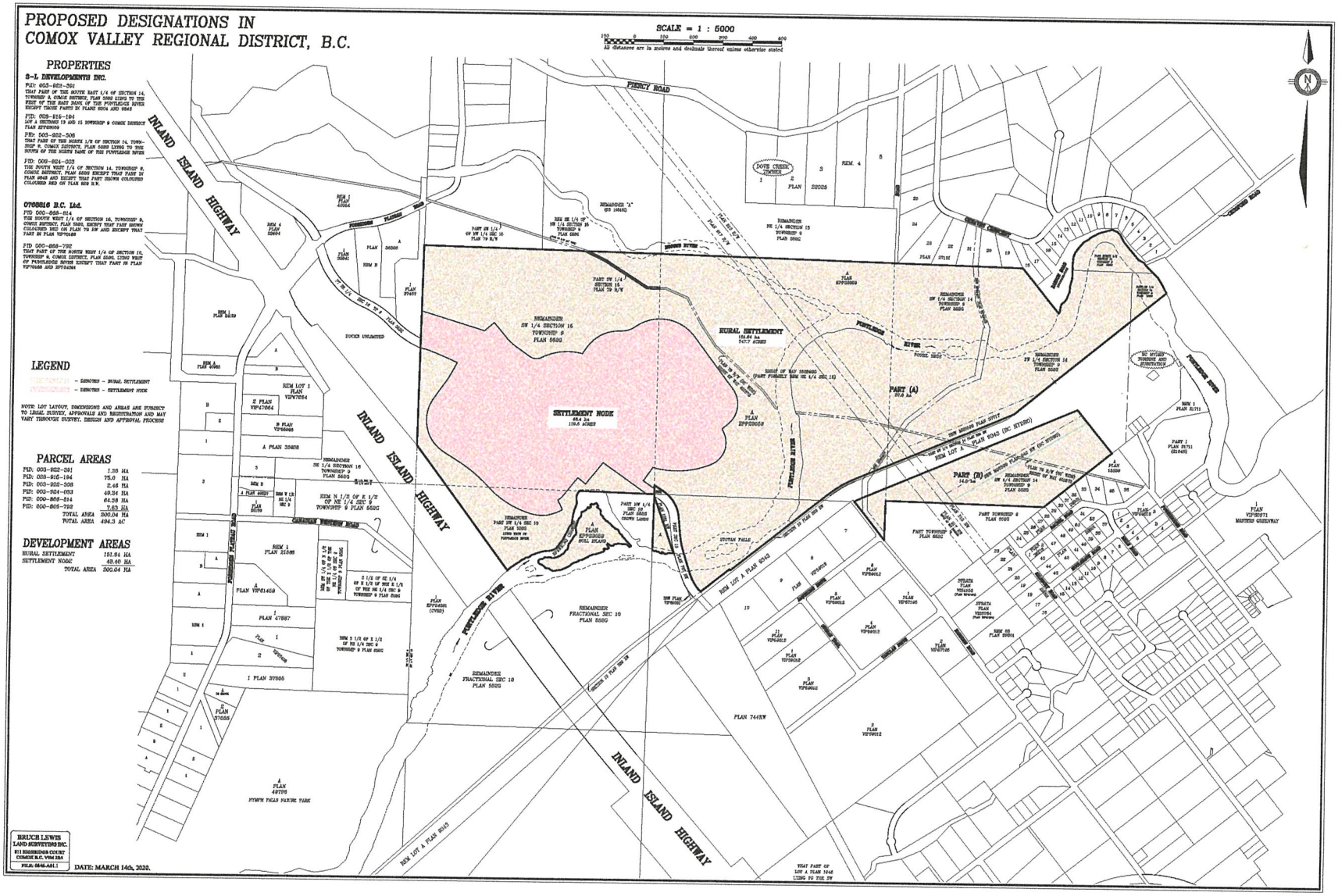
RIVERWOOD
COMOX VALLEY

comprising 49% of the lands.

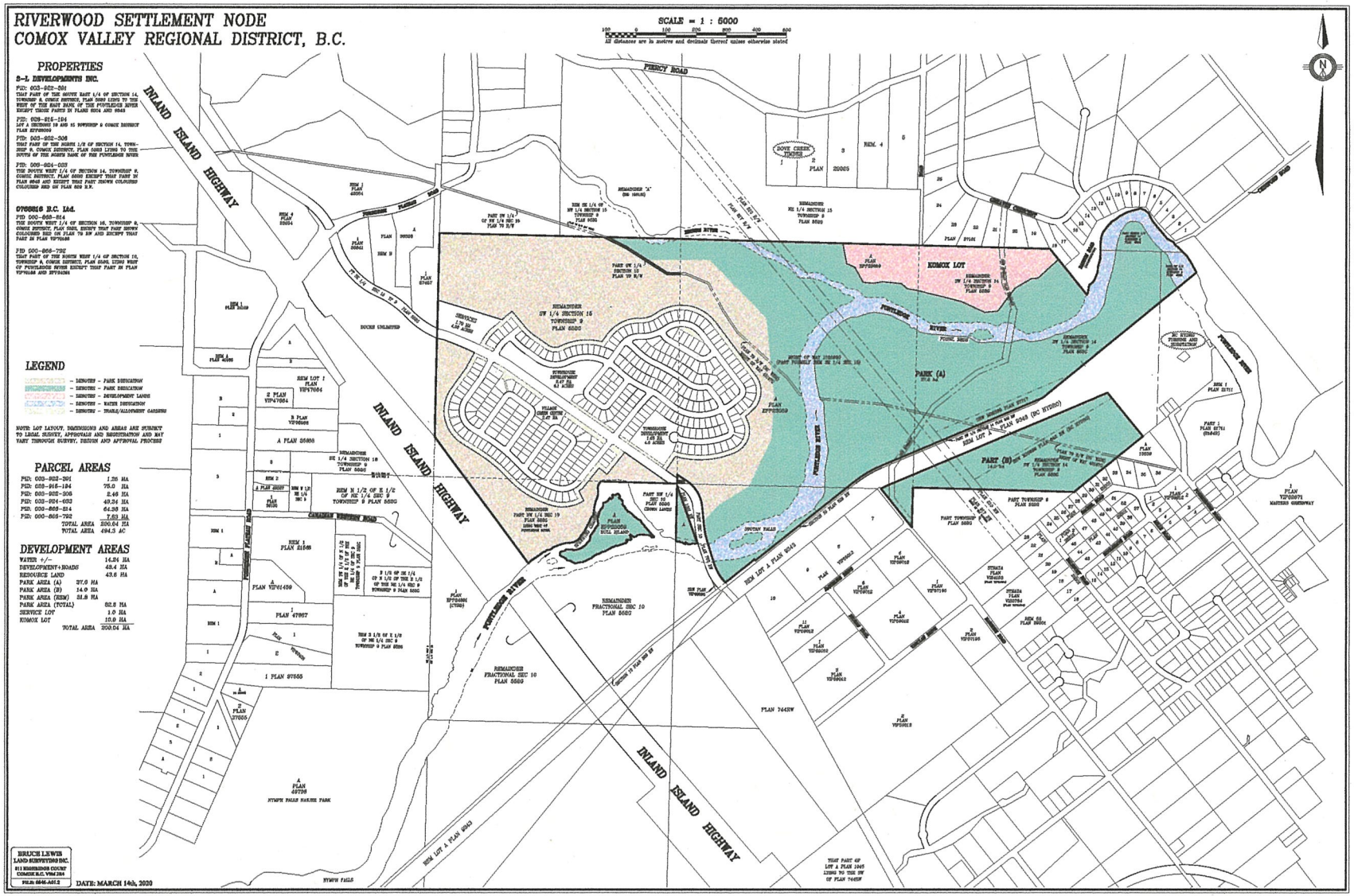
3. Development will be clustered on a small footprint comprising 25% of the lands.
4. Housing Density will be limited to 335 single family lots with suites and two areas of low and medium density housing comprising 110 residential units.
5. Affordable housing will be provided through inclusionary zoning which will allow a secondary suite in each house.
6. Assisted and special needs housing will be accommodated in the low and medium density housing areas.
7. All housing will be constructed and certified Builtgreen.
8. Local retail services will allow residents to walk to shop at the neighbourhood village green.
9. The Village Centre will include a community room and gathering place.
10. A perimeter trail and green way will include allotment gardens and serve as an interface fire hazard defense measure.
11. Dedicated Parkland and trails will achieve the CVRD's park and greenway goals for this property.
12. Private sewage and water treatment plants built and operated to provincial standards.
13. The regional road network will be enhanced with the dedication of road through the property. The development can be accommodated by the existing traffic network.
14. The Development will incorporate sustainable transportation features recommended by the Bunt Traffic Assessment.
15. The proponent will support the K'omoks First Nation in its aspirations for the land proposed for its ownership.

RIVERWOOD
COMOX VALLEY

For more information please contact iPlan Planning and Development Services
250-884-0972



REVERWOOD
COMOX VALLEY



REVERWOOD
COMOX VALLEY

RIVERWOOD
COMOX VALLEY

APPENDIX A
Rationale for the New Settlement Node

There are several reasons for amending the RGS and OCP to designate a new settlement node. In general these are:

1) a need for additional new housing stock to reduce an existing supply demand imbalance that is responsible for worsening the housing affordability issue in Comox Valley;
2) The existing Settlement Expansion area identified on the subject property has several issues that support relocating the planned growth area on the property.
3) There proposed Riverwood Settlement node is key to achieving many regional goals identified in the RGS, OCP, Transportation Road Network Plan and the Parks and Greenway Strategy. Without the development of this new node, these goals may provide difficult or unlikely to be achieved.
4) The proposed node is consistent with many other growth management principles in the RGS and OCP.

These reasons are discussed below.

RGS Policy

The RGS cites a number of trends that help shape the RGS goals and policies. Several of these trends support the new Settlement Node we propose for the Riverwood Lands.

1) The third trend (RGS Page 9) notes the increasing trend towards unaffordable housing. It is a fact that when supply does not keep pace with demand, prices increase. A February 24, 2020 report from the Vancouver Island Real Estate Board concludes that greater demand and lack of housing supply continues to make housing prices unaffordable (Troy Landreville). This is making the housing affordability issue more critical and supports the need for more housing development. The CVRD's Housing Needs Project consultants, Neil Lovitt and Sarah Ravlic, have confirmed the unaffordability of single family dwellings in the Comox Valley in their recent report.

   A new settlement node will contribute to housing supply. While the RGS notes sufficient capacity for new housing within Valley, it would seem that the delivery of new housing is not keeping pace. We suggest that not all of the capacity for new housing identified in the RGS may be easily or readily developed. One solution to this is to increase the sources of new housing through an additional settlement node so that additional housing is actually

RIVERWOOD
COMOX VALLEY

produced. This would not interfere with the goal to have most housing directed to the core areas. As long as the core areas are actually approving sufficient development, the new settlement node would augment the housing produced in the core hopefully with the result working towards a better balance of supply and demand.

2) The proposed Riverwood settlement node will open up a closed logging road for public access. Development of these lands will improve the Regional Transportation network by offering more direct routes for some traffic. (Trend 6, p 10). The Region's transportation plan identifies a north south road through Riverwood and a bicycle lane through the land. Development of Riverwood would facilitate these plan goals.

3) The Riverwood settlement node would be the closest settlement node to the core areas of Courtenay, Comox, and Cumberland compared to the other designated settlement nodes.

4) This node will allow the CVRD to realize one of its important parks and greenway strategy goals which is to have a greenway and trail system through the property (Trend 4, p 9)

5) The Riverwood Settlement node offers an opportunity for a low impact development being very level and with an existing impacted ecosystem due to recent logging. (RGS Trend 4, p 9)

6) The Riverwood Settlement node offers the opportunity for food production within three minute walk on surrounding rural resource land (RGS Trend 8, p 10)

7) Access to on site and regional trail system and allotment gardens works towards the public health goals in the RGS. (RGS Goal 10, p 11)

8) The site offers an opportunity to support the RGS's goal of supporting First Nations economic development opportunities through a gift of land and opportunity for employment opportunities (RGS Goal 11, p 11)

Other reasons supporting The Riverwood Settlement node:

The overarching RGS vision statement reads:

The Comox Valley will continue to evolve as a region of distinct, well-connected and well-designed urban and rural communities. As stewards of the environment, local governments, the K'ómoks First Nation, public agencies, residents, businesses and

RIVERWOOD
COMOX VALLEY

community and non-governmental organizations will work collaboratively to conserve and enhance land, water and energy resources and ensure a vibrant local economy and productive working landscapes.

The Riverwood settlement node would fit this vision as one of the distinct communities and one that conserves and enhances land and environmental resources.

Once Riverwood is rezoned, there will be public access to Stotan Falls and River trails. Realization of the CVRD's parks and Greenway strategy goals for the trail network through the property and RGS Objective 2-D (Ensure access to parks, recreation areas) would be realized with the development of the property as a settlement node. Without that rezoning, this goal may not be achieved.

The suitability of the lands currently designated for urban expansion south east portion of the site is questionable. First, it currently hosts areas of significant mature forest and forest ecosystems. This would be impacted with development (this is in conflict with RGS Objective 2-A). The Riverwood Node would allow that ecosystem to remain in its current state. Second, access would be impractical with the Penstock dissecting the land. Third, there is a major hydroelectric transmission line dissecting the property (See photo). Residential use under or near these lines should be avoided because of electromagnetic radiation concerns. The presence of the Penstock and the main hydro transmission lines would also present a negative visual element in a new neighbourhood.

RIVERWOOD
COMOX VALLEY

One of the RGS's goals is to avoid sprawl. The urban expansion lands currently designated on the lands are proximate to the City of Courtenay and adjacent suburban development. We are proposing that the intended growth designated for those lands be shifted to another part of the Riverwood lands as a settlement node. The relocation of the planned development does not increase development in the Comox Valley. It simply relocates it across the Puntledge River onto a more suitable site that protects ecological values and realizes recreational values. This node would be separated from the adjacent urban and suburban development by a large park and green belt that is called for generally by the RGS and the Parks and Greenway strategy.

The RGS sets policies regarding farming and food production as follows:

> Objective 6-A: Protect land for existing and future agriculture and associated activities and allow for the growth and expansion of such activities.
>
> • Rural Areas: Additional farming occurs in non-ALR rural areas. There is the potential for innovative agricultural enterprises and location of agricultural- supported activities in these areas, such as food processing plants, storage and distribution centres (e.g., farmers markets).

The Riverwood Settlement Node is situated adjacent lands that will be assessed for agriculture and opportunities for growing and food system activities.

The RGS encourages the use of electric vehicles as follows:

> 8B-7 In order to promote the use of electric vehicles, local governments should develop incentives and infrastructure for low-emissions vehicles such as recharging infrastructure and priority parking.

The Riverwood Settlement node will include public EV charging stations.

The RGS calls for attention to interface fire hazard protection as follows:

> 8F-7 Address fire protection needs for developments in the interface areas where there is a high risk of forest fires.

The location of Riverwood provides a number of advantages for interface fire hazard protection. For example, the Inland Island Highway provides a significant fire break as does the Browns and Puntledge rivers. This makes the settlement node a well protected area. In addition, a perimeter trail around the node will provided an

RIVERWOOD
COMOX VALLEY

additional fire-break and ability for firefighters to defend structures from interface fire. Further, an area around the node will be prepared for agriculture and on-site vegetation from clearing will be used as soil amendments to improve that soil when practical.

The RGS's first Growth Management Policy is to "Protect key natural and ecological features throughout the Comox Valley". Riverwood provides a unique opportunity to protect key green ecological corridors.

The Regional District's Transportation Road Network Plan shows the Duncan Bay main as part of the road network and bicycle network. Development of this settlement node will facilitate securing and improving these transportation elements thus improving the connectivity of the regional system and enable shorter trips/fewer GHG emissions.

The Comox Valley Official Community Plan contains a number of policies that the Riverwood Settlement node would assist in achieving.

CVOCP Natural environment – objectives:

1. To identify and protect unique natural features and characteristics of the Comox Valley.

2. To protect, restore and enhance coastal shorelines, streams, wetlands and the marine environment.

Riverwood would protect and preserve a critical segment of the Valley's green corridor and trail system along with the Puntledge and Browns river ecosystems.

CVOCP Parks and Greenway -- Objectives:

The CVOCP has specific park and greenway policies that RIverwood would assist in achieving as follows:

"To recognize the parks and greenway system as a vital part of the existing CVRD network of parks, open space, trails and recreational facilities.

To improve and maintain public access to water bodies – lakes, streams and the foreshore."

Development of the Riverwood Settlement node will provide access to the Puntledge River and Stotan falls.

RIVERWOOD
COMOX VALLEY

CVOCP Transportation Objectives:

The CVOCP calls to "increase opportunities for rural residents to walk, bicycle and use public transit". The trails within Riverwood and along the Puntledge and Browns Rivers will increase walking opportunities. Improvement and access to the Comox Main will secure a portion of the planned bicycle route through the property. Public transit facilities will be provided within Riverwood.

Development of Riverwood would help achieve the CVOCP policy regarding growth. It sets the following settlement node objectives:

Settlement Nodes – objectives:

1. To implement the CVRD regional growth strategy by directing most growth in the electoral areas of the CVRD to the settlement nodes
2. To encourage residential intensification as a means of increasing the amount of available housing including rooming, boarding and lodging houses, accessory dwelling units, infill, re-development and conversions within existing neighbourhoods, provided the additional housing is compatible with the scale, design context and community features of the neighbourhood.

3. To ensure that the design of the built environment strengthens and enhances the character of existing distinctive locations and neighbourhoods, and that proposals for intensification and infill within existing neighbourhoods are designed to be compatible with the existing neighbourhood character.

4. To integrate assisted and special needs housing in the settlement nodes and provide for a supply of assisted and special needs housing.

5. To promote complete communities and neighbourhoods within the settlement nodes where people can live, work, play and shop. "

In response to these objectives, Riverwood would help keep development in a settlement node, allow the integration of assisted and special needs housing in the settlement, and provide a complete neighbourhood by providing homes, recreation, shopping, working and food production land uses.

Settlement Nodes – policies:

33. The following policies apply to the lands designated as "settlement node"

RIVERWOOD
COMOX VALLEY

1. Approved local area plans establish the goals and objectives for residential, commercial, park, industrial and institutional land uses including a range of residential types and densities in each node.
2. Facilitate the provision of water and sewer services, where possible, in order to meet the needs of existing residents within the settlement nodes, and to protect public health and the natural environment in situations where on-site and privately owned systems are deemed to be insufficient.
3. Promote community facilities within settlement nodes with programs and initiatives to promote or enhance cultural activities, social interaction and educational opportunities.
4. Apply the community amenity policy included in part 4 of this OCP for development of the settlement nodes. Community amenities that support the goals and objectives of the settlement node and approved local area plans, will be considered as priority. "

We will draft a local area plan that establishes the above noted goals. There are no on site residents aside from a single caretaker. A community facility and gathering area will be provided. The community facility along with trails, parks and allotment gardens will be provided as community amenities.

In conclusion, the Riverwood Settlement node is key to the ability of the Comox Valley Regional District to achieve several of its important regional growth management, parks and greenway, and transportation goals. The plan is consistent with many of the CVRD's growth management policies. It would be an important measure to start addressing the housing affordability crisis that has developed in the Comox Valley. It does not create additional planned settlement areas; rather, it simply shifts planned growth from one part of the property to another part. Finally, with the Riverwood Settlement node, a very important and cherished part of the Comox Valley will be protected from potential resource extraction activities and be accessible to public use and enjoyment.

LEGAL DESCRIPTION AND OWNERSHIP

1. That Part of the NW ¼ of Section 10, Tp. 9, Comox District, Plan 552G, Lying west of Puntledge River except that part in Plan VIP70188 and EPP24391 – PID 000-866-792
   Owned by 0768816 BC. Ltd.

2. The SW ¼ of Section 15, Tp. 9, Comox District, Plan 552G, except that part shown coloured red on Plan 79 RW and except that Part in Plan VIP70188 – PID 000-866-814
   Owned by 0768816 BC Ltd.

3. Lot A, Sections 10 and 15, Tp. 9, Comox District, Plan EPP23059 – PID 028-915-194. Owned by 3L Developments Inc.

4. That Part of the Nort ½ of Section 14, Tp. 9, Comox District, Plan 552G lying to the south of the north bank of the Puntledge River – PID 000922-308. Owned by 3L Developments Inc.

   003 HM

5. That Part of the SE ¼, Tp. 9, Comox District, Plan 552G lying to the west of the east bank of the Puntledge River except those parts in Plans 8304 and 9343 – PID 003-922-391. Owned by 3L Developments Inc.

6. The SW ¼ of Section 14, Tp. 9, Comox District, Plan 552G, except that part in Plan 9343 and except that part shown coloured red on Plan 829 RW – PID 003-924-033. Owned by 3L Developments Inc.

Ecology and Wildlife Summary
RiverWood Development

Prepared For

3L Developments Inc.

Prepared By

Cindy Hannah, R.P.Bio.
Wayne B. Wall, R.P.Bio.

Proponent Contact Information

FishFor Contracting Ltd
Suite 110 – 1720 14th Avenue
Campbell River, BC V9W 8B9
Tel: (250) 286-9908 | Fax: (250) 286-9908
Cindy.Hannah@FishFor.ca | www.FishFor.ca

Submission Date

18 December 2009

Cindy Hannah, R.P.Bio.
FishFor Contracting Ltd

Wayne B. Wall, R.P.Bio.
FishFor Contracting Ltd

Table of Contents

Executive Summary

FishFor Contracting Ltd. was retained by 3L Developments Inc. to provide assistance in the ecology and wildlife component of their RiverWood development. This included locating, mapping and describing all waterways on the property for the development of the subdivision layout, as well as having input from a wildlife biologist to develop a conservation plan to meet the objectives of their Sustainability Matrix.

The project has been divided into sections based on sustainability issues of the RiverWood Sustainability Matrix. The sections include:

- Ecology – Conservation
- Ecology – Restoration
- Ecology – Natural Wetlands and Surface Water

The section on conservation will describe the conservation of local flora and fauna and how the development will protect imperiled species and ecological communities and ecologically sensitive areas.

The section on Restoration will describe how the development will provide habitat and promote biodiversity.

The section on Natural Wetlands and Surface Water will describe the twenty two waterways that were located and identified in the assessment and what protection is needed to meet the requirements under the Riparian Areas Regulation (RAR). One of the identified waterways will have some impact from the development and the onsite with Fisheries and Oceans Canada has been described. The resulting map and photographs of the waterways have been included.

This report has been completed as part of the rezoning process. Some of the issues surrounding the ecology and wildlife portion of the development will require further assessments at an appropriate time of year.

Location

The RiverWood development is located on approximately 395 acres (160 hectares) within the Comox Regional District adjacent to the Puntledge and Browns Rivers. Duncan Bay Main bisects the property.

Not to Scale

Figure 1. Area map showing location of proposed RiverWood development

Methodology

Ecology – Conservation

No specific field inventories were conducted in the development area.

A query was conducted for animals and plants using BC Species and Ecosystems Explorer. The query was refined to Red and Blue listed species that occur within the Comox Valley Regional District. Species were evaluated on their global ranking. Species that were critically imperiled (G1) or imperiled (G2) were reviewed to determine the potential for occurrence within the development area. The possibility of occurrence was based on habitat requirements found in the literature and distribution. These were compared to general habitats found in the development area and a general possibility of occurrence was stated. If the habitat types did not occur in the development area (based on biogeoclimatic information or specific habitat types) the probability was Nil. If the range of the species occurred in the development area but specific habitat features were absent the possibility of occurrence was considered Unlikely. If the basic habitat information indicated that the species could occur, the possibility of occurrence was Potential. If habitat information on species was not available, no probability was assigned.

A plant community list was developed using BC Species and Ecosystems Explorer. The query was refined to Red and Blue listed species that occur within the Comox Valley Regional District. Species were evaluated on their global ranking. Plant communities that were critically imperiled (G1) or imperiled (G2) were reviewed to determine the potential for occurrence within the development area. The level of stratification was based on the biogeoclimatic sub-zone/variant in which the plant community occurs. If the plant community did not occur in the CWH xm1 it was determined that the possibility of occurrence was nil. If the plant community occurred in the CWH xm1 the site series were reviewed to determine the possibility of occurrence in the development area. The probabilities in this case were subjectively stated as Unlikely (low probability) and Potential (moderate to high probability)

Ecology – Restoration

The development area was assessed against the need for restoration outlined in the RiverWood Sustainability Matrix. The aim for the sustainability issue is to *Provide habitat and promote biodiversity*. The Proposed Measure in the Matrix was *to restore 10% of the development footprint to native habitat*.

Prior to commencing a field visit of the proposed development area, a review of existing inventory information was conducted. This review included locating specific features in the Comox Valley Regional District Habitat Atlas as well as reviewing the distribution of forest cover and relative age of the forest using Google Earth. A field review was conducted at an overview level to look at the relative values in the development footprint in relation to area designated as reserve.

Ecology – Natural Wetlands and Surface Water

Prior to commencing field work all safety precautions were taken based on our in-house Occupational Health and Safety Program. The assessments were carried out to the standards outlined in the Resource Inventory Standards Committee (RISC) guidelines and methodologies for quality assurance and control. The RISC is a provincial initiative to ensure that all data collection, storage, analysis interpretation and reporting relating to natural and cultural resources are undertaken using standardized compatible systems. Both government and industry recognize and utilize RISC standards in the implementation of projects relating to ecosystem assessments and mapping. In addition, the following reference material was utilized to determine and apply appropriate field sampling techniques:

Riparian Areas Regulation: Implementation Guidebook, January 2006, Ministry of Water Land and Air Protection (Ministry of Environment).

Riparian Areas Regulation: Assessment Methodology, January 2006, Ministry of Water Land and Air Protection (Ministry of Environment), Department of Fisheries and Oceans Canada.

Reconnaissance (1:20000) Fish and Fish Habitat Inventory Manual, March 1999, Resource Inventory Committee (RIC)

Fish Stream Identification Guidebook, August 1998, Forest Practices Code of BC

Using working level 1:10,000 scale maps from the Ministry of Environment Habitat Wizard showing TRIM streams, the field crews located and assessed all waterways on the property. The waterways were located using a Trimble GeoXT Mapping Grade GPS Receiver operating to RIC standards for an accuracy of 5m. Streams were mapped as line features and GPS points of significance were taken at various locations along each watercourse to note features such as barriers to fish passage, beaver dams etc.

Stream widths, gradients, substrates and morphology were noted. Habitat quality observations were made.

Although the RAR methodology and data analysis was not completed at this time, the required information was collected to determine the appropriate setback if the detailed assessment is done.

Field equipment that was used in this study included:

- Standard personal equipment for forestry related stream work (compasses, clinometers, hip chains, radios, field safety gear, etc...)
- Laser Rangefinders
- Trimble GeoXT Mapping Grade GPS Receiver and external antenna with data dictionaries
- Olympus 8.5 mega pixel digital cameras

Collected GPS data was corrected to the local base station provider to increase accuracy and precision. GPS data was manually corrected by an experienced GIS analyst using the field notes as reference. Communication between field crews and GIS analysts ensures the map data accurately represents observed field conditions.

Results and Observations

Ecology – Conservation

The aim of this sustainability issue is to address the conservation of local flora and fauna and protect imperiled species and ecological communities. Although this might seem like a difficult task in a development such as RiverWood, the fact that 50% of the development will stay in its present state makes the conservation of local flora and fauna more attainable. The 50% of the development that will be retained consists of most of the older forest on the property and areas associated with water bodies that were identified during the riparian area assessment.

With regards to imperiled species and ecological communities, an initial query of potential species and ecological communities was conducted using BC Species and Ecosystem Explorer. BC Species and Ecosystem Explorer is supported by NatureServe, an internationally accredited system for ranking species at risk.

Local Flora and Fauna

A course filter approach was used to evaluate the developments impact on local flora and fauna. When looking at the risk to these species the property is evaluated on forest age and generally ecological significance. Forests associate with riparian habitats and older forests generally sustain the highest levels of biological diversity. For example the Clayoquot Scientific Panel indicates that 72% of forest dwelling species use riparian habitats for all or a portion of their life cycle[1]. Reserves have been designed around all water bodies on the property and are described further in the natural wetland and surface water section of this report.

Older forests generally have a greater structural diversity with important attributes such as snags and course woody debris. A significant portion of the oldest forests on the property will be retained. At this time, these forests have limited structural diversity. These older forests are found along the two major water bodies on the property and should contribute significantly to biodiversity.

Reference was made to the Comox Valley Regional District Habitats Atlas to determine impacts of the development on documented sensitive habitats.[2] Habitats identified by the Habitat Atlas were associated with riparian areas and wetlands. The proposed reserve design associated with the development will augment the areas identified in the Habitat Atlas.

Imperiled Species – Animals and Plants

Imperiled Species is not a common phrase used in British Columbia or Canada when looking at species at risk. The term as defined by NatureServe, means Extirpated, Endangered or Threatened. A query was conducted using BC Species and Ecosystem Explorer of Red or Blue Listed species found in the Comox Valley Regional District. The list was further refined to include both Critically Imperiled (G1) and Imperiled (G2) species. These species are listed in Table 1.

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[1] 1995, Clayoquot Sound Scientific Panel. Report 5, Sustainable Ecosystem Management in Clayoquot Sound: Planning and Practices, pg 27

[2] Comox Valley Regional District Habitat Atlas. http://www.imap.rdcs.bc.ca. Accessed, December 17, 2009.

Table 1 Comox Regional District – List of Imperilled Species - Plants and Animals

Scientific Name	English Name	COSEWIC Status	Global Ranking	Possibility of occurrence
Marmota vancouverensis	Vancouver Island Marmot	Endangered	G1	**Nil** Ranges of species does not overlap development area
Trematodon boasii		Not Ranked	G1	**Nil** Found in Mountain Hemlock Zone[3]
Copablepharon fuscum	Sand-verbena Moth	Endangered	G1G2	**Nil** Closely associated with yellow sand verbena (vascular plant). This plant is not found in development area
Deroceras hesperium	Evening Field Slug	Data Deficient	G2	**Unknown** Very little is known about this species. NatureServe Explorer indicates that it could be extirpated in BC[4]
Limanthes macounii	Macouns's meadow-foam	Threaten	G2	**Nil** This species is generally associated with Garry oak ecosystems[5]
Andreaea schofieldiana		Not Ranked	G2G3	**Nil** Occurs in montane to subalpine ecosystems[6]
Myotis keenii	Keen's Myotis	Data Deficient	G2G3	**Highly Unlikely** There are no karst features noted on the property. Limestone caves are used as hibernacula for this species.[7]
Pristiloma johnsoni	Broadwhorl Tightcoil	Not Ranked	G2G3	**Potential** These species could occur within the property area.

Source: BC Species and Ecosystem Explorer – Comox Valley Regional District Search, December 16, 2009

Each imperiled species found in the query were evaluated for possibility of occurrence in the area of the property. In cases like the Vancouver Island Marmot, the process of elimination was simple as the property does not overlap the range of the species. In other cases an evaluation of habitat features such as karst (limestone caves) was used to assign the possibility of occurrence.

A summary of the species, general distribution and habitat description of the species has been included. In the case of the evening field slug, very little information could be found. This is also reflected in the COSEWIC status in Table 1. Although much of the information on the species comes from multiple references only the source reference has been cited.

[3] Ryan M.W. Bryophytes of British Columbia: rare species and priorities for inventory. Res. Br., B.C. Min .For., and Wildl.Br., B.C. Min. Environ., Lands and Parks. Victoria, B.C. Work. Pap. 12/1996. Pg.13.

[4] NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 16, 2009).

[5] COSEWIC, 2004. Assessement and Update Status Report on the Macoun's Meadowfoam *Limnanthes macounii* in Canada. Executive Summary pg iv.

[6] Christy, J.A. & D.H. Wagner. 1996. Guide for the identification of rare, threatened or sensitive bryophytes in the range of the northern spotted owl, western Washington, western Oregon, and northwestern California. USDI Bureau of Land Management. 200 pp.

[7] B.C. Ministry of Environment. 2004. Identified Wildlife Management Strategy. Accounts and Measures for Managing Identified Wildlife: Keen's Long-eared Myotis, *Myotis keenii.* B. C. Ministry of Environment, Victoria, BC.

Vancouver Island Marmot

This marmot is endemic to Vancouver Island and has declined by more than 50% in the past ten years. Less than 30 mature animals remain in the wild, where they are confined to four mountains. Most colonies occur on south-west slopes between 1000 and 1400 m in elevation. Marmots require grasses and forbs for forage, suitable soils for digging burrows, and a microclimate that permits summer foraging, thermoregulation and successful hibernation. Habitat scarcity is the primary reason for marmot rarity, but recent declines are due to high losses of both adults and juveniles to predators and to unsuccessful hibernation. Other threats include the impacts of climate change on vegetation and reduced dispersal success through logged habitats. Intensive recovery efforts, including captive breeding are ongoing.[8]

Trematodon boasii

Basic Description: Mosses erect, tiny, 2-4 mm tall. Leaves 2-4 mm long, green or yellow-green, glossy, imbricate and flexuose but not much contorted when dry, consisting of a short, sheathing blade tapering to a long awl-shaped and flexuose apex. Setae yellow, 1-4 mm long, flexuose. Capsules usually numerous, reddish-brown, 0.5-1 mm long, 0.5 mm wide, with a yellowish neck of about the same length tapering to the seta. Peristome well developed. Lid of capsule has a distinct beak (Christy & Wagner 1996).

Habitat Comments: Forming loose mats on moist bare soil, often with organic content, along edges of trails, streams and ponds in the subalpine zone (Christy 1996).[9]

Sand-verbena Moth

Habitat Comments: Beaches, dunes, and sand spits with dense vigorous patches of sand verbena (*Abronia latifolia*), but not sandy meadows or nearly bare sand with sparse or non-flowering sand verbena plants only.

Food Comments: The larvae are monophagous on yellow sand verbena *Abronia latifolia.* Adults take nectar from its flowers.

Phenology Comments: Adults occur from mid or late May though June, about 45-55 days per year. Eggs hatch in about two weeks. Larvae overwinter in one or more late instars and pupate in late April or May.[10]

Evening Field Slug

Potentially extirpated in Washington State and British Columbia.[11] Limited information available on distribution or habitat requirements in British Columbia.

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[8] Species at Risk &Local Government: A Primer for British Columbia. http//:www.speciesatrisk.bc.ca Accessed December 16, 2009.

[9] NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 17, 2009).

[10] NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 17, 2009).

[11] NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 17, 2009

Macoun's meadow-foam

Distribution: Macoun's meadow-foam is known only from southern Vancouver Island and several other islands close to Vancouver Island. It has not been found on the mainland of British Columbia nor in Washington State.

Habitat: Plants occur in seasonally wet depressions or along intermittent seeps in low elevation and usually close to the ocean. The majority of the sites are in open areas of Garry oak ecosystems.[12]

Keen's Myotis

Terrestrial Habitat(s): Bare rock/talus/scree, Cliff, Forest - Conifer, Woodland – Conifer

Special Habitat Factors: Standing snag/hollow tree

Habitat Comments: The distributional range suggests an association with coastal forest habitat (van Zyll de Jong 1985; Nagorsen and Brigham, unpubl. manuscript). Apparently this bat is associated with mature forests (Balcombe, 1988 COSEWIC report), but it is not restricted to old growth (COSEWIC 2003). Across the range it has been found roosting in southwest-facing rock crevices, among geothermally heated rocks, in tree cavities, in bark crevices, and in buildings (D. Burles, pers. comm.; Firman et al. 1993; Nagorsen and Brigham 1993; Parker and Cook 1996; Mather et al. 2000). Tree cavities and loose bark are important natural roost sites and may be limiting in some parts of the range (British Columbia Ministry of Water, Land and Air Protection 2004). In British Columbia, one maternity colony (on Hot Springs Island in the Queen Charlotte Islands) is situated within geothermally heated rocks associated with hot spring activity (British Columbia Ministry of Water, Land and Air Protection 2004). The only other known maternity colony in British Columbia was suspected to be in a tree located in a low elevation, southwest-facing cliff at Knoll Hill near Tahsis, Vancouver Island (COSEWIC 2003). Known maternity roosts and summer feeding areas in British Columbia are at elevations below 240 meters; known hibernation sites occur above 400 meters in caves over 100 meters long (British Columbia Ministry of Water, Land and Air Protection 2004). These bats have been observed foraging over hot spring pools and clearings above scrubby salal (*Gaultheria shallon*).[13]

Andreaea schofieldiana

Basic Description: Erect mosses, rarely over 1 cm tall, dark reddish-brown to blackish. Leaves lanceolate, 2-2.5 mm long, imbricate when dry, sometimes falcate at tip of shoot, broad enough at back to show a portion of the blade on each side of the well-defined costa. Leaf margins entire, or finely crenate toward tips because of projecting cells. Capsules opening by four vertical valves, the urn shrinking vertically when dry, to resemble a Japanese urn (Christy & Wagner 1996).

Habitat Comments: Forming mats on dry and exposed to moist, shaded igneous rocks, montane to subalpine. Associated species include Saxifraga, Sedum, Selaginella, Gymnomitrion, Cladonia and crustose lichens (Christy 1996).[14]

[12] COSEWIC, 2004. Assessement and Update Status Report on the Macoun's Meadowfoam *Limnanthes macounii* in Canada. Executive Summary pg iv.

[13] NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 17, 2009).

[14] NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 17, 2009).

Broadwhorl Tightcoil

This tiny (to 2.8 mm), flattened, translucent to waxy-white snail is found from the mid-coast of British Columbia (including Vancouver Island) south to Oregon. It is considered rare within this range and is typically found in the leaf litter of deciduous, mixed or coniferous forests below 1300 m elevation. The major threats are habitat loss and fragmentation to forest harvest, urbanization, and agricultural development.[15]

The only potentially Critically Imperiled or Imperiled species that could occur on the property is the Broadwhorl Tightcoil.

Imperiled Species – Ecological Communities (Plant Communities)

A query was conducted using BC Species and Ecosystem Explorer of Red or Blue Listed plant communities found in the Comox Valley Regional District. The list was further refined to include both Critically Imperiled (G1) and Imperiled (G2) plant communities. The Comox Valley Regional District covers a broad range of ecosystems. The possibility of occurrence of many of the plant communities is nil as the biogeoclimatic units in which they occur are not found within the area of the development. In other cases, the biogeoclimatic units may occur in the area of the property but the possibility of occurrence could be easily determined that based on known location. For example, Henderson's checker-mallow Tidal Marsh is associated with tidal marshes. The development is located well above sea level.

Table 2 Comox Regional District – List of Imperilled Species - Plant Communities

Scientific Name	English Name	Biogeoclimatic Units	Global Ranking	Possibility of occurrence
Festuca idahoensis ssp. roemeri - Koeleria macrantha	Roemer's fescue - junegrass	CDFmm/00 CWHxm1/00	G1	**Nil** Plant Community does not occur in development area
Sidalcea hendersonii Tidal Marsh	Henderson's checker-mallow Tidal Marsh	CWHxm1/00	G1	**Nil** Plant Community does not occur in development area
Carex macrocephala Herbaceous Vegetation	large-headed sedge Herbaceous Vegetation	CDFmm/00 CWHvh1/00 CWHwh1	G1G2	**Nil** Biogeoclimatic sub-zone/variant does not occur in development area
Picea sitchensis / Maianthemum dilatatum Very Wet Hypermaritime 1	Sitka spruce / false lily-of-the-valley Very Wet Hypermaritime 1	CWHvh1/08	G1G2	**Nil** Biogeoclimatic sub-zone/variant does not occur in development area
Picea sitchensis / Rubus spectabilis Dry	Sitka spruce / salmonberry Dry	CWHdm/08 CWHds1/08	G1G2	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Populus tremuloides / Malus fusca / Carex obnupta	trembling aspen / Pacific crab apple / slough sedge	CDFmm/00 CWHxm1	G1G3	**Nil** Plant Community does not occur in development area

[15] Species at Risk &Local Government: A Primer for British Columbia. http//:www.speciesatrisk.bc.ca Accessed December 16, 2009.

Scientific Name	English Name	Biogeoclimatic Units	Global Ranking	Possibility of occurrence
Thuja plicata - Picea sitchensis / Oplopanax horridus Very Wet Hypermaritime 1	western redcedar - Sitka spruce / devil's club Very Wet Hypermaritime 1	CWHvh1/07	G1G3	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Abies amabilis - Thuja plicata / Tiarella trifoliata Moist Maritime 1	amabilis fir - western redcedar / three-leaved foamflower Moist Maritime 1	CWHmm1/05	G2	**Nil** Biogeoclimatic sub-zone/variant does not occur in development area
Arbutus menziesii / Arctostaphylos columbiana	arbutus / hairy manzanita	CDFmm/00 CWHxm1/00	G2	**Nil** Plant Community does not occur in development area
Carex lasiocarpa - Rhynchospora alba	slender sedge - white beak-rush	CDFmm/Wf53 CWHmm1/Wf53 CWHmm2/Wf53 CWHxm1/Wf53 CWHxm2/Wf53	G2	**Nil** Plant Community does not occur in development area
Carex sitchensis / Sphagnum spp.	Sitka sedge / peat-mosses	CWHvh2/Wf51 CWHvm1/Wf51 CWHvm2/Wf51 CWHwh1/Wf51 CWHwm/Wf51 CWHws2/Wf51 ICHvc/Wf51 ICHwc/Wf51 MHmm1/Wf51	G2	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Deschampsia cespitosa - Sidalcea hendersonii	tufted hairgrass - Henderson's checker-mallow	CWHxm1/00	G2	**Nil** Plant Community does not occur in development area
Salix sitchensis - Salix lucida ssp. lasiandra / Lysichiton americanus	Sitka willow - Pacific willow / skunk cabbage	CDFmm/Ws51 CWH/Ws51 ICH/Ws51	G2	**Nil** Plant Community does not occur in development area
Pseudotsuga menziesii - Pinus contorta / Holodiscus discolor / Cladina spp.	Douglas-fir - lodgepole pine / oceanspray / reindeer lichens	CWHdm/02	G2G3	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Thuja plicata / Polystichum munitum Dry Maritime	western redcedar / sword fern Dry Maritime	CWHdm/05	G2G3	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Thuja plicata - Pseudotsuga menziesii / Acer circinatum	western redcedar - Douglas-fir / vine maple	CWHds1/05 CWHds2/05	G2G3	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Tsuga heterophylla - Abies amabilis / Hylocomium splendens	western hemlock - amabilis fir / step moss	CWHms1/01 CWHms2/01	G2G4	**Nil** Biogeoclimatic sub-zone variant does not occur in development area

Scientific Name	English Name	Biogeoclimatic Units	Global Ranking	Possibility of occurrence
Tsuga heterophylla - Pseudotsuga menziesii / Rhytidiadelphus triquetrus Dry Submaritime 1	western hemlock - Douglas-fir / electrified cat's-tail moss Dry Submaritime 1	CWHds1/01	G2G3	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Tsuga heterophylla - Thuja plicata / Blechnum spicant	western hemlock - western redcedar / deer fern	CWHdm/06 CWHxm1/06 CWHxm2/06	G2G3	**Potential** Plant community could exist within development area
Pseudotsuga menziesii - Pinus contorta / Holodiscus discolor / Cladina spp.	Douglas-fir - lodgepole pine / oceanspray / reindeer lichens	CWHdm/02	G2G4	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Pseudotsuga menziesii / Polystichum munitum	Douglas-fir / sword fern	CWHdm/04 CWHxm1/04 CWHxm2/04	G2G4	**Highly Unlikely** Limited possibility that plant community could exist in development area
Thuja plicata / Oplopanax horridus	western redcedar / devil's club	CWHds1/07 CWHds2/07	G2G4	**Nil** Biogeoclimatic sub-zone variant does not occur in development area
Tsuga heterophylla - Abies amabilis / Blechnum spicant Moist Maritime	western hemlock - amabilis fir / deer fern Moist Maritime	CWHmm1/06 CWHmm2/06	G2G4	**Nil** Biogeoclimatic sub-zone variant does not occur in development area

Source: BC Species and Ecosystem Explorer – Comox Valley Regional District Search, December 16, 2009

As indicated in Table 2, there are two plant communities that could be present within the development area. It is recommended that a qualified professional conduct and overview assessment to determine the occurrence, amount and distribution of these plant communities.

Ecology – Restoration

The aim of this sustainability issue is to provide habitat and biodiversity. The proposed measure is to restore 10% of the development footprint to pre-development habitat. The present design addresses this measure through retention of approximately 50% of the development in reserve. The reserve design utilizes riparian areas, wetlands and older forests. These areas presently exhibit the area of higher biodiversity on the property. Over time, the reserve network should increase in structural diversity and provide habitat for a wide range of species.

Ecology – Natural Wetlands and Surface Water

The aim of this sustainability issue is to identify and protect surface water bodies (watersheds, wetlands and riparian areas). Protection of waterways and their associated riparian areas is a requirement under the Riparian Areas Regulation (RAR). Rather than design the development, apply for rezoning and finally complete a RAR assessment at the time that a development permit was required, 3L Developments Inc. had a vision of using the water bodies as positive features on the property. Prior to the design of the RiverWood development, FishFor Contracting Ltd was retained to locate, map and note uses of the waterways on the property. The maps would be used by the architect to design the layout of RiverWood around these features, ensuring that the riparian areas are protected and determine appropriate areas of additional setbacks to be dedicated as park/open spaces.

On March 30, April 1, 3-8, 14 and June 30, 2009 waterways were located and traversed to be mapped accurately for the development of the property. The property was walked along slopes that would drain to the known water bodies (Puntledge, Browns and Forbidden Plateau Creek) to locate watercourses. Waterways were identified and preliminary assessments on habitat quality were noted. Required setbacks under the Riparian Areas Regulation (RAR) have been listed although the detailed assessments and the completion of a RAR Assessment Report to meet the criteria needed under the RAR have not been completed to date.

Conclusions are based upon an inspection of the waterways mentioned in this report and on the conditions observed March 30, April 1, 3-8, 14 and June 30, 2009. Conclusions and recommendations in this report have been made in a manner consistent with the level of care and skill normally applied by environmental professionals practicing under similar conditions to those encountered at the time of the assessment. Geological and/or morphological changes can occur in waterways. Any change in conditions from those observed on the above date has the potential to invalidate the conclusions in this report. This report has been prepared for use and distribution by 3L Developments Inc.

Although a detailed assessment under the RAR has not been completed at this stage of the development, the waterways on the property were located and mapped. Fish use and habitat quality were noted. Amphibian use was also noted. Stream widths and gradient were measured to determine the appropriate setback that would be required under the RAR.

The results are shown in Table 3. The resulting map showing the location of the identified waterways is included in Appendix 1. Representative photos were taken of each waterway and are included in Appendix 2.

Table 3 RiverWood Property Natural Wetlands and Surface Water Identification

Waterway ID	Width	Setback Required under RAR detailed assessment	Comments	Photo #
Puntledge River	+15m	30m	The Puntledge River has steep sideslopes that will need assessing by a qualified professional to determine if the setback is sufficient in providing slope stability.	
Browns River	+10m	30m	The Browns River has steep sideslopes that will need assessing by a qualified professional to determine if the setback is sufficient in providing slope stability.	
1	n/a	n/a	This small drainage dissipates and does not connect to fish bearing water.	1
2	±1m	10m	This small stream flows directly into Waterway 3 (Forbidden Plateau Creek) a known fish bearing stream. The stream offers rearing and limited spawning habitat for resident fish.	2
3 Forbidden Plateau Creek	±4m	10-15m	This is a known fish bearing stream. It offers excellent spawning and rearing habitat for resident fish. The beaver ponds offer habitat for amphibians, Red Legged frog egg masses were noted.	3
4	n/a	15m, 30m due south	This wet site has evidence of old beaver activity. Fish access would be extremely limited due to poor habitat attributes (shallow, no pools).	4, 5
5	n/a	n/a	There is a small seepage that does not provide fish access or habitat.	
6	±1m	10m	This shallow (<5cm deep) drainage is 15m long. It provides marginal fish access and habitat (shallow, no pools). There is no spawning habitat.	6
7	±2m	10m	This shallow waterway offers limited fish access during high flows for ~20m. There is no spawning habitat.	7
9 stream	±1m	10m	The stream drops 4m into the Browns River. Above barrier sampling did not locate resident fish.	8
9 wetland	n/a	15m, 30m due south	This wetland has evidence of recent beaver activity. It offers quality amphibian habitat and numerous egg masses were noted. There is no fish access into the wetland.	9
10	<1m	n/a	Dissipates and does not connect to fish bearing water.	
11	±1m	n/a	This waterway dissipates upslope of the Puntledge River and does not connect to fish bearing water.	10, 11

Waterway ID	Width	Setback Required under RAR detailed assessment	Comments	Photo #
12	±1m	n/a	This short waterway dissipates upslope of the Puntledge River and does not connect.	12
13	±1.5m	10m on stream 15m, 30m due south on wetland	This stream connects directly to the Puntledge River. There is fish access for 42m to an increase in gradient to +40% including a +3m high vertical drop. The seasonal stream was dry in the lower reaches and intermittent upslope. There is no suitable resident fish habitat upslope (no spawning substrates). The wetland does provide limited amphibian habitat. The wetland is dominated by hummocks with low lying areas vegetated in sedges, grasses and fern.	13, 14
14	±1m	10m	This seasonal stream had minimal water at the time of the assessment. It connects directly to the Puntledge River and offers limited fish access to the base of the topographic bench. There is no suitable habitat (shallow, seasonally dry) for resident fish habitation upslope.	15
16	±1m	n/a	This small waterway does not connect directly to fish bearing water and therefore does not trigger the RAR. It has a muck bottom with sedges along the perimeter. The upper reaches have been modified into a drainage area for the surrounding property.	16
17	n/a	n/a	This waterway is a small isolated wet area. It does not connect to fish bearing water.	17
18	n/a	n/a	This waterway is a small isolated wet area. It does not connect directly to fish bearing water.	18, 19
19	n/a	n/a	This waterway is a small isolated wet area. It does not connect to fish bearing water.	
20	±1.5m	10m	This stream connects directly to the Puntledge River and offers both spawning and rearing habitat for fish. Coho fry were observed. The upper reaches are unconfined but there is sufficient depth of water for fish use.	20, 21
21	n/a	n/a	This waterway is a small isolated wet area. It does not connect to fish bearing water.	22, 23
22	±1m	n/a	This small waterway sources from Highway 19 ditchline. It does not connect to fish bearing water.	24

Wetland 13

This wetland (at the headwaters of Stream 13) that was identified during the initial assessment was determined to pose a problem with the proposed development layout. As the RAR process does not allow for encroachment into waterways or their riparian areas, consultation with Fisheries and Oceans Canada was initiated.

On June 22, 2009 an onsite meeting was held between Kabel Atwall of 3L Developments Inc, Cindy Hannah of FishFor Contracting Ltd and Doug Swift of Fisheries and Oceans Canada to discuss the marginal wetland. The proposed development requires filling in portions of the marginal wetland to accommodate the layout. As a result of the onsite a subsequent assessment was recommended to locate and map the area of the wetland that exhibits the best wetland characteristics to ensure that this portion of the wetland is protected during the development. The marginal areas of the wetland are dominated by hummocks vegetated in terrestrial plants, including both coniferous and deciduous species. Low lying areas are dominated by sedges, grasses and ferns. The ground is wet, but a surface water connection throughout the wetland is difficult to determine.

The wetland was re-assessed on June 30 (and a visual assessment was done in December 2009 to ensure that the area located in June is correct) to locate and map areas of the wetland that exhibit defined wetland characteristics (vegetation type and direct connectivity to the outlet stream). The development will not encroach on this area of the wetland. As the development is in the preliminary stages, specific details of both the amount of wetland that will be lost and how the loss will be compensated has not been determined. An agreement in theory has been accepted by Mr. Swift and his comments will be utilized to develop the plan that will be used when completing the "Request for Review under the Habitat Provisions of the Fisheries Act Form" when the development reaches that phase. This plan will ensure that there is "no net loss" of fish habitat. Although the wetland itself is non-fish bearing, it does provide a water source to fish bearing water and thus under the *Fisheries Act* could be considered fish habitat.

Discussion

3L Developments Inc. RiverWood Development within the Comox Valley Regional District is being designed to be a Sustainable Development. In their Sustainability Guidelines and Matrix, the objectives are divided into three main areas of sustainability; environmental, social and economic. FishFor Contracting Ltd was retained to provide assistance with the Ecology and Wildlife section of the Environmental Sustainability area.

Within the RiverWood Sustainability Matrix several Issues are described within theEcology and Wildlife Section. Three of these issues are described in this report. They include:

- Ecology – Conservation
- Ecology – Restoration
- Ecology – Natural Wetlands and Surface Water

Ecology – Conservation

The aim of this sustainability issue is to:

"Conserve local flora and fauna and protect imperiled species and ecological communities"

The fact that 50% of the development will stay in its present state makes the conservation of local flora and fauna more attainable. The 50% of the development that will be retained consists of most of the older forest on the property and areas associated with water bodies that were identified during the riparian area assessment. Riparian areas are critical to both aquatic species as well as other forest dwelling creatures. By having these areas set aside as park will meet the aim of conserving local flora and fauna.

The only potentially Critically Imperiled or Imperiled species that could occur on the property is the Broadwhorl Tightcoil, a very small slug that lives in the leaf litter of forests below 1300m elevation. It is recommended to discuss the potential for the slug to occur on the property with a biologist familiar with this invertebrate prior to any field assessments being conducted.

There are two plant communities that could be present within the development area. There is some potential to have the western hemlock - western redcedar / deer fern plant community occurring on the property. There is a less likelihood of having the douglas-fir / sword fern plant community occurring on the property. It is recommended that a qualified professional conduct and overview assessment to determine the occurrence, amount and distribution of these plant communities. Assessment for occurrence of plants is generally conducted in late spring/early summer for accurate identification.

Ecology – Restoration

The aim of this sustainability issue is to:

"Provide habitat and promote biodiversity"

The proposed measure is to restore 10% of the development footprint to pre-development habitat. The present design addresses this measure through retention of approximately 50% of the development in reserve. The reserve design utilizes riparian areas, wetlands and older forests. These areas presently exhibit the area of higher biodiversity on the property. Over time, the reserve network should increase in structural diversity and provide habitat for a wide range of species.

Ecology – Natural Wetlands and Surface Water

The aim of this sustainability issue is to:

"Identify and protect surface water bodies (watersheds, wetlands and riparian areas)"

This was achieved by locating and mapping all watercourses on the property prior to designing the layout of the development. This ensured that the development could be designed in such a way to both protect the aquatic features on the property and highlight these habitats as park areas that the residents in the community can enjoy. The development is within a development permit area of the Comox Valley Regional District, thus requiring the property to have a Riparian Areas Regulation Assessment done on the property during the subdivision. As the project is at the re-zoning stage, a complete RAR assessment has not been completed, but sufficient data was collected to determine the required setbacks that a detailed assessment would determine, to ensure that the design of the development accounted for the required riparian areas to maintain the form and function of each of the waterways on the property.

One waterway was determined to pose a problem for the design, and consultation with Fisheries and Oceans Canada commenced immediately to ensure that the vision of the project could be completed without negatively impacting the waterway. Recommendations from Fisheries and Oceans Canada will be utilized when designing the final layout of that phase of the project.

Appendices

Map of located waterways and associated setbacks
Photo documentation of the located waterways

Photo Documentation

Photo 1, Waterway 1:
This drainage dissipates and does not connect to fish bearing water. It does not require a setback under the RAR.

Photo 2, Waterway 2:
This small stream offers potential rearing and spawning habitat for fish.

Photo 3, Waterway 3:
Forbidden Plateau Creek is known to be fish bearing. It offers both spawning and rearing habitat for fish.

Photo 4, Waterway 4:
This wet area offers very limited fish access and limited rearing habitat.

Photo 5, Waterway 4:
There is evidence of old beaver activity.

Photo 6, Waterway 6:
This seepage is 15m long. It offers marginal fish access and limited rearing habitat.

Photo 7, Waterway 7:
This waterway offers limited fish access and limited rearing habitat for ~20m during high water levels.

Photo 8, Waterway 9:
The stream drops 4m into the Browns River. No resident fish were sampled upstream.

Photo 9, Waterway 9:
There is ongoing beaver activity upstream. The wetland offers excellent habitat for amphibians.

Photo 10, Waterway 11:
The waterway dissipates upslope of the Puntledge River and does not connect to fish bearing water.

Photo 11, Waterway 11:
Typical morphology upslope of the trail, predominantly muck/fines substrate with skunk cabbage growing throughout.

Photo 12, Waterway 12:
The waterway dissipates upslope of the Puntledge River. There is no connection to fish bearing water.

Photo 13, Waterway 13:
This +3m high vertical drop with the +40% gradient slope is a barrier to upstream fish access. There is no resident fish habitat upstream.

Photo 14, Waterway 13:
The wetland does not provide suitable habitat for resident fish habitation, but does offer habitat for amphibians. The water is generally shallow.

Photo 15, Waterway 14:
Upslope of the barrier to fish, the waterway does not offer suitable habitat for resident fish habitation.

Photo 16, Waterway 16:
This waterway does not connect directly to fish bearing water. It is shallow with a muck substrate and sedges growing along the perimeter.

Photo 17, Waterway 17:
This is a small isolated wet area. It does not connect to fish bearing water.

Photo 18, Waterway 18:
There is no connection to fish bearing water.

Photo 19, Waterway 18:
There is a small isolated wet area upslope of the trail.

Photo 20, Waterway 20:
This stream offers both spawning and rearing habitat for fish. Coho fry were observed.

Photo 21, Waterway 20:
The upper reaches are unconfined, but there is sufficient depth of water for fish access.

Photo 22, Waterway 21:
This waterway does not connect to fish bearing water.

Photo 23, Waterway 21:
The waterway is an isolated wet area.

Photo 24, Waterway 22:
This waterway that sources from the Highway 19 ditchline does not connect to fish bearing water.

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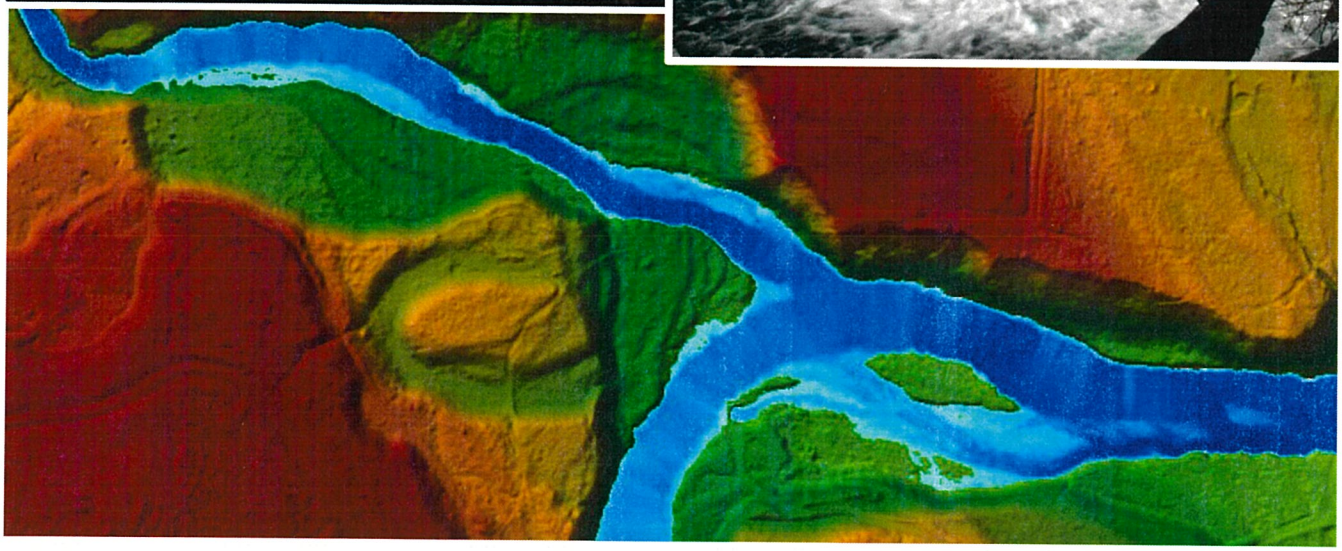
REVISION 0 - FINAL

RIVERWOOD DEVELOPMENT FLOODPLAIN ASSESSMENT

Puntledge & Browns Rivers

3-L Developments Inc.

July 12, 2018 | Our File: 2211-47519-00



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Contact: Eric Heel, PEng
Hydrotechnical Engineer
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CONTENTS

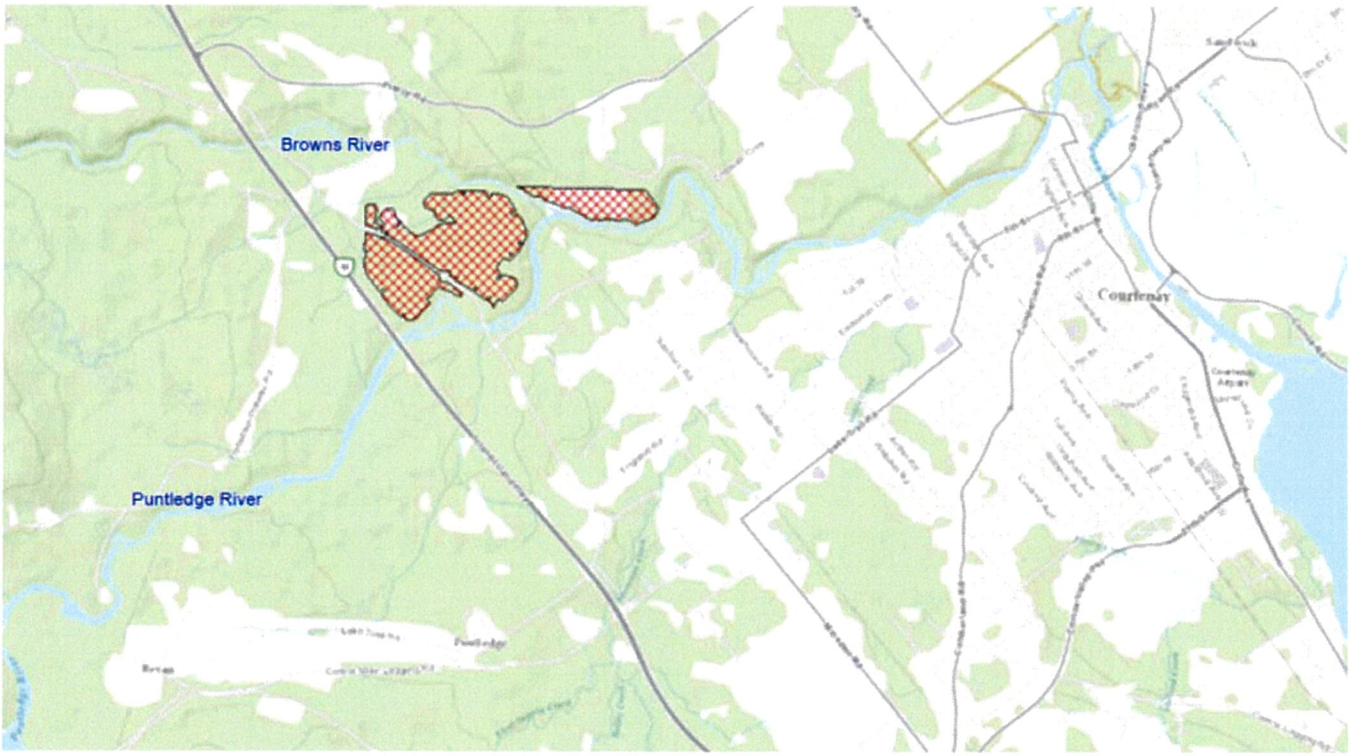
FIGURES

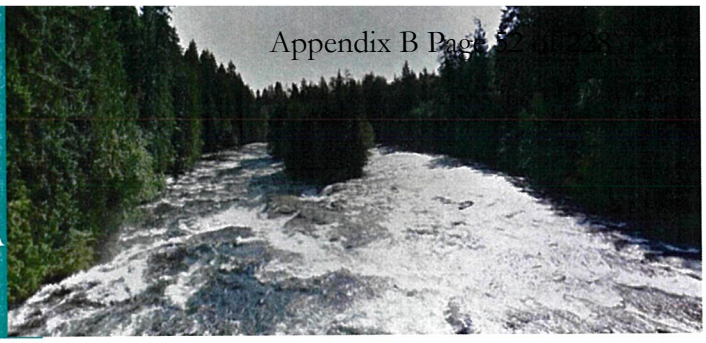
1. INTRODUCTION

3-L Developments Inc. is proposing to construct a residential development at the confluence of the Puntledge River & Brown's River, near Courtenay, BC. This report details the hydrologic and hydraulic analyses completed to assess these watercourses, with the purpose of determining appropriate Flood Construction Levels (FCLs) and construction setbacks for the development.

Figure 1, shows the project location.

Figure 1: Site Location, East of Courtenay, BC (Shown by Red Cross-Hatch)





2. BACKGROUND & DESIGN CRITERIA

The project is located within the Comox Valley Regional District (CVRD) and must follow the CVRD's *Floodplain Management Bylaw 2005*.

This bylaw establishes the requirements for Flood Construction Levels (FCLs) as well as floodplain setbacks. Specifically, for the Browns & Puntledge Rivers, the bylaw states:

- **Flood Construction Level:** *Bylaw 2005*, Section 302 Item 2)d): "Where Floodplain Mapping is NOT available, the following elevations are specified as flood construction levels: 3.0 meters above the natural boundary of Browns & Puntledge rivers.

- **Floodplain Setback:** *Bylaw 2005, Section 303, Item 1)b)*: 30.0 meters from the natural boundary of the Browns & Puntledge rivers.

A detailed survey of the "natural boundary" is not available. In lieu of conventional field survey of the natural boundary, detailed LiDAR data was recently collected. This provides a detailed topographic surface of the site and the adjacent rivers to a level of accuracy of +/- 5 cm. We used the LiDAR information as the basis for a detailed river analysis to recommend the FCLs and floodplain setbacks. These recommendations, subject to approval by the CVRD, are considered generic FCL and floodplain setback recommendations noted in *Bylaw 2005*.

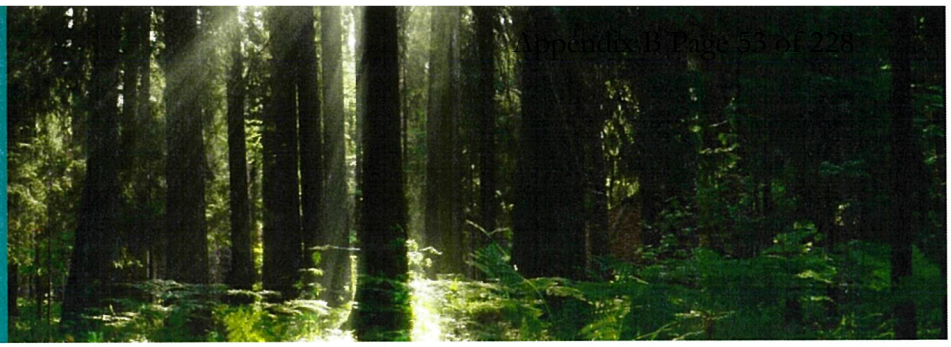
In addition to the CVRD's Bylaw, the following guidelines were referenced as part of this analysis:

- *Professional Practice Guidelines - Legislated Flood Assessments in a Changing Climate in BC* (APEGBC, June 2012)

- *Flood Mapping in BC – APEGBC Professional Practice Guidelines* (V1.0, January 2017)

- *Technical Circular T-06/15: Climate Change and Extreme Weather Event Preparedness and Resilience in Engineering Infrastructure Design* (MoTI, August 2016)

Appendix A includes an *Assurance Statement*, recognizing that the guidelines have been followed in our analysis.



3. HYDROLOGY

3.1. 200-YEAR FLOW RATES

As per *Bylaw 2005*, the "Designated Flood" for determination of FCLs and floodplain setbacks is the 200-year return period flood event.

We referred to the City of Courtenay's *Integrated Flood Management Study* (McElhanney & KWL, December 2013) to estimate the 200-year return period flows for the Browns & Puntledge Rivers. **Appendix B** provides the relevant excerpts from the IFMS Report and associated appendices. The Designated Flood flow for each watercourse is:

- Puntledge River 200-Year Flow Rate = 439 m^3/s
- Browns River 200-Year Flow Rate = 428 m^3/s

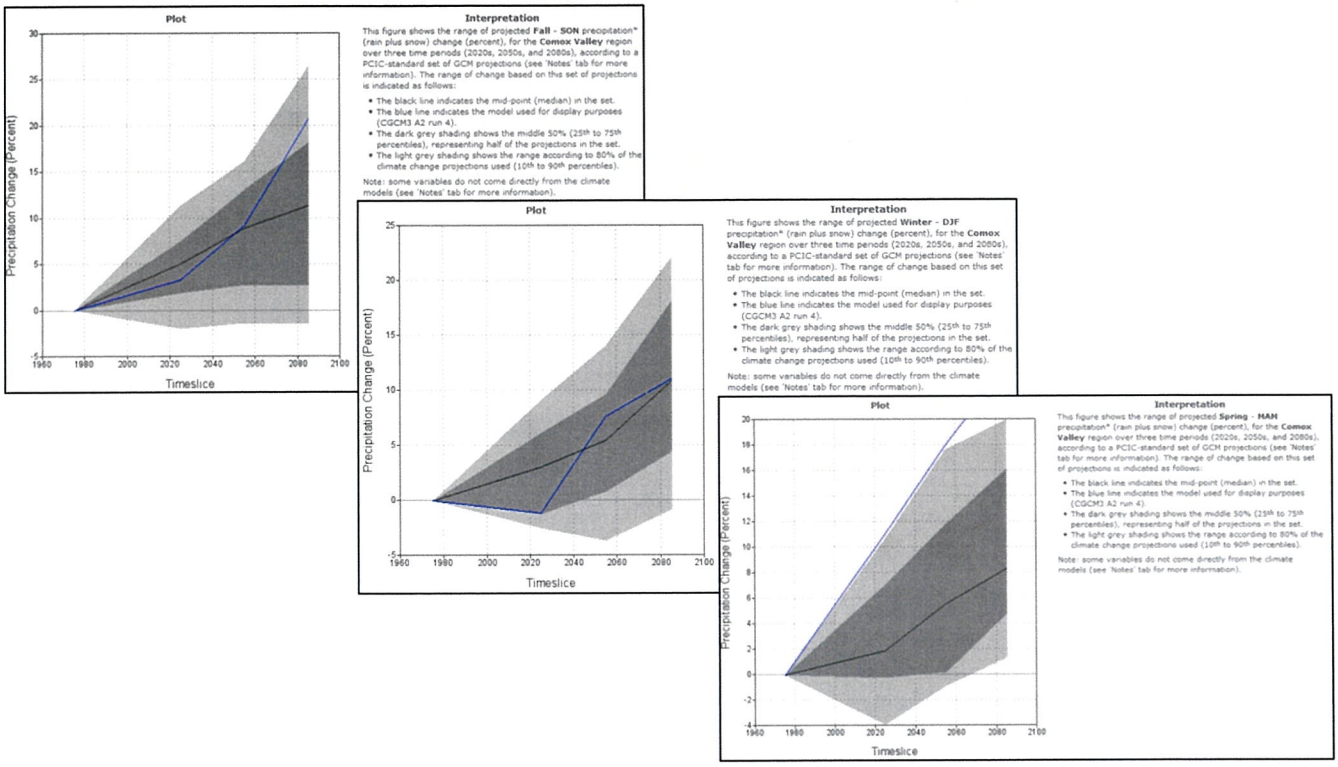
3.2. CLIMATE CHANGE

The peak flows of the Puntledge River & Browns River are generally caused by severe rain or rain-on-snow storm events, occurring between November to March. Climate change is anticipated to alter precipitation patterns within these watersheds, and result in stronger and more intense winter storms and therefore increased peak flows.

To estimate the impact of climate change on the 200-year peak flows, the *Plan2Adapt* tool provided by the Pacific Climate Impacts Consortium (PCIC) was used. This tool provides estimates of changes to rainfall patterns for various regional districts in British Columbia. **Figure 2** shows the estimated precipitation increases for the CVRD during the fall, winter & spring periods, projecting the year 2090. The *average* (50^{th} percentile) estimated increase in precipitation is 10%. However, the 75^{th} percentile estimated increase in precipitation is approximately 18%. Due to the large uncertainty inherent in long-range forecasting, we increased the 200-year peak flow by 18% for this study. This is directly related to the increase in precipitation. The revised designated flood flows for each watercourse are:

- Puntledge River 200-Year Flow Rate (incl. Climate Change adjustment) = 518 m^3/s
- Browns River 200-Year Flow Rate (incl. Climate Change adjustment) = 505 m^3/s

Figure 2: Estimated Impacts of Climate Change on Rainfall for the CVRD (from PCIC's Plan2Adapt Tool)



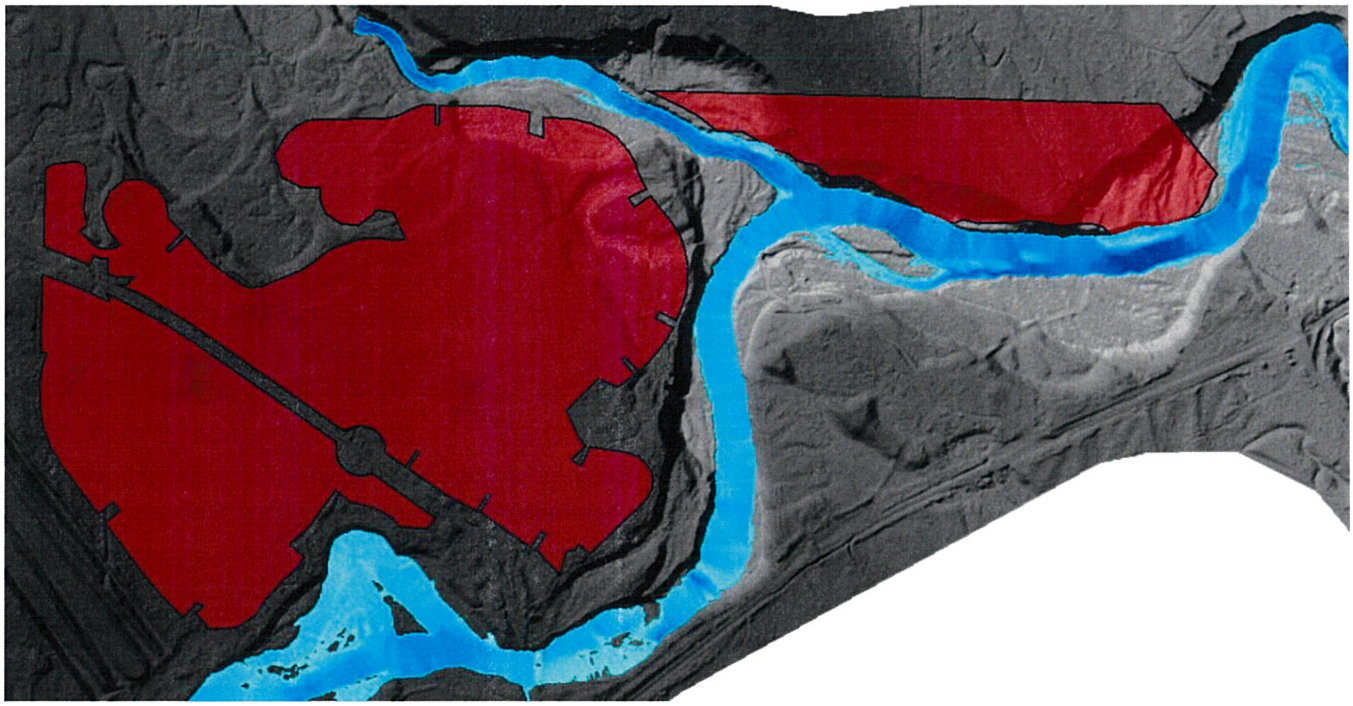
4. HYDRAULIC ANALYSIS

The hydraulic analysis of the Browns River & Puntledge River was completed using the HEC-RAS (v5.0.5) hydraulic modelling software. This software is the River Analysis System (RAS), developed and maintained by the US Army Corps of Engineers Hydraulic Engineering Center (HEC). The two-dimensional mesh modelling functionality was used in conjunction with the LiDAR data (Spring 2018). The model estimates the water surface elevation, and water velocity and direction at all locations within the model's boundaries.

4.1. INPUT PARAMETERS & MODEL CREATION

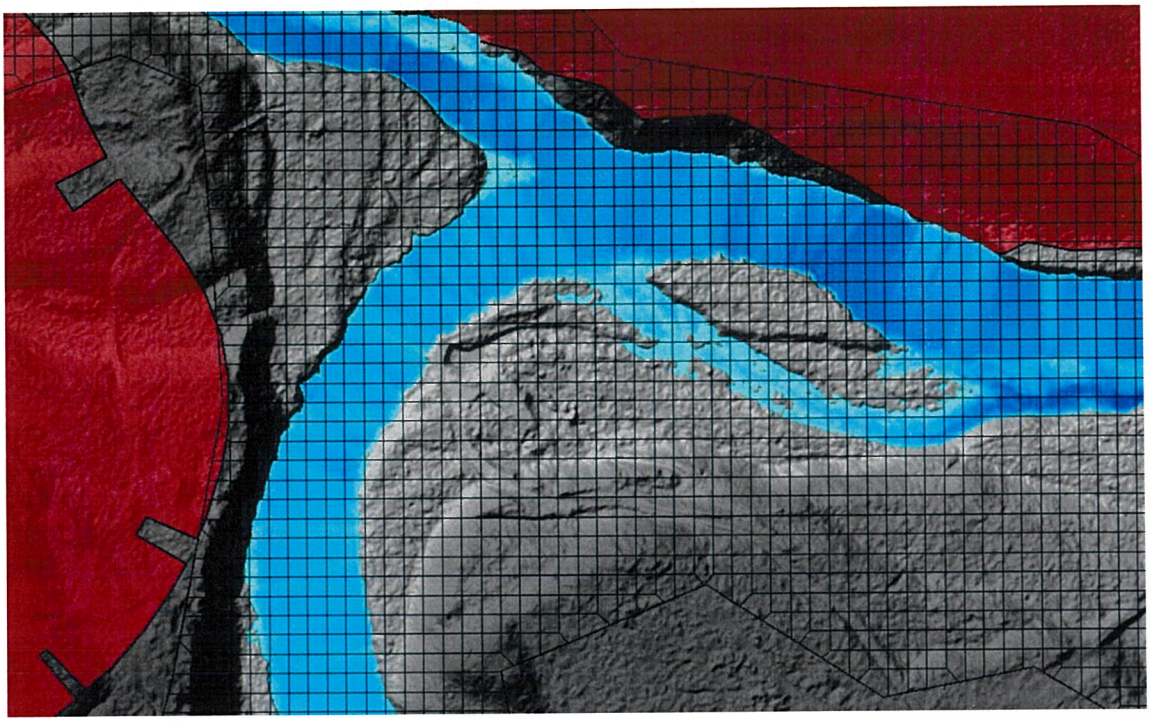
LiDAR data was collected by McElhanney in Spring 2018 via an airplane mounted sensor. It provides coverage of the study area to approximately +/- 5 cm accuracy. **Figure 3** shows the Digital Terrain Model (DTM) created from the LiDAR data.

Figure 3: Prop. Development Areas (Red) Overlaid on Digital Terrain Model (DTM, grey) & Puntledge / Browns Rivers Main Flow Channels (Blue)



We employed a computational mesh size of 12m x 12m (see **Figure 4**). It was overlaid on top of the Digital Terrain Model. Channel roughness coefficients (Manning's 'n' values) were assigned based on site information and aerial imagery. A value of 0.04 was assigned to the main river channel, and a value of 0.10 was used for the overbank / vegetated areas outside of the main channel.

Figure 4: Detail showing 12m Computation Mesh inside HEC-RAS Model



4.2. RESULTS

Both the Brown's River and Puntledge River flow within well-defined, incised channels. The Puntledge River, from the Highway 19 crossing to its confluence with the Brown's River, flows within a minimum 60-meter wide channel bordered by steep banks that rise 10 meters from the river channel (see **Figure 5**). The designated flood flow is contained within the lower portion of the channel, with an average water depth of approximately 2 meters.

Figure 5: Puntledge River Cross-Section near Stotan Falls (approx. 100m Downstream of Duncan Bay Rd Bridge)

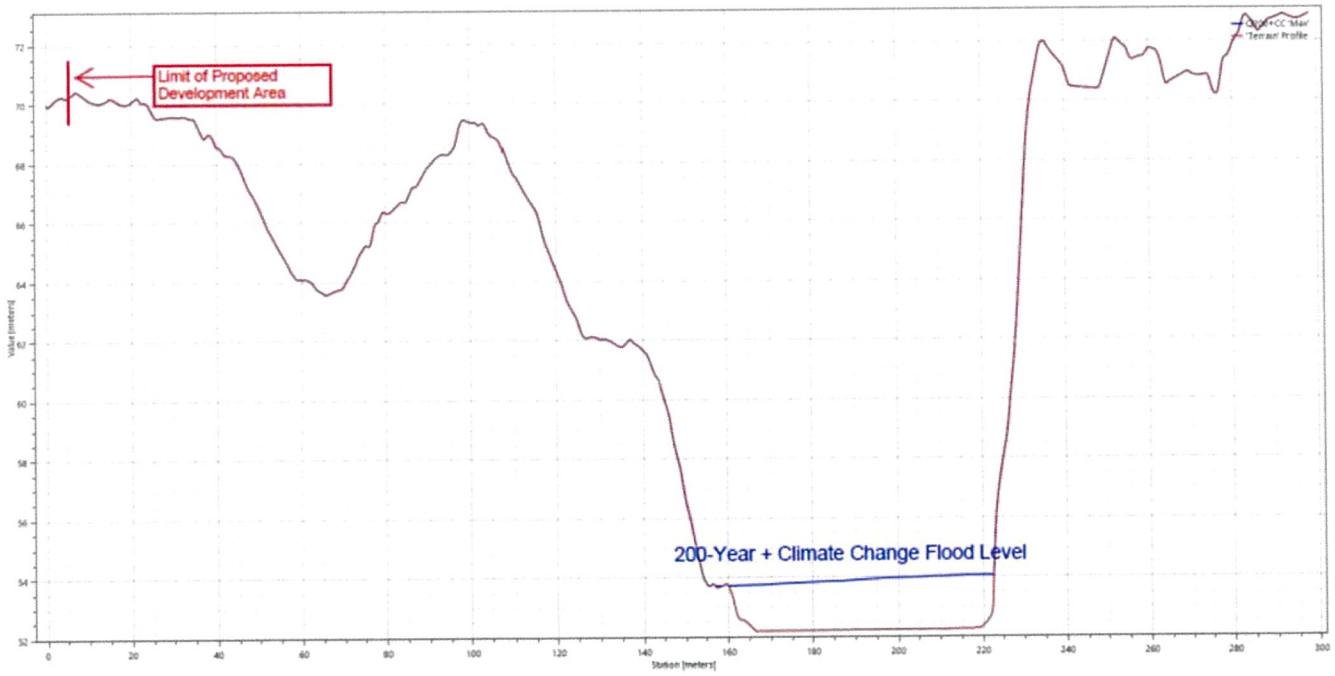


Figure 6 (plan view), and **Figures 7 & 8** (3D isometric views), highlight the proposed development area west of the confluence. This area is situated above the predicted water surface elevation under designated flood conditions.

Figure 6: Proposed Development Areas (red) & 200-Year Flood Extents (Blue indicates Flood Depth: Light Blue = shallow, Dark Blue = up to 4m deep)

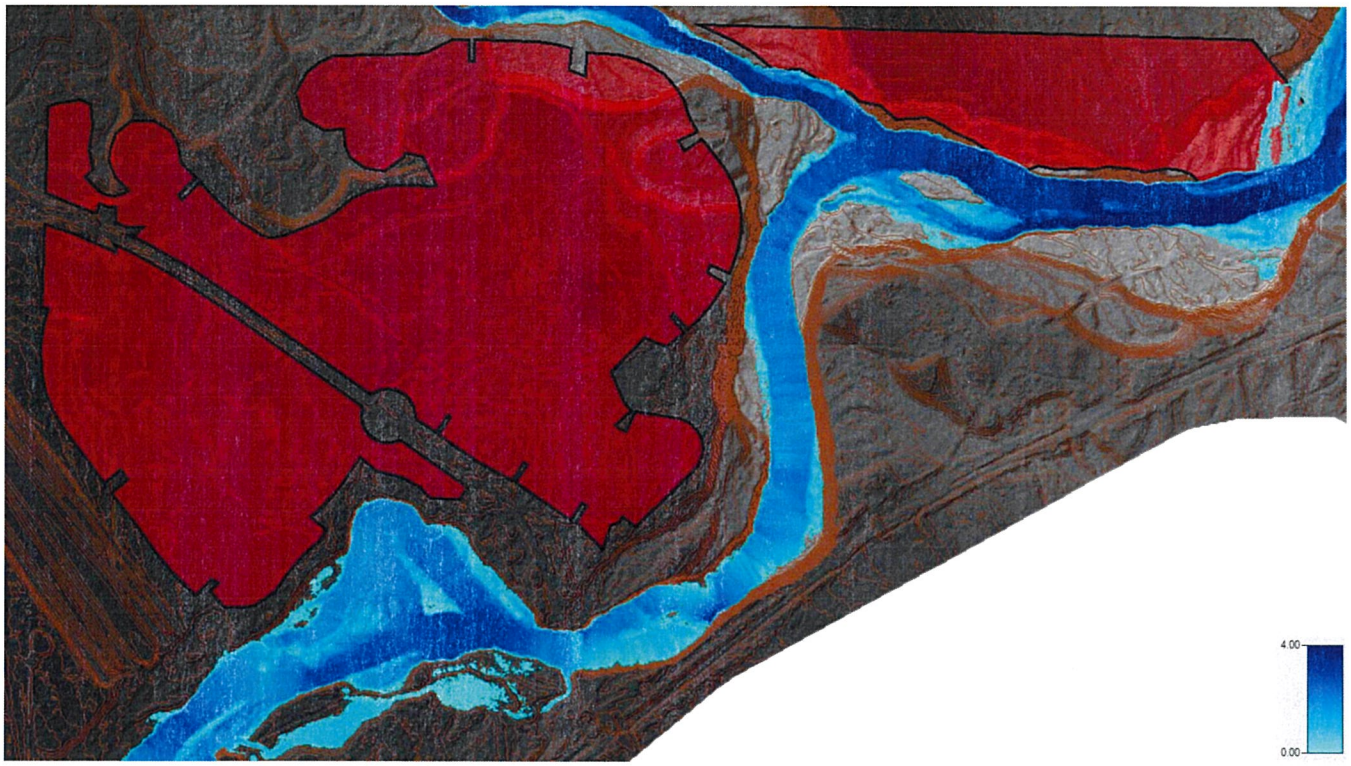


Figure 7: 3-D Isometric View, Looking from South to North (approx.) Showing the Proposed Development Areas on Either Side of Duncan Bay Road & 200-Year Flood Extents

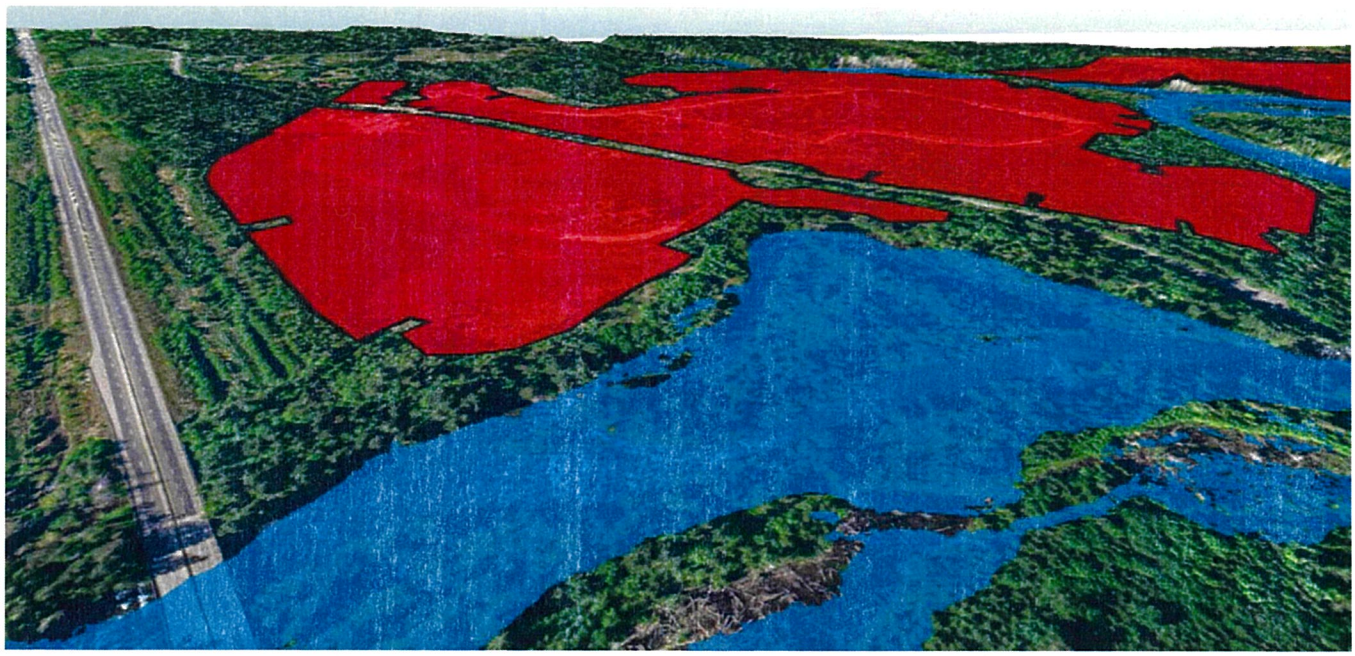
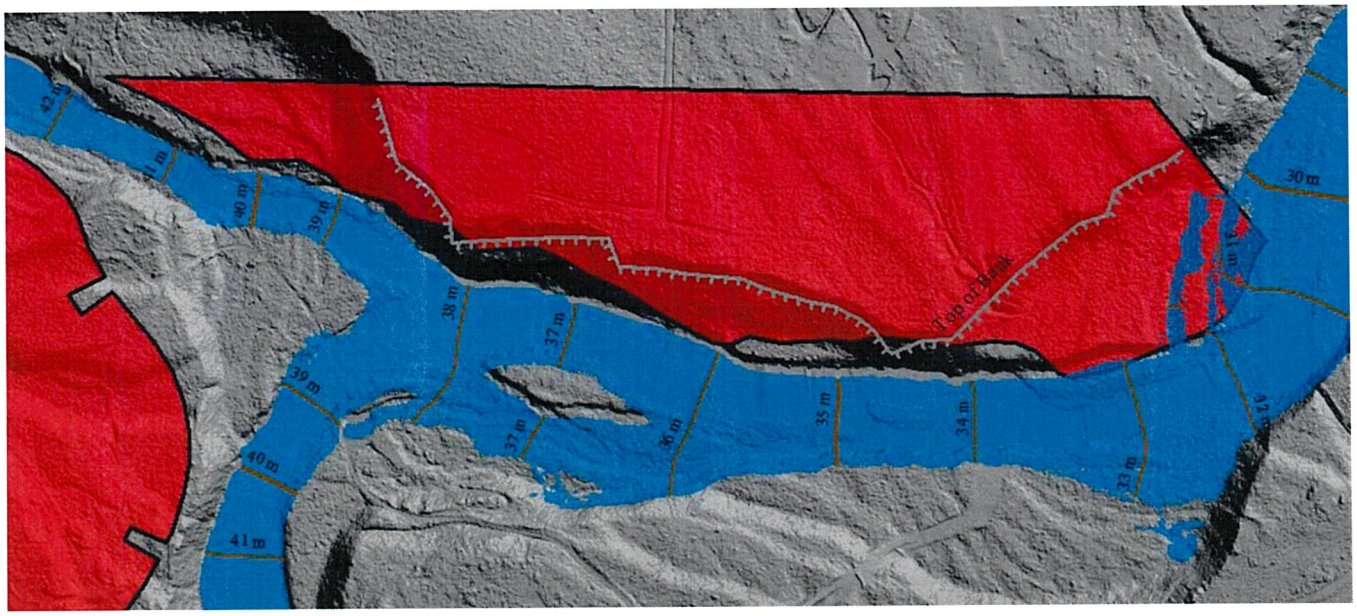


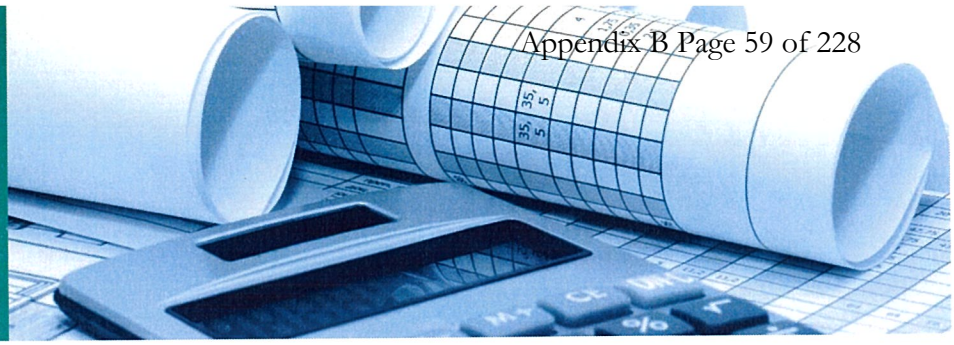
Figure 8: 3-D Isometric View, Looking from North to South (approx.) Showing the Proposed Development Areas on Either Side of Duncan Bay Road & 200-Year Flood Extents

Most of the development area east of the confluence is also located above the top of bank and outside of the potential flood hazard area. The westernmost portion of the development extends along the north side of Browns River. It is situated below the top of bank. We recommend development in this area be built above the FCL elevation and respect the recommended floodplain setback (recommendations provided in *Section 5* of this report).

Figure 9: Development Area East of Confluence of Browns & Puntledge Rivers, including 200-Year Floodplain Elevation Contours



Similarly, a the easternmost development area is below the top of bank and should be respect the FCL and floodplain setback recommendations.



5. CONCLUSION

The proposed development is situated above the higher river banks of the Puntledge River and Browns River. Most of the proposed development area is above the recommended FCL and respects the floodplain setbacks.

Due to the complex terrain around this proposed development site, it is our recommendation that the conclusions and recommendations described herein be adopted for use in the design and construction of any proposed development within this area, in lieu of the generic recommendations provided in the CVRD's Floodplain Bylaw.

In general, this proposed development likely meets or exceeds the setback and Flood Construction Level (FCL) requirements of the CVRD's Bylaw. However, in lieu of a lengthy and difficult field survey to determine the "natural boundary" of these rivers, it is recommended that the floodplain setbacks and FCLs be instead based on the extents and elevations of the calculated flood levels, as described below:

- Development within any of the "proposed development areas" described within this study shall:
    - Have a "floodplain setback" of at least 15m from the limits of the estimated 200-year return period flood;
    - Have a "Flood Construction Level" of at least 0.6m above the estimated floodplain elevations for the 200-year return period flood.

The attached **Figure 10** shows the recommended floodplain setback areas and FCLs. This information will also be provided electronically along with this report, in the form of: a floodplain setback shapefile (*.shp file); and a flood construction level contours shapefile (*.shp file).

We trust this analysis and report will suit your needs. If you have any questions or concerns, please contact the undersigned.

McELHANNEY CONSULTING SERVICES LTD.

Prepared by:

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA E.C. HEEL

July 16 2018

Eric Heel, P.Eng.
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Reviewed by:

PROFESSIONAL ENGINEER D. A. JOHNSTON 2018/07/16

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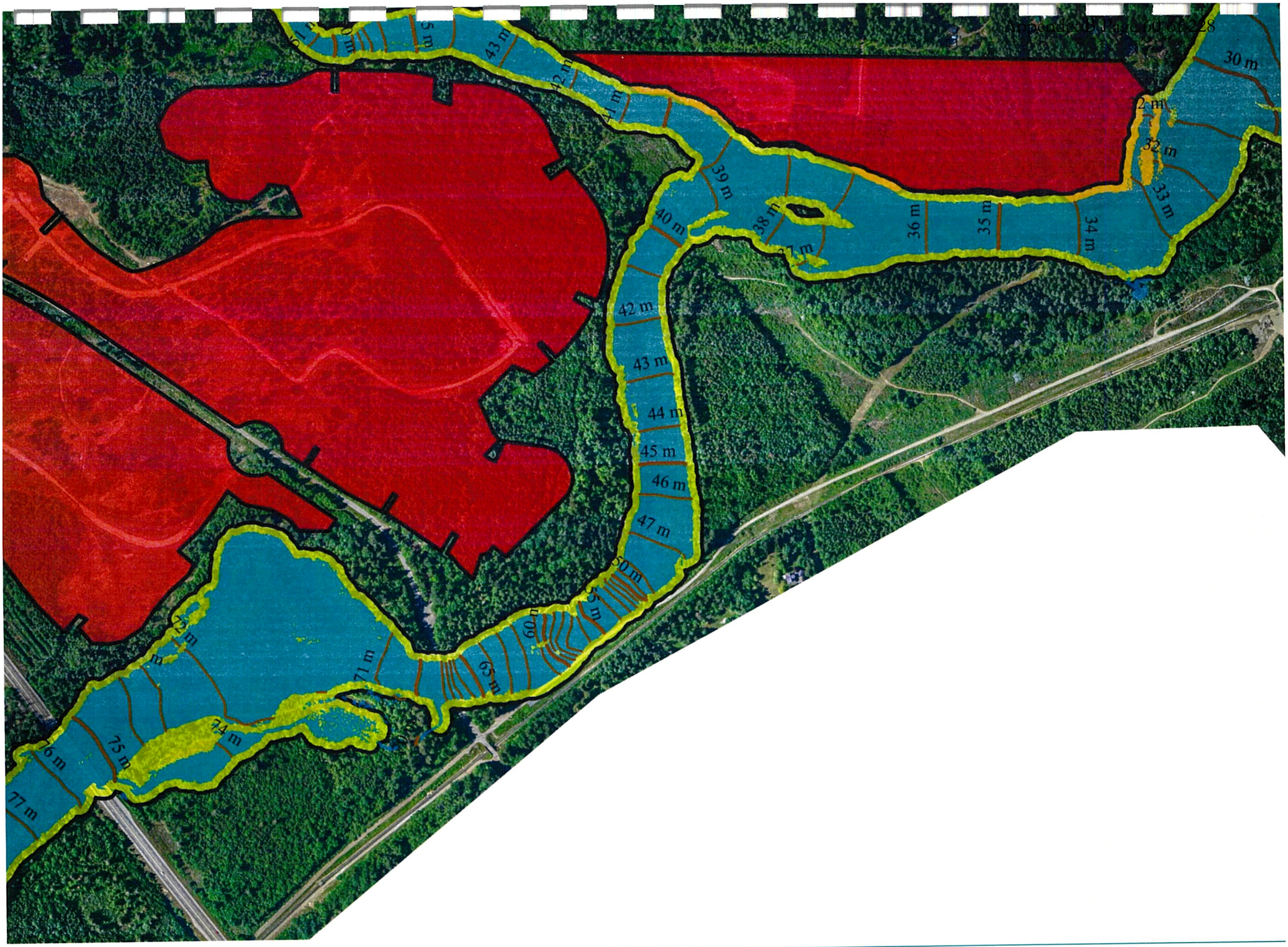


FIGURE # 10 – *PROPOSED DEVELOPMENT AREAS (RED), 200-YEAR FLOOD CONSTRUC*

APPENDIX A: ASSURANCE STATEMENT

APPENDIX A: FLOOD MAPPING ASSURANCE STATEMENT

To: The Client

Date: July 16, 2018

3-L Developments Inc. (Attn.: Kabel Atwall)

Name (print)

Address (print)

Flood Mapping Project:

Riverwood Comox Valley - Proposed Development near Puntledge & Browns Rivers

The undersigned hereby gives assurance that he/she is an APEGBC registered professional and the Qualified Professional for the project identified above.

I have signed, sealed and dated the attached report in accordance with the *APEGBC Professional Practice Guidelines – Flood Mapping in BC*. The report supports and accurately reflects the assurances made in this Assurance Statement.

I have completed the following activities:

(Check the applicable items)

	Activity
✓	Reviewed the relevant provincial legislation and local government regulations, policies, and floodplain bylaws
✓	Reviewed available and relevant background information, documentation and data
✓	Visited the site and reviewed the conditions in the field that may be relevant
✓	Considered the need for, and scale of, investigations that address future land use changes and climate change
✓	Developed and executed the flood mapping in accordance with the criteria established by the client
✓	Addressed any significant comments arising from internal or peer reviews
✓	Prepared a flood mapping report along with the accompanying digital information

I hereby give assurance that the attached flood mapping report and supporting digital documentation have been produced in accordance with the *APEGBC Professional Practice Guidelines – Flood Mapping in BC*.

Eric Heel, P.Eng.
Name (print)

Signature

July 16, 2018
Date

McElhanney Consulting Services Ltd.
Address (print)
1196 Dogwood Street
Campbell River, BC V9W 3A2

(Affix Professional Seal here)

250-287-7799
Telephone
eheel@mcelhanney.com
(email)

If the APEGBC Qualified Professional is a member of a firm, complete the following:

I am a member of the firm McElhanney Consulting Services Ltd. (Print name of firm), and I sign this letter on behalf of the firm.

APPENDIX B: EXCERPTS FROM COURTENAY INTEGRATED FLOOD MANAGEMENT STUDY (IFMS)

5 HYDROLOGIC AND HYDRAULIC MODELING

5.1 HYDROLOGIC ASSESSMENT

The provincial Floodplain Mapping Guidelines are based on an estimated 200-year return period peak water levels to determine floodplain mapping levels (or flood construction levels). The 200-year return period event is also used in developing flood protection options and assessing upstream and downstream impacts.

Flood hydrology of the Courtenay River basin is dependent on a complex number of variables. These combine to influence the magnitude of stream flow experienced during a flood event. Development of design floods for the mandated 200-year return period requires an assessment of flows within the tributary streams, an assessment of the timing of tributary peak flows relative to each other, and the magnitude and timing of tide levels in Comox Bay.

A detailed hydrologic assessment was completed by KWL, relating available hydrometric data to the timing of peak flows and tide levels, arriving at predicted design discharges and hydrographs. This information was then used as input to the development of flood profiles in the river and floodplain. The results of their hydrologic assessment are provided in Appendix C and are summarized below.

5.1.1 Available Hydrologic Data

Six Water Survey of Canada (WSC) hydrometric stations are located within the Courtenay River watershed, providing stream flow and water level data. These stations include:

- Puntledge River at Courtenay (08HB006)
- Puntledge River below Diversion (08HB084)
- Tsolum River near Courtenay (08HB011)
- Browns River near Courtenay (08HB025)
- Cruickshank River near the mouth (08HB074)
- Courtenay River at 5th Street Bridge (08HB083)
- Comox Bay near Comox (08HB087)

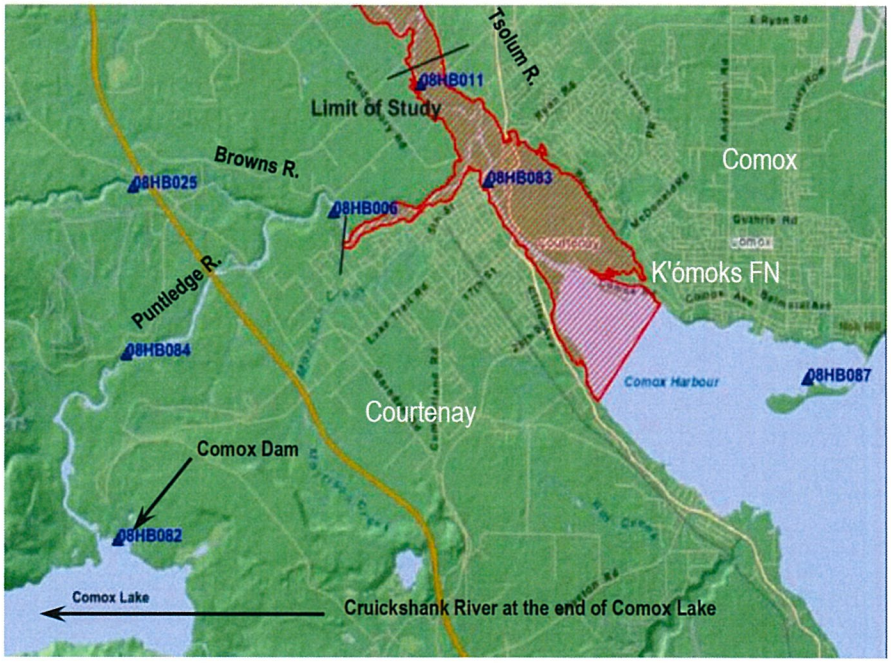


Figure 5.1: Hydrometric Stations

In addition to the Water Survey of Canada records, BC Hydro also maintains a daily record of inflow to Comox Lake which is back calculated based on the recorded Comox Lake levels and controlled outflows into the Puntledge River at the Comox Lake Dam. The locations of the hydrometric gauges are shown on Figure 5.1.

The magnitude of the peak design flows for the Courtenay, Puntledge and Tsolum Rivers have been estimated through a regional flood frequency analysis. This analysis uses peak flood records from hydrometric stations from watersheds across the region, having similar physical characteristics and similar statistical peak flood characteristics as those for the study watersheds.

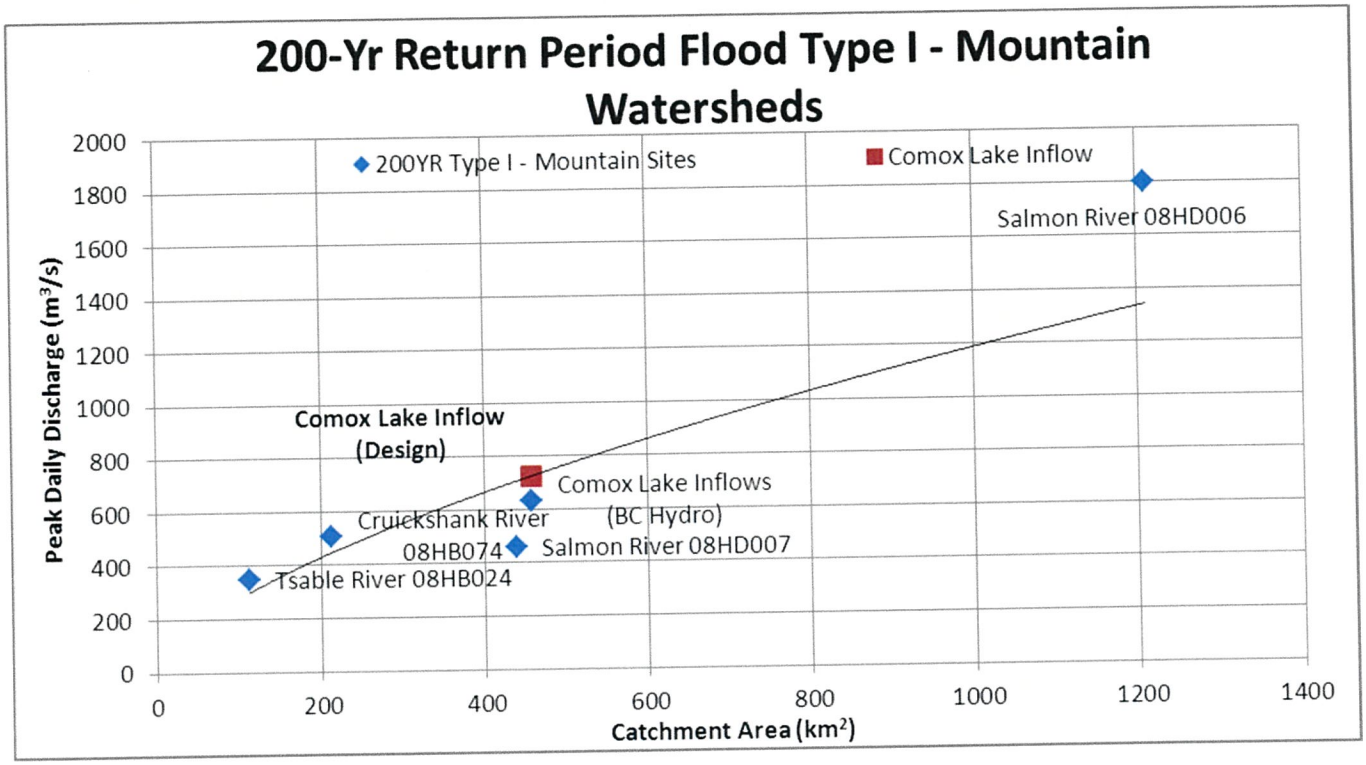
Screening of regional hydrometric stations was carried out to identify watersheds with similar characteristics as the Puntledge and Tsolum Rivers. Regional stations selected to estimate peak flood flows for the Puntledge River, Comox Lake Inflow and Browns River where based on watersheds with higher elevation mountainous watersheds. For the Tsolum River, watersheds with lower average elevation and lower elevation mountain watersheds were selected.

Regional flood frequency involves calculating the 200-year return period peak daily discharges for each of the selected regional stations. These peak flood estimates are then plotted against watershed area to develop a regional flood frequency curve for each of the watershed types, high mountainous watersheds and lower mountain and lowland watersheds. A copy of the regional flood frequency curves for the high mountain and lower mountain watersheds are included in Figures 5.2 and 5.3, respectively.

The results of the regional analysis indicate that the estimate of the daily 200-year inflow to Comox Lake would be marginally higher, about 10% greater, than what would be estimated using the BC Hydro inflow records alone. This is shown as the difference between the blue diamond labeled Comox Inflows (BC Hydro) and the red square labeled Comox Inflow (Design) in Figure 5.2. For the Tsolum River, the regional 200-year return period peak daily flow is about 30% higher than the 200-year return period estimate based on the annual daily peak record from the Tsolum River near Courtenay (WSC 08HB011) gauge. The suitability of both the regional estimate and the single station estimates were carefully considered for adoption as the design value for the assessment. Ultimately, discussions held with the Inspector of Dykes during development of the study, led to using the more conservative regional estimate due to the uncertainty in estimating peak flood flows based on a single station.

Instantaneous peak flow estimates for each of the rivers has been estimated using the results of the regional analysis, by applying an average instantaneous to daily peaking factor based on the over-lapping period of record for the daily and instantaneous flows.

Figure 5.2 – Regional Flood Frequency Curves for Mountain Watersheds

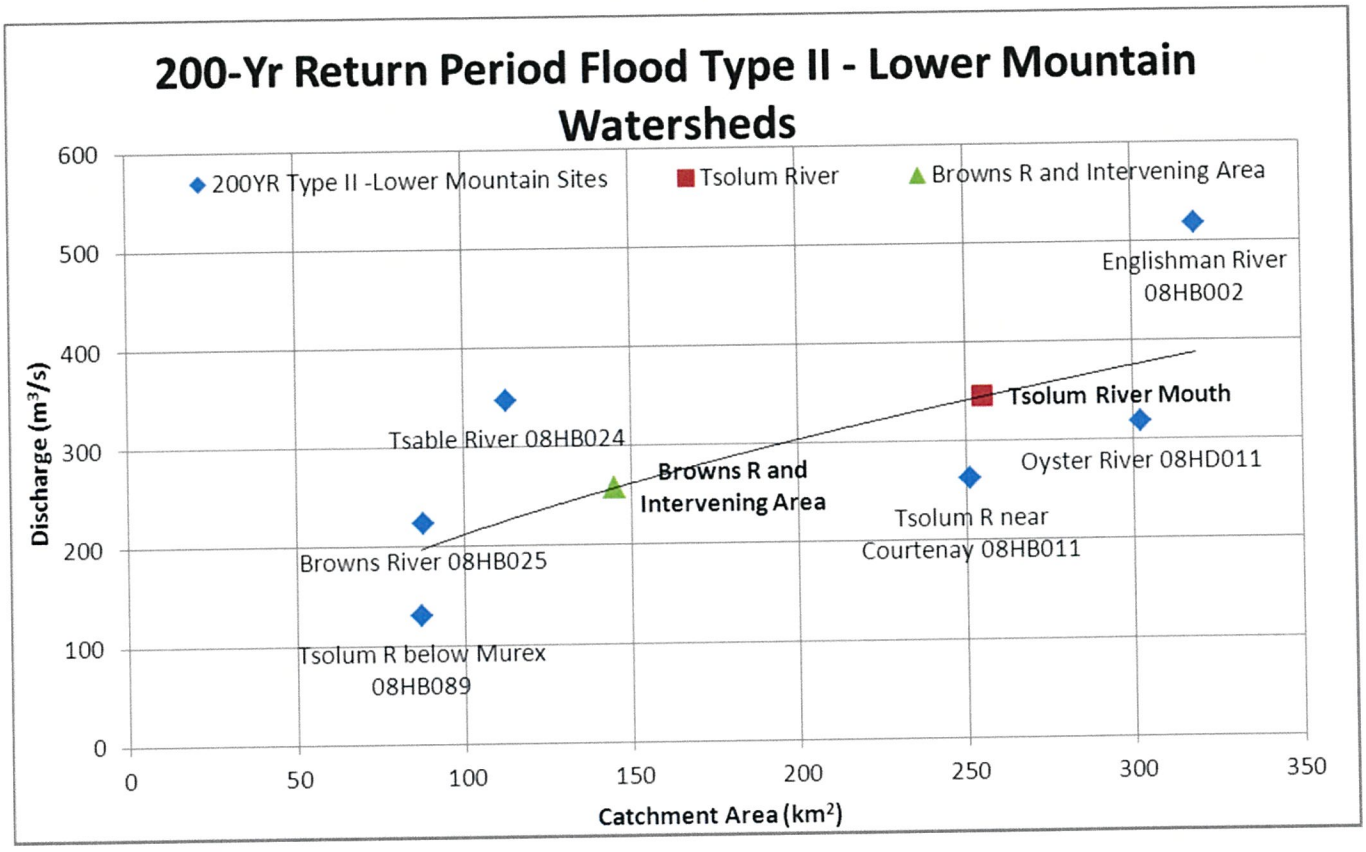


Since discharge in the Puntledge River is strongly influenced by operation of the Comox Lake dam, a frequency analysis of the recorded flows at the Puntledge River gauge does not provide a good indication of the river discharge conditions under the design flood event. For the IFMS study, frequency analysis was performed for Comox Lake inflows (back calculated by BC Hydro), together with the Browns River flows, to determine respective peak design flows. The design return period Puntledge flows were then calculated by adding the following three components:

1. The estimated Comox Lake inflow being routed via the lake and the control dam
2. The estimated Browns River flow
3. The design flow from the additional intervening area of 47 km^2 between Comox Lake and Courtenay River (excluding the Browns River, based on the Browns River design flow).

A reservoir operation model was developed, based on BC Hydro's Operating Orders, to simulate discharges from Comox Lake. This model incorporated the current Operating Orders which outline how the dam is to be operated under flood conditions. Under the orders, flow releases from the dam are to be reduced during high tide periods, to limit the potential for flooding; however, this is limited by the storage capacity of Comox Lake.

Figure 5.3 – Regional Flood Frequency Curve for Lower Watersheds



The model assumes that the Comox Lake water level is at the spillway crest level at the start of the 200-year return period flood event, at El. 135.33 m. Typically, BC Hydro operates the dam to control water levels below this level. However, per discussions with the Provincial Authorities, for the 200-year return period event, it has been assumed that water levels in the lake have been raised to the limit of control, as a result of high inflow to the lake prior to the start of the 200-year return period flood event. Therefore, flow is released from Comox Lake uncontrolled from the start of the 200-year return period event until such time as the reservoir level falls below the spillway crest and the operating orders can resume.

Once the magnitude of peak flows for each of the tributaries to the Courtenay River was estimated, the distribution of flow over time (hydrograph shape) and relative timing of flows had to be established for the design event. Both hydrograph shape and relative timing were based on review of recent flood events. The design event hydrograph shapes were selected to have a single peak, cover typical flood event durations and produce larger than average total volume. The historical events were then scaled up to the magnitude of the design events, by multiplying the ratio of the design event peak flow and the recorded peak flow to hourly data points from the historical recorded flood event. The historical flood events used to develop hydrograph shapes for the Tsolum River and Browns River are based on

recorded events from November 4 to 16, 2004, and from November 12 to 19, 2011, respectively. The design Comox Lake Inflow hydrograph is based on hourly records from the Cruickshank River gauge, located at the headwaters of Comox Lake, for an event recorded in November 10th to 20th, 2004.

Relative timing of the peak floods was based on a review of historical flood events. These indicate that for those storm events which produce large flood peaks on all tributary streams, the Browns River tends to peak prior to that of Comox Lake inflow, while Tsolum River tends to peak after the peak of the Comox Lake Inflow. The timing of the peak flows between Comox Lake Inflow and the Browns River and Tsolum River were found to occur 1 hour before and 4 hours after, respectively. This combination produces a peak flow at the mouth of the Puntledge River that is coincident with the peak flow on the Tsolum River. A summary of the design peak flood discharges at various locations in the study area is shown in Table 5.1. Plots of the 200-year return period flood event hydrographs are shown on Figure 5.4.

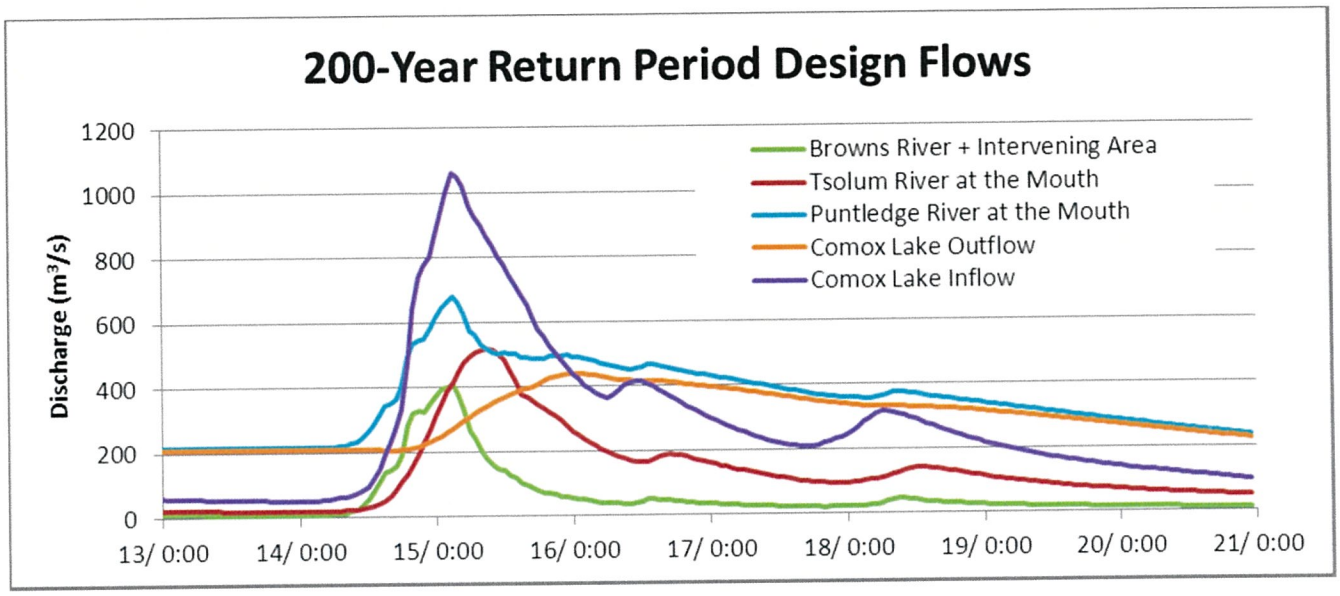
A sensitivity analysis was carried out to assess the influence of relative timing of the Comox Lake inflow peak and the Tsolum River peak flow. Due to the routing effect of Comox Lake and the flattening of the Puntledge River peak, it was found that adjusting the relative timing of the peaks had very little influence on the magnitude of peak flows in the Courtenay River.

Table 5.1: 200-year Return Period Design Storm Event Values

River	Peak Instantaneous Discharge (m^3/s)
Comox Lake Inflow	1059
Comox Lake Discharge[1]	439
Puntledge River at the Mouth	679
Tsolum River at Mouth	516
Courtenay River[3]	1105

Note: 1 – Table shows magnitude of instantaneous flood peaks but not the relative timing of the peaks. The peak discharges in the contributing watersheds do not occur at the same time which is reflected in the peak flow estimates for Puntledge River at the mouth and Courtenay River.
2 – Comox Lake Discharge is based on controlled outflows using the Operating Rules until lake levels rise above free overflow spillway at which point flows are assumed to be uncontrolled.
3 – Contribution to peak flow from intervening area between Comox Lake Dam and Puntledge River mouth not including Browns River.
4- Peak Courtenay River Discharge is estimated by adding Puntledge River and Tsolum River hydrographs which provides an estimate of total peak flow in the river channel and across the floodplain.

Figure 5.4: 200-Year Design Flood Event



5.2 HYDRAULIC MODEL DEVELOPMENT

MIKE FLOOD is a hydrodynamic computer modeling software developed by Danish Hydraulic Institute (DHI) for flood modeling. It is an integrated tool for river channel, floodplain, and coastal flood studies. The MIKE FLOOD model for the Courtenay River watershed is a combination of the MIKE 11 one-dimensional hydrodynamic model used to model flows and water levels in the main river channels and the MIKE 21 two-dimensional model in the floodplain area and coastal areas. The MIKE 21 Flexible Mesh module was used to allow for variations in the grid sizes in the floodplain and therefore to increase topographic detail in critical overflow areas while allowing for reduced topographic detail in areas of ponding or areas outside the flood extents, thereby limiting model size and run times. The model covers the following extents:

- Courtenay River from tide water at Comox Bay to the confluence of the Old Tsolum River Channel and Puntledge River;
- Puntledge River from the confluence with the Courtenay River to the Puntledge River at Courtenay Gauge (WSC 08HB006) downstream of the BC Hydro Puntledge Powerhouse;
- Tsolum River from the confluence with the Puntledge River to a point approximately 300 m upstream of the Dove Creek Road bridge; and
- Old Tsolum River Channel adjacent to Headquarters Road, the Old Island Highway and Lewis Park.

The limits of the model are shown on Figure 2.1, and are consistent with the limits of the Study Area.

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Technical Memorandum

DATE: October 8, 2013 **YOUR FILE:**

TO: Derek Richmond, City of Courtenay

CC: Mark DeGagne, McElhanney Consultants Ltd.

FROM: Craig Sutherland, P.Eng.

RE: **CITY OF COURTENAY**
Courtenay River Integrated Flood Management Study
Hydrodynamic Model Boundary Conditions
Our File 0755.016

Background

The following technical memorandum outlines the development of model boundary conditions for the Courtenay River Integrated Flood Management Study (IFMS) being prepared for the City of Courtenay.

This technical memorandum outlines:

1. The study area and description of regional hydrology
2. Development of 200-year design floods for Puntledge River and Tsolum River
3. Development of design ocean flood levels
4. Boundary conditions under the future climate change conditions

Water levels in the Puntledge River, Tsolum River and Courtenay River as well as the floodplain area will be modelled using a MIKE FLOOD combined one-dimensional/two dimensional hydro-dynamic model. The primary purpose of this memo is to outline the development of design flows and ocean water levels that will be used as boundary conditions for the MIKE FLOOD hydrodynamic model.

Study Area & Hydrology

Courtenay River is a 3.1 km waterway flowing through the city of Courtenay into tide water at Comox Bay and is formed by its two main tributaries - the Tsolum River and the Puntledge River. Flooding in the City of Courtenay is governed by the magnitude of peak discharges of the rivers and high tide levels in Comox Bay. The relative timing of the peak flows in the rivers and high tide in Comox Bay is also an important factor to peak flood levels.

The Tsolum River and the Puntledge River drain watersheds which rise up the eastern face of the Vancouver Island range to maximum elevations of 1,590 m and 2,134 m, respectively. Both watersheds can accumulate significant snowpack at higher elevations during the winter months. However, peak discharges as a result of spring snowmelt are generally much less than those peak flows that are due to high rainfall events with a low pressure system causing a storm surge in Comox Bay. As a result, flooding in the Courtenay River system occurs most frequently between October and February when higher tides and higher precipitation are prevalent.

The primary study area extends from Comox Bay to the Dove Creek Road Bridge on the Tsolum River and to the Water Survey of Canada (WSC) hydrometric gauge just downstream of the BC Hydro Power Station on the Puntledge River. The MIKE FLOOD model will model water levels throughout the floodplain which is outlined in red on Figure 1 below.

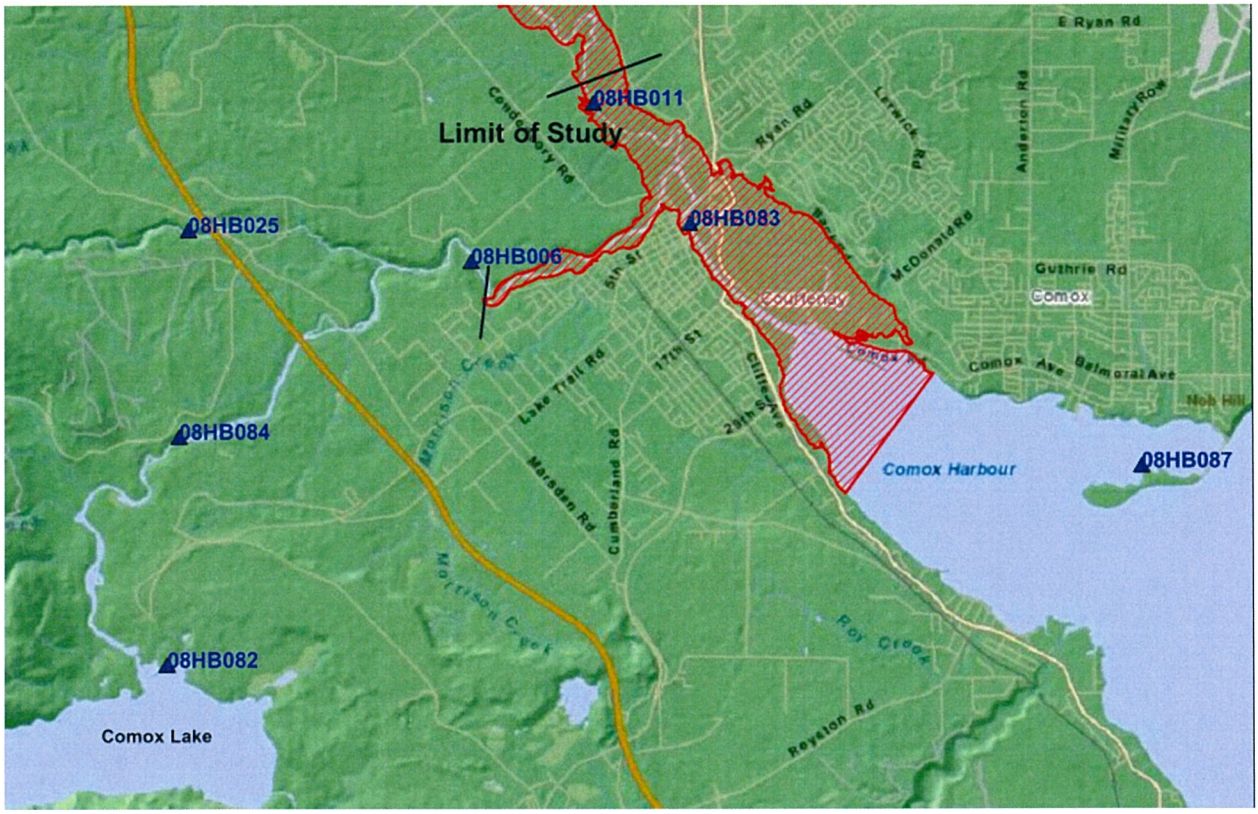

Figure 1: Study Area and Hydrometric Station Locations

The WSC has a network of hydrometric stations in the study watershed which provide essential historic and current data to forecast probable events. In addition to the stream flow and water level records from the WSC gauges, daily inflows to Comox Lake from BC Hydro were also used in the analysis. The inflow records are back calculated based on the measured Comox Lake Levels (WSC 08HB082) and controlled outflows into the Puntledge River. Table 1 lists of the WSC gauges used in the study in selection of calibration and verification events and the development of design flood discharges. The locations of the gauges are shown in Figure 1.

Table 1: Major WSC hydrometric stations in the study area

Station Name	Station ID	Catchment Area (km^2)	Years of Record
Tsolum River near Courtenay	08HB011	255	51
Puntledge River near Courtenay	08HB006	590	52
Courtenay River at 5th street bridge	08HB083	867	15
Browns River	08HB025	89	33
Cruickshank River	08HB074	215	29
Comox Harbour at Goose Spit	08HB087	-	3
BC Hydro Comox Lake Inflow	-	-	48

Recent Flood Events

High flows in the Puntledge and Tsolum Rivers combined with large tides in Comox Bay, resulted in flooding in the City of Courtenay on Dec. 21 to 29, 2009 and Nov. 12 to 19 2010 with maximum Courtenay River water levels recorded at the 5th Street Bridge of 3.154 and 3.002 m, respectively. These two flood events were used to calibrate and verify the MIKE FLOOD model developed for the Courtenay River watershed. Recorded discharge and water level hydrographs for the two events are shown in Figures 2 and 3.

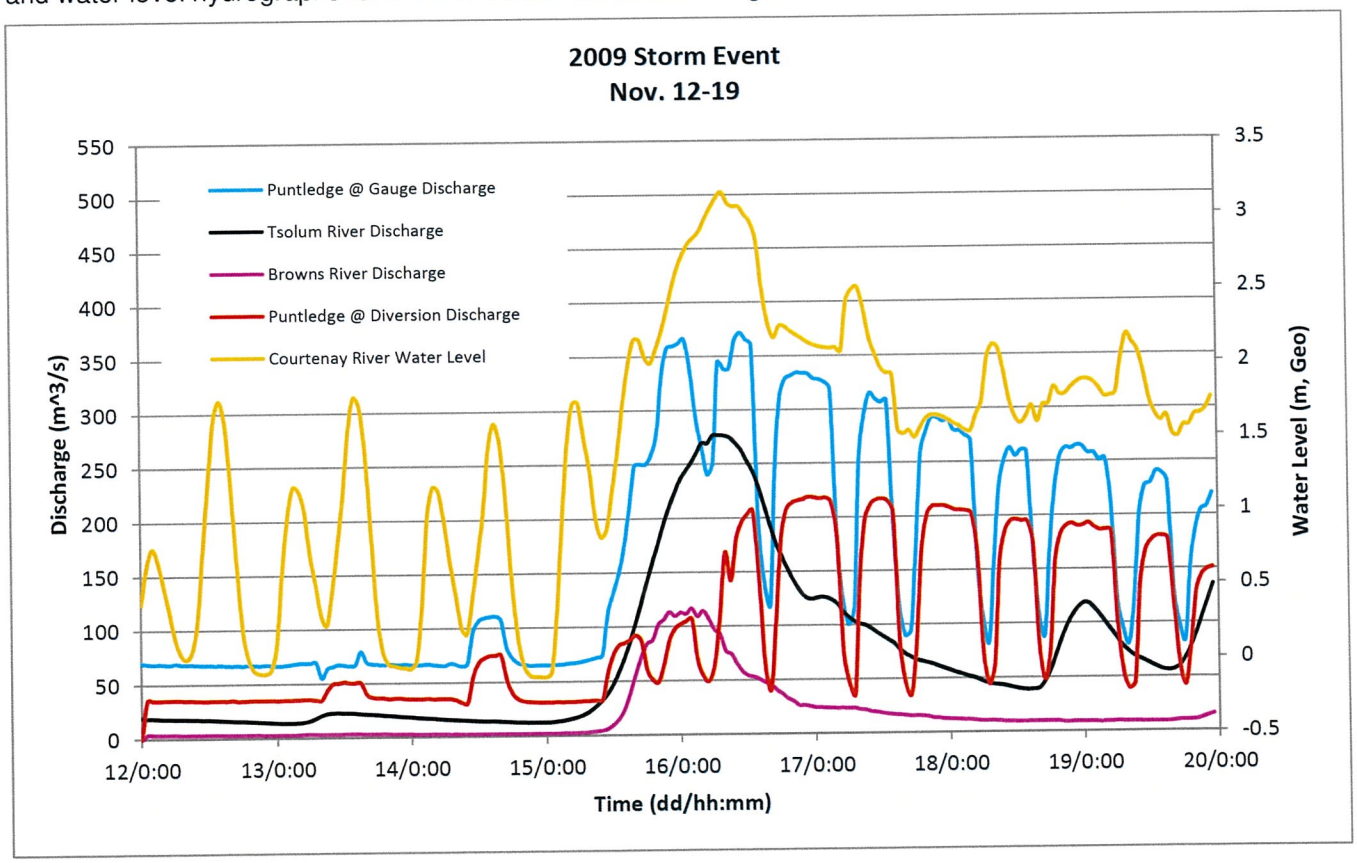

Figure 2: 2009 Storm Event Hydrographs

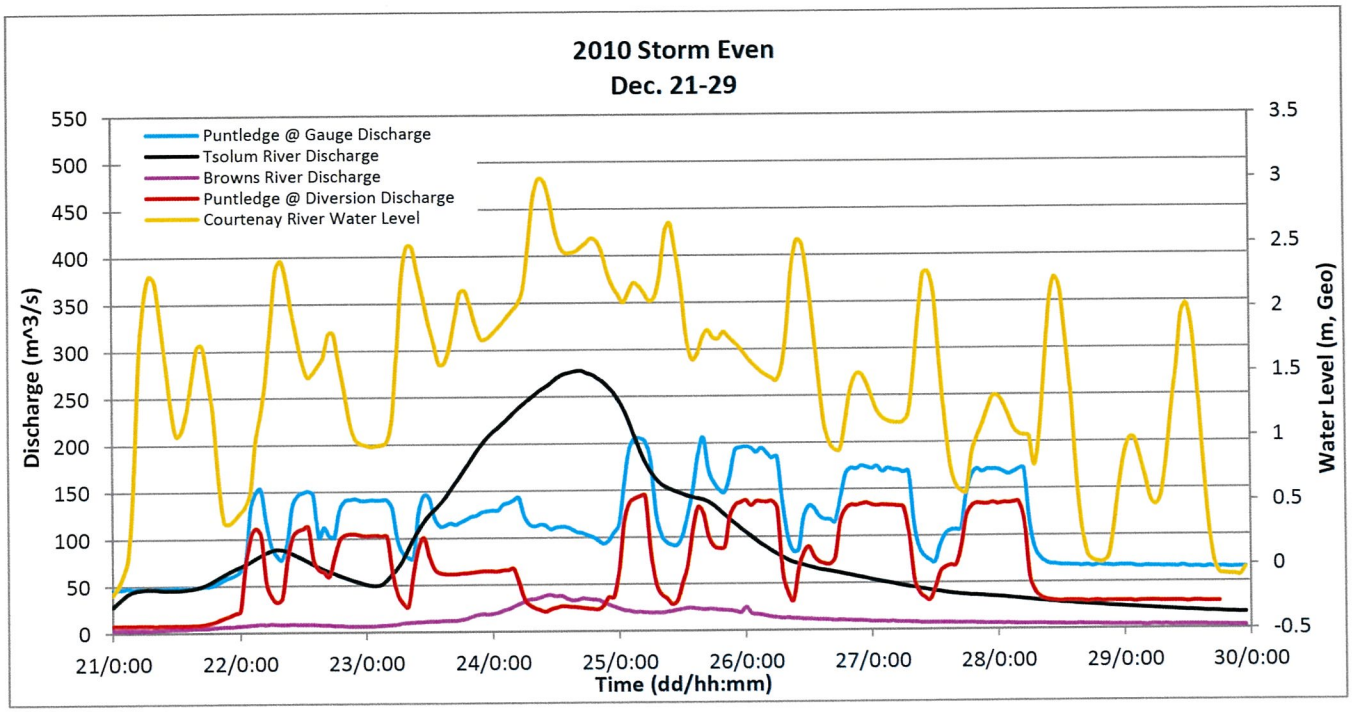

Figure 3: 2010 Storm Event Hydrographs

Design Flood Events

The provincial Floodplain Mapping Guidelines requires the use of the estimated 1:200-year return period peak water levels to determine floodplain mapping levels (or the flood construction levels) for the type of watersheds as the Courtenay River. On this basis, modelling of the 1:200-year return period flood event was performed for the Courtenay River floodplain mapping study. The proposed flood management options were also tested mainly using the design 1:200-year return period flood event model. In addition to the 1:200-year return period event, the 1:50-year and 1:100-year return period modelling were also performed during the selection of the design parameters of the proposed flood management options. Therefore boundary condition data were also to be generated for the 1:50-year and 1:100-year flood conditions.

The Courtenay River watershed is a typical costal watershed that the flood levels in the floodplain are influenced by both the ocean tides and the river discharges. Likely, the 1:200-year flood level near the coastal area of the floodplain would be governed by the ocean tide levels, while the design flood levels in the upstream section of the floodplain would be governed by the river discharges. Design flood levels in the middle section of the watershed would be a combined effect from both the coastal tide levels and river discharges. Typically methodology used for the floodplain mapping studies for this type of watersheds includes performing a series of analysis with combined probabilities of the ocean tide data and the river discharges.

For the Courtenay River study, we performed the MIKE FLOOD modelling using 1:200 return period river discharge data combined with typical higher high tide and the 1:200-year return period ocean tide with average annual flood. The higher water levels from these two scenarios has been used to establish the peak 200-year return period design water levels. Same methodology was also used for modelling of the 1:50-year and 1:100-year flood events.

Regional Flood Frequency Analysis

The magnitude of the peak design flows for the Courtenay, Puntledge and Tsolum Rivers have been estimated through a regional flood frequency analysis. This analysis uses peak flood records from hydrometric stations from watersheds across the region which have similar physical characteristics and with peak flood data with similar statistical characterisitcs as those for the study watersheds.

A screening of regional hydrometric stations was carried out to identify watersheds with similar characterisitics as the Puntledge and Tsolum Rivers. Regional stations selected to estimate peak flood flows for the Puntledge River, Comox Lake Inflow and Browns River where based on watersheds with higher elevation mountainous watersheds. For the Tsolum River, watersheds with lower average elevation and lower elevation mountain watersheds were selected. The stations selected for initial screening included the regional analysis are shown in Table 2, on following page.

Regional flood frequency involves calculating the 200-year and 50-year return period peak daily discharges for each of the selected regional stations. These peak flood estimates are then plotted against watershed area to develop a regional flood frequency curve for each of the watershed types, high mountainous watersheds and lower mountain and lowland watersheds. A copy of the regional flood frequency curves for the high mountain and lower mountain watersheds are included in Figures 4 and 5.

As most stations have longer periods of record for daily average floods. The average daily flood discharge has been estimated using the regional analysis. The instantaneous flood estimate for each of the rivers has then been estimated by applying an average instantaneous to daily peaking factor based on the over lapping period of record for the daily and instantaneous flows.

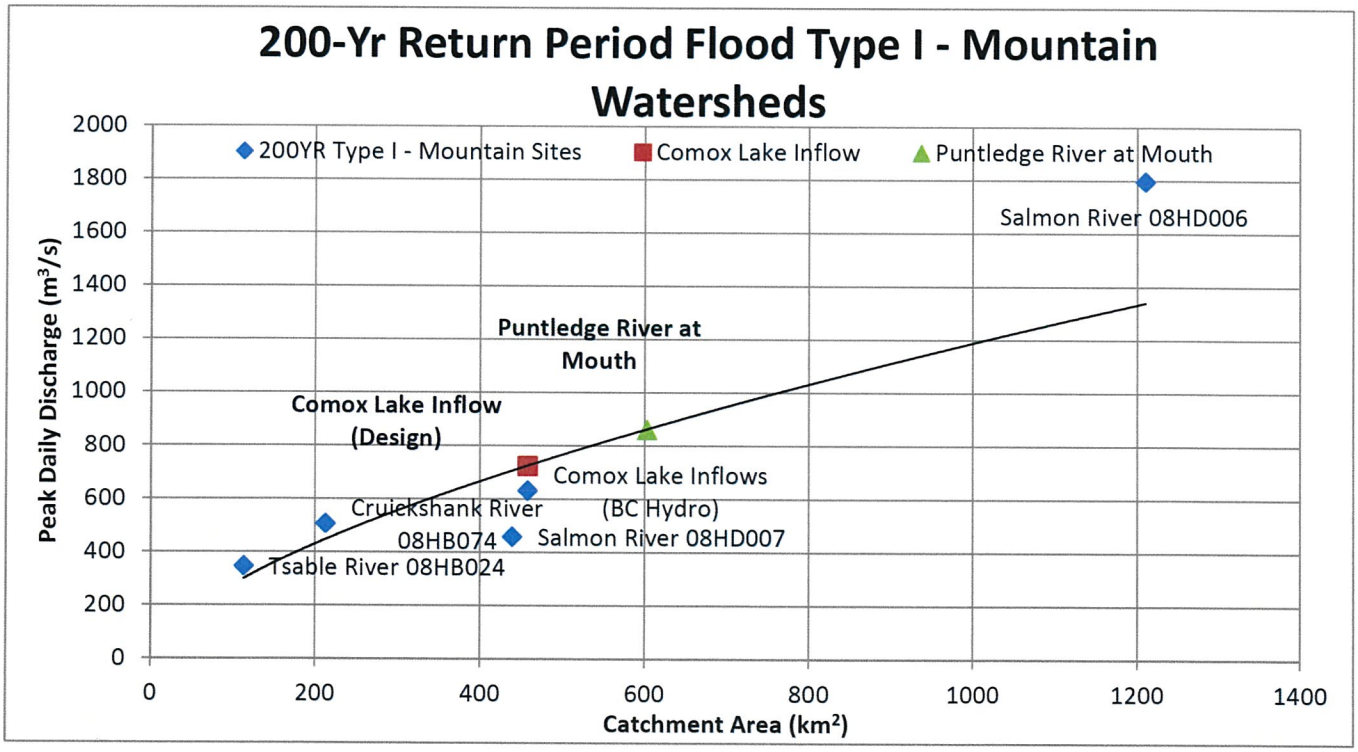

Figure 4 – Regional Flood Frequency Curves for Mountain Watersheds

TABLE 2 – Regional Stations used in Flood Frequency Analysis

Regional Stations used in Regional Analysis					
Catchment Name	Catchment Area (km^2)	Median Elevation (m)	Mean Annual Flood (m^3/s)	200YR Return Period Daily Flow (m^3/s)	200YR Return Period Instantaneous Flow (m^3/s)
Type I Watersheds – High Mountain					
Cruickshank River 08HB074	213	976	186	507	775
Tsable River 08HB024	113	780	138	347	547
Salmon River 08HD006	1210	627	712	1797	2336
Salmon River 08HD007	439	619	209	459	730
Comox Lake Inflows (BC Hydro)	458	752	284	633	
Type II Watersheds – Low Mountain					
Browns River 08HB025	88	800	70	224	428
Oyster River 08HD011	302	762	144	318	472
Tsable River 08HB024	113	780	138	347	547
Tsolum R near Courtenay 08HB011	251	230	128	262	358
Tsolum R below Murex 08HB089	87		59	131	199
Englishman River 08HB002	319	571	205	518	812

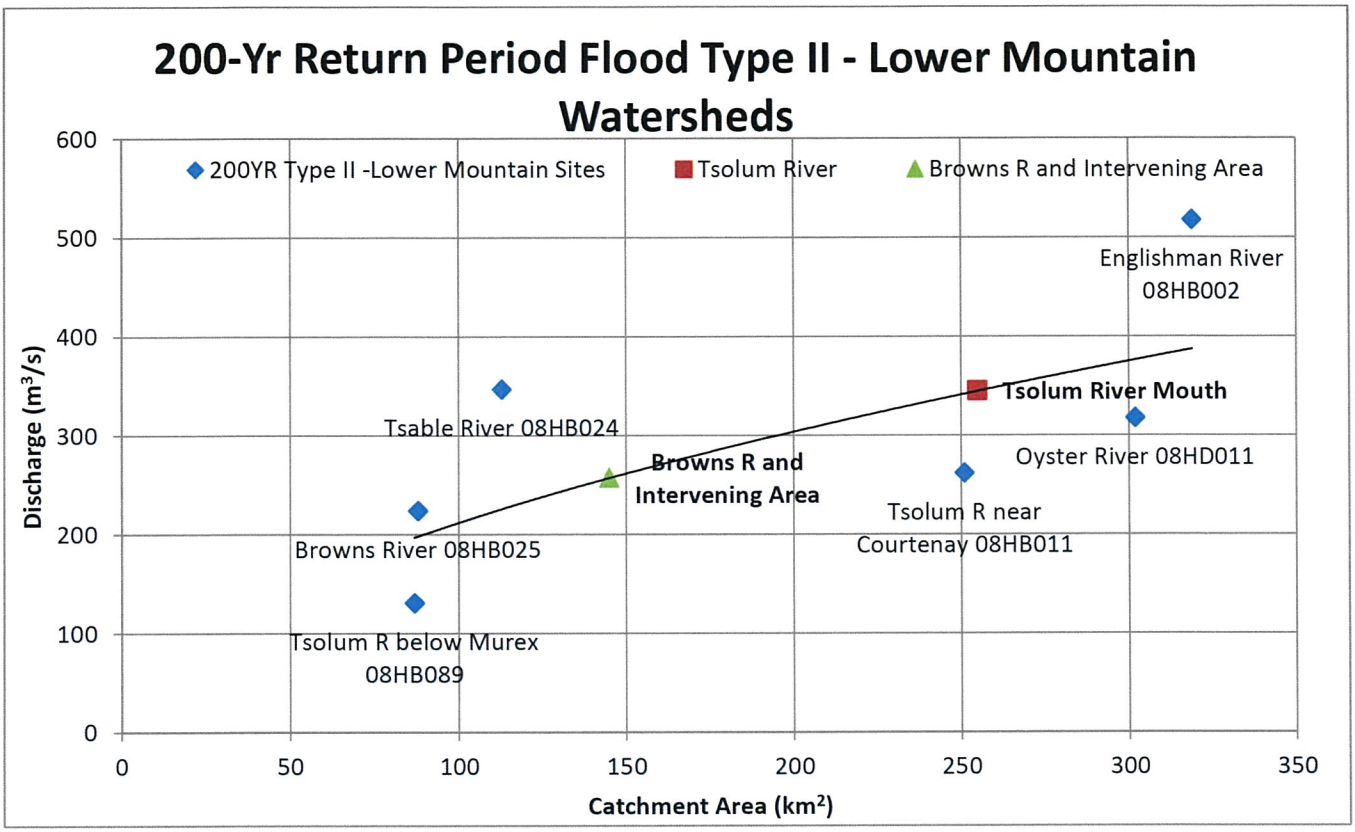

Figure 4 – Regional Flood Frequency Curve for Lower Watersheds Watersheds

Tsolum River

The Tsolum River has a catchment area of 266 km^2 and consists mainly of lowlands with minor proportion of the catchment draining the east facing slopes of the Vancouver Island Mountains. The discharge values recorded at the WSC gauge downstream of the Dove Creek Road Bridge (08HB011) were used in the regional analysis to estimate peak design discharges for various return period flood events. The results of the regional flood frequency assessment indicate that the 200-year return period flood has a magnitude of 345 m^3/s and 516 m^3/s for the daily and instantaneous peaks, respectively.

The recorded Tsolum River flows for both the 2009 and 2010 events were approximately the same (277 m^3/s and 278 m^3/s) and roughly equal to the 1:20-year return period peak design flow.

The flow distribution shape of the storm event of November 2004 was selected as the distribution shape of the design flood for the Tsolum River. The November 2004 storm event had a duration of approximately three days and a single peak. The 2004 event was scaled up to match the peak instantaneous discharge for the required design return period event.

Puntledge River

The Puntledge River has a catchment area of 598 km^2 with two significant tributaries, Browns River and Comox Lake. Browns River consists of lowlands with minor proportion of mountains without any lakes or structures that

could influence the peak discharges. Comox Lake is primarily fed by a large catchment area from Cruickshank River (215 km^2). Flows released from the Comox Lake are controlled by BC Hydro to provide water supply for their power generating penstock, fisheries, and water distribution systems.

The WSC has a few active flow measurement gauges in the Puntledge River watershed including the gauge in Puntledge River near Courtenay (08HB006, downstream of the Comox Lake dam), in the Browns River (08HB025) and in the Cruickshank River (08HB074). In addition, inflows to the Comox Lake have also been recorded by BC Hydro. Although the Puntledge River near Courtenay gauge measures flows in the Puntledge River including the discharges from both the Browns River and the Comox Lake, the recorded Puntledge River flows show flows being strongly influenced by the Comox Lake dam operation. A frequency analysis to the recorded flows from the Puntledge River gauge would not likely provide a representative peak flows under the desired return period flood conditions. For the current floodplain mapping study, we performed frequency analysis to the recorded Comox Lake inflows and the Browns River flows to determine their peak design flows. The design return period Puntledge flows were then calculated by adding the following three components:

- The estimated Comox Lake inflow being routed via the lake and the control dam
- The estimated Browns River flow
- The design flow from the additional intervening area of 48 km^2 between Comox Lake and Courtenay River excluding the Browns River based on the Browns River design flow.

As previously discussed, the BC Hydro dam plays an important role in controlling discharges from the Comox Lake into the Puntledge River. The *Generation Operating Order* report issued in 2010 by BC Hydro provides the current flow release protocols for the Comox Lake dam. The operating orders are determined by a series of triggers that are sent live from BC Hydro's hydrometric stations downstream of the dam to limit flood risks during a storm event. BC Hydro monitors the following parameters to mitigate flood hazards:

- Puntledge River near Courtenay discharge
- Tsolum River near Courtenay discharge
- Comox Lake water levels
- Courtenay River water levels
- Courtenay River discharge (assumed to be Puntledge + Tsolum discharge values)
- Comox Bay predicted tides

BC Hydro reduces discharge from Comox Lake in the event of high tides and/or high water levels in the Courtenay River. During the rising limb of the flood and when tides and river water levels are low the dam is operated to release as much water as safely possible to balance the flood risk between the downstream properties and properties around the lake. It should be noted that the concrete dam is designed to be overtopped during extremely high flood events (greater than the 200-year event).

BC Hydro has a long record (48 years) of daily inflow data to Comox Lake, which were back calculated based on change in lake levels and outflows using the mass balance equation. This data set was used to determine the 1:200-year return period peak daily inflow value. Although hourly inflow data are also available from BC Hydro, there appears to be significant noise in the record due to slight errors in water level measurements or discharge records which can result in significant variation in inflows. For our study, hourly inflow time-series data for the design events was developed based on recorded hydrograph shapes of the Cruickshank River. A daily flow to instantaneous flow peaking factor of 1.53 determined for the Cruickshank River was used to calculate the peak instantaneous discharge value for the design hydrographs.

A reservoir operation model was developed using Excel and BC Hydro's Operating Orders to simulate discharge from Comox Lake during the different return period design events. The model assumes that the orders are

followed exactly as written. A review of historical data indicates that this may not always be the case because of difficulty in knowing in advance if the event will be an extreme flood or not.

The operation model was used to simulate the controlled discharges from Comox Lake. The model assumes that the water level at the start of the flood event is at the spillway crest level at the start of the 200-year flood event, at El. 135.33 m. Typically, BC Hydro operate the dam to control water levels below this level. However, for the 200-year event it has been assumed that water levels in the lake have raised to the limit of control as a result of phigh inflow to the lake prior to the start of the 200-year flood event.

Estimated design peaks of the Comox Lake inflow, the Comox Lake outflow, the Browns River flow and the flow for the intervening area are summarized in Table 4.

Table 2: Puntledge River Tributaries Storm Event Values

	200-Year Return Period Event (m^3/s)
Comox Lake Inflow (Peak Instantaneous Flow)	1059
Comox Lake Discharge Uncontrolled (Peak Instantaneous Flow)	439
Puntelge River (Peak Instantaneous Flow)	679

Figures 6. and 6 shows the design flow hydrographs generated at various locations of the Courtenay River watershed for the 1:50-year and 1:200-year return period flood events, respectively. Hydrographs for the Tsolum and Puntledge Rivers were used as inflow boundary conditions for the hydraulic model.

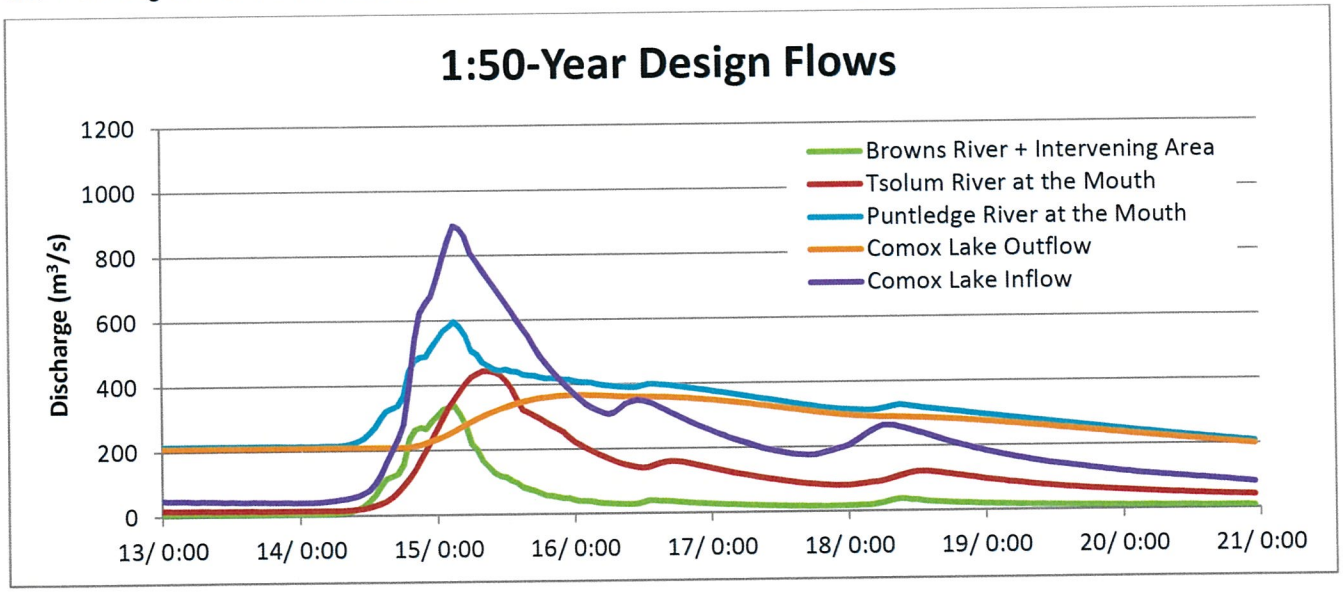

Figure 4: Puntledge River 1:50-Year Design Flows

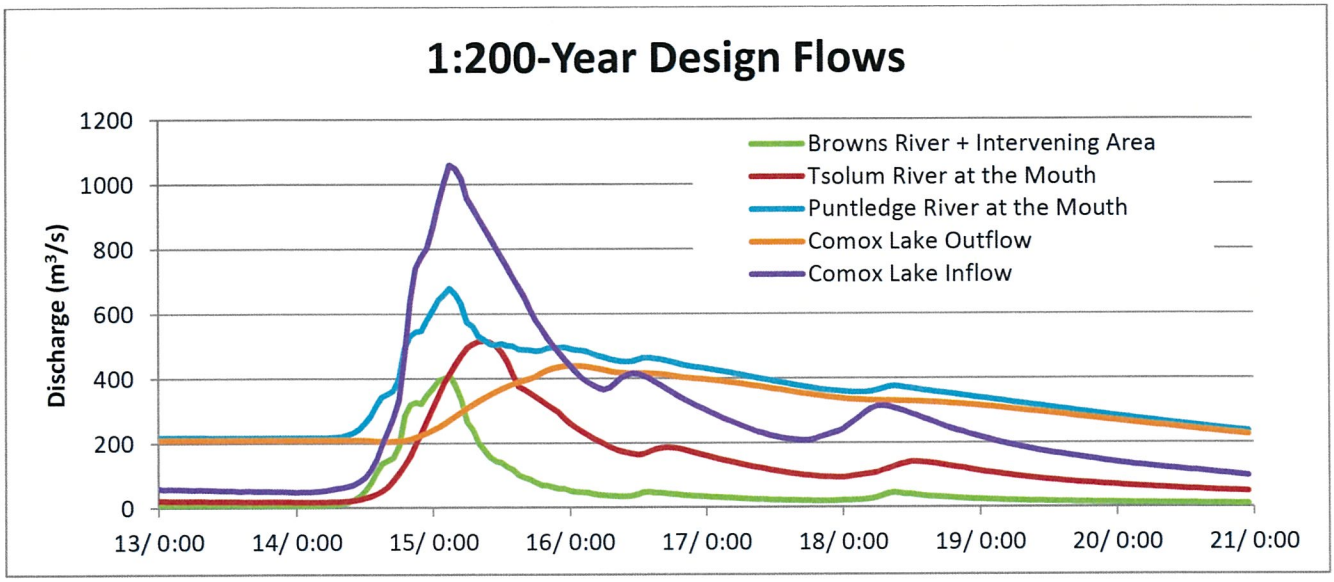

Figure 6: Puntledge River 1:200-Year Design Flows

Comparison with Previous Studies

There have been several studies conducted investigating design flood flows in Courtenay. Most notably are the Floodplain Mapping study conducted by Ker Priestman & Associates Ltd. (KPA) in 1990 and the Flood Hydrology Investigation Study of the Tsolum River conducted by Northwest Hydraulic Consultants (NHC) in 2011. A summary of the estimated design flows from the past studies in comparison of the results of the current study are shown in Table 5.

Table 3: Estimated River Flows in Previous Studies and the Current Study

	KPA, 1990 (m^3/s)	NHC 2011 (m^3/s)	KWL 2013 (m^3/s)
Tsolum River - 1:200-Year Peak Instantaneous Flow (m^3/s)	495	345	516
Comox Lake Inflow - 1:200-Year Peak Instantaneous Flow (m3/s)	1107	-	1040
Puntledge River - 1:200-Year Peak Instantaneous Flow (m^3/s)	748	-	539
Courtenay River - 1:200-Year Peak Instantaneous Flow (m^3/s)	926	-	1105

Note: Courtenay River Peak Flow based on combining the Tsolum River hydrograph and Puntledge River hydrograph with time-lag based on average of historical records.

For the Tsolum River, KPA and KWL have estimated design flows based on a regional analysis while NHC used only the Tsolum River data to compute the 200-year return period event. For the Puntledge River, KPA estimated peak flows in the Puntledge River at the mouth by first calculating the 200-year event based on the regional analysis for the entire watershed, assuming no regulation from Comox Lake. This peak discharge was then

reduced by subtracting the difference between the Comox lake inflow and outflow based on flood routing through the lake. KPA used a storm event from 1981 to provide a shape for the inflow hydrograph, which included three and assumed that lake levels would be controlled until water levels were over-topping the dam and which time the gates would be opened resulting in very high peak outflow from the dam.

KWL have used a similar approach, except that we have assumed that lake levels start at the spillway crest elevation and are then released uncontrolled through the entire period of the storm event. This assumes that higher inflows to the lake occurred prior to the 200-year event, resulting in controlled lake levels rising to the spillway crest at which time BC Hydro opens the spillway gates to allow water to flow from the lake uncontrolled. In addition, the inflow to Comox Lake is based on 2004 inflow event which has a single peak which has been scaled up to match both the 200-year instantaneous peak as well as the 200-year 2-day total volume. These two assumptions are likely the reasons why KWI have estimated a lower outflow from the lake.

Interestingly, eventhough the Comox Lake outflow is lower, the combined hydrographs for the Puntledge River and Tsolum River result in an increased 200-year peak flow estimate for the Courtenay River in comparision with the KPA study.

Coastal Boundary Conditions

A coastal MIKE 21 HD model of Comox Harbour was established roughly between the tip of Goose Spit and the mouth of the Trent River in Royston to generate water level hydrographs at the Courtenay River mouth for using as the downstream boundary conditions for the MIKE FLOOD river model. The following data were used as the inputs to the costal model:

- Astronomical tide time series;
- Storm surge;
- Wind speed and direction; and
- Courtenay River discharge.

Storm surge impacts were estimated and added to the astronomical tide to become the coastal model downstream boundary condition. The combined Tsolum River and Puntledge River discharges were used as the upstream discharge boundary condition of the coastal model. It was found that river discharges have minor impacts on the results of the coastal model; therefore our study did not perform iterations between the river and the coastal model to match up the water level and discharge data at the mouth. Wind shear and wind set up were simulated within the coastal model by adding estimated wind direction and speed under the design flood conditions. The storm wave and propagations in Comox Harbour induced by the 200-year design wind storm were modelled in MIKE 21 and used in conjunction with sea levels during the design storm events. The derivation of the boundary conditions for the coastal model is discussed in the following sections.

Astronomical Tides

Astronomical tides are the daily changes in water level due to the rotation and motion of the earth, moon and sun. The design astronomical tide time-series data were developed based on predicted astronomical tide data for Comox Harbour by the Canadian Hydrographic Service (CHS). The 200-Year design tide is based on the higher high water large tide (HHWLT), which is the average of the highest high water levels from 18.6 years of data calculated and published by CHS. The HHWLT for Comox Harbour is 2.19 m, Geodetic. The 50 & 100 design tides were based on a selected high astronomical tide event (in December 2005) in which large low (Lower Low Water Level) and high (Higher High Water Level) tides occur in one tidal cycle. The peak differences between the two design tide series is 0.33 m, The design astronomical tide time-series is shown in Figure 7.

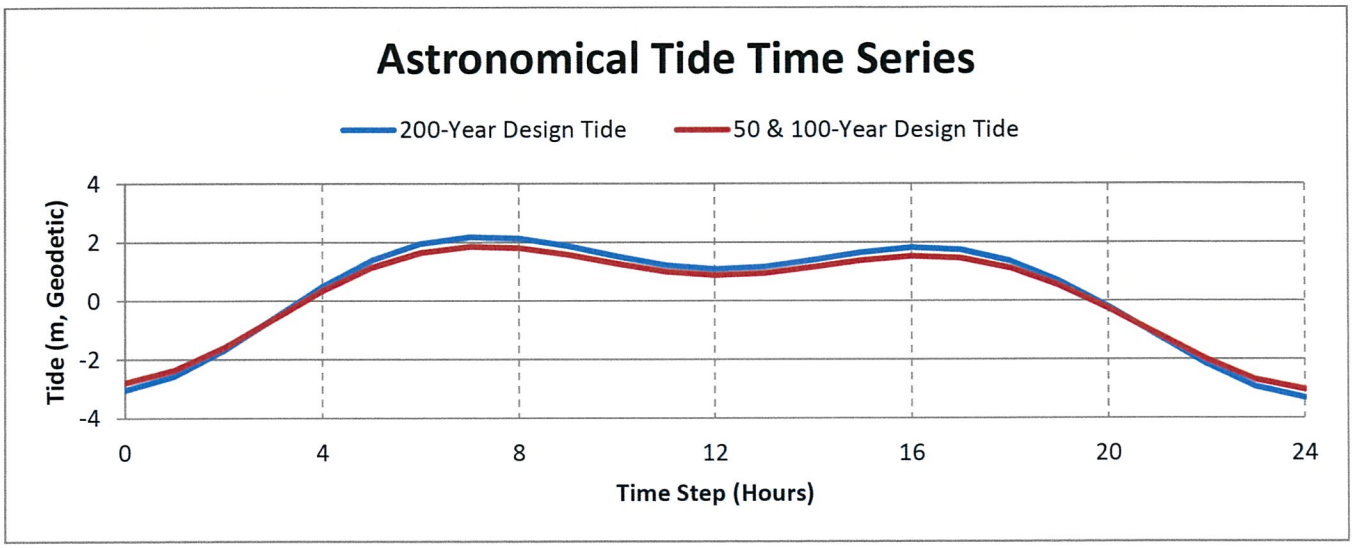

Figure 7: Design Astronomical Tide

Storm Surge

Storm surge is an episodic rise or fall in water level caused by gradients in atmospheric pressure and the associated flow of water during storm events. The design storm surge in Comox Harbour has been determined through analysis of predicted and measured tides. The difference between the predicted tide (i.e. astronomical tide) and the measured tide is primarily the storm surge.

Ideally, the design storm surge in Comox Harbour would be determined through extreme value analysis of data collected in Comox Harbour. Unfortunately, measured water level data in Comox Harbour is only available from 1967-1969 (collected by CHS) and 2010-Present (collected by Water Survey of Canada); these brief data series are not suitable for extreme value analysis.

The closest port with a long measured water level data set in Campbell River (1967- Present). A visual analysis of the correlation of storm surge was performed and it was determined that the storm surge data from Campbell River can be used as a proxy for Comox Harbour.

Extreme value analysis was performed on the Campbell River Data set (annual maximum, hourly data); it was found that the data is best fit by the Weibull Distribution. The estimated storm surge for various return periods including 90% confidence limits are summarized in Table 6.

Table 6: Estimated Peak Design Storm Surge Values at Comox Harbour

	20-Year Return Period Event	50-Year Return Period Event	100-Year Return Period Event	200-Year Return Period Event
Storm Surge (m)	1.00	1.09	1.15	1.19
Upper 90% Confidence Interval (m)	1.09	1.19	1.25-	1.31
Lower 90% Confidence Interval (m)	0.92	0.99	1.04-	1.08

Wind Speeds and Directions

Design wind speeds have been determined based on extreme value analysis of hourly wind speeds collected by the Atmospheric Environment Service at Comox Airport (1953-Present). This data consists of 5-minute average wind speeds collected on the hour, and when used for extreme value analysis, is generally considered to be representative of the hourly average wind speed. The extreme value analysis was conducted for 16 compass directions, and it was found that the greatest wind speeds are from the south-east. The estimated wind speeds from the south-east for various return periods including 90% confidence limits are summarized in Table 7.

Table 7: Estimated Southeast Wind Speeds for Comox Airport

	20-Year Return Period Event	50-Year Return Period Event	100-Year Return Period Event	200-Year Return Period Event
South-East Wind (km/hr)	83.5	87.1	89.5	91.8
Upper 90% Confidence Interval (km/hr)	86.0	90.1	92.8-	95.3
Lower 90% Confidence Interval (km/hr)	80.9	84.1	86.3-	88.3

Climate Change Impacts

Sea level is predicted to rise moderately in the period of 2010 to 2025 and more rapidly in the period leading up to 2100 and 2200. As the sea level rises and more frequent storm events are experienced, there is an increased risk of flooding to coastal communities that poses a challenge for local government in terms of land development planning. Climate change impacts on the Courtenay River watershed were evaluated in this study. The impacts were elevated for the following four scenarios:

- Year 2100 sea level rise only
- Year 2100 sea level rise and rainfall increase
- Year 2200 sea level rise only
- Year 2200 sea level rise and rainfall increase

Estimated rates of sea level rise have recently been assessed for BC based on the latest research. According to the Ministry of Forests, Lands and Natural Resources Operations' *Coastal Floodplain Mapping – Guidelines and Specifications* (June 2012), the expected sea level rise to Year 2100 time horizon is 1 m and to Year 2200 time horizon is 2 m over the Year 2000 level. In this study, it was assumed that the 1:200-year return period ocean levels would be increased by 1 m by Year 2100 and by 2 m by Year 2200 in comparison with the estimated existing condition 1:200-year return period tide levels.

Climate change on costal storms and river runoffs is also considered in the study. Recent studies predicated 10% to 20% increases to rainfall and runoff values in the BC coastal regions. Our study assumed that by Year 2100, the 1:200-year return period design storm surge values and river flood flows would be increased by 15% and by another 15% on top of the Year 2100 values by Year 2200.

Closing

We trust that this memo provides an outline of the modelling boundary coditions and proposed modelling scenarios. Should you have any other questions, please contact the undersigned at (250) 595-4223.

KERR WOOD LEIDAL ASSOCIATES LTD.
consulting engineers

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

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Reviewed by:

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Reviewed by:

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Statement of Limitations

This document has been prepared by Kerr Wood Leidal Associates Ltd. (KWL) for the exclusive use and benefit of the intended recipient. No other party is entitled to rely on any of the conclusions, data, opinions, or any other information contained in this document.

This document represents KWL's best professional judgement based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practising under similar conditions. No warranty, express or implied, is made.

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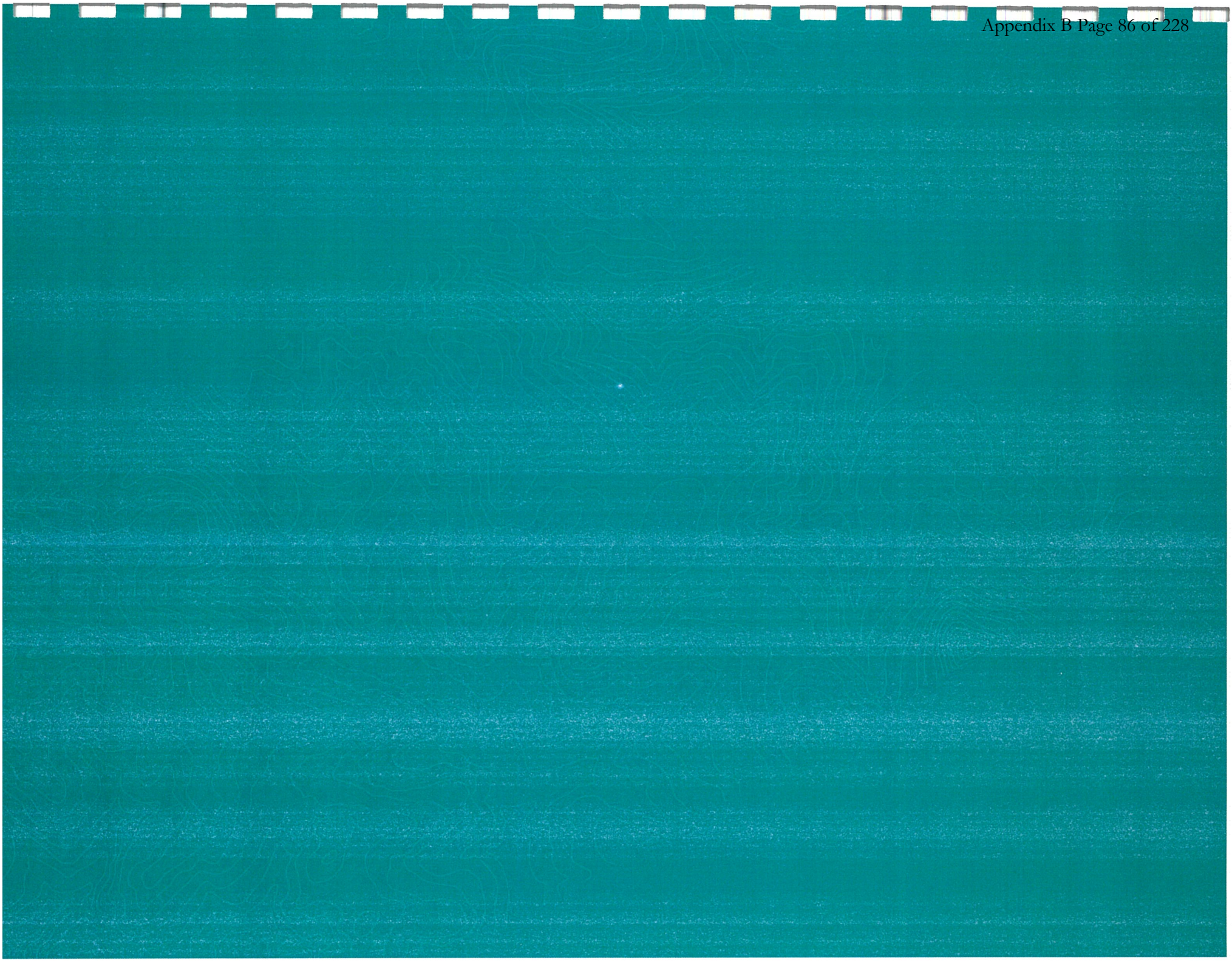
Revision History

Revision #	Date	Status	Revision	Author
0	Sept. 21, 2012		Draft for Review	CS
1	May 8, 2013		Final	CS
2	Oct 9, 2013		Revised Final with input from MFLNRO	CS



INNOVATIVE
ENGINEERING
SPECIALISTS

GeoHazard Assessment

Riverwood Subdivision
Courtenay, B.C.

Prepared for:

3L Developments Inc.

Prepared By:

Base Geotechnical Inc.
www.basegeotechnical.ca

Peter Bullock, P.Eng., M.Eng.
Principal

July 27, 2018
BGI File: 12920180509
MoTI File: 2017-07384

BASE
Geotechnical Inc.

1. Introduction

This report summarizes the results of a geohazard assessment for the proposed Phase 1 Riverwood subdivision within the Comox Valley Regional District (CVRD) just west of Courtenay B.C.. The property as a whole is approximately 208 hectares in size (520 acres) and is situated at the confluence of the Puntledge and Browns Rivers, however this report is limited to the upper plateau region on the west side of the property (see Figure 1). The limited scope was implemented to match the phased approach for development and covered the areas that are considered to of low geohazard risk. Additional study and reporting will be completed on an as needed basis to match the development needs. It was understood that 3L confirmed this with MoTI, and the Approving Officer agreed to this approach.

The hazard assessment was conducted by Base Geotechnical Inc. (BGI) in accordance with the *"Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia"* (revised May 2010) and "Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC (June 2012) prepared by the Association of Professional Engineers & Geoscientists of BC (APEGBC).

This report is subject to the attached Statement of General Conditions. These conditions should be clearly understood while reading or interpreting this report.

2. Scope of Work

The assessment was based on a review of the available background information and field reconnaissance across the west terrace and much of the remaining property. The following documents and records were reviewed as part of this investigation. The scope for this report was limited to the western upper plateau area (see Figure 1) of low geohazard risk to help expedite the phased development approach. Further study and reports are anticipated as the next phases are implemented.

- MoTI Proposed Subdivision Review Status Letter, eDAS File # 2017-07384, Dated March 21, 2018.
- FishFor Contracting Ltd., Ecology and Wildlife Summary RiverWood Development, December 18, 2009.
- McElhanney, Riverwood Development Floodplain Assessment – Draft, Puntledge and Browns Rivers 3L Developments Inc., July 12, 2018
- APEGBC, Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC, Revised May 2010
- APEGBC, Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC, June 2012
- APEGBC, Flood Mapping in BC – APEGBC Professional Practice Guidelines (V1.0, January 2017)
- MoTI, Geotechnical Design Specifications for Subdivisions, July 4, 2017
- MoTI – Technical Circular T04-17: Geotechnical Design Criteria, March 22, 2017
- MoTI, Technical Circular T-06/15: Climate Change and Extreme Weather Event Preparedness and Resilience in Engineering Infrastructure Design, August 2016.

The phased approach and discussions were completed in a meeting at the McElhanney office in Courtenay on May 18, 2018; Kabel Atwall of 3L, Kerry Barth and Bob Hudson of McElhanney, and Peter

Bullock of BGI were present. Further to this meeting a series of emails between all aforementioned party's and two field visits of the property were completed by Peter Bullock.

3. Level of Landslide Safety

The only province-wide adopted level of landslide safety is the statement "that the land may be used safely for the use intended" associated with the Land Title Act (Section 86) for subdivision approvals; however, there is no definition of what constitutes "safe." The BC Ministry of Transportation & Infrastructure (MOTI) generally accepts a probability of occurrence of a landslide hazard affecting the proposed structure of less than 10% in 50 years or 1:475 per annum. Where potential consequences include loss of life, a more commonly accepted standard is a probability of death to an individual (PDI) of 1:10,000 per annum.

The Fraser Valley Regional District (FVRD) devised a series of acceptable hazard tables based on the type of hazard (i.e. rock fall) and type of development ranging from "minor repair" to rezoning. The most common type of hazard affecting this development is "Small-scale Localized Landslip" along either the foreshore slope or the gully bank. The FVRD's level of acceptable hazard for a new building without restrictions is <1:10,000 per annum or 1:500 with siting requirements or measures to protect the structure. Note that the levels of acceptable hazard pertain directly to the building rather than the lot and should be referred to as "levels of acceptable partial risk".

Another means of assessing the slope hazard for a specific building site is to analyze the factor of safety of a slope failure capable of damaging the structure. The tolerable or acceptable factor of safety can vary but the most common standard is that applied by the District of North Vancouver (DNV). For new houses, the minimum factor of safety is 1.5 under static conditions and 1.0 under seismic conditions, or less than 15 cm displacement under the 1 in 2,475 year earthquake. This earthquake standard is consistent with the requirements of the BC Building Code to assess the slope stability under the design earthquake having a probability of exceedance of 2% in 50 years (annual probability of 1:2,475).

CVRD Planning Department confirmed they do not have qualitative risk criteria; therefore, both the FVRD's and DNV's levels of acceptable hazard and risk were adopted for this assessment.

4. Geology

The BC Geological Survey (BCGS) bedrock geology map for the Courtenay area shows the bedrock to be sedimentary in nature and part of the Nanaimo Group from the Upper Cretaceous period. This rock was found only in the river exposures on the property. The BCGS describes the rock to be of boulder, cobble, and pebble conglomerate, coarse to fine sandstone, siltstone, shale and coal. The bedrock within the property was not studied in detail, but the reconnaissance did confirm the sedimentary nature and coarser sediments as the dominant exposures.

The property was characterized by terraced sediments. Approximately 20 shallow test pits were hand excavated across the property and several past larger machine test pits were found across the property and investigated too. The soil was consistent as a silty fluvial soil of sand and gravel with varying percentage of cobble and boulders. These findings were consistent with the GeoScience BC Map 2013-NVI-1-1. The map described the area as "Quaternary Cover: alluvium, glaciofluvial gravels and sand, till".

5. Site Description

5.1 General

The property trends essentially east/west roughly triangular in shape. Both the southeastern and south western corners have been trimmed off and a small piece along the north boundary was also removed. Most of the property is between the Puntledge and the Browns River which run east to the ocean. The confluence of the rivers just east of the mid point of the property, with reduced development opportunity downstream.

There are three basic terrains on the property: flat river/marine terraces, natural soil slopes between the terraces and the active river/flood plain.

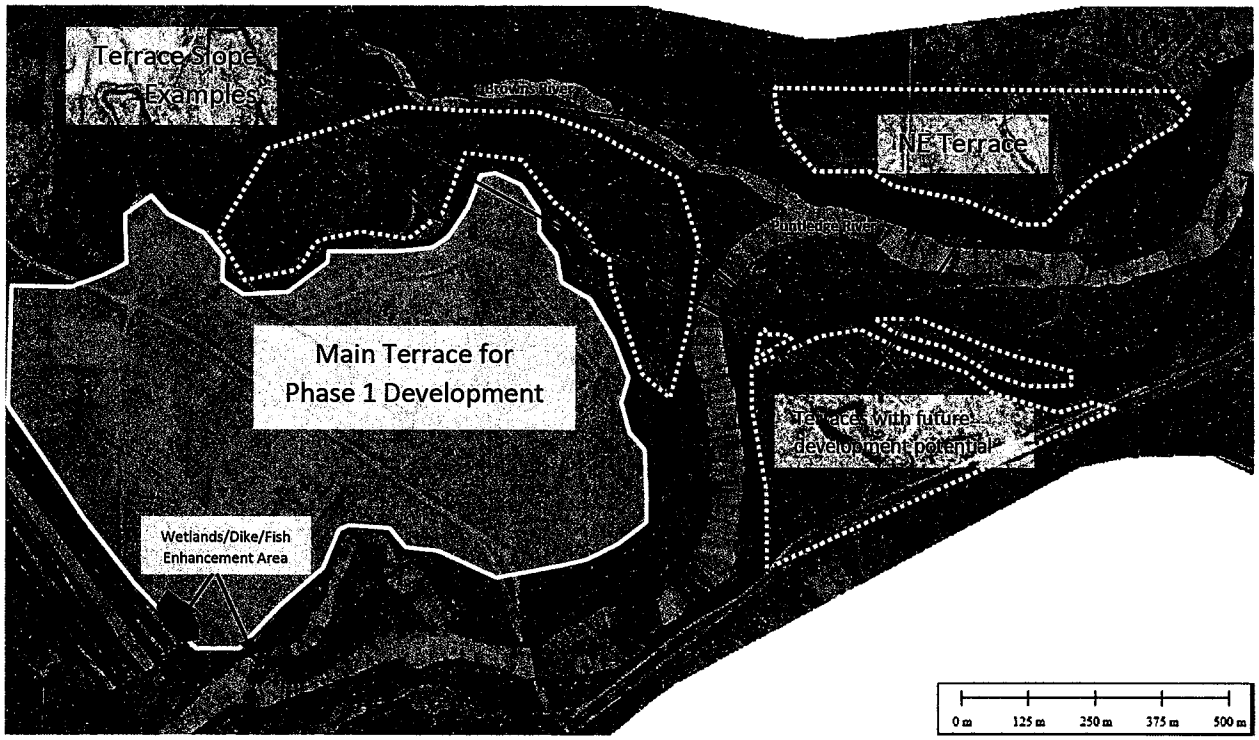


Figure 1 - Topo and Hill shade imagery of the property, with the main terrace terrain highlighted.

The terraces will be the primary development sites. They are easily accessed by existing roads or foreseeable new construction down the terrace slopes. The primary development area is the "main terrace" in the west. Relatively large terraces also exist on either side of the Puntledge River below the confluence. The upper terraces have been slightly disturbed with road building and past infilling from localized leveling. The disturbances were not found to be extensive, but these disturbances should be accounted for and investigated for construction.

The slopes between the terraces were naturally shaped from past river erosion at the toe and soil wasting. They were found to vary between 1.5H:1V and 2H:1V. Soil creep was noted on all slopes with localized slumping at some locations. Deep seated, or progressive landslides were not noted in the subject area.

The river areas were bedrock controlled with highly variable terrain, generally steep with frequent hazards. The rivers were both stepped with waterfall cascades and pools down their lengths.

5.2 West side, Main Terrace

This terrace accounts for the majority of the usable land within the property. Duncan Bay Logging road provides access through this area is currently lightly utilized with a fenced storage area on to the west of the road and a frisbee golf course to the east. Recreational trails and river access are also common in this area.

Other than the southwestern corner the terrace was found to be dry with relatively free draining soils and no flood hazard. A rock spur into the Puntledge River (Photo 1) and fisheries enhancements were found in the southwest corner of the property adjacent to Hwy 19. The wetlands were supplied with water from 2 large box culverts under the highway (Photo 2), and were drained back to the Puntledge River. The history and limits for this work will need further investigation prior to development.

There were signs of surficial earth movement across much of the terrace from past industrial use. These earthworks appeared to be limited to thin fills and leveling. There were areas of woody debris, but no garbage or large fills were noted. It is however recommended that further study be competed on a lot by lot basis as the development progresses.

No deep seated landslides were noted in the field reconnaissance or aerial imagery. A typical 10m building set back from slopes less than 10m high is suggested and this set back should be increased to 15m for slopes greater than 10m high. The set back should be measured from the transition between "level" and the initial roll of the crest. These setbacks may be reduced on a lot by lot basis with further study.

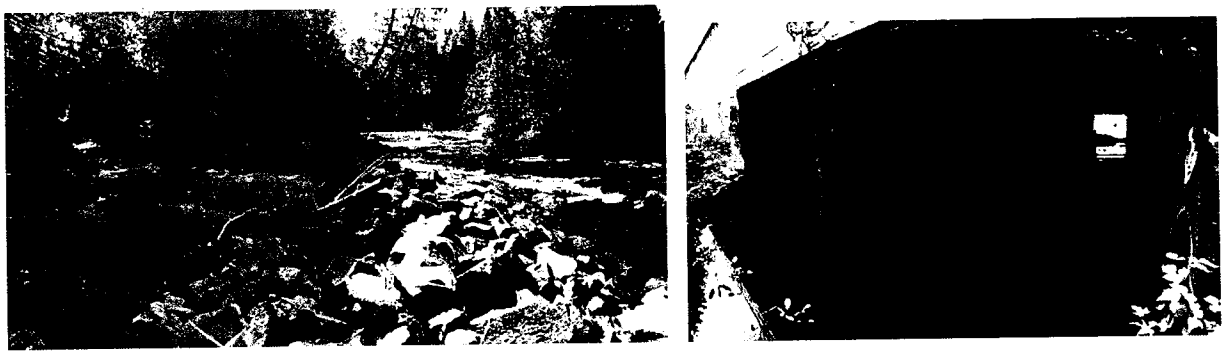


Photo 1 and 2 - Puntledge River Dike and Hwy 19 Box Culverts

5.3 Other River/Marine Terraces

The property has a series of other flat river terraces. There were at least 6 other zones which could prove to be suitable for future development. The two larger terraces on the north and south sides of the river adjacent to the river confluence and the stepped terrace terrain below the western "main" terrace maintain development potential. These terraces have significant slopes down to the river but should not be dismissed due to hazard considerations alone. The other terraces are smaller but could prove to be suitable for future phases as well.

5.4 Terrace Slopes

Between the terraces were forested soil slopes. These slope were comprised of the alluvial silty sands and gravels found across the property. Rock exposure was limited to the active river areas alone. The soil slopes ranged between 22 to 35 degrees. This is the expected natural angle of repose for this soil type under varying groundwater conditions. Deep seated failures were not noted, but surficial soil creep was common and localized slumping was identified in several places.

While there were no distinct slope stability issues, the overall stability and site-specific construction setbacks were not investigated in detail. The typical 10m setback from slopes less than 10m high, and increase to 15m for slopes higher than that is considered appropriate for the basic development planning at this time. Further detailed studies are recommended on a site by site basis as the need arises. Road construction down or across these slopes is not expected to be too challenging if properly planned through the early stages of development.

Photo 3 – typical terrace slope. The undulations and curved trees are indicative of soil creep.

6. Landslides

The upper terrace as defined in Section 5.2 has no landslide hazard. There is no land above and there is no foreseeable risk of toe erosion below. Soil loss through natural weathering on the slopes below have been accounted for within the construction setback. This upper terrace is considered "save for the use intended".

7. Flooding

Other than the wetlands area in the southwestern corner the land was dry with no ponding. The only foreseeable flooding hazard within the "main terrace", as defined in Section 5.2, is from the Puntledge and Browns Rivers. However, the McElhanney "Riverwood Development Floodplain Assessment – Draft", June 12, 2018, File: 2211-47519-00 shows that the Phase 1 "Main Terrace" area is well above any flood considerations (Figure 2). The physical workings of the constructed wetlands were not fully investigated, but it was clear that the area drains toward the Puntledge River and is not expected to flood anymore than the immediate area. No future work is anticipated, and the area is considered "safe for the use intended".

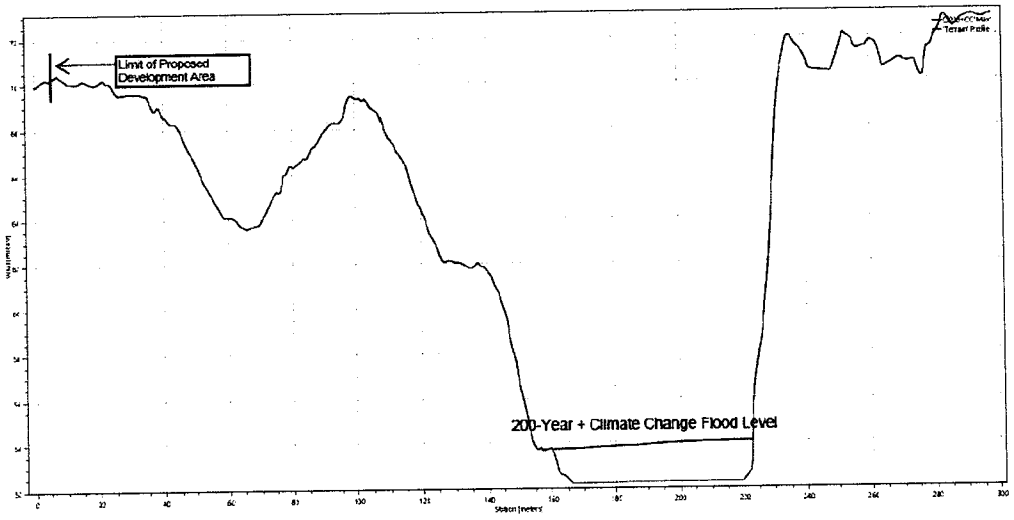
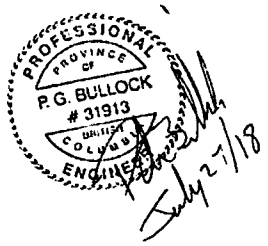


Figure 2 – from the McElhanney Report. This cross section was taken along the Puntledge River approximately 100m below the Duncan Main Logging Road.

8. Summary

The Riverwood Development property has been investigated confirmed to suit the needs of the Phase 1 development. The "Main Terrace" area, as described in Section 5.2 and roughly outlined in Figure 1, is considered to be "safe for the use intended" based on level of safety described in Section 3 of this report.

Sincerely,



Peter Bullock, P.Eng., M.Eng.
Principal
Base Geotechnical Inc.

General Conditions and Limitations

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Base Geotechnical Inc.'s (BGI) Client. BGI does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than BGI's Client unless otherwise authorized in writing by BGI. Any unauthorized use of the report is at the sole risk of the user.

2.0 ALTERNATE REPORT FORMAT

Where BGI submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed BGI's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by BGI shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of BGI's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except BGI. BGI's instruments of professional service will be used only and exactly as submitted by BGI.

Electronic files submitted by BGI have been prepared and submitted using specific software and hardware systems. BGI makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, BGI has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. BGI does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. BGI does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

BGI will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO BGI BY OTHERS

During the performance of the work and the preparation of the report, BGI may rely on information provided by persons other than the Client. While BGI endeavours to verify the accuracy of such information when instructed to do so by the Client, BGI accepts no responsibility for the accuracy or the reliability of such information which may affect the report

APPENDIX J: *FLOOD HAZARD AND RISK* ASSURANCE STATEMENT

Note: This Statement is to be read and completed in conjunction with the "*APEGBC Professional Practice Guidelines - Legislated Flood Assessments in a Changing Climate*, March 2012 ("*APEGBC* Guidelines") and is to be provided for *flood assessments* for the purposes of the *Land Title Act*, Community Charter or the *Local Government Act*. Italicized words are defined in the *APEGBC* Guidelines.

To: The *Approving Authority*
Ministry of Transportation & Infrastructure - Courtenay BC
Jurisdiction and address

Date: July 27/18

With reference to (check one):

- ☐ Land Title Act (Section 86) – Subdivision Approval
- ☐ Local Government Act (Sections 919.1 and 920) – Development Permit
- ☐ Community Charter (Section 56) – Building Permit
- ☐ Local Government Act (Section 910) – Flood Plain Bylaw Variance
- ☐ Local Government Act (Section 910) – Flood Plain Bylaw Exemption

For the Property:
See Attached
Legal description and civic address of the Property

The undersigned hereby gives assurance that he/she is a *Qualified Professional* and is a *Professional Engineer* or *Professional Geoscientist.*

I have signed, sealed and dated, and thereby certified, the attached flood assessment report on the Property in accordance with the APEGBC Guidelines. That report must be read in conjunction with this Statement. In preparing that report I have:

Check to the left of applicable items

- ✓ 1. Collected and reviewed appropriate background information
- ✓ 2. Reviewed the proposed *residential development* on the Property
- ✓ 3. Conducted field work on and, if required, beyond the Property
- ✓ 4. Reported on the results of the field work on and, if required, beyond the Property
- ✓ 5. Considered any changed conditions on and, if required, beyond the Property
- 6. For a *flood hazard* analysis or *flood risk* analysis I have:
  - ✓ 6.1 reviewed and characterized, if appropriate, floods that may affect the Property
  - ✓ 6.2 estimated the *flood hazard* or *flood risk* on the property
  - ✓ 6.3 included (if appropriate) the effects of climate change and land use change
  - ✓ 6.4 identified existing and anticipated future *elements at risk* on and, if required, beyond the Property
  - ✓ 6.5 estimated the potential *consequences* to those *elements at risk*
- 7. Where the *Approving Authority* has adopted a specific level of *flood hazard* or *flood risk* tolerance or return period that is different from the standard 200-year return period design criteria[1], I have
  - ___ 7.1 compared the level of *flood hazard* or *flood risk* tolerance adopted by the *Approving Authority* with the findings of my investigation
  - ___ 7.2 made a finding on the level of *flood hazard* or *flood risk* tolerance on the Property based on the comparison
  - ___ 7.3 made recommendations to reduce the *flood hazard* or *flood risk* on the Property

[1] *Flood Hazard Area Land Use Management Guidelines* published by the BC Ministry of Forests, Lands , and Natural Resource Operations and the 2009 publication *Subdivision Preliminary Layout Review – Natural Hazard Risk* published by the Ministry of Transportation and Public Infrastructure. It should be noted that the 200-year return period is a standard used typically for rivers and purely fluvial processes. For small creeks subject to debris floods and debris flows return periods are commonly applied that exceed 200 years. For life-threatening events including debris flows, the Ministry of Transportation and Public Infrastructure stipulates in their 2009 publication *Subdivision Preliminary Layout Review – Natural Hazard Risk* that a 10,000-year return period needs to be considered.

8. Where the *Approving Authority* has **not** adopted a level of *flood risk* or *flood hazard* tolerance I have:

✓ 8.1 described the method of *flood hazard* analysis or *flood risk analysis* used

✓ 8.2 referred to an appropriate and identified provincial or national guideline for level of *flood hazard* or *flood risk*

✓ 8.3 compared this guideline with the findings of my investigation

✓ 8.4 made a finding on the level of *flood hazard* of *flood risk* tolerance on the Property based on the comparison

✓ 8.5 made recommendations to reduce *flood risks*

✓ 9. Reported on the requirements for future inspections of the Property and recommended who should conduct those inspections.

Based on my comparison between

Check one

☐ the findings from the investigation and the adopted level of *flood hazard* or *flood risk* tolerance (item 7.2 above)

☑ ✓ the appropriate and identified provincial or national guideline for level of *flood hazard* or *flood risk* tolerance (item 8.4 above)

I here b y give my assurance that, based on the conditions contained in the attached flood assessment report,

Check one

☑ ✓ for subdivision approval, as required by the *Land Title Act* (Section 86), "that the land may be used safely for the use intended".

Check one

☐ with one or more recommended registered *covenants*.

☐ without any registered *covenant*.

☐ for a development permit, as required by the *Local Government Act* (Sections 919.1 and 920), my report will "assist the local government in determining what conditions or requirements under [Section 920] subsection (7.1) it will impose in the permit".

☐ for a building permit, as required by the Community Charter (Section 56), "the land may be used safely for the use intended".

Check one

☐ with one or more recommended registered *covenants*.

☐ without any registered *covenant*.

☐ for flood plain bylaw variance, as required by the *Flood Hazard Area Land Use Management Guidelines* associated with the *Local Government Act* (Section 910), "the development may occur safely".

☐ for flood plain bylaw exemption, as required by the *Local Government Act* (Section 910), "the land may be used safely for the use intended".

Peter Bullock
Name (print)

Peter Bullock
Signature

720 Fern Road E
Address

Qualicum Beach BC V9K1M3

250.228.2421
Telephone

July 27/18
Date

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P. G. BULLOCK
31913
July 27/18

(Affix Professional seal here)

If the *Qualified Professional* is a member of a firm, complete the following.

I am a member of the firm Base Geotechnical Inc
and I sign this letter on behalf of the firm. (Print name of firm)

APPENDIX D: *LANDSLIDE ASSESSMENT ASSURANCE STATEMENT*

Note: This Statement is to be read and completed in conjunction with the "*APEGBC Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia*", March 2006/Revised September 2008 ("*APEGBC* Guidelines") and the "2006 BC Building Code (BCBC 2006)" and is to be provided for *landslide assessments* (not floods or flood controls) for the purposes of the Land Title Act, Community Charter or the Local Government Act. Italicized words are defined in the *APEGBC* Guidelines.

To: The *Approving Authority*
Ministry of Transportation & Infrastructure - Courtenay
Jurisdiction and address

Date: July 27/18

With reference to (check one):

- ☒ Land Title Act (Section 86) – Subdivision Approval
- ☐ Local Government Act (Sections 919.1 and 920) – Development Permit
- ☐ Community Charter (Section 56) – Building Permit
- ☐ Local Government Act (Section 910) – Flood Plain Bylaw Variance
- ☐ Local Government Act (Section 910) – Flood Plain Bylaw Exemption
- ☐ British Columbia Building Code 2006 sentences 4.1.8.16 (8) and 9.4 4.4.(2) (Refer to BC Building and Safety Policy Branch Information Bulletin B10-01 issued January 18, 2010)

For the Property: See Attached
Legal description and civic address of the Property

The undersigned hereby gives assurance that he/she is a *Qualified Professional* and is a *Professional Engineer* or *Professional Geoscientist.*

I have signed, sealed and dated, and thereby certified, the attached *landslide assessment* report on the Property in accordance with the *APEGBC Guidelines*. That report must be read in conjunction with this Statement. In preparing that report I have:

Check to the left of applicable items

✓ 1. Collected and reviewed appropriate background information
✓ 2. Reviewed the proposed *residential development* on the Property
✓ 3. Conducted field work on and, if required, beyond the Property
✓ 4. Reported on the results of the field work on and, if required, beyond the Property
✓ 5. Considered any changed conditions on and, if required, beyond the Property
6. For a *landslide hazard analysis* or *landslide risk analysis* I have:
✓ 6.1 reviewed and characterized, if appropriate, any *landslide* that may affect the Property
✓ 6.2 estimated the *landslide hazard*
✓ 6.3 identified existing and anticipated future *elements at risk* on and, if required, beyond the Property
✓ 6.4 estimated the potential *consequences* to those *elements at risk*
7. Where the *Approving Authority* has adopted a *level of landslide safety* I have:
___ 7.1 compared the *level of landslide safety* adopted by the *Approving Authority* with the findings of my investigation
___ 7.2 made a finding on the *level of landslide safety* on the Property based on the comparison
___ 7.3 made recommendations to reduce *landslide hazards* and/or *landslide risks*

8. Where the *Approving Authority* has **not** adopted a *level of landslide safety* I have:

✓ 8.1 described the method of *landslide hazard analysis* or *landslide risk analysis* used

✓ 8.2 referred to an appropriate and identified provincial, national or international guideline for *level of landslide safety*

✓ 8.3 compared this guideline with the findings of my investigation

✓ 8.4 made a finding on the *level of landslide safety* on the Property based on the comparison

✓ 8.5 made recommendations to reduce *landslide hazards* and/or *landslide risks*

✓ 9. Reported on the requirements for future inspections of the Property and recommended who should conduct those inspections.

Based on my comparison between

Check one

☐ the findings from the investigation and the adopted *level of landslide safety* (item 7.2 above)

☑ the appropriate and identified provincial, national or international guideline for *level of landslide safety* (item 8.4 above)

I hereby give my assurance that, based on the conditions[1] contained in the attached *landslide assessment* report,

Check one

☑ for subdivision approval, as required by the Land Title Act (Section 86), "that the land may be used safely for the use intended"

Check one

☐ with one or more recommended registered covenants.

☑ without any registered covenant.

☐ for a development permit, as required by the Local Government Act (Sections 919.1 and 920), my report will "assist the local government in determining what conditions or requirements under [Section 920] subsection (7.1) it will impose in the permit".

☐ for a building permit, as required by the Community Charter (Section 56), "the land may be used safely for the use intended"

Check one

☐ with one or more recommended registered covenants.

☐ without any registered covenant.

☐ for flood plain bylaw variance, as required by the "Flood Hazard Area Land Use Management Guidelines" associated with the Local Government Act (Section 910), "the development may occur safely".

☐ for flood plain bylaw exemption, as required by the Local Government Act (Section 910), "the land may be used safely for the use intended".

Peter Bullock
Name (print)

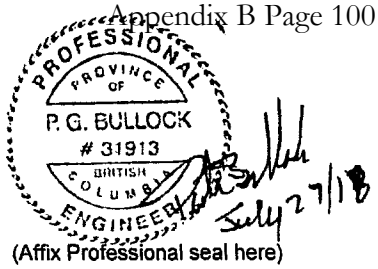
July 27/18
Date

Peter Bullock
Signature

[1] When seismic slope stability assessments are involved, *level of landslide safety* is considered to be a "life safety" criteria as described in the National Building Code of Canada (NBCC 2005), Commentary on Design for Seismic Effects in the User's Guide, Structural Commentaries, Part 4 of Division B. This states:

"The primary objective of seismic design is to provide an acceptable level of safety for building occupants and the general public as the building responds to strong ground motion; in other words, to minimize loss of life. This implies that, although there will likely be extensive structural and non-structural damage, during the DGM (design ground motion), there is a reasonable degree of confidence that the building will not collapse nor will its attachments break off and fall on people near the building. This performance level is termed 'extensive damage' because, although the structure may be heavily damaged and may have lost a substantial amount of its initial strength and stiffness, it retains some margin of resistance against collapse".

720 Fern Rd E.
Address
Qualicum Beach BC
V9K 1M3 250.228.2421
Telephone



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If the *Qualified Professional* is a member of a firm, complete the following.

I am a member of the firm Base Geotechnical Inc.
and I sign this letter on behalf of the firm. (Print name of firm)

LEGAL DESCRIPTION AND OWNERSHIP

1. **That Part of the NW ¼ of Section 10, Tp. 9, Comox District, Plan 552G, Lying west of Puntledge River except that part in Plan VIP70188 and EPP24391 – PID 000-866-792**
   Owned by 0768816 BC. Ltd.

2. **The SW ¼ of Section 15, Tp. 9, Comox District, Plan 552G, except that part shown coloured red on Plan 79 RW and except that Part in Plan VIP70188 – PID 000-866-814**
   Owned by 0768816 BC Ltd.

3. **Lot A, Sections 10 and 15, Tp. 9, Comox District, Plan EPP23059 – PID 028-915-194. Owned by 3L Developments Inc.**

4. **That Part of the Nort ½ of Section 14, Tp. 9, Comox District, Plan 552G lying to the south of the north bank of the Puntledge River – PID 000922-308. Owned by 3L Developments Inc.**

5. **That Part of the SE ¼, Tp. 9, Comox District, Plan 552G lying to the west of the east bank of the Puntledge River except those parts in Plans 8304 and 9343 – PID 003-922-391. Owned by 3L Developments Inc.**

6. **The SW ¼ of Section 14, Tp. 9, Comox District, Plan 552G, except that part in Plan 9343 and except that part shown coloured red on Plan 829 RW – PID 003-924-033. Owned by 3L Developments Inc.**

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RIVERWOOD RESIDENTIAL DEVELOPMENT

TRANSPORTATION ASSESSMENT

FINAL REPORT

Prepared For:	**3L Developments Inc.**
Prepared By:	**Bunt & Associates Engineering Ltd**
File Number:	**5804.04**
Date of Issue:	**October 30, 2009**

Table of Contents

Exhibits

Appendix

1. Introduction

3L Developments Inc. is proposing to rezone the subject property on Duncan Bay Main Road (DBM Road) in the Comox Valley from the Rural 20 (RU20) district into a Residential Subdivision consisting of 600 properties across 400 acres. Bunt & Associates has been commissioned by 3L Developments Inc. to provide traffic and transportation advice to support their rezoning application to develop the Riverwood Residential development. This report provides an overview of the potential off-site transportation impacts of the proposed development, as well as potential strategies to reduce the auto-dependence of the development in keeping with the principals of sustainability.

This report has been set out in the following manner:

- Section 2 describes the existing conditions in the study area and establishes the general scope for the planned study network;
- Section 3 outlines relevant municipal, regional and provincial transportation plans and policies that need to be considered in the context of the site development;
- Section 4 provides information on the proposal for the site development;
- Section 5 outlines the methodology for predicting the vehicle trip generation by the subdivision, using data that is consistent with the characteristics of the development design and the planned infrastructure and initiatives to support it. It also examines the likely trip distribution, including the potential for internal, linked and diverted trips
- Section 6 will assess the effect of the development traffic on the study road network, it will identify locations where off-site improvements are considered appropriate to support the site redevelopment;
- Section 7 outlines potential sustainable transportation measures for the site;
- Section 8 sets out the conclusions and recommendations of the study.

2. Existing Conditions

This section will review the existing conditions by describing the site layout, surrounding land uses, the site's current zoning, and the local road network and transportation movements.

2.1 Site Location & Existing Land Uses

The site location is illustrated on **Exhibit 1** in the context of the local road network. The site covers approximately 400 acres of rural land and is bounded by rural properties to the north, Browns River to the east, the Puntledge River to the south, and the Inland Island Highway (Highway 19) to the west. The site is divided by the Duncan Bay Main Road / Comox Logging Co. Road (referred throughout as DBM Road) which runs from north to south through the middle of the site and from which site access will be provided.

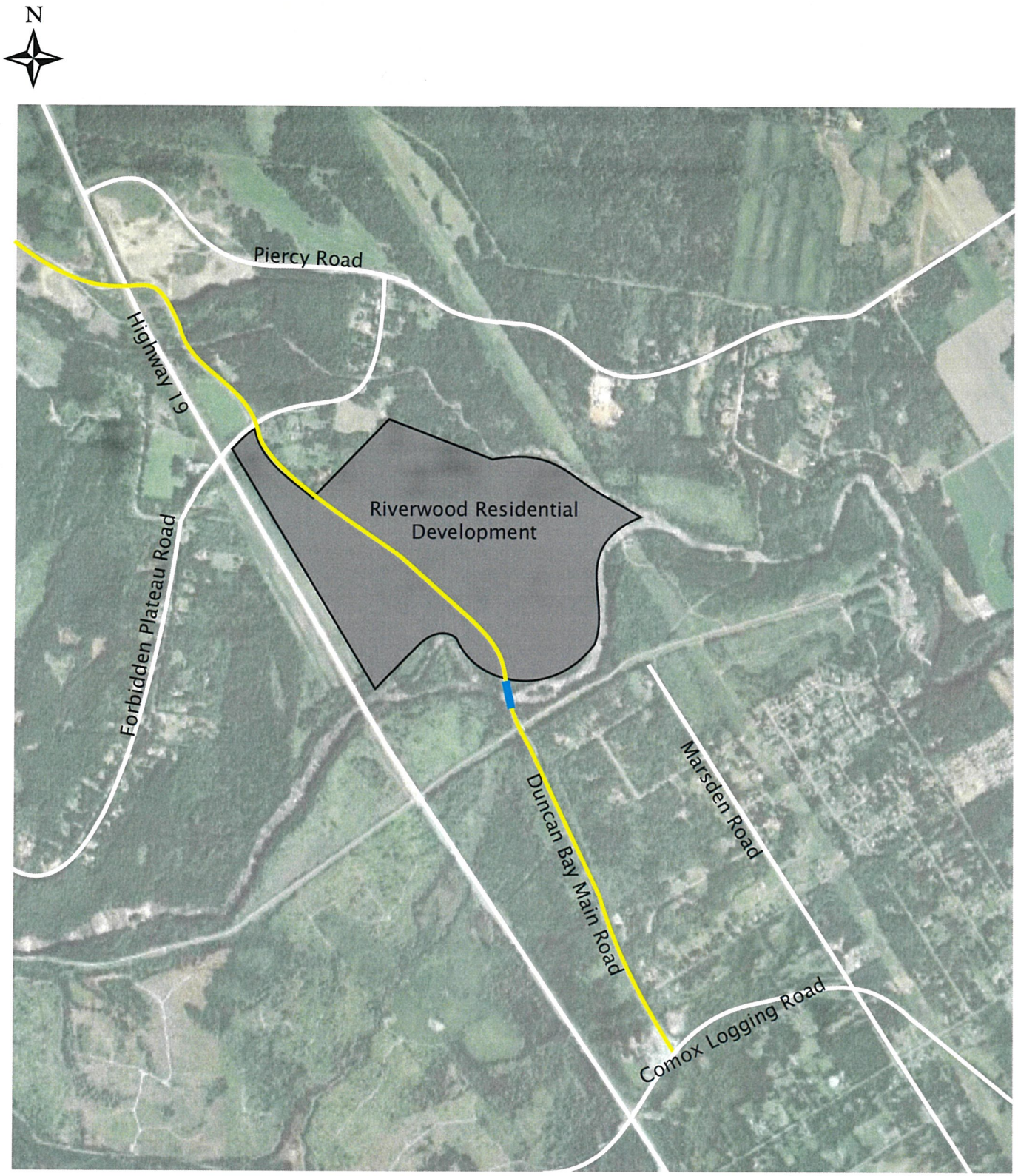
2.2 Current Zoning

The development site is subject to a rezoning application. At present, the site is zoned RU20 Rural. While the southern area of the site bordering on the Puntledge River is not zoned as a park, it is currently used as a recreational area by those accessing the river and existing trails along the north side of the river.

2.3 Existing Road Network

Highway 19 is a limited access Arterial Highway that runs parallel to the Island Highway (Highway 19A) from Parkville to Campbell River. Highway 19 is a four-lane divided facility with a mix of grade separated interchanges and at-grade signals that provide an alternative and more direct route along the eastern coast line than the Old Island Highway.

To access the site from the north, vehicles are required to take exit 127 from Highway 19 at Piercy Road, turn right onto Forbidden Plateau Road before turning left onto DBM Road to access the site. The intersection of the Highway 19 and Piercy Road is a signalized T-intersection with separate right turn lanes on all approaches. On the Highway 19 approaches to the intersection the posted speed limit is 90km/hr and on Piercy Road the speed limit of 70km/hr. Pedestrian crossing facilities are provided at the intersection; however pedestrians are not permitted to walk along the highway and sidewalks are not



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Location of the site and Northern Access

Riverwood Residential Development, Courtenay

Exhibit 1

provided on any of the approaches. Road condition, pavement marking and signage are currently of a high standard.

Piercy Road is a Rural Collector road providing access from Highway 19 into the northern part of downtown Courtenay. Forbidden Plateau Road is a Rural Local road providing access to adjacent residential properties as well as industrial, agricultural and forestry block properties located south and west of its intersection with DBM Road.

The intersection of Piercy Road and Forbidden Plateau Road is a stop controlled intersection, with priority afforded to Piercy Road. A 30m long left turn bay is provided on the westbound approach on Piercy Road and 30m right and left turn bays are provided on the Forbidden Plateau Road approach. The posted speed limit on both roads in this location is 60km/hr and paved shoulders are also provided on both roads. While the road pavement at the intersection is currently in good condition; however the pavement markings are very faded on the northbound approach, as shown in **Exhibit 2**. During the site visit, it was observed that this intersection is used by a significant number of heavy vehicles turning to and from Forbidden Plateau Road, including oversize loads. On the day of the site visit the sight distance from a car stopped at the stop bar looking west to approaching traffic on Piercy Road was measured and it was noted that a row of pine trees on the southern side of Piercy Road, just west of the intersection limited the available sight distance for vehicles exiting Forbidden Plateau Road. In keeping with the rural environment, pedestrian facilities are not provided at this intersection.

Exhibit 2 – Faded road markings on Forbidden Plateau Road approach to Piercy Road

The intersection of Forbidden Plateau Road and DBM Road is stop sign controlled with priority afforded to traffic on Forbidden Plateau Road. The intersection is elevated via fill from the surrounding rural properties in order to tie-in with the Forbidden Plateau Road overpass of Highway 19, some 200m west of the intersection. As a result, there are no shoulders provided on DBM Road and there is Concrete Roadside Barrier provided to protect a residential property in the southeast quadrant of the intersection. The elevation of the intersection assists with good sight distances from all approaches. The pavement is currently in good condition; however the pavement markings are worn on Forbidden Plateau Road and not provided on DBM Road, as shown in **Exhibit 3**. During the site visit, it was observed that this intersection is also used by a large number of heavy vehicles as well as cyclists.

Exhibit 3 – No road markings on DBM Road northbound approach to Forbidden Plateau Road

DBM Road is a Ministry of Forests road for several hundred metres south of its intersection with Forbidden Plateau Road, then becomes a private road which runs through the site from Forbidden Plateau Road to the private one lane bridge crossing the Puntledge River. Although it is a private road, DBM Road is currently available for use by the public and it was observed during the site visit that the route is well used by both vehicular and cycling traffic. Once the site is redeveloped, it is proposed to make the section of DBM Road between Forbidden Plateau Road to just north of the one-lane bridge over the Puntledge River a public road. South of the one-lane bridge, the DMB Road continues through private property and across a private gravel industrial yard, used as the headquaters for a logging operation, to the intersection of Comox Logging Road. This gravel yard begins 150m north of the intersection, and where the two roads meet is about 50m wide. There is no positive guidance to drivers through this gravel yard.

The intersection of Comox Logging Road and Marsden Road is stop sign controlled with priority afforded to traffic on Comox Logging Road. The pavement is currently in good condition, but markings at this intersection are very faded. Unsealed shoulders are provided on all approaches and the posted speed limit is 60km/hr.

To access the site from the south (if the private section of DBM Road is available) vehicles would take exit 117 from Highway 19 at the Comox Valley Parkway interchange. This interchange is about 8km south of the site and the most direct route from this exit point is left onto Cumberland Road, left onto Marsden Road, left onto Comox Logging Road and right onto DBM Road. The route travels through forestry and agricultural land along these minor roads and is shown in the context of the wider road network in **Exhibit 4**.

The most convenient route to the southern part of Downtown Courtenay from the site is to travel south of the site on DBM Road via Comox Logging Road, onto Lake Trail Road, Pidcock Avenue and Cumberland Road. The most convenient route to Comox is north along DBM Road to Piercy Road, via Forbidden Plateau Road. At the end of Piercy Road vehicles turn right onto Dove Creek Road, cross a signalized one lane bridge, and follow Headquarters Road and Vanier Drive to Veterans Memorial Parkway. The Parkway then becomes Lenwick Road and Guthrie Road, before intersecting Anderton Road in Comox.

2.4 Study Road Network

The study area for the traffic impact assessment was agreed with the Ministry of Transportation and Infrastructure (MoTI) as follows:

Signalized Intersections:

- Highway 19 and Piercy Road

Unsignalized Intersections:

- Piercy Road and Forbidden Plateau Road
- Forbidden Plateau Road and DBM Road
- Comox Logging Road and Marsden Road

The laning and form of traffic control at these key intersections are shown in **Exhibit 5**.

Given the development will be primarily residential, the peak periods for the traffic impact assessment were agreed to be the weekday morning, weekday afternoon and the Saturday midday peak hours.

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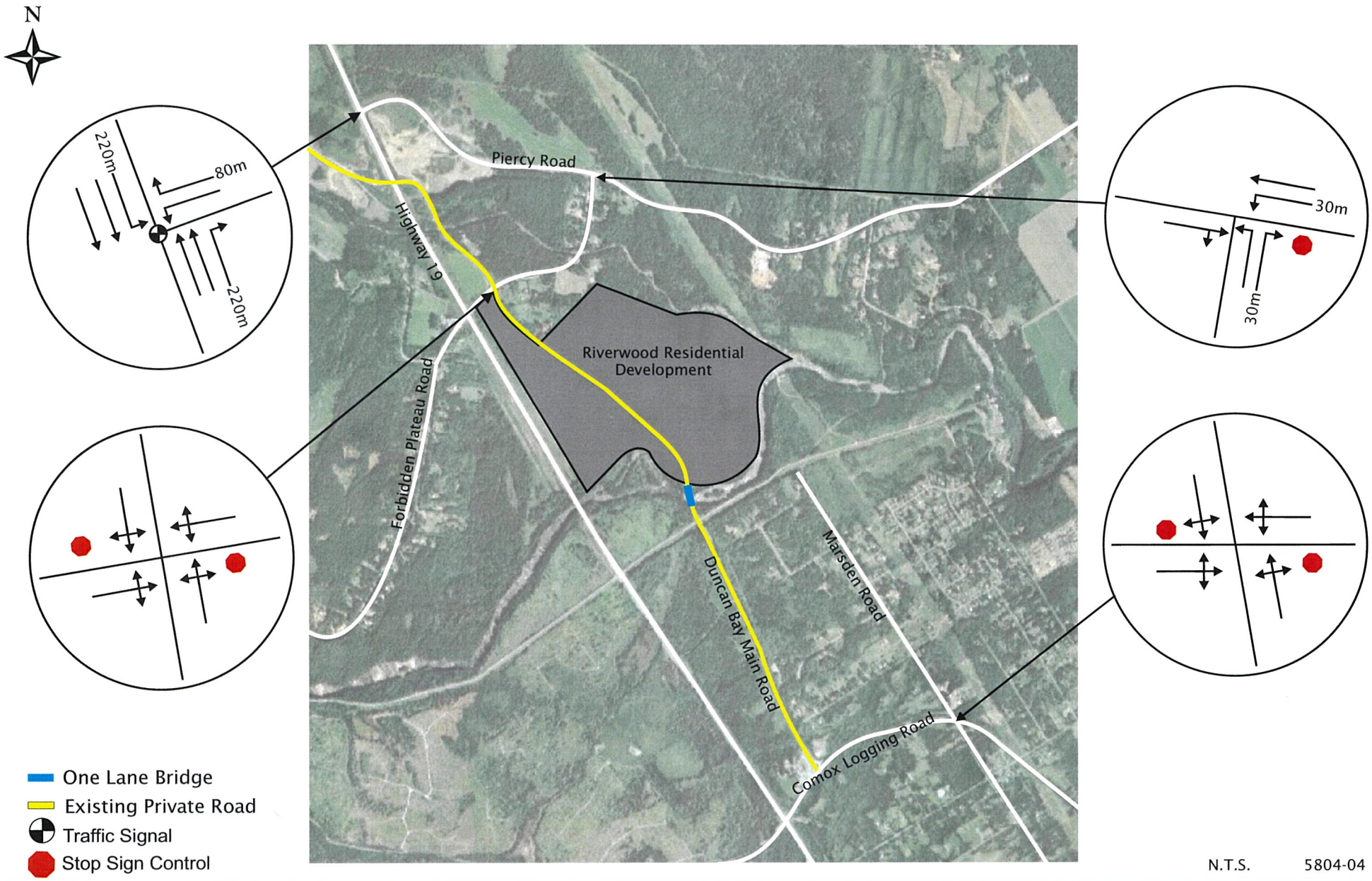
Location of the site and Southern Access

Riverwood Residential Development, Courtenay

Exhibit 4



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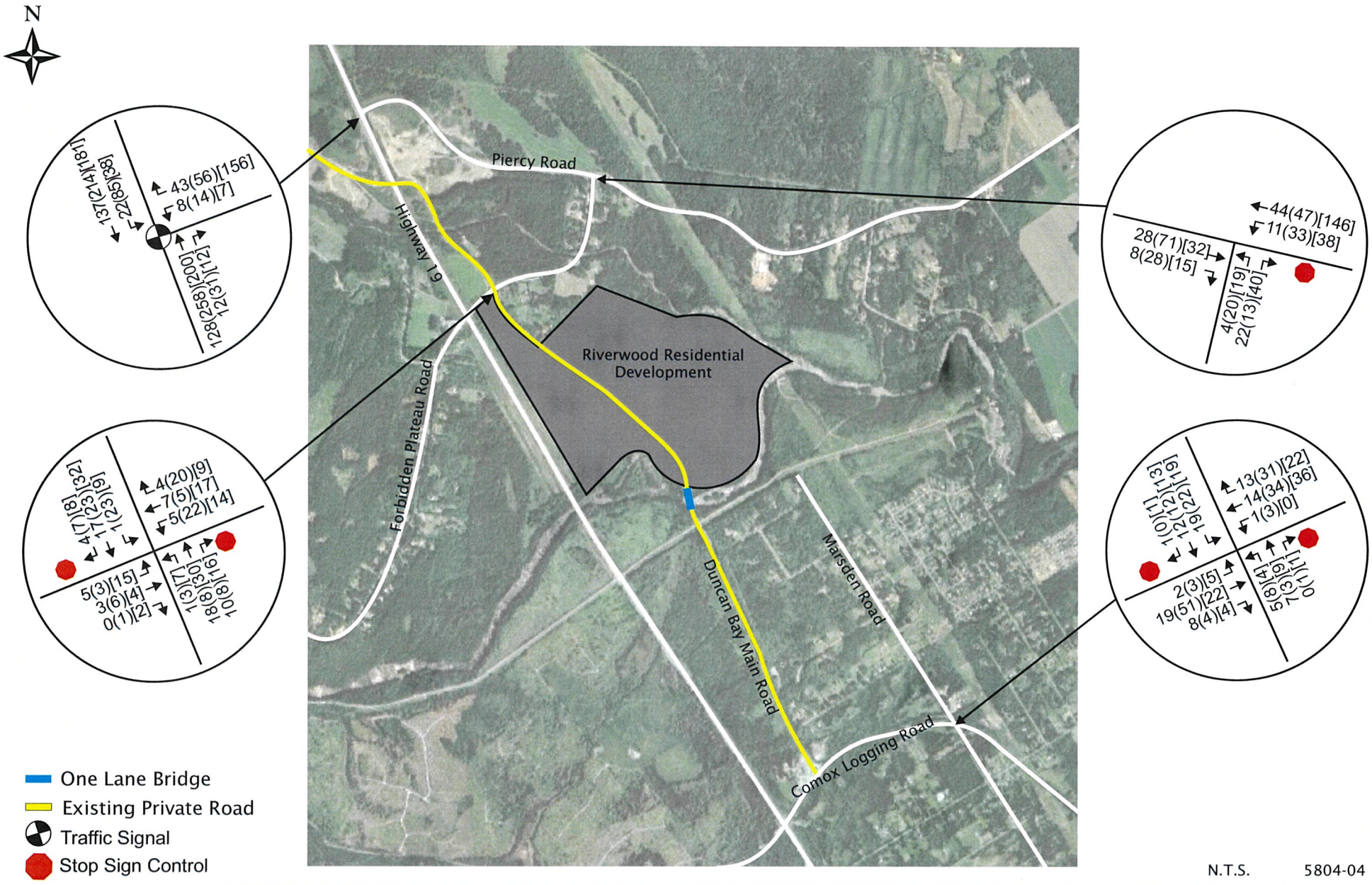
Intersection Layouts

Riverwood Residential Development, Courtenay

Exhibit
5



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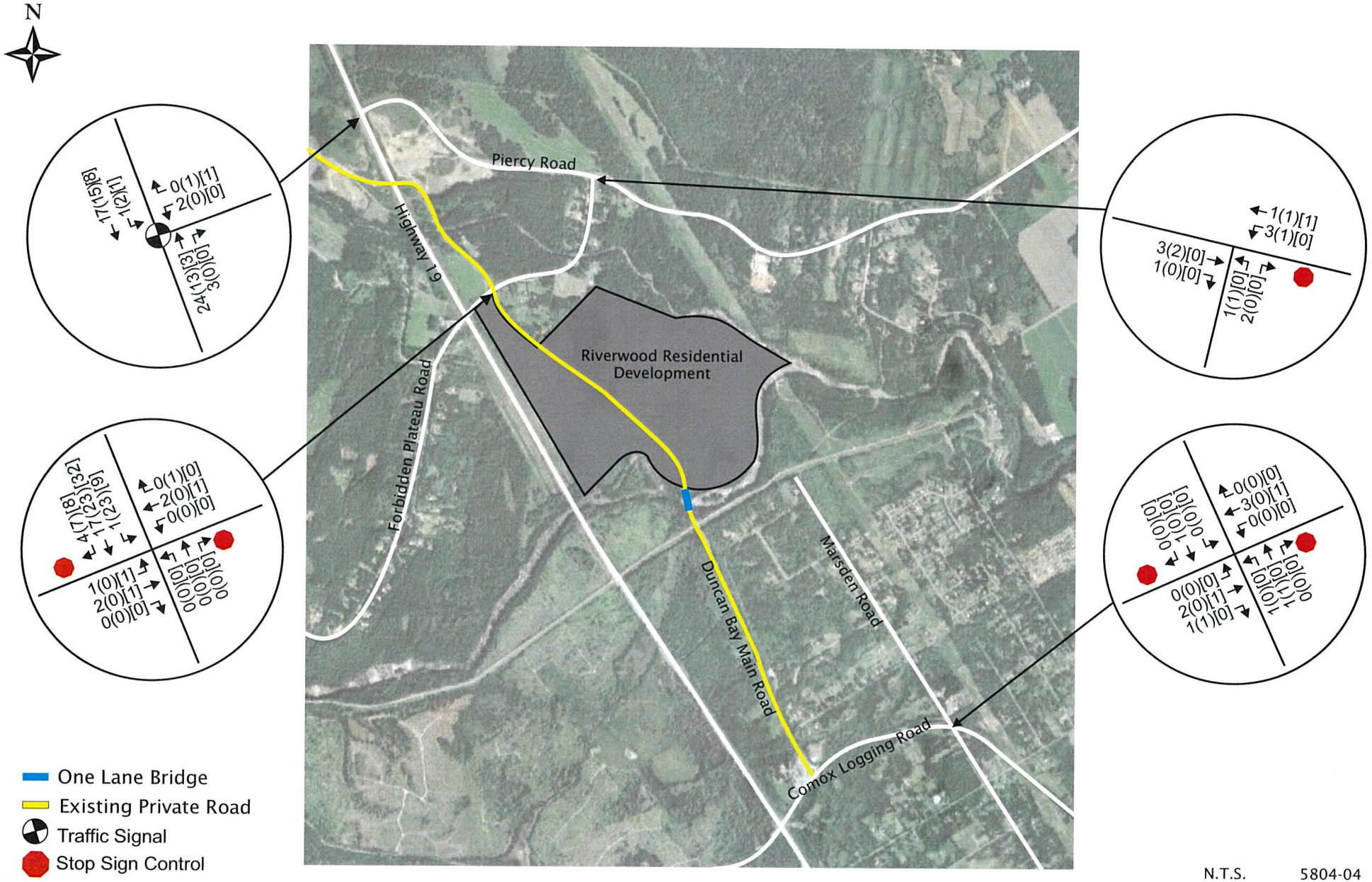
Existing Total Traffic Volumes

Riverwood Residential Development, Courtenay

Exhibit 6



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Existing Heavy Vehicle Volumes

Riverwood Residential Development, Courtenay

Exhibit 7

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3. Current Transportation Plans & Infrastructure Change

3.1 Provincial Plans

As part of this study, discussion with MoTI District staff confirmed that MoTI has no plans for any roadway or traffic control improvements associated with roadways in the study area.

3.2 Regional Plans & Polices

Both the Regional Growth Strategy (RGS) and the Comox Valley Sustainability Strategy (CVSS) are currently being drafted. At this stage it is envisioned that a preliminary draft of the RGS will be available in January 2010, with a final draft by July 2010. A final draft for the CVSS was issued in July 2009. Both these documents provide a good indication of the direction of both land use and transportation plans and policies in the area of the site; each of these plans aim to introduce a number of transportation changes in the Comox valley to reduce the reliance upon the private automobile.

This section will first describe the policies identified in the RGS and the CVSS. Brief descriptions will then be provided for each of the transportation infrastructure schemes identified above.

Regional Growth Strategy

The document "Understanding Our Choices" was prepared in June 2009 to provide the foundation from which the RGS is to be developed. Therefore, this document outlines the role of the RSG, describes the trends and issues and then raises points for discussion. This document provides a good overview of how the region currently operates and with regards to transport it outlines the key infrastructure elements in the Comox Valley.

Further to this, the document suggests "Points for Discussion" and identifies proper land use planning, management of development at highway exits, support transit-first development, encourage transportation demand management, evaluate intelligent transportation systems and advocate cycle lanes on all major regional roads as policy ideas for consideration.

Comox Valley Sustainability Strategy

The CVSS provides a series of goals that are addressed with objectives, targets and actions. With respect to transportation these goals are primarily focused on reducing the reliance upon private vehicles with the draft goals outlined as follows:

- Reduce the need for single occupant vehicles;
- Promote high-efficiency, low emission, and no-emission vehicles and alternative fuels; and,
- Implement transportation programs that increase walking, cycling and transit use.

The proposed Riverwood Residential development aims to address these goals. Section 7 below offers some options for implementing sustainable transportation measures for the development.

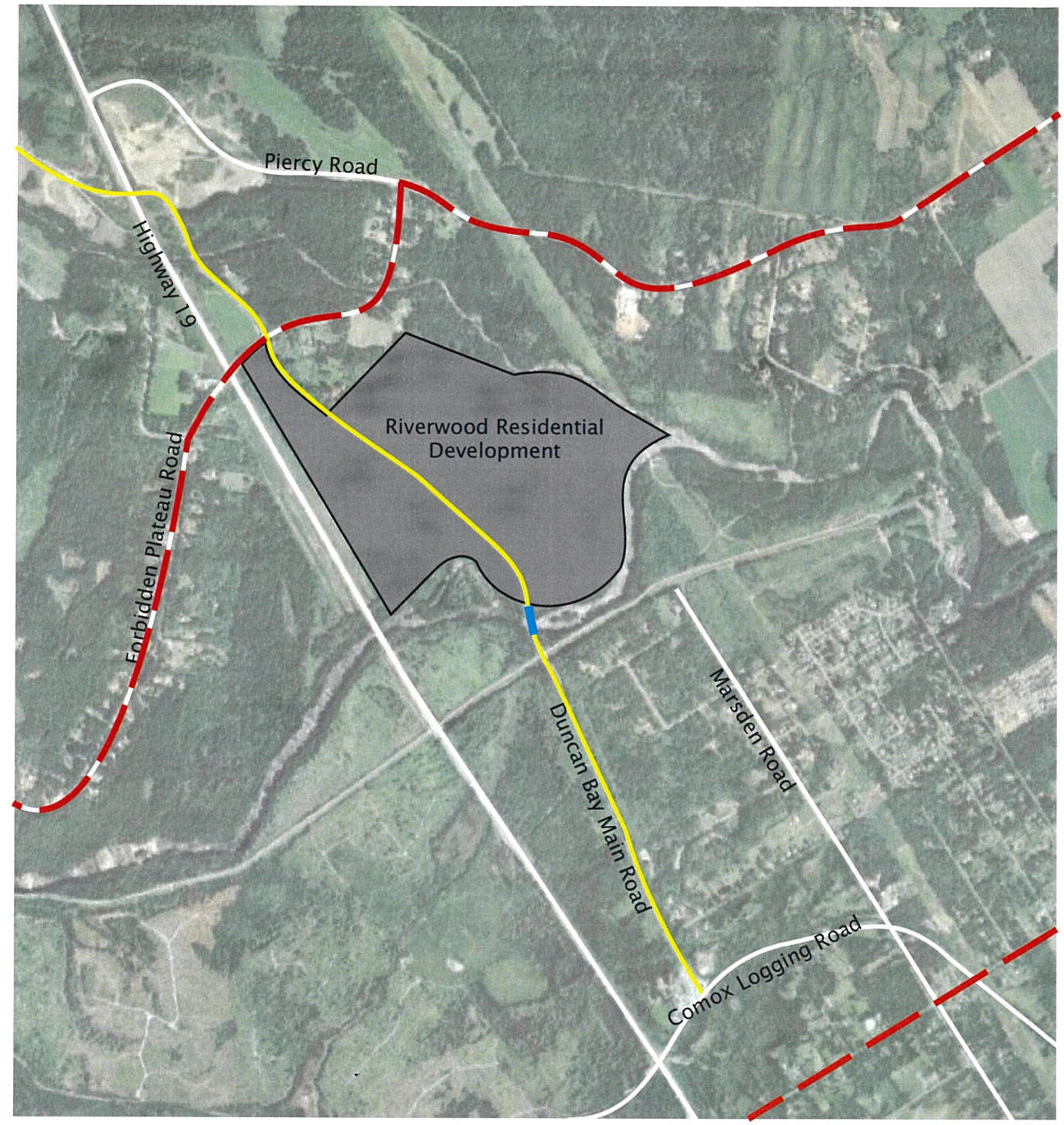
The Comox Valley Regional District currently has Cycleway and Greenway Plans that will be reviewed as part of the CVSS. Exerts from the Cycleway map is shown in **Exhibit 8** and the Greenway map is shown in **Exhibit 9**. A cycleway is shown following Forbidden Plateau Road and continues along Piercy Road, to the north of the site. This cycleway intersects with Dove Creek Road and then heads south into Courtenay. To the south of the site a cycleway follows Lake Trail Road and this also takes cyclists into Courtenay.

The Regional District Greenway plan shows the various greenway trails and roads. Within the study area a greenway is shown running parallel to the Highway, along Piercy Road, adjacent to a section of Forbidden Plateau Road and adjacent to both the Brown's River and Puntledge River. In addition to these, a trail is shown running adjacent to DBM Road from the one lane bridge to Comox Logging Road. Given that there are Greenway trails to the north and south of the proposed site, it is recommended that the possibility of connecting up these greenways be considered as part of the improvements to DBM Road.

3.3 Municipal Plans

The site lies outside of the boundary of the cities of Courtenay and Comox so municipal improvement plans will only indirectly impact the site. Courtenay and Comox have plans to connect Piercy Road directly with Veterans Memorial Parkway via a river crossing, which would make a more direct northern connection between Highway 19 and Comox. However, the timing of this improvement is unknown. The impact of this new connection will be to make Piercy Road more attractive as an access to Highway 19, so traffic volumes are expected to increase. In this study, background traffic growth scenarios have been selected

which, in our view, would address the range of volumes anticipated on Piercy Road if the connection to Veteran's Memorial Parkway was completed within the study time horizons.



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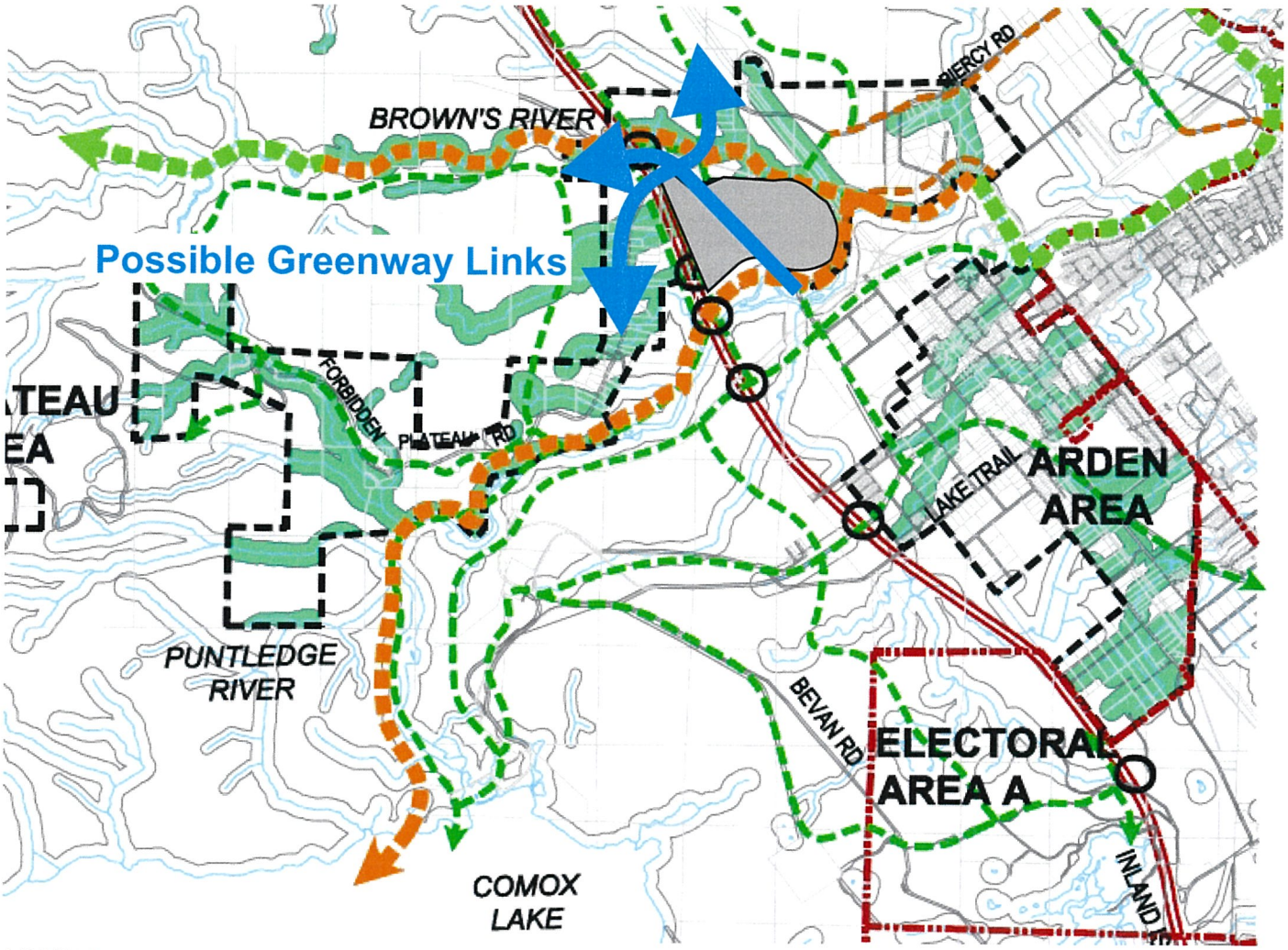
Cycle Network

Riverwood Residential Development, Courtenay

Exhibit 8



Source: Map #6: Area C Greenway Plan, Regional District of Comx-Strathcona Electoral Area C N.T.S. 5804-04

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Proposed Greenway Network

Riverwood Residential Development, Courtenay

Exhibit 9

4. Development Plan

3L Developments Inc. is proposing to rezone the property on DBM Road from the Rural 20 (RU20) district into a Residential Subdivision consisting of 600 properties across 400 acres.

It is anticipated that the development will be developed in phases, with the first phase of 60 homes being completed by 2012 and all remaining phases with 540 homes and some neighbourhood retail completed by 2022. The planned uses and areas for the development are summarized in **Table 4.1** below.

Table 4-1: Proposed Development Content

Land Use	Number / Area
Residential – Single Family Residence	450 house
Residential – Patio Homes, Carriage Homes	150 houses
Neighbourhood Retail	n/a*

Note that the amount of neighbourhood retail development is not yet known although it will is intended to be relatively small scale; therefore for the purposes of this analysis, no retail has been assumed to be present. This is a conservative approach, as the presence of some local retail opportunities would reduce the vehicle trip generation of the site development, without adding vehicle trips from those originating outside of the site development.

5. Traffic Forecasts

This section provides estimates of the number of vehicle trips that could potentially be generated by the proposed development given, a range of development scenarios. It will also outline the key assumptions applied in determining the site-generated trips and how these are distributed on the road network.

5.1 Site Trip Generation

The proposed residential development is planned to provide mainly single family residential properties with some smaller townhouses also available.

In order to determine the likely trip generation rate of the site both the MoTI rates and the ITE rates have been reviewed for comparison. The rates obtained from ITE assume 75% of trips are from single family properties, and 25% are from townhouses (representing the smaller Patio Homes and Carriage Homes). This distinction within residential properties was not available from the MoTI data and as a result all trips have been conservatively assigned a single family residential trip rate. **Table 5-1** sets out the MoTI generation rates for the proposed Riverwood Residential Development. It should be noted that MoTI do not provide a trip generation rate for the Saturday midday peak period.

Table 5-1: MoTI Trip Generation Rates for the Proposed Development

Land Use	Weekday Morning			Weekday Afternoon		
	In	Out	Total	In	Out	Total
Single Family residential	0.26	0.74	1.00	0.77	0.43	1.20

By comparison the ITE trip generation rates are outlined below in **Table 5-2**.

Table 5-2 ITE Trip Generation Rates for the Proposed Development

Land Use	Weekday Morning			Weekday Afternoon			Saturday Midday		
	In	Out	Total	In	Out	Total	In	Out	Total
Single Family Residential	0.19	0.56	0.75	0.64	0.37	1.01	0.49	0.44	0.93
Townhouse Residential (Patio Homes, Carriage Homes)	0.07	0.37	0.44	0.35	0.17	0.52	0.25	0.22	0.47

As shown in **Table 5-2**, the ITE rates for a single family residential property are lower than the MoTI rates, and as expected the ITE townhouse rate representing the Patio and Carriage Homes is lower again. In the analysis to follow both the MoTI and ITE rates have been applied and compared to determine the number of trips generated by the site. As expected the number of trips generated was much higher when the MoTI rate was applied.

5.2 Site Vehicle Trip Summary & Distribution

The number of trips generated by the development was estimated and is summarized by phase in the tables below. Once again the analysis has been carried out using both the MoTI rates and the ITE rates. These results are outlined in **Tables 5-3 and 5-4**.

Table 5-3: MoTI Trip Generation Levels for the Proposed Development

Phase	Total Number of properties	Weekday Morning			Weekday Afternoon		
		In	Out	Total	In	Out	Total
Phase 1 (2012)	60	16	44	60	46	26	72
Phase 2* (2022)	600	156	444	600	461	259	720

Table 5-4 ITE Trip Generation Levels for the Proposed Development

Phase	Total Number of Properties	Weekday Morning			Weekday Afternoon			Saturday Midday		
		In	Out	Total	In	Out	Total	In	Out	Total
Phase 1 (2012)	60	9	29	39	32	19	50	25	22	47
Phase 2* (2022)	600	90	293	384	321	148	506	247	218	466

*Phase 2 is the full development

The ITE trip generation results shown in **Table 5-4** have also been reduced by 5% to account for internal trips within the development due to the presence of the neighbourhood commercial shops and the surrounding parks, which would be attractive for some walking or cycling trips.

As **Tables 5-3 and 5-4** demonstrate, the proposed development will generate between of 720 and 506 trips (two-way) during the afternoon peak period and between 600 and 384 trips during the morning peak period.

Trip distribution of the residential development has been assigned according to two different scenarios. The first scenario assumes that all development traffic must enter and exit the site from the north, as would be the case if the private road to the south of the site is closed to public use. The second scenario assumes that 60% of traffic will enter and exit the site from the north and 40% from the south. This second scenario is in keeping with the existing traffic patterns in the area and assumes that the private road is used by residents to travel south of the site. **Tables 5-5 and 5-6** show the predicted traffic distribution patterns for the two scenarios during the peak periods.

Table 5-5: Predicted Traffic Distribution Pattern – 100% North

Street	Weekday Morning		Weekday Afternoon		Saturday Midday	
	In	Out	In	Out	In	Out
Piercy Road (east)	85%	85%	85%	85%	68%	68%
Highway 19 (north)	10%	13%	11%	12%	24%	30%
Highway 19 (south)	5%	2%	4%	3%	8%	2%
Comox Logging Road (east)	0%	0%	0%	0%	0%	0%
Marsden Road (south)	0%	0%	0%	0%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 5-6: Predicted Traffic Distribution Pattern – 60% North, 40% South

Street	Weekday Morning		Weekday Afternoon		Saturday Midday	
	In	Out	In	Out	In	Out
Piercy Road (east)	51%	51%	51%	51%	41%	41%
Highway 19 (north)	6%	8%	7%	7%	14%	18%
Highway 19 (south)	3%	1%	2%	2%	5%	1%
Comox Logging Road (east)	30%	30%	30%	30%	30%	30%
Marsden Road (south)	10%	10%	10%	10%	10%	10%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

5.3 Site Traffic Assignment

Flow diagrams of site traffic have been produced to cover each step of the analysis for the two trip generation scenarios and the two trip distribution patterns. These flow diagrams are included in **Appendix B**.

5.4 Traffic Forecast Scenarios

For the purposes of the transportation assessment, two background growth rate scenarios were considered. The first scenario assumes a background growth rate of 2% on Highway 19 and Piercy Road, and a 1% growth rate on all other roads. The second scenario assumes a background growth rate of 4% on Highway 19 and Piercy Road, and a 2% growth rate on all other roads. The first scenario reflects average historical growth on Highway 19 near Piercy, according to MoTI data, and the second scenario reflects peak directional growth in the same location.

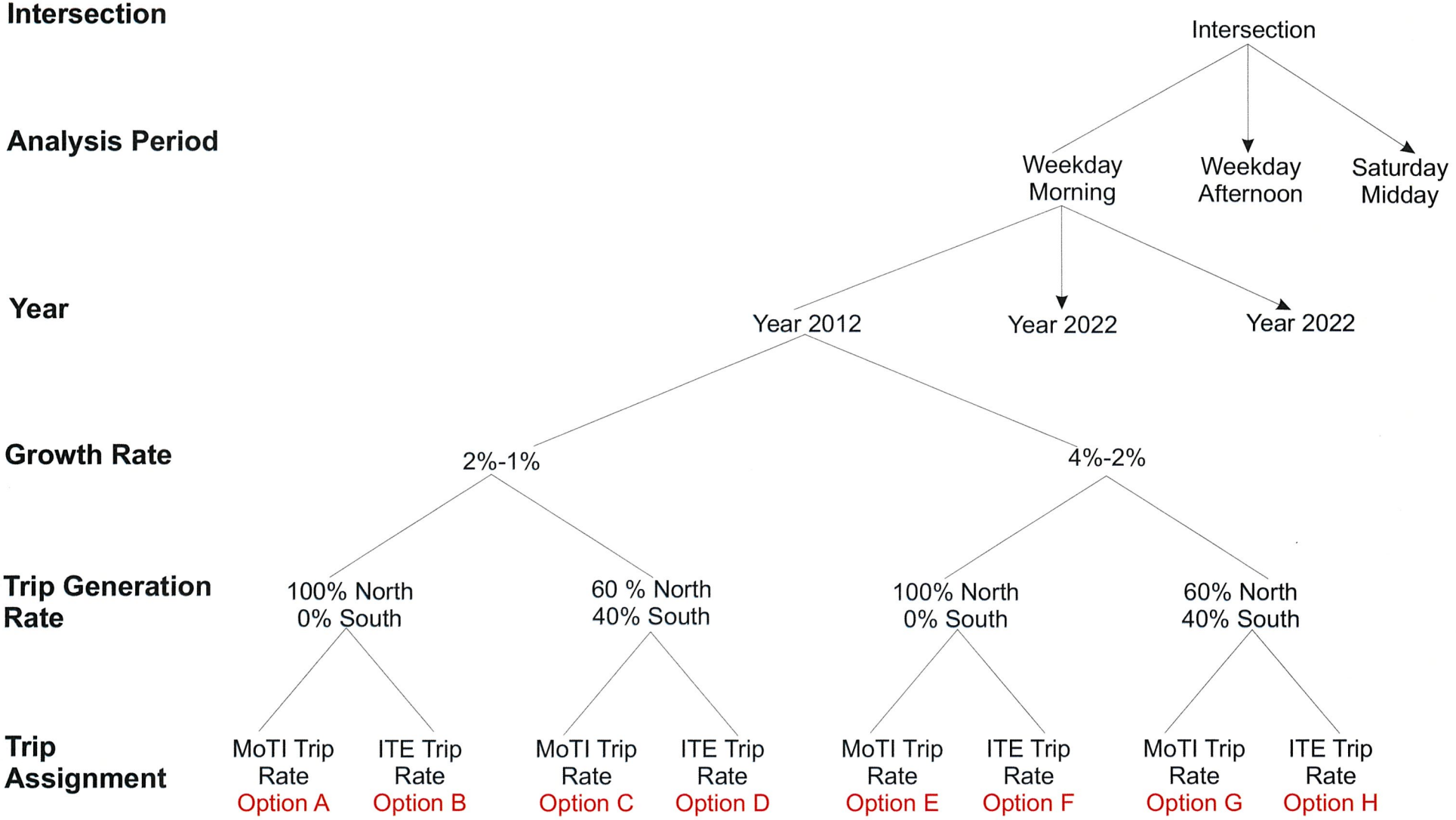
Each intersection in the study area has been assessed under the various scenarios and the resulting options are shown in **Exhibit 10**. These options have been analysed for each peak period, year and intersection and are summarised as follows:

Option A: this has a growth rate of 2% on Highway19 and Piercy Road and a growth rate of 1% on all other roads, 100% of traffic travel to and from the north and the MoTI trip generation rate has been used.

Option B: this has a growth rate of 2% on Highway 19 and Piercy Road and a growth rate of 1% on all other roads, 100% of traffic travel to and from the north and the ITE trip generation rate has been used.

Option C: this has a growth rate of 2% on Highway 19 and Piercy Road and a growth rate of 1% on all other roads, 60% of traffic travel north, 40% of traffic travel south and the MoTI trip generation rate has been used.

Option D: this has a growth rate of 2% on Highway 19 and Piercy Road and a growth rate of 1% on all other roads, 60% of traffic travel north, 40% of traffic travel south and the ITE trip generation rate has been used.



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TRANSPORTATION PLANNERS AND ENGINEERS

Analysis Forecast Options

Riverwood Residential Development, Courtenay

Exhibit
10

Option E: this has a growth rate of 4% on Highway 19 and Piercy Road and a growth rate of 2% on all other roads, 100% of traffic travel to and from the north and the MoTI trip generation rate has been used.

Option F: this has a growth rate of 4% on Highway 19 and Piercy Road and a growth rate of 2% on all other roads, 100% of traffic travel to and from the north and the ITE trip generation rate has been used.

Option G: this has a growth rate of 4% on Highway 19 and Piercy Road and a growth rate of 2% on all other roads, 60% of traffic travel north, 40% of traffic travel south and the MoTI trip generation rate has been used.

Option H: this has a growth rate of 4% on Highway 19 and Piercy Road and a growth rate of 2% on all other roads, 60% of traffic travel north, 40% of traffic travel south and the ITE trip generation rate has been used.

6. Traffic Operations with Site Developed

This section provides an assessment of the off-site impacts of the development traffic within the local road network and it draws upon the traffic surveys presented in Section 2, along with the trip generation and distribution figures outlined in Section 5.

This assessment considers the operation of the road network on Opening Day in 2012 (phase 1), Build-Out in 2022 (phase 2) and Build-Out plus 10 years in 2032 for both the three peak periods. A summary of the capacity analysis for the intersections in the study network is presented in tabular format.

The traffic operations at the study intersections were evaluated using Trafficware's Synchro 6.0 traffic analysis model. This model uses Highway Capacity Manual (HCM) procedures to assess the Volume to Capacity ratio (v/c) and the corresponding delay-based traffic Level of Service (LOS) at the each of the intersections on the study network. For the Level of Service indicator, the following summarize the range of delays (in seconds per vehicle) for signalized and unsignalized intersections:

- For signalized intersection, the Level of Service ranging from LOS 'A' conditions with minimal delay (< 10 sec per vehicle) through to LOS 'E' 'near capacity' conditions (> 55 sec to ≤ 80 sec per vehicle) and LOS 'F' 'over-saturated' conditions (> 80 sec per vehicle).
- For unsignalized intersection, the Level of Service ranging from LOS 'A' conditions with minimal delay (< 10 sec per vehicle) through to LOS 'E' 'near capacity' conditions (> 35 sec to ≤ 50 sec per vehicle) and LOS 'F' 'over-saturated' conditions (> 50 sec per vehicle).

For the purposes of this analysis, we have assumed that the following performance thresholds would trigger the need for off-site improvements to support the site development:

- V/C ratios greater than 0.85; and,
- LOS D or worse.

6.1 Intersection of Highway 19 and Piercy Road

The Volume to Capacity (v/c) ratio and the Level of Service (LOS) for the intersection of Highway 19 and Piercy Road has been reported in **Table 6-1** for the various scenarios. The signal timing of this intersection has been modelled with the existing signal timing and phasing information as provided by the MoTI.

Table 6-1: Highway 19 / Piercy Road Intersection Operations Summary

Year	Option	Morning Peak		Afternoon Peak		Saturday Peak	
		V/C	LOS	V/C	LOS	V/C	LOS
2012	A	0.24	A	0.25	A		
	B	0.24	A	0.25	A	0.47	A
	C	0.23	A	0.25	A		
	D	0.23	A	0.25	A	0.46	A
	E	0.25	A	0.26	A		
	F	0.24	A	0.26	A	0.48	A
	G	0.24	A	0.26	A		
	H	0.24	A	0.26	A	0.48	A
2022	A	0.38	A	0.34	A		
	B	0.34	A	0.32	A	0.57	A
	C	0.34	A	0.32	A		
	D	0.31	A	0.30	A	0.54	A
	E	0.40	A	0.37	A		
	F	0.37	A	0.36	A	0.62	A
	G	0.36	A	0.35	A		
	H	0.34	A	0.34	A	0.60	A
2032	A	0.40	A	0.36	A		
	B	0.36	A	0.35	A	0.61	A
	C	0.36	A	0.34	A		
	D	0.33	A	0.33	A	0.59	A
	E	0.45	A	0.50	A		
	F	0.42	A	0.47	A	0.76	A
	G	0.42	A	0.47	A		
	H	0.40	A	0.45	A	0.72	A

The intersection of Highway 19 and Piercy Road recorded a maximum volume to capacity ratio of 0.76 during the Saturday midday peak period. As shown the intersection maintains a level of service of A across all time periods and options. Option E is found to represent the worst case scenario at this intersection when the growth rate is 4%, all traffic enters and exit the site from the north and the MoTI trip generation rate is used. Even under this scenario the intersection operates well and as a result no capacity or traffic control improvements are required at this intersection to support the site development.

6.2 Intersection of Piercy Road and Forbidden Plateau Road

The Volume to Capacity (v/c) ratio and the Level of Service (LOS) for the critical movement at the intersection of Piercy Road and Forbidden Plateau Road has been reported in **Table 6-2** for the various scenarios.

Table 6-2: Piercy Road / Forbidden Plateau Road Operational Analysis Summary

Year	Option	Weekday Morning			Weekday Afternoon			Saturday Midday		
		Critical move-ment	v/c	LOS	Critical move-ment	v/c	LOS	Critical move-ment	v/c	LOS
2012	A	NBL	0.06	A	EBT	0.07	A			
	B	NBL	0.05	A	EBT	0.07	A	NBL	0.10	A
	C	NBL	0.05	A	EBT	0.07	A			
	D	NBL	0.04	A	EBT	0.07	A	NBL	0.10	A
	E	NBL	0.06	A	EBT	0.08	A			
	F	NBL	0.05	A	EBT	0.07	A	NBL	0.10	A
	G	NBL	0.05	A	EBT	0.07	A			
	H	NBL	0.04	A	EBT	0.07	A	NBL	0.10	A
2022	A	NBL	0.43	B	NBL	0.49	C			
	B	NBL	0.29	A	WBL	0.25	A	NBL	0.32	B
	C	NBL	0.27	B	WBL	0.22	A			
	D	NBL	0.19	A	WBL	0.16	A	NBL	0.17	B
	E	NBL	0.45	B	NBL	0.56	C			
	F	NBL	0.30	B	NBL	0.29	C	NBL	0.39	C
	G	NBL	0.28	B	WBL	0.23	A			
	H	NBL	0.19	A	WBL	0.18	A	NBL	0.21	B
2032	A	NBL	0.44	B	NBL	0.56	C			
	B	NBL	0.30	B	NBL	0.28	B	NBL	0.38	C
	C	NBL	0.28	B	WBL	0.23	A			
	D	NBL	0.19	A	WBL	0.17	A	NBL	0.20	B
	E	NBL	0.47	B	NBL	0.88	E			
	F	NBL	0.32	B	NBL	0.43	C	NBL	0.59	C
	G	NBL	0.30	B	NBL	0.34	B			
	H	NBL	0.21	A	NBL	0.22	B	NBL	0.31	B

The critical approach to this intersection is the north bound left turn movement on Forbidden Plateau Road, which is required to stop and yield to traffic on Piercy Road. This movement is expected to operate at LOS C or better under all scenarios and all horizon years, except for Scenario E in 2031. In this case, the northbound left turn is expected to operate with a weekday peak hour volume to capacity ratio of 0.88 and a level of service E in 2032, under Option E. This same movement had a 95th percentile queue length of 67m (around 10 vehicles) in this scenario. When the intersection is modelled with just the background traffic flow and with no development traffic it is found to operate with a LOS B on the worst approach (northbound left turn movement) and a volume to capacity ratio of 0.07. Therefore, it is concluded that the site development traffic is responsible for the significant increase in delay and decrease in capacity.

We have estimated that by 2024, the northbound left turn movement under Option E drops below the desired level of service threshold of LOS D in 2024 when the volume to capacity ratio is 0.63; therefore, it is also concluded that some kind of off-site improvement is required under Option E by the year 2024 to meet operational targets.

To improve the level of service at this intersection to meet the performance threshold targets, both a roundabout and traffic signals have been considered for implementation at this intersection. A TAC Signal Warrant Analysis was completed for this intersection and the results are attached as **Appendix C**. The analysis found that a traffic signal would not be warranted at the intersection of Forbidden Plateau Road and Piercy Road in 2032 under the worst case traffic forecast scenario of Option E.

The operation of the roundabout has also been reviewed and was analysed using Sidra Intersection software. The Volume to Capacity (v/c) ratio and the Level of Service (LOS) for the intersection in 2032 is shown in **Table 6-3**.

Table 6-3: Piercy Road / Forbidden Plateau Road Roundabout

Year	Option	Morning Peak		Afternoon Peak		Saturday Peak	
		V/C	LOS	V/C	LOS	V/C	LOS
2032	A	0.32	A	0.35	B		
	B	0.22	A	0.27	B	0.33	A
	C	0.20	A	0.24	B		
	D	0.14	A	0.20	A	0.27	A
	E	0.33	A	0.40	B		
	F	0.23	A	0.32	B	0.44	A
	G	0.28	A	0.29	B		
	H	0.15	A	0.24	A	0.38	A

As shown in **Table 6-3** the introduction of a roundabout at this intersection will reduce the volume to capacity ratio and improve the level of service from an E to a B (assuming one circulating lane and one approach lane on each leg). Queue lengths on the critical northbound left turn are also reduced from 67m to 14m.

Based on the above analysis, we would conclude that under Option E, a roundabout would be the preferred off-site improvement to support the site development and that this roundabout should be in place by 2024. However, we are also of the opinion that the Option E forecast assumptions are unrealistically conservative:

- a 4% annual growth rate per year, extended through 20 years, is a very high level of growth sustained for a considerable period of time. Historical growth of traffic in the area has, on average, been closer to 2%;
- The MoTI trip rates were developed from studies conducted many years ago and are unrealistically high compared to other sources. We have been advised by MoTI staff from the Lower Mainland District that the MoTI has actually abandoned use of these rates as they are considered too high;
- The MoTI rates do not reflect the significant portion of patio homes or carriage houses, which will be smaller than the single family homes and therefore are expected to generate less vehicle trips;
- The site trip generation calculations do not include the effect of the retail component on the site, nor the adjacent recreational facilities, which could both serve to reduce vehicle trip generation;
- The site trip distribution assumes 100% of all traffic originates to and from the north. This results in a high volume turning left from Forbidden Plateau Road to Piercy

Road; this forecast would be very unrealistic if the private road to the south of the site remains open.

For these reasons, it is our opinion that the site development will not require any off-site roadway capacity or traffic control improvements at this intersection to support the additional traffic generated by the site development.

Option D is the most realistic option and under this scenario westbound left turn (the worst approach) queues reach 1 vehicle. Therefore it is concluded that the existing intersection layout can accommodate this level of traffic. However, several improvements to the existing layout are recommended.

To improve the sight distance from Forbidden Plateau Road to the west it recommended that the trees planted along the fence line of the property at 3976 Forbidden Plateau Road be removed. It was also noted that the stop bar on the Forbidden Plateau Road approach is set back from the intersection and as a result vehicles move forward over the line to gain better sight distance. It is our opinion that the stop line not be moved to ensure that the turning path of westbound left turning heavy vehicles does not cross into the northbound approach lanes.

In addition, it is recommended that the pavement markings on the northbound approach and the westbound left turn bay be repainted as they have been worn away.

6.3 Intersection of Forbidden Plateau Road and Duncan Bay Main Road

The Volume to Capacity (v/c) ratio and the Level of Service (LOS) for the critical movement at the intersection of Forbidden Plateau Road and DBM Road has been reported in **Table 6-4** for the various scenarios. For the purposes of this summary, it is assumed that Duncan Bay Main Road runs north-south and Forbidden Plateau runs east-west.

Table 6-4: Forbidden Plateau Road / Duncan Bay Main Road Operational Analysis Summary

Year	Option	Weekday Morning			Weekday Afternoon			Saturday Midday		
		Critical move-ment	v/c	LOS	Critical move-ment	v/c	LOS	Critical move-ment	v/c	LOS
2012	A	NBL	0.08	A	SBL	0.02	B			
	B	NBL	0.07	A	SBL	0.02	B	SBL	0.07	B
	C	NBL	0.06	A	SBL	0.01	B			
	D	NBL	0.05	A	NBL	0.07	A	SBL	0.07	B
	E	NBL	0.08	A	SBL	0.02	B			
	F	NBL	0.07	A	SBL	0.02	B	SBL	0.08	B
	G	NBL	0.06	A	SBL	0.02	B			
	H	NBL	0.05	A	NBL	0.07	A	SBL	0.07	B
2022	A	NBL	0.50	B	SBL	0.11	E			
	B	NBL	0.34	B	SBL	0.06	C	SBL	0.20	C
	C	NBL	0.32	B	SBL	0.05	C			
	D	NBL	0.22	B	SBL	0.03	C	NBL	0.24	B
	E	NBL	0.51	B	SBL	0.14	E			
	F	NBL	0.35	B	SBL	0.07	D	SBL	0.24	C
	G	NBL	0.32	B	SBL	0.06	C			
	H	SBL	0.04	B	SBL	0.04	C	NBL	0.26	B
2032	A	NBL	0.51	B	SBL	0.14	E			
	B	NBL	0.35	B	SBL	0.07	C	SBL	0.23	C
	C	NBL	0.32	B	SBL	0.06	C			
	D	SBL	0.04	B	SBL	0.04	C	NBL	0.26	B
	E	NBL	0.23	B	SBL	0.19	F			
	F	NBL	0.36	B	SBL	0.09	D	SBL	0.31	C
	G	NBL	0.34	B	SBL	0.07	C			
	H	SBL	0.06	B	SBL	0.05	C	NBL	0.30	B

As shown in the table above the critical movement for this intersection is the southbound left turn movement during the weekday afternoon peak hour of traffic. There is no development traffic associated with this movement; that is, all of the southbound left turn traffic is background traffic that would be present regardless of whether the Riverwood project proceeded, or not. Therefore, it is concluded that the Riverwood project would not generate the need for any roadway or traffic control improvements to address this problem.

It is important to note that while the delays associated with this movement are relatively high for some forecast scenarios resulting in LOS D-F, the volume impacted is very low, at 5 vehicles per hour. This very low level of traffic demand would not, in our view, justify any kind of roadway capacity or traffic control improvement.

From the site visit undertaken in August it was noted that existing pavement markings at this intersection are significantly faded and repainting is recommended on all approaches, regardless of whether the site redevelops.

6.4 Intersection of Comox Logging Road and Marsden Road

The Volume to Capacity (v/c) ratio and the Level of Service (LOS) for the critical movement at the intersection of Comox Logging Road and Marsden Road has been reported in **Table 6-5** for the various scenarios.

Table 6-5: Comox Logging Road / Marsden Road

Year	Option	Weekday Morning			Weekday Afternoon			Saturday Midday		
		Critical move-ment	v/c	LOS	Critical movement	v/c	LOS	Critical move-ment	v/c	LOS
2012	A	SBL	0.04	A	SBL	0.05	A			
	B	SBL	0.04	A	SBL	0.05	A	SBL	0.04	A
	C	SBL	0.04	A	SBL	0.05	A			
	D	SBL	0.04	A	SBL	0.05	A	SBL	0.04	A
	E	SBL	0.04	A	SBL	0.05	A			
	F	SBL	0.04	A	SBL	0.05	A	SBL	0.05	A
	G	SBL	0.04	A	SBL	0.05	A			
	H	SBL	0.04	A	SBL	0.05	A	SBL	0.05	A
2022	A	SBL	0.05	A	SBL	0.05	A			
	B	SBL	0.05	A	SBL	0.05	A	SBL	0.05	A
	C	SBL	0.06	B	NBL	0.12	B			
	D	SBL	0.06	B	NBL	0.08	B	NBL	0.07	B
	E	SBL	0.05	A	SBL	0.06	B			
	F	SBL	0.05	A	SBL	0.06	B	SBL	0.06	A
	G	SBL	0.07	B	NBL	0.13	B			
	H	SBL	0.06	B	NBL	0.09	B	SBL	0.07	B
2032	A	SBL	0.05	A	SBL	0.06	A			
	B	SBL	0.05	A	SBL	0.06	A	SBL	0.05	A
	C	SBL	0.07	B	NBL	0.12	B			
	D	SBL	0.06	B	NBL	0.09	B	SBL	0.07	B
	E	SBL	0.07	A	SBL	0.08	B			
	F	SBL	0.07	A	SBL	0.08	B	SBL	0.07	A
	G	SBL	0.09	B	NBL	0.14	B			
	H	SBL	0.08	B	SBL	0.11	B	SBL	0.09	B

The intersection of Comox Logging Road and Marsden Road will continue to operate with a low volume to capacity ratio with the additional traffic from the development. The critical northbound left turn movement was found to have a maximum 95th percentile queue length

of 3.8m (less than one vehicle) in the weekday afternoon peak period, for 2032 Option G, which can easily be accommodated on this approach.

6.5 Summary of Traffic Impact

If the private road to the south of the site remains open, then no off-site roadway capacity or traffic control improvements on public roads will be required to support the site redevelopment, although sight distance (tree removal) and pavement marking improvements are recommended at Piercy Road & Forbidden Plateau Road, and pavement marking improvements are recommended at Forbidden Plateau Road and DBM Road. If site traffic is permitted to use the private portion of DBM Road to the south, then some positive guidance to drivers through the private gravel works yard is recommended for safety reasons; this could include paving a road surface, signage and pavement markings.

If the private road to the south of the site is closed to the public, in all forecast scenarios but one, no off-site improvements other than those noted above at Piercy Road & Forbidden Plateau Road and at Forbidden Plateau Road and DBM Road will be necessary. Only if traffic grows on Piercy Road at about 4% per year and the site generates over 720 vehicles per hour during the weekday PM Peak Hour will there be a need to address northbound left turn delays at Piercy Road & Forbidden Plateau Road by about 2024. Traffic signals will not be warranted, but a roundabout may be an effective solution to traffic operations and reduce delays.

However, it is our opinion that the latter scenario is highly unlikely: 4% growth for 20 years is extremely high, MoTI trip rates are considered inappropriately high for this site and the trip generation estimates do not reflect the mixed use nature of the site and adjacent recreational opportunities which would generate more walking trips. In our opinion, the most likely forecast scenario is one with 2% growth for 20 years, with ITE trip rates and with the private road remaining open. In our view, the likelihood of the private road being closed is not high, given its significant level of use by the community.

7. Sustainable Transportation Measures

The Comox Valley Sustainability Strategy (CVSS) provides a series of goals that are addressed with objectives, targets and actions. With respect to transportation, these goals are primarily focused on reducing the reliance upon private vehicles with the draft goals outlined below:

- Reduce the need for single occupant vehicles;
- Promote high-efficiency, low emission and no-emission vehicles and alternative fuels;
- Implement transportation programs that increase walking, cycling and transit use.

To support site planning, Bunt & Associates has researched sustainable transportation measures that could be applicable to this site. The measures identified herein are based on best practices from other developments in British Columbia and across North America (some of which originated in Europe). The measures selected are specifically intended to maximize the sustainable elements of the Riverwood neighbourhood based on its scale, mix, and location. They have three primary objectives:

- Minimize automobile use (number and length of trips)
- Optimize transportation choice
- Reduce vehicle ownership

Strategy 1: Encourage Walking

Walking trips can be encouraged through a number of design aspects of the development, including:

- Centrally located services (convenience shopping, daycare, etc.) to reduce the need to travel out of the neighbourhood;
- Walkable access to a variety of transportation or community services;
- Traffic calmed streets with achieve 20-30 km/h operating speeds;
- An extensive, inviting, and safe network of sidewalks and trails within the neighbourhood and connecting to destinations outside of the neighbourhood with good lighting, signage and way finding maps; and
- Pedestrian-permeable and/or small development blocks.

Approximately half of the development land is dedicated as park land to ensure continued public access to the Puntledge River and Browns River Trail systems and other natural amenities of the area.

Strategy 2: Encourage Cycling

Cycling trips for transportation (not recreational) purposes can be encouraged through a number of design aspects of the development by incorporating the following features:

- New cycling facilities (on-street bike lanes, multi-use paved pathways within the street right-of-way, or off-street paved multi-use pathways to/from key travel destinations);
- Convenient connections to the existing and planned future cycling network;
- Way-finding and signage;
- Short term (bike racks) and long term (bike rooms, bike cages) parking located near neighbourhood services and transit hubs, and within multi-family developments;
- A charging station for electric bikes and scooters located near neighbourhood services.

Besides site design elements, developers can also support cycling through a "free bike" program with the sale of every home or provide seed money for a community bike share program.

The Comox Valley Cycling Task Force is working to develop a comprehensive cycling strategy. Its goal is to improve cycling access in the Comox Valley, both recreationally and for commuting, and to improve safe travel for all members of the public and safe access to regional bikeways. The Task Force focuses on education, recreation, and transportation. The developer could work with the Task Force, along with the Regional District, to identify and fund key cycling projects which would benefit cycling in the study area as a whole.

Strategy 3: Provide Transit to Key Destinations

Currently, there is no transit service to the proposed development area and we understand that discussions with BC Transit staff indicate that such service is unlikely given the development's lack of proximity to existing urban services and relative small population. However, the developer could provide a community shuttle van and operating funds for a private transit service to take residents into downtown Courtenay and Comox for work, shopping and personal business trips. This could be an on-demand or regularly scheduled service, originating out of the central area, which could become a transportation hub focussed around community services.

If community demand for transit use increases and ultimately could justify the investment in public transit services, a program could be implemented similar to that for residents in the Cape Lazo/Point Holmes area and the Huband Road/Seal Bay area, who have Community Bus service. This service is available three times a day, Monday to Friday. Passengers are bussed to key exchange points where they can then transfer to and from regular Comox Valley Transit trips.

Strategy 4: Encourage Car Pooling

A carpool consists of two or more people sharing a ride in a vehicle to travel to a common destination. Ride sharing may involve one person who does all the driving, with riders volunteering to pay for a share of fuel and operating costs. Drivers can also rotate with any kind of mutually acceptable cost sharing agreement.

At Riverwood, the developer could include a community amenity space in the central transportation hub that includes a "Ride Share Board" and/or internet access that would allow residents to match to other residents when making regular trips.

Strategy 5: Encourage Car Sharing

Car-sharing in BC and Canada is growing exponentially as more and more people become aware of the benefits it brings. In particular, it provides a low cost and flexible alternative to private vehicle ownership, while developers benefit by being able to reduce parking requirements and therefore achieving cost savings (for example, in the Lower Mainland the cities of Vancouver and Burnaby now allow reductions in parking supply if car-share stalls, and agreements with car-share providers are provided by developers).

Typically, 1 car-share vehicle can support somewhere between 150 and 200 units if at least one person per unit is a member of the car-share program. Vehicles are purchased by the developer ($25,000 to $35,000 depending on the model) and maintained by the car-share operator (Cooperative Auto Network, Car Share Co-op, Zip Car; all operating in BC). Members must pay a fee to join (typically, about $500 which is refundable if a member leaves the program) and then must pay for use of the vehicle by the hour or day. Members pre-book vehicles over the phone or through the internet. Best practice suggests that vehicles should be located in publically accessible and visible locations and preferably be located close to the community facilities.

In the case of Riverwood, the neighbourhood could potentially support two car-share vehicles, which should be centrally located in the development. However, as the

neighbourhood is primarily single family and patio/carriage homes, it is unlikely a parking supply reduction could be justified for these individual properties as they do not share parking supply. It is recommended that the developer contact the three car share operators and determine whether Riverwood would meet their criteria for provision of car share vehicles; it may be that the development is too small or not sufficiently dense to be a good candidate.

Strategy 6: Discourage Excessive Parking Supply

Excessive parking provision can undermine sustainability provisions and negatively impact walkable and cycling-friendly urban design. In single family development without lanes, providing one garage space per unit plus space for one additional vehicle in the driveway should be sufficient, with on-street parking supporting any resident or visitor vehicle overflow. Also, providing on-street parking on only one side of the street is usually more than sufficient for single family neighbourhoods. For single family homes with rear lanes there is more on-street supply available as there are no driveways present, so again, one-car garages should be sufficient. This approach encourages on-street parking which has been proved to reduce vehicle speeds, thereby creating a more pedestrian and cycle friendly neighbourhood.

For "pod" townhouse development with minimal street frontage that could be used for on-street parking, a maximum of 1.2 stalls per unit on-site should be provided. On-site visitor parking should be pooled rather than spread over the development site and should be a maximum of 10% of the total number of townhouse units. For street-oriented townhouse development, rear lanes with one car garages should be used and on-street parking should be provided on both sides of the street to support both resident overflow and visitor parking.

Strategy 7: Eliminate Trips

The impetus behind electronic or e-transport is to eliminate the need to make particular trips altogether, in particular shopping, education, and commuter trips. From a development perspective, high-speed internet should form a key requirement for the development and it should be something delivered to each unit at time of purchase. Those who can work from home should be encouraged to do so. The developer could also establish a neighbourhood work centre equipped with video and phone conferencing facilities.

8. Conclusions & Recommendations

The following key points summarise the findings of the Traffic Assessment for the proposed Riverwood Residential Development in Courtenay:

1. Existing traffic volumes in the study area are relatively low, except on Highway 19.

2. Existing traffic operations in the study area are good, at LOS B or better, with no queuing problems.

3. Existing pavement markings at Piercy Road & Forbidden Plateau Road are faded.

4. There is an existing sight distance obstruction for northbound drivers at Piercy Road & Forbidden Plateau Road; it appears an adjacent home owner has planted trees which block drivers' views to eastbound traffic approaching the intersection. Drivers are forced to cross the northbound stop bar in order to see oncoming traffic.

5. The first phase of development, planned to be completed by 2012, will be 60 homes and is expected to generate 39 to 60 vph in the Weekday AM Peak Hour; 50 to 72 vph in the Weekday PM Peak Hour and 47 vph in the Saturday Mid-day Peak Hour. In our view, the lower end of the range of trip generation is more likely, as the MoTI trip rates are considered too conservative for this development..

6. By build-out in 2022, the additional 540 homes and neighbourhood retail is expected to generate, in total, 384 to 600 vph in the Weekday AM Peak Hour, 506 to 720 vph in the Weekday PM Peak Hour and 466 vph in the Saturday Mid-Day Peak Hour. Again, the lower end of the range of trip generation is considered to be more likely for this development.

7. If the private road to the south of the site remains open, then no off-site roadway capacity or traffic control improvements on public roads will be required to support the site redevelopment, although sight distance (removal of trees) and pavement marking improvements are recommended at Piercy Road & Forbidden Plateau Road, and pavement marking improvements are recommended at Forbidden Plateau Road and DBM Road. If site traffic is permitted to use the private portion of DBM Road to the south, then some positive guidance to drivers through the private gravel works yard is recommended for safety reasons; this could include paving a road surface, signage and pavement markings.

Appendix A – MoT Turning Movement Summary Sheets

VEHICLE TURNING MOVEMENT SURVEY
Ministry of Transportation & Highways
South Coast Region

Major Route: HW 19
Minor Route: Piercy Road
Municipality: Comox Valley Regional District
Filename: MoT - HW19 & Piercy Site Code: 00000

Date: Sept 18, 2009
Day-of-week: Friday

Speed Limit Major Rte: 90
Speed Limit Minor Rte: 70

East/West Route: Piercy Road
Intersection Type: 5 ---> 3-leg east approach
Signalized (y/n?): Yes
Weather: dry and sunny

	Lanes								Bus Stop		Bus
	TLR	R	(ch)	TR	T	TL	L	Grade	Near	Far	Bay
North Approach					2		1				
South Approach		1			2						
West Approach		1					1				
East Approach											

note: (ch) - channelized A: parallel lane B: taper

	Start	Duration
A.M. Shift	07:30	3.25
Noon Shift	11:00	2.00
P.M. Shift	15:00	3.00
	Total	8.25

Note: duration: decimal hours
start time: 24 hr clock (15 min increments)

Comments: _____

Notes: North Approach - vehicles approaching intersection from the north
15x4 - 15 min volume (from max 15 minute period [+] in peak hour period [*]) x 4
Pedestrians - N indicates pedestrians crossing north approach (east/west)

urvey Data

Location: HW 19 @ Piercy Road
Date: Sept 18, 2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0				
:45	4	37	0	0	31	3	0	0	0	4	0	7	86				
:00	8	28	0	0	36	1	0	0	0	2	0	10	85				
08:15	2	42	0	0	30	6	0	0	0	0	0	6	86				
:30	5	25	0	0	29	2	0	0	0	3	0	8	72				
:45	10	37	0	0	26	1	0	0	0	2	0	13	89				
09:00	5	33	0	0	43	3	0	0	0	3	0	16	103				
09:15	3	43	0	0	33	3	0	0	0	3	0	3	88				
:30	9	34	0	0	33	4	0	0	0	3	0	4	87 *				
:45	8	42	0	0	31	3	0	0	0	2	0	10	96 +				
10:00	8	49	0	0	27	0	0	0	0	3	0	9	96 +				
:15	10	41	0	0	31	1	0	0	0	3	0	10	96 +				
Total	72	411	0	0	350	27	0	0	0	28	0	96	984	0	0	0	0
Pk Hr	35	166	0	0	122	8	0	0	0	11	0	33	375 *	0	0	0	0
x4	40	164	0	0	124	4	0	0	0	12	0	40	384 +	0	0	0	0
11:00													0				
:15													0				
:30													0				
11:45													0				
:00													0 +				
:15													0 +				
:30													0 +				
12:45													0 +				
tal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pk Hr	0	0	0	0	0	0	0	0	0	0	0	0	0 *	0	0	0	0
x4	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
15:00	20	55	0	0	37	3	0	0	0	5	0	3	123				
15:15	13	46	0	0	40	2	0	0	0	0	0	10	111				
:30	21	63	0	0	59	4	0	0	0	12	0	9	168				
:45	18	67	0	0	50	1	0	0	0	1	0	10	147				
16:00	20	63	0	0	53	6	0	0	0	1	0	9	152				
:15	22	50	0	0	71	11	0	0	0	4	0	11	169 +				
:30	17	44	0	0	71	5	0	0	0	8	0	19	164 *				
16:45	20	54	0	0	61	11	0	0	0	0	0	14	160 *				
17:00	26	66	0	0	55	4	0	0	0	2	0	12	165 *				
:15	12	57	0	0	43	6	0	0	0	1	0	11	130				
:30	21	44	0	0	56	8	0	0	0	1	0	8	138				
17:45	18	38	0	0	54	3	0	0	0	2	0	7	122				
tal	228	647	0	0	650	64	0	0	0	37	0	123	1749	0	0	0	0
Pk Hr	85	214	0	0	258	31	0	0	0	14	0	56	658 *	0	0	0	0
x4	88	200	0	0	284	44	0	0	0	16	0	44	676 +	0	0	0	0

AM Peak Period

Location: HW 19 @ Piercy Road
Date: Sept 18, 2009

Time	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:45	4	37	0	0	31	3	0	0	0	4	0	7	86	0	0	0	0
08:00	8	28	0	0	36	1	0	0	0	2	0	10	85	0	0	0	0
:15	2	42	0	0	30	6	0	0	0	0	0	6	86	0	0	0	0
:30	5	25	0	0	29	2	0	0	0	3	0	8	72	0	0	0	0
08:45	10	37	0	0	26	1	0	0	0	2	0	13	89	0	0	0	0
09:00	5	33	0	0	43	3	0	0	0	3	0	16	103	0	0	0	0
:15	3	43	0	0	33	3	0	0	0	3	0	3	88	0	0	0	0
:30	9	34	0	0	33	4	0	0	0	3	0	4	87 *	0	0	0	0
09:45	8	42	0	0	31	3	0	0	0	2	0	10	96 +	0	0	0	0
:00	8	49	0	0	27	0	0	0	0	3	0	9	96 +	0	0	0	0
:15	10	41	0	0	31	1	0	0	0	3	0	10	96 +	0	0	0	0
tal	72	411	0	0	350	27	0	0	0	28	0	96	984	0	0	0	0
k Hr	35	166	0	0	122	8	0	0	0	11	0	33	375 *	0	0	0	0
15x4	40	164	0	0	124	4	0	0	0	12	0	40	384 +	0	0	0	0
g Hr	22	126	0	0	108	8	0	0	0	9	0	30	303	0	0	0	0

Peak Hour	09:30
Peak 15min	10:15
North approach PHF	0.99
South approach PHF	1.02
West approach PHF	n/a
East approach PHF	0.85

N
^
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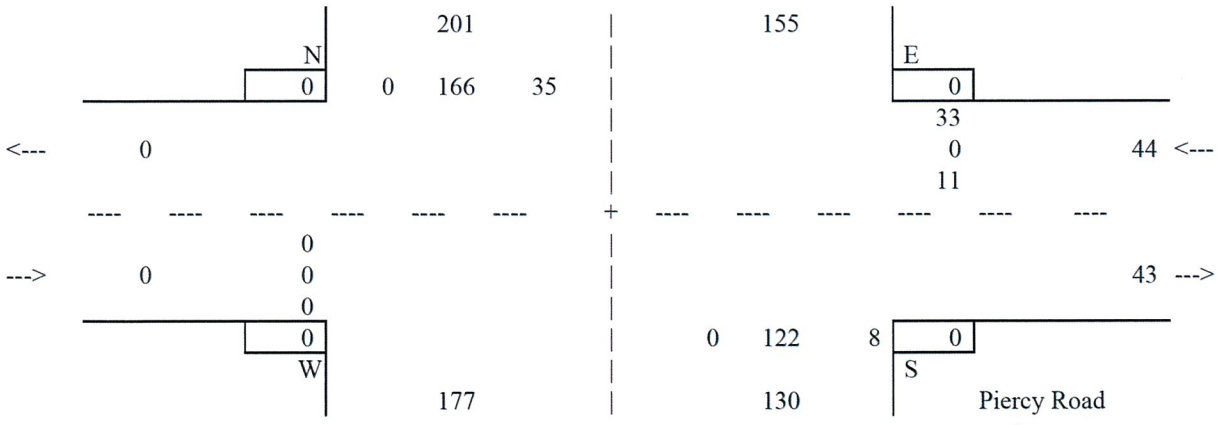
AM Peak Hour Volumes



M Peak Period

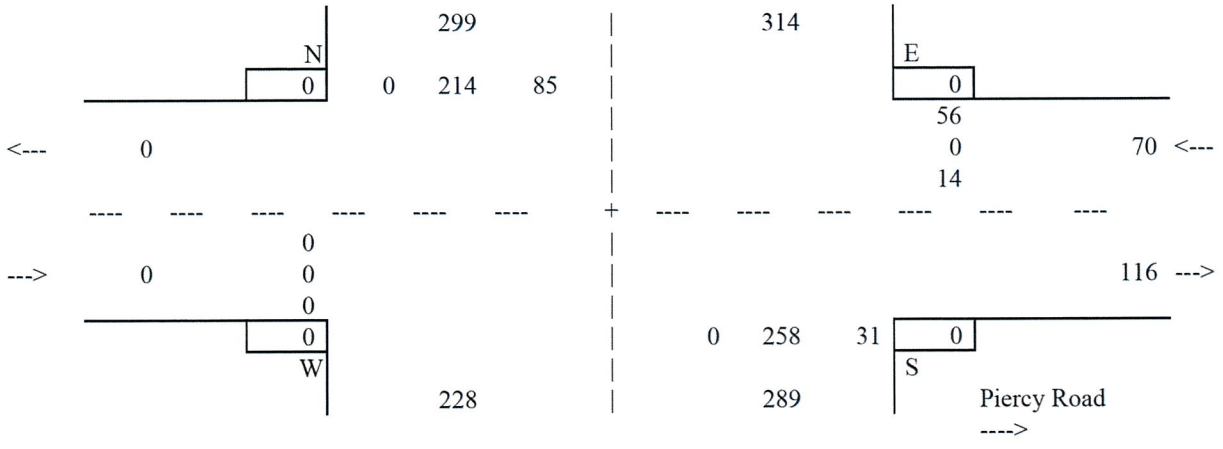
Location: HW 19 @ Piercy Road
Date: Sept 18, 2009

Time Period	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total Volume	Pedestrians			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		N	S	W	E
15:00	20	55	0	0	37	3	0	0	0	5	0	3	123	0	0	0	0
:15	13	46	0	0	40	2	0	0	0	0	0	10	111	0	0	0	0
:30	21	63	0	0	59	4	0	0	0	12	0	9	168	0	0	0	0
15:45	18	67	0	0	50	1	0	0	0	1	0	10	147	0	0	0	0
:00	20	63	0	0	53	6	0	0	0	1	0	9	152	0	0	0	0
:15	22	50	0	0	71	11	0	0	0	4	0	11	169 +	0	0	0	0
16:30	17	44	0	0	71	5	0	0	0	8	0	19	164 *	0	0	0	0
16:45	20	54	0	0	61	11	0	0	0	0	0	14	160 *	0	0	0	0
:00	26	66	0	0	55	4	0	0	0	2	0	12	165 *	0	0	0	0
:15	12	57	0	0	43	6	0	0	0	1	0	11	130	0	0	0	0
17:30	21	44	0	0	56	8	0	0	0	1	0	8	138	0	0	0	0
:45	18	38	0	0	54	3	0	0	0	2	0	7	122	0	0	0	0
Total	228	647	0	0	650	64	0	0	0	37	0	123	1749	0	0	0	0
Pk Hr	85	214	0	0	258	31	0	0	0	14	0	56	658 *	0	0	0	0
x4	88	200	0	0	284	44	0	0	0	16	0	44	676 +	0	0	0	0
Avg Hr	76	216	0	0	217	21	0	0	0	12	0	41	583	0	0	0	0

Peak Hour	16:15
Peak 15min	16:15
North Leg PHF	1.04
South Leg PHF	0.88
West Leg PHF	n/a
East Leg PHF	1.17

N
^
,

PM Peak Hour Volumes



VEHICLE TURNING MOVEMENT SURVEY
Ministry of Transportation & Highways
South Coast Region

Major Route: Piercy Road
Minor Route: Forbidden Plateau Road
Municipality: Comox valley Regional District
Filename: MoT Intersection Count templ Site Code: 00000

Date: September 18,2009
Day-of-week: Friday

Speed Limit Major Rte: 70 km/hr
Speed Limit Minor Rte: 60

East/West Route: Piercy Road
Intersection Type: 3 ---> 3-leg south approach
Signalized (y/n?): No
Weather: Dry and Sunny

	Lanes								Bus Stop		Bus
	TLR	R	(ch)	TR	T	TL	L	Grade	Near	Far	Bay
North Approach											
South Approach	0	1	0	0	0	0	1				
West Approach	0	0	0	1	0	0	0				
East Approach	0	0	0	0	1	0	1				

note: (ch) - channelized A: parallel lane B: taper

	Start	Duration
A.M. Shift	07:30	3.00
Noon Shift	11:00	2.00
P.M. Shift	15:00	3.00
	Total	8.00

Note: duration: decimal hours
start time: 24 hr clock (15 min increments)

Comments: _____

Notes: North Approach - vehicles approaching intersection from the north
15x4 - 15 min volume (from max 15 minute period [+] in peak hour period [*]) x 4
Pedestrians - N indicates pedestrians crossing north approach (east/west)

urvey Data

Location: Piercy Road @ Forbidden Plateau Road
Date: September 18,2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:45	0	0	0	6	0	7	0	4	2	8	11	0	38	0	0	0	0
:00	0	0	0	1	0	7	0	7	1	1	8	0	25	0	0	0	0
08:15	0	0	0	1	0	7	0	8	2	0	5	0	23	0	0	0	0
:30	0	0	0	0	0	2	0	4	0	4	9	0	19	0	0	0	0
:45	0	0	0	2	0	7	0	6	2	6	13	0	36 *	0	0	0	0
09:00	0	0	0	1	0	6	0	10	4	1	17	0	39 +	0	0	0	0
09:15	0	0	0	2	0	1	0	2	3	4	5	0	17 *	0	0	0	0
:30	0	0	0	4	0	3	0	8	3	5	3	0	26 *	0	0	0	0
:45	0	0	0	3	0	8	0	7	1	7	8	0	34	0	0	0	0
10:00	0	0	0	1	0	7	0	9	0	4	13	0	34	0	0	0	0
:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	21	0	55	0	65	18	40	92	0	291	0	0	0	0
Pk Hr	0	0	0	9	0	17	0	26	12	16	38	0	118 *	0	0	0	0
x4	0	0	0	4	0	24	0	40	16	4	68	0	156 +	0	0	0	0
11:00													0				
:15													0				
:30													0				
11:45													0				
:00													0 +				
:15													0 +				
:30													0 +				
12:45													0 +				
tal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pk Hr	0	0	0	0	0	0	0	0	0	0	0	0	0 *	0	0	0	0
x4	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
15:00	0	0	0	1	0	12	0	19	1	3	10	0	46	0	0	0	0
15:15	0	0	0	3	0	6	0	12	5	8	7	0	41	0	0	0	0
:30	0	0	0	4	0	15	0	16	5	8	17	0	65	0	0	0	0
:45	0	0	0	3	0	5	0	13	6	2	11	0	40	0	0	0	0
16:00	0	0	0	3	0	3	0	16	8	8	5	0	43	0	0	0	0
:15	0	0	0	3	0	4	0	19	6	7	10	0	49	0	0	0	0
:30	0	0	0	8	0	1	0	20	7	10	3	0	49 *	0	0	0	0
16:45	0	0	0	4	0	5	0	17	7	12	17	0	62 +	0	0	0	0
17:00	0	0	0	5	0	3	0	15	8	4	7	0	42 *	0	0	0	0
:15	0	0	0	1	0	8	0	15	8	8	12	0	52 *	0	0	0	0
:30	0	0	0	3	0	8	0	16	5	5	9	0	46	0	0	0	0
17:45	0	0	0	4	0	5	0	19	3	9	7	0	47	0	0	0	0
tal	0	0	0	42	0	75	0	197	69	84	115	0	582	0	0	0	0
Pk Hr	0	0	0	18	0	17	0	67	30	34	39	0	205 *	0	0	0	0
x4	0	0	0	16	0	20	0	68	28	48	68	0	248 +	0	0	0	0

AM Peak Period

Location: Piercy Road @ Forbidden Plateau Road
Date: September 18,2009

Time	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:45	0	0	0	6	0	7	0	4	2	8	11	0	38	0	0	0	0
08:00	0	0	0	1	0	7	0	7	1	1	8	0	25	0	0	0	0
:15	0	0	0	1	0	7	0	8	2	0	5	0	23	0	0	0	0
:30	0	0	0	0	0	2	0	4	0	4	9	0	19	0	0	0	0
08:45	0	0	0	2	0	7	0	6	2	6	13	0	36 *	0	0	0	0
09:00	0	0	0	1	0	6	0	10	4	1	17	0	39 +	0	0	0	0
:15	0	0	0	2	0	1	0	2	3	4	5	0	17 *	0	0	0	0
:30	0	0	0	4	0	3	0	8	3	5	3	0	26 *	0	0	0	0
09:45	0	0	0	3	0	8	0	7	1	7	8	0	34	0	0	0	0
:00	0	0	0	1	0	7	0	9	0	4	13	0	34	0	0	0	0
:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
tal	0	0	0	21	0	55	0	65	18	40	92	0	291	0	0	0	0
k Hr	0	0	0	9	0	17	0	26	12	16	38	0	118 *	0	0	0	0
15x4	0	0	0	4	0	24	0	40	16	4	68	0	156 +	0	0	0	0
g Hr	0	0	0	7	0	18	0	22	6	13	31	0	97	0	0	0	0

Peak Hour	08:45
Peak 15min	09:00
North approach PHF	n/a
South approach PHF	0.93
West approach PHF	0.68
East approach PHF	0.75

N
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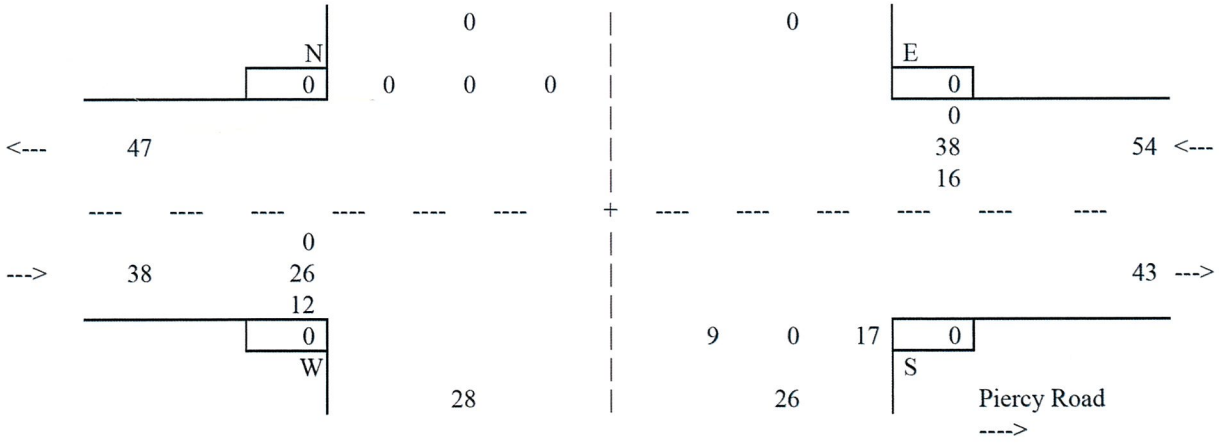
AM Peak Hour Volumes



oon Peak Period

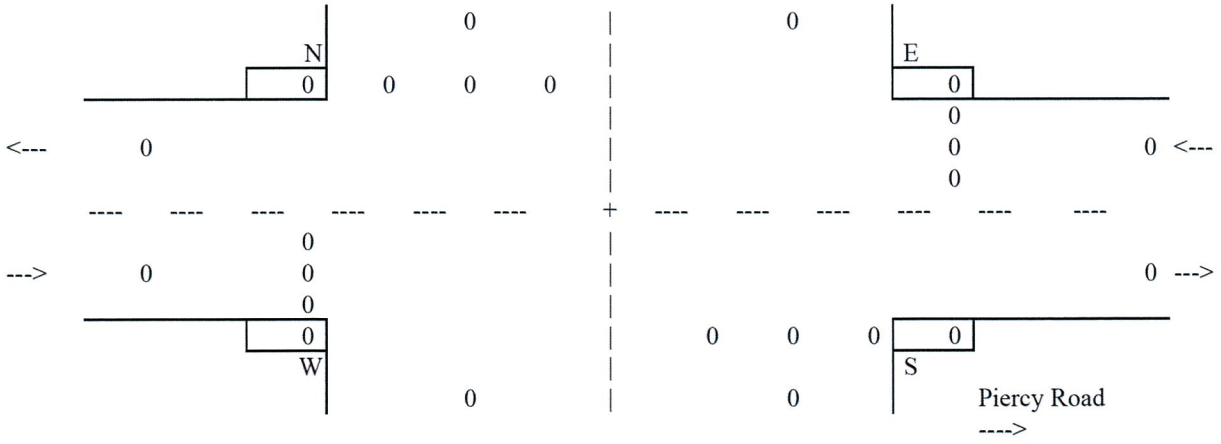
Location: Piercy Road @ Forbidden Plateau Road
Date: September 18,2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:00	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
:15	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
otal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hr	0	0	0	0	0	0	0	0	0	0	0	0	0 *	0	0	0	0
;x4	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
Avg Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour	12:00
Peak 15min	12:45
North Leg PHF	n/a
South Leg PHF	#DIV/0!
West Leg PHF	#DIV/0!
East Leg PHF	#DIV/0!

N
^
,

Noon Peak Hour Volumes



M Peak Period

Location: Piercy Road @ Forbidden Plateau Road
Date: September 18,2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
15:00	0	0	0	1	0	12	0	19	1	3	10	0	46	0	0	0	0
:15	0	0	0	3	0	6	0	12	5	8	7	0	41	0	0	0	0
:30	0	0	0	4	0	15	0	16	5	8	17	0	65	0	0	0	0
15:45	0	0	0	3	0	5	0	13	6	2	11	0	40	0	0	0	0
:00	0	0	0	3	0	3	0	16	8	8	5	0	43	0	0	0	0
:15	0	0	0	3	0	4	0	19	6	7	10	0	49	0	0	0	0
16:30	0	0	0	8	0	1	0	20	7	10	3	0	49 *	0	0	0	0
16:45	0	0	0	4	0	5	0	17	7	12	17	0	62 +	0	0	0	0
:00	0	0	0	5	0	3	0	15	8	4	7	0	42 *	0	0	0	0
:15	0	0	0	1	0	8	0	15	8	8	12	0	52 *	0	0	0	0
17:30	0	0	0	3	0	8	0	16	5	5	9	0	46	0	0	0	0
:45	0	0	0	4	0	5	0	19	3	9	7	0	47	0	0	0	0
Total	0	0	0	42	0	75	0	197	69	84	115	0	582	0	0	0	0
Pk Hr	0	0	0	18	0	17	0	67	30	34	39	0	205 *	0	0	0	0
x4	0	0	0	16	0	20	0	68	28	48	68	0	248 +	0	0	0	0
Avg Hr	0	0	0	14	0	25	0	66	23	28	38	0	194	0	0	0	0

Peak Hour	16:30
Peak 15min	16:45
North Leg PHF	n/a
South Leg PHF	0.97
West Leg PHF	1.01
East Leg PHF	0.63

N
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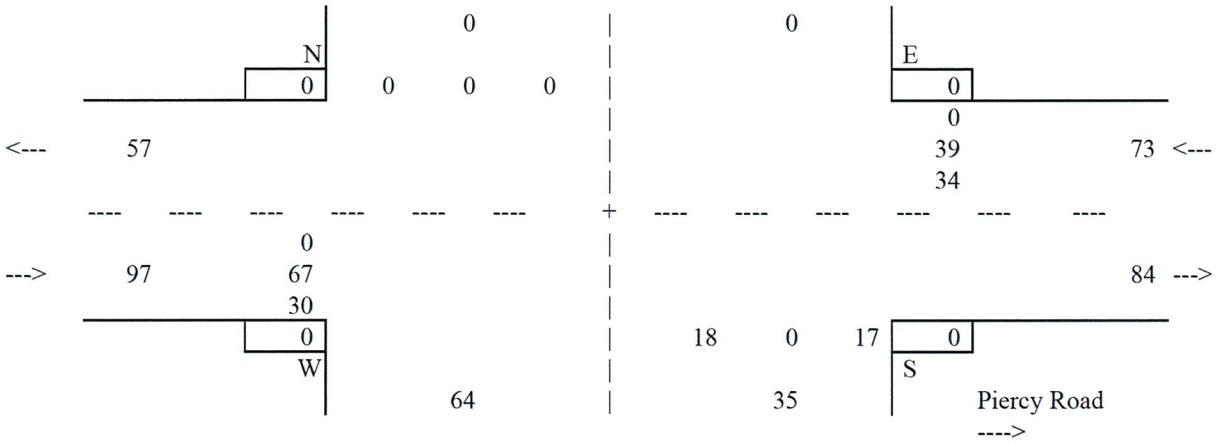
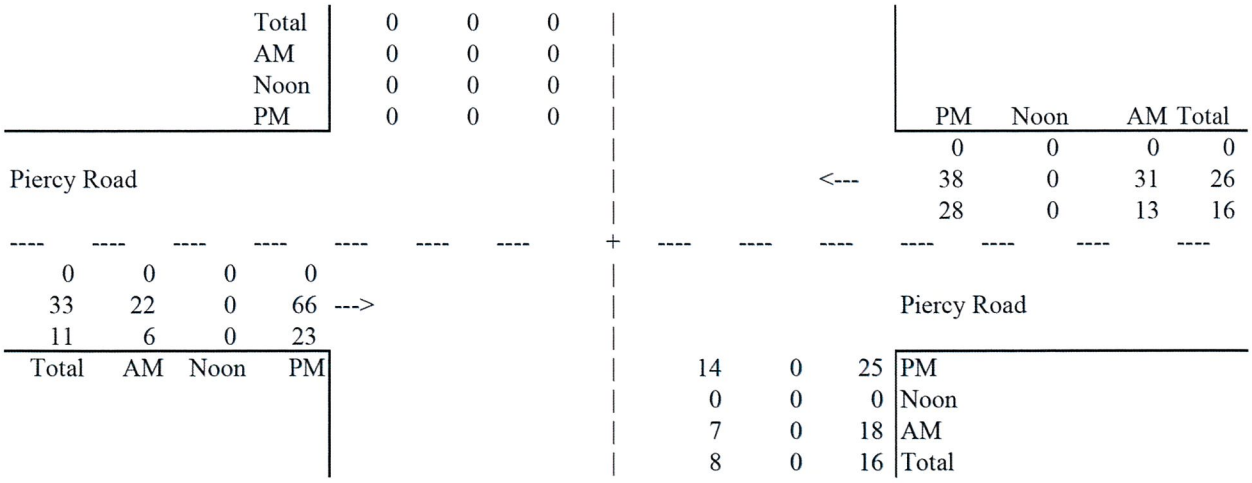
PM Peak Hour Volumes



verage Hour Period Location: Piercy Road @ Forbidden Plateau Road
September 18,2009

	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
urvey																	
Total	0	0	0	63	0	130	0	262	87	124	207	0	873	0	0	0	0
ours	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
vg Hr	0	0	0	8	0	16	0	33	11	16	26	0	109	0	0	0	0
M Period																	
Total	0	0	0	21	0	55	0	65	18	40	92	0	291	0	0	0	0
ours	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
vg Hr	0	0	0	7	0	18	0	22	6	13	31	0	97	0	0	0	0
oon Period																	
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hours	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
vg Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M Period																	
otal	0	0	0	42	0	75	0	197	69	84	115	0	582	0	0	0	0
Hours	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
vg Hr	0	0	0	14	0	25	0	66	23	28	38	0	194	0	0	0	0

Average Hour Volumes



VEHICLE TURNING MOVEMENT SURVEY
Ministry of Transportation & Highways
South Coast Region

Major Route: Forbidden Plateau Road
Minor Route: Duncan Bay Main Road
Municipality: Comox Valley Regional District
Filename: MoT - FP & DBM Site Code: 00000

Date: Sept 18, 2009
Day-of-week: Friday

Speed Limit Major Rte: 60
Speed Limit Minor Rte: 60

East/West Route: Forbidden Plateau Road
Intersection Type: 1 ---> 4-leg
Signalized (y/n?): No
Weather: dry and sunny

	Lanes								Bus Stop		Bus
	TLR	R	(ch)	TR	T	TL	L	Grade	Near	Far	Bay
North Approach	1										
South Approach	1										
West Approach	1										
East Approach	1										

note: (ch) - channelized A: parallel lane B: taper

	Start	Duration
A.M. Shift	07:30	2.75
Noon Shift	11:00	2.00
P.M. Shift	15:00	3.00
	Total	7.75

Note: duration: decimal hours
start time: 24 hr clock (15 min increments)

Comments: _____

Notes: North Approach - vehicles approaching intersection from the north
15x4 - 15 min volume (from max 15 minute period [+] in peak hour period [*]) x 4
Pedestrians - N indicates pedestrians crossing north approach (east/west)

urvey Data

Location: Forbidden Plateau Road @ Duncan Bay Main Road
Date: Sept 18, 2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0				
:45	0	11	2	0	3	2	2	1	0	1	1	2	25				
:00	0	2	0	0	10	4	1	1	0	4	5	0	27				
08:15	1	1	1	1	3	2	0	1	0	0	0	1	11				
:30	0	3	1	0	2	2	2	0	0	0	1	1	12				
:45	1	3	1	0	7	2	0	2	0	1	0	1	18				
09:00	1	1	0	0	3	0	1	3	0	0	2	1	12				
09:15	0	6	2	0	2	1	0	2	1	1	2	2	19 *				
:30	2	5	1	0	4	2	2	1	0	3	3	2	25 +				
:45	0	2	3	0	6	0	3	1	0	3	1	0	19 *				
10:00	1	1	0	0	1	3	2	2	1	2	5	3	21 *				
	0	0	0	0	0	0	0	0	0	0	0	0	0				
Total	6	35	11	1	41	18	13	14	2	15	20	13	189	0	0	0	0
Pk Hr	3	14	6	0	13	6	7	6	2	9	11	7	84 *	0	0	0	0
x4	8	20	4	0	16	8	8	4	0	12	12	8	100 +	0	0	0	0
11:00													0				
:15													0				
:30													0				
11:45													0				
:00													0 +				
:15													0 +				
:30													0 +				
12:45													0 +				
tal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pk Hr	0	0	0	0	0	0	0	0	0	0	0	0	0 *	0	0	0	0
x4	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
15:00	1	4	1	0	2	1	1	2	1	1	1	3	18				
15:15	6	5	2	0	9	5	1	3	0	4	5	7	47				
:30	6	4	2	0	10	2	3	3	0	3	0	4	37				
:45	5	4	0	1	2	3	0	1	0	1	1	2	20				
16:00	5	11	0	0	2	5	1	2	1	1	1	2	31				
:15	5	4	0	0	2	3	1	0	0	3	1	6	25				
:30	7	7	5	1	2	2	1	1	0	7	3	6	42 +				
16:45	5	8	1	1	1	3	1	3	0	8	0	3	34 *				
17:00	6	4	1	1	3	0	0	2	1	4	1	5	28 *				
:15	7	8	0	0	5	1	1	2	2	4	1	3	34 *				
:30	5	3	1	0	5	2	1	0	0	3	0	2	22				
17:45	2	8	0	0	2	1	0	2	0	7	0	6	28				
tal	60	70	13	4	45	28	11	21	5	46	14	49	366	0	0	0	0
Pk Hr	25	27	7	3	11	6	3	8	3	23	5	17	138 *	0	0	0	0
x4	28	28	20	4	8	8	4	4	0	28	12	24	168 +	0	0	0	0

AM Peak Period

Location: Forbidden Plateau Road @ Duncan Bay Main Road
Date: Sept 18, 2009

Time Period	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total Volume	Pedestrians			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		N	S	W	E
:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:45	0	11	2	0	3	2	2	1	0	1	1	2	25	0	0	0	0
08:00	0	2	0	0	10	4	1	1	0	4	5	0	27	0	0	0	0
:15	1	1	1	1	3	2	0	1	0	0	0	1	11	0	0	0	0
:30	0	3	1	0	2	2	2	0	0	0	1	1	12	0	0	0	0
08:45	1	3	1	0	7	2	0	2	0	1	0	1	18	0	0	0	0
09:00	1	1	0	0	3	0	1	3	0	0	2	1	12	0	0	0	0
:15	0	6	2	0	2	1	0	2	1	1	2	2	19 *	0	0	0	0
:30	2	5	1	0	4	2	2	1	0	3	3	2	25 +	0	0	0	0
09:45	0	2	3	0	6	0	3	1	0	3	1	0	19 *	0	0	0	0
:00	1	1	0	0	1	3	2	2	1	2	5	3	21 *	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
tal	6	35	11	1	41	18	13	14	2	15	20	13	189	0	0	0	0
k Hr	3	14	6	0	13	6	7	6	2	9	11	7	84 *	0	0	0	0
15x4	8	20	4	0	16	8	8	4	0	12	12	8	100 +	0	0	0	0
g Hr	2	13	4	0	15	7	5	5	1	5	7	5	69	0	0	0	0

Peak Hour	09:15
Peak 15min	09:30
North approach PHF	0.72
South approach PHF	0.79
West approach PHF	1.25
East approach PHF	0.84

N
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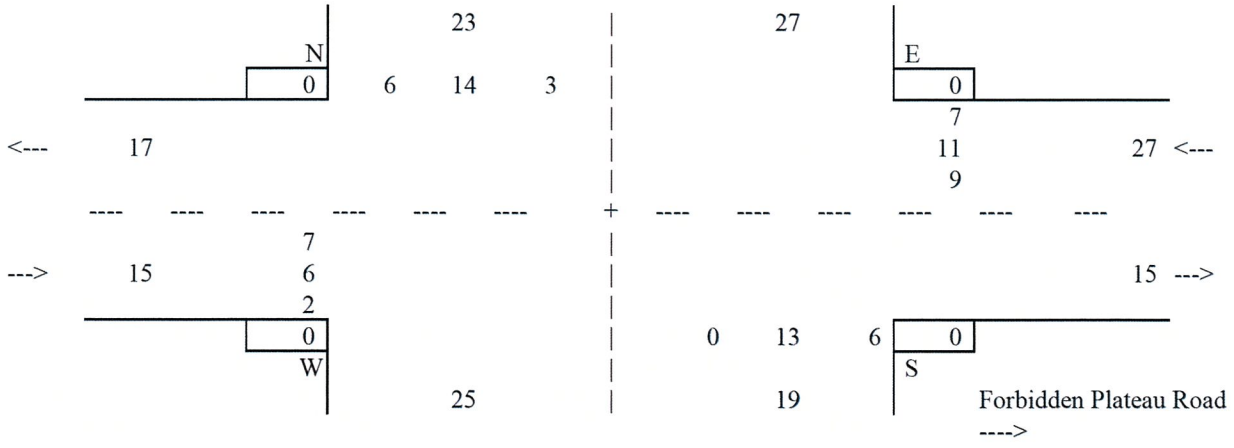
AM Peak Hour Volumes



oon Peak Period

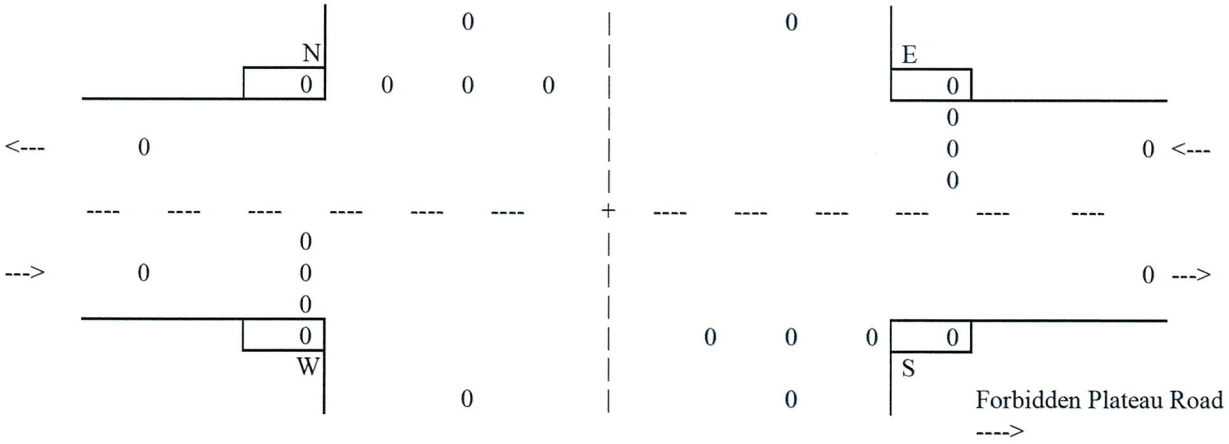
Location: Forbidden Plateau Road @ Duncan Bay Main Road
Date: Sept 18, 2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
tal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hr	0	0	0	0	0	0	0	0	0	0	0	0	0 *	0	0	0	0
x4	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
Avg Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

N
^
,

Peak Hour	12:00
Peak 15min	12:45
North Leg PHF	#DIV/0!
South Leg PHF	#DIV/0!
West Leg PHF	#DIV/0!
East Leg PHF	#DIV/0!

Noon Peak Hour Volumes



M Peak Period

Location: Forbidden Plateau Road @ Duncan Bay Main Road
Date: Sept 18, 2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
15:00	1	4	1	0	2	1	1	2	1	1	1	3	18	0	0	0	0
:15	6	5	2	0	9	5	1	3	0	4	5	7	47	0	0	0	0
:30	6	4	2	0	10	2	3	3	0	3	0	4	37	0	0	0	0
15:45	5	4	0	1	2	3	0	1	0	1	1	2	20	0	0	0	0
:00	5	11	0	0	2	5	1	2	1	1	1	2	31	0	0	0	0
:15	5	4	0	0	2	3	1	0	0	3	1	6	25	0	0	0	0
16:30	7	7	5	1	2	2	1	1	0	7	3	6	42 +	0	0	0	0
16:45	5	8	1	1	1	3	1	3	0	8	0	3	34 *	0	0	0	0
:00	6	4	1	1	3	0	0	2	1	4	1	5	28 *	0	0	0	0
:15	7	8	0	0	5	1	1	2	2	4	1	3	34 *	0	0	0	0
17:30	5	3	1	0	5	2	1	0	0	3	0	2	22	0	0	0	0
:45	2	8	0	0	2	1	0	2	0	7	0	6	28	0	0	0	0
Total	60	70	13	4	45	28	11	21	5	46	14	49	366	0	0	0	0
Pk Hr	25	27	7	3	11	6	3	8	3	23	5	17	138 *	0	0	0	0
x4	28	28	20	4	8	8	4	4	0	28	12	24	168 +	0	0	0	0
Avg Hr	20	23	4	1	15	9	4	7	2	15	5	16	122	0	0	0	0

Peak Hour	16:30
Peak 15min	16:30
North Leg PHF	0.78
South Leg PHF	1.00
West Leg PHF	1.75
East Leg PHF	0.70

N
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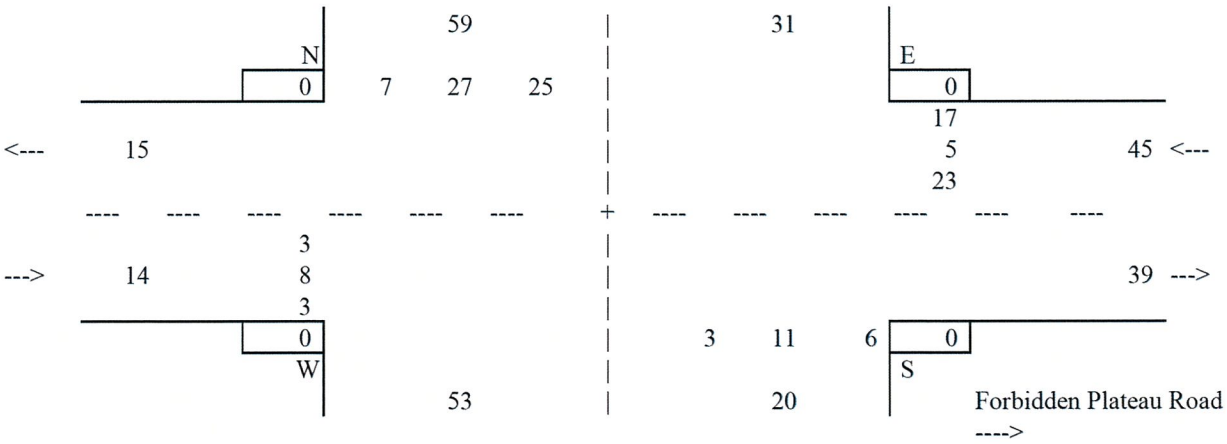
PM Peak Hour Volumes



verage Hour Period Location: Forbidden Plateau Road @ Duncan Bay Main Road
Sept 18, 2009

	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
urvey																	
Total	66	105	24	5	86	46	24	35	7	61	34	62	555	0	0	0	0
ours	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
g Hr	9	14	3	1	11	6	3	5	1	8	4	8	72	0	0	0	0
M Period																	
Total	6	35	11	1	41	18	13	14	2	15	20	13	189	0	0	0	0
ours	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
g Hr	2	13	4	0	15	7	5	5	1	5	7	5	69	0	0	0	0
oon Period																	
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hours	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
g Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M Period																	
tal	60	70	13	4	45	28	11	21	5	46	14	49	366	0	0	0	0
Hours	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
g Hr	20	23	4	1	15	9	4	7	2	15	5	16	122	0	0	0	0

Average Hour Volumes

Total	3	14	9
AM	4	13	2
Noon	0	0	0
PM	4	23	20

PM	Noon	AM	Total
16	0	5	8
5	0	7	4
15	0	5	8

Forbidden Plateau Road <---

3	5	0	4
5	5	0	7
1	1	0	2

--->

Forbidden Plateau Road

Total	AM	Noon	PM
1	15	9	PM
0	0	0	Noon
0	15	7	AM
1	11	6	Total

VEHICLE TURNING MOVEMENT SURVEY
Ministry of Transportation & Highways
South Coast Region

Major Route: Comox Logging Road
Minor Route: Marsden Road
Municipality: Comox Valley Regional District
Filename: MoT - Comox & marsden Site Code: 00000

Date: Sept 18, 2009
Day-of-week: Friday

Speed Limit Major Rte: 50
Speed Limit Minor Rte: 50 km/hr

East/West Route: Comox Logging Road
Intersection Type: 1 ---> 4-leg
Signalized (y/n?): No
Weather: dry and sunny

	Lanes								Bus Stop		Bus
	TLR	R	(ch)	TR	T	TL	L	Grade	Near	Far	Bay
North Approach	1										
South Approach	1										
West Approach	1										
East Approach	1										

note: (ch) - channelized A: parallel lane B: taper

	Start	Duration
A.M. Shift	07:30	3.25
Noon Shift	11:00	0.00
P.M. Shift	15:00	3.00
	Total	6.25

Note: duration: decimal hours
start time: 24 hr clock (15 min increments)

Comments: _____

Notes: North Approach - vehicles approaching intersection from the north
15x4 - 15 min volume (from max 15 minute period [+] in peak hour period [*]) x 4
Pedestrians - N indicates pedestrians crossing north approach (east/west)

urvey Data

Location: Comox Logging Road @ Marsden Road
Date: Sept 18, 2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0				
:45	1	1	1	0	3	1	2	4	0	1	4	0	18				
:00	7	4	2	0	2	3	0	1	2	1	0	0	22				
08:15	7	6	1	0	5	3	1	2	0	0	4	1	30 +				
:30	8	2	0	0	1	4	0	0	0	2	4	2	23 *				
:45	2	2	0	0	6	3	4	0	0	0	5	2	24 *				
09:00	2	2	0	1	2	3	0	5	0	0	6	3	24 *				
09:15	1	2	0	0	2	2	2	1	0	0	6	1	17				
:30	6	2	0	0	6	1	3	1	0	2	2	2	25				
:45	2	2	0	2	4	3	2	1	0	0	5	0	21				
10:00	4	1	0	0	7	2	2	3	0	0	3	0	22				
:15	3	5	1	0	5	3	1	2	1	0	4	3	28				
Total	43	29	5	3	43	28	17	20	3	6	43	14	254	0	0	0	0
Pk Hr	19	12	1	1	14	13	5	7	0	2	19	8	101 *	0	0	0	0
x4	28	24	4	0	20	12	4	8	0	0	16	4	120 +	0	0	0	0
n/a													0				
n													0				
n													0				
n/a													0				
a													0 +				
n													0 +				
n/a													0 +				
n/a													0 +				
otal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pk Hr	0	0	0	0	0	0	0	0	0	0	0	0	0 *	0	0	0	0
x4	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0				
15:15	0	1	0	0	4	4	0	2	1	0	9	3	24				
:30	5	6	1	1	3	4	0	2	0	2	7	10	41				
:45	4	0	0	0	5	3	1	2	0	1	9	2	27				
16:00	2	2	0	0	3	5	1	0	0	0	12	2	27				
:15	10	7	0	0	10	7	1	1	0	1	9	0	46 +				
:30	4	1	0	1	14	10	2	1	0	0	12	1	46 +				
16:45	3	2	0	2	6	10	2	0	1	2	14	1	43 *				
17:00	5	2	0	0	4	4	3	1	0	0	16	2	37 *				
:15	0	1	0	0	10	7	2	0	0	0	8	1	29				
:30	3	2	1	0	6	7	4	1	0	1	10	1	36				
17:45	6	1	0	0	0	4	2	4	0	0	8	0	25				
otal	42	25	2	4	65	65	18	14	2	7	114	23	381	0	0	0	0
Pk Hr	22	12	0	3	34	31	8	3	1	3	51	4	172 *	0	0	0	0
x4	16	4	0	4	56	40	8	4	0	0	48	4	184 +	0	0	0	0

AM Peak Period

Location: Comox Logging Road @ Marsden Road
Date: Sept 18, 2009

Time Period	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total Volume	Pedestrians			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		N	S	W	E
:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:45	1	1	1	0	3	1	2	4	0	1	4	0	18	0	0	0	0
08:00	7	4	2	0	2	3	0	1	2	1	0	0	22	0	0	0	0
:15	7	6	1	0	5	3	1	2	0	0	4	1	30 +	0	0	0	0
:30	8	2	0	0	1	4	0	0	0	2	4	2	23 *	0	0	0	0
08:45	2	2	0	0	6	3	4	0	0	0	5	2	24 *	0	0	0	0
09:00	2	2	0	1	2	3	0	5	0	0	6	3	24 *	0	0	0	0
:15	1	2	0	0	2	2	2	1	0	0	6	1	17	0	0	0	0
:30	6	2	0	0	6	1	3	1	0	2	2	2	25	0	0	0	0
09:45	2	2	0	2	4	3	2	1	0	0	5	0	21	0	0	0	0
:00	4	1	0	0	7	2	2	3	0	0	3	0	22	0	0	0	0
:15	3	5	1	0	5	3	1	2	1	0	4	3	28	0	0	0	0
tal	43	29	5	3	43	28	17	20	3	6	43	14	254	0	0	0	0
k Hr	19	12	1	1	14	13	5	7	0	2	19	8	101 *	0	0	0	0
15x4	28	24	4	0	20	12	4	8	0	0	16	4	120 +	0	0	0	0
g Hr	13	9	2	1	13	9	5	6	1	2	13	4	78	0	0	0	0

Peak Hour	08:15
Peak 15min	08:15
North approach PHF	0.57
South approach PHF	0.88
West approach PHF	1.00
East approach PHF	1.45

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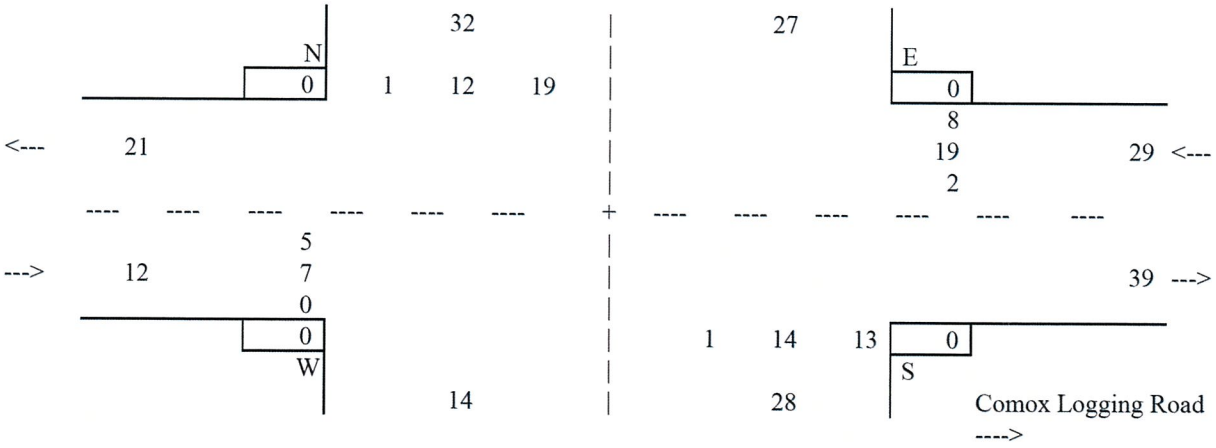
AM Peak Hour Volumes



oon Peak Period

Location: Comox Logging Road @ Marsden Road
Date: Sept 18, 2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
a/a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a/a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
a/a	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
a/a	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0

otal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hr	0	0	0	0	0	0	0	0	0	0	0	0	0 *	0	0	0	0
ox4	0	0	0	0	0	0	0	0	0	0	0	0	0 +	0	0	0	0
Avg Hr	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#DIV/0!	#####	#####	#####	#####

Peak Hour	n/a
Peak 15min	n/a
North Leg PHF	#DIV/0!
South Leg PHF	#DIV/0!
West Leg PHF	#DIV/0!
East Leg PHF	#DIV/0!

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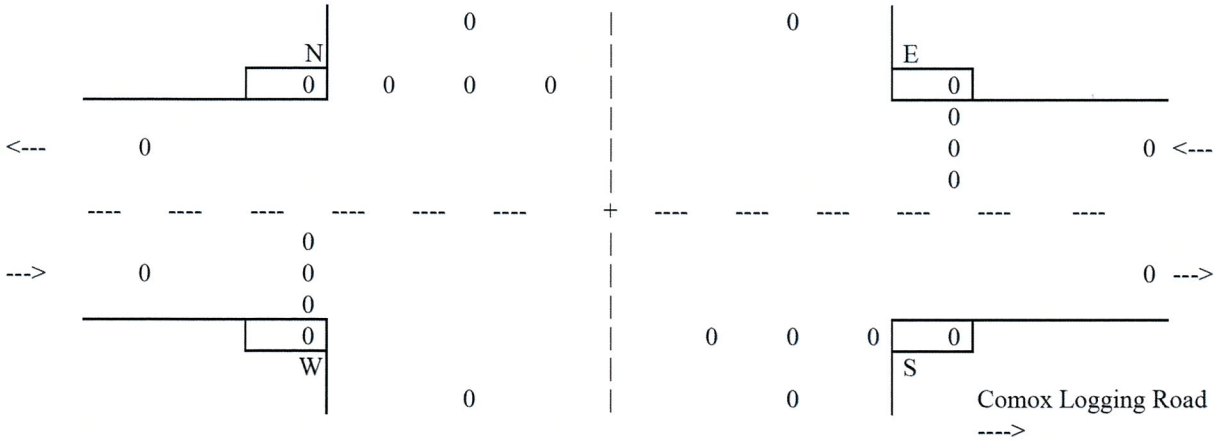
Noon Peak Hour Volumes



M Peak Period

Location: Comox Logging Road @ Marsden Road
Date: Sept 18, 2009

ime	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
Period	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
:15	0	1	0	0	4	4	0	2	1	0	9	3	24	0	0	0	0
:30	5	6	1	1	3	4	0	2	0	2	7	10	41	0	0	0	0
15:45	4	0	0	0	5	3	1	2	0	1	9	2	27	0	0	0	0
:00	2	2	0	0	3	5	1	0	0	0	12	2	27	0	0	0	0
:15	10	7	0	0	10	7	1	1	0	1	9	0	46 +	0	0	0	0
16:30	4	1	0	1	14	10	2	1	0	0	12	1	46 +	0	0	0	0
16:45	3	2	0	2	6	10	2	0	1	2	14	1	43 *	0	0	0	0
:00	5	2	0	0	4	4	3	1	0	0	16	2	37 *	0	0	0	0
:15	0	1	0	0	10	7	2	0	0	0	8	1	29	0	0	0	0
17:30	3	2	1	0	6	7	4	1	0	1	10	1	36	0	0	0	0
:45	6	1	0	0	0	4	2	4	0	0	8	0	25	0	0	0	0
Total	42	25	2	4	65	65	18	14	2	7	114	23	381	0	0	0	0
Pk Hr	22	12	0	3	34	31	8	3	1	3	51	4	172 *	0	0	0	0
x4	16	4	0	4	56	40	8	4	0	0	48	4	184 +	0	0	0	0
Avg Hr	14	8	1	1	22	22	6	5	1	2	38	8	127	0	0	0	0

Peak Hour	16:15
Peak 15min	16:30
North Leg PHF	1.70
South Leg PHF	0.68
West Leg PHF	1.00
East Leg PHF	1.12

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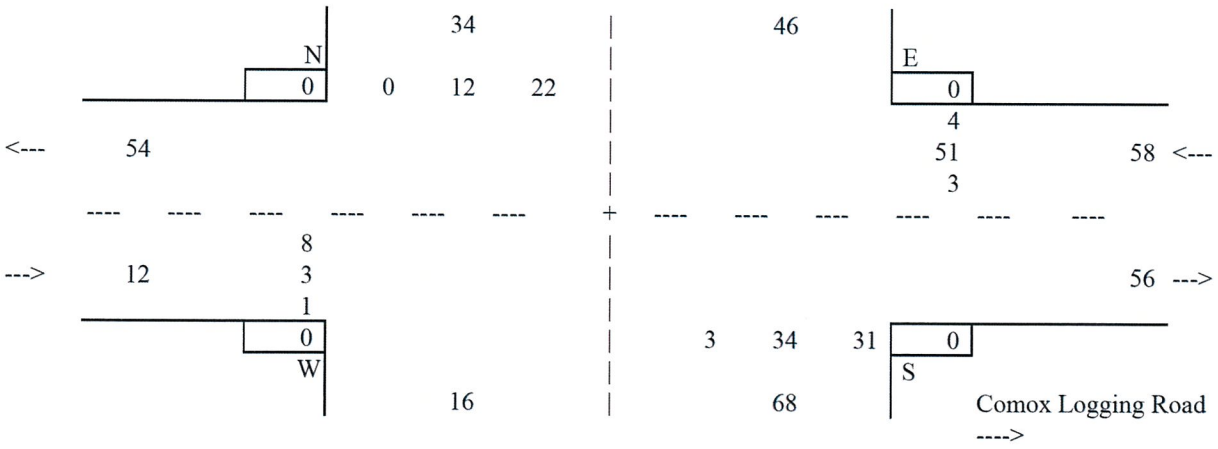
PM Peak Hour Volumes



verage Hour Period

Location: Comox Logging Road @ Marsden Road
Sept 18, 2009

	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			Total	Pedestrians			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume	N	S	W	E
urvey																	
otal	85	54	7	7	108	93	35	34	5	13	157	37	635	0	0	0	0
ours	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
vg Hr	14	9	1	1	17	15	6	5	1	2	25	6	102	0	0	0	0
M Period																	
otal	43	29	5	3	43	28	17	20	3	6	43	14	254	0	0	0	0
ours	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
vg Hr	13	9	2	1	13	9	5	6	1	2	13	4	78	0	0	0	0
oon Period																	
otal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vg Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M Period																	
otal	42	25	2	4	65	65	18	14	2	7	114	23	381	0	0	0	0
Hours	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
vg Hr	14	8	1	1	22	22	6	5	1	2	38	8	127	0	0	0	0

Average Hour Volumes

Total	1	9	14
AM	2	9	13
Noon	0	0	0
PM	1	8	14

PM	Noon	AM	Total
8	0	4	6
38	0	13	25
2	0	2	2

Comox Logging Road <---

Total	AM	Noon	PM
6	5	0	6
5	6	0	5
1	1	0	1

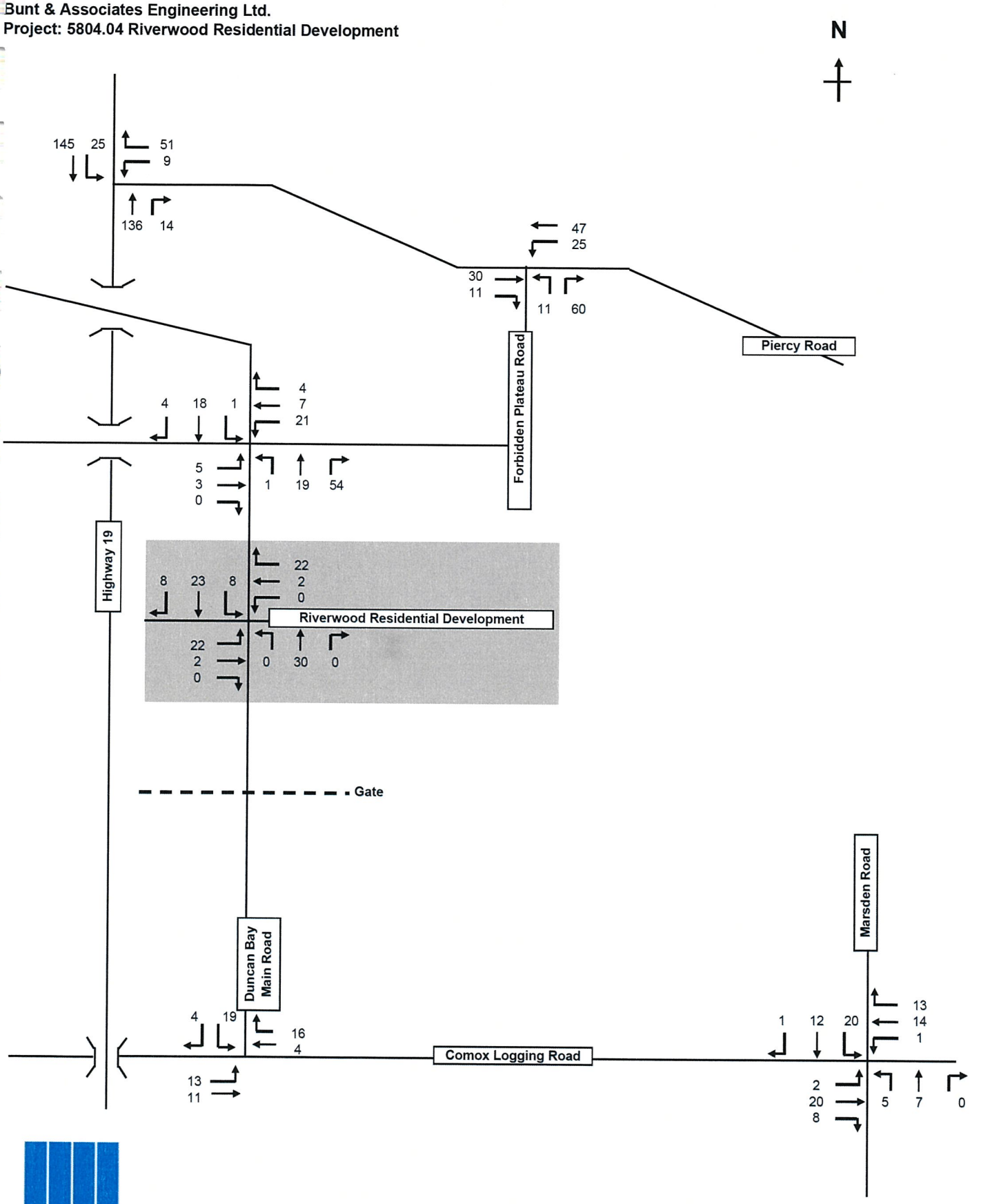
--->

Comox Logging Road

1	22	22	PM
0	0	0	Noon
1	13	9	AM
1	17	15	Total

Appendix B – Future Traffic Flow Diagrams

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

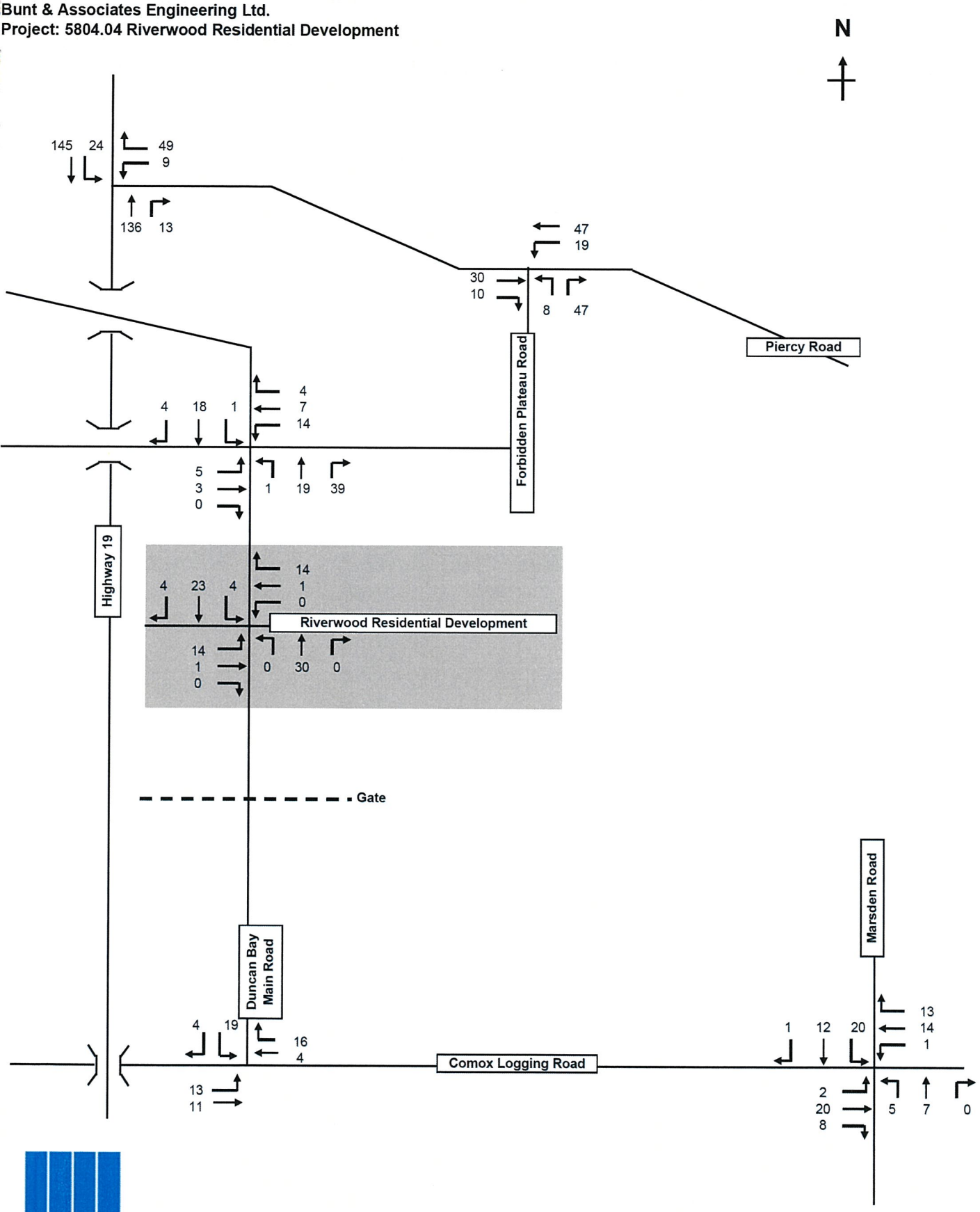


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
AM Peak
8:15am-9:15am

Option A (AM peak Period, Year 2012, Growth rate 2% -1%, 100% north, Trip Gen with MoT rate)

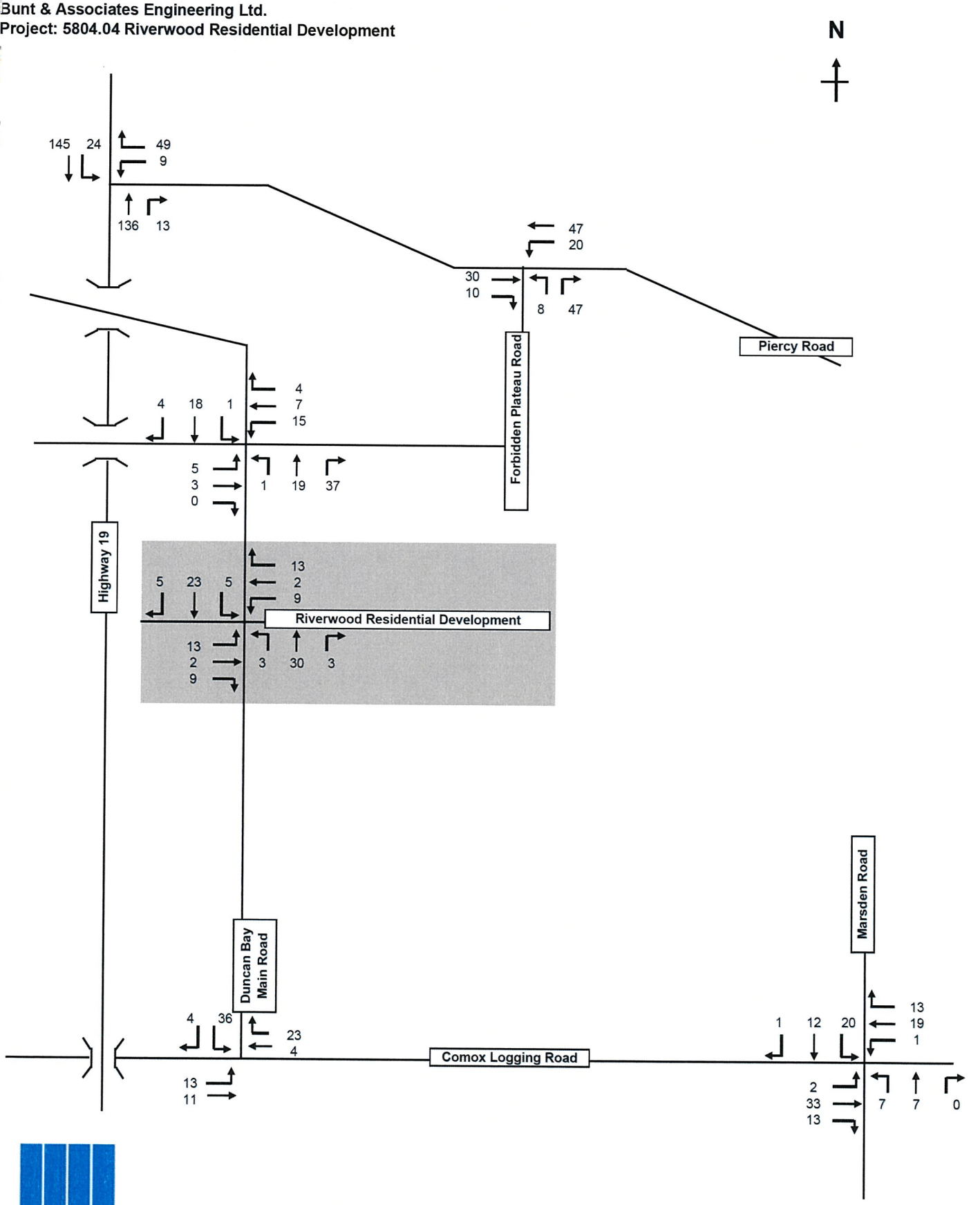
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2012
AM Peak
8:15am-9:15am

Option B (AM Peak Period, Year 2012, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

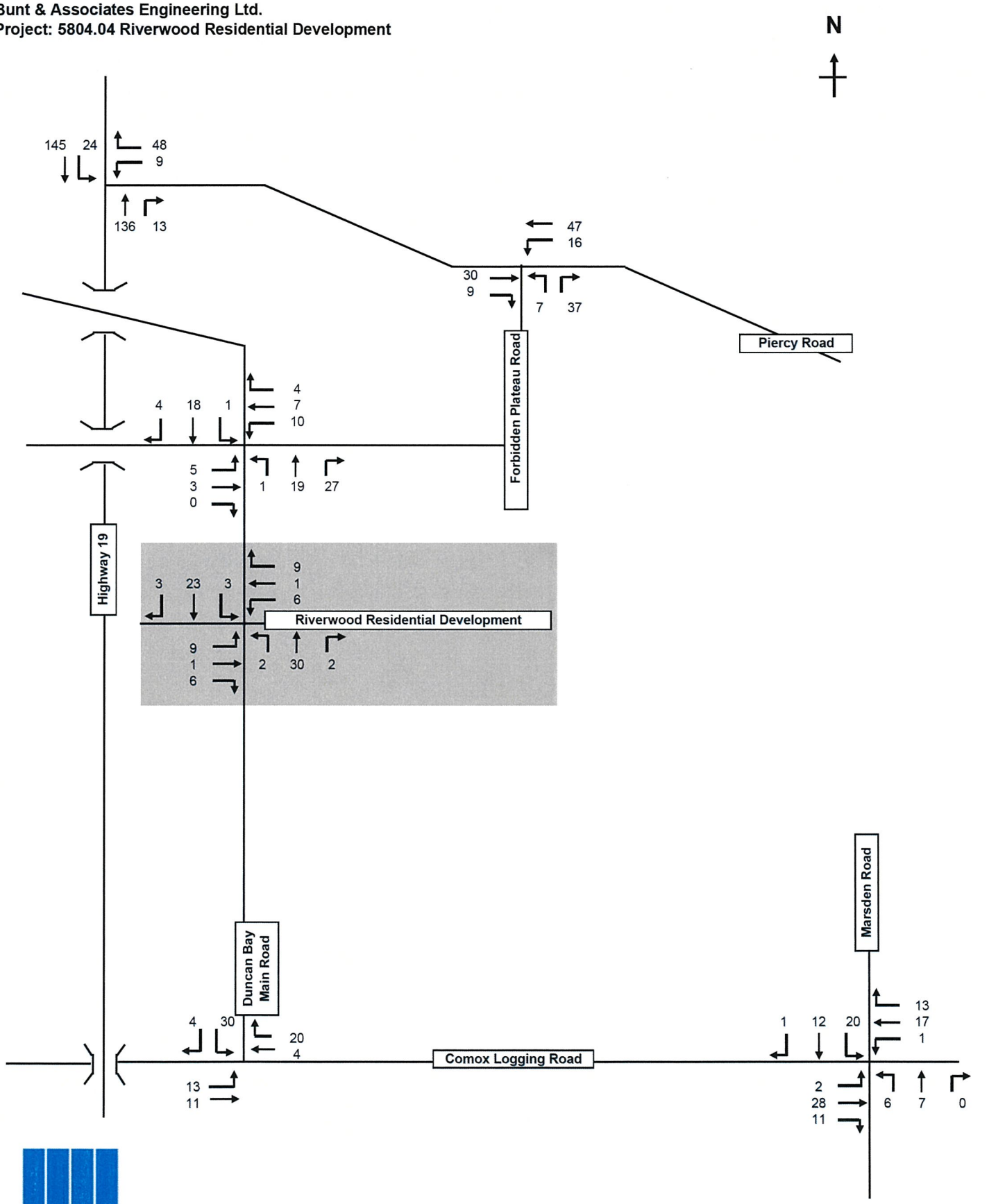


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
AM Peak
8:15am-9:15am

Option C (AM Peak Period, Year 2012, Growth rate 2% -1%, 60% north, Trip Gen with MoT rate)

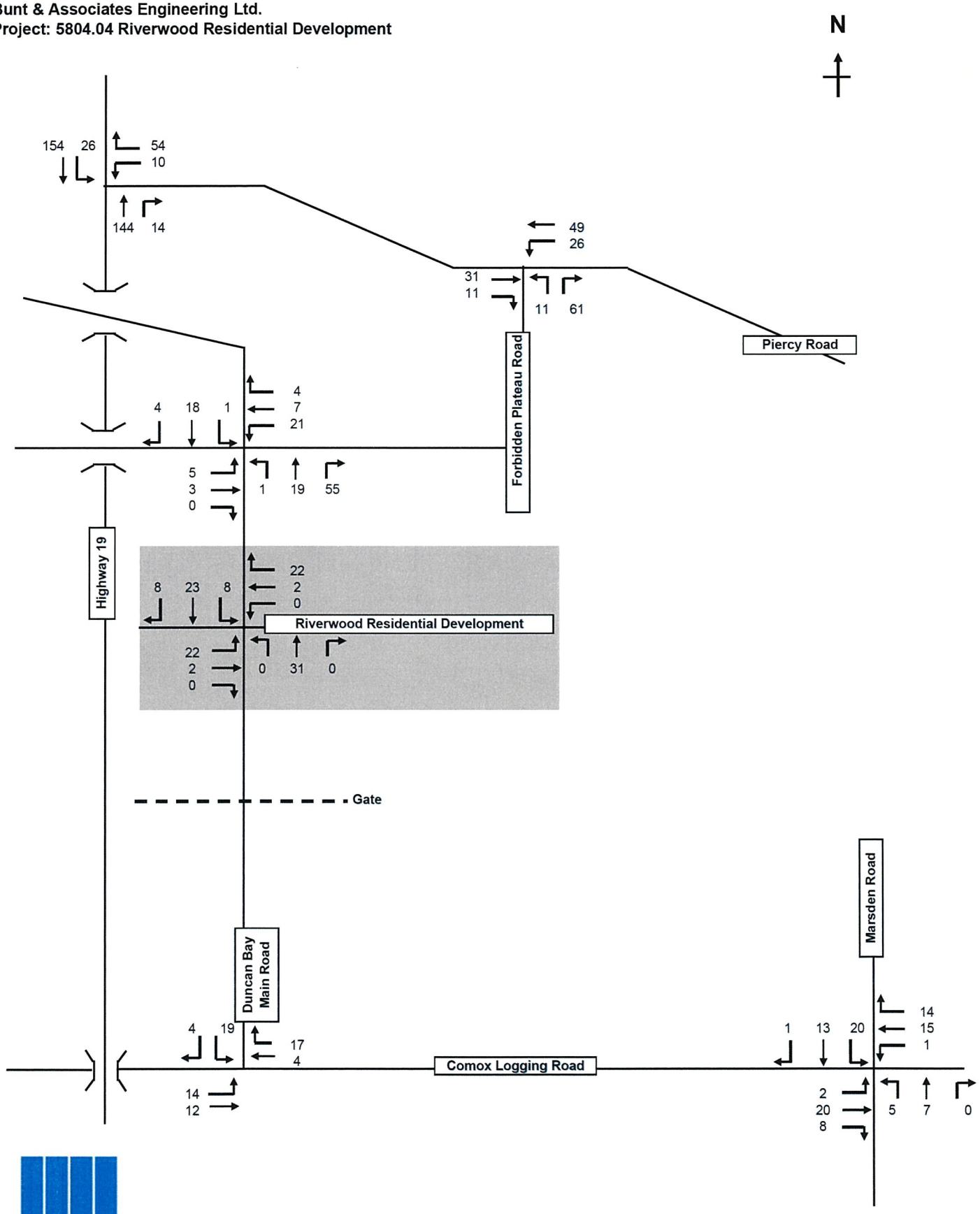
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2012
AM Peak
8:15am-9:15am

Option D (AM Peak Period, Year 2012, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

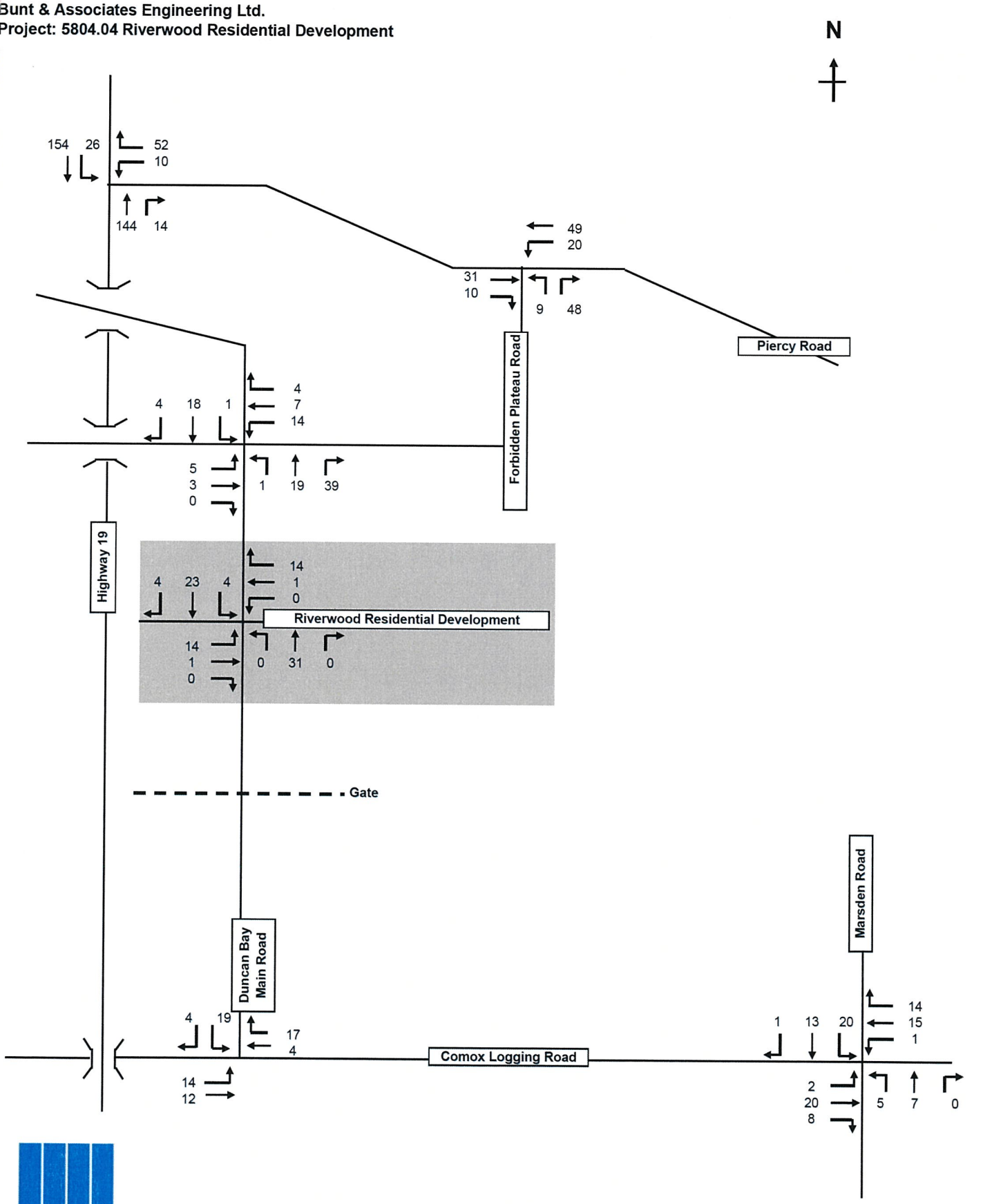


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
AM Peak
8:15am-9:15am

Option E (AM Peak Period, Year 2012, Growth rate 4% -2%, 100% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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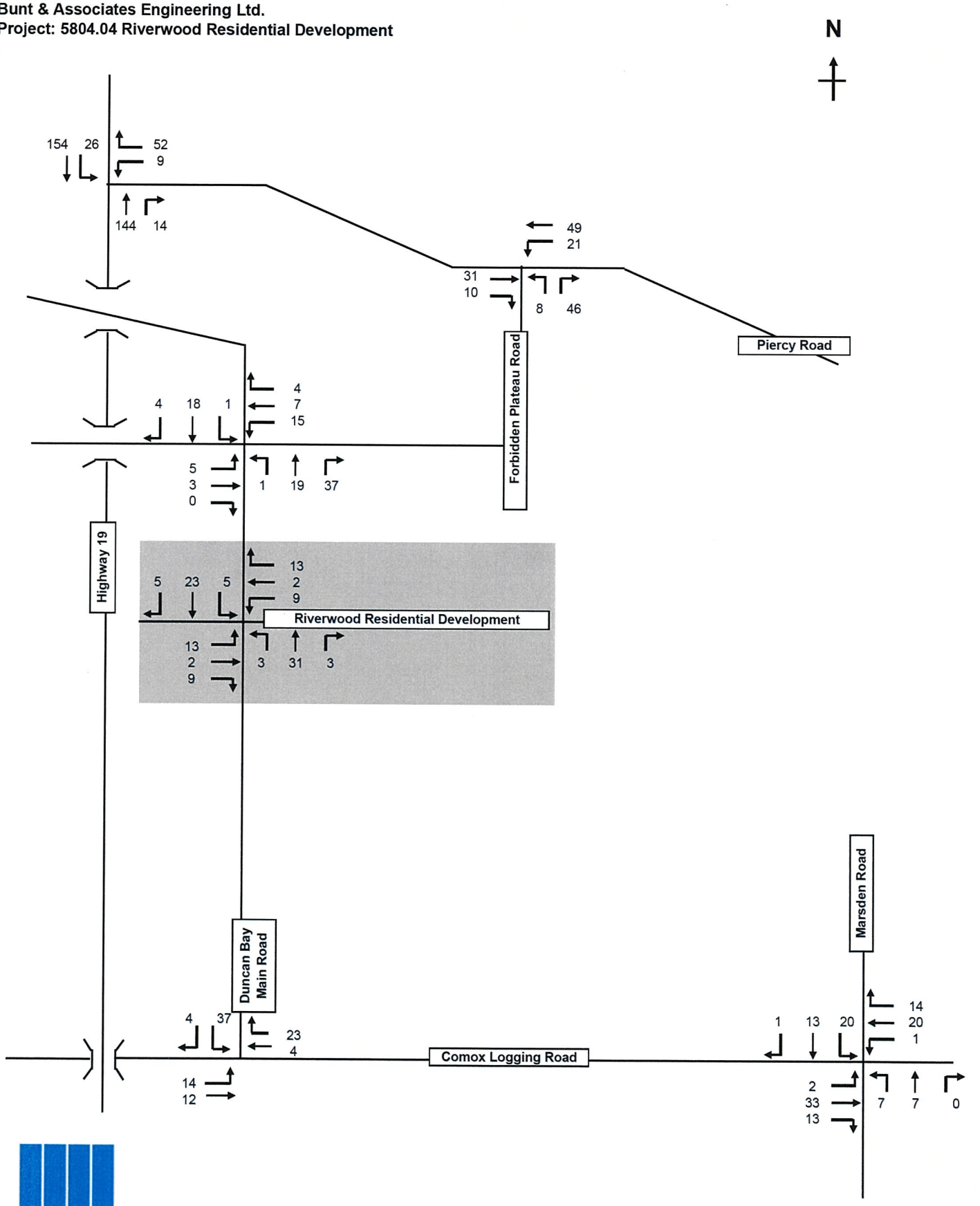
TRANSPORTATION PLANNERS AND ENGINEERS

2012
AM Peak
8:15am-9:15am

Option F (AM Peak Period, Year 2012, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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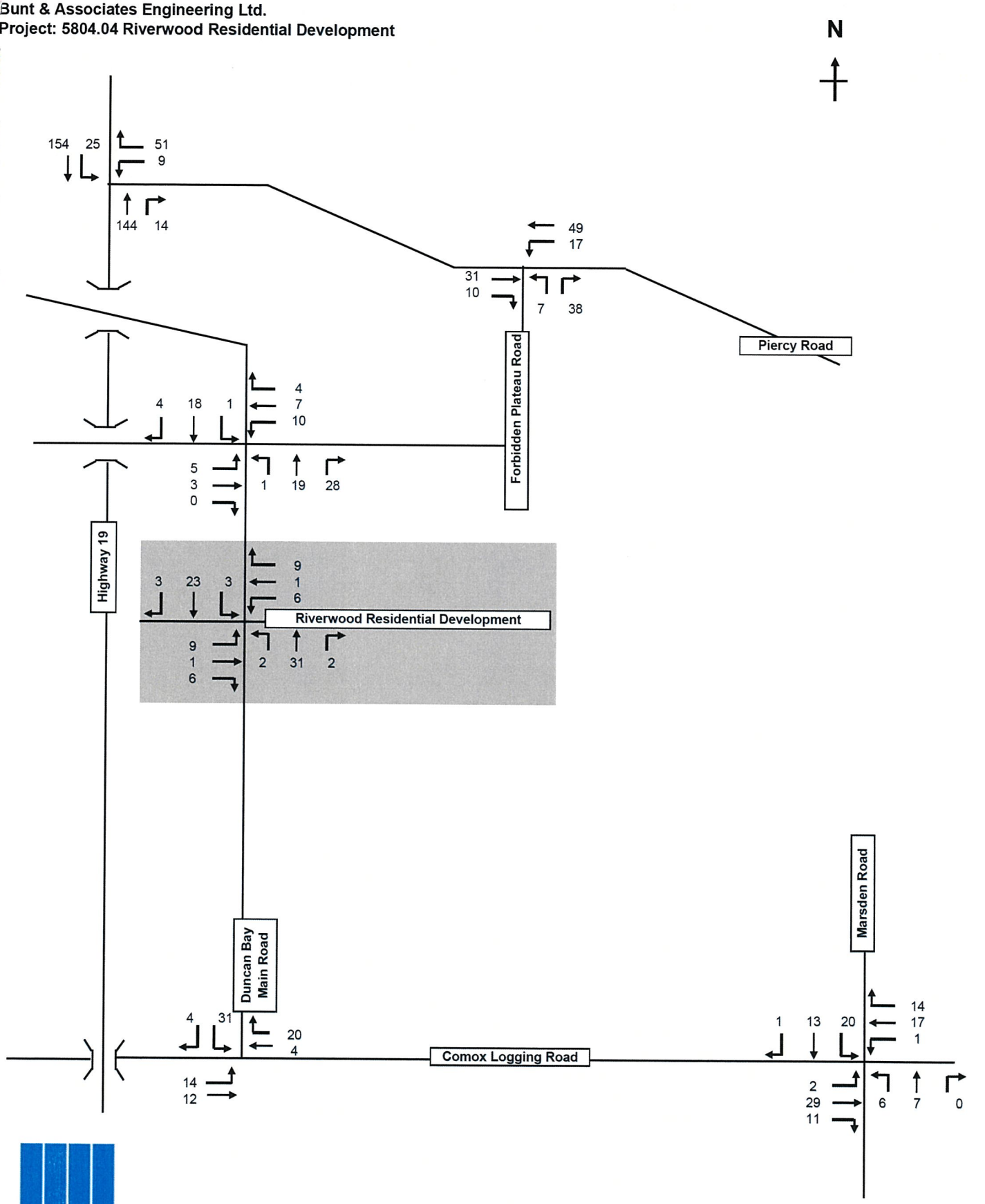
2012
AM Peak
8:15am-9:15am

Option G (AM Peak Period, Year 2012, Growth rate 4% -2%, 60% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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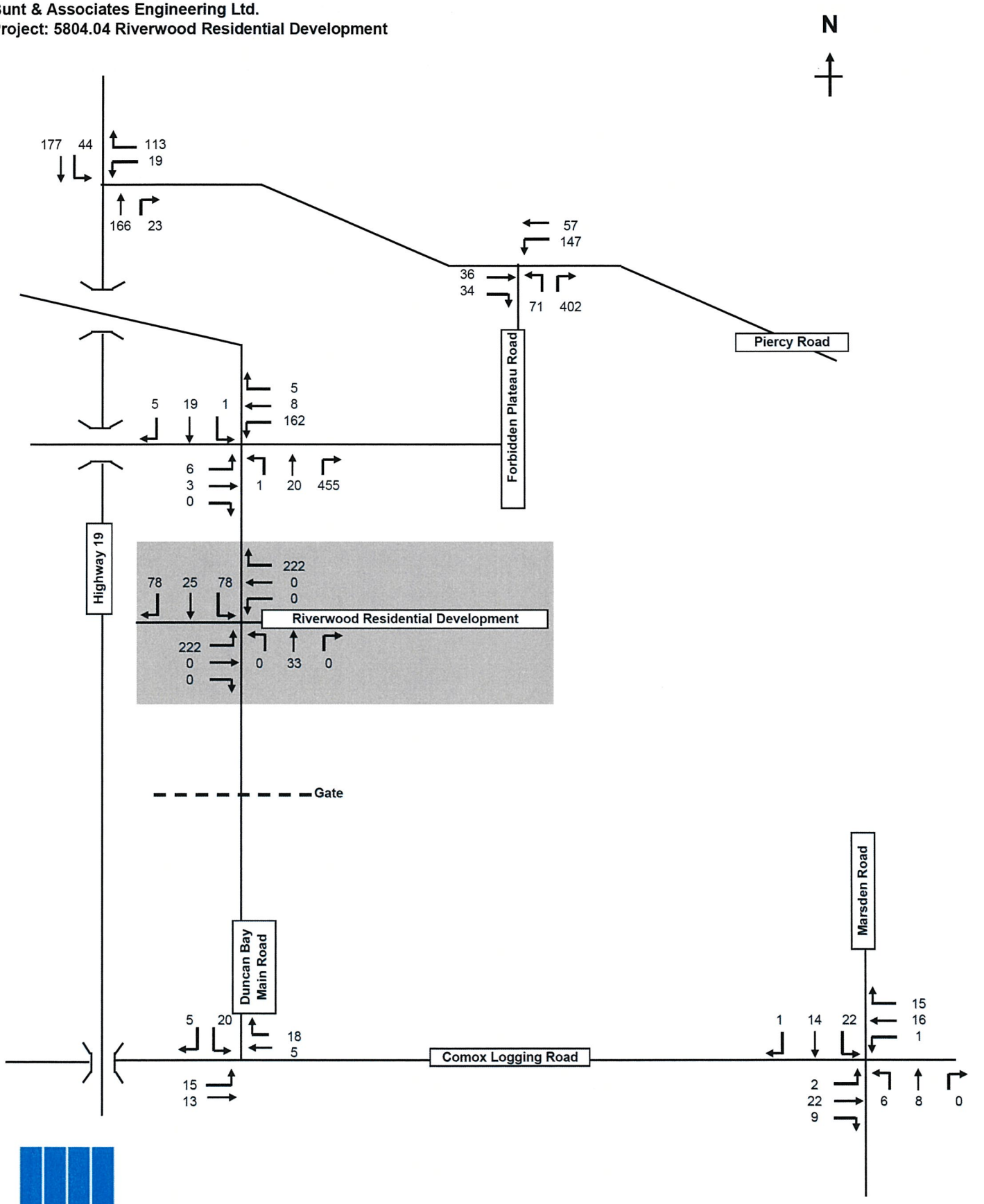
2012
AM Peak
8:15am-9:15am

Option H (AM Peak Period, Year 2012, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
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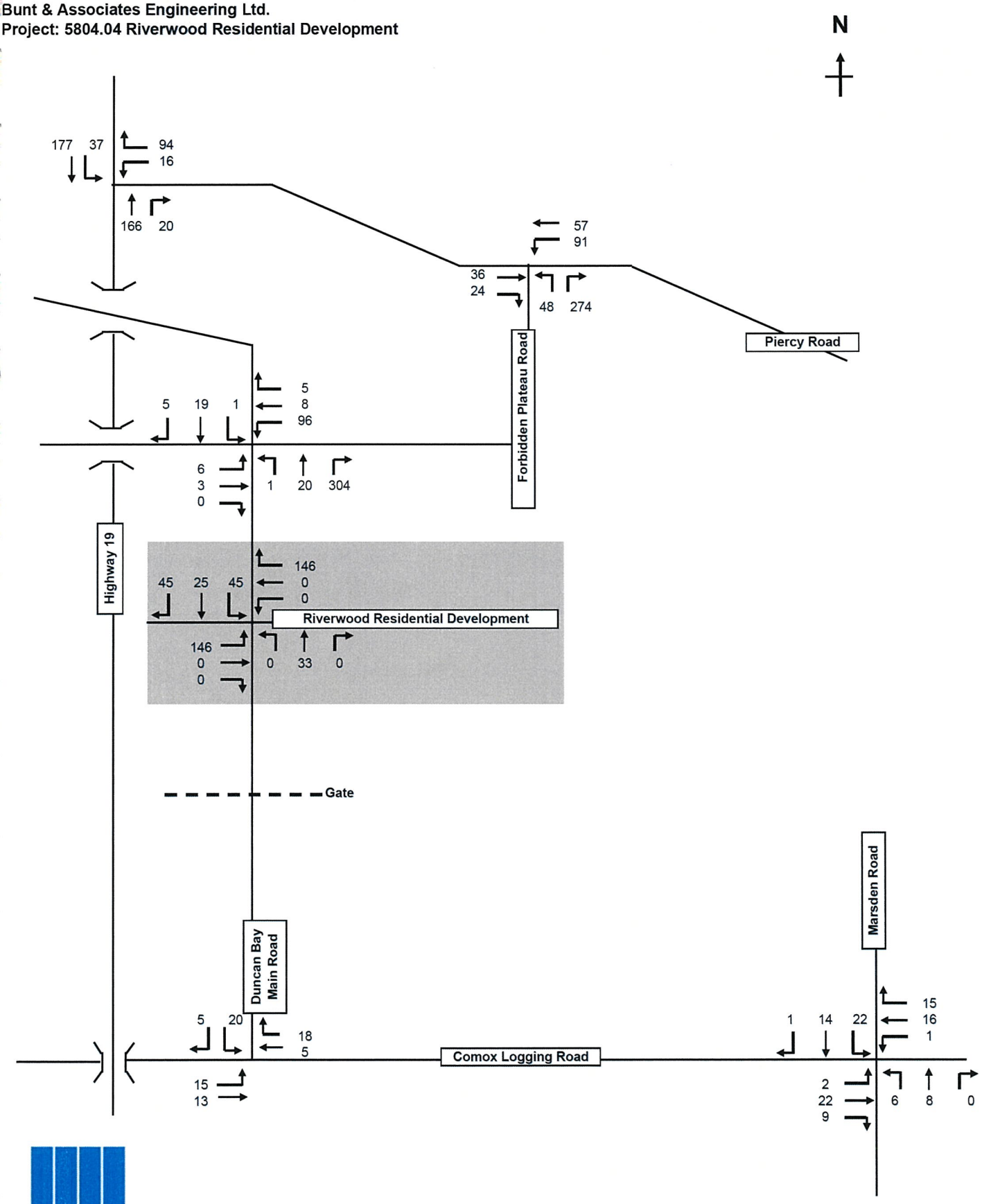
2022
AM Peak
8:15am-9:15am

Option A (AM peak Period, Year 2022, Growth rate 2% -1%, 100% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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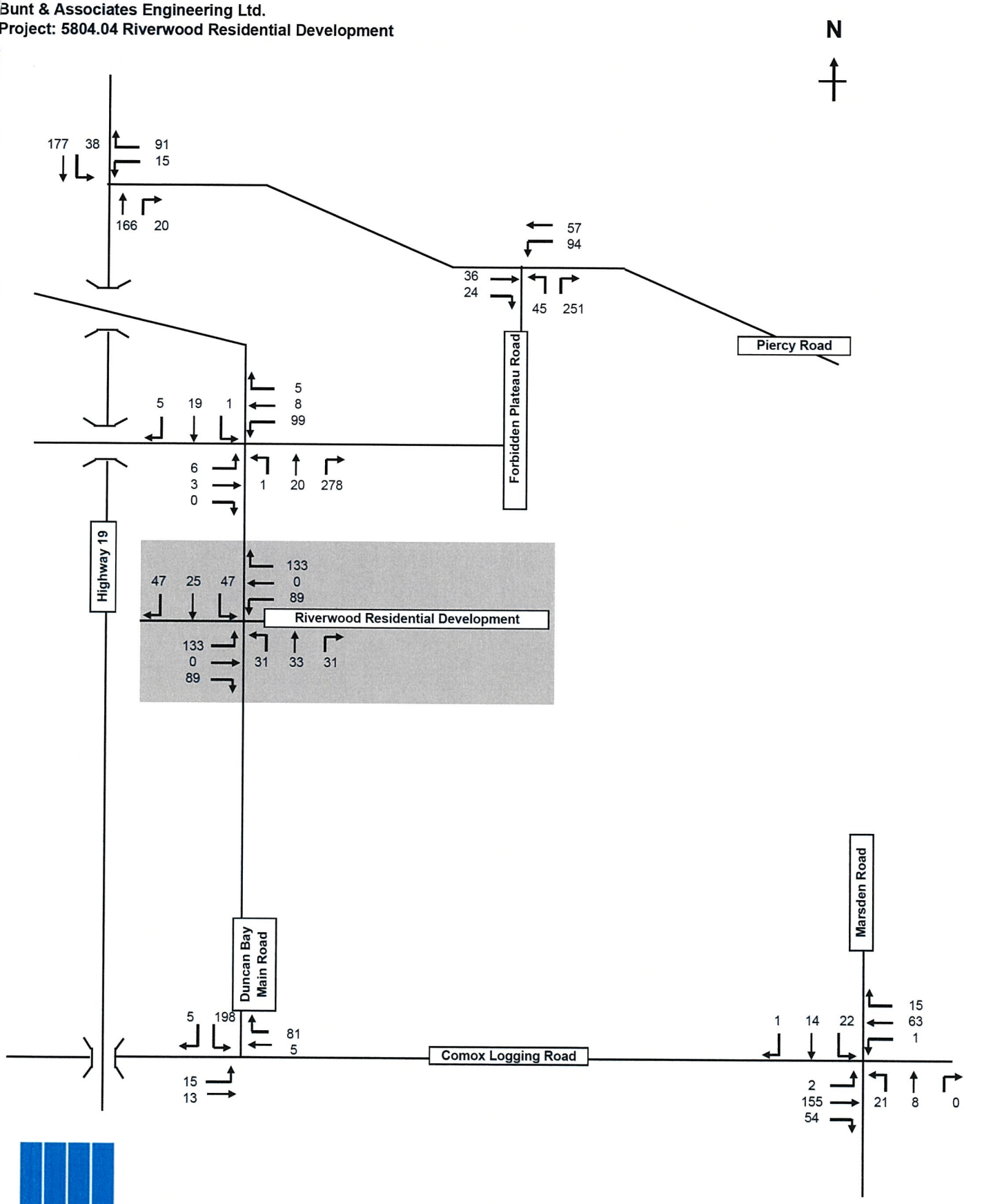
2022
AM Peak
8:15am-9:15am
Option B (AM Peak Period, Year 2022, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

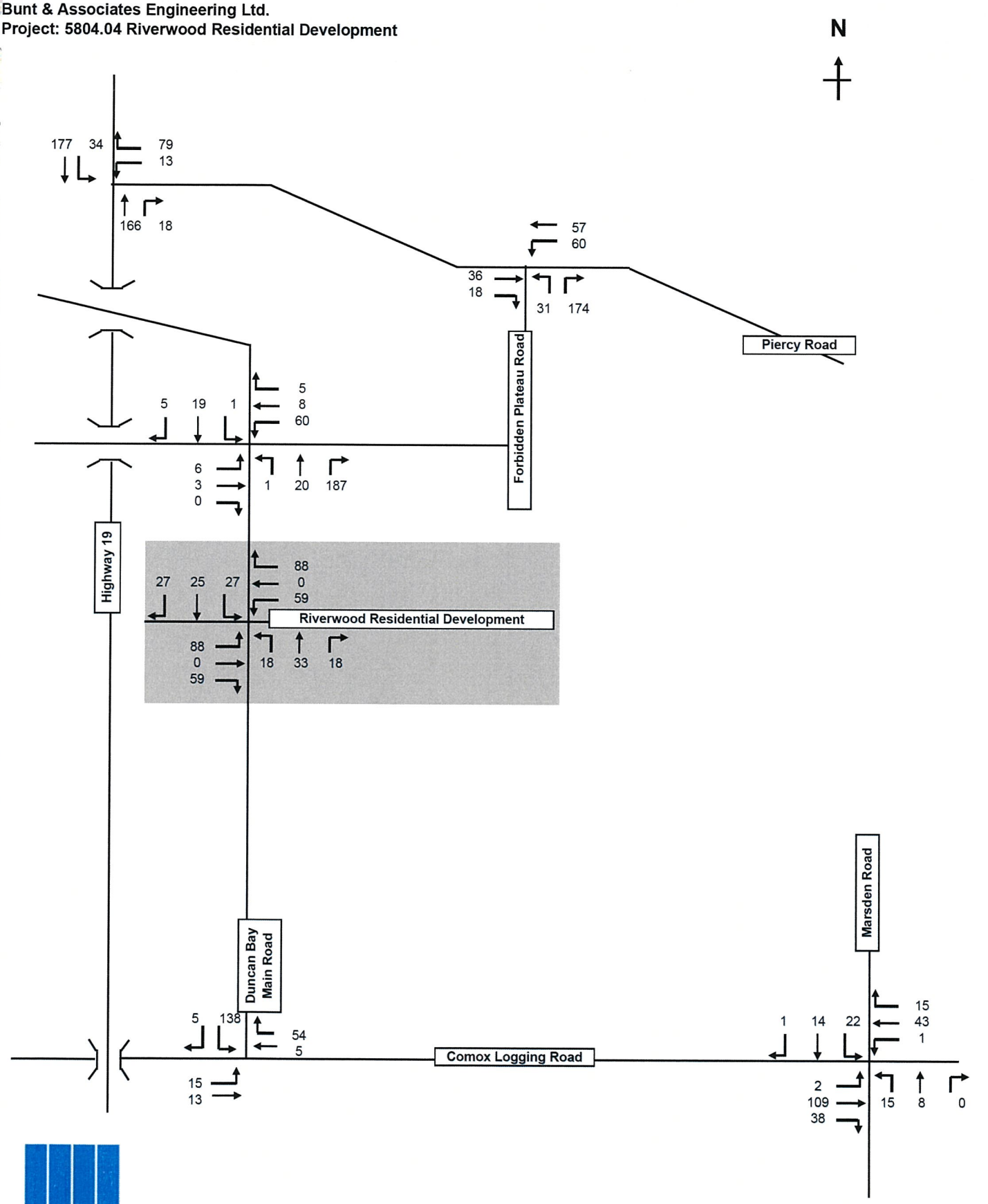


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2022
AM Peak
8:15am-9:15am

Option C (AM Peak Period, Year 2022, Growth rate 2% -1%, 60% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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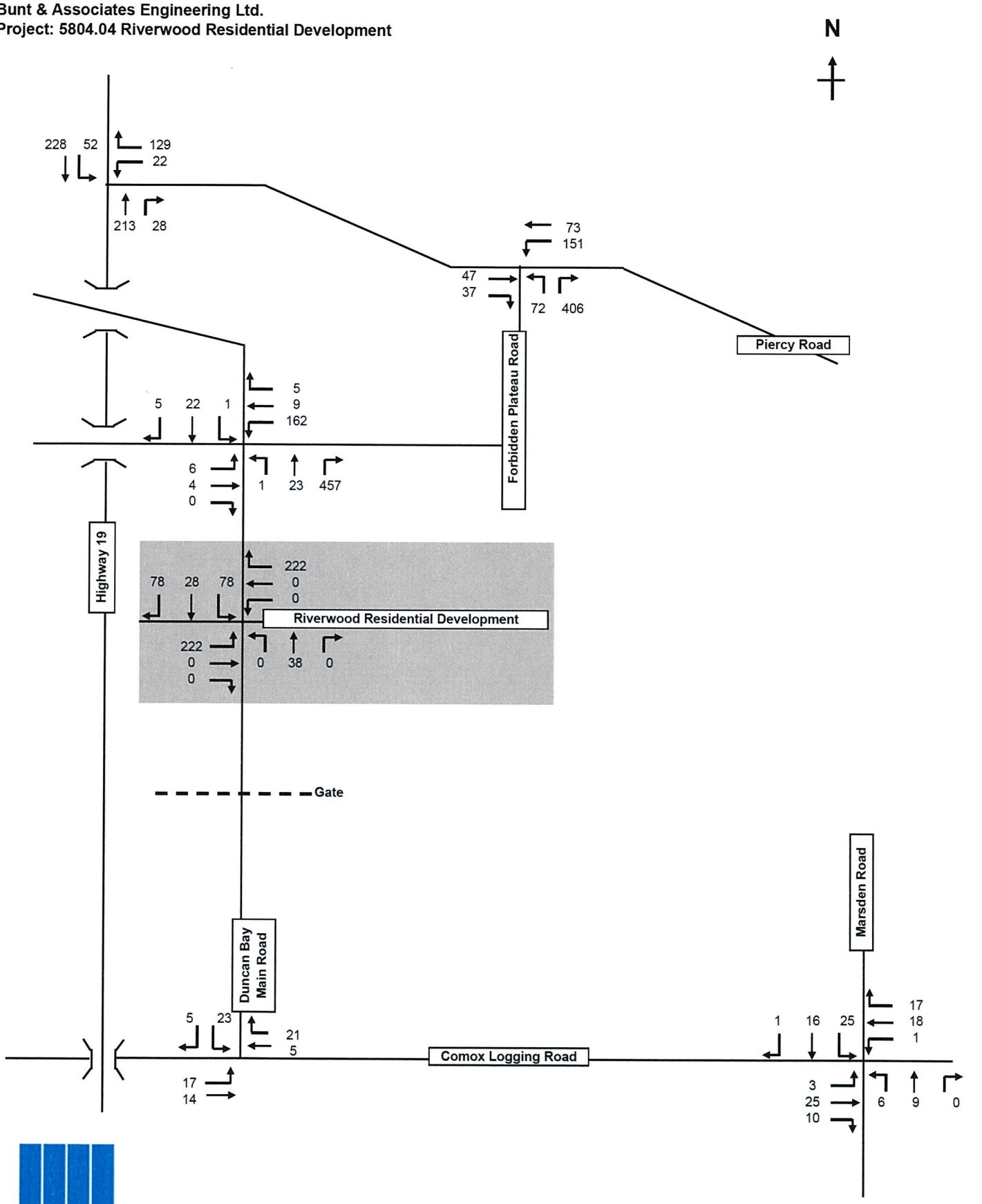
TRANSPORTATION PLANNERS AND ENGINEERS

2022
AM Peak
8:15am-9:15am

Option D (AM Peak Period, Year 2022, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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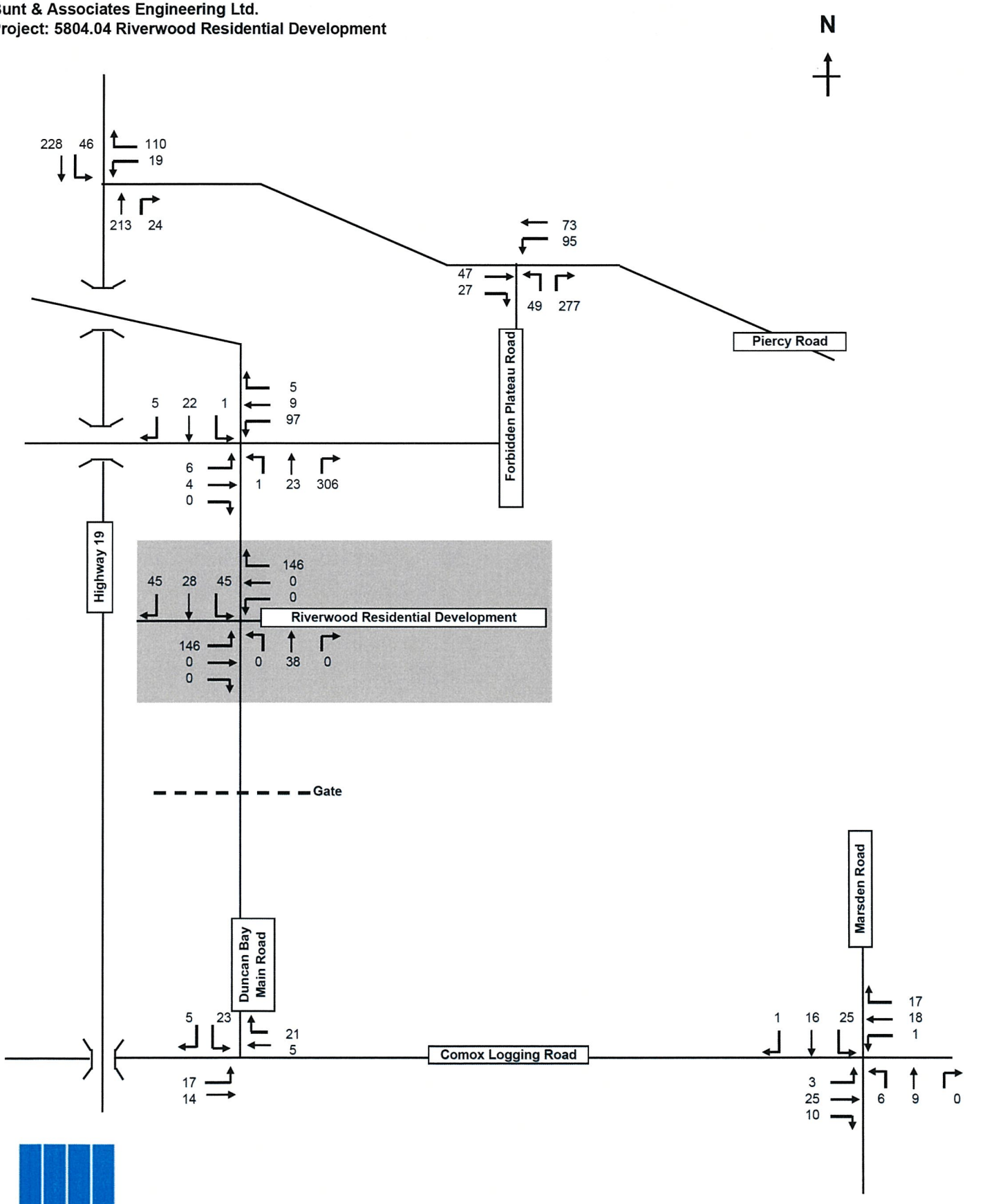
TRANSPORTATION PLANNERS AND ENGINEERS

2022
AM Peak
8:15am-9:15am

Option E (AM Peak Period, Year 2022, Growth rate 4% -2%, 100% north, Trip Gen with MoT rate)

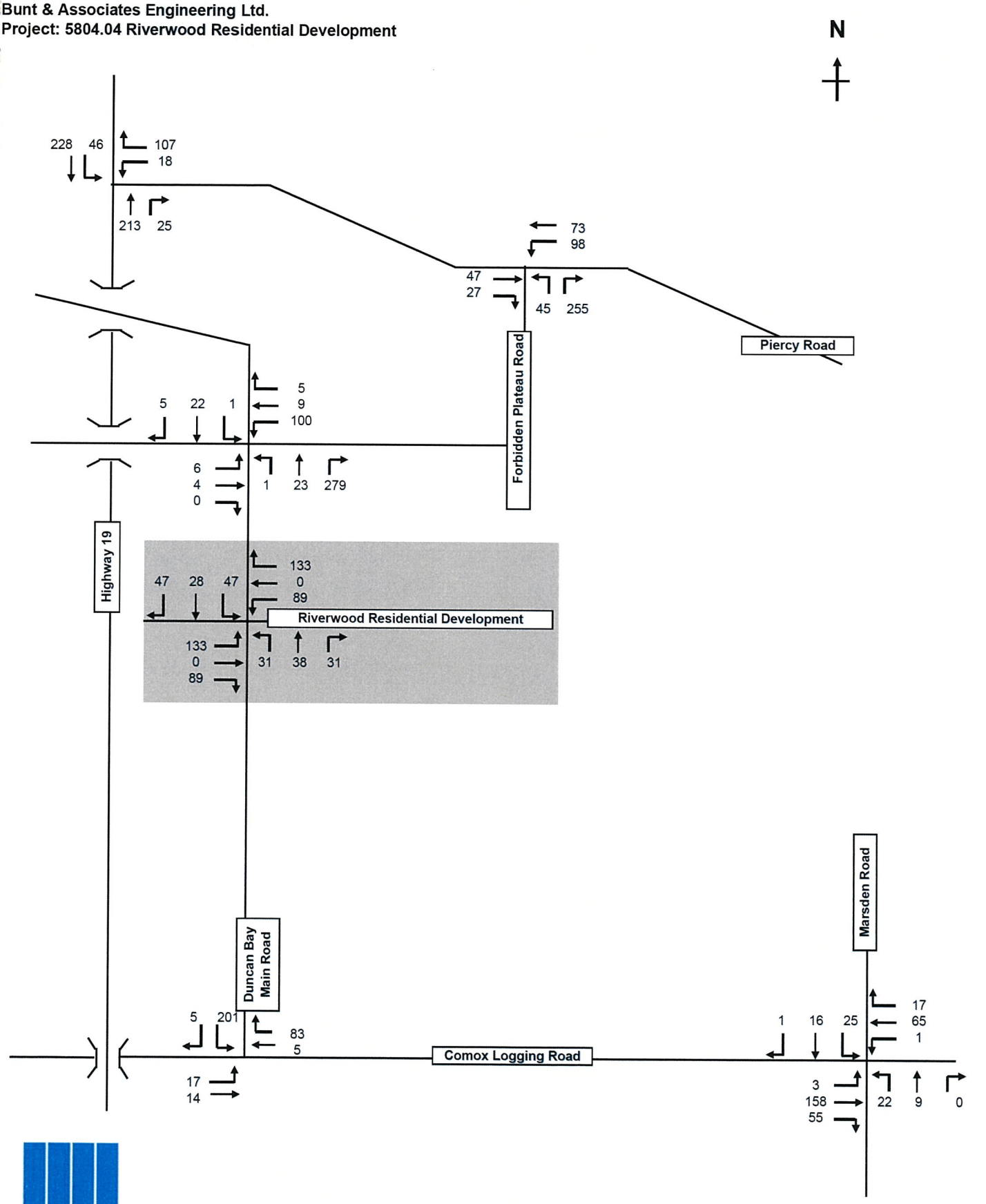
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2022
AM Peak
8:15am-9:15am

Option F (AM Peak Period, Year 2022, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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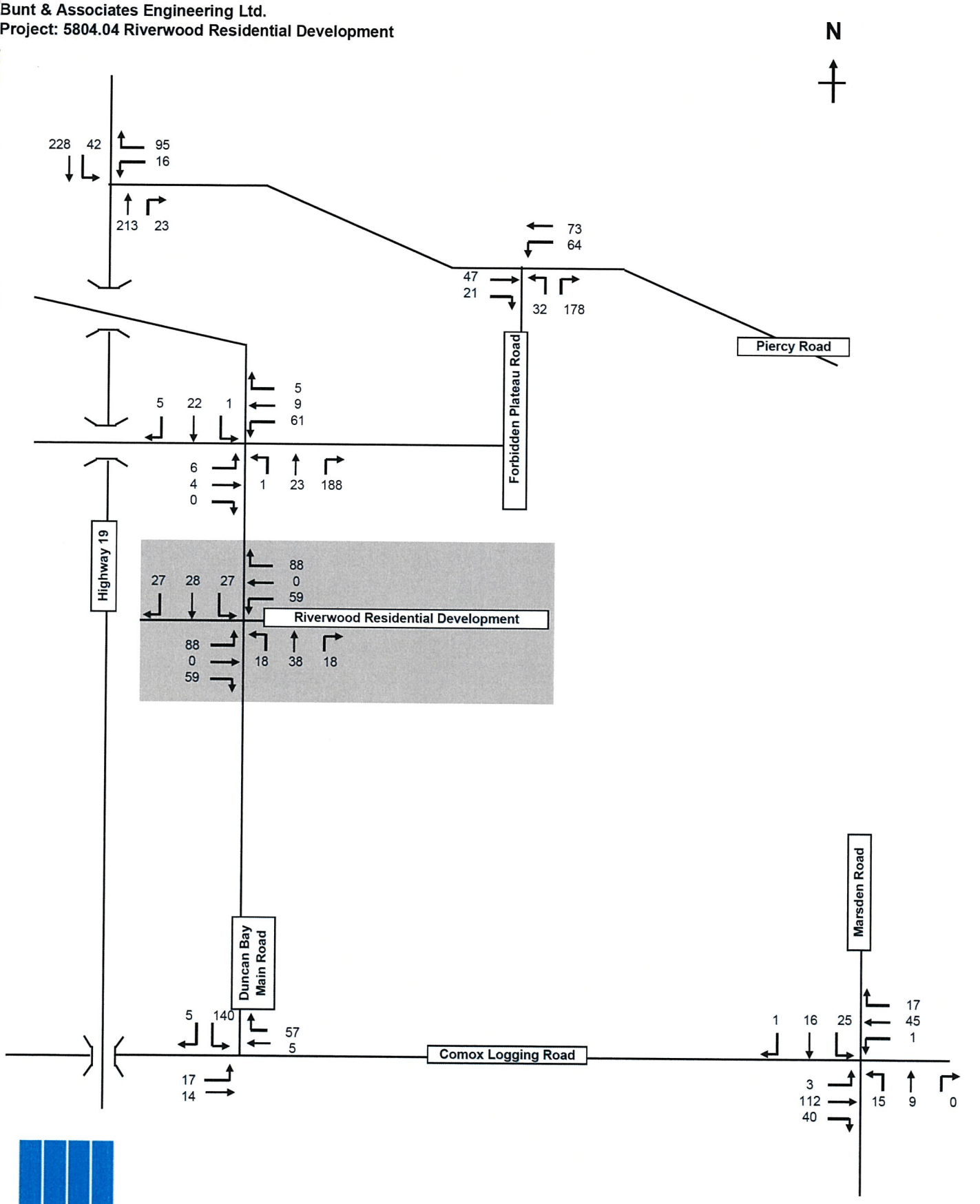
TRANSPORTATION PLANNERS AND ENGINEERS

2022
AM Peak
8:15am-9:15am

Option G (AM Peak Period, Year 2022, Growth rate 4% -2%, 60% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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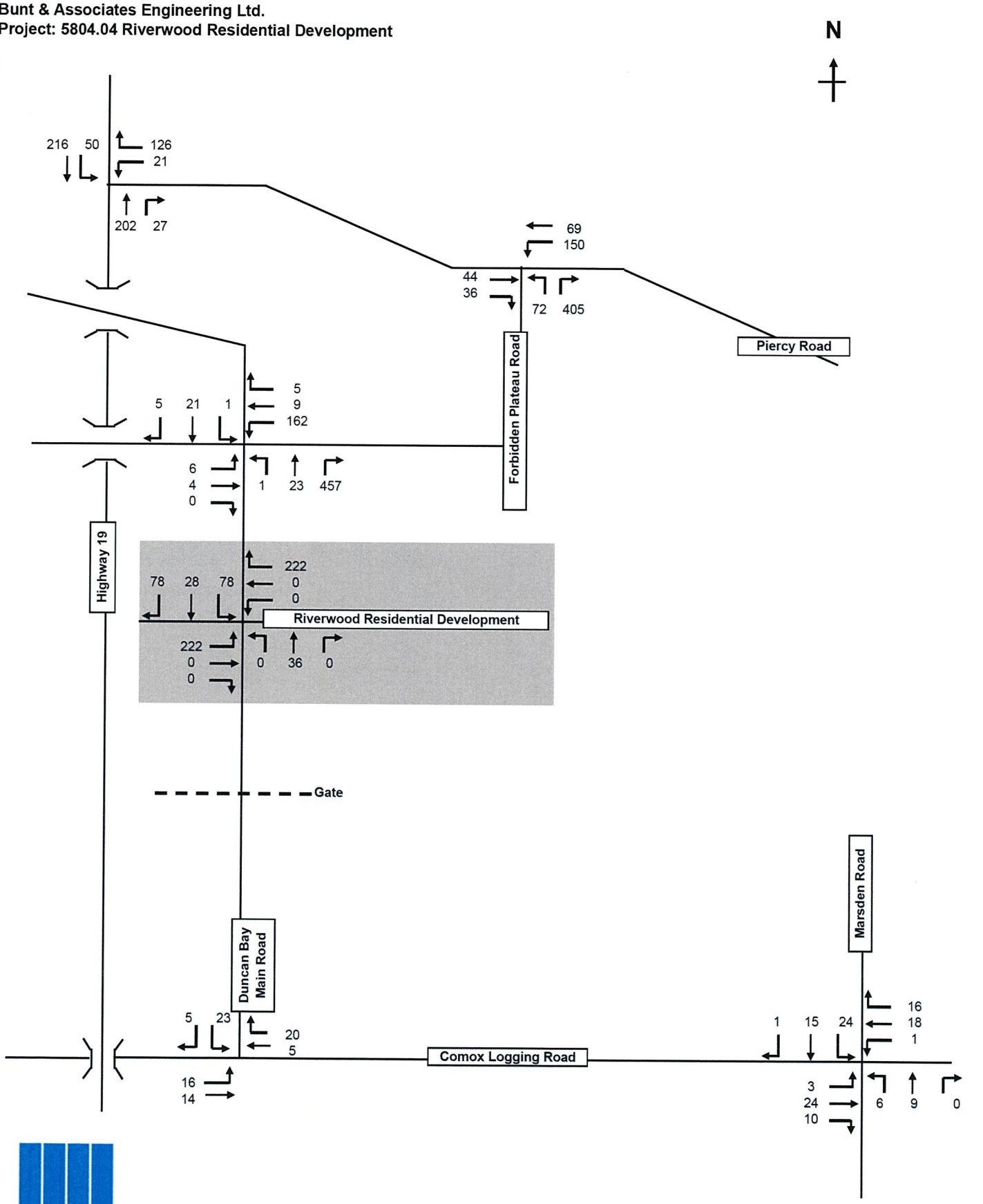
2022
AM Peak
8:15am-9:15am

Option H (AM Peak Period, Year 2022, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
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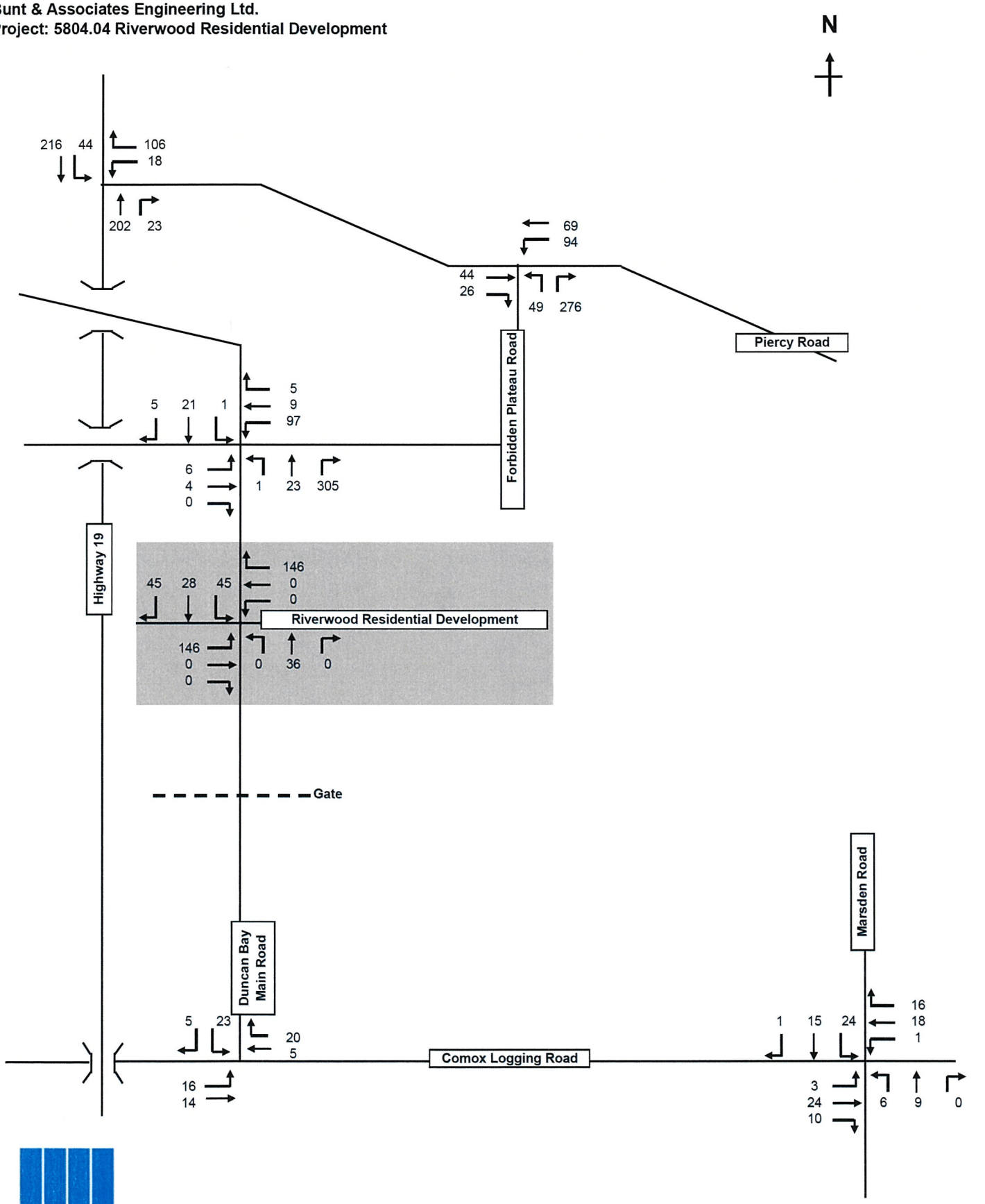
2032
AM Peak
8:15am-9:15am

Option A (AM peak Period, Year 2032, Growth rate 2% -1%, 100% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

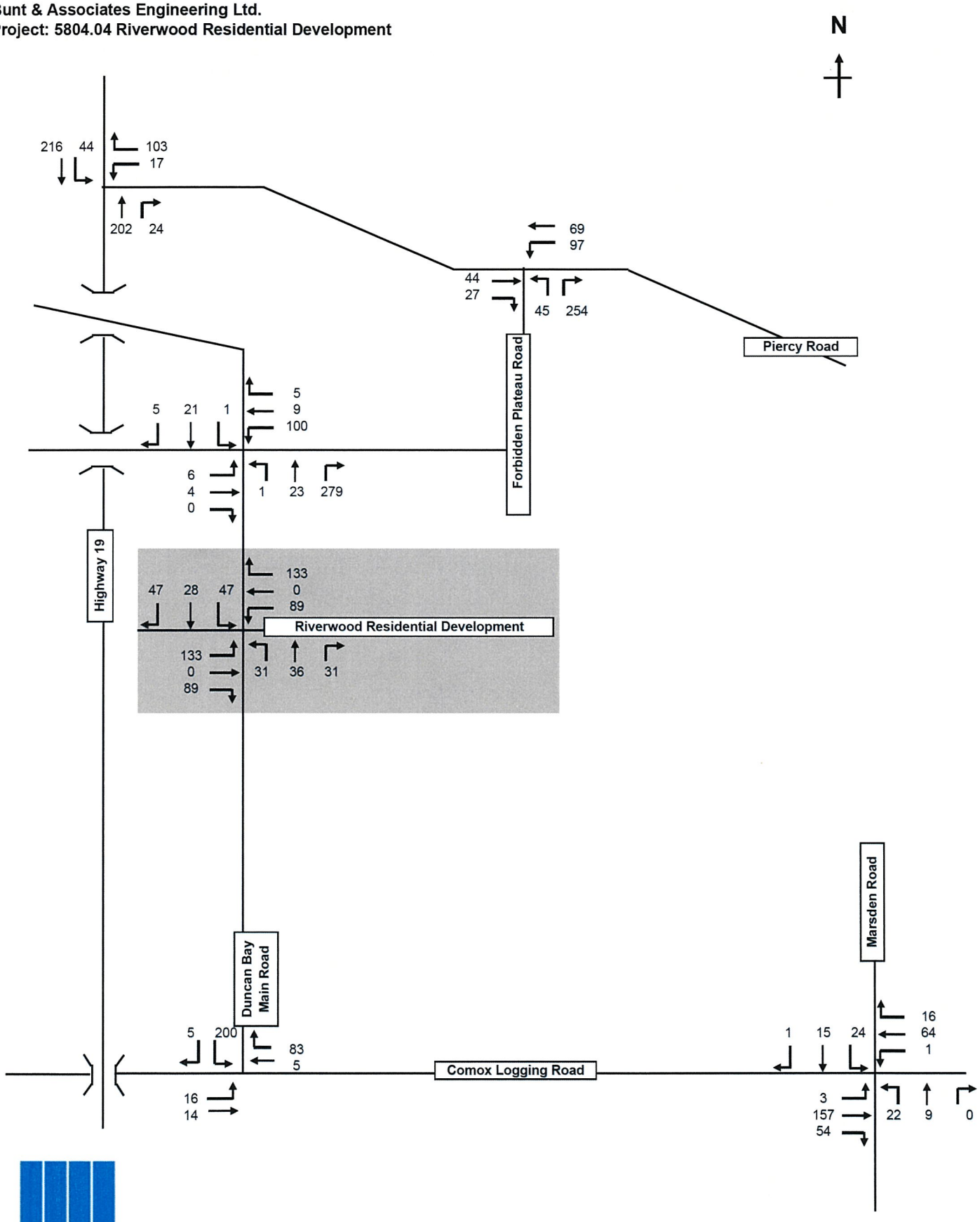


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2032
AM Peak
8:15am-9:15am

Option B (AM Peak Period, Year 2032, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

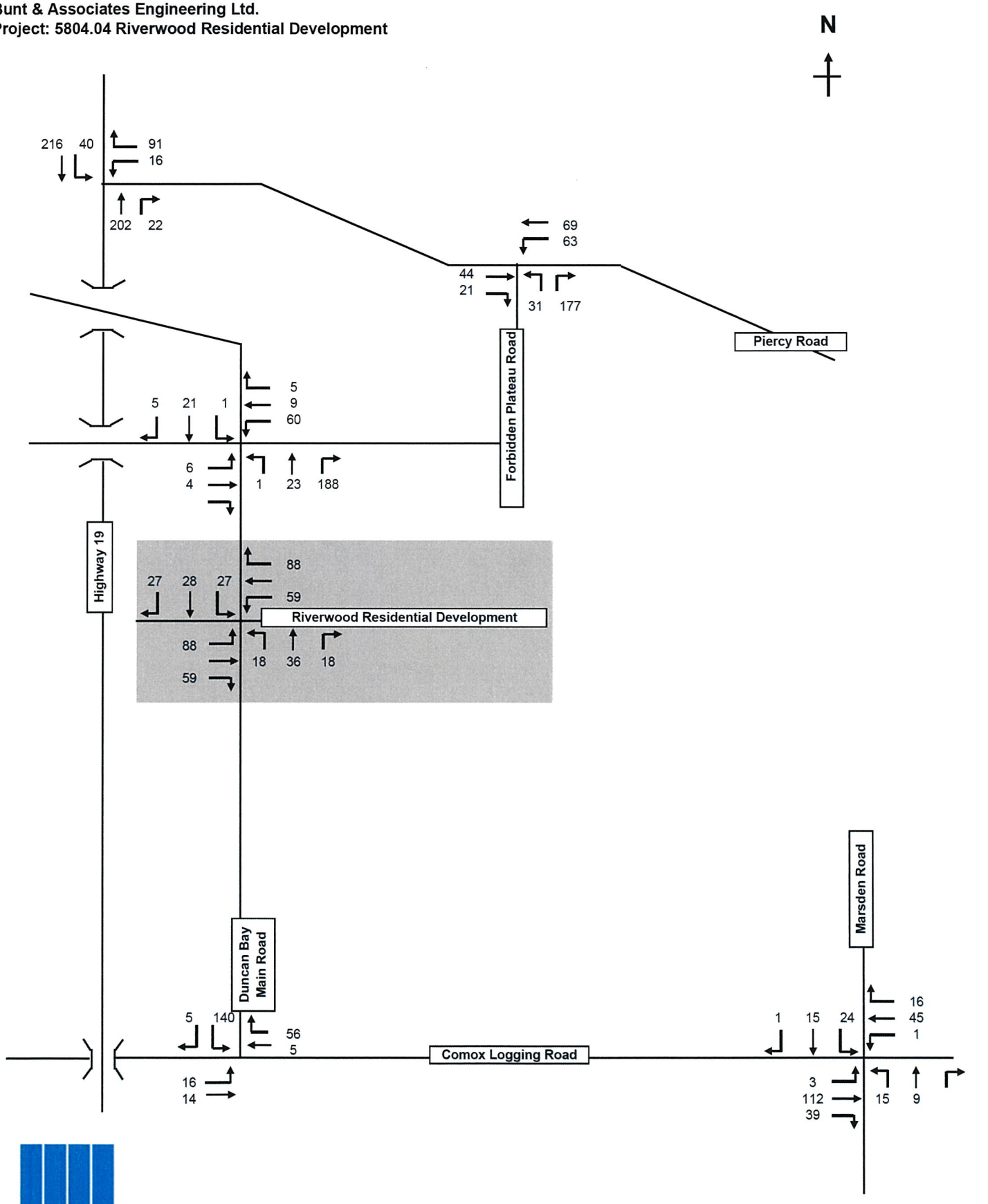
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2032
AM Peak
8:15am-9:15am
Option C (AM Peak Period, Year 2032, Growth rate 2% -1%, 60% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

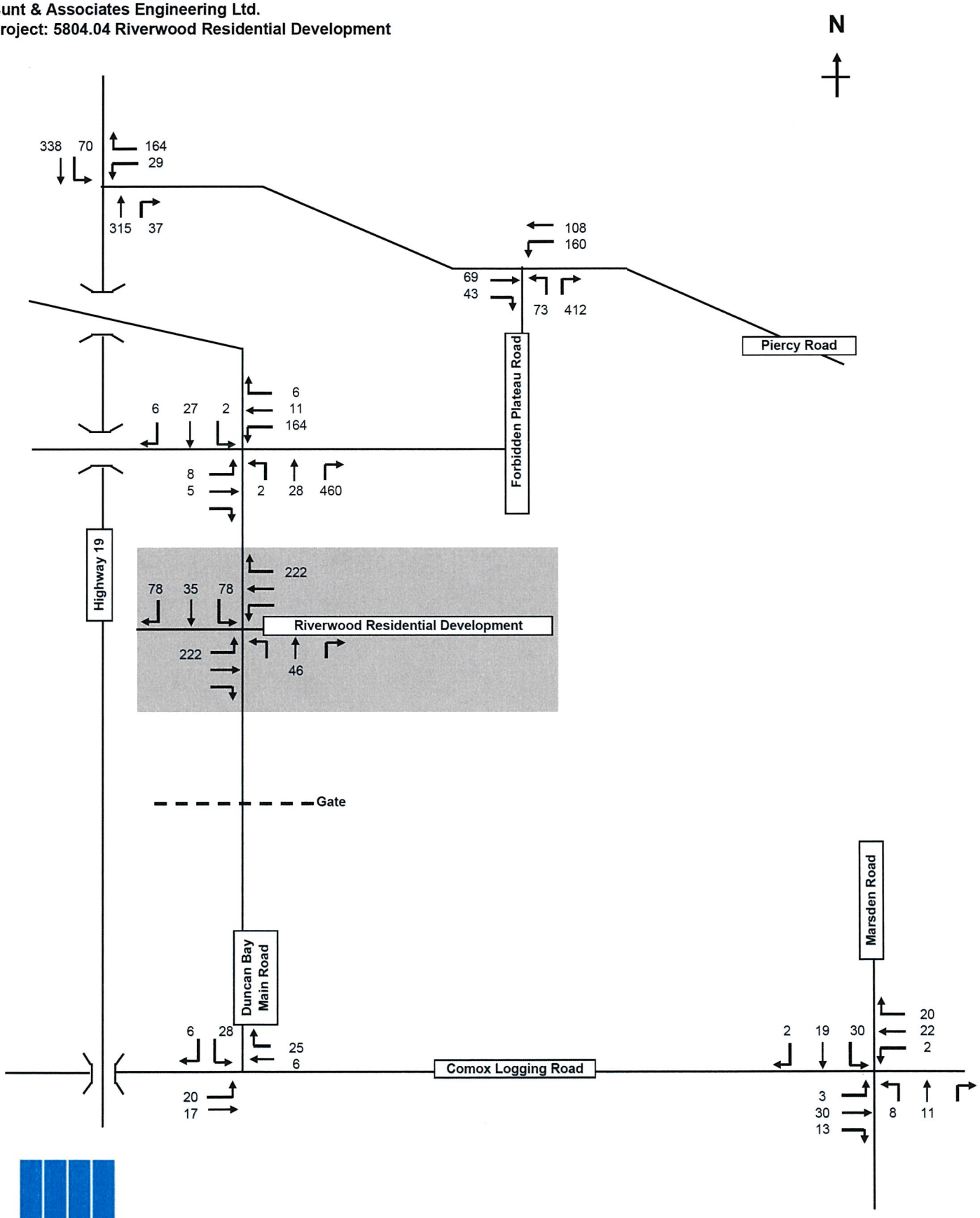


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2032
AM Peak
8:15am-9:15am

Option D (AM Peak Period, Year 2032, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

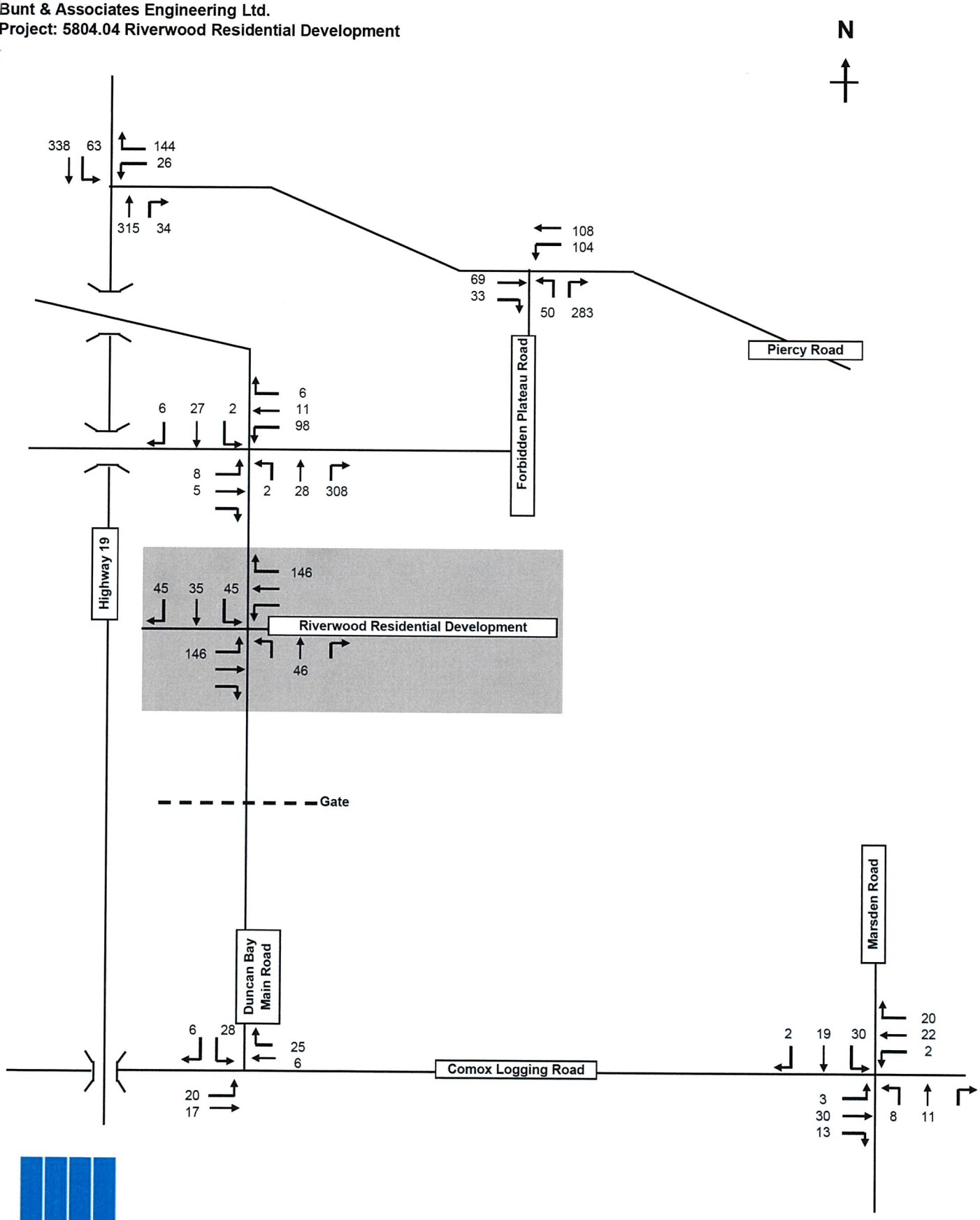
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2032
AM Peak
8:15am-9:15am
Option E (AM Peak Period, Year 2032, Growth rate 4% -2%, 100% north, Trip Gen with MoT rate)

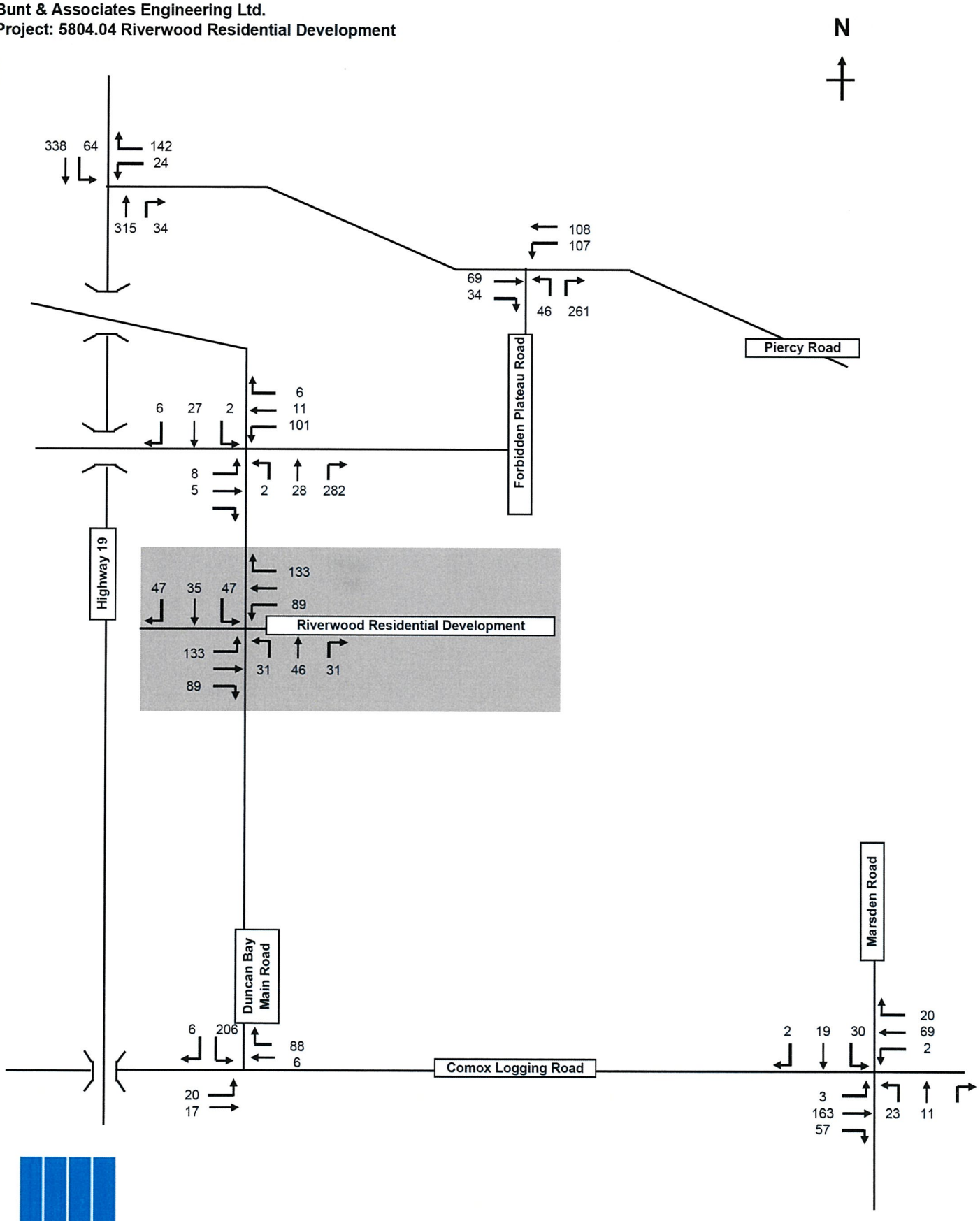
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2032
AM Peak
8:15am-9:15am

Option F (AM Peak Period, Year 2032, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

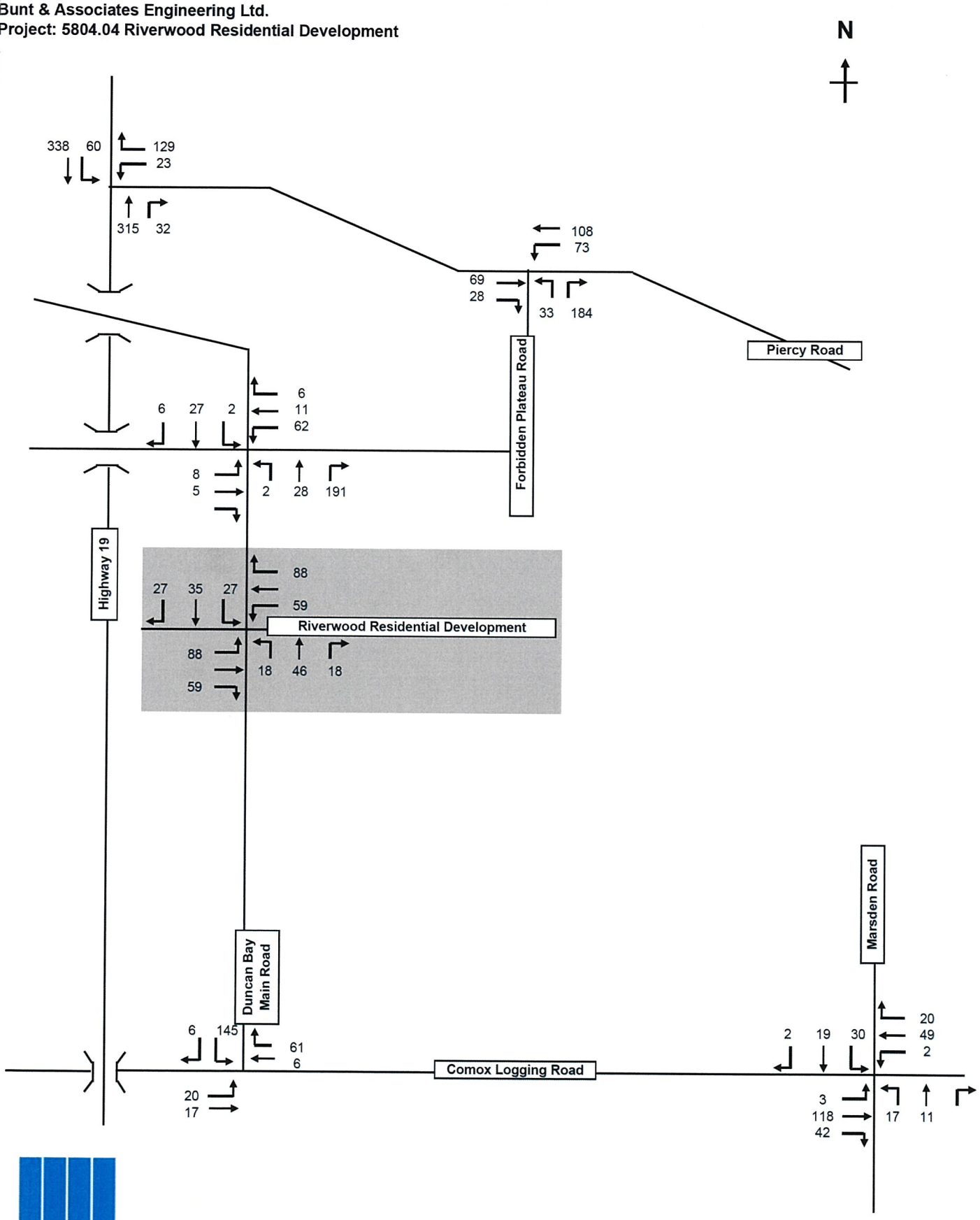
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2032
AM Peak
8:15am-9:15am

Option G (AM Peak Period, Year 2032, Growth rate 4% -2%, 60% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

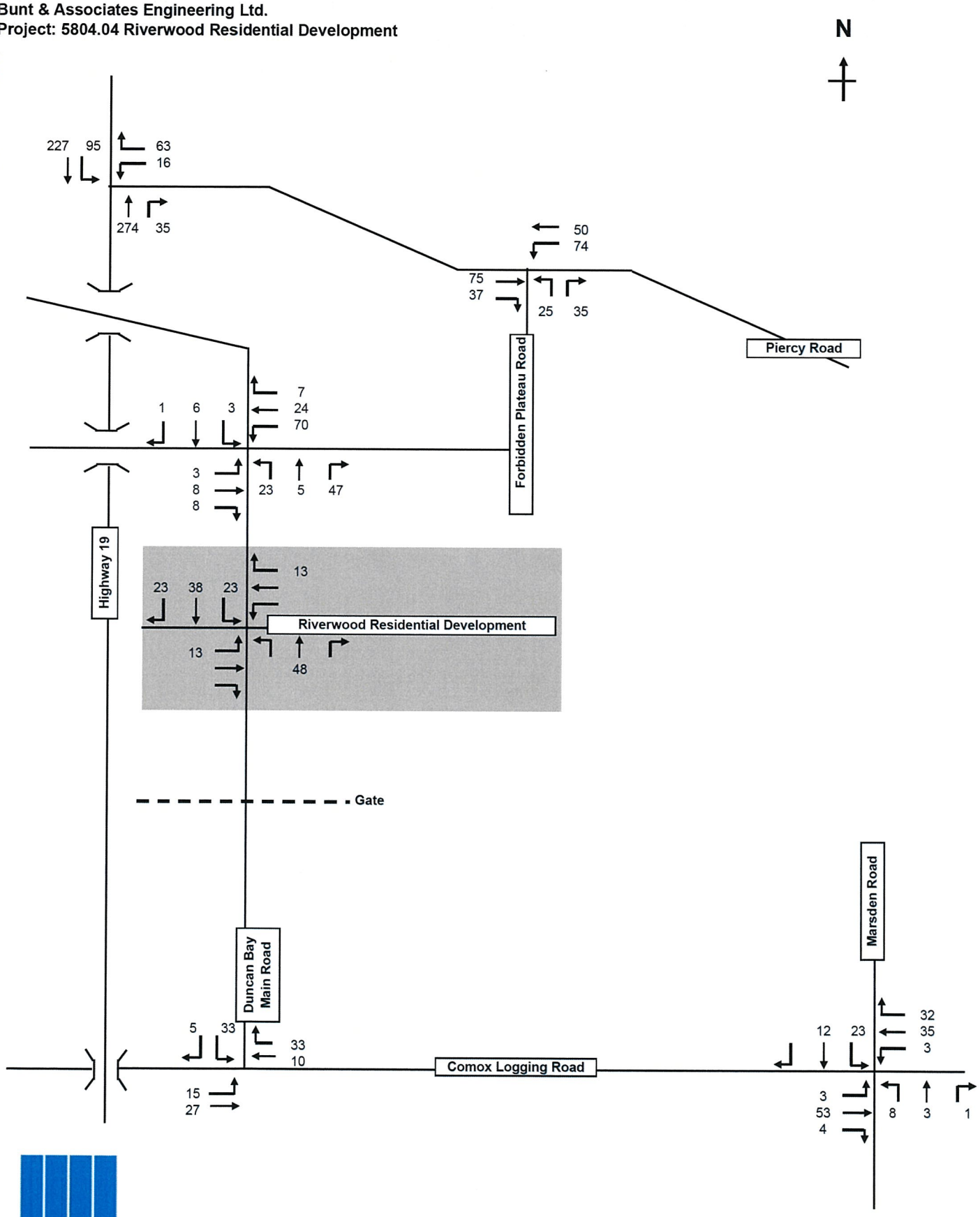


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2032
AM Peak
8:15am-9:15am

Option H (AM Peak Period, Year 2032, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

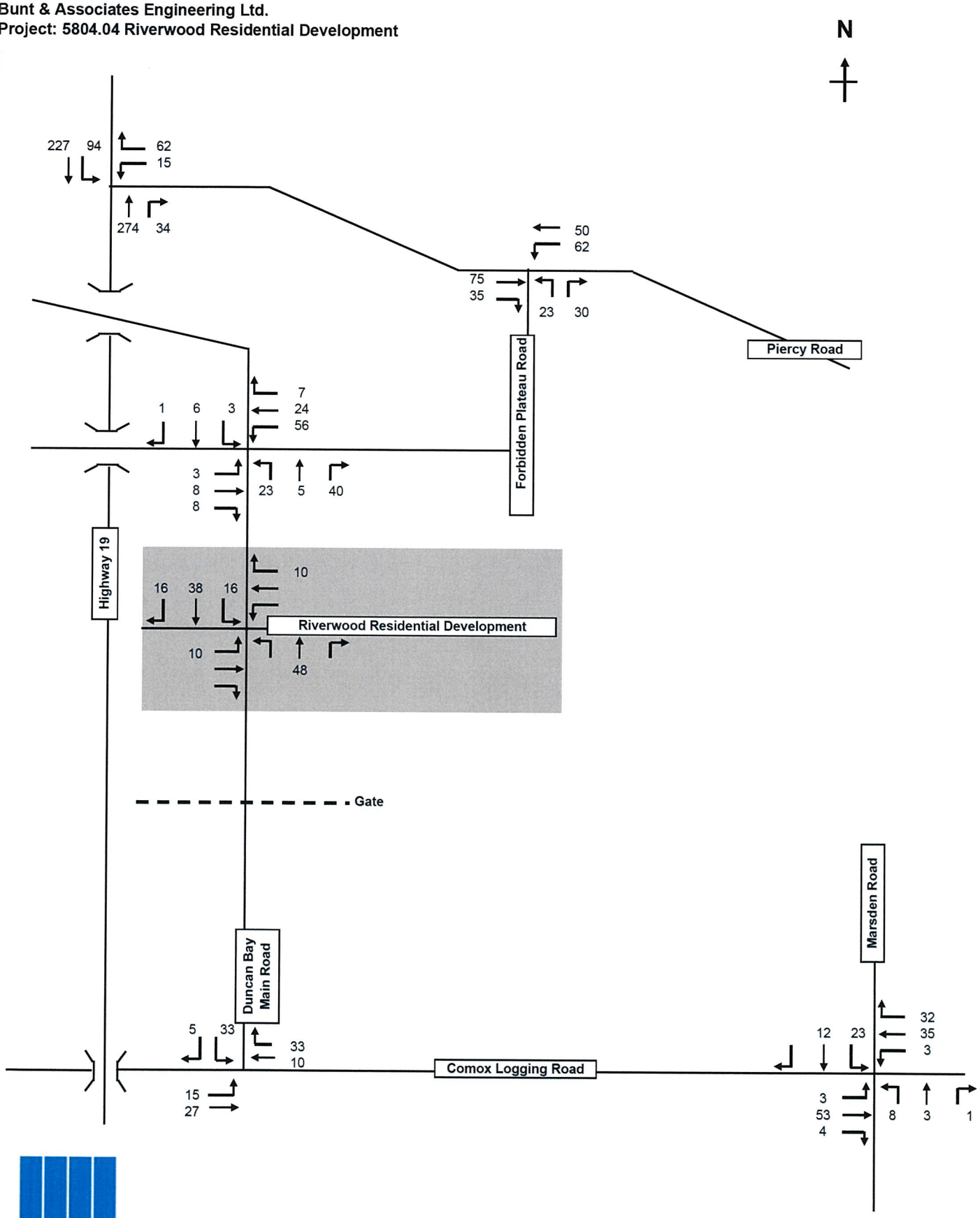
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2012
PM Peak
4:15pm-5:15pm

Option A (PM peak Period, Year 2012, Growth rate 2% -1%, 100% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

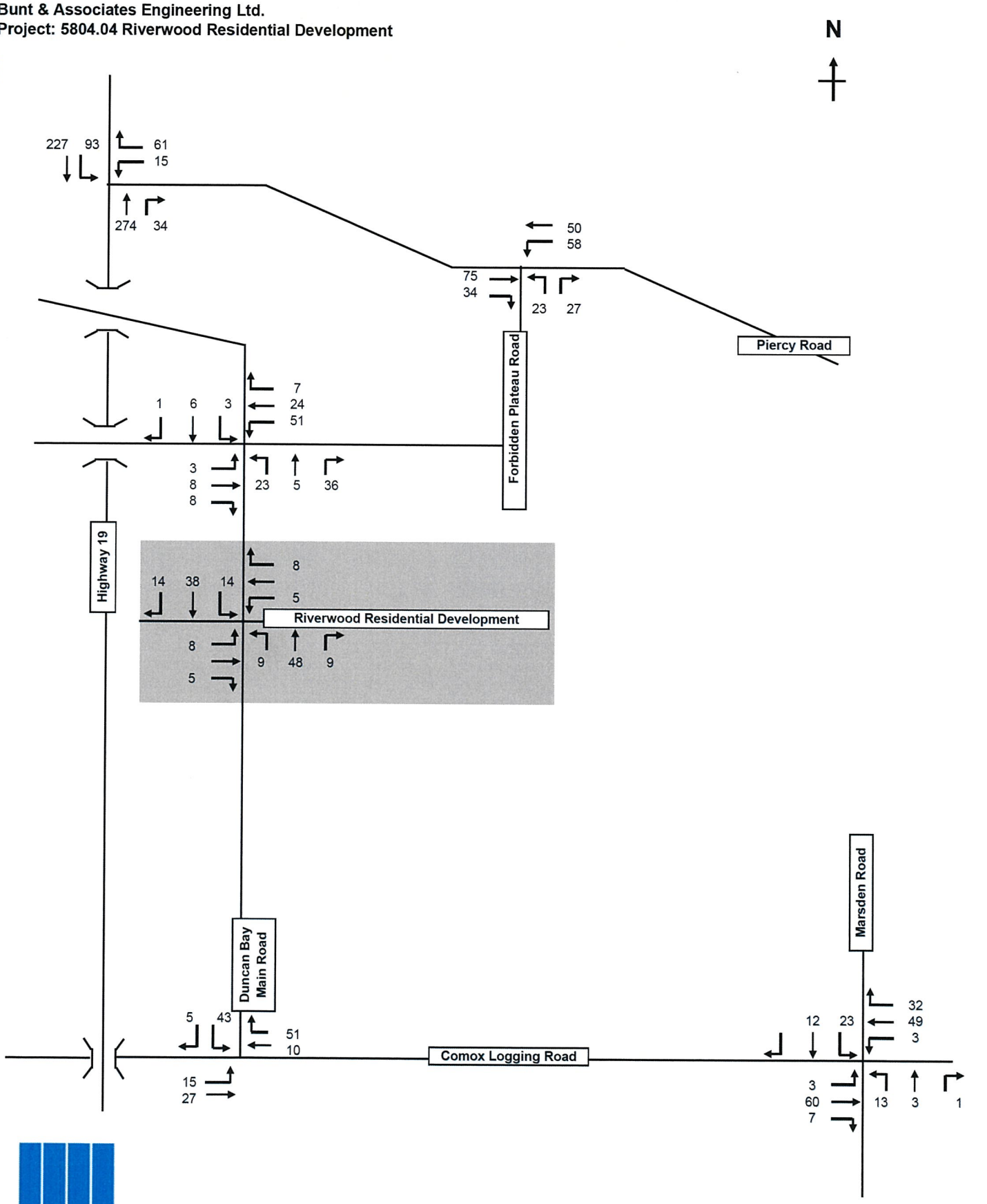


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
PM Peak
4:15pm-5:15pm

Option B (PM Peak Period, Year 2012, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

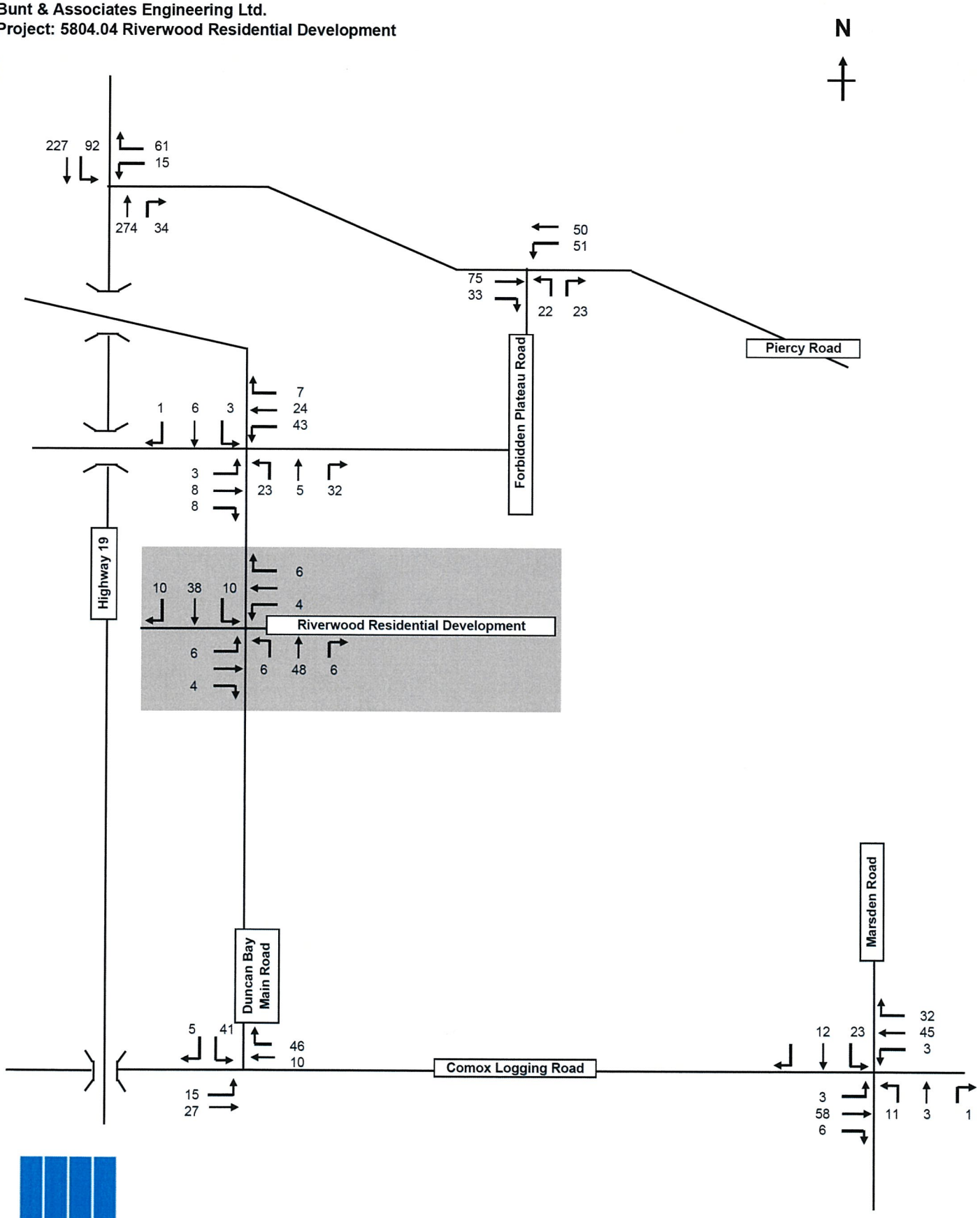


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
PM Peak
4:15pm-5:15pm

Option C (PM Peak Period, Year 2012, Growth rate 2% -1%, 60% north, Trip Gen with MoT rate)

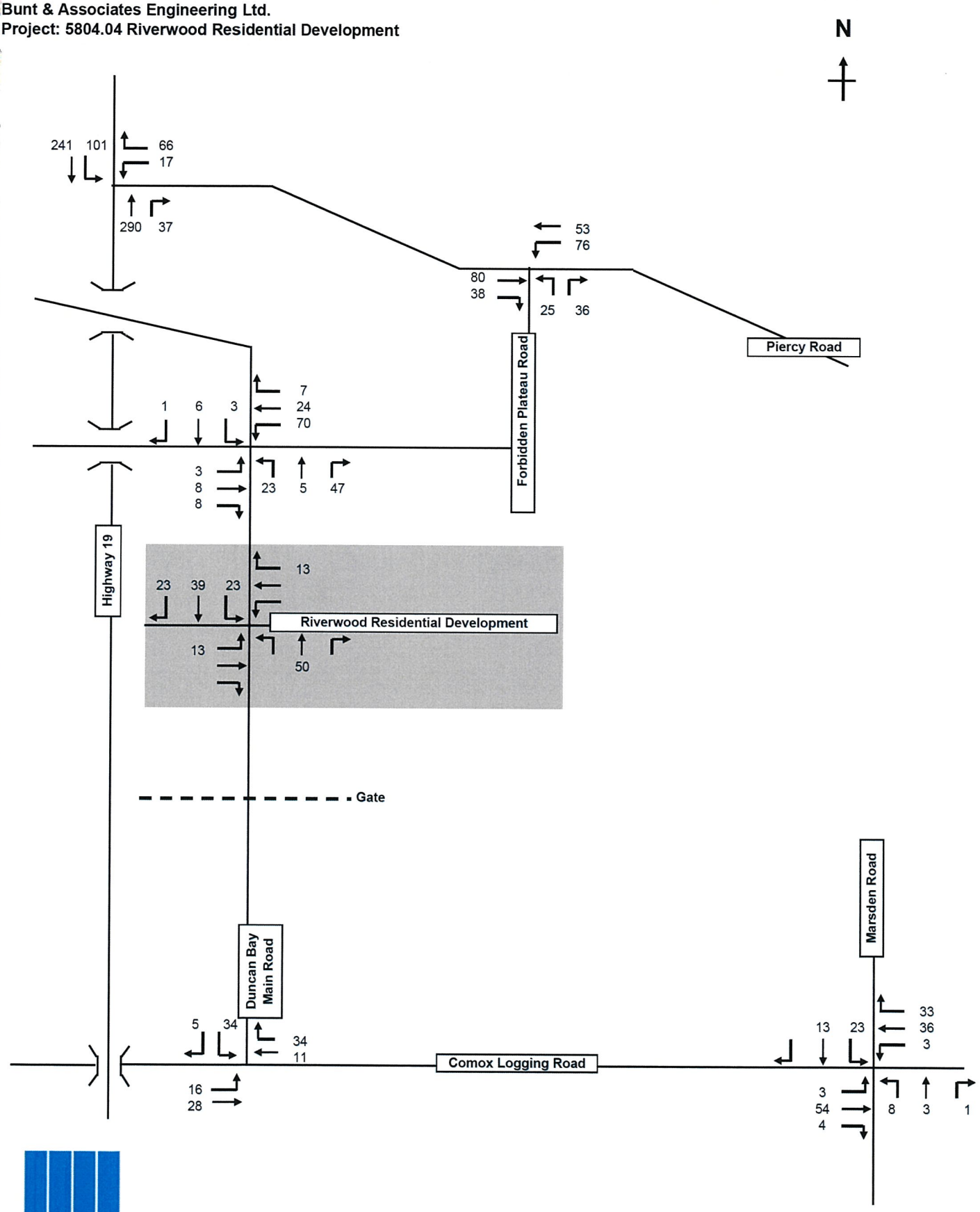
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2012
PM Peak
4:15pm-5:15pm

Option D (PM Peak Period, Year 2012, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

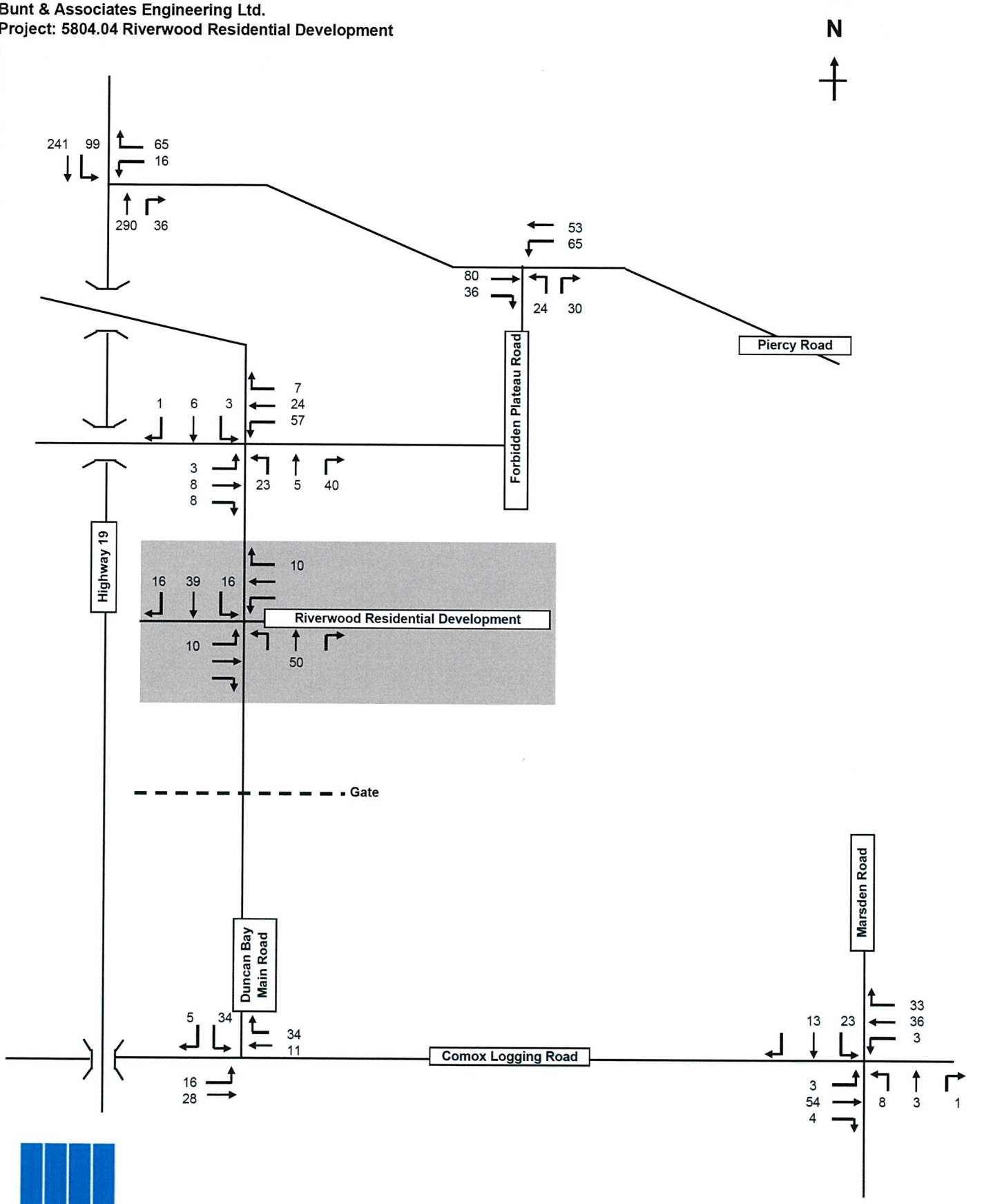


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
PM Peak
4:15pm-5:15pm

Option E (PM Peak Period, Year 2012, Growth rate 4% -2%, 100% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

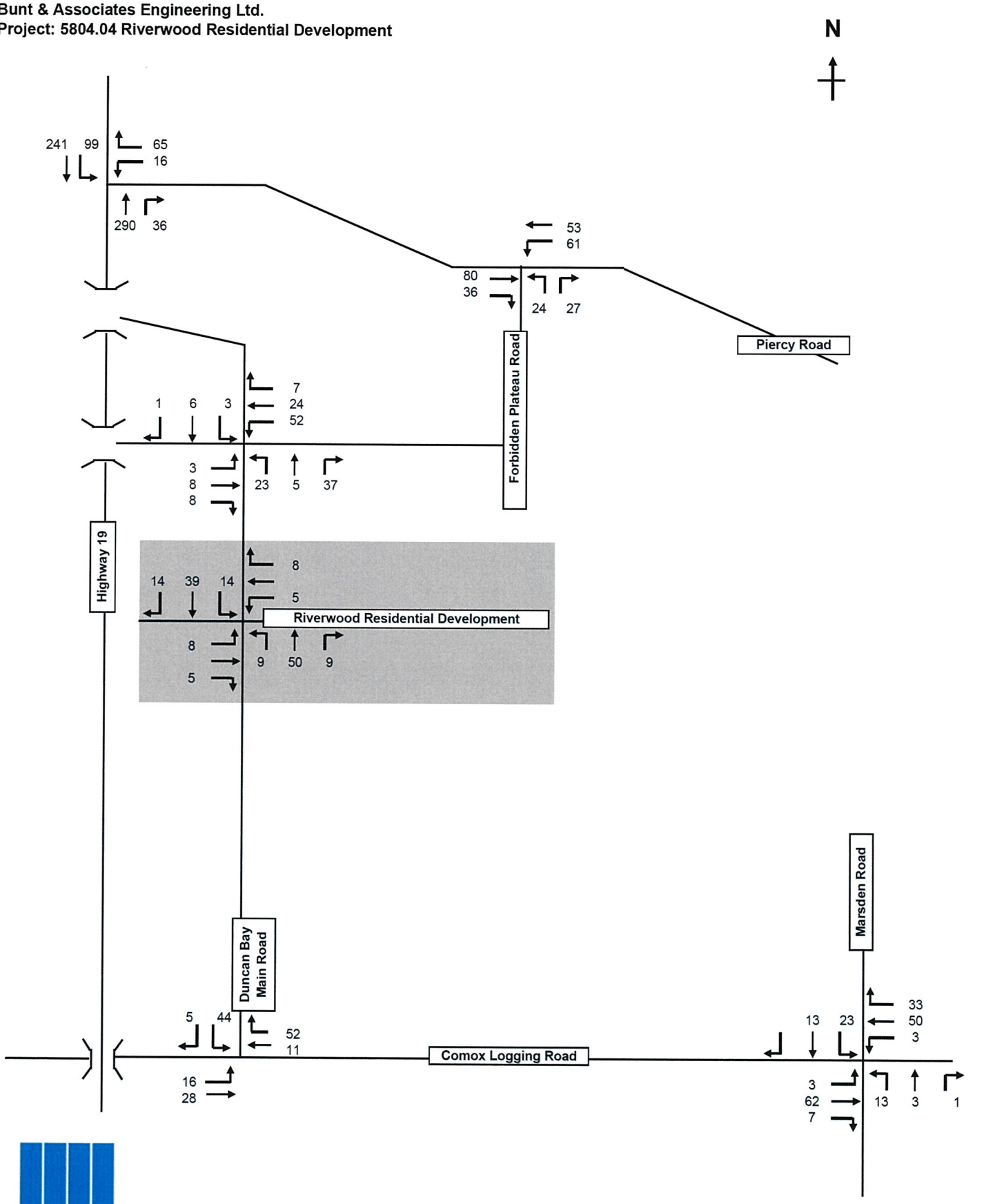


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
PM Peak
4:15pm-5:15pm

Option F (PM Peak Period, Year 2012, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

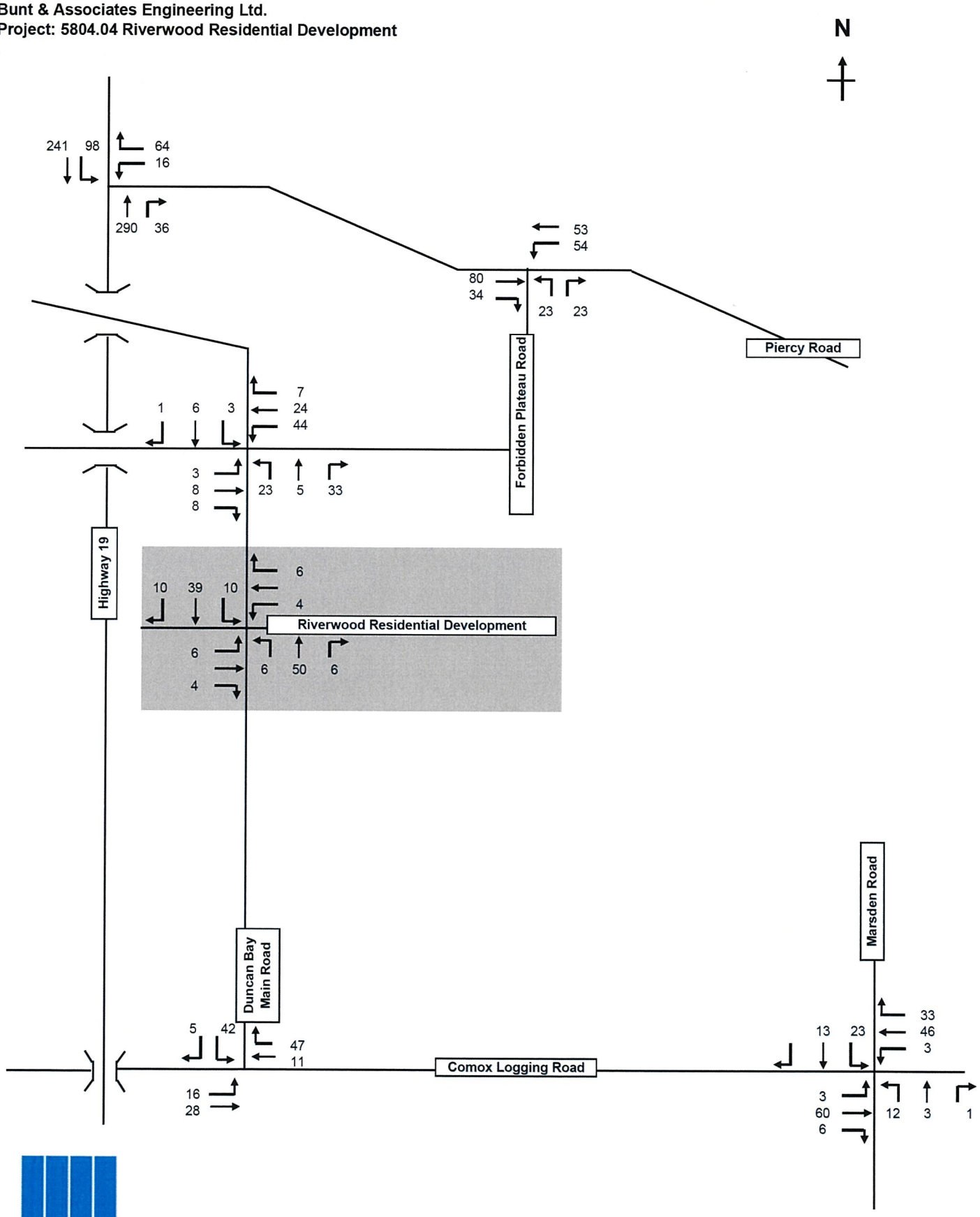
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2012
PM Peak
4:15pm-5:15pm

Option G (PM Peak Period, Year 2012, Growth rate 4% -2%, 60% north, Trip Gen with MoT rate)

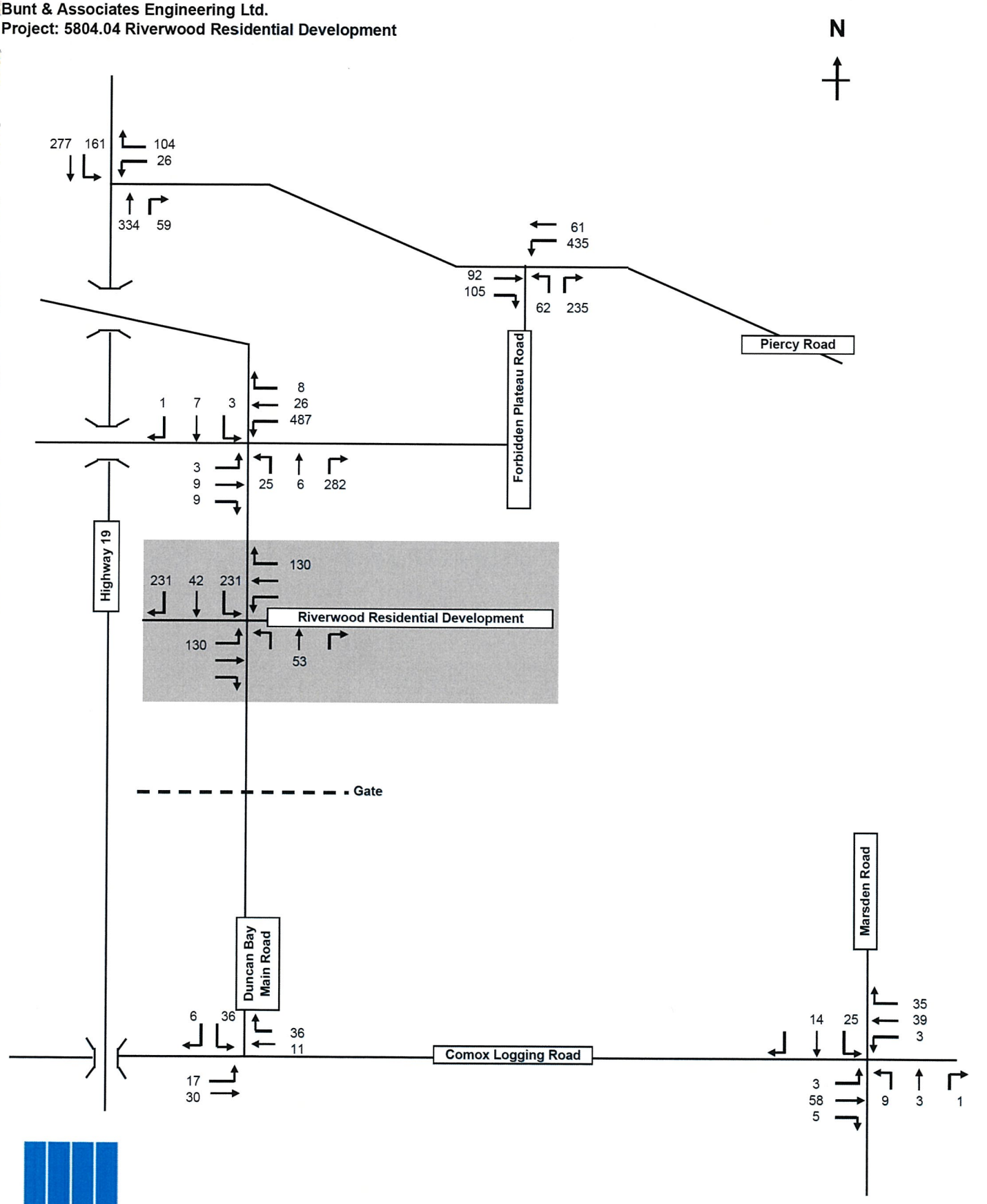
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2012
PM Peak
4:15pm-5:15pm

Option H (PM Peak Period, Year 2012, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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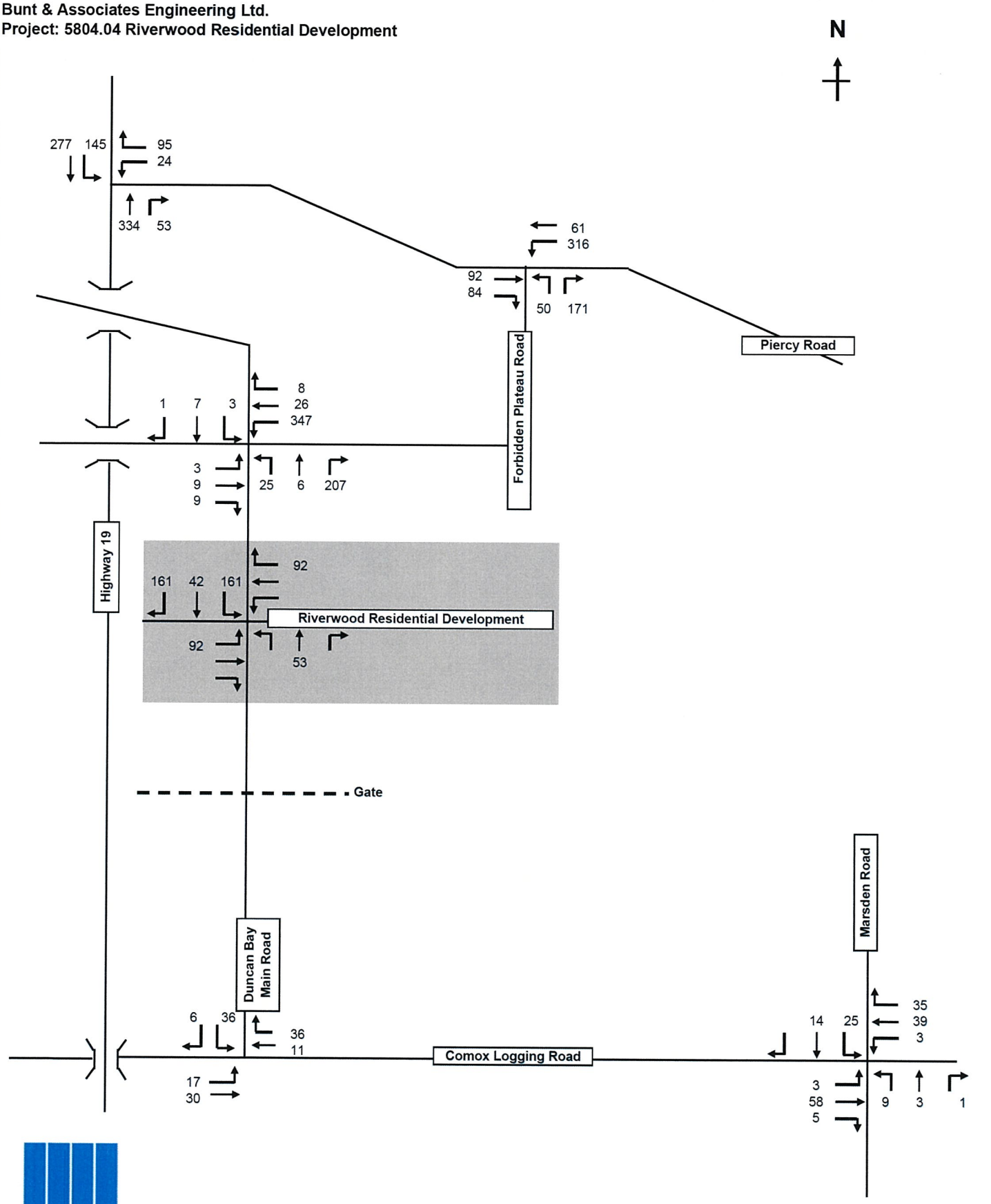
TRANSPORTATION PLANNERS AND ENGINEERS

2022
PM Peak
4:15pm-5:15pm

Option A (PM peak Period, Year 2022, Growth rate 2% -1%, 100% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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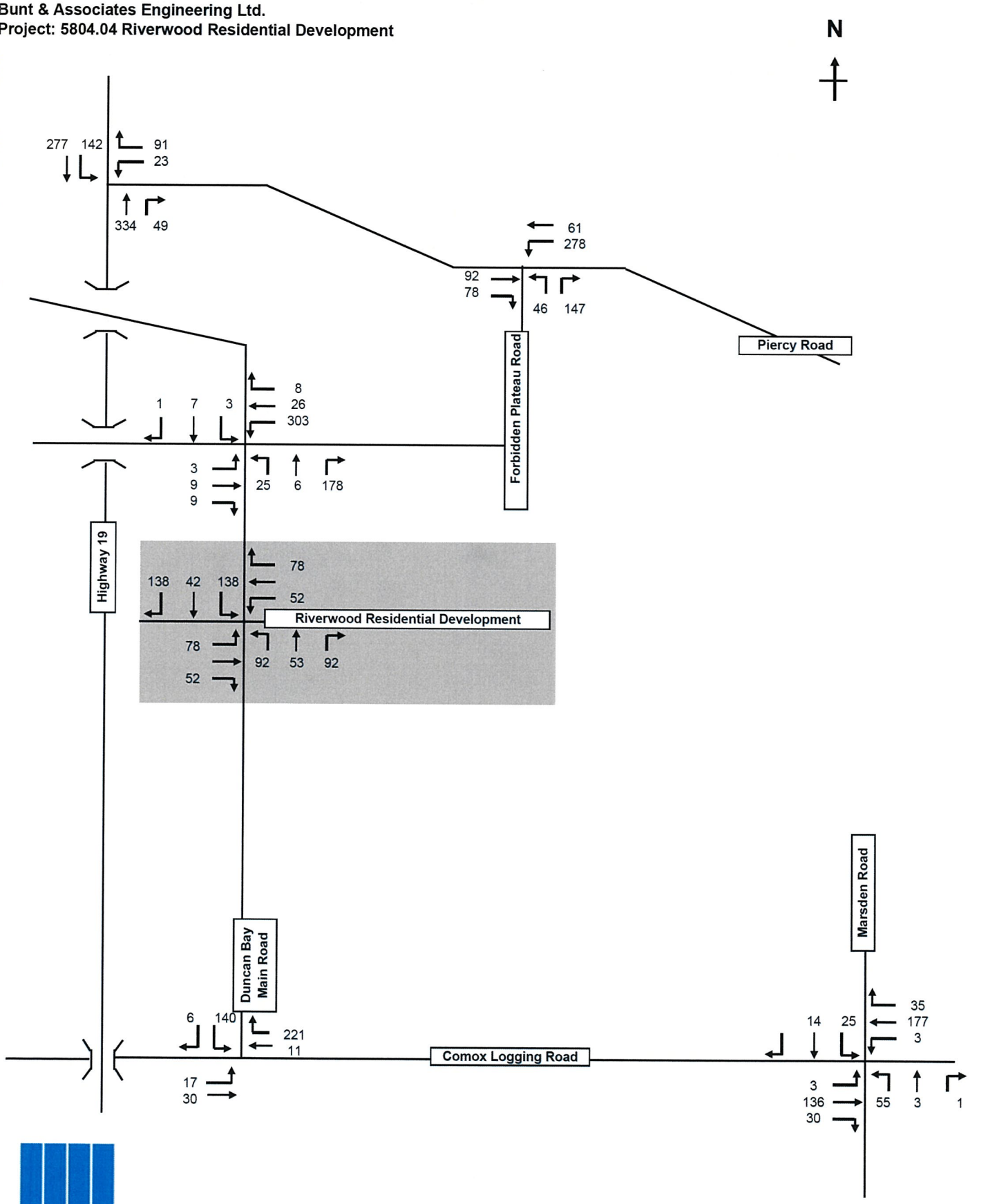
TRANSPORTATION PLANNERS AND ENGINEERS

2022
PM Peak
4:15pm-5:15pm

Option B (PM Peak Period, Year 2022, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

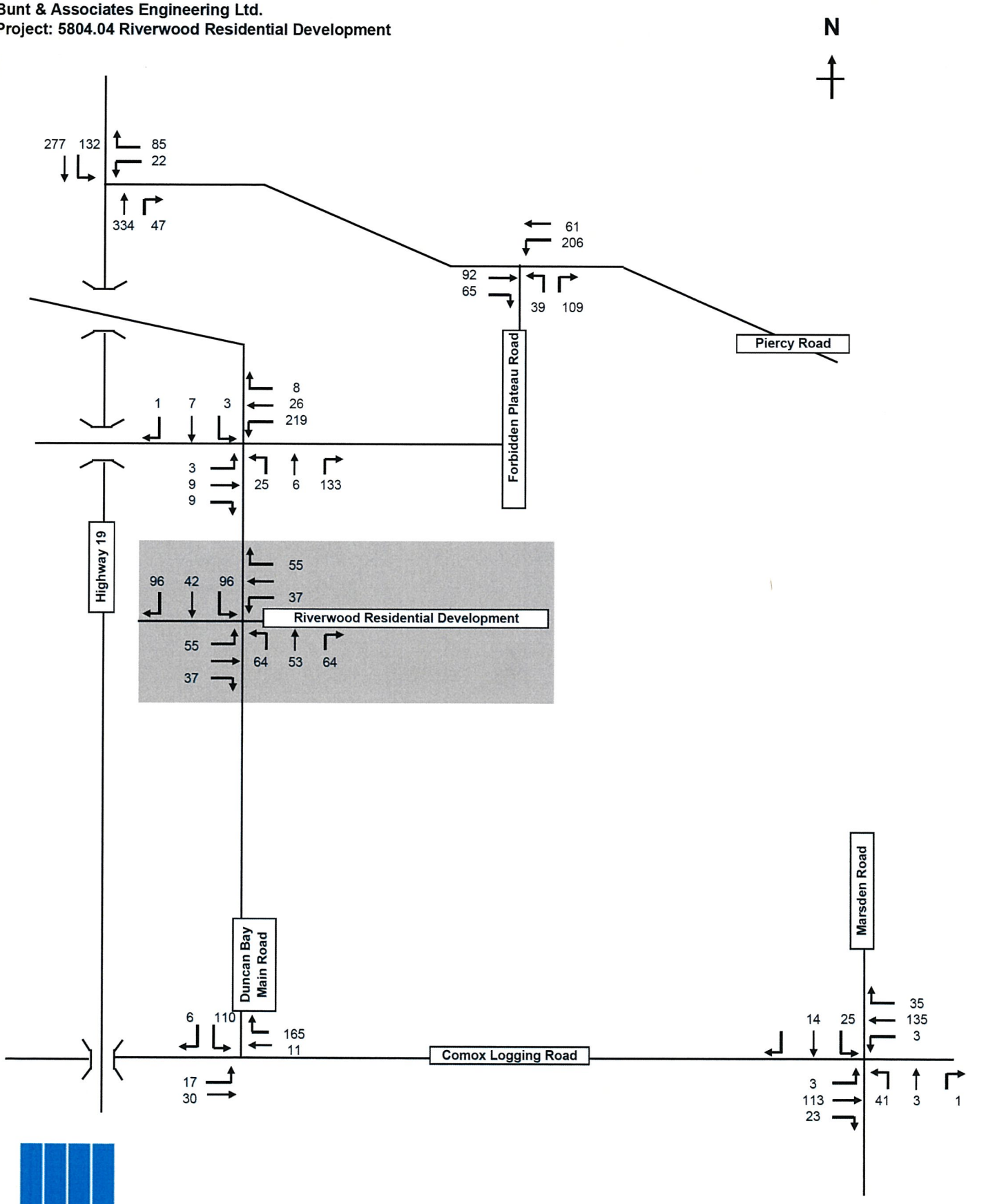
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2022
PM Peak
4:15pm-5:15pm

Option C (PM Peak Period, Year 2022, Growth rate 2% -1%, 60% north, Trip Gen with MoT rate)

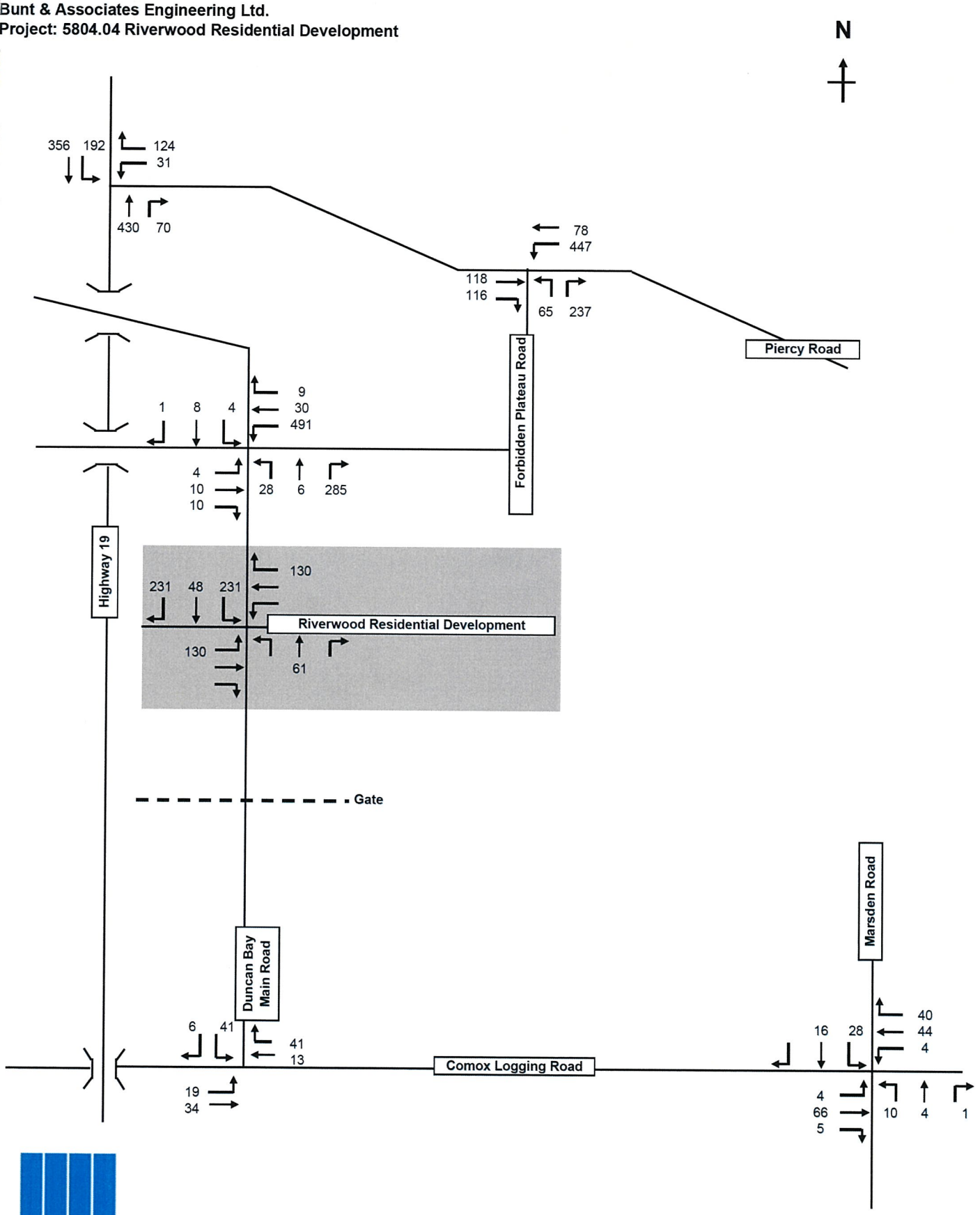
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2022
PM Peak
4:15pm-5:15pm

Option D (PM Peak Period, Year 2022, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

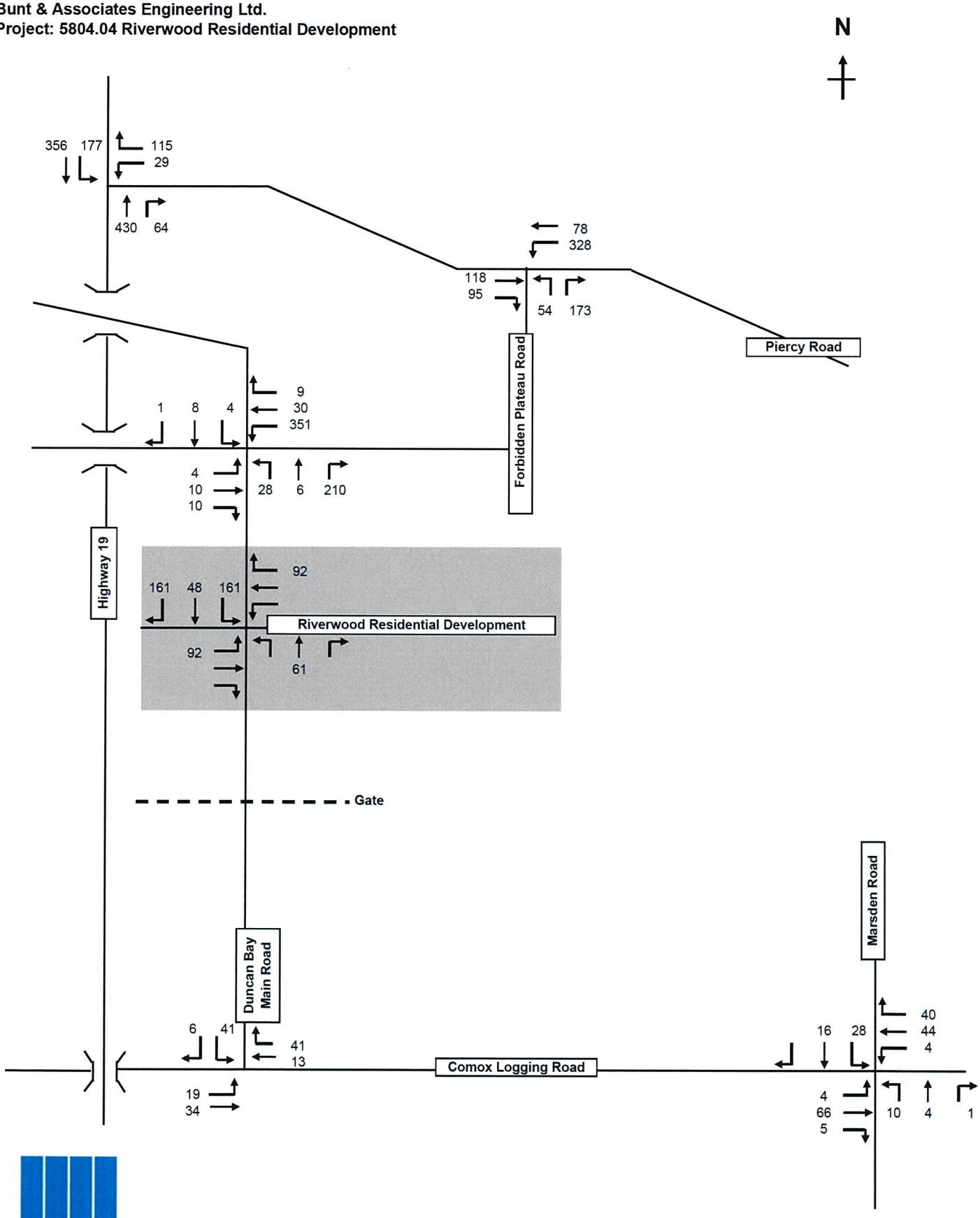


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2022
PM Peak
4:15pm-5:15pm

Option E (PM Peak Period, Year 2022, Growth rate 4% -2%, 100% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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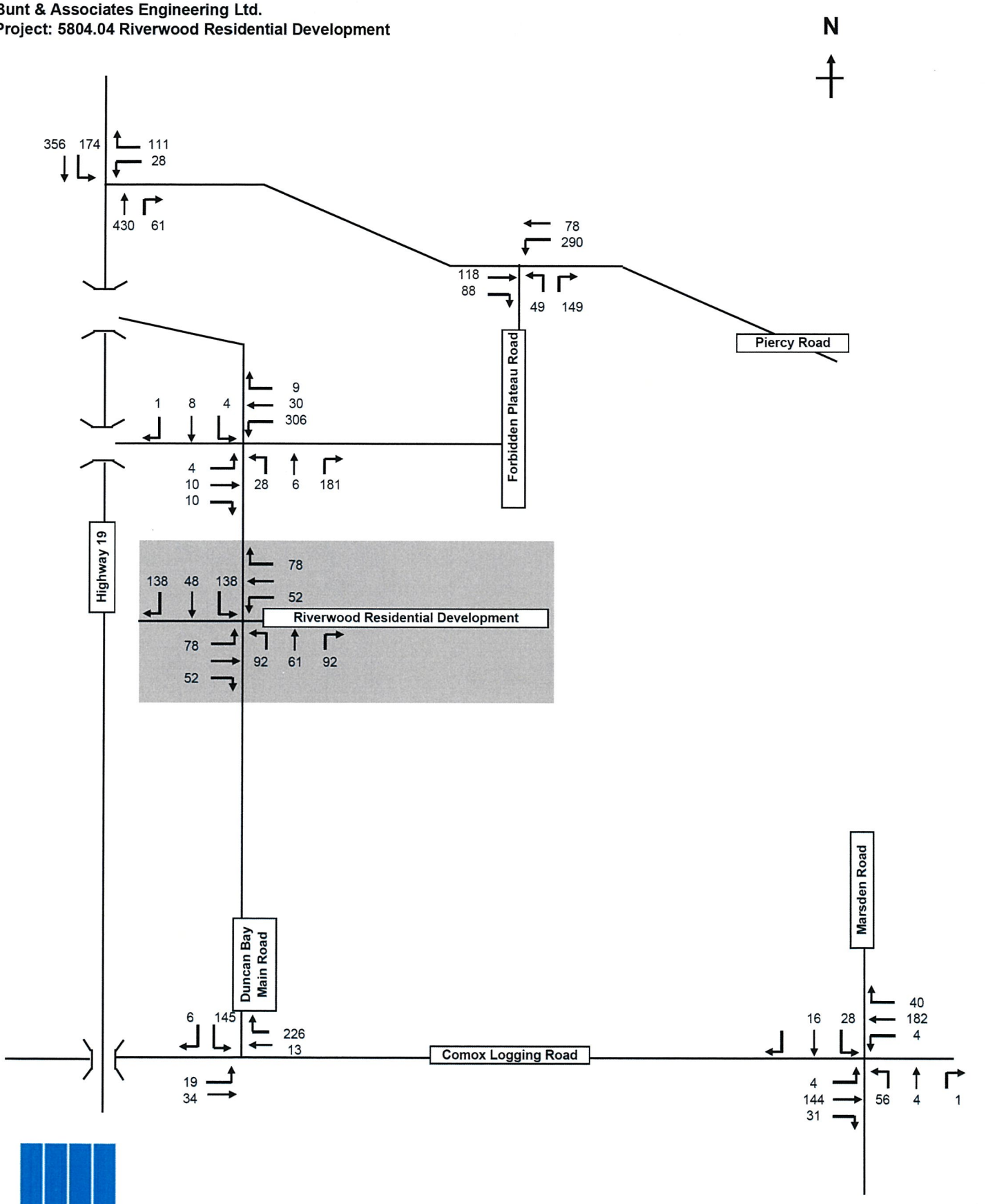
TRANSPORTATION PLANNERS AND ENGINEERS

2022
PM Peak
4:15pm-5:15pm
Option F (PM Peak Period, Year 2022, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

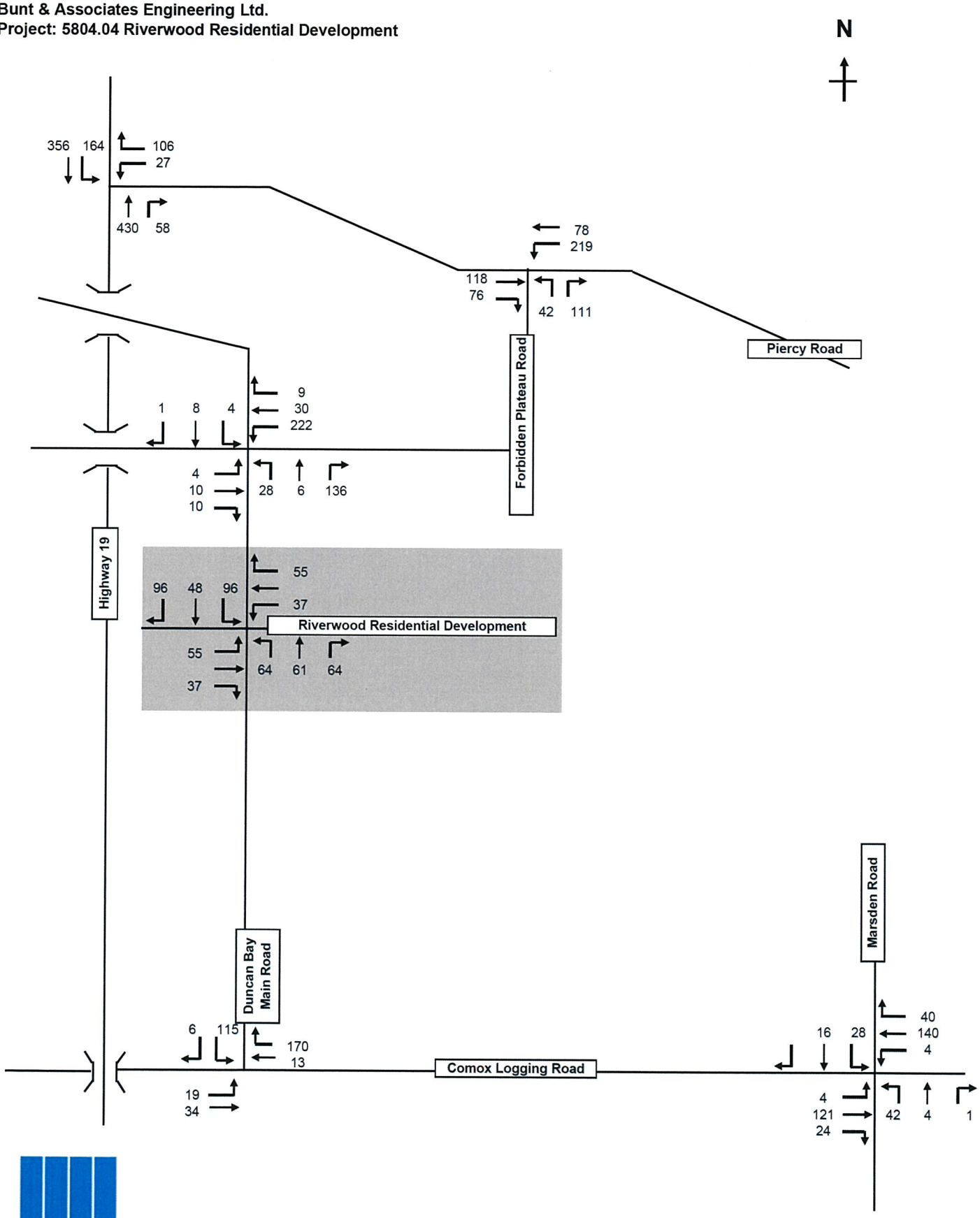
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2022
PM Peak
4:15pm-5:15pm

Option G (PM Peak Period, Year 2022, Growth rate 4% -2%, 60% north, Trip Gen with MoT rate)

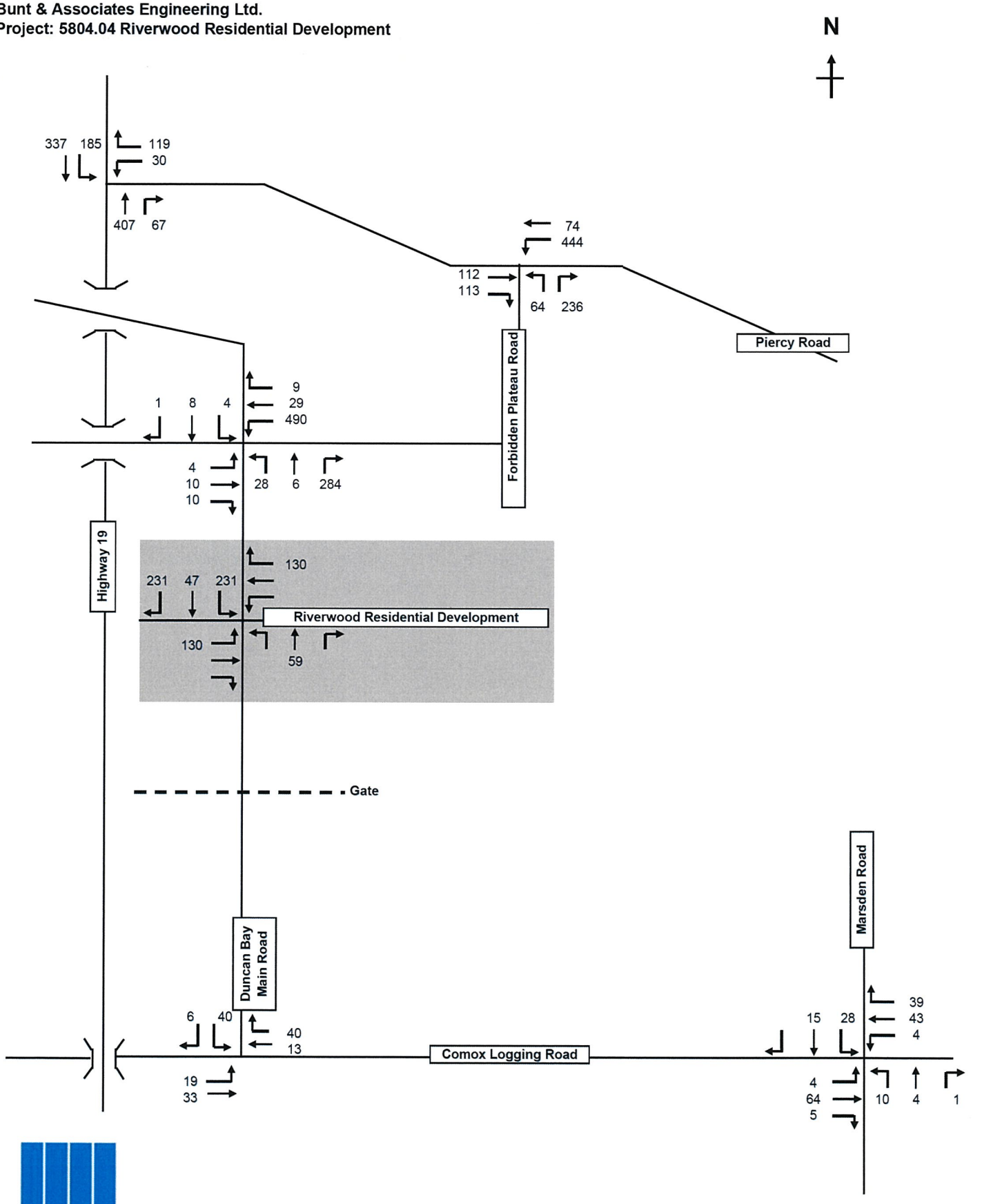
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2022
PM Peak
4:15pm-5:15pm

Option H (PM Peak Period, Year 2022, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

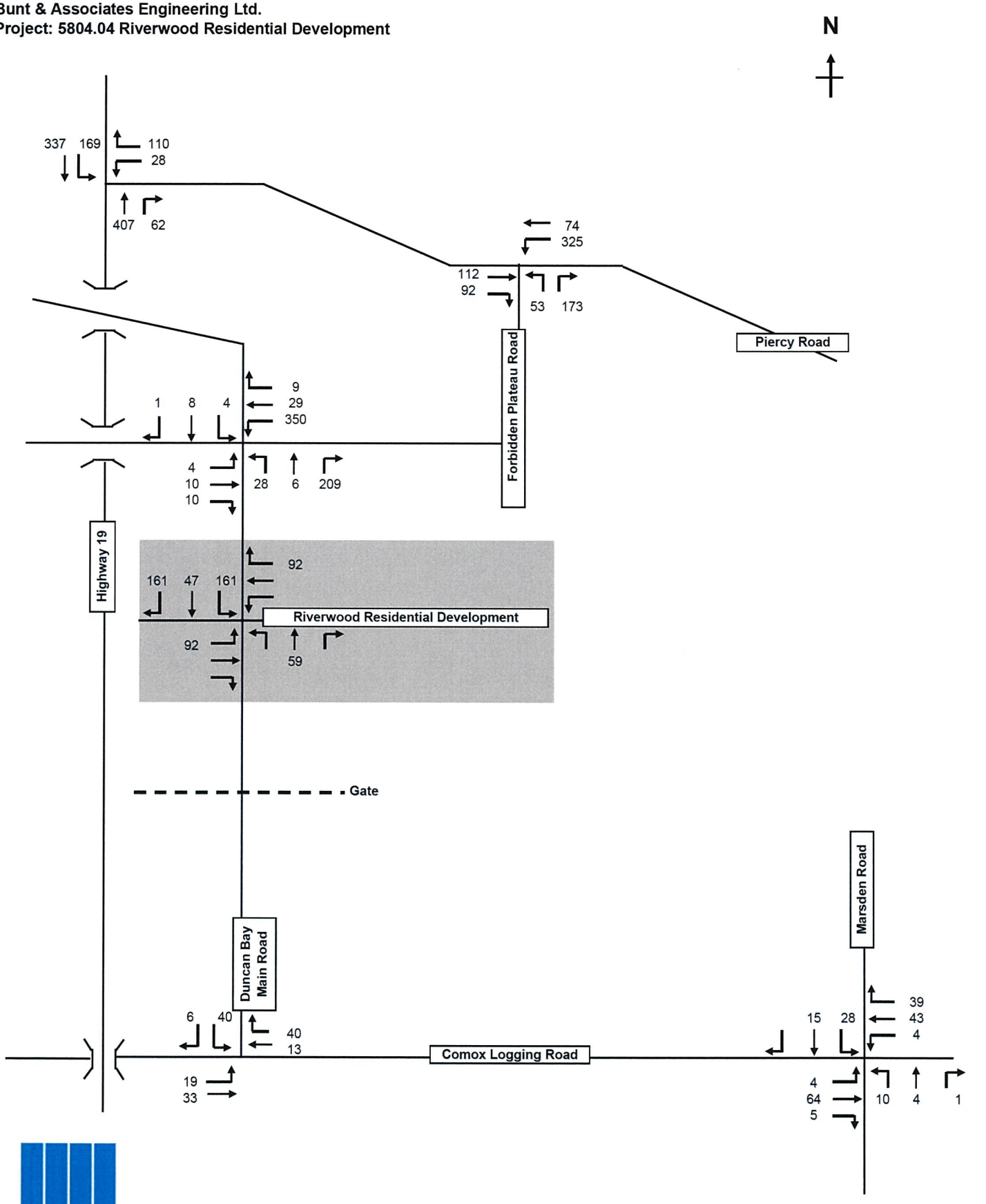
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2032
PM Peak
4:15pm-5:15pm

Option A (PM peak Period, Year 2032, Growth rate 2% -1%, 100% north, Trip Gen with MoT rate)

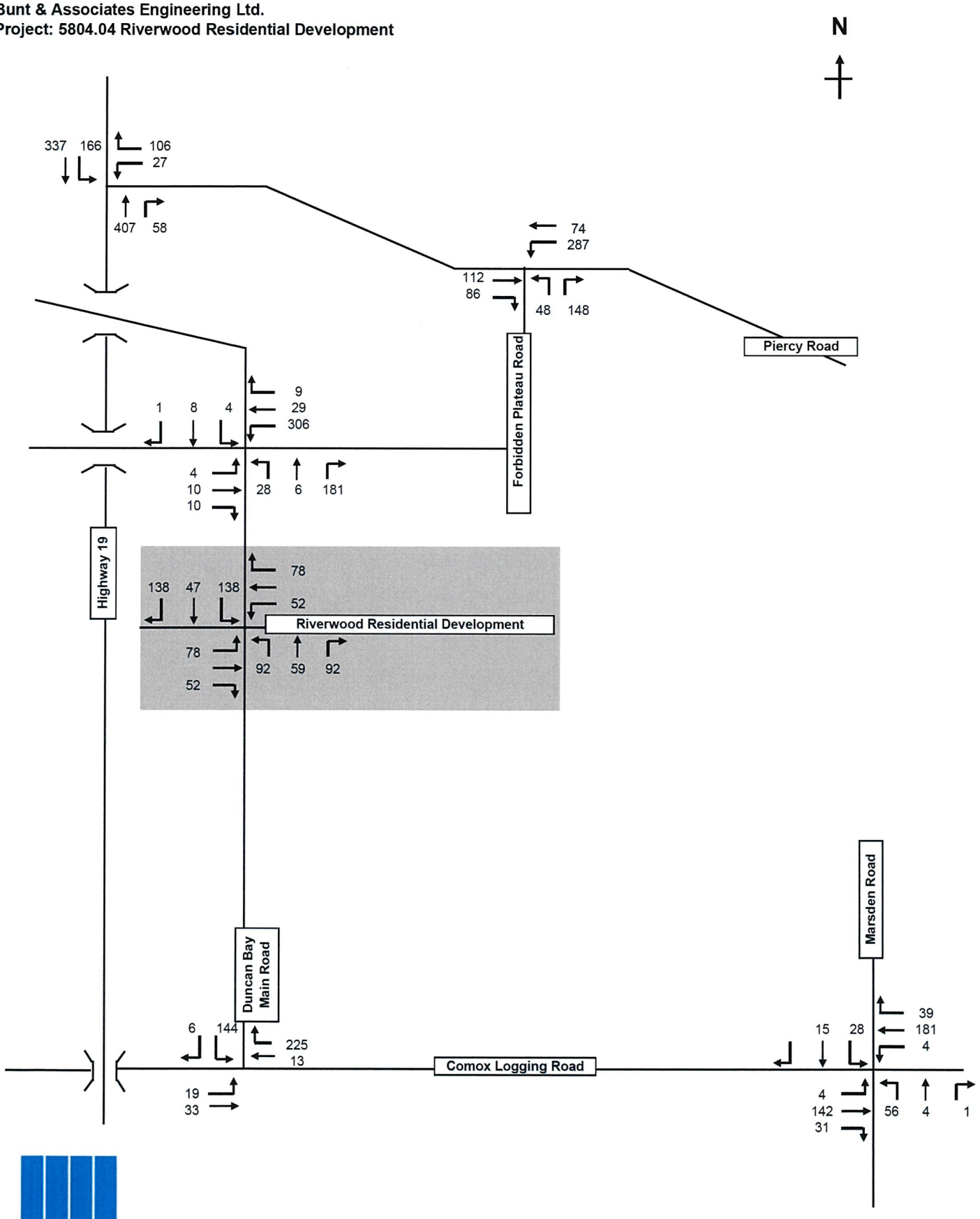
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2032
PM Peak
4:15pm-5:15pm

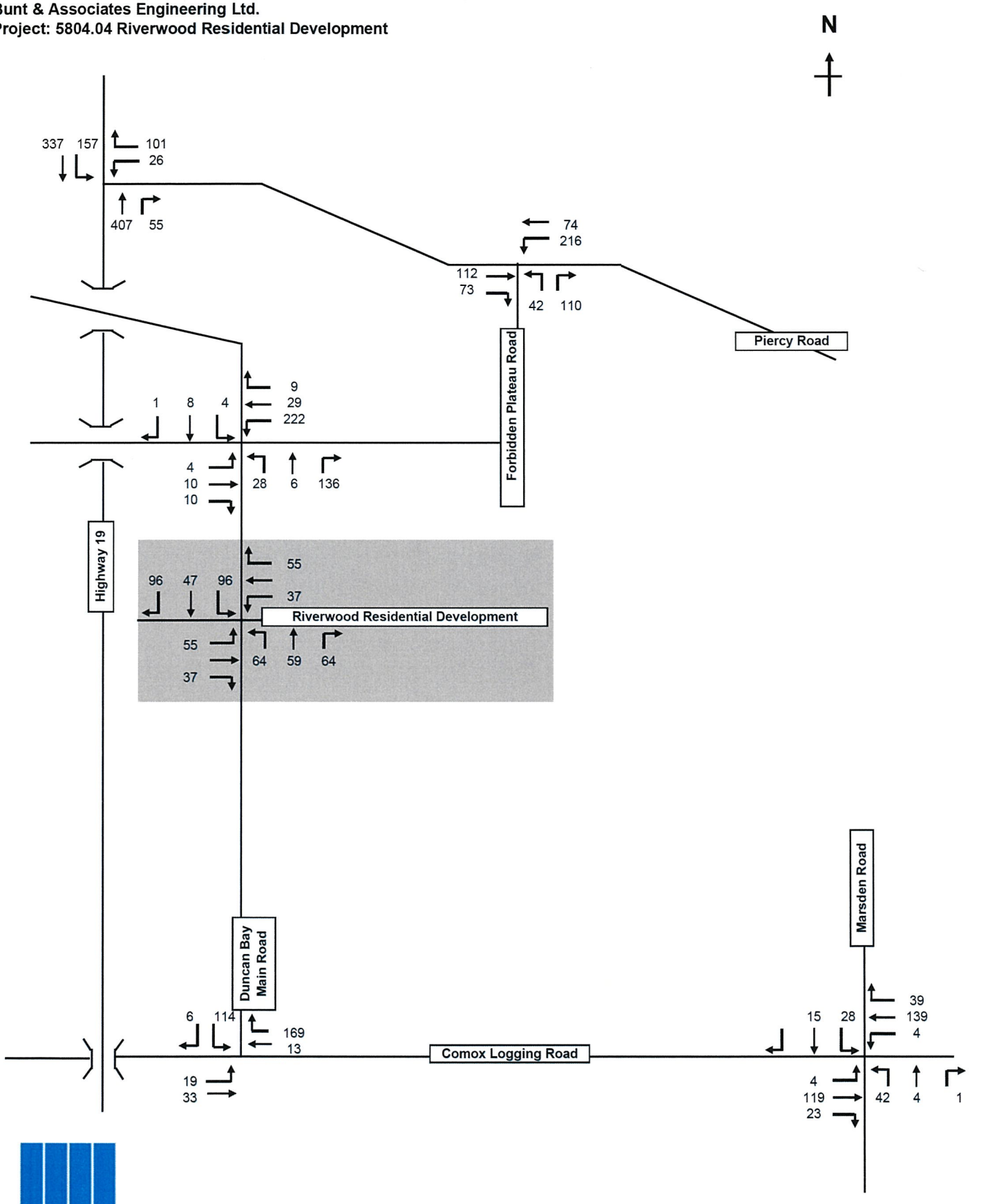
Option B (PM Peak Period, Year 2032, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2032
PM Peak
4:15pm-5:15pm
Option C (PM Peak Period, Year 2032, Growth rate 2% -1%, 60% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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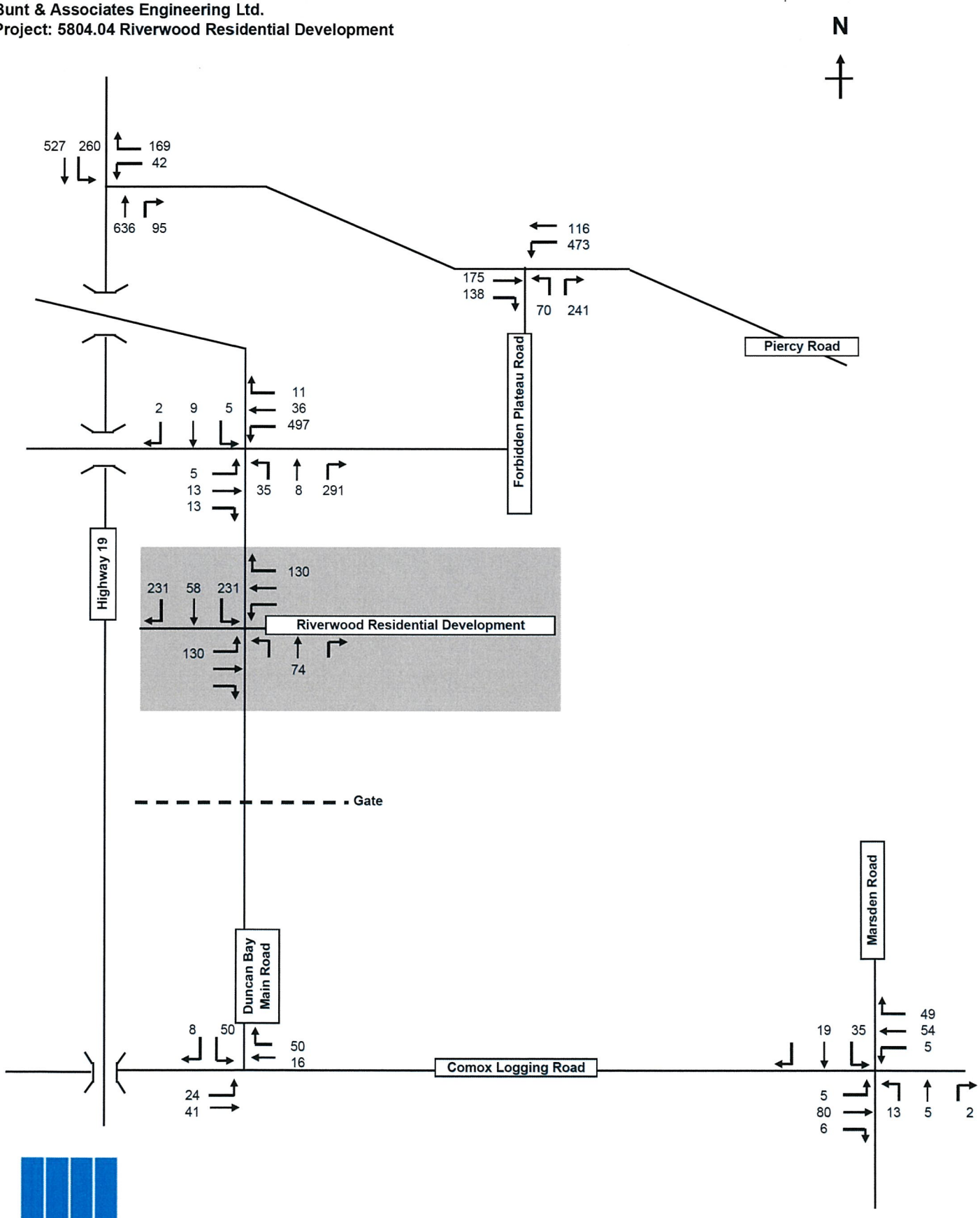
2032
PM Peak
4:15pm-5:15pm

Option D (PM Peak Period, Year 2032, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

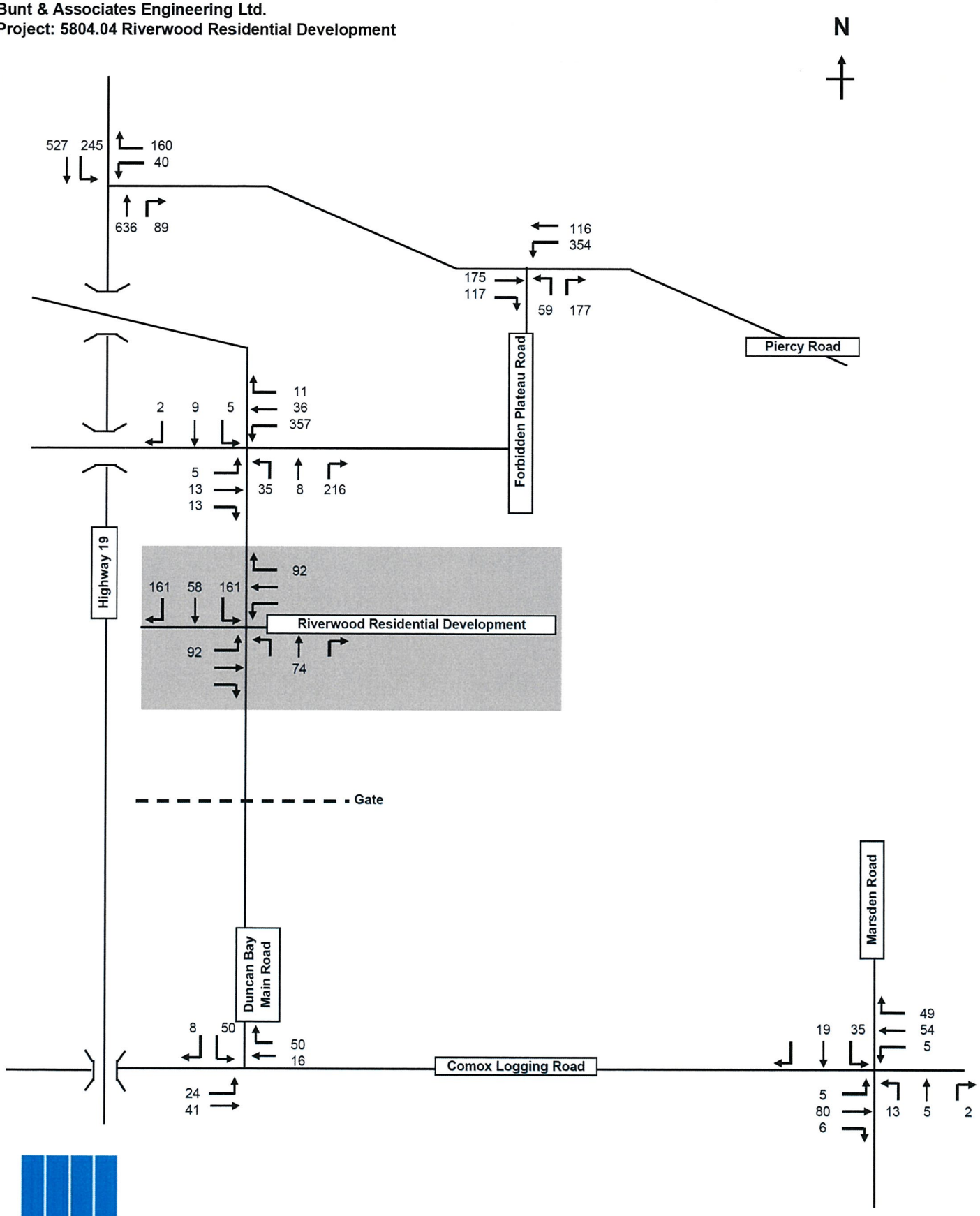


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2032
PM Peak
4:15pm-5:15pm

Option E (PM Peak Period, Year 2032, Growth rate 4% -2%, 100% north, Trip Gen with MoT rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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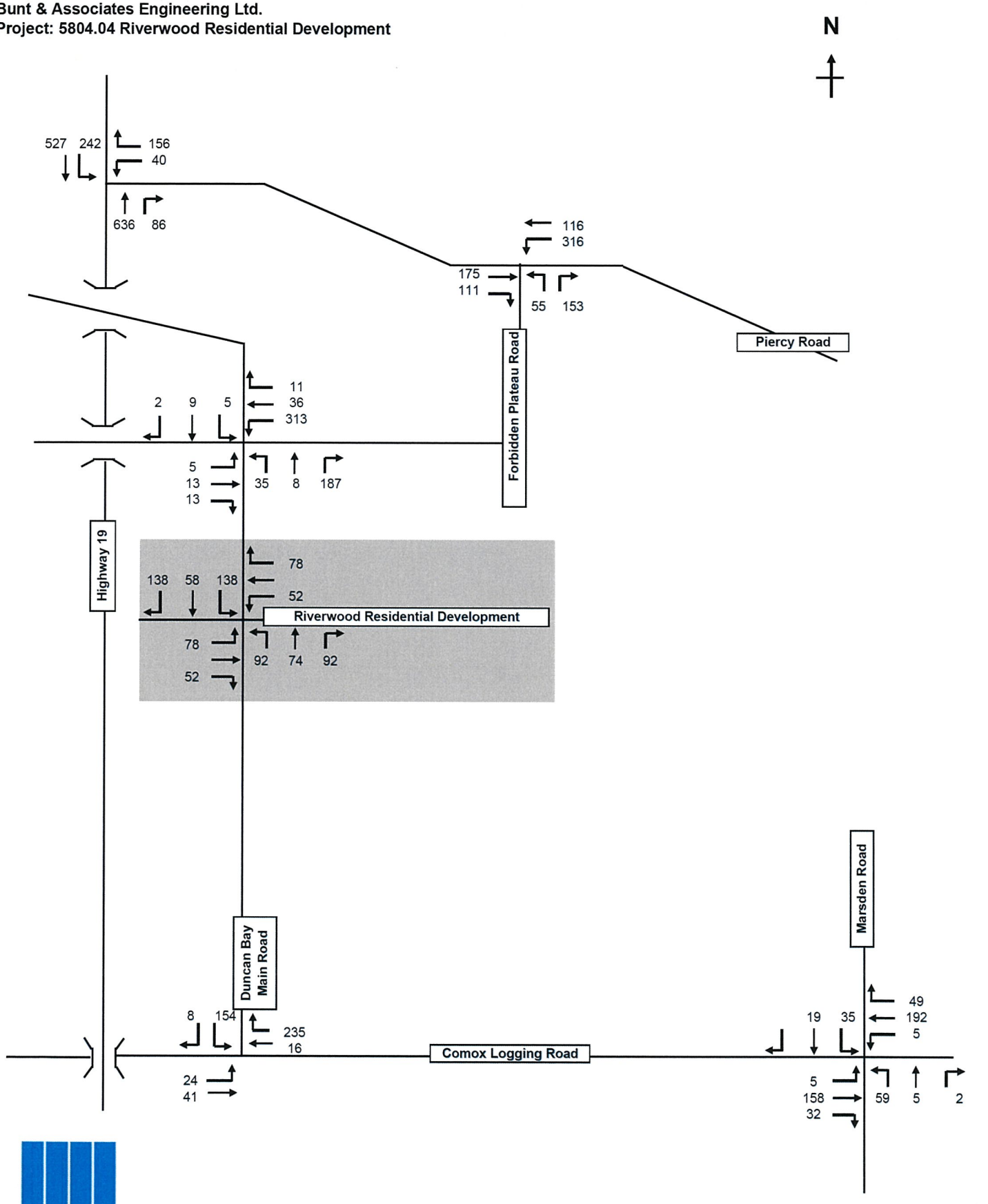
2032
PM Peak
4:15pm-5:15pm
Option F (PM Peak Period, Year 2032, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

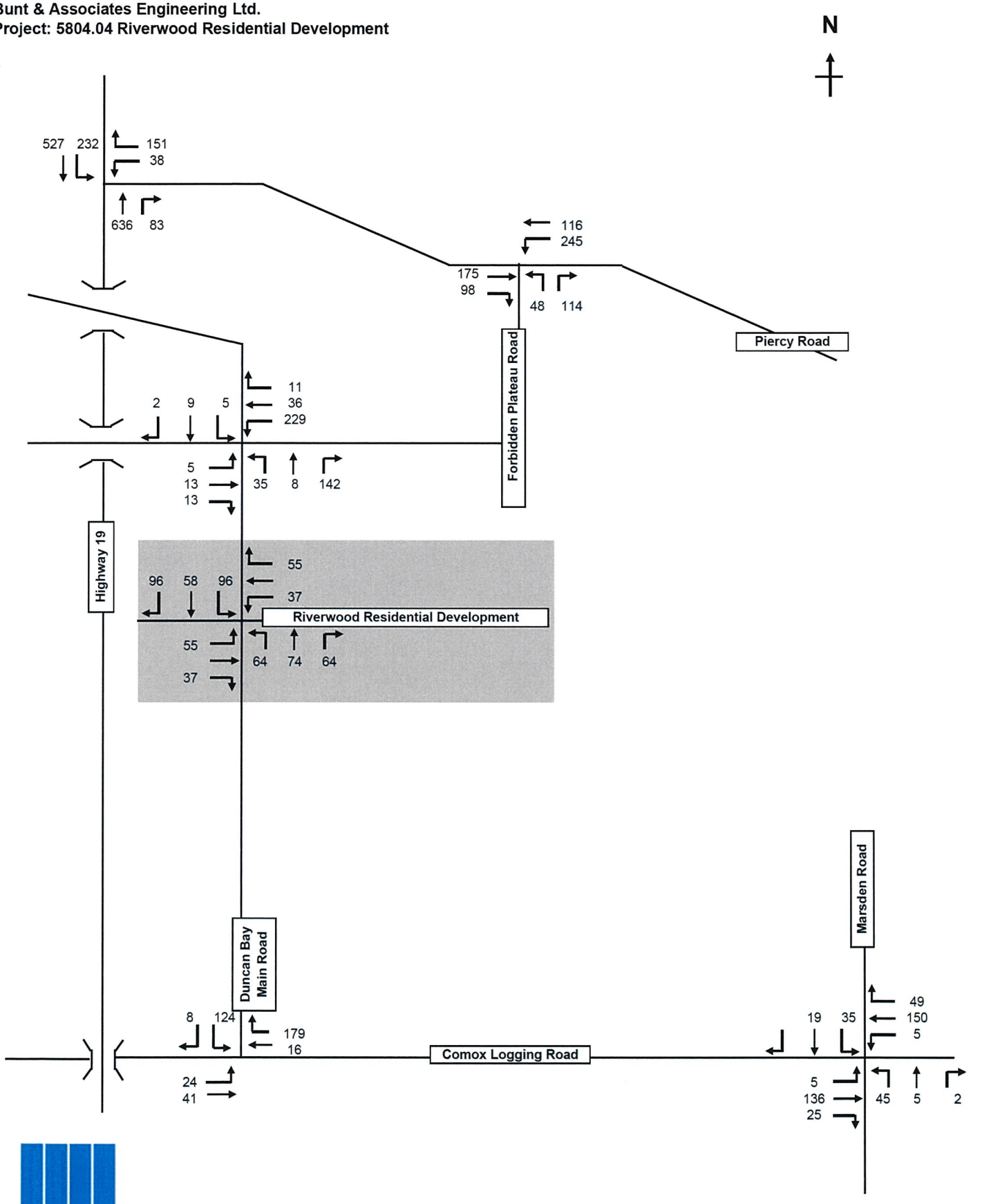
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2032
PM Peak
4:15pm-5:15pm

Option G (PM Peak Period, Year 2032, Growth rate 4% -2%, 60% north, Trip Gen with MoT rate)

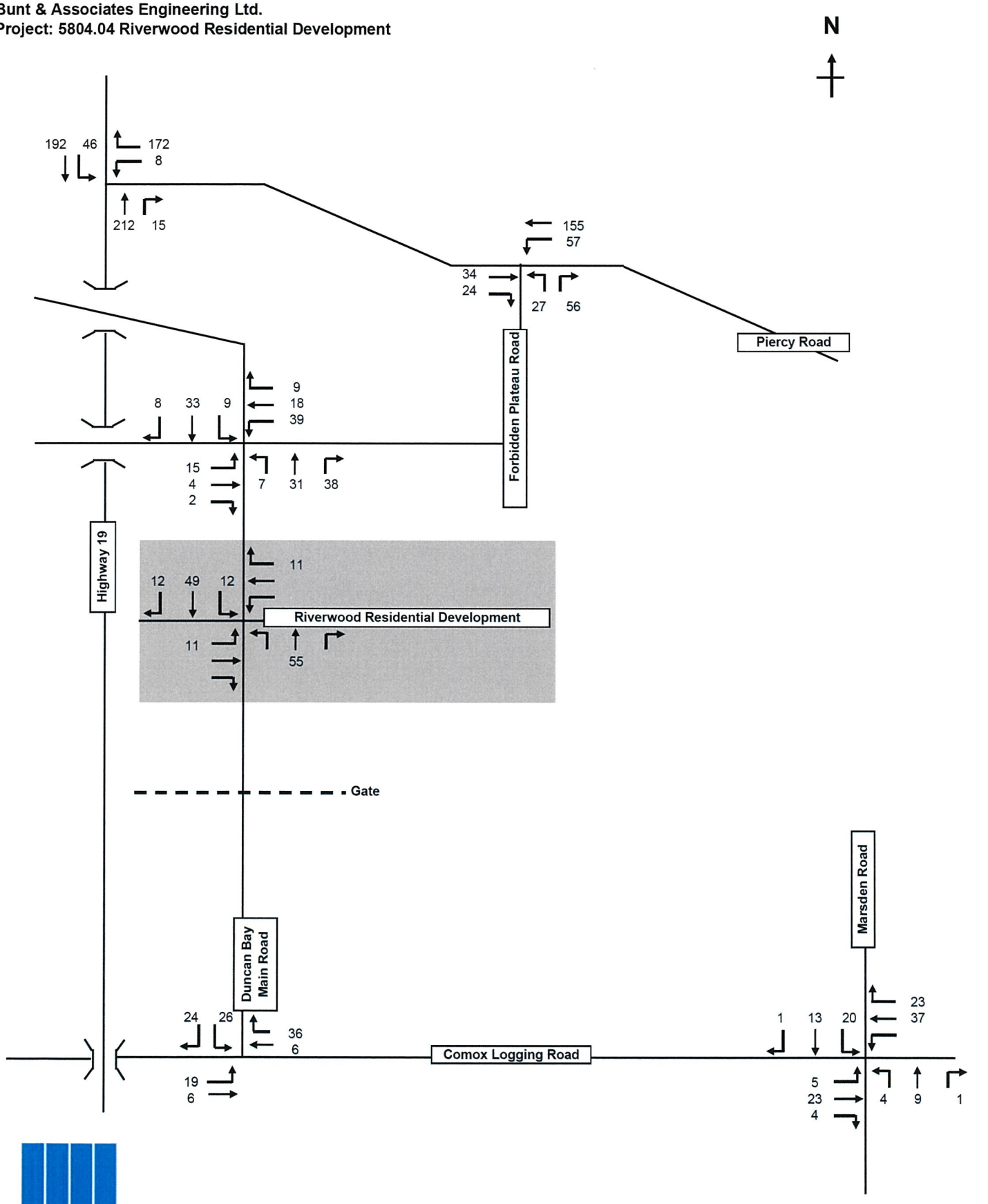
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2032
PM Peak
4:15pm-5:15pm
Option H (PM Peak Period, Year 2032, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development

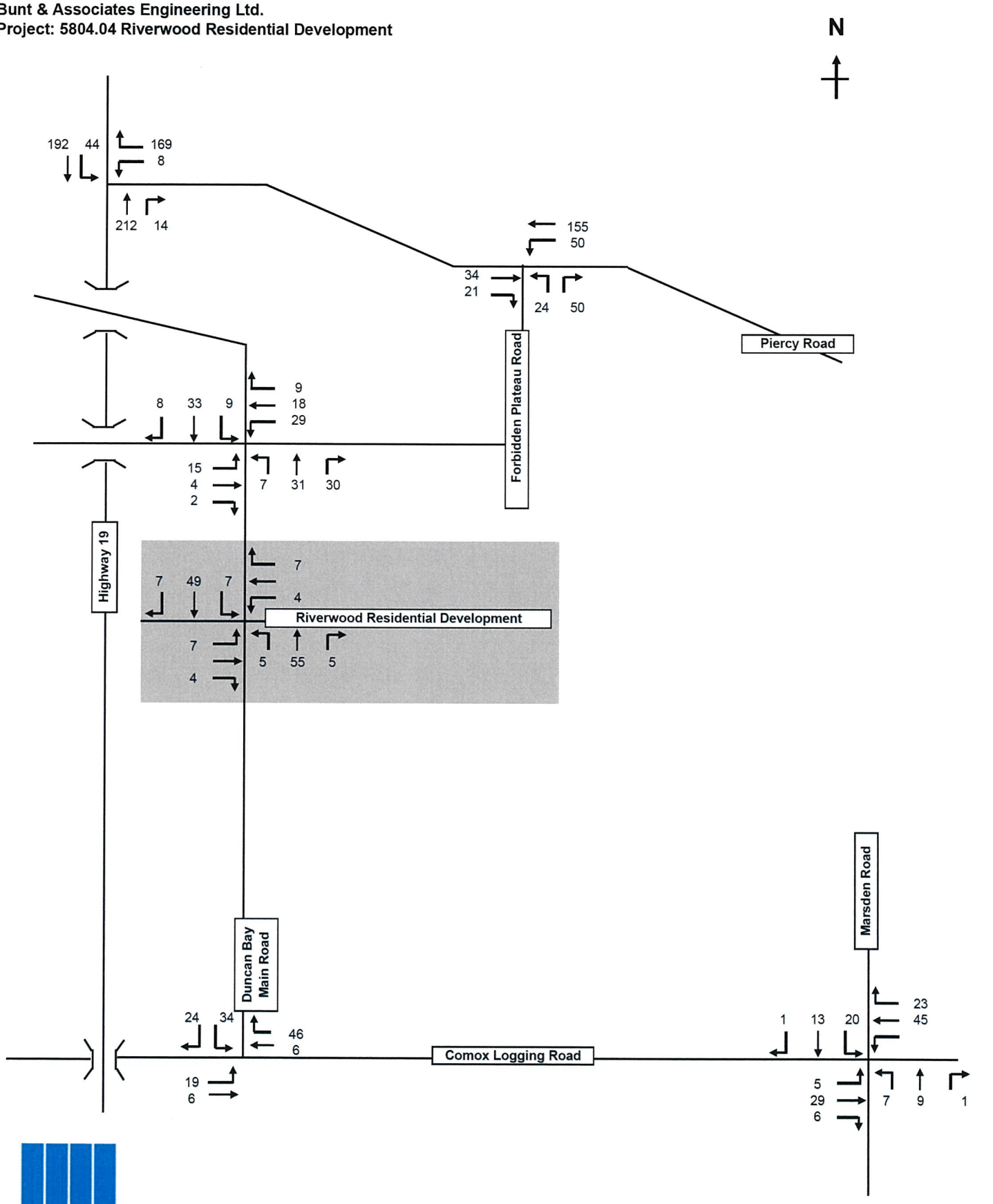


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
Sat Peak
11:45am-12:45pm

Option B (AM Peak Period, Year 2012, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

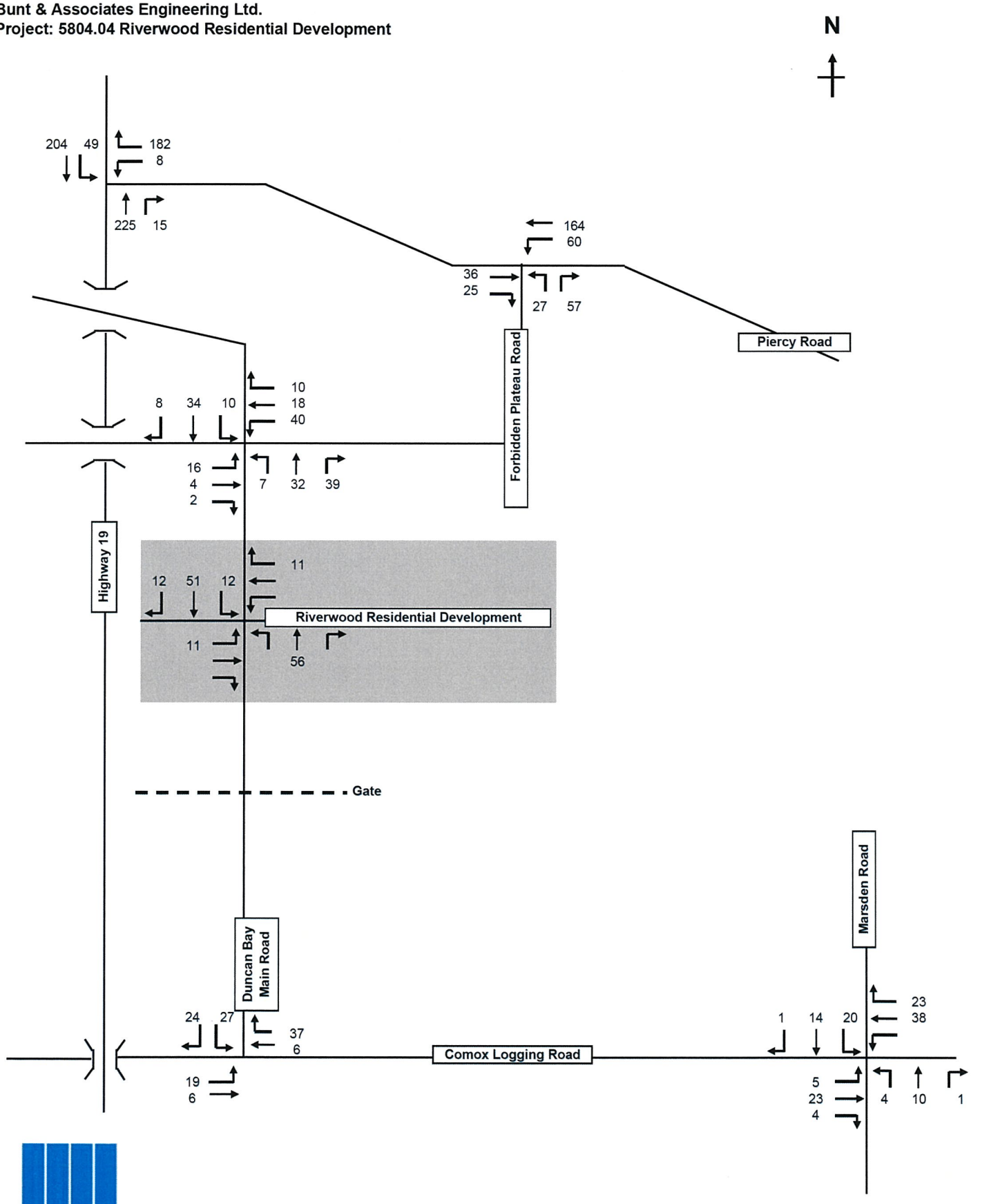
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
Sat Peak
11:45am-12:45pm
Option D (AM Peak Period, Year 2012, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

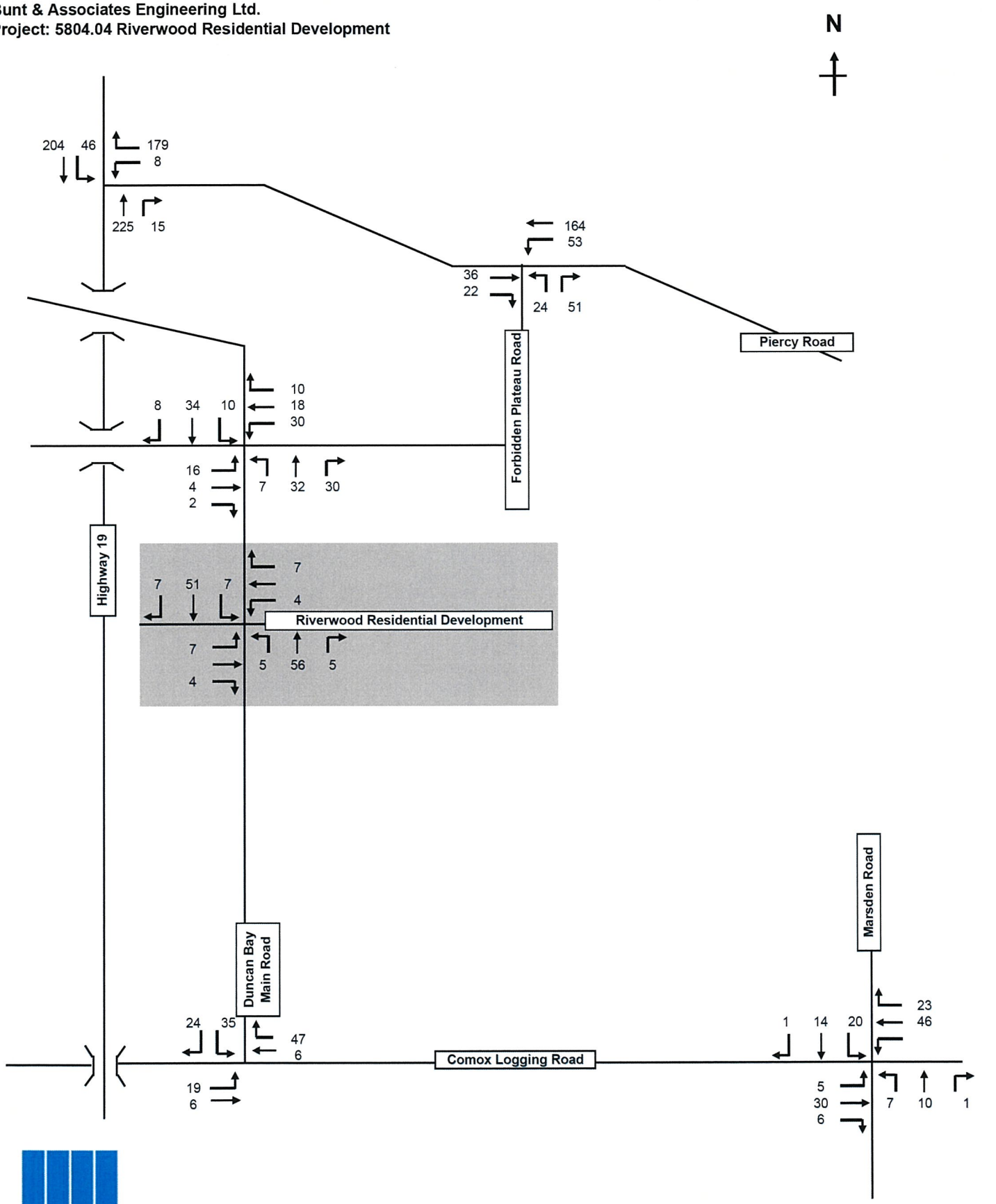
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
Sat Peak
11:45am-12:45pm
Option F (AM Peak Period, Year 2012, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2012
Sat Peak
11:45am-12:45pm

Option H (AM Peak Period, Year 2012, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
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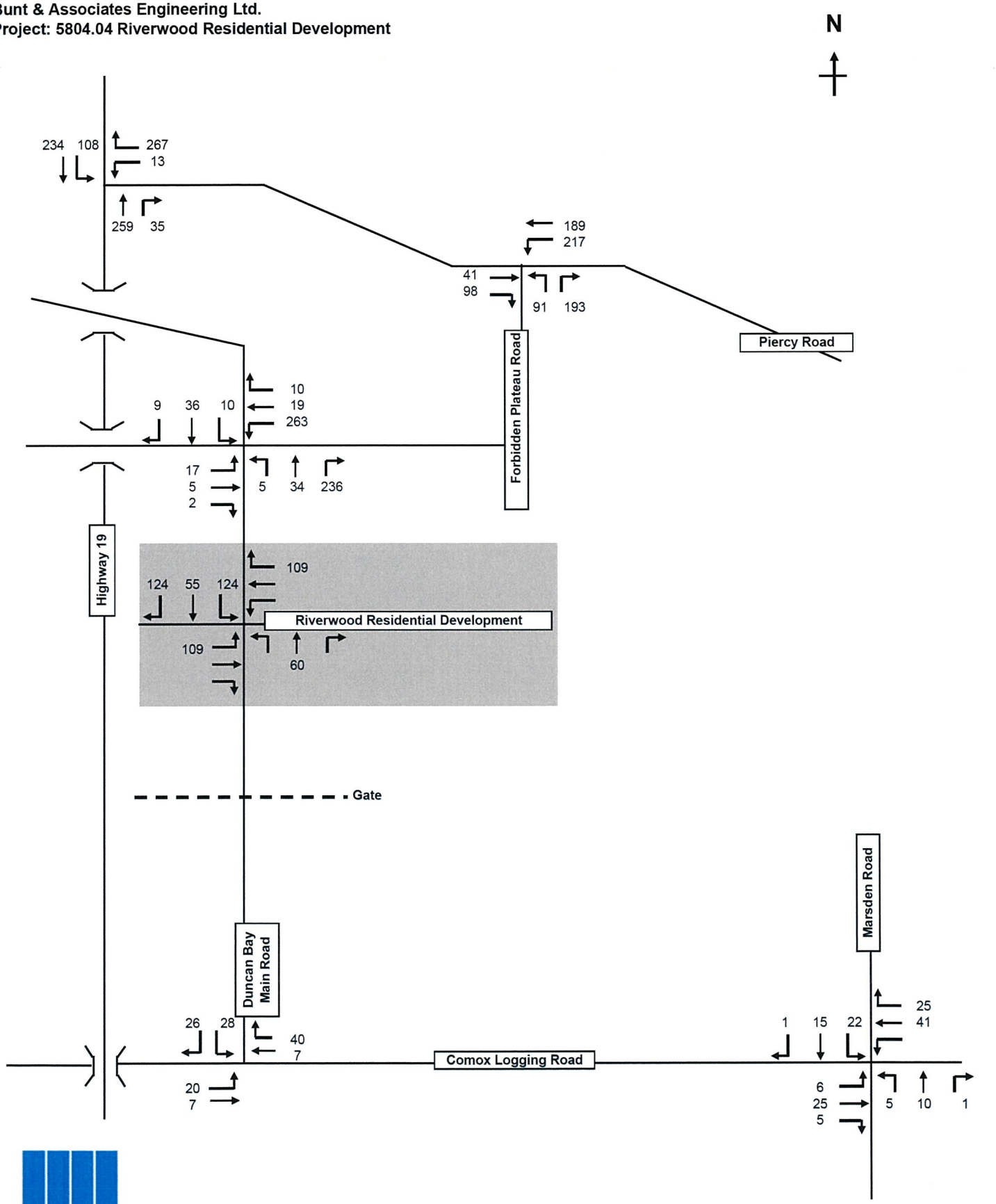
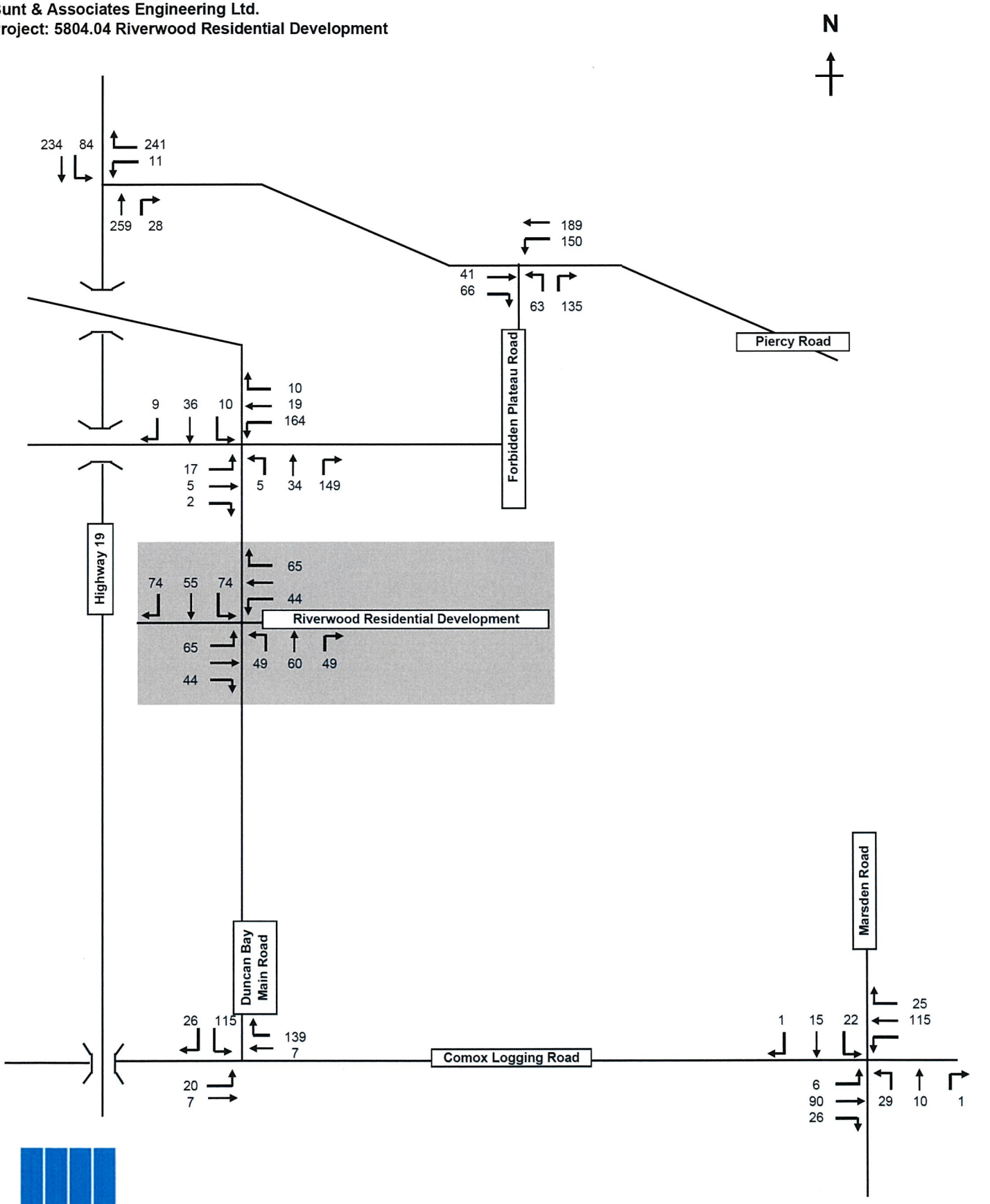


bunt & associates
TRANSPORTATION PLANNERS AND ENGINEERS

2022
Sat Peak
11:45am-12:45pm

Option B (AM Peak Period, Year 2022, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

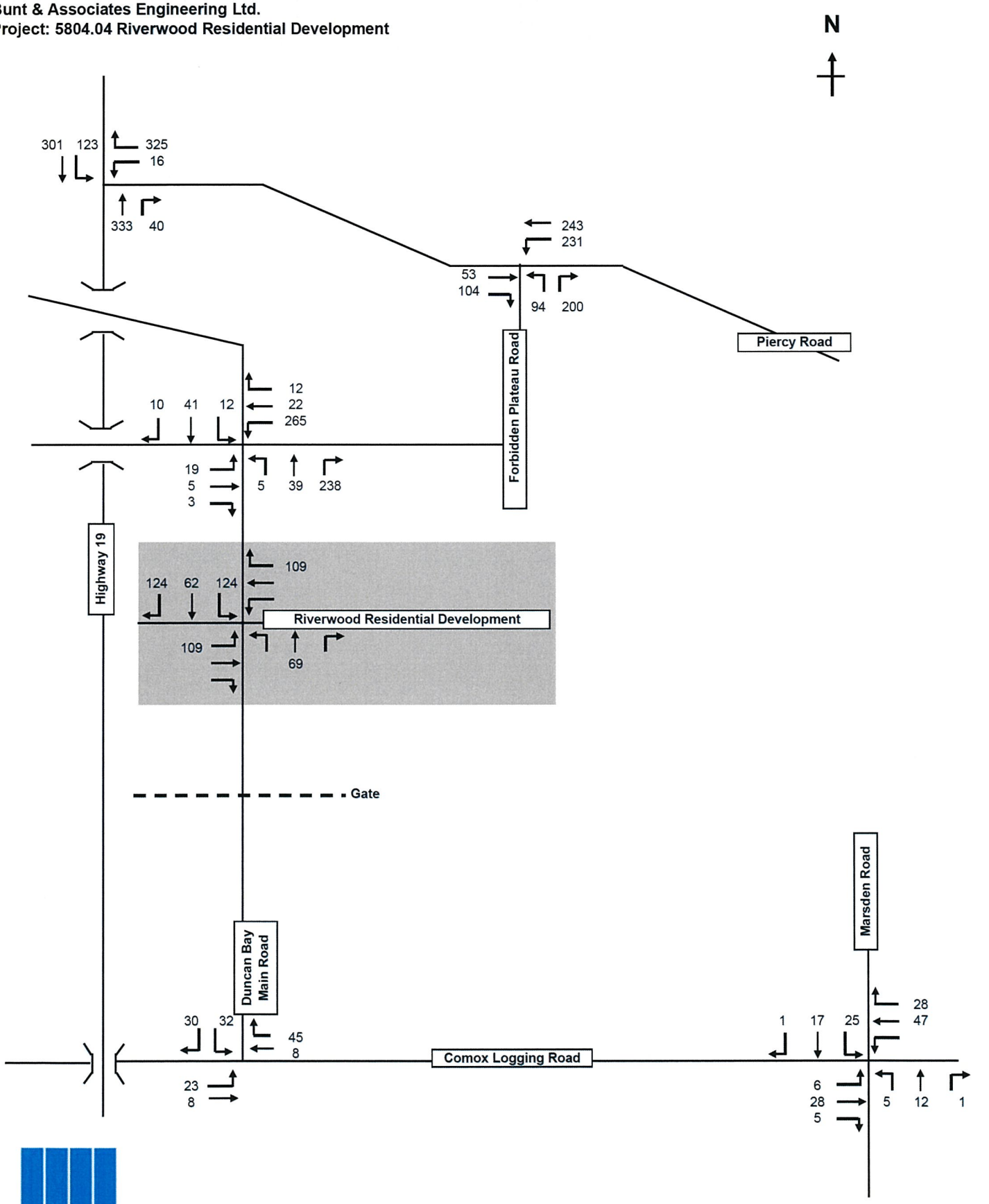
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2022
Sat Peak
11:45am-12:45pm

Option D (AM Peak Period, Year 2022, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

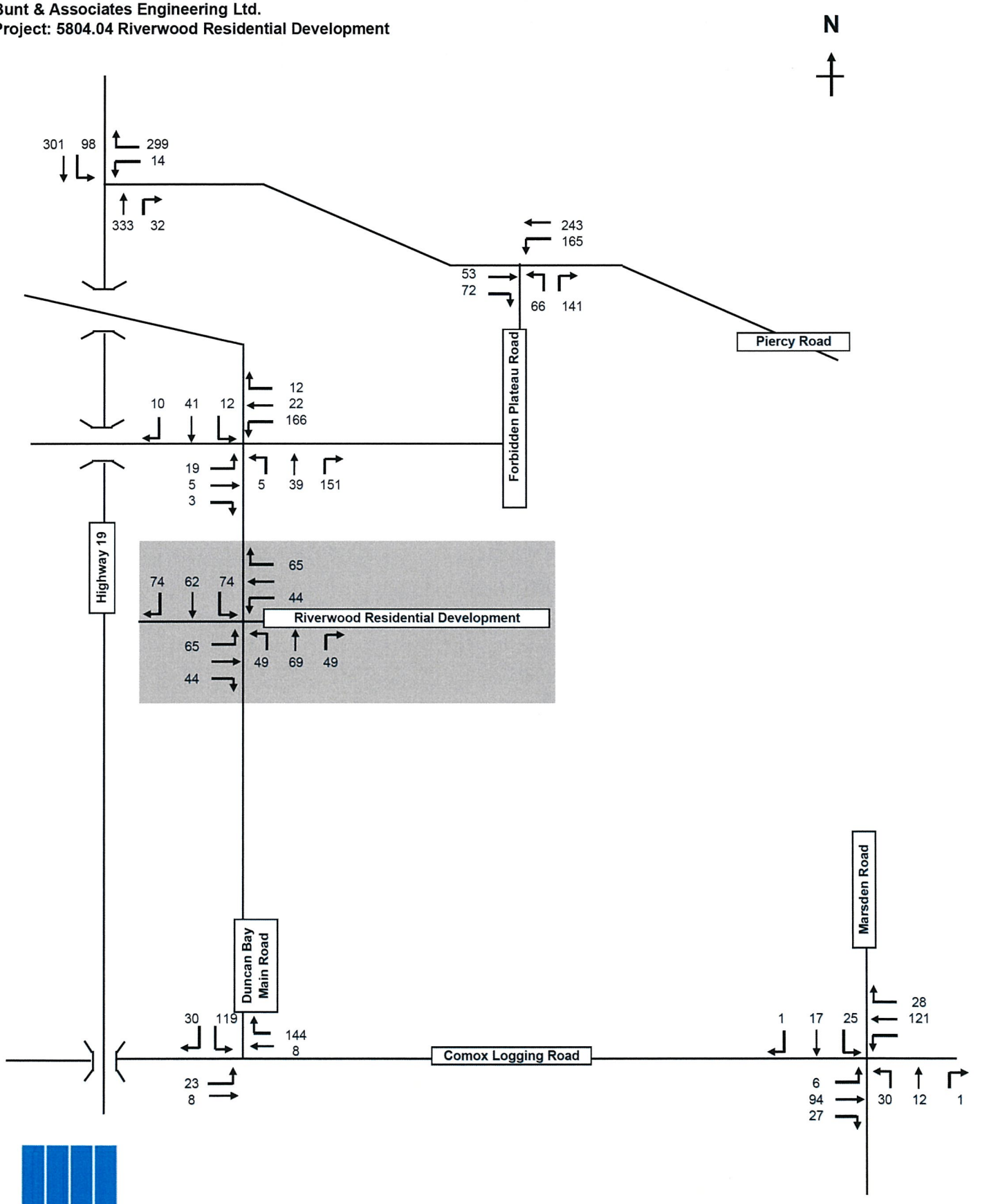
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2022
Sat Peak
11:45am-12:45pm

Option F (AM Peak Period, Year 2022, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

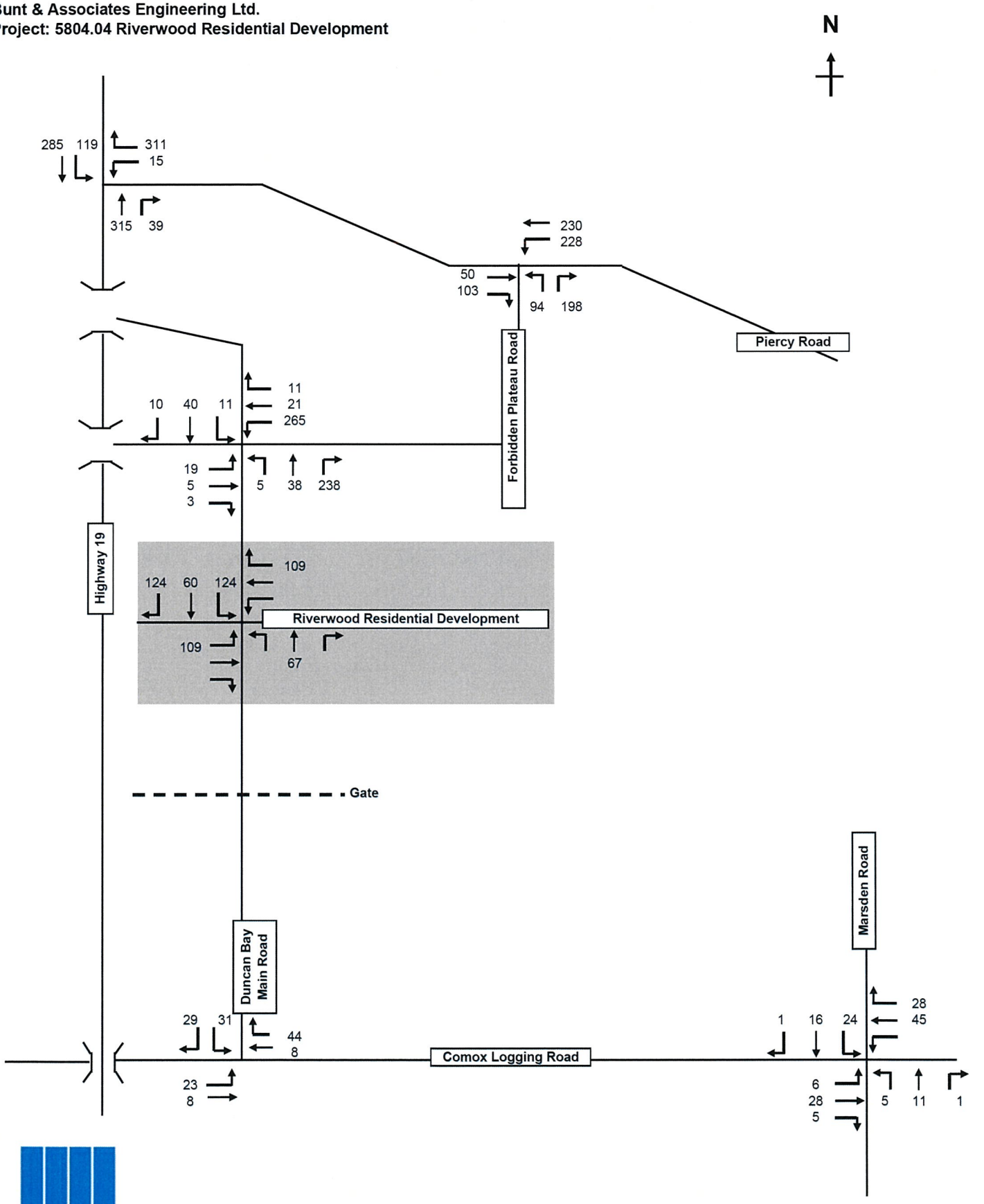
Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



2022
Sat Peak
11:45am-12:45pm

Option H (AM Peak Period, Year 2022, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



bunt & associates
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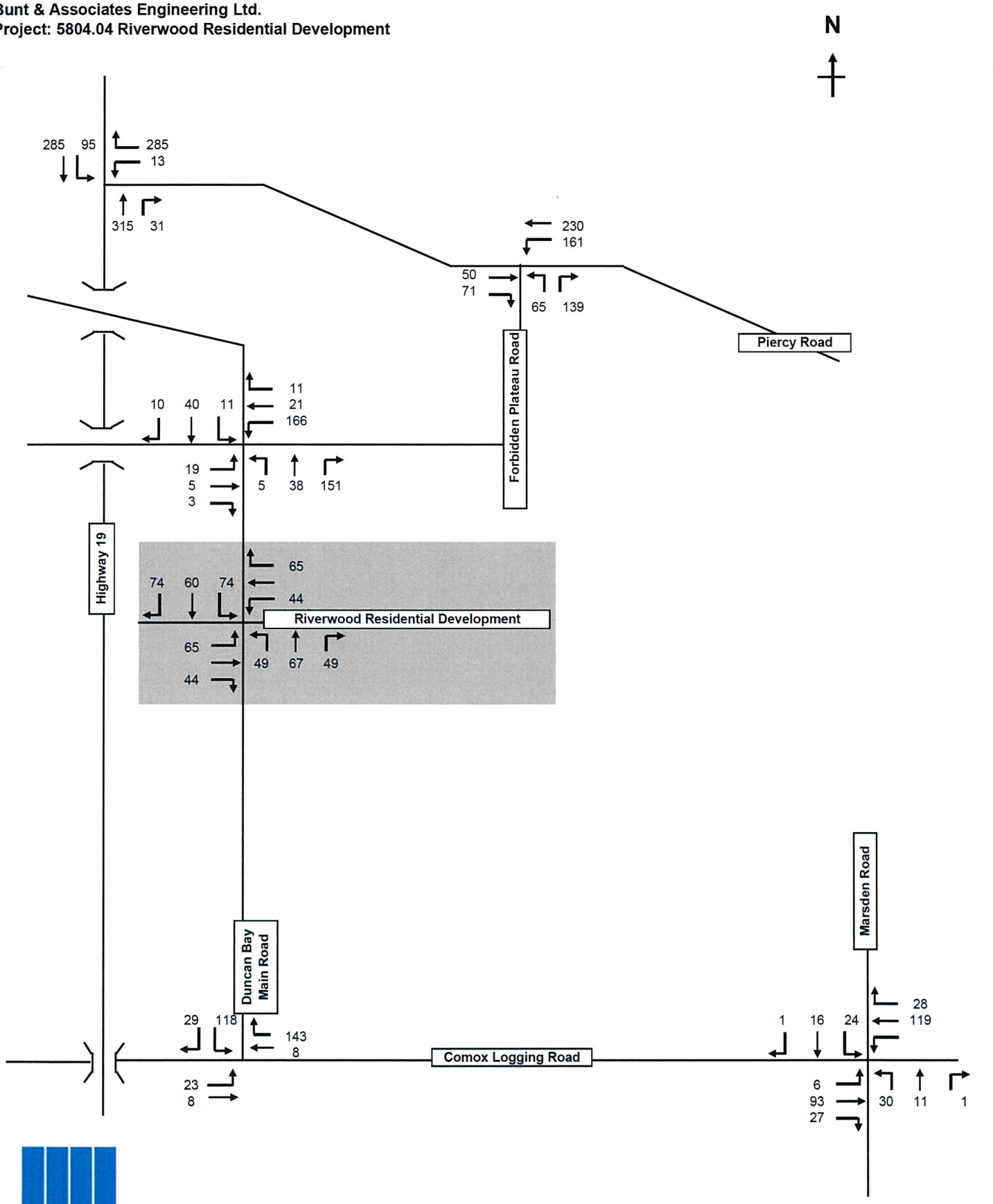
2032
Sat Peak
11:45am-12:45pm

Option B (SAT Peak Period, Year 2032, Growth rate 2% -1%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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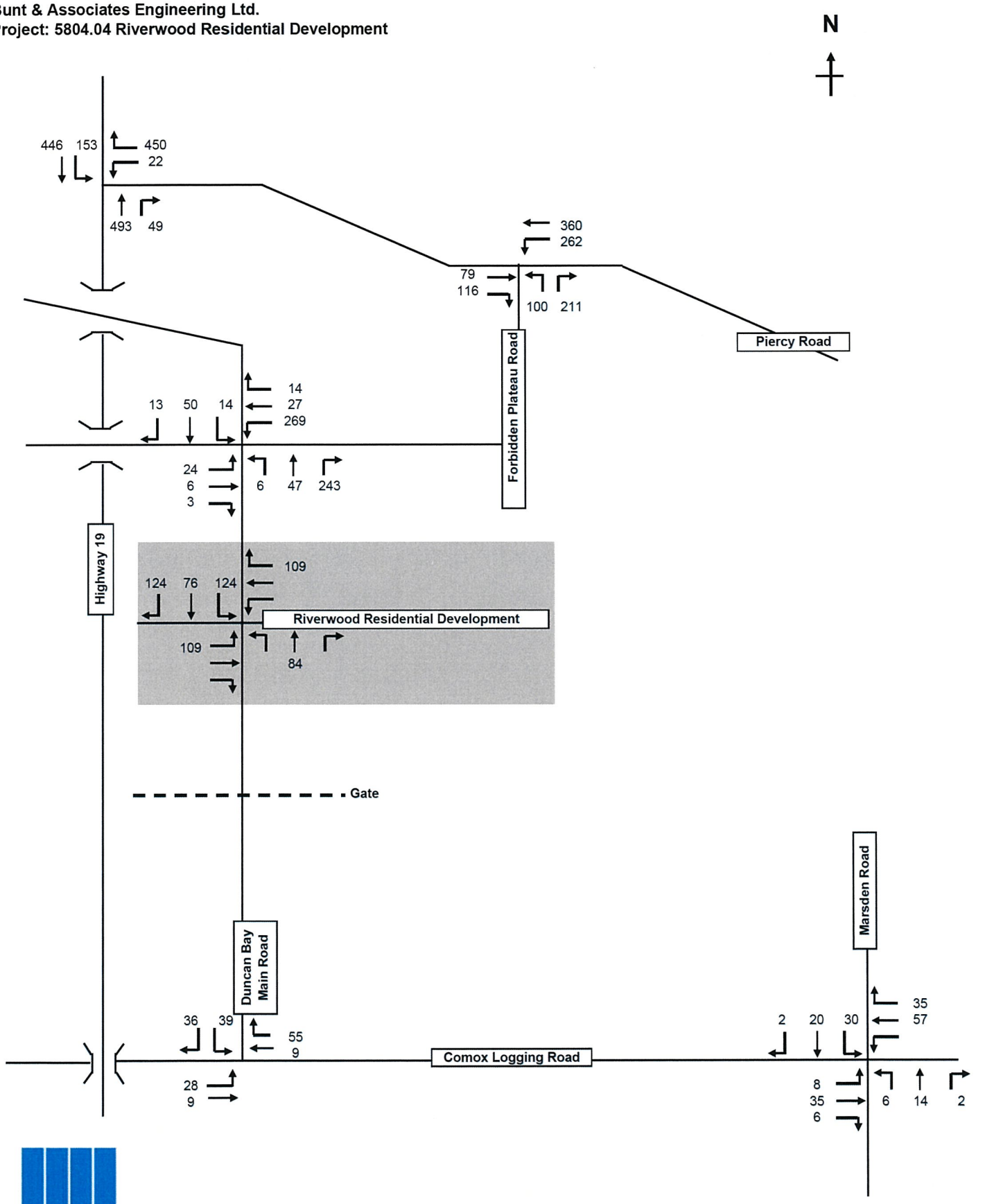
TRANSPORTATION PLANNERS AND ENGINEERS

2032
Sat Peak
11:45am-12:45pm

Option D (SAT Peak Period, Year 2032, Growth rate 2% -1%, 60% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
Project: 5804.04 Riverwood Residential Development



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2032
Sat Peak
11:45am-12:45pm

Option F (SAT Peak Period, Year 2032, Growth rate 4% -2%, 100% north, Trip Gen with ITE rate)

Bunt & Associates Engineering Ltd.
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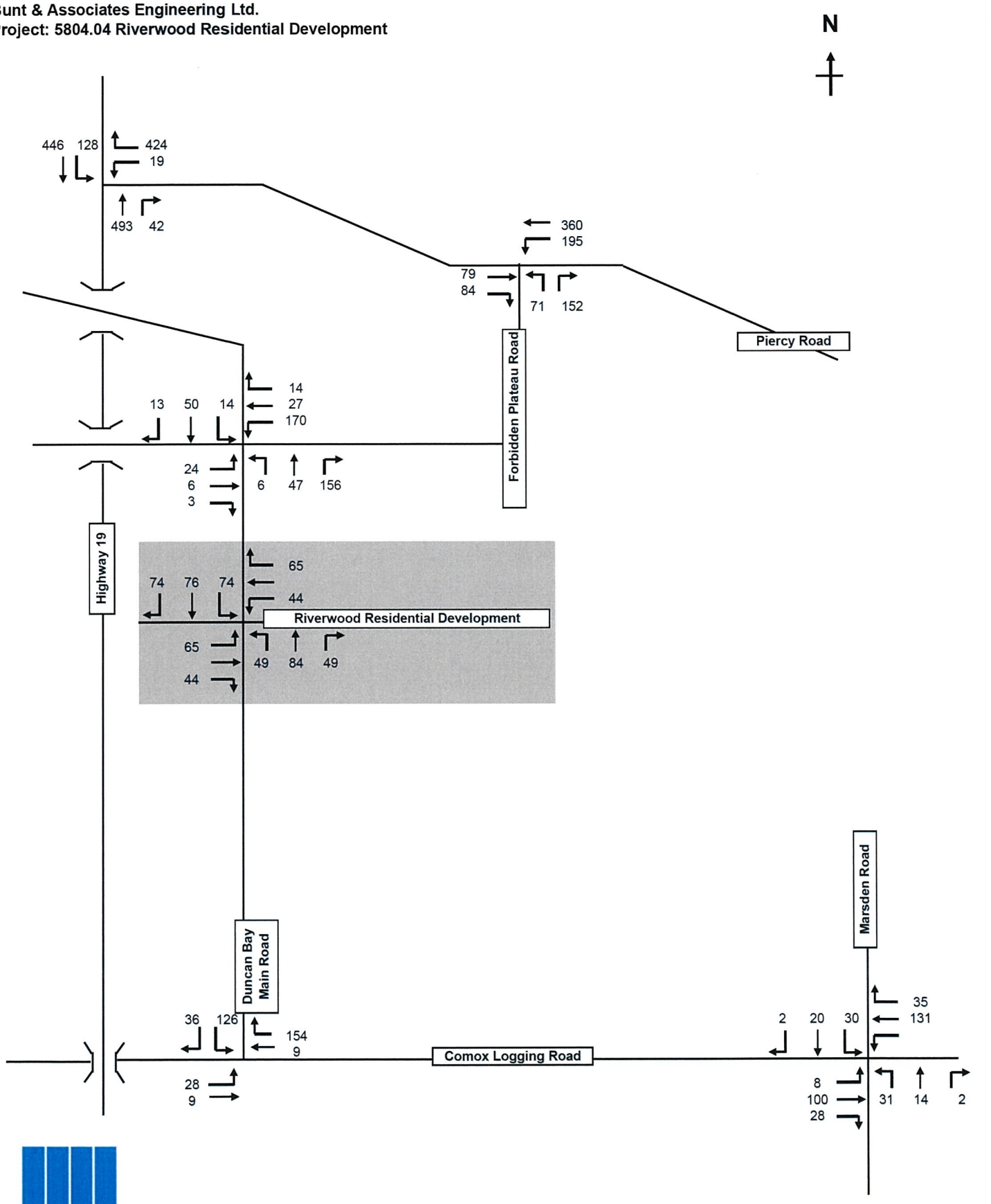


2032
Sat Peak
11:45am-12:45pm

Option H (SAT Peak Period, Year 2032, Growth rate 4% -2%, 60% north, Trip Gen with ITE rate)

Appendix C – TAC Signal Warrant Analysis

2005 Canadian Matrix Traffic Signal Warrant Analysis

Main Street (name)	Piercy Road	Direction (EW or NS)	EW	Date:	Oct 05, 2009
Side Street (name)	Forbidden Plateau Road	Direction (EW or NS)	NS	City:	Comox Valley Regional District
Quadrant (if appl)					

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Piercy Road	WB	1	0	1	0	0		1	
Piercy Road	EB	0	0	1	0	0	1,444	1	
Forbidden Plateau Road	NB	1	0	0	0	1			
Forbidden Plateau Road	SB	0	0	0	0	0			

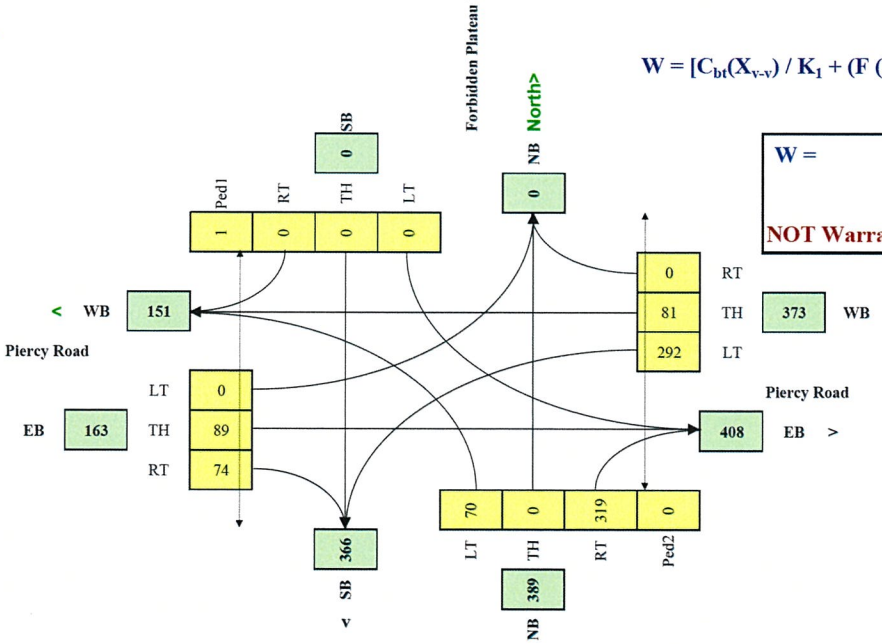
Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Piercy Road	EW	70	7.0%	n	0.0
Forbidden Plateau Road	NS		4%	n	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	0	E Side	N Side	S side
7:30 - 8:30	116	0	540	0	0	0	89	60	0	0	60	43	4	0	0	0
8:30 - 9:30	73	0	412	0	0	0	160	108	0	0	69	24	0	0	0	0
11:30 - 12:30	32	0	294	0	0	0	436	77	0	0	36	51	0	0	0	0
12:30 - 13:30	39	0	130	0	0	0	226	58	0	0	62	58	0	0	0	0
16:00 - 17:00	63	0	241	0	0	0	530	111	0	0	136	138	0	0	0	0
17:00 - 18:00	97	0	294	0	0	0	311	73	0	0	171	127	1	0	0	0
Total (6-hour peak)	**420**	**0**	**1,911**	**0**	**0**	**0**	**1,752**	**487**	**0**	**0**	**534**	**441**	**5**	**0**	**0**	**0**
Average (6-hour peak)	**70**	**0**	**319**	**0**	**0**	**0**	**292**	**81**	**0**	**0**	**89**	**74**	**1**	**0**	**0**	**0**

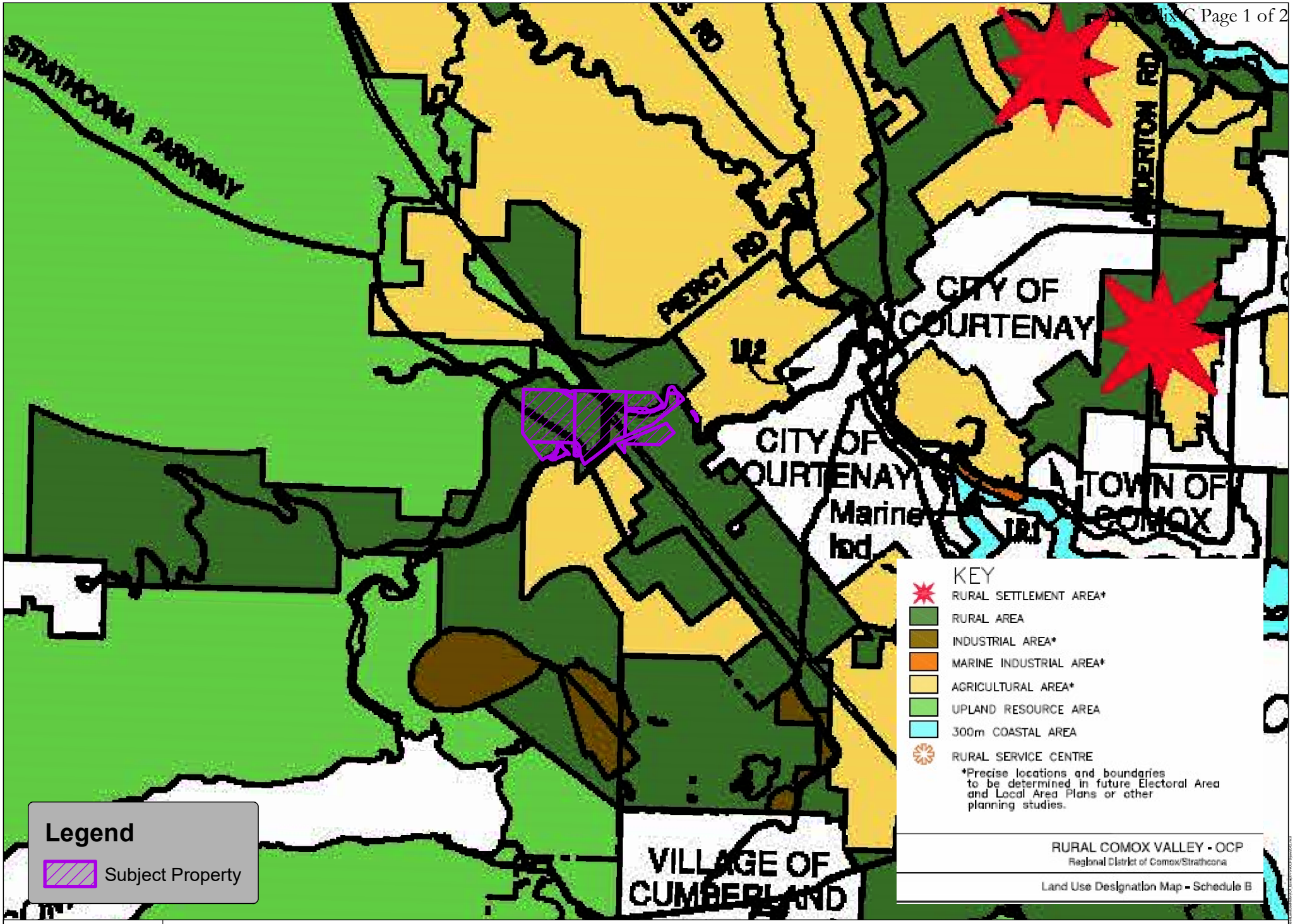
Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$



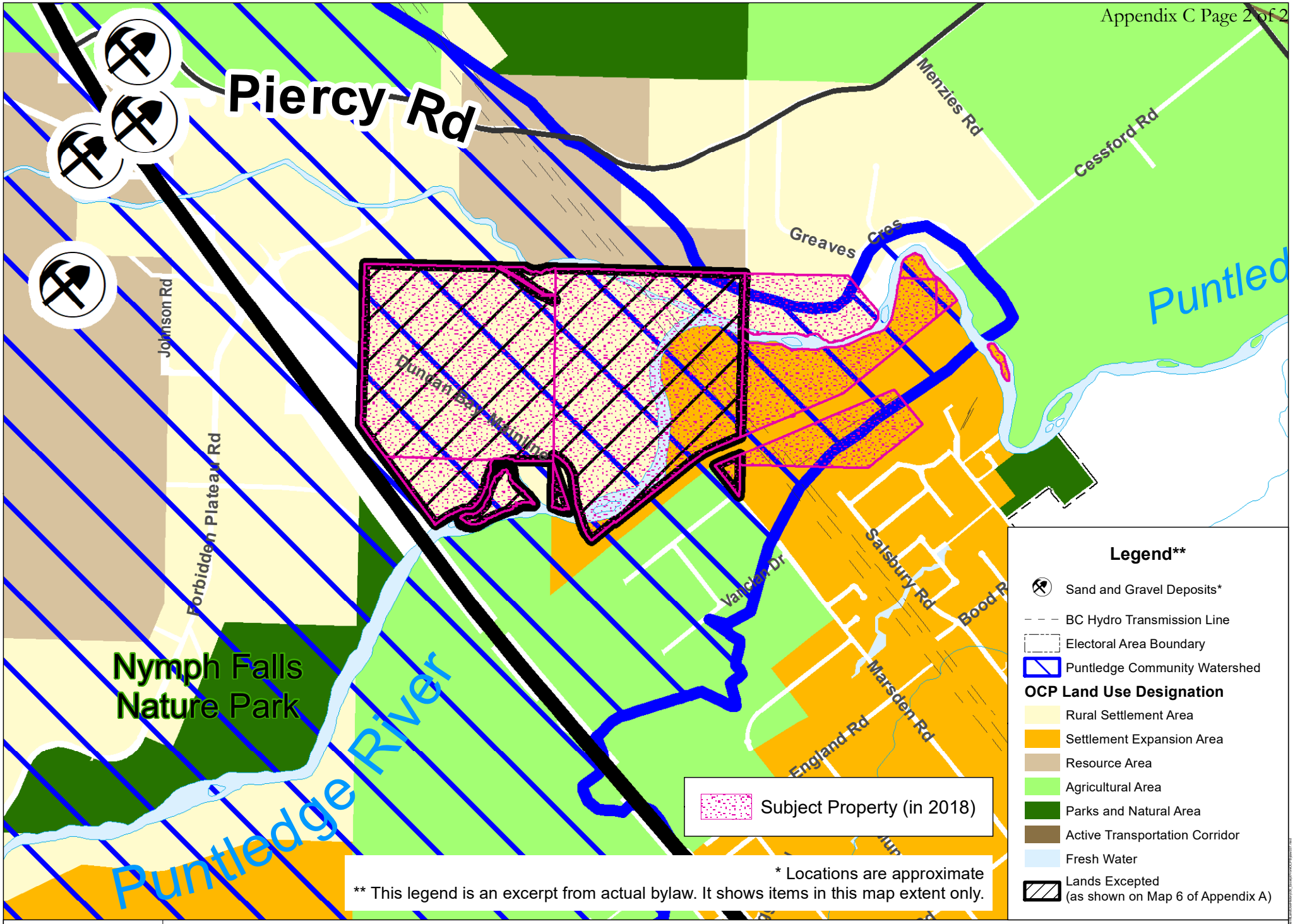
W =	64	64	0
		Veh	*Ped*

NOT Warranted



Comox Valley REGIONAL DISTRICT

Excerpt from Schedule B of the
Rural Comox Valley Official Community Plan Bylaw, 1998



* Locations are approximate

** This legend is an excerpt from actual bylaw. It shows items in this map extent only.

Comox Valley Regional District

Excerpt from Appendix A Map 3 of the
Rural Comox Valley Official Community Plan Bylaw, 2014

802 Rural Twenty (RU-20)

1. Principal Use

i) **On any lot:**

a) Single detached dwelling
b) Agricultural use
c) Veterinary establishment
d) Plant nursery and greenhouse
e) Silviculture
f) Fish Hatchery (including community based)

ii) **On any lot greater than 2.0 hectares in area the following uses are also permitted:**

a) Animal kennel
b) Riding academy

iii) **On any lot greater than 4.0 hectares in area the following uses are also permitted:**

a) Wood processing
b) Sawmill including portable sawmill
c) Gravel, mineral or peat extraction, gravel crushing and screening, excluding manufacturing or sales of concrete or concrete products

iv) **On any lot 4.0 hectares in area or larger classified as private managed forest land or farm pursuant to the *Assessment Act* or within a license area under the *Forest Act* the following uses are also permitted:**

a) Research and teaching facility
b) Rural resource centre to a maximum floor area of 300.0 square metres

2. Accessory Uses

i) **On any lot:**

a) Carriage house
b) Secondary suite
c) Secondary dwelling
d) Bed and Breakfast
e) Home occupation
f) Domestic industrial use
g) Retail and wholesale sales of agricultural and forestry products to a maximum floor area of 100.0 square metres

3. Conditions of Use

i) **Animal kennels shall be subject to the following conditions:**

a) Maintain a minimum setback of buildings and structures of 15.0 metres along all lot lines.

b) All structures and area utilized in association with the animal kennel, shall be sited at least 30.0 metres from the boundary of any lake, sea or watercourse.

c) No parking, loading or storage areas shall be located in any required setback area.

d) Screening shall be provided at not less than 1.5 metres in height for animal kennel.

e) No more than one sign, not exceeding 1.0 square metre in area on each side may be placed on the lot on which the animal kennel use is carried out.

ii) **Wood processing, gravel, sand and mineral extraction (including crushing and screening of aggregate extracted onsite), research and teaching facilities, and rural resource centres shall be subject to the following conditions:**

a) A minimum setback for buildings and structures of 15.0 metres along all lot lines.

b) Minimum setback requirement for stockpiles shall be 15.0 metres along all lot lines.

c) A minimum setback for buildings and structures of 30.0 metres from any lot line abutting a lot zoned Residential or Country Residential.

d) No loading or storage areas shall be located in any required setback.

e) Screening of not less than 2.0 metres in height shall be provided for wood processing uses and a rural resource centre abutting a lot zoned Residential.

f) Screening of not less than 1.5 metres in height shall be provided for wood processing uses and a rural resource centre abutting a lot zoned Country Residential.

4. <u>Density</u>

i) **Residential density is limited to two dwellings units:**

a) **On any lot:** one single detached dwelling and one carriage house, secondary suite, or secondary dwelling limited in area to 90.0 square metres are permitted.

b) **On a lot greater than 1.0 hectare in area:** two single detached dwellings.

5. <u>Siting and Height of Buildings and Structures</u>

The maximum height of principal buildings is 10.0 metres and the maximum height of accessory buildings is 8.0 metres.

i) The setbacks required for buildings and structures shall be as set out in the table below.

		Required Setback				
Type of Use	**Height of Structure**	**Front Yard**	**Rear Yard**	**Side Yard** **Front Lot Line <31m**	**Front Lot Line >31m**	**Side Yard Abutting Road**
Principal	10.0m	7.5m	7.5m	1.75m	3.5m	7.5m
Accessory	4.5m or less	7.5m	1.0m	1.0m	1.0m	7.5m
Accessory	8.0m - 4.6m	7.5m	7.5m	1.75m	3.5m	7.5m

6. Floor Area Requirements

i) The combined floor area of all buildings and structures shall not exceed 15 per cent.

7. Subdivision Requirements

i) **Minimum lot area**: 20.0 hectares

End • RU-20

804 Upland Resource (UR)

1. Principal Use

i) **On any lot:**

a) Silviculture
b) Agricultural use
c) Fish hatchery
d) Explosives sales, storage manufacturing and distribution
e) Firearm range
f) Wood processing
g) Gravel, mineral or peat extractions, gravel crushing and screening, bulk mixing, processing of soil mixtures for commercial resale
h) On any lot in the Agriculture Land Reserve any other use specifically permitted by the *Agricultural Land Commission Act*, regulations and orders

2. Accessory Uses

i) **On any lot:**

a) Single detached dwelling

3. Conditions of Use

i) **All wood processing, gravel, sand and mineral extraction (including crushing and screening of aggregate extracted onsite), bulk mixing, processing of soil mixtures shall be subject to the following conditions:**

a) A minimum setback of 15.0 metres along all lot lines.
b) A minimum setback of 30.0 metres from any lot line abutting an area zoned under Part 700, Residential Zones, and Water Supply and Resource Area zones.
c) No loading or storage areas shall be located in any required setbacks.
d) Uses abutting an area zoned under Part 700, Residential Zones, shall be screened and buffered from adjacent properties through the use of fencing, berm and evergreen vegetation being not less than 2.0 metres in height.
e) All structures and area utilized in association with wood processing, gravel, sand and mineral extraction (including crushing and screening of aggregate extracted onsite), bulk mixing, processing of soil mixtures shall be sited at least 30.0 metres from the boundary of any lake, sea, watercourse or wetland.

4. Density

i) **Residential density is limited to:**

a) **On any lot:** One single detached dwelling.

5. Lot Coverage

i) The lot coverage of all buildings and structures is 35 per cent to a maximum of 1000.0 square metres.

6. Siting and Height of Buildings and Structures

The maximum height of principal buildings and accessory single detached dwellings is 10.0 metres and the maximum height of accessory buildings is 7.0 metres.

i) The setbacks required for buildings and structures shall be as set out in the table below.

		Required Setback				
Type of Use	**Height of Structure**	**Front Yard**	**Rear Yard**	**Side Yard Front Lot Line <31m**	**Front Lot Line >31m**	**Side Yard Abutting Road**
Principal	10.0m	7.5m	7.5m	1.75m	3.5m	7.5m
Accessory	4.5m or less	7.5m	1.0m	1.0m	1.0m	7.5m
Accessory	7.0m - 4.6m	7.5m	7.5m	1.75m	3.5m	7.5m

7. Subdivision Requirements

i) The minimum lot area for subdivision shall be as follows:

a) 40.0 hectares for the area east of the most westerly boundary of the BC Hydro transmission right-of-way Plans 509, 510, 511, 512, 914, 932, 933 and 934.

b) 40.0 hectares for the area within 1.0 kilometre west of the most westerly boundary of the said rights-of-way, with measurement made perpendicularly to the boundary of the said rights-of-way, except as modified in Clause (e).

c) 40.0 hectares for the areas approximately 1.0 kilometre east, south, and west of the Village of Cumberland, except as modified in Clause (e).

d) 400.0 hectares for the area more than 1.0 kilometre west of the most westerly boundary of the said right-of-way's, with measurement made perpendicularly to the boundary of the said rights-of-way except as modified in Clause (e).

e) Where a lot is subject to both the 40.0 and 400.0 hectare minimum lot area, the minimum lot area which applies to the greatest portion of the lot shall be the minimum lot area for creation of that lot. Where a lot is divided into portions of equal area, the minimum lot area in respect of the entire lot shall be 40 hectares.

ii) The minimum permitted highway frontage for lots created by subdivision shall be 100.0 metres.

End • UR

RGS Amendment Comparison Chart

Board Initiates Amendment

Board decides minor or standard and provides notice of initiation to affected local governments and minister LGA s.433

Minor RGS Amendment Process per section 5.2.4

1st reading and adopt consultation plan concurrently

If affirmative vote of majority of board members present, then proceed to 2nd reading

If not affirmative vote of majority of board members present, staff will report back to Board with its options for the next step in the process

2nd reading

Public Hearing (if required)

3rd reading

Adoption

Standard RGS Amendment Process

Adoption of consultation plan LGA s.434

1st reading

Public Hearing (if required)

2nd reading

Refer to affected local governments and minister for acceptance LGA s.436

All affected local governments accept

3rd reading

Adoption

Not all affected local governments accept

Minister decides resolution process LGA s.436

Binding resolution

Non-binding resolution

Settlement or Arbitration

Comox Valley REGIONAL DISTRICT

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