WOODLANDS NEIGHBOURHOOD PLAN

WOODLANDS
Nature's Place

CITY OF
PRINCE GEORGE

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EXECUTIVE SUMMARY

On behalf of Woodlands Property Development Corporation, L&M Engineering Limited is proud to present the Woodlands Neighbourhood Plan for consideration by Prince George City Council. This Plan represents 18 months of research, public engagement, technical assessments, site visits and collaboration with the City of Prince George Sustainable Development Department. L&M would like to recognize and thank the City of Prince George for their technical support with respect to existing policy and infrastructure considerations throughout the planning process for this Plan.

The Vision

The land use vision and corresponding policy within this Plan has been informed by the public engagement process, the City of Prince George's long range plans and Bylaws together with a technical analysis of environmental, geotechnical and civil engineering reports prepared by the appropriate qualified professionals. In addition, the Winter Cities, Crime Prevention Through Environmental Design, Visitable Housing Design, Universal Design Guidelines and Healthy Cities Design Guidelines have also contributed to the creation of the Woodlands Neighbourhood Plan.

The vision for the Woodlands Neighbourhood Plan is to establish a low-density residential built form that represents the northern identity in balance with the natural biodiversity of the area, which accommodates recreational interests while maintaining environmental stewardship within a new pedestrian and family friendly neighbourhood.

Planning Process

The planning process for the Woodlands Neighbourhood Plan (the Plan) began in the summer of 2018 and was informed by two concurrent forms of analysis: Technical Analysis and Public Consultation. The findings have been summarized and integrated into this Plan to increase its relevancy and applicability throughout all future development phases within the Plan area.

Throughout the summer and fall of 2018 as well as early 2019, technical reports were requested from qualified professionals to assess the geotechnical, civil and environmental conditions of the Plan area. These reports were utilized to create the base plan to be shared with the surrounding neighbours, and ultimately formed the basis for meaningful discussions about the Plan area at future public engagement meetings.

During the initial public consultation held in November 2018, the neighbourhood identified itself as a family friendly neighbourhood that was interested in maintaining the greenspace and access to trails with an increased focus on keeping the traffic low and inclusion of pedestrian infrastructure throughout the Plan area. Protection of the sensitive ecosystems found within the two wetlands was also highlighted as a core value by the majority of the surrounding neighbours who participated. The feedback collected throughout the public consultation process was salient in defining a set of guiding principles for this Plan that are representative of the area and of the people who live there.

In the spring of 2019 a second public open house was held and the neighbours within the original distribution area for the first public engagement event were invited to attend again. The intent of this meeting was to share a sample of the draft Vision, Design Guidelines, Policy Recommendations and associated posters for each section of this Plan to maintain consistency with the guiding principles of the document identified by the surrounding neighbours at the first public open house as well as to promote transparency throughout the planning process. In general, neighbours who attended this second public engagement event expressed their satisfaction with the amount of greenspace that had been retained and the majority of people commented that their values had been reflected in the draft Plan.

Following the second public open house the draft plan was finalized and submitted to the City for review and approval.

The Plan

The Woodlands Neighbourhood Plan is a comprehensive planning document that is intended to inform future development within the Plan area. In recent years, the Hart community has seen a spike in new residential development, particularly within the vicinity of lands bounded by and surrounding the Chief Lake Road and Kelly Road North areas. This Plan integrates the long range policy objectives of the City of Prince George's Official Community Plan, the Parks and Trails Strategy as well as other design guidelines that are intended to elevate the standard for aesthetic design and livability within the Plan area.

The Plan is characterized by the following:

- Low density single-family residential housing;
- 17.75 ha of dedicated riparian and open greenspace areas;

- 1.04 ha neighbourhood park, which will create an overall 2.04 ha neighbourhood park for the enjoyment of the area once constructed next to the existing 1.0 ha park in an adjacent neighbourhood;
- Completion of multiple Environmental Assessments, Reviews and Reports to promote the significance and ensure the protection of the three wetland features and their respective ecosystems throughout all stages of development.
- Promotion of excellence in design standards including Winter Cities, Healthy Communities, Universal Design, Visitable Design and Crime Prevention Through Development Design.

Conclusion

On behalf of the property owners, L&M Engineering Limited is very pleased to present the Woodlands Neighbourhood Plan to Prince George City Council and appreciates Council's consideration. Should Council approve the Woodlands Neighbourhood Plan, the first phase of residential development is scheduled to begin construction in the spring of 2020.

Sincerely,

L&M ENGINEERING LIMITED

Ashley Elliott

Ashley Elliott, MCIP, RPP
Community Planner

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Acknowledgements

The Woodlands Neighbourhood Plan acknowledges the lands within the Woodlands Neighbourhood Plan area to be within the traditional territory of the Lheidli T'enneh, and honours them as the original keepers of this land. We will endeavour to honour the land, be stewards for its sensitive environmental features and to respect the people whose history is tied to these lands.

On behalf of the property owners, L&M Engineering Limited would also like to acknowledge the efforts, time and valuable input received from the City of Prince George staff, the surrounding Woodlands Neighbourhood and the qualified professionals who have worked together to bring this plan to fruition.

1.0 INTRODUCTION

The Woodland Neighbourhood Plan Area, identified on F1: Context Plan is approximately 40 hectares (ha) in size and is located in the northern sector of Prince George, British Columbia. Located north of the Foothills Boulevard and Chief Lake Road intersection, the Woodlands Neighbourhood Plan area is defined by its biodiversity including wetlands, informal trails and wildlife corridors. This area was amalgamated with the City of Prince George in the late 1970s and primarily consists of residential developments that provide a variety of housing types, lot sizes and lifestyles. The purpose of Neighbourhood Plans is to provide a clear and comprehensive land use vision for larger tracts of land (typically for parcels larger than 40 hectares in size) in order to provide certainty for residents, land owners, and developers with respect to how an area may be developed.

This Neighbourhood Plan works in alignment with the Official Community Plan to find a balance between the goals of the surrounding neighbours, the City of Prince George and the need to protect the sensitive natural features within the boundaries of the Plan area with economic realities. This Plan is intended to be implemented throughout the projected 10-15 year development horizon for the Plan area and has been prepared by L&M Engineering in close consultation with City Staff, property owners, and the public with additional professional opinion received from Triton Environmental Consultants as well as GeoNorth Engineering Ltd. The public process included consultation with surrounding property owners, School District 57 and the Archaeological Branch of British Columbia.

2.0 PLANNING CONTEXT

The City of Prince George provides policy direction as well as goals and objectives within the Official Community Plan and enacted throughout a wide variety of land use bylaws, which are intended to guide future development in a way that promotes and supports a range of lifestyles, public safety and wellbeing, as well as shared needs and diverse interests. Taking into consideration issues such as seasonal challenges, healthy lifestyles and housing needs, the City encourages new and innovative subdivision planning to further the quality of life for existing and future residents of Prince George.

In 2006, Council advised that prior to the approval of any new land use applications within the Woodlands area, a comprehensive vision needed to be identified in the form of a new Neighbourhood Plan. This was largely due to an overwhelming number of land use amendment applications, which created uncertainty for residents and required servicing and traffic assessments to ensure the area is thoughtfully planned in the future. In response, this Plan has been drafted in collaboration with the City of Prince George and surrounding residents to provide a guide for future development within the

Woodlands Neighbourhood Plan area, alongside the Official Community Plan and Zoning Bylaw. This Plan contains development design objectives and policy recommendations to aid future land use planning decisions within the Woodlands Neighbourhood Plan area to strengthen the overall design and vision for future residential, environmental, geotechnical and recreational planning.

The following section outline the Woodlands Neighbourhood Plan's consistency with the City's goals and objectives and identifies specific design frameworks that have been integrated into this document to raise the standard for future development within the Woodlands Neighbourhood Plan area.

2.1 Official Community Plan

The City of Prince George Official Community Plan Bylaw No. 8383, 2011 (OCP) is the overarching guiding document for the City of Prince George and is legislated through the Local Government Act (LGA). Currently the OCP designates the Woodlands Neighbourhood Plan area primarily for Neighbourhood Residential development with a planned future park development (Figure 5). The Neighbourhood Residential designation supports housing that is compatible with the scale and character of existing neighbourhoods, home design that is conducive to aging in place and the retention of greenspace so that residents are provided with good access to local recreation opportunities.

The OCP includes Schedule B-4 Growth Management, which identifies the Woodlands Neighbourhood Plan Area as the Phase 1 and Phase 2 Growth Management classifications. From a strategic perspective, the Phase 1 and Phase 2 classifications are based upon growth management direction and existing municipal servicing capacities to provide gradual expansion of the Urban area. The assumption therefore, is that Phase 1 would be developed first, followed by Phase 2 once services have been extended into the Phase 2 areas. OCP Policy direction also indicates that all infrastructure required to support development in Phase 1, Phase 2, and Future Urban areas should be funded in full by the developer. A detailed overview of the servicing strategy and policy direction for the Plan Area can be reviewed in Section 4.8 of this Plan and in the Servicing Brief found in Appendix G.

2.2 Neighbourhood Plans

To guide future development, the OCP outlines the requirement for new

Neighbourhood Plans to provide a clear and comprehensive land use vision for larger tracts of land. This requirement is intended to provide clarity for the community as well as for future developers. Neighbourhood Plans are detailed plans that supplement the OCP and provide additional guidance for new growth and development in a given area. The Woodlands Neighbourhood Plan addresses issues related to land use, environmental protection, density and servicing and has been prepared with a horizon of fifteen to twenty years, during which time it is expected that the majority of vacant land within the Woodlands Neighbourhood Plan area will be developed. Guided by the City of Prince George OCP, 2011, the Woodlands Neighbourhood Plan considers and includes the following:

a. Neighbourhood Context
b. Community Vision
c. Core Values
d. Residential Development Objectives, Design Guidelines & Policy Recommendations
e. Open Space, Parks & Connectivity Objectives, Design Guidelines & Policy Recommendations
f. Environmental Protection & Enhancement Objectives & Policy Recommendations
g. Transportation Networks Objectives & Policy Recommendations
h. Servicing and Infrastructure Objectives & Policy Recommendations
i. Subdivision & Phasing Objectives & Policy Recommendations
j. Implementation

2.3 Zoning Bylaw

The City of Prince George Zoning Bylaw No. 7850, 2007 presently provides for six distinct zoning districts within the Neighbourhood Plan boundary. The zones within the Woodlands Neighbourhood Plan area are AG: Greenbelt, AF: Agriculture & Forestry, RS1: Suburban Residential, RS2: Single Residential, RM1: Multiple Residential, and P1: Parks and Recreation. With the updated analysis completed for the plan area and the existing irregular zoning boundaries there is an inconsistency with environmentally sensitive areas and incompatibility with the surrounding neighbourhoods; therefore, a broad zoning amendment will be required in order to achieve the Neighbourhood Plan Objectives and land use direction.

2.4 Design Frameworks

In addition to the City of Prince George, municipalities throughout North America prepare and adopt design frameworks that are intended to inform their respective planning processes in an effort to encourage a higher aesthetic and accessibility standard for the design of new public spaces, housing and infrastructure. For the purposes of this Plan, the following design frameworks have been included as they align with the vision and guiding principles of this Plan. The design guidelines provided in this section are also incorporated in the design guidelines for each relevant section of the Plan in an effort to encourage their inclusion during the future detailed design stage of new public spaces, subdivision and building permits for new housing.

a. Winter Cities Design Guidelines

Northern lifestyles provide a range of opportunities, and challenges with respect to the livability, sustainability and affordability, of a community. Given that a substantial percentage of the year in Prince George is spent in the winter season, it is important that this Plan embraces the Winter Cities Design Guidelines. The Winter City Design Guidelines address streetscape and building design as well as open space design concepts in order to design communities that find balance between the benefits of winter with the challenges that a winter climate can have on infrastructure, population and quality of life for residents (Winter City Edmonton, 2016). Throughout Section 4.0 of this Plan, Winter Cities Design Guidelines will be recommended in an attempt to improve the level of comfort and accessibility for all new development in an attempt to increase the functionality and usability of both public and private spaces.

b. Crime Prevention Through Environmental Design

Crime Prevention Through Environmental Design (CPTED) is focused on the design and effective use of physical space to lead to a reduction in both the incidence and fear of crime. The Royal Canadian Mountain Police website identifies the four basic CPTED strategies as:

1. Natural Access Control - Guiding pedestrian to and from spaces by utilizing both real and psychological barriers;
2. Natural Surveillance - Placement of physical features, land uses, activities and people in such a way as to maximize visibility;
3. Territoriality - Physical design can contribute to a sense of territory;
4. Maintenance - Providing efficient maintenance of space to ensure natural surveillance; natural access control and territoriality are maximized.

These CPTED strategies are incorporated in the design guidelines throughout Section 4.0 of this Plan in order to inform the site design process for new development within the Woodlands Neighbourhood Plan boundary. This approach aims to reduce the incidences of crime, nuisance behaviour and fear of crime so that future residents and visitors will feel safe and free to enjoy the many benefits of the expanded Woodlands neighbourhood and the recreational opportunities therein.

c. **Visitable Housing Design**

In recognition of the well-documented knowledge that the population of Prince George is aging, visitable housing design is increasing in demand and in many cases can be incorporated at a relatively low cost. The majority of cost savings, are best realized at the building design stage rather than retroactively trying to make an existing building more visitable. In 2011, the City of Prince George undertook a Visitable Housing Project, which resulted in a Summary Report of key findings to inform future development with respect to the anticipated need for increased visitable housing options. The Summary Report identifies that “Prince George is expected to experience a dramatic increase in elderly residents (65+) in the coming years from 7,195 in 2008 to 19,049 in 2038”. Further, the Summary Report states that “Over the lifetime of a house, 25% to 60% of all new homes will have a resident with a long-term severe mobility impairment and 80% of people over the age of 50 prefer to remain in their homes as long as possible”.

The recognized visitable housing standards are:

1. At least one no-step first storey entrance,
2. Adequate passage doors featuring a minimum width of 81.28 cm (32 inches) and hallways with a minimum width of 91.5 cm (36 inches) wide on the first storey to

a visitable bathroom (and visiting space), and

3. A bathroom on the first storey that allows a person using a wheelchair to enter and close the door.

During the public consultation process for this Plan, approximately 26% of entrance surveys completed by surrounding neighbours expressed support for visitable housing design in new homes. The surveys also indicated that 37% of respondents identified themselves as being aged 65 or over, which indicates a higher than projected aging demographic for the Woodlands neighbourhood and a resultant benefit to be gained by implementing the seemingly modest house design standards identified above.

d. **Universal Design Guidelines**

Universal design extends beyond home design, affecting almost all aspects of a subdivision including the road networks, pedestrian infrastructure, homes and recreational amenities. In addition to people requiring a mobility device such as a wheelchair, universal design also considers the needs of mothers with strollers, the elderly and people temporarily in need of a mobility aid such as crutches etc. The vast majority of people at a given juncture in their lives will benefit from the implementation one or all of the 7 universal design guidelines:

Table 1: Universal Design Guidelines

Universal Design Principle	Guidelines
1. Equitable Use	The design is useful for people with diverse abilities.
2. Flexibility in Use	The design accommodates a wide range of individual preferences and abilities
3. Simple and Intuitive Use	Use of the design is easy to understand regardless of the user's experience, knowledge, language skills, or current concentration level.
4. Perceptible Information	The design communicates necessary information effectively to the use regardless of ambient conditions or the user's sensory abilities
5. Tolerance for	The design minimizes hazards and the adverse consequences of

Error	accidental or unintended actions.
6. Low Physical Effort	The design can be used efficiently and comfortably and with a minimum of fatigue
7. Size and Space for Approach and Use	Appropriate size and space is provided for approach, reach, manipulation and use regardless of user's body size, posture or mobility

Table 1: Universal Design Guidelines – (Table 4.1 The Principles of Universal Design, Version 2.0 (connell et al., 1997))

e. **Healthy Communities Design Guidelines**

According to the 2nd Planning Healthy Communities Fact Sheet Series prepared by the Canadian Institute of Planners "being healthy is not just about how we live, but also largely about where we live" and there are multiple opportunities to implement Healthy Communities Design Guidelines within new subdivisions. Designing a healthy community requires careful consideration into the factors that influence a person's proclivity toward living an active lifestyle. By removing barriers to activity such as unlit or uneven sidewalks and including opportunities which promote being active like increased access to naturalized greenspaces and gathering places, residents may be more inclined to integrate physical activity into their daily routines.

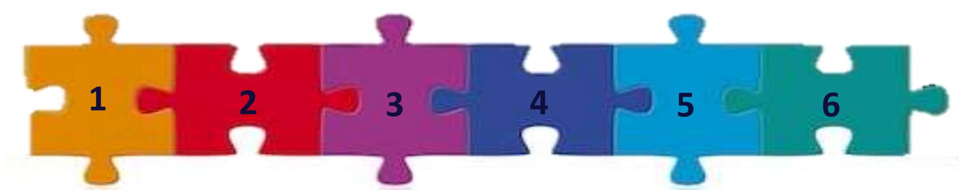
Photo used with permission

The health of a community involves the social, mental and physical capacity of its residents and is largely affected by the walkability of a neighbourhood, availability of housing, the ability to age-in-place, ease of access to public amenities and greenspace as well as a connection to neighbours (Canadian Institute of Planners, n.d.). Healthy Communities Design links the traditional concepts of planning (such as land use, transportation, community facilities, parks, and open space) with health themes (such as physical activity, public safety, healthy food access, mental health, air and water quality, and social equity issues). Healthy Communities Design strives to encourage increased pedestrian and recreational activity through the application of the following design guidelines:

1. Recognizing the importance of preserving natural environments for health and well-being.
2. Quality streetscape design such as lighting, landscaping and sidewalks where appropriate to promote a positive relationship with people’s decisions to walk or bike.
3. Retention of natural features with sensitive and/or aesthetic qualities to promote recreational usage and environmental protection.

2.5 Conceptual Framework

A Neighbourhood Plan includes a variety of technical, social and public input that culminates in a useable document that is reflective of the community it is intended to represent. Recognizing the significant number of variables that affect the final document, the following conceptual framework was identified at the outset of this process and was dilligently followed throughout the entirety of the planning process to ensure the final Neighbourhood Plan is an effective guide for future development within the Woodlands community.



Phase 1: Technical Review, Define Area Context

Phase 2: Public Engagement, Develop Neighbourhood Vision, Define Core Values

Phase 3: Draft Plan per Technical Review & Neighbourhood Vision

Phase 4: Public Engagement, Present Draft Vision and Policies to Neighbours

Phase 5: Plan Refinement Based on Public, Technical & City Feedback

Phase 6: Implementation

2.6 Planning Process

The planning process for the Woodlands Neighbourhood Plan (the Plan) began in the summer of 2018 and was informed by two concurrent forms of analysis: technical analysis and public consultation. The findings have been summarized and integrated into this Plan to increase its relevancy and applicability throughout future development phases.

Throughout the summer and fall of 2018, technical reports were requested from qualified professionals to assess the geotechnical, civil and environmental conditions of the Plan area. These reports were utilized to create the base plan to be shared with the surrounding neighbours, and ultimately formed the basis for meaningful discussions about the Plan area at future public engagement meetings. These reports are discussed further in this Plan and have been included within the appendices located at the end of this Plan.

On October 19, 2018 303 invitations to attend a public open house were delivered to surrounding neighbours via Canada Post. The invitation package included an entrance questionnaire, which was intended to gather baseline data for the Plan area as well as to help identify the demographic and land use vision of the surrounding neighbourhoods. A summary of the entrance survey responses is provided in the Public Open House Summary in Appendix I. The open house included multiple opportunities for input including mind mapping, dotmocracy, and sticky note exercises as well as a preference survey for future park options.

During the initial public consultation, the neighbourhood identified itself as a family friendly neighbourhood that was interested in maintaining the greenspace and access to trails with an increased focus on keeping the traffic low and inclusion of pedestrian

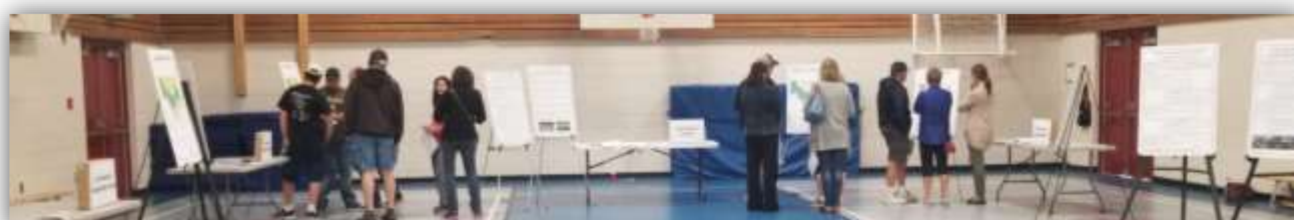


Photo taken at the 2nd public open house held on June 4th, 2019 at Springwood Elementary School.

infrastructure throughout the Plan area. Protection of the sensitive ecosystems found within the two wetlands was also highlighted as a core value by the majority of respondents. The feedback collected throughout the public consultation process was salient in defining a set of guiding principles for this Plan that are representative of the area and of the people who live there.

The winter months of 2018 and early 2019 were spent finalizing the environmental reporting for the area to include protection measures for the wetland features. The environmental recommendations also extended to include recommendations for setback distances, drainage planning and future construction.

In the spring of 2019 a second public open house was held and the neighbours within the original distribution area for the first public engagement event were invited to attend again. The intent of this meeting was to share a sample of the draft Vision, Design Guidelines, Policy Recommendations and associated maps for each section of the draft Plan to maintain consistency with the guiding principles of the document identified by the surrounding neighbours at the first public open house as well as to promote transparency throughout the planning process. A summary of the meeting and the questionnaire responses are provided in the Public Open House #2 Summary in Appendix J. In general, neighbours who attended expressed their satisfaction with the amount of greenspace that had been retained with the majority of people commenting that their values had been reflected in the draft Plan.

3.0 NEIGHBOURHOOD CONTEXT

The lands surrounding the Plan area have seen a steady increase in rezoning applications and subsequent residential development in recent years. The existing Woodlands neighbourhood is developed with urban services including street lighting, municipal services, curb and gutter and sidewalks, whereas the residential areas within the rural servicing designation in the lands to the west and north of the Plan area remains largely rural in nature with larger lots and onsite services. The demographic is characterized by families and deep-rooted residents residing in single-family homes.

Presently, the area is utilized by the surrounding neighbourhoods for snowshoeing, cross-country skiing, off-road recreational vehicle use and other activities such as walking dogs and pedestrian short cuts to adjacent neighbourhoods. The defining environmental features in the area are the long established wetlands, which have resulted from poorly draining soils and a long history of beaver activity.

The following section includes baseline information about the existing Woodlands neighbourhood and provides context for which the design guidelines and policy recommendations of this Plan are intended to build upon.

3.1 Surrounding Land Use Network

The Woodlands Neighbourhood Plan Area is approximately 38.54 hectares (ha) in size and is located within the municipal boundaries of the City of Prince George. The Plan area is presently vacant and used informally by surrounding residents for walking dogs, snowshoeing, cross-country skiing and connecting to lands beyond. Existing schools are within close proximity of the Plan area including two elementary schools within approximately 2 kilometres, and a Secondary School located only approximately 1.8 km away. Additionally, a strip mall is approximately 3.0 km away which features amenities such as a grocery store, a bank, liquor store etc. as well as public transit stops that connect to the greater City-wide transit network.

3.2 Surrounding Transportation Network

Foothills Boulevard and Chief Lake Road are the arterial roads that connect the plan area with the larger network of Prince George and to the John Hart Highway, respectively. Section 4.7 of this Plan discusses how the proposed development of the Woodlands Neighbourhood could potentially integrate with the existing transportation network, including the timing of infrastructure improvements which may be triggered when development traffic volumes begin to adversely impact the existing neighbourhood roads. Many of the surrounding subdivisions lack sidewalk connections with the exception of the first three phases of the Woodlands subdivision. Chief Lake Road was identified as the preferred walking route for local students from the neighbourhood to the Secondary School, but is lacking a dedicated pathway, which increases the potential of a vehicle related pedestrian incident. Presently, there are no bus stops as there is no transit service to this area of the community except for the school bus stop near the intersection of Chief Lake Road and Foothills Boulevard, which has been identified as problematic due to the lack of a dedicated pull-out where the bus can safely pull to a stop to let the children load and unload during the scheduled pick up and drop offs.

The Policy Recommendations of Section 4.7 of this Plan will provide direction for future transportation planning including traffic, public transit, cyclist and pedestrian infrastructure recommendations to ensure that the future neighbourhood encourages healthy lifestyles and accessible design standards.

3.3 SD57

School District 57 (SD57) is bounded to the north by the District of Mackenzie, to the south by Hixon and to the east by McBride and Valemount amassing a total area of 52,000 km^2 and educating approximately 13,000 school-aged people. The School District has identified a strategy for accommodating students within catchment areas in the event that schools exceed their operating capacities identified in the 2010 Long Range Facility Plan as follows:

1. Adjustment of boundaries between adjacent catchment areas; or
2. Addition of portables.

The Woodlands Neighbourhood is within the Springwood Elementary and Kelly Road Secondary School catchment areas. Section 4.4 of this Plan includes a summary of the projected number of households and calculates the resultant population increase that is estimated for the area. Section 4.4 includes Table 6: Woodland Population Projection, which estimates that approximately 190 single-family residential homes could be constructed within the study area. This estimated number of households was then applied in Table 2: Projected School-Aged Population below to help analyze the impact to the above-identified catchment areas. As outlined in Table 2, the estimated elementary school-aged population is calculated to be approximately 76 based on the standard of 0.4 elementary students per household. The secondary school-aged population is calculated to be 53.2 based on the standard of 0.28 secondary students per household. The total school-aged population is estimated to be 129.2 which represents a relatively modest increase to the overall school catchment population over the projected 10-15 year development horizon for this Plan.

Assuming that the ages of school-aged children will be distributed throughout the various grades and will grow slightly with each development phase (approximately 20 houses per year on average); the resultant population increase is not anticipated to create unmanageable pressure on the respective school catchment areas. The following tables identify the operating capacities (OpCap), enrollment and projected enrollment volumes for each school, together with a snapshot of the projected school-aged population that would be added by the proposed residential development within the Plan area at full build out.

Table 2: Projected School-Aged Population

	Total Dwelling Units	Average Students per Dwelling	Number of Students
Elementary School	190	0.4	76
Secondary School	190	0.28	53.2
Total			129.2

Table 3: School Operating Capacities and Enrollment

School	OpCap	Enrollment (2019/2020)	Projected Enrollment (School years)	Projected Increase within Plan area
Springwood Elementary	220*	227	Unknown (2024/2025)	76
Kelly Road Secondary	1150**	788	587 (2024/2025)	53.2

Operating Capacity and Projected enrollment retrieved from SD57 2015 and the 2015 Long Range Facilities Plan.

* Occupancy can be increased to 270with the addition of portables.

**New school will have a capacity 950 following occupancy of the new building.

3.4 Environmental Context

Within the boundaries of the Plan area there are sensitive natural ecosystems, some of which have been identified to contain species requiring varied levels of protection per the *Water Sustainability Act* (WSA). There are three main wetland features, which, together with the 15 metre riparian leave strip areas surrounding the wetlands and streams are to be respected as natural areas and are recommended to remain free of development. Any development proposed to occur in these areas must be approved by the Ministry of Forests Lands, Natural Resource Operations and Rural Development (FLNRORD). Greater detail surrounding the sensitive ecosystems within the Plan area and the associated environmental policy recommendations can be found in Section 4.6 and Appendix B of this Plan.

Figure 6 identifies the extent of the environmentally sensitive areas and Table 4 further clarifies the features in greater detail by type, area, and permitting requirements of the *Water Sustainability Act* (WSA):

Table 4: Environmentally Sensitive Areas and Permitting Requirements

FEATURE	AREA	LEVEL OF PROTECTION REQUIRED	WSA PERMITS REQUIRED PRIOR TO DEVELOPMENT
Fen (Wetland)	11.3 Ha	High	Yes
Riparian Leave Strips	3.8 Ha	Moderate	Yes
Bog	4.9 Ha	Low	No
Swamp	0.47 Ha	Moderate	Yes

3.5 Geotechnical Context

In 2006 GeoNorth Engineering Ltd. completed a geotechnical overview of the Plan area, which included discussions of development constraints, develop-ability and probable soil types following a review of aerial imagery and a field reconnaissance. Test pits were hand-dug by GeoNorth within the Plan area and revealed that the Plan area is underlain by glaciolacustrine sediments that were deposited by Glacial Lake Prince George. Glacial till deposited by glacial ice was observed at higher elevations of the Plan area, which includes a mixture of sand, gravel and cobbles in a silt or clay matrix.

Geotechnical conditions within the Plan area were concluded by GeoNorth to be favourable for residential construction; however, as some constraints exist, further investigation may be required on a site-specific basis prior to construction. The full geotechnical overview with recommendations for residential development is provided in Appendix E.

3.6 Archaeological Context

The Plan area is entirely contained within the traditional territory of the Lheidli T'enneh. The Lheidli T'enneh, translated as "the people from the confluence of two rivers", is a Carrier-speaking First Nation whose traditional territory extends from the Prince George area east to the Alberta border.

Archaeological sites (recorded and unrecorded, disturbed and intact) are protected under the *Heritage Conservation* Act and cannot be altered or damaged without a permit from the Archaeology Branch of B.C. At the time of this Neighbourhood Plan process, the Archaeological Branch confirmed that there were no known areas of archaeological significance within the plan area; However, if any archaeological sites or items of archaeological significance are encountered during development then all development activities must be halted until the Archaeology Branch is contacted for direction.

The Woodlands Neighbourhood Plan has been created with the intention of incorporating the collective vision of the surrounding neighbourhoods as they align with the goals and objectives outlined in the OCP. The following sections have incorporated the above policies, objectives and design guidelines in order to inform future development within the Woodlands Neighbourhood Plan area as directed by Council and supported by the OCP to create a supportive and engaged community with strong social connections that recognizes, celebrates and protects neighbourhood identities.

4.0 THE PLAN

The following section presents the land use plan and policy recommendations of the Woodlands Neighbourhood Plan. The proposed land uses in this Plan (see Table 5: Proposed Land Use Summary) are discussed independently with separate policy recommendations for each proposed land use. The land use vision and corresponding policy has been informed by the public engagement processes, as well as City of Prince George plans, policies and Bylaws and a technical analysis of environmental, geotechnical and civil engineering reports prepared by the appropriate qualified professionals. In addition, the Winter Cities, Crime Prevention Through Environmental Design, Universal Design Guidelines, Visitable Housing, and Healthy Cities Design Guidelines have also contributed to the creation of the Woodlands Neighbourhood Plan.

Table 5: Proposed Land Use Summary

Land Use	Total Area (ha)
Single-Family Residential	19.75
Neighbourhood Park	1.04
Greenbelt	6.52
Riparian	11.23
Total	**38.54**

4.1 Vision

The vision for the Woodlands Neighbourhood Plan has been identified as a result of public consultation with the surrounding neighbourhood and stakeholders, as follows:

> ***"To establish a low-density residential built form that represents the northern identity in balance with the natural biodiversity of the area, which accommodates recreational interests while maintaining environmental stewardship within a new pedestrian and family friendly neighbourhood. "***

4.2 Woodlands Neighbourhood Plan Goals

- Refine the level of policy detail at the neighbourhood level within the context of the Official Community Plan.
- Respect the environment by protection, retention and restoration of natural areas and ensure development occurs in a sensitive manner.
- New housing development should encompass a range of accessibility standards and sizing so that residents may remain in the Woodlands Neighbourhood despite changes in their own life circumstances, family size or income level.
- Transportation networks and the design of streets should strive to meet the needs of both non-motorized means of travel and motorized vehicle use.
- To ensure that the Woodlands Neighbourhood is developed in a logical manner and serviced with urban services to City of Prince George standards at the onset of development as outlined in this Plan.

4.3 Core Values

As part of the initial public open house, multiple opportunities for surrounding neighbours to provide feedback about their values, hopes, vision and preferences were provided. Analyzing the results of the entrance questionnaire and the feedback collected through the first public open house, patterns began to emerge from the information collected. These patterns were then categorized and identified as the Core Values to be applied throughout the Woodlands Neighbourhood Plan. The Core Values were used to determine the Guiding Principles of the Plan as follows:

	Core Value	Guiding Principles
	**Safe, Family Oriented Design**	• CPTED Principles should be considered at all stages of development. • Street calming methods should be considered when designing road networks. • Avoid overcrowding. • Provide logical connections to the school and bus pickup locations.
	**Retain Community Identity**	• Ensure development is consistent with surrounding residential development. • Ensure the character of the area is respected and supported. • Facilitate development that supports a continuation of current recreational uses. • Support housing types that complement existing neighbourhoods.
	**Accessible Pedestrian Network**	• Pedestrian networks designed to provide curb drops and let downs where necessary for seamless transitions between surface types. • Pedestrian networks to incorporate Winter Cities Guidelines and CPTED identified in Sections 2.4(a) and 2.4(b) respectively.

	**Integrate Parks & Environmental Areas**	• Natural features within the Plan area should be emphasized where possible into neighbourhood design. • Useable greenspace as a continuous lineal system to support informal recreational linkages.
	**Maintain Environmental Integrity**	• Recommended riparian setbacks to remain free from development unless otherwise approved through designated approving authorities. • Wetland ecosystems are to be protected from development where feasible. • Acknowledgement of the interconnected nature of the wetlands as well as their associated drainages, riparian areas and ecosystems as they extend beyond the Plan area.
	**Build Strong Neighbourhoods**	• Provide access to social and recreational spaces within Plan area • Provide opportunities for residents to age in place with visitable design guidelines as a benchmark for accessible housing options. • Physical surrounding supports mental health via access to transportation, parks and green spaces and public meeting spaces

4.4 Residential Development

The City of Prince George has identified a goal to create a supportive and engaged community with strong social connections that recognizes, celebrates and protects neighbourhood identities. Throughout the public consultation process for this Plan, the surrounding neighbourhood expressed a strong interest in the preservation of the existing community identity: A safe and family oriented community with multiple opportunities to access the natural environment. The preferred housing form expressed throughout the process was single family, with opportunities for both smaller "starter homes" as well as larger family homes. There was also interest in options for accessible and/or visitable housing design due to the aging population's desire to eventually be able to age-in-place. Low density housing is therefore proposed throughout the developable area of the Plan, featuring small to medium scale single family homes with encouragement for visitable housing design as the focus of this section.

Population data was calculated for the Plan area utilizing a review of the STATSCAN Community Profile for Prince George, Census Area data from PGMap, and the draft City of Prince George Design Guidelines. The average number of persons per household was determined to be 3.0 for single-family dwellings. Table 6 below demonstrates the population for the Woodlands Neighbourhood Plan will be approximately 570 people, while Chart 1 below provides the projected age/sex breakdown of that population.

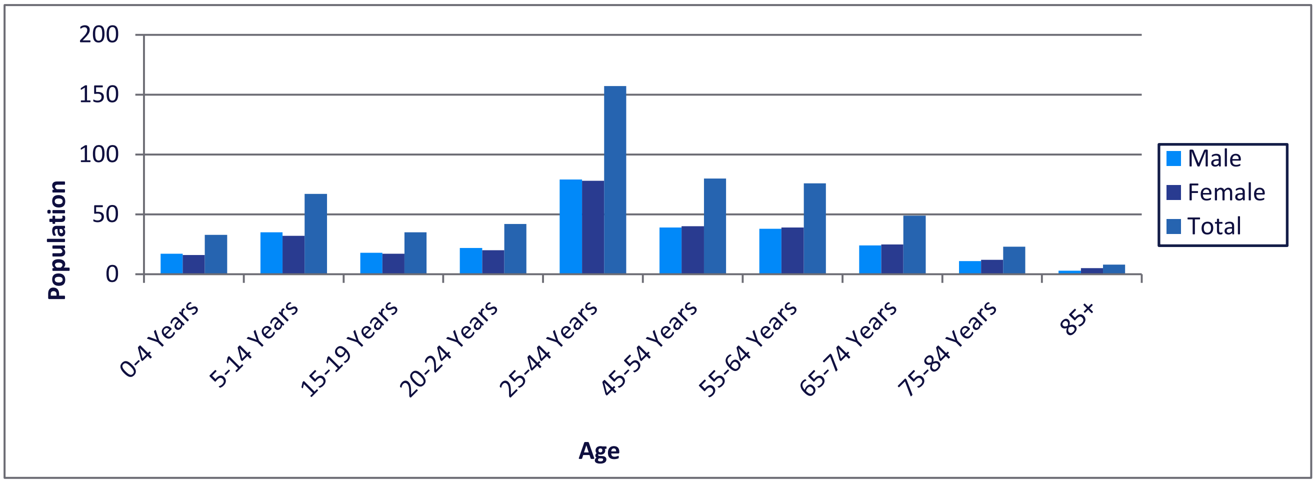
Table 6: Woodlands Estimated Population

Housing Form	Developable Area (ha)	Dwelling Units/ha	Number of Dwelling Units	Persons/ Dwelling Unit	Estimated Population
Single Family	20.7	9.2	190	3.0	**570**

Chart 1: Projected Age/Sex Population Breakdown

	0-4 Years	5-14 Years	15-19 Years	20-24 Years	25-44 Years	45-54 Years	55-64 Years	65-74 Years	75-84 Years	85+ Years	Total
Male	16.6	34.7	18.0	22.2	78.6	39.3	37.8	23.8	11.1	3.1	285
Female	15.9	32.5	17.0	20.1	78.1	40.2	38.6	25.4	12.1	4.8	285
Total	32.5	67.2	35	42.4	156.7	79.5	76.4	49.3	23.1	7.9	**570**

Chart 2: Projected Age/Sex Population Breakdown Graph



a. **Residential Development Objectives**

1. To manage residential growth in such a way that minimizes environmental impacts and protects existing quality of life.
2. To provide for a range of residential opportunities regardless of varying financial resources, ages and household compositions.
3. To foster a physical and social sense of community in residential neighbourhoods.

b. **Residential Development Design Guidelines**

Residential development in the Woodlands Neighbourhood is intended to promote a strong neighbourhood identity in a community with an ecologically responsible subdivision design. Specific development regulations will be identified via future phased rezoning processes but should also strive to include, where possible, the following Design Guidelines:

1. The design and siting of homes should take advantage of views, natural amenities and adjacent open spaces.
2. The design and siting of new homes should provide the maximum sun exposure to enhance the liveability of future residents in accordance with the Winter Cities Design Guidelines identified in Section 2.4(a).

3. Street trees included within the subdivision should be designed utilizing the principles of W*inter Cities Design Guidelines,* as outlined in Section 2.4(a) so that deciduous trees are planted on southern elevations to shade in summer and allow sun in the winter months.
4. Residential housing forms and subdivisions should be designed to provide natural surveillance of public spaces in accordance with the *Crime Prevention Through Environmental Design* best practices*,* as outlined in Section 2.4(b) of this document.
5. Residential housing forms and subdivisions should be designed utilizing the principles of *Visitable Housing Design,* as outlined in Section 2.4(c) of this document so that at least one no-step first storey entrance is provided.
6. Residential Housing forms and subdivisions should be designed utilizing the principles of *Visitable Housing Design,* as outlined in Section 2.4(c) of this document so that adequate passage doors feature a minimum width of 81.28 cm and hallways providing access to a first storey visitable bathroom and living space are constructed to a minimum standard of 91.5 cm.
7. Residential Housing forms and subdivisions should be designed utilizing the principles of *Visitable Housing Design,* as outlined in Section 2.4(c) of this document so that a first storey bathroom is provided with enough space so that a person utilizing a mobility device such as a wheelchair may enter and close the door.
8. Where possible, housing design should integrate passive solar into building design with proper orientation, massing, window location, shading ventilation and shade structures.

c. **Residential Development Policy Recommendations**

1. Development of housing in “neighbourhood” designated areas will continue to be regulated through the policies of the Official Community Plan.
2. Existing trees, sensitive natural features and viewscapes such as the wetland features and riparian areas should be retained where feasible.
3. Detailed geotechnical investigation shall be required prior to subdivision to determine the depth of organic material to be removed as well as the volume and compaction of structural fill required as indicated in Appendix E

Geotechnical Overview.

4. Detailed geotechnical investigation shall be required prior to subdivision to determine the depth to and seasonal variability of local groundwater as indicated in Appendix E Geotechnical Overview.
5. Lot configurations shall be designed at the subdivision stage of development in accordance with the guidelines and principles of this Plan.
6. If at any time any archaeological sites or items of archaeological significance are encountered during development then all development activities must be halted until the Archaeology Branch is contacted for direction.

4.5 Open Space, Parks and Connectivity

The subject property features two extensive, naturally occurring and connected wetlands as the result of historically persistent beaver activity and poorly draining soils. The location, extent and shape of the wetlands and the surrounding riparian features opens the door for a new, innovative neighbourhood design that respects the environmentally sensitive features, while simultaneously providing both active and passive recreational opportunities for future residents of the expanded Woodlands neighbourhood.

Official Community Plan

The Official Community Plan (OCP) identifies an objective to "embrace the environmental context by respecting existing ecosystems, biodiversity, natural features and views". The OCP also supports a high quality of life for residents, which is inextricably linked with one's relationship with the physical environment and natural areas. With a particular emphasis on winter recreation activities, the wetlands provide a distinctive backdrop for a future neighbourhood that would promote a closer relationship with the natural environment.

Parks & Trails Master Plan (2008) and Park Strategy (2017)

The City of Prince George provides two plans that are used to guide future park acquisition, development and maintenance of parks within the municipal boundaries. The first plan was adopted in 2008 as the City's Parks & Trails Master Plan and outlines the goals, priorities and implementation approaches for the existing park inventory as well as future acquisition targets within specific areas throughout the City.

Picture used with permission.

The 2017 Park Strategy is the result of a significant public engagement process and speaks to the demand for Neighbourhood Parks throughout the community. This is supported by the overwhelming response through the public engagement processes associated with this Plan for access to greenspace. Many of the surrounding neighbours provided feedback throughout this Neighbourhood Plan process that focused on maintaining the identity of the neighbourhood and the continued recreational usage of the natural environment found within the Plan boundary. The Objectives, Design Guidelines and Policy Recommendations found in Section 4.5 of this Plan, have been provided to support the City of Prince George's objectives to preserve sensitive ecosystems, acquire new parklands that offer a diverse range of recreational opportunities and improving public access to the natural environment.

Woodlands Open Space and Connectivity Strategy

The feedback received during the public consultation process for this Plan consistently identified a preference for a naturalized green space over other types of parks. Specifically, a park-like network was requested to facilitate the continued use of the lands within the Plan area for walking, snowshoeing and observing the various ecosystems found within the wetlands and the surrounding natural environment. To achieve this, the neighbourhood park is proposed to be located adjacent to the wetland, which will provide natural and informal linkages connecting residents with the wetlands and drainage corridors to lands beyond. This Plan endeavors to ensure that future residential development is designed to support the continued recreational use of the property with minimal disruption to users and without negatively impacting the wetlands or their related ecosystem functions.

Woodlands Park Strategy

The Local Government Act (LGA) legislates that a 5% parkland dedication is required for new subdivisions within the City of Prince George. The Neighbourhood Park provides an opportunity to install trail networks or playground equipment to be used in the summer, whereas in the winter months the area would connect to an extensive snowshoeing and cross-country skiing network through the frozen riparian and wetland areas, which was identified as a goal by the community through the public engagement process.

The Design Guidelines and Policy Recommendations identified in this section are based upon the parkland dedication calculation as indicated in Table 7below:

Table 7: Proposed Parkland Dedication

Total Property Area (ha)	Total Developable Area (ha)	Area of Proposed Parkland (ha)	Percentage of Parkland
38.54 ha	20.79 ha	1.04 ha	5%

A balanced approach will be necessary in order to make this unique neighbourhood design a reality. The policy direction provided below is intended to balance future growth with the unique natural landscape and surrounding neighbourhoods to establish a built form that is in harmony with the natural setting and seeks a balance with the retention of the natural character of the area.

a. **Open Space, Parks & Connectivity Objectives**

1. To develop a central and accessible Neighbourhood Park that adjoins the dedicated parkland to the east as shown on Figure 9 and supports the Woodlands neighbourhood as well as the surrounding residential subdivisions and the residents who reside there.
2. Ensure there is sufficient supply of functional and accessible open space to meet the needs of current and future residents.

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3. Establish a park space that is efficient to manage and to be maintained as a neighbourhood park.
4. Establish a neighbourhood that supports nature-based recreation and contributes to the social and physical health of the community.
5. Ensure the provision of public space provides for a diverse range of activities.

b. **Open Space, Parks & Connectivity Design Guidelines**

1. All parkland should be designed to maximize visual and physical access by ensuring that the majority of the park is fronted by road or other public space.
2. Parkland shall be designed to contribute to the public's appreciation of the natural environment by ensuring the location of the park does not interrupt the viewscapes of the wetland ecosystems.
3. Where possible, parkland shall encourage biodiversity by retaining existing intact vegetation communities and wildlife corridors.
4. Parks and natural features should be linked via green corridors to provide informal public access to the natural features within the Plan and to lands beyond.
5. Natural access control should be implemented throughout the Plan area for pedestrian spaces via physical and psychological barriers to identify areas intended for public use in accordance with CPTED best practices identified in Section 2.4(b).;
6. Wherever possible, subdivision and building design should facilitate the natural surveillance of all parks, children's play areas and other public spaces in accordance with CPTED best practices as identified in Section 2.4(b).
7. Parks and open spaces should be designed to implement the principles of *Universal Design Guidelines,* as outlined in Section 2.4(d) of this document so that the design is useful for people with diverse abilities.
8. Parks and open spaces should be designed to implement the principles of *Universal Design Guidelines,* as outlined in Section 2.4(d) of this document so that the design accommodates a wide range of individual preferences and abilities.
9. Parks and open spaces should be designed to implement the principles of

Universal Design Guidelines, as outlined in Section 2.4(d) of this document so that the design can be used efficiently, comfortably and with a minimum of fatigue.

10. Parks and open spaces should be designed to implement the principles of *Universal Design Guidelines,* as outlined in Section 2.4(d) of this document so that the design minimizes hazards and adverse consequences of accidental or unintended actions.

c. **Open Space, Parks & Connectivity Policy Recommendations**

1. As outlined in Table 7: Proposed Parkland Dedication, the required parkland dedication represents 5% of the total developable area (20.07 ha), totalling approximately 1.04 ha.
2. Detailed locations of parkland boundaries shall be determined at the rezoning or subdivision stage or as appropriate.
3. Lands zoned and dedicated to the City of Prince George for the purpose of parkland shall become the property of the City of Prince George.
4. Development of the dedicated parkland should consider park plans and strategies and considers financial mechanisms consistent with OCP growth management direction.

4.6 Environmental Protection and Enhancement

The Woodlands Neighbourhood Plan area is characterized by large wetland fens, multiple natural drainages as well as dominating tree species including lodgepole pine, hybrid white spruce and trembling aspen. Within the wetland, bog and riparian areas, black spruce and black cottonwood are the dominant species and are utilized together with other dominating vegetative species to identify the boundaries of wetland and riparian ecosystems (See Environmental Overview in Appendix A).

In response to the Servicing Design Brief that was prepared for this Plan, Triton Environmental

Consultants prepared a Woodlands Recommendations Memo (see Appendix D), which includes recommendations for development within the Plan area that is respectful of the sensitive natural features contained within and reflects the environmental values expressed by this Plan. The Woodlands Recommendations Memo includes best practice guidelines and recommendations for road crossings, stormwater management, and groundwater mitigation and recommends that an Environmental Management Plan be prepared to include a site specific Erosion and Sediment Control Plan in advance of development to prevent unintended adverse impacts to the wetlands and their related ecosystems.

Wetlands provide many functions that are beneficial within residential areas when undisturbed, such as:

- Groundwater recharge;
- Natural flood protection;
- Natural purification of surface water through nutrient absorption such as phosphorus and nitrogen, heavy metals and pesticides;
- Habitat and food sources for waterfowl, flora, reptiles, and wildlife;
- Absorption of C02 and methane;
- Contributing factor of natural evapotranspiration and climatic cycles; and,
- Valuable recreational and educational amenities to residents (UPA, n.d.).

In addition to these important functions, wetlands also provide many socio-economic contributions to the surrounding environment including:

- Attractions for recreation;
- A rich and varied landscape serving as a valued aesthetic resource;
- Topics for scientific research; and
- Natural heritage areas (Government of Canada, 2016).

Recognizing the value that wetland features contribute to a community, the following environmental policies are intended to help guide the preservation and integration of wetlands into the neighbourhood as well as to foster sustainable management practices for future generations.

a. **Objectives**

1. To ensure the continued functions of the wetland in accordance with the

Water Sustainability Act.

2. To recognize the ecological, cultural, social, and economic value of wetlands and their corresponding wetland functions.
3. To recognize the interconnected nature of adjacent properties as the wetlands together with their associated drainages, riparian areas and ecosystems extend into the adjacent properties beyond the Plan boundary as shown on Figure 9.
4. To maintain natural wetland functions by avoiding, minimizing and if necessary, replacing lost wetland value.
5. To mitigate the impacts of development on existing drainage networks.
6. To ensure the safety of people and property from natural hazards in environmentally sensitive areas and drainage corridors.
7. To reduce human-wildlife conflict.
8. To retain natural features with sensitive and/or aesthetic qualities to promote environmental protection and recreational usage in accordance with the *Healthy Communities Guidelines* as outlined in Section 2.4(e) of this document.

b. **Policy Recommendations**

1. All new development within the Plan area must be in accordance with the environmental recommendations as identified in the Triton Environmental Report (2006) the Triton Environmental Memo (2018) and the Triton Environmental Recommendations Memo (2019) in Appendix A, Appendix B and Appendix D respectively.
2. Provincial WSA Permits will be required prior to development for wetland, Riparian leave strips and swamp features as indicated in Table 4 of Section 3.4.
3. Clearing activities cannot occur within the Bird Nesting window until a nesting study has been completed by a qualified professional and submitted to the City. The Bird Nesting window is identified as April 19 – August 24th inclusive.
4. The two main wetland features (WF02) are to be retained as a natural feature within the Plan area. Any changes to the WF02 wetland features will

require approvals under the provincial *Water Sustainability Act*.

5. Existing drainage patterns are to be maintained.
6. All new residential development shall be set back a minimum of 15 metres from the high water mark of all wetlands and identified streams as classified by the *Water Sustainability Act* or any subsequent amendments or replacements of the Act.
7. In accordance with regulations set out in the BC Weed Control Act, reasonable efforts shall be made during all construction activities to control the spread of noxious and invasive plant species into the wetland areas including, but not limited to, Canada Thistle (Cirsium Arvense) and Marsh Thistle (Cirsium Palustre).
8. Landscape design that reduces opportunities for human-wildlife conflict shall be implemented, including the restriction of fruit bearing trees and securing residential garbage within the Neighbourhood Plan area.
9. Prohibit new development and restrict redevelopment within creek corridors or significant environmental areas except for public works such as crossings for roads, services and municipal trails.
10. Any lands required by the City of Prince George to be dedicated as leave strips in excess of the recommended 15 m setback shall be purchased by the City from the property owners for full market value as assessed at the time of future land purchase.
11. The primary purpose of riparian leave strips is to protect and enhance the body of water and surrounding habitat. Development of trails, viewing points and rest areas within riparian leave strips will be supported when done in an environmentally sensitive manner.

12. Tree removal within the Plan area is regulated through the City's Tree Protection Bylaw and should be limited to selective clearing within future subdivision phases where possible to support the retention of mature trees to promote recreational and environmental protection as recommended by the *Healthy Communities Guidelines* outlined in 2.4(e) of this document.
13. Detailed subdivision design shall include retention of mature trees, where possible.
14. Site specific Erosion and Sediment Control Plans shall be required prior to construction in accordance with the 2019 Woodlands Recommendations Memo completed by Triton in Appendix D to prevent unintended adverse impacts to the wetlands or their respective ecosystems.
15. Should removal of a beaver dam become necessary to protect roads or properties from flooding, a General Wildlife Permit from the Ministry of Forests, Lands, Natural Resource Operations and Rural Development may be required in accordance with Section 9 of the Wildlife Act as amended or replaced from time to time.
16. Should removal of a beaver dam become necessary to protect roads or properties from flooding, a Notification of Changes in and About a Stream may be required in accordance with the Water Sustainability Act as amended or replace from time to time.

4.7 Transportation and Infrastructure

Throughout the City of Prince George Official Community Plan, transportation planning is referenced within the context of air quality, accessibility, healthy lifestyles, and the built environment in addition to the obvious movement of people throughout the community. In recognition of the variety of transportation modes, this section provides the objectives, design guidelines and policy recommendations to help ensure that transportation planning considers the values of the community and the surrounding neighbours to create a safe, efficient and pedestrian friendly transportation network.

Public Transit Networks

Throughout the public planning process for this Plan, multiple residents expressed an interest in an expanded public transit system so that they may benefit from the many advantages of having better access to the local bus system. Presently, no route exists

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within this area of Chief Lake Road with the nearest transit route extending slightly north of the Chief Lake Road and Highway 97 North intersection. The existing route 91 connects the Hart with the Spruceland Exchange, an exchange that provides access to a number of other routes throughout the City and offers hourly, weekday and weekend service. The City identifies the goal of providing transit service within 400 metres or a 5 minute walking distance for 90% of the residents (City of Prince George Future Transit Plan and Official Community Plan). Currently, the only school bus service in the area is a school bus route that stops at the Chief Lake Road and Foothills Boulevard intersection. Expansion of the City's transit system will be dependent upon development growth and future agreements between the City of Prince George and B.C. Transit as warranted by demand. For the purpose of this section, recommended design guidelines for the location and type of transit shelters have been provided for future reference upon such an expansion of the City's transit system into the Plan area.

Pedestrian Networks

Pedestrian network design is increasingly recognized as an important component of transportation planning and contributes to a more healthy, vibrant and livable community. Throughout the planning process, surrounding neighbours increasingly commented on a lack of existing pedestrian connectivity within and surrounding the Plan area. Residents expressed a strong desire for improved pedestrian options throughout the Woodlands neighbourhood. The 2004 Pedestrian Network Study completed by the City of Prince George reiterates the importance of useable, accessible pedestrian opportunities when it states that:

> *"Everyone benefits when walking trips are increased. Individuals who walk can experience health and social benefits. Those who choose not to walk may benefit from reduced vehicle emissions and increased community appeal".*

To this end, this section proposes a pedestrian network of sidewalks, constructed along the 'sunny' side of the streets (north & east), unless this would create a disruption or unsafe connection for users. The proposed pedestrian network provides residents with access from their residences to the park, open spaces, and to lands beyond including future connections toward Springwood Elementary School and surrounding major arterial roads, which is envisioned to be extended into future adjacent developments as shown on Figure 9 to encourage the continuity of infrastructure.

As previously mentioned, Chief Lake Road has been identified as a preferred pedestrian route, but lacks a dedicated pedestrian pathway. Schedule B-9 of the OCP identifies a proposed Boulevard Trail along Chief Lake Road, the development of which would help to alleviate this concern.

Road Networks

As part of the planning process for this Plan, a Traffic Impact Study (TIS) was completed, which assessed the intersections of Foothills Boulevard and Chief Lake Road as well as the Kelly Road North and Venta Drive/ Mabel Road intersections. The findings of the TIS ultimately contributed to the creation of the Design Guidelines and Policy Recommendations provided in this section below. The study included the 2022 existing background, 2037 projected background and the 2022 opening day development horizons, which were measured against the data collected during the peak traffic periods of 7:00 am to 9:00 am as well as the 2:30 pm to 6:00 pm (adjusted to capture the school traffic peak). The proposed trip generation for the Woodlands Subdivision site was developed using the Institute of Transportation Engineers (ITE) Trip Generation Manual 10th Edition rate according to the proposed land use.

The Opening Day scenario includes a total of 42 dwelling units and assumes the following developments will be constructed and occupied:

- 10 currently vacant lots in the existing Woodlands subdivision
- 16 lots in Woodlands Phase 3 (Tatlow Road)
- 16 lots in Woodlands Phase 4 (Northwest end of Woodland Drive)

The Total Traffic scenario includes a total of 453 dwelling units and assumes the following developments will be constructed and occupied:

- 10 currently vacant lots in the existing Woodlands subdivision
- 16 lots in Woodlands Phase 3 (Tatlow Road)
- 16 lots in Woodlands Phase 4 (Northwest end of Woodland Drive)
- 174 lots on the remainder of the Woodlands Subdivision
- 162 lot on property to the east (Owned by: Balthazar Group)
- 75 lots on property to the west of Woodvalley Gate (Owned by: Kidd Real Estate Holdings)

The proposed road network within the Plan will eventually include two points of access: Foothills Boulevard and a future connection to Kelly Road North via Venta Drive. The Woodlands road network also includes a north-south road crossing between the two main wetland features, which is addressed in the Woodlands Recommendations Memo prepared by Triton in 2019, which has been included in Appendix D and incorporated in the Policy Recommendations of this Section below. Future construction of this road crossing will need to include an environmental management plan prior to construction to prevent unintended negative impacts on the wetland and their associated drainages.

The Plan area and surrounding vacant land are comprised of large parcels of land, which have historically remained free of development and are identified on F9. During the construction approval process for these lands it will be important that development occurs in a logical and sequential manner so that the development guidelines and policy recommendations of this Plan are not disrupted and infrastructure is not orphaned from one property to the next. As is the case in other subdivisions that require connections to lands beyond and the extension of services, the main road that extends from Woodvalley Drive and will eventually connect through to Venta Drive may be constructed to a collector standard, in which case the road would be constructed to a wide enough standard to facilitate the inclusion of a dedicated bike lane as warranted by demand. The City of Prince George Active Transportation Plan (2010) identifies the Hart and North Nechako area as high priorities for new bike lanes to create a stronger, more continuous network. For the purposes of this Plan, the inclusion of dedicated bike lanes is recognized as a means of encouraging healthy lifestyles and safe modes of alternative transportation, but requires additional consideration at the detailed design stage to identify if the need for bike lanes outweighs the need for on-street residential parking along the main road through the Plan area.

a. **Objectives**

1. To ensure the transportation network is safe and efficient for all modes of transportation.
2. To ensure the transportation network is easy to maintain.
3. To ensure any and all road crossings within the wetland areas do not negatively impact the naturally occurring drainage patterns within the Plan area.
4. **To promote continuity of transportation network infrastructure including, but not limited to preferred road standard, curb and gutter as well as**

sidewalks between adjacent developments.

b. **Transportation Network Design Guidelines**

1. Ensure design does not obstruct sightlines for vehicular traffic.
2. Design transit shelters for ease of snow-clearing and to minimize ice hazards in accordance with the *Winter Cities Design Guidelines* identified in Section 2.4(a).
3. Sidewalks shall be constructed on the 'sunny side' of streets (north & east) in accordance with the *Winter Cities Design Guidelines* identified in Section 2.4(a).
4. Where possible, transit shelters should be provided adjacent to sidewalk infrastructure where sufficient lighting is available to enhance the visibility and safety in accordance with the *Crime Prevention Through Environmental Design Guidelines* identified in Section 2.4(b).
5. Pedestrian walkways such as sidewalks and trails should be designed to implement the principles of *the Healthy Communities Design Guidelines,* as outlined in Section 2.4(e) of this document so that safe crossings, sidewalk letdowns and signage are provided to ensure safe and frequent use.

c. **Transportation Network Policy Recommendations**

The following policy recommendations are to be considered during the detailed design and subdivision stages of development:

1. A westbound (on Chief Lake Road) right turn taper shall be installed at the intersection of Foothills and Chief Lake Road once 57 dwellings units have been constructed within the Neighbourhood Plan Area as shown on Figure 8. The right turn taper shall have a minimum length of 65m.
2. A westbound (on Chief Lake Road) right turn deceleration lane shall be installed at the intersection of Foothills and Chief Lake Road once 167 dwellings units have been constructed within the Neighbourhood Plan Area as shown on Figure 8. The right turn lane shall have a minimum deceleration length of 40m and a minimum taper length of 50m.
3. Crosswalks shall be provided at locations where pedestrian use of local roads may require crossing the collector road to facilitate uninterrupted use of

sidewalk infrastructure.

4. In accordance with the City's Transit Policies, public transit should be considered within the Plan area and within the Transit Future Action Plan as warranted through growth needs in the city.
5. The City of Prince George should consider boulevard trees along the proposed collector road as a future design standard requirement.
6. Detailed geotechnical investigation will be required prior to subdivision to determine the depth of organic material to be removed as well as the volume and compaction of structural fill required as indicated in Appendix E Geotechnical Overview.
7. Detailed geotechnical investigation will be required prior to subdivision to determine the depth to and seasonal variability of local groundwater as indicated in Appendix E Geotechnical Overview.
8. Sidewalks shall be installed on all roads within the Plan area to create a safe, pedestrian oriented environment. The sidewalks will generally be installed on the north and east sides ('sunny sides') of the road, except in areas where the pedestrian connectivity may be obstructed.
9. Road crossings shall not obstruct existing drainage patterns.
10. Reduce the number of stream crossings to the minimum practical.
11. The use of impermeable surfaces during road development is to be discouraged and, where possible, natural flow regimes of the drainages, surface runoff, and groundwater are to be maintained.
12. The length and steepness of slopes during road construction should be minimized where possible.
13. Create vegetated swales at outfall locations where possible to help filter pollutants from stormwater runoff.
14. Where possible, safe routes should be provided for wildlife crossings between the two wetlands.

4.8 Servicing & Infrastructure

The focus of this section is to provide preliminary servicing directions to the City of Prince George, as well as to future developers of the Woodlands neighbourhood. The Plan area contains previously identified servicing constraints, which will significantly influence the phasing and planning of the future development. As shown on Figure 9, due to the connectedness of future subdivisions, opportunities exist between adjacent property owners to improve servicing conditions such as fire flow capacity and sanitary sewer. The City should encourage collaboration between property owners to identify opportunities for cost sharing and upgrades to existing servicing deficiencies.

Water System

The Woodlands Neighbourhood Plan area is contained within the City of Prince George Pressure Zone 11 (PZ3) which obtains its static pressure from the Vellencher Reservoir (PW817) at a Top Water Elevation (TWL) of 803.0m.

It is envisioned that the water distribution system within the Plan area will be connected at the northwest end of Woodvalley Drive to the existing 150mm diameter main and at the northeast end of Woodvalley Drive to the existing 350mm diameter main. The water distribution system throughout the Plan area will consist mostly of 200mm diameter mains with a section of 250mm diameter main where the road crosses the wetlands. The pipes were sized using the City of Prince George's H_2O NET software. Based on the City's water modelling report we do not envision any major problems with the provision of water supply to the entire Woodlands Neighbourhood Plan area.

Sanitary Sewer System

The Woodlands Neighbourhood Plan area will contain single residential homes only. In accordance with the City of Prince George Servicing Bylaw No. 7652, 2004, all new developments will be fully serviced and all parcels will be connected to the municipal sanitary sewer collection system.

At the present time, a 200mm diameter sanitary stub exists at the northwest end of Woodvalley Drive and a force main exists at the northeast end of Woodvalley Drive. In addition, there are two sanitary networks that flow in opposite directions (north & south) along Kelly Road North. Phase 1 of construction will discharge into the 200mm diameter sanitary main at the northwest end of Woodvalley Drive. The developer has two options to service the remaining phases of the development. One option is to install a sanitary gravity main across the neighbouring properties to the east. The gravity main would tie into both the north and south flowing sanitary networks on Kelly Road North. Connecting to both sanitary networks on Kelly Road North would effectively optimize the system and reduce the number of future pipe upgrades triggered by this development to three pipes, as indicated in Table 8: Sanitary Pipe Upgrades.

Table 8: Sanitary Pipe Upgrades

Proposed Dwelling Units Directed to North Flowing Sanitary Network on Kelly Road North	Pipes To Be Upgraded (PGMap Asset ID's)
116	8559
127	10281
158	8557

Alternatively, the developer could install a sanitary lift station within the Plan area and tie into the existing force main on Woodvalley Drive. The lift station option does not trigger any downstream pipe upgrades. Individual upgrades that may be triggered by development within the Plan area are indicated for reference on Figure 8: Infrastructure Development Plan.

Stormwater Management

In 2019, Triton Environmental Consultants prepared a memo with recommendations for servicing of the future lots within the Plan area based on the Servicing Brief completed by L&M (see Appendix D and Appendix G, respectively). The Servicing Brief identifies a storm network that drains stormwater collected from the Plan area by gravity to the wetlands. Triton supported the storm management plan in general and agreed that wetlands can be used effectively to filter stormwater discharge when managed and designed properly. In order to safely manage storm in this manner, a future Stormwater Management Plan will need to be prepared once the timing and scope of construction is known. At that time, an Environmental Management Plan (including a site specific Erosion and Sediment Control Plan) will need to be prepared to ensure the storm water servicing design will be designed to mitigate potential impacts to the wetlands. L&M prepared a conceptual catchment plan, which illustrates three additional headwall outlets discharging into the eastern-most wetland feature within the development (see Environmental Recommendation for the Woodland Development in Appendix D). Triton recommends that control measures for the headwall outlets (e.g. riprap energy dissipater, settling pool, vegetated swale, etc.) should be located to work with the natural topography and designed/engineered to avoid disturbance within the riparian setback zone of the wetlands. The primary objective of these measures is to develop settling systems that preserve the natural, vegetated condition of the downstream swale and will be reviewed as part of the future Stormwater Management Plan and associated EMP/ESCPs at the detailed design phase of future subdivisions within the Plan area.

a. **Servicing and Infrastructure Policy Recommendations**

1. An Environmental Management Plan (EMP) that guides specific construction activities shall be developed for the Plan area at the detailed design stage, which includes:
   - Timing and monitoring for removal of wildlife trees as identified in the 2018 Environmental Memo prepared by Triton and found in Appendix B;
   - Water quality monitoring protocols and thresholds, if surface water quality is anticipated to be affected;
   - Spill and waste management plans;
   - Erosion and sediment control procedures; and
   - Requirements for permitting, wildlife surveys and salvages.
2. All municipal service mains crossing the wetland areas are to be designed and constructed in accordance with the future Environmental Management Plan recommendations to be prepared at the detailed design stage and in accordance with the best practices guidelines outlined in the 2019 Woodlands Recommendations Memo completed by Triton and provided in Appendix D.
3. A lift station analysis for PW126 shall be conducted to determine the available capacity and upgrade threshold.
4. If the sanitary networks on Kelly Road North are utilized in lieu of installing a sanitary lift on site, then sanitary pipes 8557, 8559 and 10281 will need to be upgrade. Refer to Table 8 in Section 4.8 and Figure 8 of this Plan for the timing of the potential upgrades.
5. The watermains shall be sized to ensure that the entire Neighbourhood Plan area can achieve the minimum fire flow of 60L/s for single residential development.
6. An Environmental Management Plan and Stormwater Management Plan shall be prepared by qualified professionals prior to approval of subdivision

applications where storm water is discharged into the onsite wetlands.

7. Headwall outlets shall be designed in accordance with the recommendations of future Environmental Management Plans triggered by development, but shall also abide by the following general best practices recommendations as outlined in the 2019 Woodlands Recommendations Memo (see Appendix D):
   - Prior to stormwater daylighting at the headwall outlets, a cistern-manhole should be in place to aide in capturing sediment;
   - Scour protection/energy dissipating rock pad can be constructed to prevent outlet discharge from creating additional suspending solids. Sizing of the pad shall be engineered based on the expected amount of discharge volume for each outlet;
   - Construct settling ponds/water detention areas at each outlet location to slow water velocities and encourage deposition. Sizing of the settling areas shall be engineered based on the expected amount of discharge volume for each outlet.
   - Retain as much natural vegetation around the outfall locations as possible;
   - Construct a drainage path from the outfall settling pond with passive features such as channel spanning large-woody debris, rock spurs, coir or erosion control matting rolls secured with live-stakes or willow wattles; these features shall be designed and installed to increase the length of the water flow path, slow water velocities, encourage sediment deposition, and increase natural filtration/absorption of water;
   - Within the drainage path and along the banks, native species shall be planted that thrive in wet environments such as Red-Osier Dogwood (Cornus Sericea), Willow (Salix spp.), Cattail (Typha Latifolia), and Sedges (Carex spp.) that grow densely and can aide in slowing and absorbing water and encouraging sediment deposition.
8. Groundwater infiltration shall not occur within the Neighbourhood Plan Area, as the soils have not been deemed suitable.

5.0 SUBDIVISION AND PHASING

Phasing of new development can have significant implications for the City's ability to provide a wide range of municipal services. The City of Prince George's Growth Management schedule of the Official

Community Plan identifies the plan area as Phase 1 and Phase 2, with policy direction stating that the construction costs associated with the extension to municipal services are to be borne by the developer and payable with each subdivision phase, as applicable. Subdivision approvals will be administered via the City's Approving Officer and in accordance with the City of Prince George Subdivision and Development Servicing Bylaw, No. 8618, 2014 as amended from time to time.

Preliminary subdivision phasing plans have been identified on Figure 8 based on the availability of existing tie-ins, timing and options for upgrades to existing infrastructure and the property owner's construction goals. Figure 9 highlights the proximity of adjacent lands, upon which future subdivision plans are already in progress. As these adjacent lands move forward through the development approvals process, they should be considered in tandem with the development policies recommended by this Plan for the woodlands subdivision due to their proximity to the Plan area and their ability to negatively impact the environmental, transportation, infrastructure and neighbourhood planning policies put into effect by this Plan. While the policies contained within this Plan apply only to the lands within the Neighbourhood Plan Boundary as identified on Figure 9 and do not specifically reference the surrounding properties, it is anticipated that they will not be impeded by future development of surrounding tracts of land.

Within the Plan boundary, lot sizing is envisioned to range from 550 m2 to larger cul-de-sac lots in excess of 1000 m^2 depending on available terrain with an average 873.5 m^2. Consideration may be given for more innovative subdivision layouts, with a particular emphasis on the sensitive siting of

buildings to minimize impacts to the natural landscape. The phasing and timing of construction is dependent on the extension of sanitary sewer servicing from Kelly Road North to the Woodlands property or alternatively, a lift station being installed on the Woodlands property.

Phase 1 is proposed to be constructed at the northwest end of Woodvalley Drive, which already contains the necessary servicing stubs as shown on Figure 8. Once sanitary servicing has been provided to the Woodlands property via gravity main or lift station, Phase 2 will constructed in the low spot of the site near the southeast corner of the property. The remaining phases would be constructed to the west and to the north of Phase 2. The phasing would follow the natural topography and will be constructed from the low spot to the sites high spots.

a. **Objectives**

1. To provide for the orderly & sequential development of future growth within the Woodlands Neighbourhood.
2. To ensure that new development in the Woodlands Neighbourhood is serviced with full urban services in accordance with Table 1 of the Subdivision and Development Services Bylaw as amended from time to time.

6.0 IMPLEMENTATION

The purpose of the Woodlands Neighbourhood Plan is to guide future development within the Plan boundary as a policy framework in tandem with the City of Prince George Official Community Plan (OCP). As such, the Plan has been developed in accordance with the principles and policies of the OCP and is intended to provide clear direction to decision makers, residents and developers regarding the vision for the Woodlands Neighbourhood. As the guiding policy document, this Plan will be consulted during the rezoning and subdivision phases of development to ensure conformity with its intentions. This section of the Plan is intended to provide clarity as to how the objectives, design guidelines and policy recommendations contained herein should be interpreted and implemented by City Council, the City of Prince George approving officials, developers and future property owners.

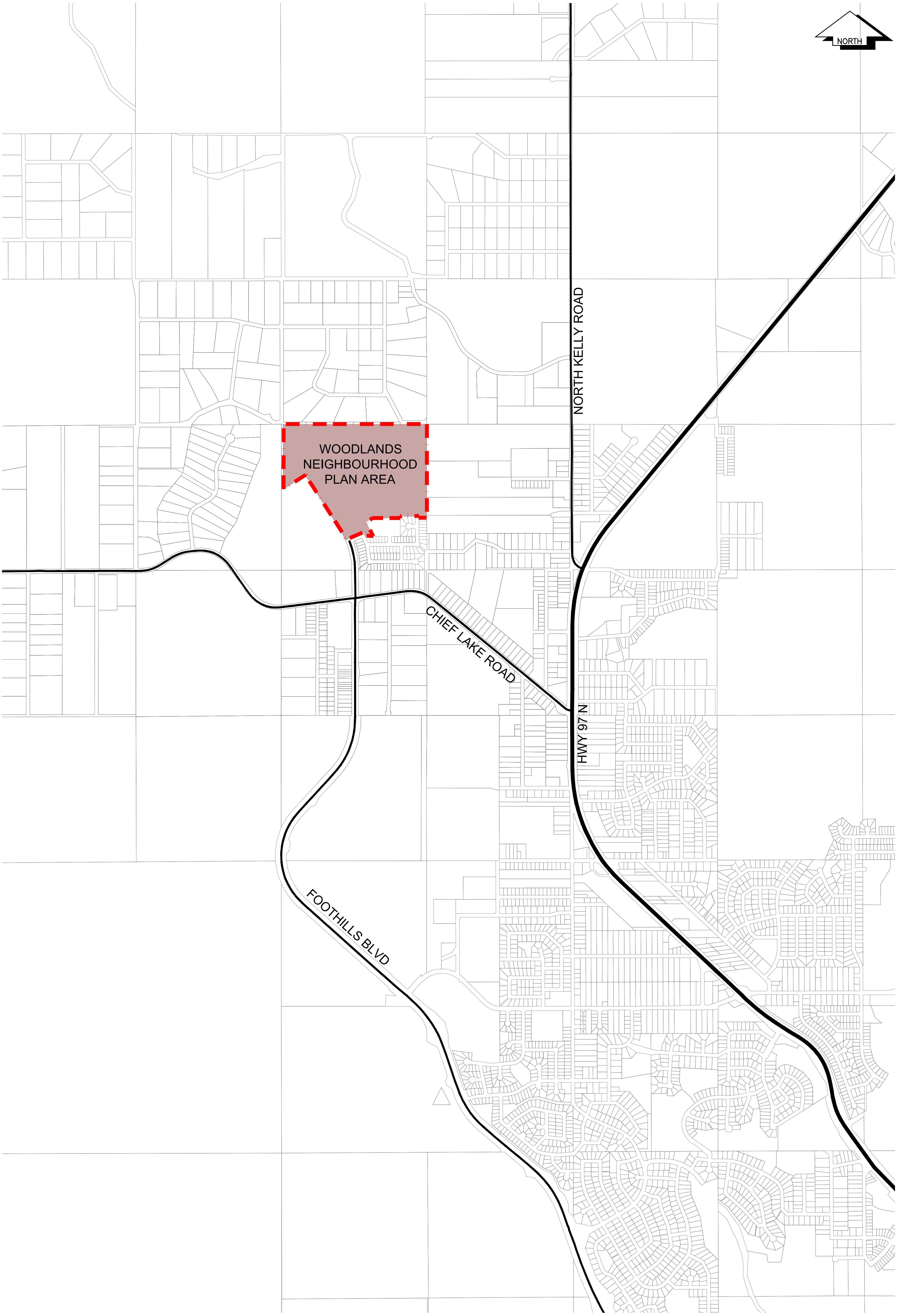
It is recommended that the Woodlands Neighbourhood Plan be adopted by Prince George City Council through resolution allowing the Plan to act as the policy guide rather than as a regulatory document. Adopting the Plan by resolution gives Council the opportunity to consider development proposals that are inconsistent with the Plan but which Council considers to be in the public interest. In the event that a developer should register a building scheme to help achieve the design guidelines and meet performance objectives it is with the explicit understanding that said building scheme is not intended for the City of Prince George to enforce. Building schemes will apply to the developer, each purchaser, lessee and sub-lessee of all or part of the land; and each successor in title, future purchaser, lessee and sub-lessee of the land as per the *Land Title Act*. Additional information for Council's consideration regarding consistency with the plan will be provided as needed at the rezoning stage.

Should Prince George City Council adopt the Woodlands Neighbourhood Plan, the City reserves the right to interpret the Plan within the context of the greater development network of the surrounding area. As shown on Figure 9, there are features of this Plan that extend beyond the Plan boundaries such as the wetlands and their related drainage patterns and riparian areas as well as the neighbourhood park and infrastructure. Therefore, due to the proximity of large tracts of lands that may or may not be zoned for future residential development, the City may consider amending the Plan to include a wider study area. By expanding the Plan area, the City may be in a stronger position to ensure that the high development standards implemented by the policies within this Plan can be met into the future. Should the City of Prince George consider expanding the scope of this Plan, a formal public process should be held to maintain transparency with surrounding property owners and to encourage the continued participation of the surrounding community who have contributed to the overall success of this Plan.

Should Prince George City Council adopt the Woodlands Neighbourhood Plan, the next steps in the development process will include submission of development applications that identify how the Neighbourhood Plan's intent and recommendations are achieved, and include:

1. Application to rezone the Plan area with land use to be approved by Prince George City Council.
2. Phased subdivision applications that may also include detailed traffic, geotechnical and environmental analysis (including the recommended Environmental Management Plan and Stormwater Management Plan identified in Sections 4.7, 4.8 and Appendix D) as warranted.
3. That The City of Prince George consider the following for implementation through these stages:
    a. Creation of new Capital Projects to be included within the Development Cost Charges Bylaw where warranted.
    b. Updates to the Subdivision and Development Servicing Bylaw for alignment with the Woodlands Neighbourhood Plan.

c. OCP Schedule Amendments including, but not limited to Schedule B-6 Future Land Use, Schedule B-8 Parks and Trails and Schedule B-4 Growth Management.



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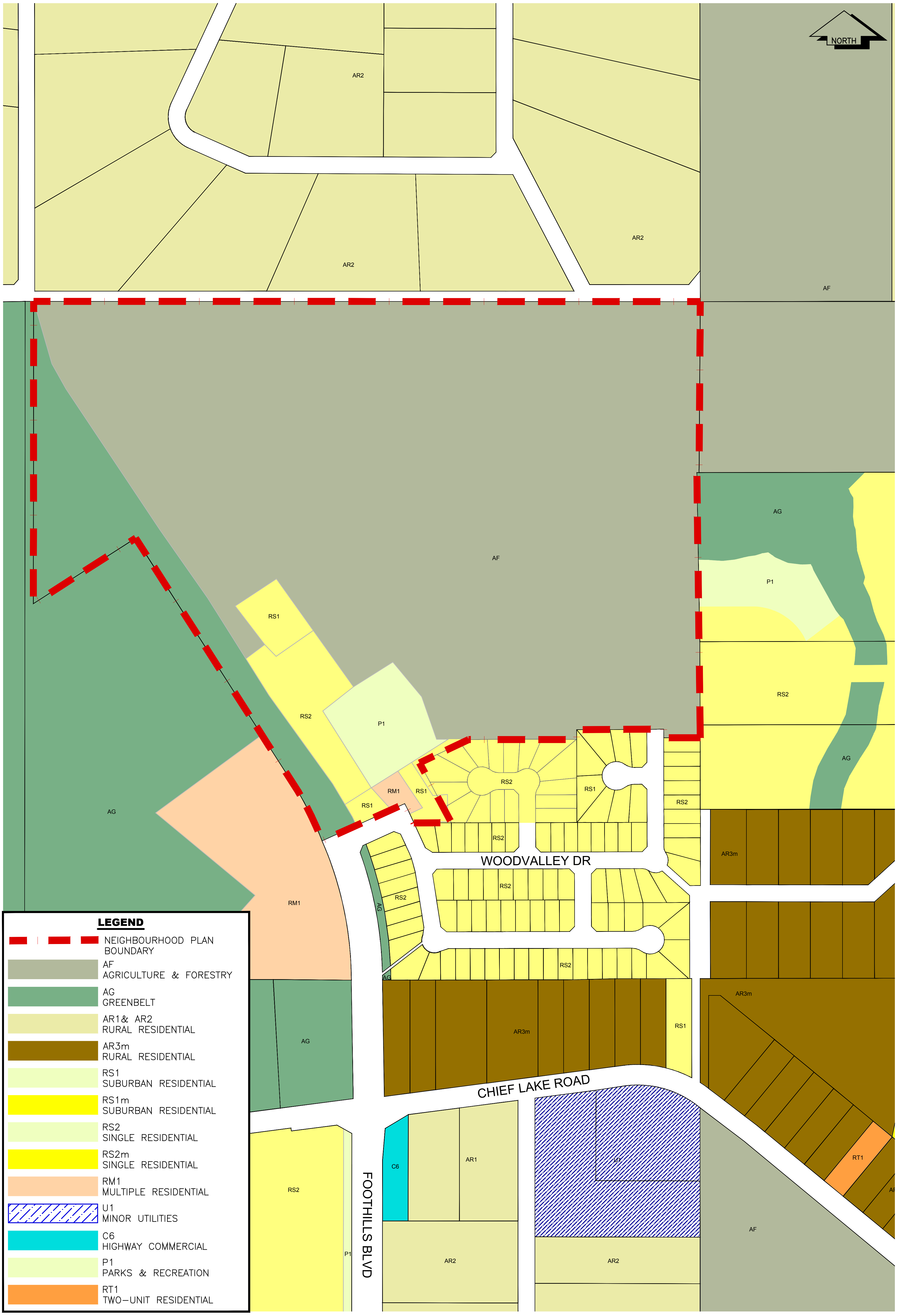
JOB No: 1631-01	WOODLANDS NEIGHBOURHOOD PLAN
DATE: SEP 2019	
DRAWN BY: KP/MM	CONTEXT PLAN
SCALE: 20,000	

DWG No F1



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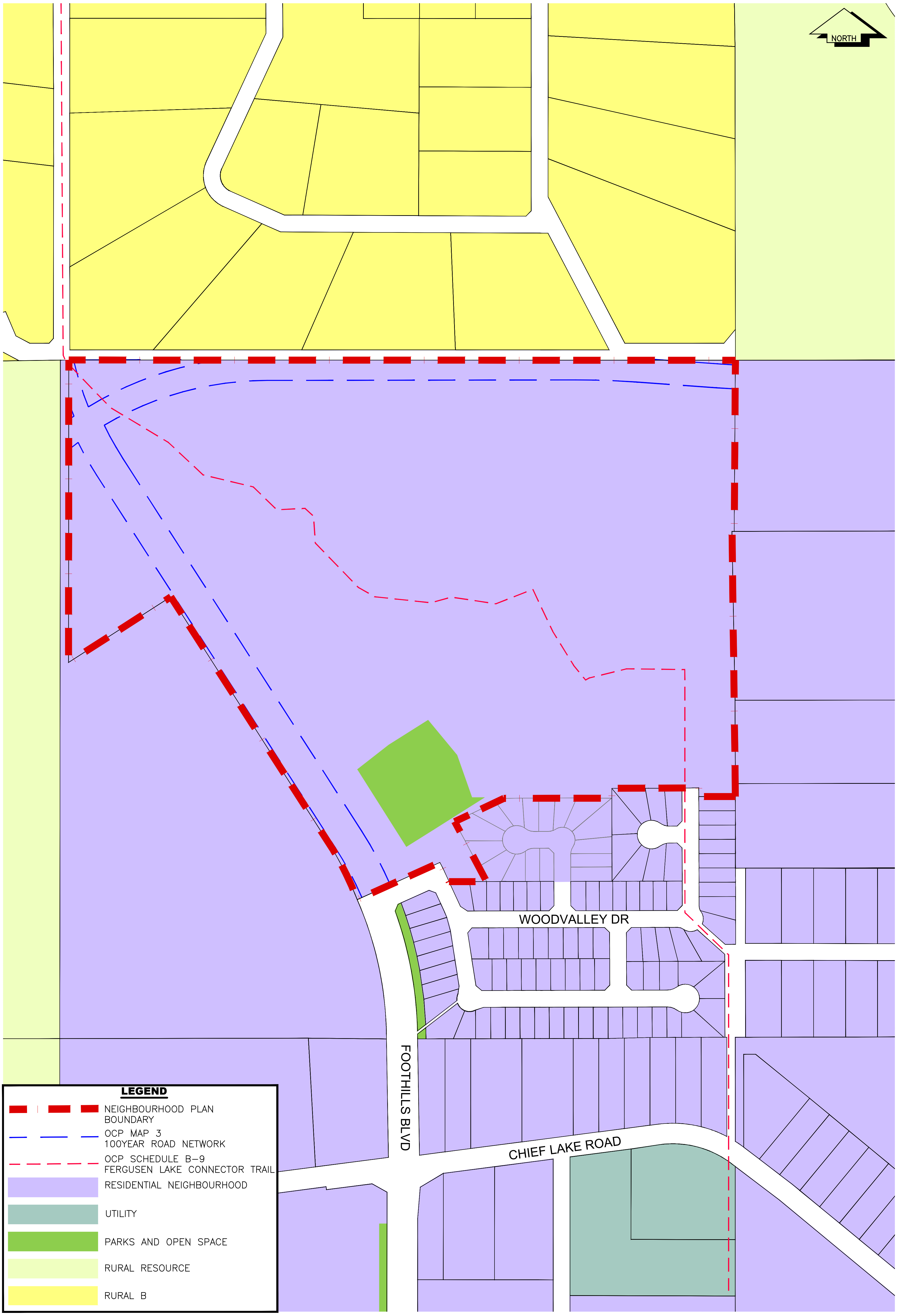
JOB No:	1631-01
DATE:	SEP 2019
DRAWN BY:	KP/MM
SCALE:	1:4,300

WOODLANDS NEIGHBOURHOOD PLAN

EXISITING ZONING

DWG No

F2



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DATE: SEP 2019
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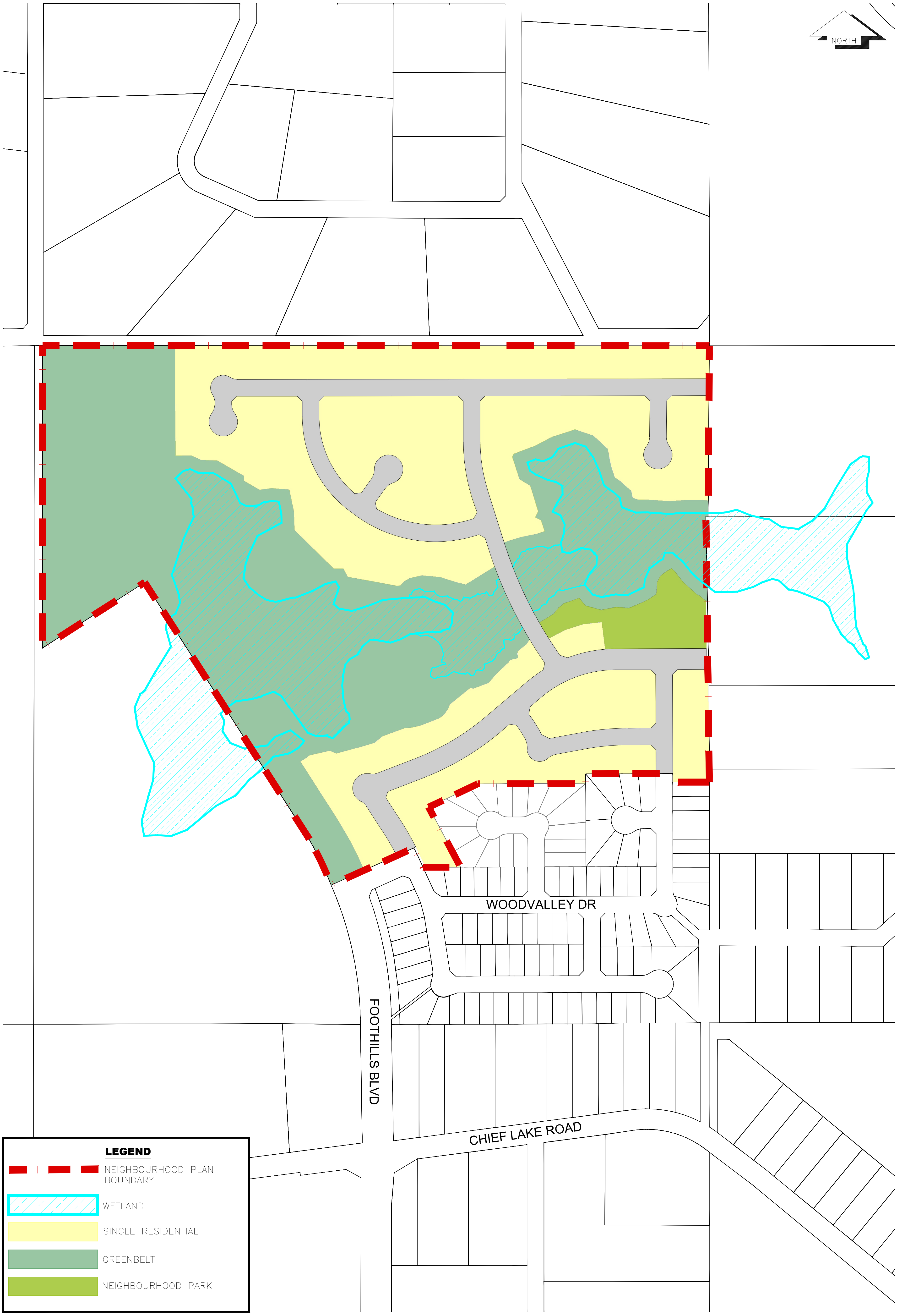
WOODLANDS NEIGHBOURHOOD PLAN

EXISTING OFFICIAL COMMUNITY PLAN FUTURE LAND USE

DWG No

F3



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JOB No: 1631-01
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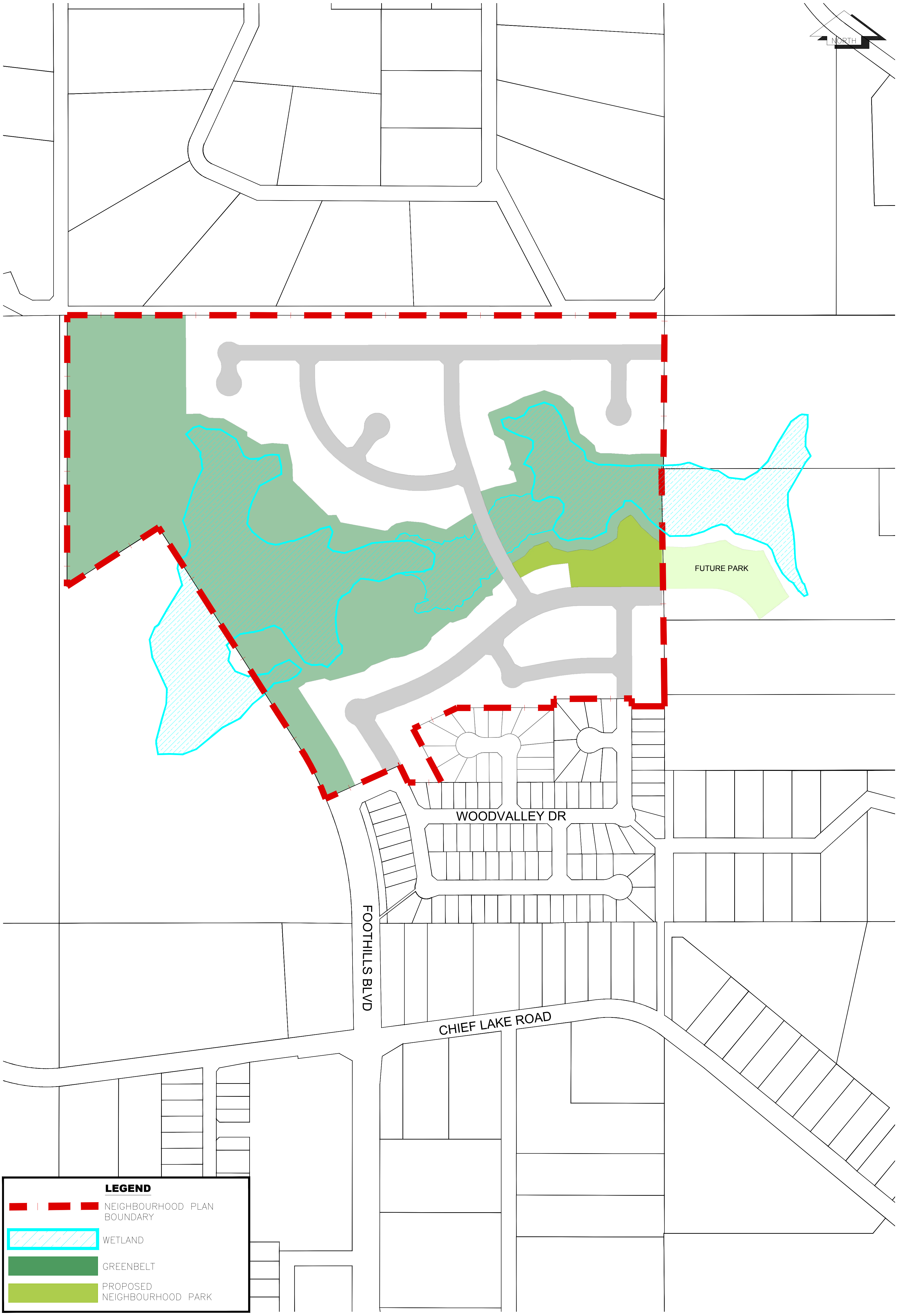
SCALE: 1:4,300

WOODLANDS NEIGHBOURHOOD PLAN

PROPOSED LAND USE PLAN

DWG No
F4



LEGEND

- NEIGHBOURHOOD PLAN BOUNDARY
- WETLAND
- GREENBELT
- PROPOSED NEIGHBOURHOOD PARK

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DATE:	SEP 2019
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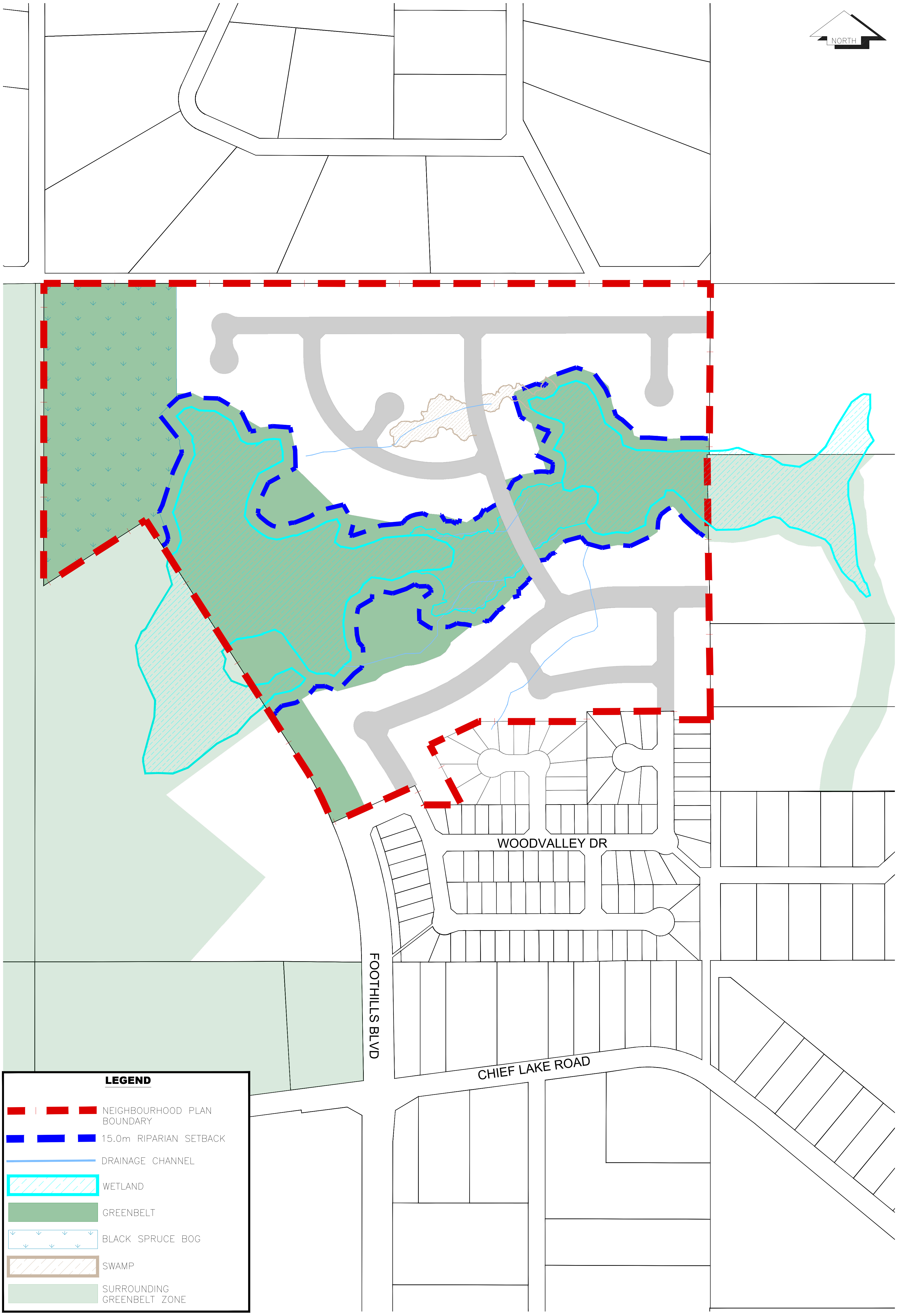
SCALE:	1:4,800

WOODLANDS NEIGHBOURHOOD PLAN

PROPOSED PARKS & OPEN SPACE

DWG No F5



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JOB No: 1631-01
DATE: SEP 2019
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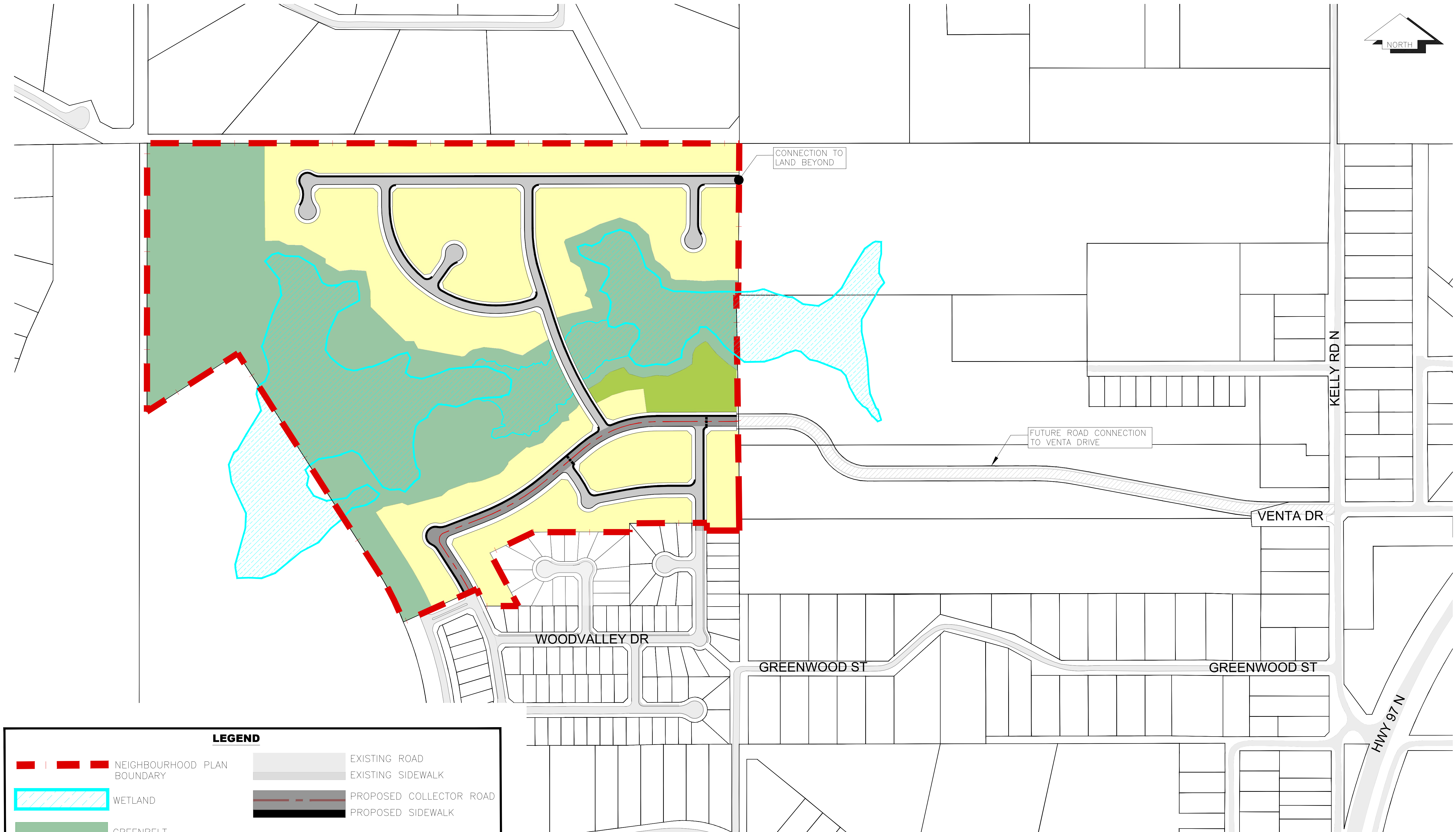
WOODLANDS NEIGHBOURHOOD PLAN

NATURAL ENVIRONMENT & SENSITIVE AREAS

DWG No F6



LEGEND

NEIGHBOURHOOD PLAN BOUNDARY	EXISTING ROAD
	EXISTING SIDEWALK
WETLAND	PROPOSED COLLECTOR ROAD
	PROPOSED SIDEWALK
GREENBELT	PROPOSED LOCAL ROAD
	PROPOSED SIDEWALK
SWAMP	PROPOSED CROSSWALK
LOW DENSITY RESIDENTIAL	FUTURE LOCAL ROAD
	FUTURE SIDEWALK

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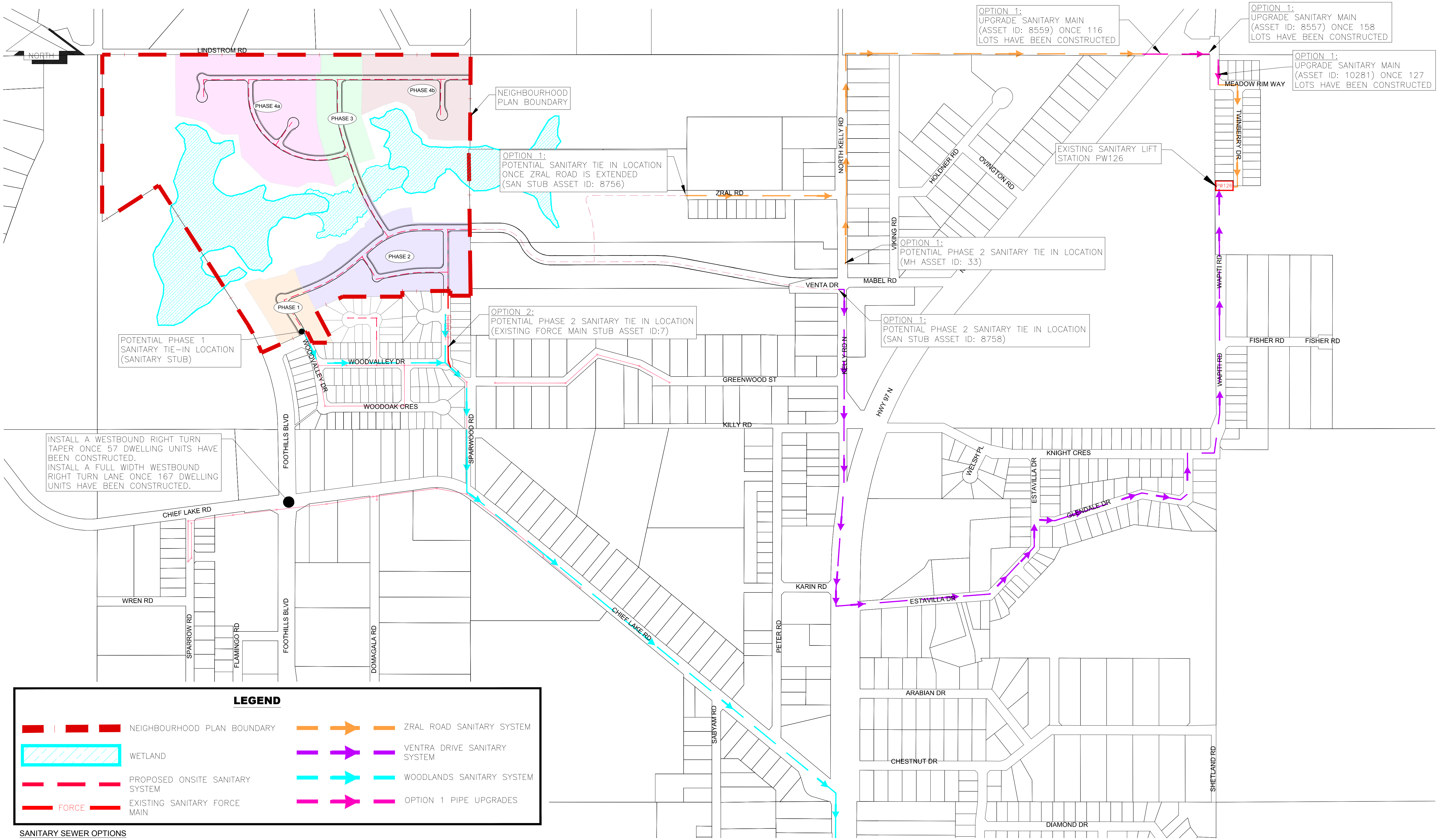
DATE: SEP 2019
DRAWN BY: KP/MM
SCALE: 1:5,000

WOODLANDS NEIGHBOURHOOD PLAN

TRANSPORTATION NETWORK

DWG No
F7



SANITARY SEWER OPTIONS

OPTION 1:
INSTALL GRAVITY SANITARY MAINS THROUGH THE NEIGHBOURING PROPERTIES TO THE EAST OF SUBJECT SITE. TIE INTO THE SANITARY STUBS ON ZRAL RD AND NORTH KELLY ROAD (ASSET IDS:8756 &8758) AND TIE INTO THE CITY MANHOLE ON N. KELLY ROAD (ASSET ID 33)

OPTION 2:
INSTALL A LIFT STATION ON THE SUBJECT PROPERTY AND PUMP THE SANITARY SEWAGE INTO THE EXISTING FORCEMAIN (ASSET ID 7) ON WOODVALLEY DRIVE.

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JOB No: 1631-01
DATE: SEP 2019
DRAWN BY: KP/MM
SCALE: 1:8,000

WOODLANDS NEIGHBOURHOOD PLAN

INFRASTRUCTURE DEVELOPMENT PLAN

DWG No F8

NOTE:
ZONING WITHIN NEIGHBOURHOOD PLAN BOUNDARY SHOWN WITH PROPOSED ZONING DISTRICTS FOR DISCUSSION PURPOSES ONLY.

LEGEND

- NEIGHBOURHOOD PLAN BOUNDARY
- WETLAND
- PROPOSED CROSSWALK
- GREENBELT
- LOW DENSITY RESIDENTIAL
- PROPOSED COLLECTOR ROAD
- PROPOSED SIDEWALK
- PROPOSED LOCAL ROAD
- PROPOSED SIDEWALK
- EXISTING ZONING
- AF AGRICULTURE & FORESTRY
- AG GREENBELT
- RS2 SINGLE RESIDENTIAL
- RM1 MULTIPLE RESIDENTIAL
- P1 PARKS & RECREATION

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JOB No: 1631-01	WOODLANDS NEIGHBOURHOOD PLAN
DATE: SEP 2019	
DRAWN BY: KP/MM	SURROUNDING DEVELOPMENT NETWORK
SCALE: 1:6,000	

DWG No
F9

APPENDIX A

Woodlands Neighbourhood Plan
L&M Engineering Limited

TRITON ENVIRONMENTAL OVERVIEW ASSESSMENT - 2006

3722/WP#P-1493

Woodlands Neighbourhood Environmental Overview Report

Prepared for:

L&M Engineering Ltd.

201-1840 Third Ave.
Prince George, B.C., V2M 1G4

Prepared by:

TRITON ENVIRONMENTAL CONSULTANTS LTD.

Suite 201 - 1157 5th Avenue

Prince George, BC, V2L 3L1

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June 30, 2006

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1.0 INTRODUCTION

1.1 Purpose of Document

The purpose of this environmental overview is to identify environmental sensitivities within the Woodlands Neighbourhood Plan area at the north end of Foothills Boulevard in Prince George, BC. This report identifies potential direct and indirect environmental effects associated with proposed residential development within this area.

This report has been prepared to:

- Provide a description of the environmental setting;
- Document baseline environmental conditions (aquatic, terrestrial and wildlife) based on existing information, field data and observations;
- Identify environmental sensitivities within the project area;
- Provide an assessment of potential cumulative effects of development within the project area;
- Identify possible mitigation measures; and
- Identify additional environmental investigations that may be required.

1.2 Project Area

The 33.5 ha project area is located immediately northwest of downtown Prince George, BC as is located at the following legal address:

DL 2425 REM SW 4, Cariboo District (PID 015 036 855)

The area is accessible from the north end of Foothills Boulevard, north of the intersection with Chief Lake Road.

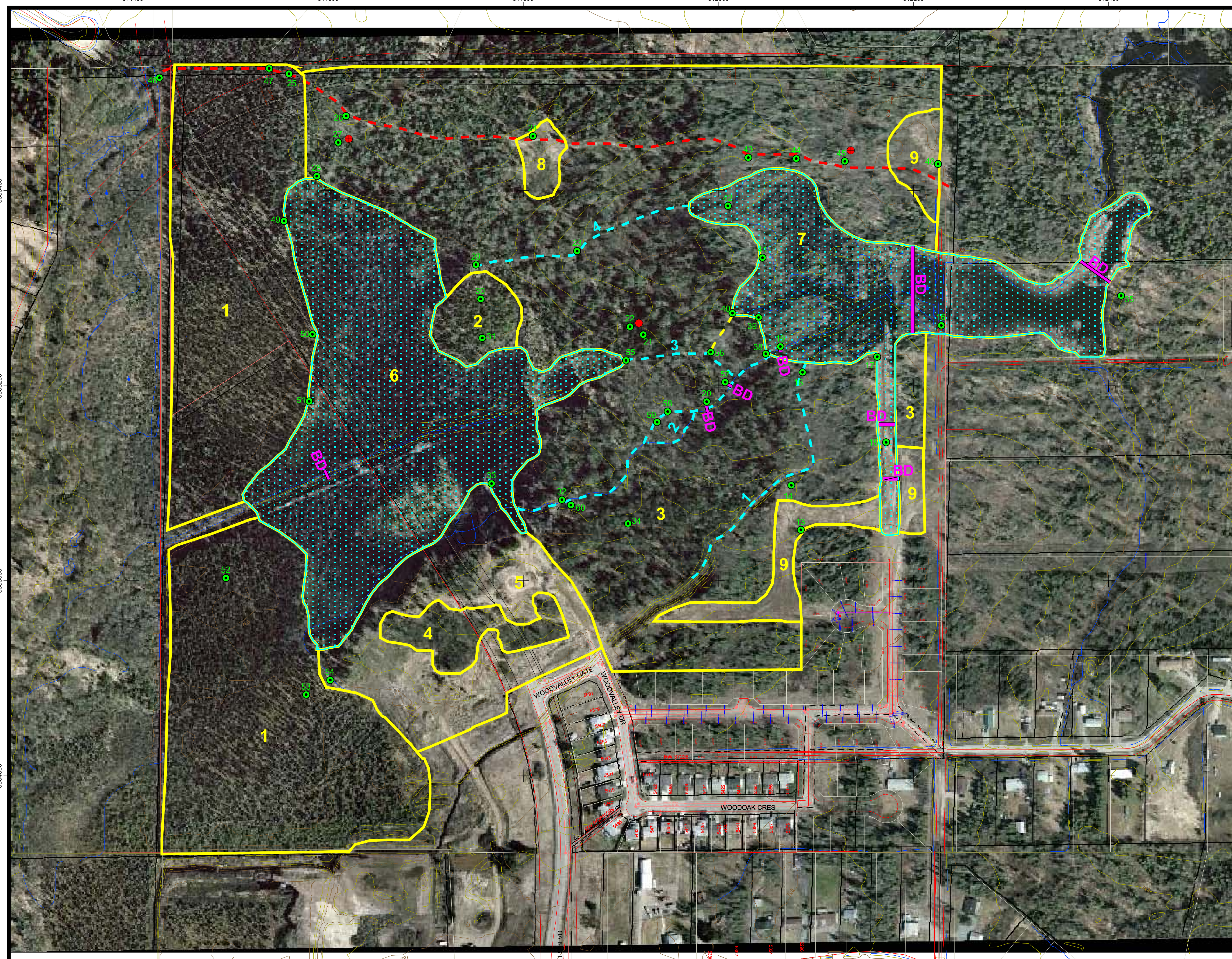
Phase 1 of the Woodlands Subdivision is already developed. The next phases of development (Phases II, IIA, and IIB) will encompass 5.74 ha. The Woodland Neighbourhood plan area is 33.52 ha in size with 4.70 ha proposed as parkland and the rest as either roadway or developed housing. The total area of the completed Woodlands Subdivision will be 39.26 ha (Appendix 4).

1.3 Environmental Setting

The project site is located along the large plateau northwest of Prince George in the Upper Fraser Ecoregion of the Sub-Boreal Interior Ecoprovince. The Sub-Boreal Spruce biogeoclimatic zone (SBS) is characteristic of the region, with hybrid white spruce, subalpine fir, and lodgepole pine predominating (Steen and Coupe 1997). The climate and vegetation communities of project area are described by the Mossvale moist cool subzone (mk1) of the SBS zone. The SBSmk1 subzone occurs at elevations ranging from 750 m to 1070 m. The project site is located at 660 m but is still best represented by this subzone.

The climate of the SBSmk1 is slightly cooler than the other SBS subzones in the Prince George Forest District. The mean annual temperature for this subzone is 1.5º C whereas the mean temperatures for the SBSdw2 and dw3 are 3.4º C and 2.6º C respectively. Precipitation is higher than that of the other subzones of the SBS, with a mean annual precipitation of 727.4 mm and the average snowfall is 306 cm (DeLong *et al.* 1993).

Within the SBSmk1 subzone, the dominant tree species include lodgepole pine, and hybrid white spruce (*Picea glauca x engelmanii*). Areas of disturbance tend to be dominated by lodgepole pine and trembling aspen. Late seral and climax stands have more hybrid white spruce and only scattered subapline fir. Douglas-fir appears on drier warmer aspects. Black spruce occurs in wetland areas while black cottonwood occurs within riparian areas. Shrub species include prickly rose (*Rosa acicularis*), thimbleberry (*Rubus parviflorus*), highbush cranberry (*Viburnum edule*), and black twinberry (*Lonicera involucrata*).



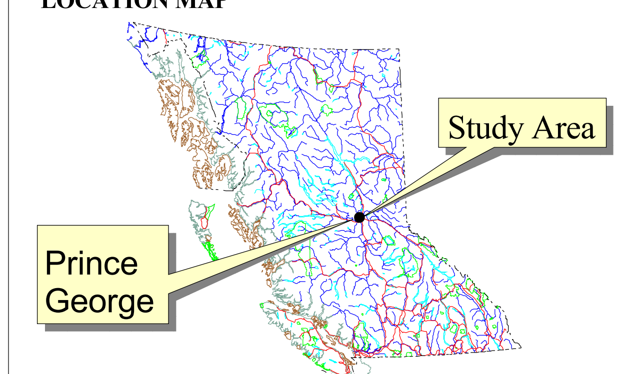
WOODLANDS NEIGHBOURHOOD PLAN

Figure 1. Environmental Overview Site Assessment

LEGEND

- GPS Sites / Numbers
- Wildlife Tree Locations
- Wetland Area
- Beaver Dams
- Polygons / Numbers
- Drainage / Number
- Old Road

LOCATION MAP



0 100 200 Meters

Scale: *1:4000*

NO.	DATE (yyyy/mm/dd)	REVISION	BY
1	2006/06/15	Initial Draft	HDW
2	2006/06/27	Rev 1.	HDW

Basemap Source: 2003 Orthophoto (www.city.pg.bc.ca/pgmap)

Map Datum: UTM NAD 83 Zone 10

Project No:	File No:	Date:	
3722	Map#: n:\active\3722\apr\map2 Layout#: Fig1-11x17	June 27, 2006	TRITON ENVIRONMENTAL CONSULTANTS LTD.

2.0 AQUATIC ECOSYSTEMS

2.1 Fish and Fish Habitat

There is one main stream mapped within the project area located between two beaver ponds. This stream is a tributary to McMillan Creek which in turn is a tributary to the Nechako River. Historical fisheries information for McMillan Creek has indicated that anadromous salmon (*Oncorhynchus sp*) utilize the lower reaches this stream for rearing and rainbow trout (*Oncorhynchus mykiss*) for spawning and rearing.

No previous fisheries information was found for this tributary. Sampling was conducted using an electrofisher and minnow traps but no fish were sampled. Minnow traps were placed in the wetland areas for 14 hours and electrofishing was conducted within the stream. As several beaver dams were observed during the assessment, it is unlikely that fish can access this area. In addition several road culverts are located on this stream which may also prevent upstream fish migration from the lower reaches.

Species of management concern that occur within the Prince George Forest District include the red-listed white sturgeon (Nechako and Upper Fraser populations), and blue-listed bull trout. Due to the distribution and habitat requirements of sturgeon and bull trout, neither species would be expected to occur within the project area. Additionally, neither species have been recorded as occurring in the parent stream (McMillan Creek).

Fish habitat information was also collected for this area (Table 1). Three non-classified drainages were identified. While portions of these drainages appear to have some flow, it disperses over the forest floor, has no alluvial substrates, lacks connectivity to the beaver pond downstream and has no definitive channel. They are likely ephemeral, lacking water during summer months. If any water is present during the summer, it will likely be in the form of isolated pools, as water table is near the surface.

Table 1. Summary of Fish and Fish Habitat Information Collected.

Drainage No.*	Channel Width	Sampling Effort	Fish Sampled	Classification
1	n/a	n/a	n/a	NCD
2	1.2	EF: 508 sec MT: 14 hours	None captured None captured	S6
3	n/a	EF: 120 sec	None captured	NCD
4	n/a	n/a	n/a	NCD

*- See Figure 1.
Abbreviations: EF = electrofishing; MT = minnow traps; NCD = non-classified drainage.

The reach located within the development area has been classified as an S6 as it has an average channel width of 1.2 m and is non-fish bearing. Regardless of the fact that several temporary barriers were observed, the watercourse lacked a definite channel both upstream and downstream of the sampled section. These areas had no alluvium, lacked a defined channel and flowed over the forest floor. There were no pools and the flows are likely ephemeral.

The stream substrate was dominated by fines and the channel was unconfined and decoupled. Cover was abundant and was comprised of overstream vegetation and small woody debris. Few pools and low discharge were identified. Overall, spawning and overwintering habitat were non-existent and rearing habitat value would be classified as marginal. According to the Fish Stream Crossing Guidebook, the Department of Fisheries and Oceans (DFO) describes marginal habitat as:

> *Habitat that has low productivity and contributes marginally to fish production. It is characterized by the absence of suitable spawning habitat and habitat with low rearing potential (absence of pools, under cut banks and stable debris and with little to no suitably sized spawning gravels for the fish species present (Province of BC 2002).*

2.2 Wetland Areas

A given wetland, based on its physical and biological characteristics, can, for example, support water storage, habitat for many species, scenic views, fish habitat, toxic buffering and flood control (Environment Canada 1992).

Two large ponds and associated wetland areas were identified within the study area. One area (4.6 ha) located along the eastern boundary of the development has been mapped and designated for protection with a city park (Appendix 4). However, this only encompasses part of the beaver pond and does not encompass the northern section of the wetland.

The second large beaver pond and wetland area (8.2 ha) located along the western boundary has not been identified on current maps (Appendix 4). The proposed City park ends at the edge of Foothills Boulevard and does not include this wetland.

These large wetland areas have current beaver activity within them as beavers were observed in both ponds as well as abundant cut trees, new trails between the ponds and excavation of the dams. While these ponded areas are non-fish bearing, they do provide habitat for a number of aquatic species such as frogs, reptiles, waterfowl, and other wildlife. These wetlands provide food and nutrients and regulate stream flows and temperatures to downstream fish habitat. These wetlands also provide significant water storage and appear to be expanding as abundant, recently deceased trees can be observed around the edges of the wetland. This indicates that the water table is rising in these areas and reducing the available rooting zone and contributing to an increase in the amount of windthrow.

2.3 Water Quality

Wetlands and riparian areas not only provide habitat for a variety of species, they are also important for the maintenance of water quality and quality within the watershed.

Wetlands and riparian areas can remove sediment and chemical sorbed to sediment, nutrients, metals, organic matter toxic chemicals and other contaminants (Province of BC 2006).

The riparian areas provide a filter for potential water contaminants, provide soil erosion control, and provide consistent stream water temperatures. The identified wetlands provide filtration and flow control for the downstream fish habitats of McMillian Creek. The first reaches of McMillian Creek are known to be fish bearing as they provide rearing and spawning habitat for rainbow trout and rearing habitat for salmon.

While the importance of wetlands has been widely documented, it is possibly that shallow wetlands can contribute to higher water temperatures in downstream habitats. Lower water temperatures result in higher dissolved oxygen concentrations and higher water temperatures can influence spawning and incubation times of salmonids. In addition, the activity of beavers such as dam construction and movement of downed trees from upslope areas into the water may increase the turbidity of the water that may potentially be transported to downstream habitats (Province of BC 2006).

3.0 TERRESTRIAL ECOSYSTEMS

3.1 Ecosystem Representation

There are two useful land classification schemes that capture the variation in plant and animal communities at a sub-regional scale. Ecosections (Regional Ecosystem Classification) are contiguous areas with similar climate and physiography, which are large enough to sustain a variety of plant and wildlife communities. Biogeoclimatic subzones and subzone variants (Biogeoclimatic Classification) are characterized by a particular combination of dominant plant species. Subzones and subzone variants are dispersed within sub-regional areas and often occur within a relatively narrow elevational range and/or in relation to aspect.

The Province has protected representative natural examples of both ecosections and subzones/variants at the landscape level. Site associations or site series units are the fine units of the biogeoclimatic classification system that capture plant community variation at the stand or operational level and these are the ecosystems that are tracked by the Conservation Data Centre (CDC). The CDC red and blue-lists identify ecosystems that are considered rare or at risk (see section 3.3.1). The biogeoclimatic site series unit is also routinely used by forest and wildlife resource managers, and provides an appropriate means to assess the local, regional and provincial significance of potential effects of habitat alteration in the study area. The ecosystems of the study area have been described at the biogeoclimatic site series level.

3.2 Terrestrial Ecosystem Classification within the Project Area

The Ministry of Forests publication <u>A field guide for site identification and interpretation for the southwest portion of the Prince George Forest Region</u> (DeLong *et al* 1993) provides a description of the regional climate, physiography and floristic patterns within the Prince George Forest Region (PGFR). The field guide contains written descriptions, diagrams, vegetation tables and edatopic grids that provide the means of classifying and describing ecosystems at the site series level based on field observations and site data collection. The field guide was used to classify ecosystems in the study area (Table 2, Figure 1) based on field data and observations collected. Field data collected include: plant community description, seral stage, assessment of representativeness, and discussion of wildlife habitat values and ecosystem sensitivities.

Forest Cover polygon boundaries were found to be relatively representative of ecosystem boundaries, however adjustments to the line work were made based on field observations and a map produced to depict polygons of site series units, some of which were subdivided based on structural stage (Figure 1).

Table 2. SBSmk1 site series representation within the project area.

Polygon No.	Site Series	Structural Stage	Comments
1	10	6	Mature black spruce bog
2	01	4	Abundant young pine with minor component of spruce.
3	07	5	Spruce with aspen (has been harvested in past)
4	07	5	Surrounded by cleared area and wetland to the north.
5	n/a	2	Open cleared area along roadway
6	n/a	1	Open water, wetland ponded area.
7	n/a	1	Open water, wetland ponded area.
8	n/a	2	Open meadow area along roadway.
9	n/a	2	Open meadow area along roadway.

Sites Series Units:
SBSmk1/ 01 Sxw-Huckleberry – highbush cranberry site series
SBSmk1/ 07 Sxw – oak fern site series
SBSmk1/ 10 Sb – scrub birch - sedge site series
Structural Stage: 1 – non-vegetated, 2- herb, 4 – pole sapling, 5 – young forest, 6-mature

Non-forested ecosystems within the project area include:

Wetland/open water areas – portions of the project area are covered with open water due to the high amount of beaver activity in the area.

Anthropogenic Areas – this includes the maintained roadways, cleared areas around older roads and trails used by ATV's and hikers.

3.3 Degree of Ecosystem Representativeness

Three biogeoclimatic site series units were recognized as occurring within the project area. Forested areas along the streams and non-classified drainages were recognized as site series unit SBSmk1/07, whereas the smaller pocket of lodgepole pine and spruce was recognized as the SBSmk1/01. Both have heavy components of aspen due to previous disturbance (partial harvesting in the late 1970's) (Ryder 2006). The SBSmk1/10 ecosystem was recognized as occurring along the western border of the project area in conjunction with the large wetland area.

SBSmk1/01 Hybrid White spruce – Huckleberry – Highbush cranberry site series

The SBSmk1/01 site series unit is recognized by the mixture of lodgepole pine, and hybrid white spruce. The understory shrub layers include thimbleberry (*Rubus parviflorus*), prickly rose (*Rosa acicularis*), black twinberry (*Lonicera involucrata*), and black gooseberry (*Ribes lacustre*). This series is slightly drier than the 07 and does not usually contain oak fern but has queen's cup (*Clintonia uniflora*) and bunchberry (*Cornus canadensis*) as abundant herb species.

SBSmk1/07 Hybrid white spruce – oak fern site series

The SBSmk1/07 ecosystem can occur on the mid to toe of slopes and on slopes from 0-50%. This series is commonly found in conjunction with the SBSmk1/01 but is slightly moister and seepage water may be present. Shrub species dominant within this series include black gooseberry, highbush cranberry, black twinberry and devil's club (*Oplopanax horridus*). Herb layer is dominated by oak fern (*Gymnocarpium dryopteris*), bunchberry, false solomon's seal (*Smilacina racemosa*) and queen's cup.

SBSmk1/10 Spruce – scrub birch – sedge site series

The SBSmk1/10 site series is present along the western boundary of the development area within an area that is flat and has high moisture content. It is described best by the presence of black spruce and dominant shrub species including Labrador tea (*Ledum* *groenlandicum*), scrub birch (*Betula glandulosa*), willows (*Salix sp*.) and black twinberry. Also present was bog laurel (*Kalmia microphylla ssp. occidentalis*), knight's plume (*Ptilium crista-castrensis*), and glow moss (*Aulacomnium palustre*). Within this series, the water table can be within 50 cm of surface which was evident during the field assessment; however surface water is not usually present and moisture is typically derived from rainfall and not runoff (*i.e*. no stream input).

3.3.1 Rare Plant Communities

The British Columbia Conservation Data Center (CDC) Rare Natural Plant Community Tracking List for the Prince George Forest District identifies two blue-listed plant and nine yellow-listed plant community (site series unit) in the SBSmk1 biogeoclimatic subzone (Table 3). Where there is poor representation of mature natural examples of SBS subzones in protected areas and there has been substantial modification of existing areas, most or all site series units in a subzone often appear on the CDC lists.

Table 3. Blue and yellow-listed plant communities in the SBSmk1.

BGC	English Name	BC Status
SBSmk1/Wf05	slender sedge / common hook-moss	Blue
SBSmk1/09	hybrid white spruce / horsetails	Yellow
SBSmk1/07	hybrid white spruce / oak fern	Yellow
SBSmk1/08	hybrid white spruce / devil's club	Yellow
SBSmk1/01;	hybrid white spruce / black huckleberry - highbush-cranberry	Yellow
SBSmk1/10;	black spruce / scrub birch / sedges	Yellow
SBSmk1/06;	black spruce / black huckleberry / sweet coltsfoot	Yellow
SBSmk1/03	lodgepole pine / red-stemmed feathermoss - reindeer lichens	Yellow
SBSmk1/02;	lodgepole pine / black huckleberry / clad lichens	Yellow
SBSmk1/05	Douglas-fir - hybrid white spruce / ricegrasses	Yellow
SBSmk1/04	Douglas-fir - hybrid white spruce / knight's plume	Blue

Other vegetation communities of particular importance and sensitivity include non-forested riparian communities and wetlands, which are not described in the site identification field guide for the SBSmk1, but typically have high wildlife values and are sensitive to disturbance. The riparian vegetation surrounding the main stream consists of young black cottonwood, willows, thistle (*Cirsium sp*.), goldenrod (*Solidago canadensis*), alfalfa (*Medicago sativa*), and other weed species, which do provide some wildlife habitat but have limited riparian function.

3.3.2 Rare Plant Species

Plant species have been identified using several keys. Generally the nomenclature follows Hitchcock *et al*. (1973), however The Vascular Plants of British Columbia (Ministry of Forests 1989, 1990, 1991 & 1994) was used where there were discrepancies in the species names used. A comprehensive plant species list of all plant species encountered within the study area has been compiled (Appendix 2) and includes 6 species of trees, 23 species of shrubs and 30 herbaceous species.

There are 11 plant species that appear on the CDC blue-list of rare vascular plant species within the SBSmk1 subzone of the Prince George Forest District (BC Conservation Data Centre 2006, Table 4). None of the listed species were observed or have significant potential to occur within the study area, based on their distribution and habitat requirements.

Table 4. Red and blue-listed plant species within the Prince George Forest District and SBSmk1 subzone.

Scientific Name	English Name	BC Status
Carex tonsa var. *tonsa*	bald sedge	Blue
Draba fladnizensis	Austrian draba	Blue
Dryopteris cristata	crested wood fern	Blue
Galium labradoricum	northern bog bedstraw	Blue
Juncus arcticus ssp. *alaskanus*	arctic rush	Blue
Juncus stygius	bog rush	Blue
Megalodonta beckii var. *beckii*	water marigold	Blue
Melica smithii	Smith's melic	Blue
Nymphaea tetragona	pygmy waterlily	Blue
Pedicularis parviflora ssp. *parviflora*	small-flowered lousewort	Blue
Sparganium fluctuans	water bur-reed	Blue

4.0 WILDLIFE RESOURCES

4.1 Overview

This section broadly considers all species of mammals, birds, reptiles and amphibians that are known to occur or have significant potential to occur within the study area, with specific reference to wildlife resources within the study area. Special attention is given to wildlife species that are of special management concern at provincial and regional levels, which are primarily administered by the Ministry of Environment (MOE) and the Ministry of Forests and Range (MOF).

Wildlife resources are described according to standard ecosystem and wildlife habitat classification systems presently used by resource managers, which include:

- Biogeoclimatic Ecosystem Classification (Meidinger *et al*. 1991).
- Regional Ecosystem Classification (Demarchi 1993)
- Biophysical Habitat Classification (Demarchi and Lea 1989)

Additional information includes several provincial wildlife initiatives (Stevens 1994), which provide relevant background information adequate to describe wildlife species assemblages, values and sensitivities within the study area. The approach used in the description and assessment of wildlife habitat values is based on cross-referencing baseline references with provincial conservation lists and is supplemented with field data collected in the study.

4.2 Methods

For the purposes of this project, the evaluation of wildlife habitat values is based on cross-referencing known or suspected wildlife species occurrence and activity within biogeoclimatic site series units (plant community types), with known habitat affinities of wildlife species. Specific reference is made to the study area, based on field observations and ecosystem descriptions.

The site series units of the biogeoclimatic classification system are distinguished by the occurrence of unique combinations of plant species, from which different values for different subsets of wildlife species are inferred. Describing wildlife habitat values associated with biogeoclimatic site series units allows for an interpretation of habitat suitability VS capability. Habitat suitability is inferred based on existing conditions, and habitat capability on the expected climax vegetation association described in the site identification and interpretation field guides (Delong *et al*. 1993). Variation in site conditions and vegetation communities within and between site series units (*e.g*. soil moisture and nutrient regime, topography and successional stage) are important considerations in assessing wildlife habitat values.

A number of habitat variables were assessed during the field survey in order to attribute values for particular wildlife species or groups of species in terms of providing primary habitats, including:

- seral stage;
- surface water features;
- standing dead (snags);
- down and dead woody debris;
- forage abundance and availability; and
- old growth attributes (veteran trees, multiple canopy layers, etc.).

4.2.1 Wildlife Habitat Capability

Wildlife habitat capability refers to the ability of the land to sustain a particular subset of wildlife species based on climatic conditions and vegetation potential. Habitat capability is strongly influenced by physiography and landscape level forest patterns. Conversely, it is largely independent of temporal factors such as seral stage, and structural and stand level features, which are transient.

4.2.2 Wildlife Habitat Suitability

Wildlife habitat suitability refers to the temporal and structural condition of the habitat with respect to sustaining a particular species, or assemblage of wildlife species. Habitat suitability is largely dependant on local factors such as seral stage distribution, and stand level attributes such as stand age, and structural features such as coarse woody debris; some species are habitat dependant while others are attribute dependant. Important habitat attributes include snags or wildlife trees, veteran trees, coarse woody debris, deciduous trees, edges and forest canopy gaps. The occurrence of such attributes in natural, undisturbed settings is a function of seral stage; most are features of mature and climax forest stands. The exception is deciduous trees, which are generally a feature of early seral stages in disturbed forests. A summary of the wildlife values associated with these attributes follows.

Snags and dying trees are particularly important for cavity dwellers such as woodpeckers, chickadees, some owls, and mammals such as marten and fisher. In riparian areas, snags have particularly high value for cavity-nesting ducks and bats (many of which forage over the open water). Snags also provide perches for birds of prey and insect-hawking birds (e.g. swallows and flycatchers), which are important in controlling potential forest pests. Generally, larger snags receive more wildlife use. Most of the project area is in early seral stages, but some snags and dying trees were observed around the edges of the wetlands. Some paper birch snags were observed throughout the study area. The majority of the dying trees were spruce that have been waterlogged and damaged by blow down.

Tree cavities and crevices under the bark of decaying trees provide natural roosts for bats. As a group, the bat species potentially utilizing habitats within the study area may be limited by the general lack of large snags with crevices or cavities, old buildings, caves and rock crevices, which offer the best opportunities for roosting and hibernacula. Many of the potentially occurring bat species are known to favour areas with clearings, open fields, and waterbodies for feeding, which would include the ponded areas. The potential effects of development are difficult to predict with respect to bats, particularly because sampling for bats has not been conducted in the study area and therefore, their presence and utilization of resources is not known. They may utilize the large pile of old wood shingles possibly from past harvesting activities.

Coarse woody debris (CWD) includes sound and rotting logs and stumps that are generally >30 cm in diameter. CWD and large decomposing stumps sustain a diverse and abundant assemblage of invertebrates and fungi. These invertebrates provide food for many species of mammals, birds, snakes, and amphibians. CWD provides primary nesting and feeding habitat for wrens and is an important insect food source for black bears, particularly when other food sources (berries) are unavailable. The presence of CWD enhances the horizontal structure of the forest floor, providing cover and foraging opportunities for deer mice and shrews, access below the snow for squirrels, marten and weasels, and courtship structures for ruffed grouse. The increased capacity of CWD to retain moisture creates favourable microhabitats for salamanders and frogs. The CWD found in seepage areas may provide favourable habitat for amphibians, particularly during the drier summer months, and primarily for terrestrial species such as the long-toed salamanders (Province of BC 2004a). Large diameter CWD is not abundant within the project area, however there are traces scattered around the project area.

Deciduous trees in a largely coniferous landscape provide habitat diversity that is exploited by many wildlife species. Many songbirds (such as warblers, vireos, and flycatchers) preferentially use deciduous trees as foraging and nesting areas. Many primary cavity nesters prefer deciduous species to conifers, likely because cavity excavation is easier. Aspen and cottonwood are particularly important because mature trees frequently have heart rot. The smaller deciduous trees such as alder, in riparian and adjacent areas are a required component for beaver, a keystone species that creates valuable habitat for many other wildlife species. A summary description of particular wildlife values associated with deciduous tree species that area common in the project area follows below:

> ***Black cottonwood*** - moderately important winter and spring browse for moose and deer, preferred food of beaver, squirrels feed on flowers and leaf buds in spring, ruffed grouse feed on buds and catkins in winter, important

perches for bald eagles in winter, important cavity nesting tree for woodpeckers, many birds nest in cottonwood (owls, hummingbirds, starling, sapsuckers, western tanager, flickers, grosbeaks and vireos)

Paper birch - important browse for moose and deer, buds, catkins and new leaves preferred by porcupine, important food for beaver, squirrels feed on flowers and leaf buds in spring, many bird species nest in birch (woodpeckers, owls, hawks, sapsuckers, flycatchers and vireos)

Trembling aspen - important for ungulates, small mammals and birds, important as winter browse for moose and deer, buds, catkins and new leaves preferred by porcupine, important food for beaver, squirrels feed on flowers and leaf buds in spring, ruffed grouse feed on buds and twigs in winter, many bird species nest in aspen (e.g. woodpeckers, raptors, Barrow's goldeneye, hooded merganser, bufflehead, owls, sapsuckers, flickers, flyctachers, nuthatches, western tanager and finches)

Large veteran trees are important sources for future snags and CWD in forests. Because veteran trees are frequently in the early stages of decay, they are often preferred by cavity nesters and birds that forage for insects found under the bark. Raptors often use veteran trees for perching and nesting. The large surface area of large trees maximizes the available habitat per unit area. No large (>1 m dia) trees were observed within the study area and the largest diameter tree was approximately 40 cm.

Edges between vegetation communities (such as between forest and field, or between wetland and dry forest) are often used by species that use each area to fulfill different life history functions. Edges also provide habitat for species that prefer the often structurally complex transition zone (ecotone) between contrasting ecosystems. Edge habitats within the project areas are minimal as the transition between wetland and dry forest were uncommon. Edge habitats were also found along the old roads and near the playground area at the south-western corner of the study areas.

Shrub Layers within the study area perform several important functions for wildlife, particularly birds. Many species are important as browse for moose and deer, and the flowers and berries are eaten by many species of birds and small mammals. Dense shrub layers provide travel and security cover for many wildlife species, as well as nesting opportunities for a wide range of birds. Shrub species of particular value to wildlife within the study area include: thimbleberry, highbush cranberry, saskatoon, red-osier dogwood, soopolallie, willows, and prickly rose. The wildlife values of a small group of the aforementioned shrubs are summarized below (Parish *et al.* 1996; Coates 1990)

- *Highbush cranberry* - winter browse for moose, berries eaten by birds and mice, twigs and stems eaten by beaver, warbler nesting
- *Red-osier dogwood* - important browse for moose, berries eaten by small mammals and birds, cover and nesting for birds
- *Saskatoon* – important winter browse for ungulates and berries eaten by small mammals and bird, especially in August.

4.3 Wildlife Habitats

Given the size of the project area, a few dominant wildlife habitats are present. In larger areas, a wider range of habitat types are available due to the greater variety of terrain features and seral stages. Based on field observations, it appears that most forested polygons are in a late immature to early mature seral stage, which results in a relatively small average tree size and explains the significant deciduous component. Some older spruce trees were observed within the spruce bog forest polygon and within the wetland areas.

Important attributes of forests within the study area (for wildlife) include scattered large diameter trees, abundant browse, berry producing shrubs, and possible raptor nesting trees. The attributes and importance of the different habitat types present are discussed in the following sections in the context of wildlife species that may occur in the area.

Attributes of deciduous and mixed forest habitats that are of particular value to wildlife include:

- Aspen is particularly important for cavity nesting species;
- Coniferous trees provide escape cover for birds;
- Abundant insects are present for foraging;
- Deciduous leaves, twigs and buds provide forage; and
- Canopy nesting opportunities.

The age of deciduous trees has a significant effect on wildlife habitat values. Very young aspen forest provides high value forage for moose and mule deer where middle to older trees have little value as browse but greater value for cavity nesting bird species. Mixed forest types are prevalent but have a large deciduous component due to past disturbance throughout the study area. Although most of the regenerating forests are not yet mature enough to produce large (>30 cm) diameter snags, which are preferred by cavity nesters, scattered mature birch do occur.

4.4 Wildlife Diversity in the SBSmk1

In order to determine the local, regional and provincial significance of habitats within the study area, it is necessary to consider the full range of wildlife species known, or with significant potential to occur. Key references that were utilized to achieve this include:

- The mammals of British Columbia (Eder and Pattie, 2001) ;
- The Birds of British Columbia Vol 1, Vol 2, Vol 3, Vol 4 (Campbell *et al*. 1990, 1990, 1997, 2001);
- A field guide to site identification and interpretation for the southwest portion of the Prince George Forest Region (Delong *et al*. 1993);
- BC Conservation Data Centre tracking lists (CDC 2000); and
- Amphibians in British Columbia (Province of BC 2004a).

4.5 Wildlife Species of Management Concern

There are several criteria by which a particular wildlife species may be considered to require special management attention by resource managers, primarily the Ministry of Environment and the Ministry of Forests. These criteria include:

Species of special management concern include:

- species with formal (Federal, Provincial) designation as species at risk;
- species that occur on provincial red, blue and yellow lists;
- species with declining or uncertain population levels (e.g. fisher, bald eagle);
- species that are uncommon or occur at low densities on the landscape;
- species with special habitat requirements (e.g. tree cavities for tree swallow, bufflehead);
- keystone species that create habitat for other species (e.g. beaver, pileated woodpecker); and
- species of commercial or recreational importance (e.g. moose, marten).

The primary warehouse of information on the status of flora and fauna in the province is the BC Conservation Data Centre (CDC). The CDC provides tracking lists for flora, fauna, and plant communities for each Forest District in the province. The District lists identify species that can be expected to occur within the District boundaries, which is often coincident with watershed divides and may include the bulk of some sub-populations of wildlife. These status lists use a colour-coding system to rank the status and management priorities for species at risk. Following is a breakdown and brief description of the status and ranking criteria used in developing these lists:

Red-listed Species:

- candidates for legal designation as threatened or endangered under Federal legislation;
- include threatened species - any indigenous species of fauna or flora that is likely to become endangered in British Columbia if the factors affecting its vulnerability do not become reversed; and

- include endangered species - any indigenous species of fauna or flora that is threatened with imminent extinction or extirpation throughout all or a significant portion of its British Columbia range.

Blue-listed Species:

- considered to be vulnerable or sensitive and are candidates for upgrade to the red-list or downgrade to yellow; and
- include vulnerable species - any indigenous species of fauna or flora that is particularly at risk in British Columbia because of low or declining populations.

Yellow-listed Species

- the yellow-listed species are those considered not at risk in British Columbia and are considered for management emphasis for various reasons including recent declines in population numbers, restricted distribution, losses of habitat, public interest, species that are maintained by ecosystem management and species for which the Province has a global responsibility.

In addition to red, blue, and yellow-listed species, numerous other species are of management concern within the province due to:

- populations that are actively managed;
- species that are of commercial value;
- species with specific habitat requirements (e.g. nest cavities);
- species found at low densities; and
- colony nesters.

In order to identify species of management concern that potentially occur in the study area, the full list of wildlife species known to occur, or with significant potential to occur within the SBSmk1 was considered. Based on sub-regional wildlife distribution, abundance, and species sensitivities the CDC has developed tracking lists for individual forest districts. The CDC red, blue and yellow list for rare vertebrate species within the Prince George

Forest District was acquired and includes 3 red-listed mammals, 9 blue-listed species, and 1 yellow-listed bird species (Table 5).

Table 5. Wildlife species of Management Concern in the Prince George Forest District.

Common name	Scientific Name	Status
caribou (southern population)	*Rangifer tarandus* population #1	Red
bobolink	*Dolichonyx oryzivorus*	Blue
American bittern	*Botaurus lentiginosus*	Blue
long-billed curlew	*Numenius americanus*	Blue
sandhill crane	*Grus Canadensis*	Blue
short-eared owl	*Asio flammeus*	Blue
grizzly bear	*Ursus arctos*	Blue
fisher	*Martes pennanti*	Blue
wolverine ssp. L*uscus*	*Gulo gulo luscus*	Blue
common pika	*Ochotona princeps septentrionalis*	Red
great blue heron	*Ardea heodias herodias*	Blue
bald eagle	*Haliaeetus leucocephalus*	Yellow
American white pelican	*Pelecanus erythrorhynchos*	Red

The comprehensive list can be reduced based on known regional distributions, specialized habitat requirements, and extreme rarity to a subset of species that is more reasonable to expect may occur within the study area, which includes 1 blue-listed bird species (American bittern), 1 yellow-listed bird species (bald eagle), and 2 blue-listed mammals (grizzly bear, fisher).

The bald eagle was formerly blue-listed but populations appear relatively stable or increasing and they have been downgraded to the yellow list. However the bald eagle remains a species of management concern, particularly for nest sites, which are typically in large cottonwood on floodplains or near waterbodies.

Birds

American Bittern - (Blue-list)

The American bittern is widely distributed in the southern half of the province and through the valleys and plateaus of the interior (Campbell *et al*. 1990). It is an uncommon resident in the north and is typically associated with large wetlands, particularly marsh habitats where it hunts for amphibians and small fish. Flooded forest and shrub swamp wetland habitats are found within the study area but marsh habitats and fish are lacking within the area, which reduces the value for bittern and the likelihood that they would occur within the study area.

Great Blue Heron - (Blue-list)

The great blue heron is widely distributed along the coast and throughout the southern half of the province and is an uncommon summer resident in the northern half of the province. Heron use in the north half of the province, roughly north of Williams Lake, is believed to be by non-breeders (Campbell *et al.* 1990). Casual observations of great blue heron have been recorded throughout the interior, including Prince George and Fort St. James, and this species appears on the CDC list for the Prince George Forest District.

The great blue heron is a colony nester and primarily nests in the south half of the province. Heron rookeries are relatively easy to locate, particularly by helicopter, and are usually well known. Heron nests or rookeries were not observed, nor are known to occur in proximity to the study area. Herons are primarily wading birds that utilize the shorelines of lakes, rivers and wetland ponds for hunting for fish and amphibians. The presence of open water but lack of fish bearing waters suggests the utilization of the study area by great blue heron would be unexpected and incidental.

Ducks and Geese

There are 16 species of waterfowl that could be expected to utilize the wetland areas including: American widgeon, Barrow's goldeneye, common goldeneye, green-winged teal, blue-winged teal, bufflehead, Canada goose, gadwall, hooded merganser, horned grebe, lesser scaup, mallard, northern pintail, northern shovelor, red-necked grebe, redhead, and ring-necked duck. Most waterfowl nest in wetlands (mostly marsh and shrub swamp) and riparian areas associated with bodies of open water.

During the time of this assessment, buffleheads, horned grebe and greater yellow legs were the only waterfowl observed.

Barrow's goldeneye has been identified as a species of management concern as it is a secondary cavity-nester (non-obligate) in large natural tree cavities or those excavated by pileated woodpecker. This species usually nests riparian forests and it may be adversely affected by the loss or removal of large snags. It is a widespread species in British Columbia and western Alberta in the summer, and common in B.C. coastal waters in winter.

Overmature aspen and birch provide the best nesting opportunities. While pileated woodpeckers were observed and may provide cavity nests suitable for Barrow's, few trees of suitable size were observed.

Bald eagle (yellow list)

The bald eagle was formerly blue-listed but has been downgraded to the yellow list as the population is considered to be recovering. Bald eagle are considered a species of management concern for several reasons including: 1) fluctuating population levels, 2) high mortality rates, 3) loss of suitable nesting trees.

Bald eagles are opportunistic feeders that often scavenge carrion or salmon carcasses, although they may prey on waterfowl, gulls and shorebirds (Butler & Campbell 1987). In the interior where salmon are a less significant seasonal food source, eagles frequently scavenge ungulate carcasses (particularly during the hunting season) and roadkills, and hunt along streams and lakes where they may find dead fish or waterfowl.

Eagles require large trees in close proximity to an abundant food source (Blood & Anweiler 1994). Nest tree size was found to average between 1.1 - 2.3 dbh, and range as far as 173 m from shorelines (Blood & Anweiler 1994). Large diameter black cottonwood are preferred for perching, roosting and nesting. No suitable nest perch trees and no nests were observed within the study areas.

Osprey

The osprey is a summer visitor that occurs throughout BC. The osprey is a species of special management concern and is conspicuous along the Fraser River. Osprey are strict fish-eaters and are closely associated with rivers, lakes and sloughs. Ospreys nest near water, usually near the top of live or dead trees, or frequently on man-made structures such as wooden pilings or power poles (Campbell *et al*. 1990). The nests are often located in partially submerged standing dead and are typically highly visible.

No osprey nests were observed within the study area. The lack of fish bearing waters within the area may explain the lack of osprey observations.

Short-eared owl (Blue list)

The short-eared owl is widely distributed in North America but is mainly a summer resident in the north where it is largely associated with open habitats such as old fields, grain stubble fields, hay meadows, pastures and coastal or inland marshes (Campbell *et al*. 1990). The largest portion of the diet (typically 95%) is comprised largely of voles, although the diet also includes shrews and smaller birds such as sandpipers, kildeer, red-winged blackbird may comprise 5% of the diet (Johnsgard 1988).

The short-eared owl breeds in prairies, grassy plains, tundra and marshes and constructs its own nest (depression with little build up) on the ground in a well-vegetated area in open country, mostly in grasslands and fields (Johnsgard 1988). There are no known nesting records in the Prince George area and there are no agricultural fields within or adjacent to the study area. Observations of short-eared owl are rare in the Prince George area and it is unlikely that short-eared owls would utilize habitats within the study area.

Woodpeckers

A total of seven species of woodpeckers could potentially occur within the study area, including downy woodpecker, hairy woodpecker, northern flicker, pileated woodpecker, red-breasted sapsucker, three-toed woodpecker, and black-backed woodpecker. The hairy woodpecker is likely the most common species found in the project area and is likely the primary cavity-builder in standing dead trees. A hairy woodpecker was observed feeding in close proximity to 5 birch snags. A nest (which may be active) was observed in one of the birch snags. Several large standing dead trees are scattered throughout the study area especially near the perimeter of the wetlands providing a source of nesting and foraging opportunities for woodpeckers and secondary cavity nesters.

The pileated woodpecker is a species of special management concern, because it is a keystone species that creates habitat for other species and requires large-diameter (>30 cm) trees to build its nest cavities, which are often used by secondary cavity-nesters such as Barrow's goldeneye. A pair of pileated woodpeckers were observed along the perimeter of the project area. Suitable nest trees (>30 cm DBH and > 6m tall) are rare across the project area.

Passerines (Songbirds)

Approximately 70 species of passerines have significant potential to occur within the study area, none of which appear on the provincial red- or blue-lists (CDC 2000). Most of the passerine species are widespread and common in western North America and most are seasonal migrants that breed in the central and northern portions of the province. Most species are neotropical migrants that breed in the north and overwinter in the south, and very few passerines are year-round residents, including black-capped chickadee, dark-eyed junco, gray jay, and pine siskin. Habitats within the study area provide suitable foraging and nesting opportunities for a wide range of songbirds.

Mammals

Grizzly bear (Blue list) and Black bear

Grizzly bears are currently blue-listed for several reasons including: declining numbers, loss of habitat, vulnerability to human disturbances, large home range requirements, and low reproductive rate. It is generally accepted that maintenance of grizzly bears require large relatively undisturbed areas to reduce bear-human conflicts. Most of the potential threats to grizzly bear populations are related to human settlement and road access. However, large, relatively undisturbed areas are becoming increasingly rare, which implies that the majority of grizzly bear habitat will require a coordinated approach to habitat management, as is recommended in *Grizzly Bear Conservation Strategy, (1995).*

Grizzly bear are typically found at low to moderate densities in the SBS zone within the Prince George Forest District, largely due to the extensive settlement and agriculture. In the SBS, grizzlies typically utilize riparian and wet forests throughout their range during summer for berrying, foraging and travel. Grizzly bears require a variety of seral stages to meet seasonal habitat requirements. Important habitats include mature forests, herb-dominated avalanche chutes, subalpine meadows, riparian areas, floodplains, salmon-bearing streams, and habitats containing berry-producing shrubs. Coarse woody debris is an important habitat feature for grizzlies foraging for insects.

Grizzly bear are infrequently observed in proximity to Prince George and are likely to occur at low densities in the general area due to the proximity to human settlement and the limited food resources reduce the suitability of habitats in the project area for grizzly bear. Due to the extremely large home range size and sensitivity of grizzly bear to human settlement, it is unlikely that habitats within the study area are critical to grizzly bear. The occurrence of a grizzly bear den would be unanticipated and considered incidental; although would have significant implications for development requiring discussion with the MOE.

The disturbed forested polygons likely provide habitat for the black bear. Black bears are more opportunistic foragers rather than predators and do not require specific habitats to survive. Black bears will forage on berries, aquatic vegetation, carrion, horsetails and insects (Eder and Pattie 2001). Black bears enjoy feeding on dandelions which can be found in disturbed areas such as roadsides and clearings. Evidence of black bear was observed throughout the study area. Development within the area would need to provide adequate measures to deter bear/human interaction (i.e. proper garbage disposal etc.).

Fisher (Blue list)

Fisher are a wide ranging species that occur in low densities on the landscape and utilize a wide range of habitats including riparian, wetland, burns, mixed and mature coniferous forest. The home range of a single fisher, depending on the quality and amount of available habitat ranges from approximately 1,500 to 3,000 ha and an average density in suitable habitat ranges between approximately one animal per 5,000 to 10,000 ha. Although fishers utilize a wide range of habitats they are known to prefer large areas of contiguous forest. Due to their low densities and large home range sizes, fishers are difficult to manage for and are typically treated under an umbrella approach where key habitats or habitat elements are management targets for groups of species.

Riparian and wetland habitats are important habitats for numerous wildlife species, including fisher, and it is assumed that protecting these habitats will significantly contribute to the management (maintenance) of dependant species. Large diameter standing dead trees are an example of a habitat feature that is particularly important to numerous wildlife species, including fisher. The vast majority of fisher den sites are found in large diameter (>90 cm) dead trees (mostly black cottonwood). Suitable denning trees were not observed within the study area.

Wolverine (Blue list)

Similar to grizzly bear, wolverine are a wide ranging species that occurs at low densities on the landscape. They are solitary animals and males have territories as large as 200,000 ha; females about 40,000 to 50,000 ha. In contrast to grizzly and fisher, wolverine are habitat specialists, with the greatest overlap in habitat requirements with caribou and grizzly bear. Wolverine are typically associated with remote wilderness areas and high elevation ecosystems where caribou carrion is an important food source. They are known to follow other predators such as grizzly bear to feed on their kills.

Wolverine are infrequently observed, however it is unlikely that wolverine would occur within the study area or be significantly affected by future development.

Moose

Moose are a species of management concern as they are used as a management indicator species, their populations and habitats are managed by the province, and they are of social and commercial value. The SBS supports the highest densities of moose and most important moose habitats in the province. Moose are widely distributed, although they are most abundant in the lower elevation plateau forests that are characterized by numerous wetlands and small lakes, as well as extensive river riparian habitats.

Moose utilize a wide range of habitat types (forested and non-forested) and seral stages to meet different life history requirements (breeding, foraging) and accommodate daily movements (travel, security and thermal cover). Early seral forest in cutblocks, burns in spruce-pine forests, and riparian habitats provide year-round forage for moose. Moose frequent wetlands and shallow lakes through the spring and summer to feed on aquatic and emergent vegetation. Moose find ample browse in cutover areas but use is typically low until stands green up enough to provide cover, which roughly coincides with the onset of the suppression of shrub growth from the shading of maturing conifers. On average sites, moose utilization is typically greatest in 15-25 year old stands. Most forest within the study area is around 40 years old.

Moose require areas of dense cover for travel, security and thermal cover. Riparian corridors along streams with high shrub cover provide resting, hiding, calving and foraging opportunities and are of particular importance. Thermal cover is largely provided by mid to late seral coniferous forest.

Evidence of moose activity was observed within the study area. Several trails and pellets were observed surrounding the wetland areas as well as across the forested polygons. Recent browse was observed on willows, highbush cranberry, alder and twinberry. This area would not be deemed critical ungulate winter range and it is not located in a sensitive natural features area as identified by the City of Prince George (2001). Moose are somewhat tolerant of development and they are known to browse natural and ornamental shrubs in close proximity to houses in low-density large lot developments, however they are generally secretive and are largely intolerant of dogs.

Mule Deer

Mule deer are a species of management concern as they are a management indicator species, their populations and habitats are managed by the province, and they are of social and commercial value. The SBS supports the low to moderate densities of mule deer. Mule deer prefer patchy habitats with a mix of dense forests for thermal and security cover, combined with open south-facing slopes, deciduous forests, riparian habitats, meadows, and herb-dominated subalpine meadows for foraging. Burns, cutblocks, and south-facing slopes are often the preferred foraging areas. In some areas, arboreal lichens may be an important food source. Warm south-facing aspects are preferred in winter and early spring.

The area proposed for development does not contain ungulate winter range habitat characteristics such as Douglas-fir forests, south facing slopes, and slope gradients between 20-40%.

Amphibians and Reptiles

There are no red or blue listed amphibian or reptile species recorded in the BC CDC for the Prince George Forest District. Reptile and amphibian species that may be present in the project area include: Western toad (*Bufo boreas),* Spotted frog (*Rana pretiosa),* Wood frog (*Rana sylvatica),* Common garter snake (*Thamnophis sirtalis),* the Western terrestrial garter snake (*Thamnophis elegans),* and the long-toed salamander *(Ambystoma macrodactylum)* (Province of BC 2004).

The reptiles and amphibians are commonly associated with aquatic habitats including river margins and ponds. No amphibian egg masses, tadpoles or hatchlings were observed during the field assessment, however they area likely present due to the abundant wetland habitat. The wetland, ponds and streams provide good breeding habitat and cover for amphibians and reptiles. The vegetation connecting these areas is also important as they provide corridors for migration between the areas and for snakes to access foraging opportunities around the wetlands. For example, Western toads and long-toed salamanders are largely terrestrial but return to water for breeding.

One common garter snake was observed near the beaver dam in the straight channel west of the large pond (Appendix 1; Figure 17).

4.6 Wildlife Summary

Forested areas such as the mixed upland forests, black spruce bog and young deciduous forests provide suitable habitats for a number of species. These habitat are considered average and do not provide critical habitat for the variety of wildlife utilizing them. Moose, black bear, and songbirds are evident within these areas but are not limited by these types of habitat. There is a lack of old growth forests, agricultural areas, mature black cottonwood, steep slopes, all which may provide critical habitats for other species. Since these are not found within the project area, the habitat is not deemed limiting.

Wetland areas within the project area do provide habitat for amphibian and reptiles and a number of waterfowl but due to their size, depth and aquatic vegetation within these areas, would not provide habitat for species of management concern or be limiting upon the landscape. Due to the short lifespan of these wetland areas, abundant aquatic vegetation has not had the opportunity to grow and thus certain species of ducks and geese would have less available forage.

No critical habitats for red or blue listed species were observed within the study area. Species of management concern with significant potential to occur within the project area are limited to moose. This area is has not been identified as ungulate winter range by the City of Prince George (2001). The habitats present around the project area provide moderate levels of capability and suitability for mammals, birds, amphibians and reptiles, and waterfowl, but do not stand out from habitat units located throughout the Prince George area.

5.0 GUIDELINES AND RECOMMENDATIONS

The following summarizes the environmental sensitivities present, best management strategies, and recommendations to guide development such that significant environmental resource values are maintained.

5.1 Aquatic Resources

The aquatic resources present within the development area include four drainages, two wetland areas and significant riparian vegetation surrounding all watercourses. Even though the stream was classified as non-fish bearing due to lack of fish captured during sampling activities and marginal habitat present, all waterbodies/watercourses in this area would be managed as fish habitat by DFO as they flow into and provide water quality/quantity, flow volumes, nutrient input to fish habitat located downstream (McMillian Creek).

<u>Fish and Wetland Habitat</u>

General recommendations and Best Management Practices for fish and wetland habitats include:

1. Maintain natural drainage patterns.
2. Avoid draining wetlands, regardless of their size, depth or duration. Try to plan development around existing wetlands by incorporating them into parkland or greenbelt areas.
3. Create a natural vegetated buffer or leave strip along the length of each drainage (City of PG 2001). A minimum 15 m set back from the high water mark is recommended (Chilibeck 1993). In areas designed for high density use (such as multi-family dwellings, a set back of 30 m is recommended). Other provincial BMP's provide different set backs. For example, Water Quality: General Best Management Practices recommends the following:
    - New homes should have a 35 m setback from a stream.
    - Lawns should have a 15 m setback from a stream.

- Septic systems should have a 15 m setback from a stream.
- New roads should have 35 m setback from a stream.
- Paved parking areas should have 15 m setback from a stream.

4. Do not use local streams or wetlands for unmanaged stormwater discharge. The increased flows can significantly increase erosion and damage aquatic habitats.
5. Create a leave strip surrounding the wetland areas (City of PG 2001). This may be 15 m from the high water mark. This area may be designated as a city park or greenspace. Trails should be designed within the park to avoid fragile or streambank areas that are susceptible to disturbance.
6. Minimize the number of crossings of wetlands or streams. Use boardwalks or bridges within the park and development to avoid impact with wetland areas or drainages.
7. Avoid altering flow regimes of creeks, surface runoff, or groundwater and avoid impermeable surfaces.

These recommendations can be found within documents such as the Land Development Guidelines, Water Quality: General Best Management Practices, Federal Fisheries Act, and Streamside Protection Guidelines. These provide general direction for development and are guidelines to ensure that fish and wildlife habitat along with water quality are not negatively impacted.

For example, the infilling of wetlands is not recommended as it would impact the water storage capability of the area, influence downstream fish habitat, remove wildlife habitat from the area. Wetlands can be highly valued by residents; therefore they can be given high visibility, serve as attractive centre pieces to developments and recreation areas, and typically increase property values (Province of BC 2006).

The Federal Policy on Wetland Conservation, which only applies to wetlands on crown lawn, advocates for the following events (in this order) during developments potentially involving wetlands: avoidance, minimize, and compensation (Environment Canada 2005). Ultimately, development of this site should incorporate these wetland features into the plans. However, if this is not feasible, it is possible with effort and resources to engineer wetlands and other water storage facilities within the development area. The overall premise being that post-development flows are maintained at pre-development levels (see next section) and that any negative impacts to habitat are compensated/mitigated.

<u>Water Quality</u>

General BMP's provided by the provincial government to protect water quality include:

1. Avoid infilling or draining of wetland areas by dam removal or breaching.
2. Retain leave strips surrounding streams, wetlands and drainages.
3. Require a stormwater management plan including BMPs for source control and removal of contaminants from site runoff.
4. Post-development flow volumes should be maintained at pre-development levels.
5. Design and erosion and sediment control (ESC) plans according to the criteria in the Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck 1993).
6. The construction and post-construction ESC plan should recommend that an environmental consultant or other responsible party:
    - provide monitoring to ensure the sediment and erosion control plan is properly implemented during the course of clearing and construction;
    - ensure construction will proceed smoothly without harmful alteration of habitat;
    - provide long-term monitoring for disturbed sites until green-up is established and the soils at the site are stable.
7. Incorporate water treatment features into systems discharging into watercourses to maintain water quality (prevent deposition of materials into watercourses) (City of PG 2001).

Constructed wetlands can not typically replace all the functions of natural wetlands, but can provide many of the water quality functions of natural wetlands. The advantage to designing a constructed wetland is that the location, size and management of it can be regulated by the developer. While costs can vary significantly, constructed wetlands have successfully provided these functions (Province of BC 2006). Constructed wetland systems can provide ground water recharge in the area, thus lessening the impact of impervious surfaces.

Arguments have been made against designed wetlands in that the creation or replacement of wetlands is not a realistic option for the compensation of wetland loss. Studies within Washington state have found that over a 10 year study, only 13 % of replacement wetlands have been successful in returning to a pre-construction ecological state (Johnson *et al*. 2002). It has been recognized by some that replacement wetlands do not have the capacity for water storage or maintain as high water quality as naturally occurring wetlands.

5.2 Terrestrial Habitats

No provincially red-listed plant communities or plant species are known to occur within the study area. The riparian areas surrounding both wetland areas and along the drainages connecting the two should be retained as leave strips in order to function as a wildlife movement corridor, maintains streambank stability, maintaining constant water temperatures, and to act as a natural filter to maintain water quality.

According to the Land Development Guidelines, the leave strips should be permanently protected and setting this area aside as a City park would meet those requirements. A set back of 15 m within residential/low density area should be adequate due to the non-fish bearing status of these drainages (Chilibeck 1993, Province of BC 2004b). However, since there are going to be multi-family dwellings and the high water mark of these drainages and wetland areas is hard to define, a 30 m set back may be required by DFO in order to protect downstream fish habitat.

The presence of yellow-listed plant communities within the development area should not impact the development potential of this area. Yellow-listed communities are present because there is poor representation of mature natural examples of SBS subzones and there has been substantial modification of existing areas, most or all site series units in a subzone often appear on the CDC lists. The forested areas within the project area have been modified and are in an immature seral stage and as such do not provide opportunities for the protection of mature representatives examples of desired ecosystems. Development may proceed as long as it is adequately planned.

5.3 Wildlife Habitats

The potential effects of development on wildlife species of management concern and others found within the area (waterfowl, amphibians, birds and beavers) could be mitigated by:

1. Ensuring leave strips are present surrounding all wetland and watercourse within the development area. These strips will function as wildlife movement corridors for moose and other mammals. These corridors between wetland, streams and terrestrial habitat are also important for amphibians in order to complete all life stages (Province of BC 2004).

2. Maintaining the wetland and ponded areas provides nesting and foraging habitat for waterfowl. This will also provide habitat for resident beavers.

3. Provincial BMP's for amphibians and reptiles indicate that preservation of all wetlands, ponds, and pools, small and/or ephemeral is important for amphibians (Province of BC 2004). Leave strips should also be present on ephemeral drainages (Figure 1, drainages 1, 3, and 4). Ephemeral drainages tend to be favoured by some amphibians as they can have fewer and smaller predators than permanent wetlands areas.

4. Designation of a City park within the riparian leave strips may increase incidences of wildlife/human interactions. May need to provide signage to inform the public of such possibilities within the park boundaries.

5. Boardwalks or other crossings may be necessary within the park to ensure movement of terrestrial wildlife to aquatic habitats for specific life stages.

Within the Omineca Region, the control of beavers and their habitat has been an issue. The removal or modification of a beaver dam may only be completed in order to protect property as per the Wildlife Act (Section 9) (Appendix 3; Province of BC 2005). Since no infrastructure is currently present within the development area and the dams have been in place for approximately 10 years (Ryder 2006), an application would need to be submitted by the developer to the Ministry of Environment to remove the dams. Dam removal would need to ensure that no damage would occur to downstream habitats (i.e. stream scouring from increased flows). Significant efforts to ensure beavers did not return to the area would be required. The installation of beaver gates on all culverts may hinder the formation of beaver dams. However, if food sources are adjacent to the development (aspen stands, especially along the eastern border of the property) maintaining a beaver-free zone may be difficult.

Understanding that if the ponded areas need to be infilled for development, engineered wetlands may provide habitat for waterfowl, amphibians and reptiles if properly designed and their connection to natural areas is maintained (see previous section).

6.0 SUMMARY

In general, development should incorporate areas considered to sustain high environmental sensitivities (wetlands, ponded areas, and streams) into the proposed design of the neighbourhood. Development within these areas is generally not compatible with the maintenance of these environmental values. However, it is recognized that there are developmental constraints in this area regarding the inundation of beaver ponds and significant wetland/flooded forested areas and that draining and/or infilling may be the only answer in order to develop this site. Infilling of a portion of the flooded forest/swamp areas while leaving the marsh/open water areas untouched may also be a solution.

There are ways to design and properly construct wetlands in order to maintain water quality functions similar to those of the natural wetlands and to ensure no negative impacts to downstream fish habitats. Following the recommendations provided in the previous sections, the terrestrial and wildlife habitats can be maintained if the riparian and aquatic habitats are maintained or adequately compensated for. It should be noted that designed wetlands lack the wildlife habitat and vegetation components of natural wetlands and would require time to establish suitable habitat components.

Areas designated as having moderate environmental sensitivity (forested polygons 3 and 4) and those already disturbed (polygons 5, 8 and 9) have potential for limited development to occur if it is adequately planned. Since these areas have been previously disturbed and contain no critical wildlife habitat, development could proceed following the recommendations and BMP's outlined above.

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APPENDIX 1

REPORT PHOTOGRAPHS

Figure 1. Pond with lodge at eastern side of development area.

Figure 2. Pond at eastern side of development area.

Figure 3. Pond at eastern edge of development area with another lodge.

Figure 4. Older dams along S6 stream flowing into eastern pond.


Figure 5. Examples of dying birch trees surrounding wetland areas.

Figure 6. Wildlife tree near western pond, northern boundary (GPS point 27).


Figure 7. Spruce forest being inundated by rising water levels causing blow down.

Figure 8. Pine/spruce polygon (2) near western pond (GPS point 30).

Figure 9. Eastern edge of western pond (GPS point 31).

Figure 10. Western pond.


Figure 11. Western pond, looking north.

Figure 12. Active beaver activity (GPS point 45).


Figure 13. Active hairy woodpecker nest near GPS point 45.

Figure 14. Recent rubbing on alder by moose (northeast corner of development area).

Figure 15. Spruce bog polygon (1) along western edge of development area.

Figure 16. Beaver lodge and straightened channel near western edge of pond.


Figure 17. Example of reptiles observed near wetland area (garter snake).

Figure 18. Typical drainage conditions between wetland areas.


Figure 19. S6 stream (drainage #2): typical channel conditions.

APPENDIX 2.

PLANT SPECIES LIST

Trees

Betula payrifera (N)	paper birch
Picea glauca x engelmanii (N)	hybrid white spruce
Picea mariana	black spruce
Pinus contorta var. *latifolia* (N)	lodgepole pine
Populus balsamifera ssp. *trichocarpa* (N)	black cottonwood
Populus tremuloides (N)	trembling aspen

Shrubs

Alnus sinuata (N)	Sitka alder
Alnus incana ssp. *tenuifolia* (N)	mountain alder
Amelanchier alnifolia (N)	saskatoon
Arctostaphylos uva-ursi (N)	bearberry
Betula glandulosa	scrub birch
Cornus stolonifera (N)	red-osier dogwood
Kalmia microphylla	bog laurel
Ledum groenlandicum	Labrador tea
Lonicera involucrata (N)	black twinberry
Mahonia aquifolium (N)	tall Oregon-grape
Prunus virginiana (N)	chokecherry
Ribes lacustre (N)	black gooseberry
Rosa acicularis (N)	prickly rose
Rubus idaeus (N)	red raspberry
Rubus pubescens	trailing raspberry
Rubus parviflorus (N)	thimbleberry
Salix exigua (N)	coyote willow
Salix lasiandra (N)	Pacific willow
Sambucus racemosa (N)	red elderberry

Sorbus scopulina (N)	western mountain-ash
Sheperdia canadensis (N)	buffaloberry, soopolallie
Symphoricarpos albus (N)	snowberry
Viburnum edule (N)	highbush cranberry

Herbs

Achillea millefolium (N)	yarrow
Agrostis scabra (I)	redtop
Anaphalis margaritacea (N)	pearly everlasting
Antennaria pulcherrima (N)	showy pussytoes
Aster conspicuus (N)	showy aster
Chrysanthemum leucanthemum (I)	oxeye daisy
Cirsium arvense (I)	Canada thistle
Clintonia uniflora	Queen's cup
Cornus canadensis	bunchberry
Descuraina sophia (I)	flixweed
Disporum trachycarpum (N)	rough-fruited fairybells
Equisetum arvense (N)	common horsetail
Fragaria virginiana (N)	wild strawberry
Galium boreale (N)	northern bedstraw
Geranium bicknelii (N)	Bicknell's geranium
Leucanthemum vulgare (I)	oxeye daisy
Maianthemum canadense (N)	wild lily-of-the-valley
Melilotus alba (I)	white sweet-clover
Mitella nuda (N)	common miterwort
Orthilia secunda	one sided wintergreen
Osmorhiza chilensis (N)	mountain sweet-cicely
Phleum pratense (I)	timothy
Prunella vulgaris (N)	self-heal
Smilacina racemosa (N)	false Solomon's seal

Solidago canadensis (N)	Canada goldenrod
Spiraea betulifolia (N)	birch-leaved spiraea
Taraxacum officinale (I)	dandelion
Trifolium pratense (I)	red clover
Trifolium repens (I)	white clover
Viola palustris (N)	marsh violet

APPENDIX 3.

BEAVER DAM REMOVAL GUIDELINES

Beaver Dam Removal in the Omineca Region
Habitat Standard Operating Procedures

Issue: The control of beavers and removal of beaver dams and has been a long-standing issue within the Omineca Region of Ministry of Water, Land and Air Protection. With many pieces of legislation and regulations pertaining to the protection of fisheries, water quality, property, wildlife and wildlife habitat values associated beavers, clear guidance is need by habitat staff for the removal of beaver dams.

Background: A beaver dam may be modified or removed only in order to protect property (e.g. a road base), as per Section 9(2) of the BC Wildlife Act. A "Habitat Officer" of the Ministry Water, Land and Air Protection (WLAP) establishes terms and conditions associated with the removal or modification of beaver dams, pursuant to Part 7, Sections 42 and 44(1)(v) of the BC Water Act Regulation and Section 9 of the BC Wildlife Act.

Recommended Practices: Terms and conditions associated with the control of beavers and removal of beaver dams in the Omineca Region.

- Modifying or removing beaver dams requires "legal authority" which the Regional Fish and Wildlife Manager considers to mean Wildlife, Fisheries and Habitat staff. Also, as this activity is considered "works in and about a stream" there is a requirement to notify a Habitat Officer.

- Upon receiving a notification, a Habitat Officer has the authority to add specific conditions to ensure the protection of fish and fish habitat. Notification is usually required in writing, using the "**WLAP - Beaver Dam Notification Form**" (see attached) and a Habitat Officer has 45 days to respond. If no response is received within 45 days, the proponent may proceed with the work.

- In locations where beaver activity occurs, bridges or oversized culverts should be used to reduce maintenance requirements, to ensure fish passage and to reduce downstream habitat damage resulting from dam removal. If non-oversized culverts are used where signs of recent beaver activity are present, measures should be taken (e.g., "beaver stops") to reduce the chance of beavers damming the culvert. Fish passage (where required) will still have to be facilitated with non-oversized culverts.

- After notifying a Habitat Officer and receiving authorization, possible implications associated with removing the dam (i.e. washing out the culvert, damaging downstream habitat or property) should be considered before removing the dam. Authorization does not remove any liability associated with actions taken to remove a dam.

- Culverts that have been plugged by beavers (these are not considered "dams") within approximately one year of the date of the inspection and where there is no evidence of occupation (no lodge present) can be maintained without the need for authorization under the Wildlife Act Permit Regulations. However, notification of a Habitat Officer for "works in and about a stream" is still required. For emergency situations, or when licensees are in the field and a situation requires immediate action (whether a plugged culvert or beaver dam), a phone call to a Habitat Officer will be accepted as notification. Notification in writing is preferred.

- Opening plugged culverts or removing beaver dams and draining ponds between September 15th and March 15th can result in mortalities of both beavers and fish. Opening plugged culverts or removing beaver dams during this winter period will not normally be accepted, but special circumstances may warrant dam removal during this time. As with all beaver dams, WLAP must be notified before dam removal, and approval may be given. WLAP must also be notified before unplugging culverts.

- Beaver dam modification or removal between April 1 and July 14 is normally not accepted on known or default fish streams as defined by the Forest Practices Code of BC Act (FPC), in order to minimize adverse impacts on fish. Unplugging a culvert during this time however, may facilitate the passage of spawning fish. As this is a sensitive time for spring spawners, requests to modify or remove beaver dams, or unplug culverts during this time period must be directed to a WLAP Habitat Officer, who will deal with such requests on a case-by-case basis.

- Any requests for killing or removing of beavers, outside of the legal trapping season, should be directed to the registered Trapline Holder for removing nuisance beavers. Second consideration should go to a contractor previously identified for dealing with nuisance beavers. Names of contract problem beaver trappers are available from the BC Trappers Association (c/o Wayne Sharpe, Trappers International (250-561-1602)) Final consideration will be for licensees to remove nuisance beavers. Registered Trapline Holders will require a permit to remove nuisance beavers if outside of the trapping season. Nuisance beaver Contractors and licensees require a permit at all times of the year. A permit can be issued the Fish, Wildlife Science and Allocation Section Head if the request is supported by a reasonable rationale. All permit holders are required to comply with any relevant legislation or regulations (i.e. Firearms Act, Wildlife Act, Water Act, Fisheries Act).

- Permits can be issued for individual nuisance beaver sites or for sections of roads where there are multiple nuisance beaver sites. However, blanket permits will not be issued for dealing with nuisance beavers over large geographic areas or for long periods of time.

- To ensure the protection of other water users, all conditions of Part 7, Section 43 of the BC Water Act Regulation must be met in the modification or removal of a beaver dam.

- The federal Department of Fisheries and Oceans (DFO) **must** also be notified prior to the modification or removal of any beaver dam, and any conditions established by this agency adhered to.

- Where private land will be crossed, permission in writing must be obtained from all property owners prior to dam modification or removal.

- A beaver dam that is located on a known or default fish stream as defined by the FPC can not be breached or removed using explosives.

- Every reasonable effort must be extended to prevent deleterious substances, including sediment, from entering a stream. All equipment used on site should be in good repair and free of excess grease and oil. Machinery must work from the stream bank or naturally dry channel rather than within the wetted perimeter of a stream. Only the digging bucket from machinery should enter a stream.

- Where two or more dams in succession will be modified or removed, the dam furthest downstream must be modified or removed first, and its associated pond allowed to drain to the target level, before the next dam upstream can be modified or removed.

- Dam removal must occur slowly, a bit at a time, in order to minimize scouring and the addition of silt to downstream areas. Water flowing through a dam breach should normally not exceed 0.2 square metres in area (i.e., a typical breach could measure 1.0 metre x 20 centimetres in size).

- All material removed from a beaver dam must be side-cast in such a manner that it cannot re-enter the stream.

- If an area is de-watered as a result of dam removal or modification and results in the stranding of species of fish listed for a "fish stream" in Operational Planning Regulation 1 of the FPC, then such fish must be salvaged and returned to the stream.

- All reasonable care must be exercised to avoid damaging any land, works, trees, stream-banks or other property during the course of beaver dam modification or removal. Full compensation to the owners must be made for any such damage or loss that is unjustified.

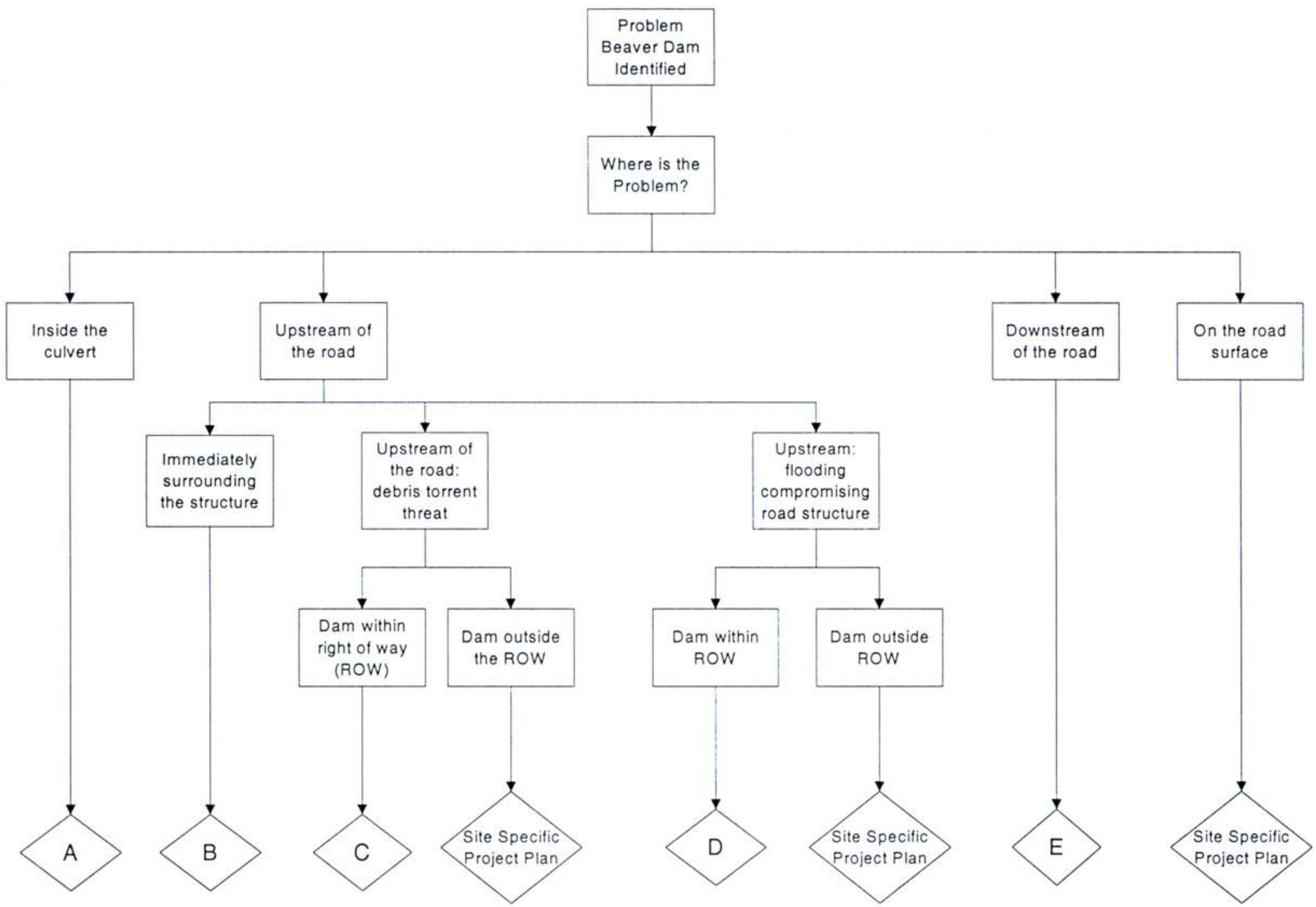
- Significant damage to a stream channel or fish habitat, or the introduction of significant quantities of a deleterious substance to a stream as a result of beaver dam modification or removal, must be reported to WLAP or DFO immediately.

Credit: The habitat section would like to acknowledge the extensive work by Don Cadden (Section Head Fisheries - Omineca Sub-Region), in the development of these terms and conditions. The Procedure Tree matrix was developed by Jocelyn White and is attached to provide an example of a management process that a forest licensee could adopt for road right-of-way maintenance associated with problem beaver dams.

Term: This direction remains in place until revoked or amended by the Omineca Ecosystems Section Head or is reaffirmed at the periodic 5 year review.

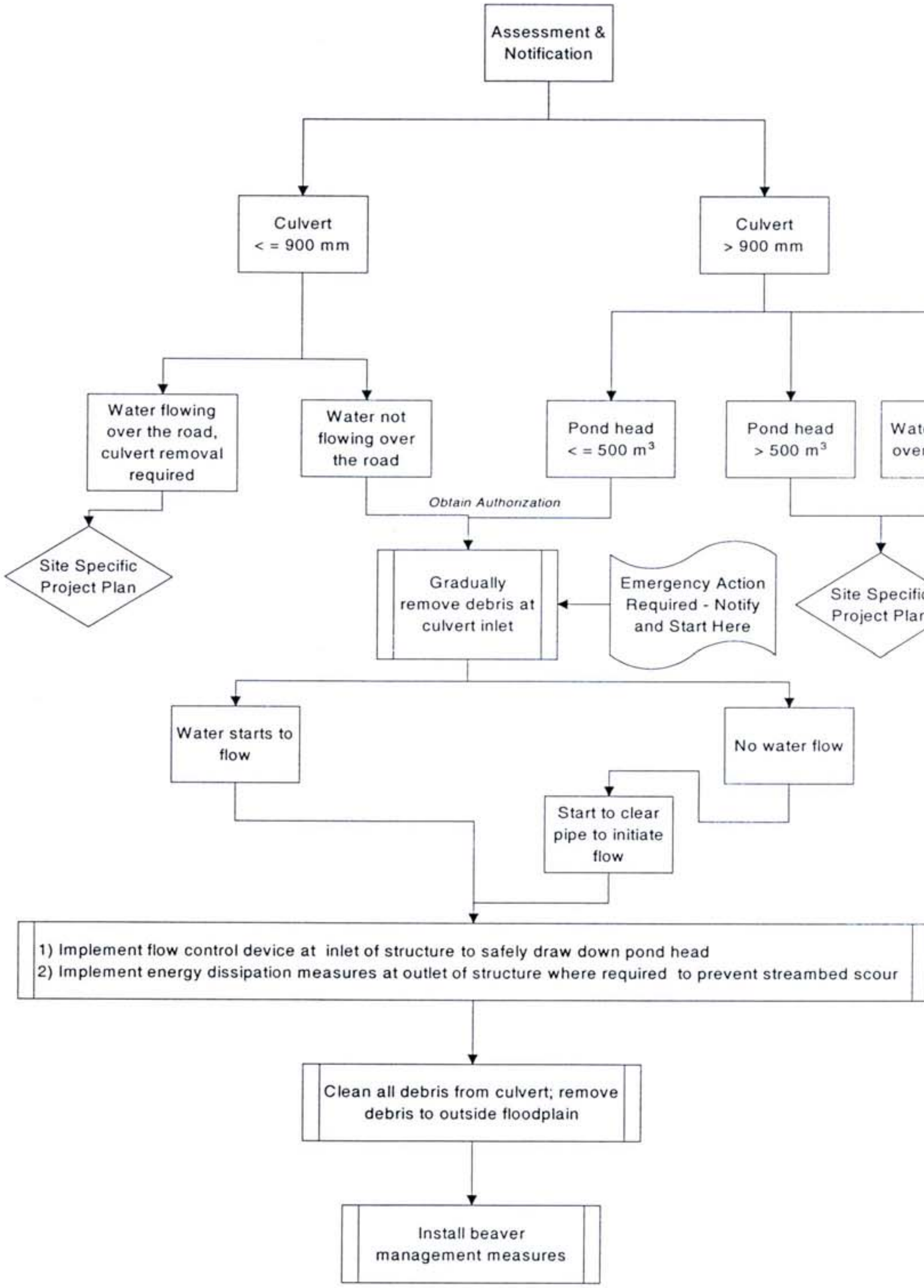
Chris Ritchie
Omineca Ecosystems Section Head **October 9, 2002**

PROCEDURE TREE

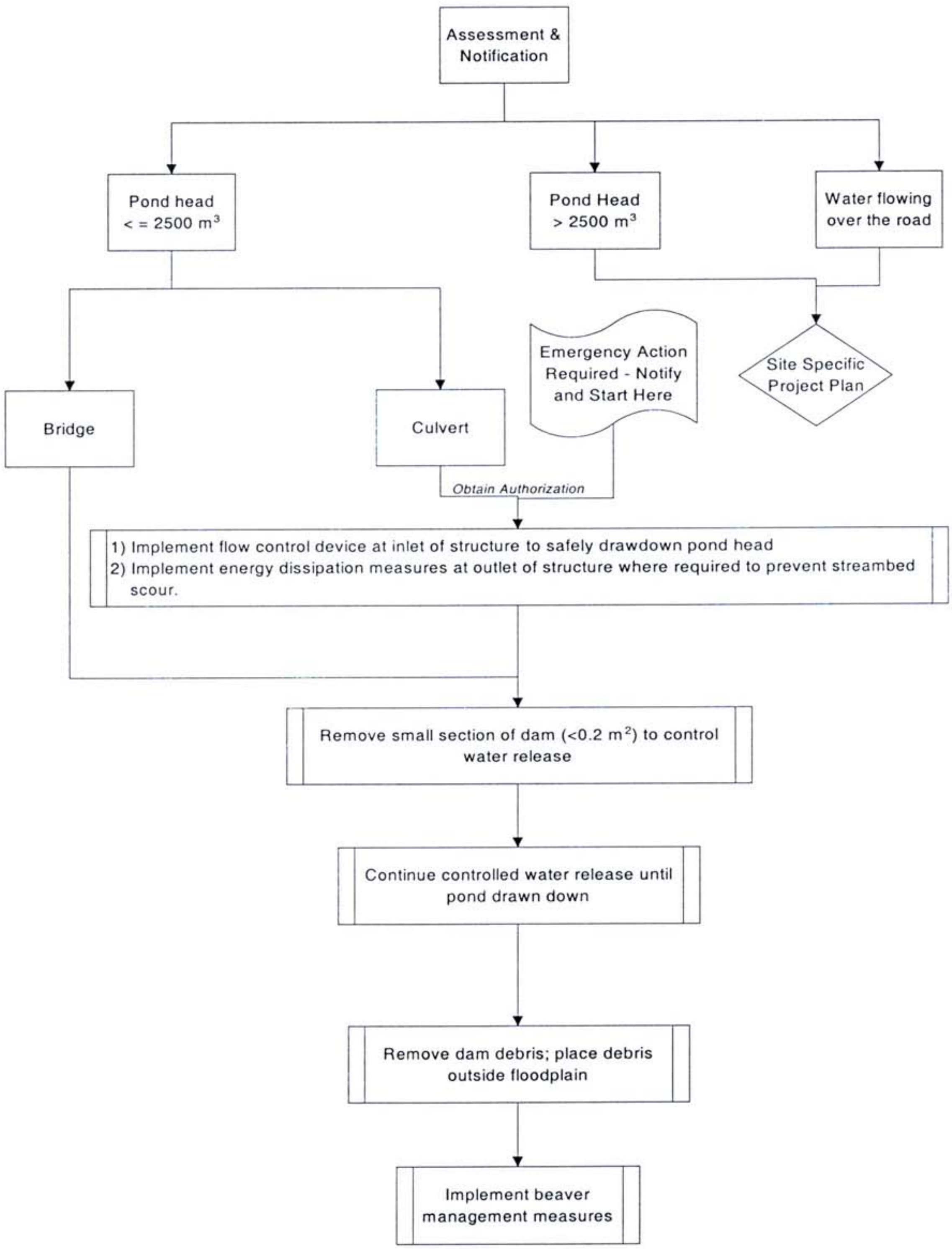


APPENDI

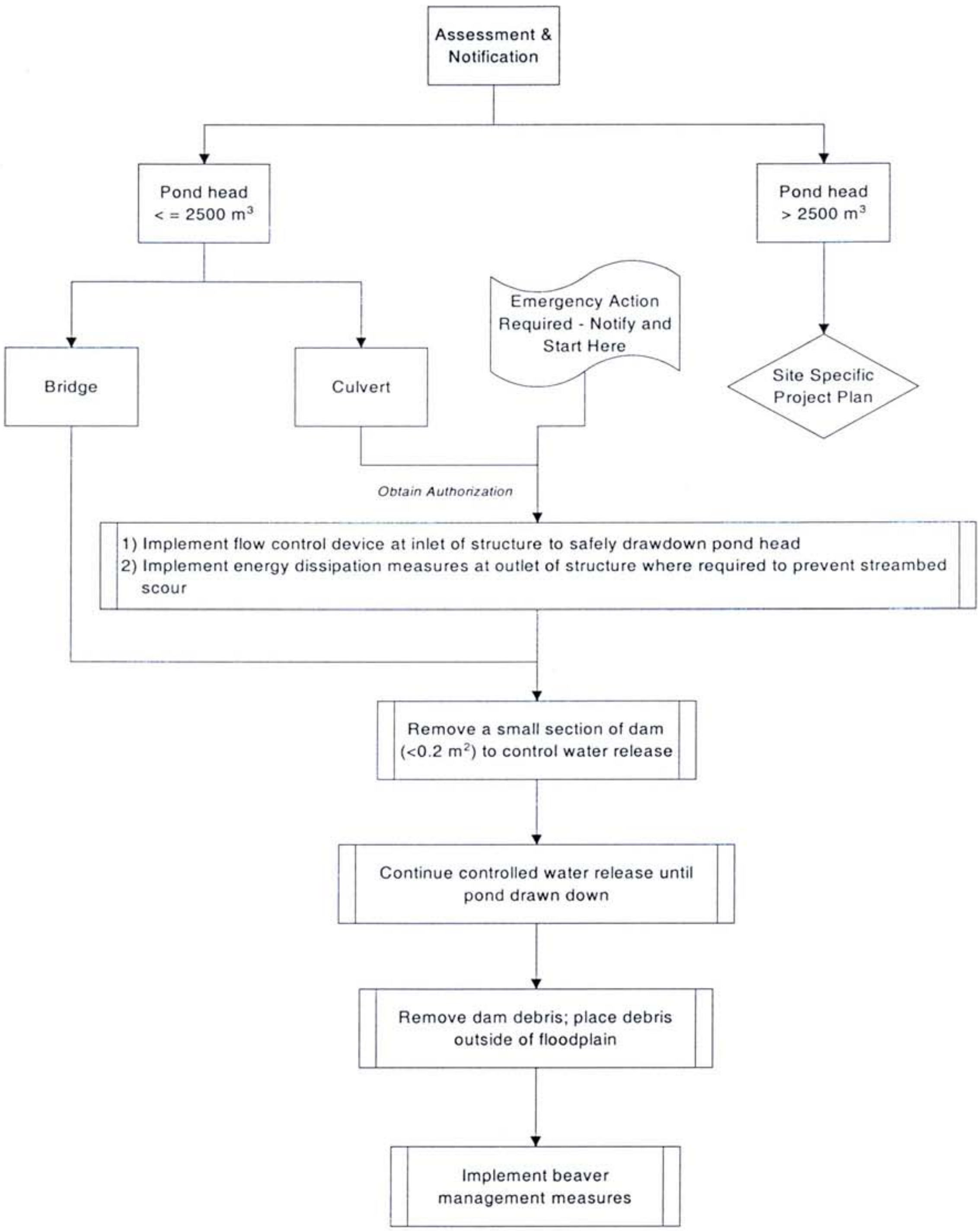
Procedure A: Plugged Culvert - Standing Water or Evidence of Occupation



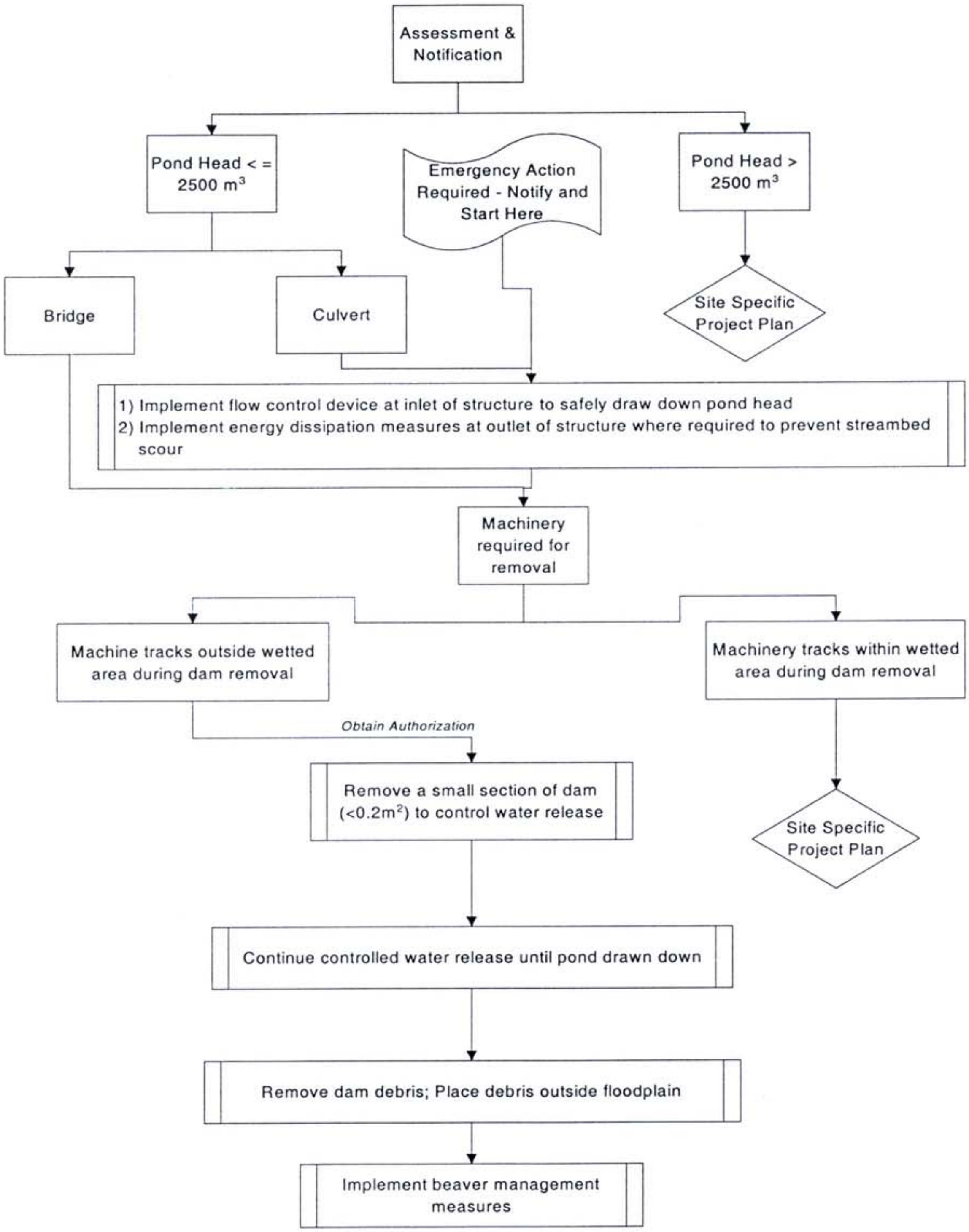
Procedure B: Immediately Surrounding the Structure



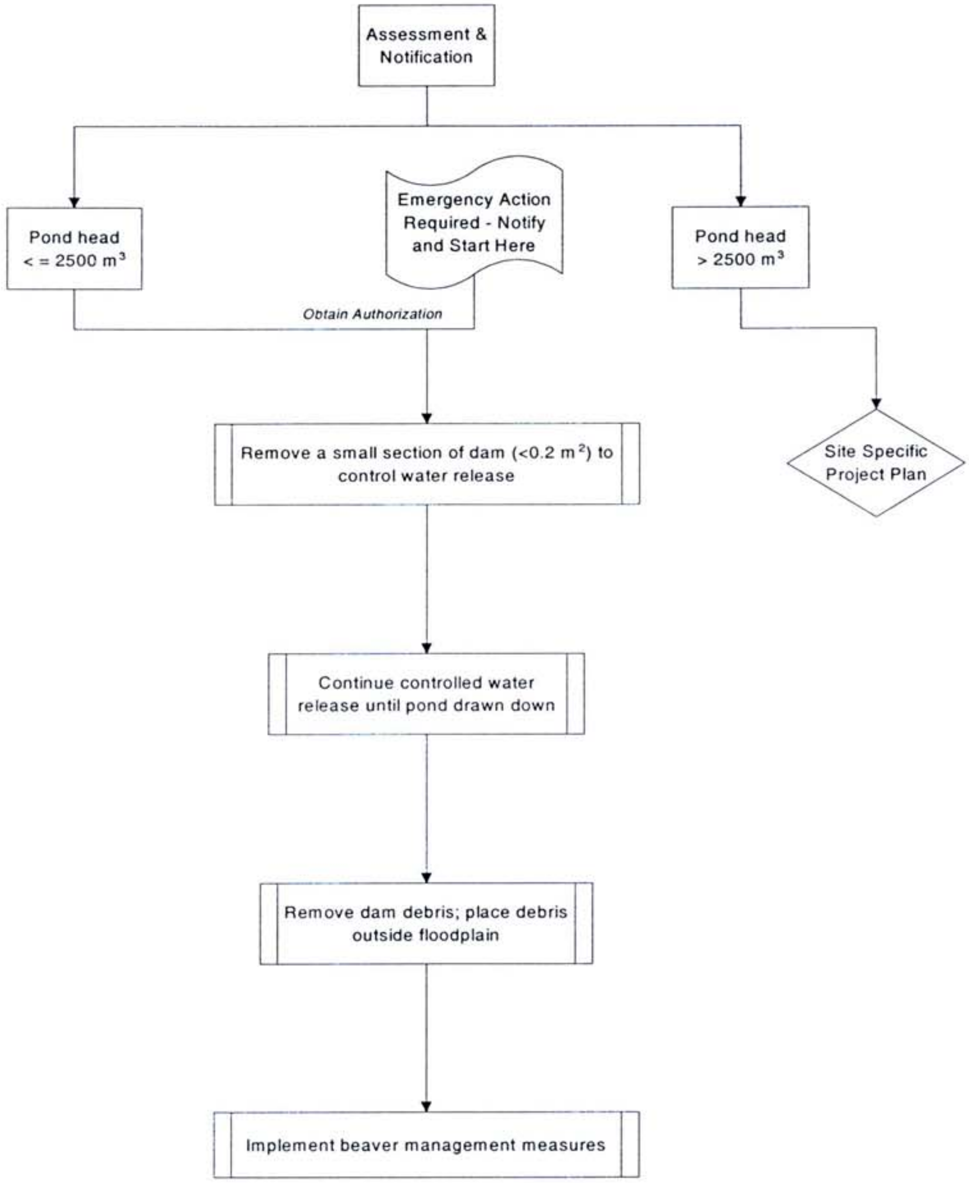
Procedure C: Upstream of the Road - Debris Torrent Threat (within ROW)



Procedure D: Upstream Flooding Compromising Road Structure (within ROW)



Procedure E: Downstream of the Road



WLAP (Forestry) - Beaver Dam Notification Form

To: (FAX) or VIA E-Mail	
☐ (DFO) Fisheries Officer (250) 561-5534	☐ **Emergency - Immediate Action Required**
☐ (WLAP - Prince George) Habitat Officer (250) 565-6629	☐ 3 Day Response
☐ (WLAP - Fort St. John) Habitat Officer (250) 787-3219	☐ 14 Day Response
	☐ not a emergency

1) Road Condition
   - ☐ The road is being washed out.
   - ☐ The road is at risk of being washed out.
   - ☐ The road is saturated and/or water is percolating through the fill

2) Road Use: ☐ High ☐ Low

3) Where is the problem occurring: General Location ______________________________
   ☐ (see attached map) or Dam location

Dam Location UTM Co-ordinate	Zone Number:		Easting:	Northing:
Stream Classification	☐ S1 ☐ S3 ☐ S5	☐ S2 ☐ S4 ☐ S6	Stream Name:	Forest Road:

- ☐ Blockage inside the culvert.
- ☐ Dam on the road surface.
- ☐ Dam upstream of the road
  - ☐ Surrounding the mouth of the structure
  - ☐ Upstream of the road - directly affected structure
  - ☐ Upstream of the road - flooding around the dam and compromising other sections of the road
- ☐ Downstream of the road.

4) Age of Dam ☐ < 1 year ☐ > 1 year

5) Type of Structure: ☐ Bridge ☐ Culvert, Size: ______________________(mm)

Site Sketch	Procedure:	☐ A ☐ B ☐ C ☐ D ☐ E ☐ Project Plan to follow

Contact Name: ______________________ E-Mail:__________________________

Contact Number: ________________(day)________________(night)

Requested Activity Dates: ________________________________

WLAP (General) - Beaver Dam Notification Form

To: (FAX) or VIA E-Mail
☐ (DFO) Fisheries Officer (250) 561-5534
☐ (WLAP - Prince George) Habitat Officer (250) 565-6629
or Mail To: Ecosystem Section, 325 – 1011 Fourth Avenue, Prince George, BC V2l 3H9

☐ **Emergency - Immediate Action Required**
☐ 3 Day Response
☐ 14 Day Response
☐ not a emergency

Where is the problem occurring: General Location and Description, ______________________________
____
____
____

☐ (see attached map 1:50,000 or better) of Dam location

Dam Location UTM Co-ordinate	Zone Number:		Easting:	Northing:
Stream Name	Width	Depth	Fish Present ☐ Yes ☐ No ☐ Unknown	Access From:

Age of Dam ☐ < 1 year ☐ > 1 year
Evidence of Active Beaver Use (e.g. lodge, cuttings, fallen trees) ☐ yes ☐ no
Beaver Dam Affecting Road: ☐ The road is being washed out.
☐ The road is at risk of being washed out.
☐ The road is saturated and/or water is percolating through the fill
Beaver Dam Affecting Other Property (specify): ______________________________

☐ Blockage inside the culvert or ☐ Bridge Culvert or bridge size:__________(cm)
☐ Dam on the road surface.
☐ Dam upstream of the road
☐ Dam downstream of the road.
☐ Other location (specify) ______________________________

Site Sketch

Contact Name: ________________________ E-Mail:____________________________

Contact Number: __________________(day)__________________(night)

Requested Activity Dates: ____________________________________

TERMS AND CONDITIONS ASSOCIATED WITH THE REMOVAL OF BEAVER DAMS IN THE PRINCE GEORGE FOREST REGION

- The Ministry Water, Land and Air Protection (WLAP) establishes terms and conditions associated with the removal or modification of beaver dams, pursuant to Part 7, Sections 42 and 44(1)(v) of the BC Water Act Regulation and Section 9 of the BC Wildlife Act.

- A beaver dam may be modified or removed only in order to protect property (e.g. a road base), as per Section 9(2) of the BC Wildlife Act.

- Modifying or removing beaver dams requires "legal authority" which the Regional Fish and Wildlife Manager considers to mean Wildlife, Fisheries and Habitat staff. Also, as this activity is considered "works in and about a stream" there is a requirement to notify a Habitat Officer.

- Upon receiving a notification, a Habitat Officer has the authority to add specific conditions to ensure the protection of fish and fish habitat. Notification is usually required in writing and a Habitat Officer has 45 days to respond. If no response is received within 45 days, the proponent may proceed with the work.

- In locations where beaver activity occurs, bridges or oversized culverts should be used to reduce maintenance requirements, to ensure fish passage and to reduce downstream habitat damage resulting from dam removal. If non-oversized culverts are used where signs of recent beaver activity are present, measures should be taken (e.g., "beaver stops") to reduce the chance of beavers damming the culvert. Fish passage (where required) will still have to be facilitated with non-oversized culverts.

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June 21, 2001

- Beaver dam modification or removal between April 1 and July 14 is normally not accepted on known or default fish streams as defined by the Forest Practices Code of BC Act (FPC), in order to minimize adverse impacts on fish. Unplugging a culvert during this time however, may facilitate the passage of spawning fish. As this is a sensitive time for spring spawners, requests to modify or remove beaver dams, or unplug culverts during this time period must be directed to a WLAP Habitat Officer, who will deal with such requests on a case-by-case basis.

- All requests for killing or removing of beavers, outside of the legal trapping season, should be directed to a Conservation Officer.

- The registered Trapline Holder should be given first consideration for removing nuisance beavers. Second consideration should go to a contractor previously identified for dealing with nuisance beavers. Final consideration will be for licensees to remove nuisance beavers. Registered Trapline Holders will require a permit to remove nuisance beavers if outside of the trapping season. Nuisance beaver Contractors and licensees require a permit at all times of the year. All permit holders are required to comply with any relevant legislation or regulations (i.e. the Firearms Act, Wildlife Act…).

- Permits can be issued for individual nuisance beaver sites or for sections of roads where there are multiple nuisance beaver sites. However, blanket permits will not be issued for dealing with nuisance beavers over large geographic areas or for long periods of time.

- To ensure the protection of other water users, all conditions of Part 7, Section 43 of the BC Water Act Regulation must be met in the modification or removal of a beaver dam.

- The federal Department of Fisheries and Oceans (DFO) **must** also be notified prior to the modification or removal of any beaver dam, and any conditions established by this agency adhered to.

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- Where two or more dams in succession will be modified or removed, the dam furthest downstream must be modified or removed first, and its associated pond allowed to drain to the target level, before the next dam upstream can be modified or removed.

- Dam removal must occur slowly, a bit at a time, in order to minimize scouring and the addition of silt to downstream areas. Water flowing through a dam breach should normally not exceed 0.2 square metres in area (i.e., a typical breach could measure 1.0 metre x 20 centimetres in size).

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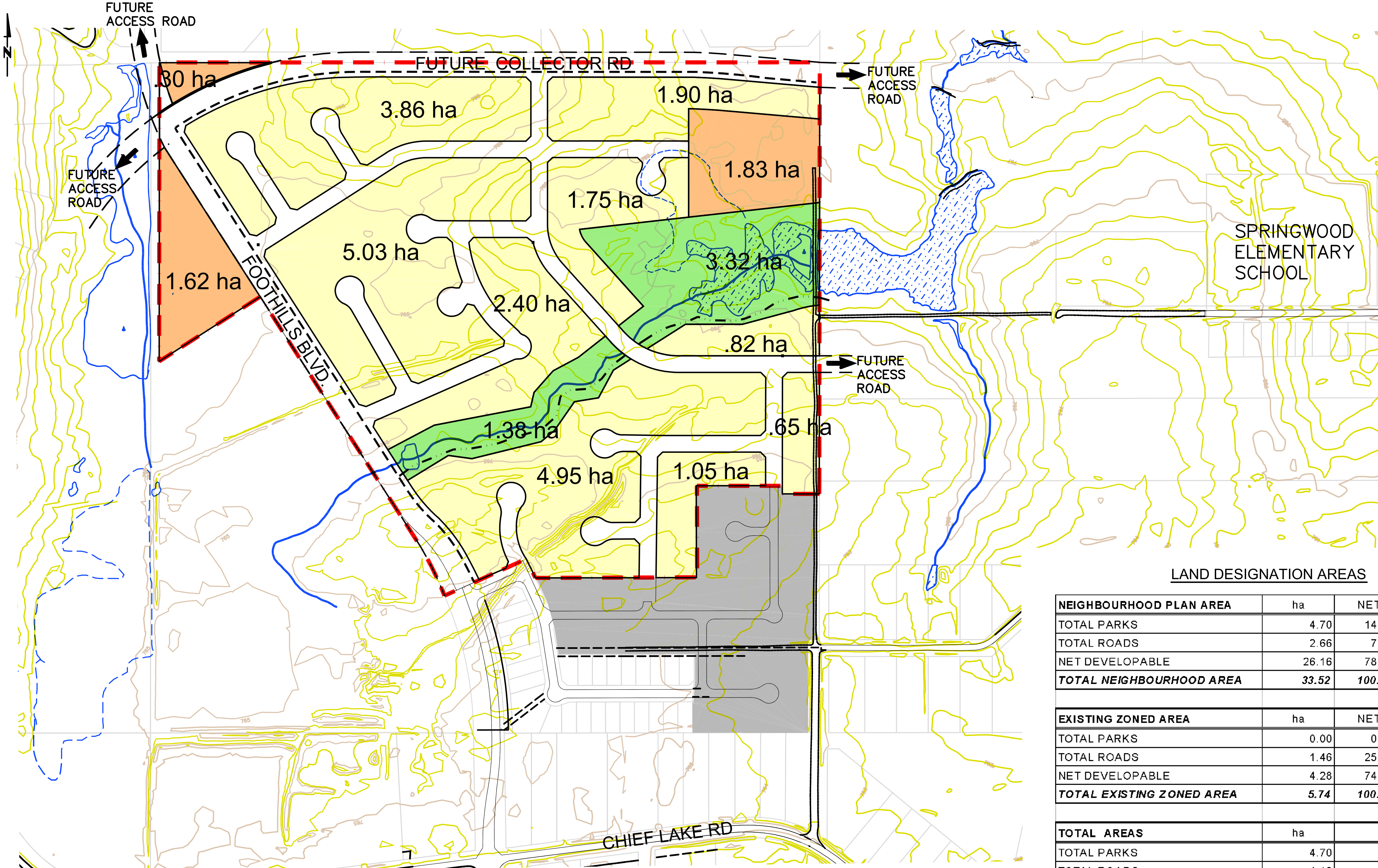
- Significant damage to a stream channel or fish habitat, or the introduction of significant quantities of a deleterious substance to a stream as a result of beaver dam modification or removal, must be reported to MELP or DFO immediately.

APPENDIX 4.

L&M Drawing No. 1107-08-00



LEGEND

- SINGLE FAMILY
- MULTI FAMILY
- CITY PARK
- EXISTING ZONED AREA
- RIGHT OF WAY
- PROPOSED TRAILS
- PROPOSED BIKE TRAIL
- EXISTING GRAVEL ROADS
- EXISTING PAVED ROADS
- EXISTING PROPERTY LINES
- NEIGBOURHOOD PLAN BORDER
- CREEK
- SWAMP
- LAKE/POND

WOODLANDS NEIGHBOURHOOD PLAN

SCALE 1:2 500

HALF-SIZE DRAWING

LAND DESIGNATION AREAS

NEIGHBOURHOOD PLAN AREA	ha	NET	GROSS
TOTAL PARKS	4.70	14.02%	11.97%
TOTAL ROADS	2.66	7.94%	6.78%
NET DEVELOPABLE	26.16	78.04%	66.63%
TOTAL NEIGHBOURHOOD AREA	***33.52***	***100.00%***	***85.38%***

EXISTING ZONED AREA	ha	NET	GROSS
TOTAL PARKS	0.00	0.00%	0.00%
TOTAL ROADS	1.46	25.44%	3.72%
NET DEVELOPABLE	4.28	74.56%	10.90%
TOTAL EXISTING ZONED AREA	***5.74***	***100.00%***	***14.62%***

TOTAL AREAS	ha	GROSS
TOTAL PARKS	4.70	11.97%
TOTAL ROADS	4.12	10.49%
TOTAL DEVELOPABLE AREA	30.44	77.53%
TOTAL GROSS AREA	***39.26***	***100.00%***

POPULATION DENSITIES

DESIGNATION AREAS	DWELLING AREAS (ha)	DWELLING UNITS /ha	NUMBER OF DWELLING UNITS	PERSONS/ DWELLING UNIT	ESTIMATED POPULATION
SINGLE FAMILY	22.41	9.60	215.14	2.65	570
MULTI FAMILY	3.75	20.00	75.00	2.65	199
TOTAL	***26.16***		***290.14***		***769***

GENESIS DEVELOPMENT CORP.

CIVIC ADDRESS:
GREENWOOD ST

LEGAL DESCRIPTION
PID: 015036855
DL:2425REM SW4

WOODLANDS NEIGHBOURHOOD PLAN

No.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED
PLANNING CENTRE
#201 1840 Third Ave.
PRINCE GEORGE, B.C.
V2M 1G4
Tel. (250) 562-1977
Fax (250) 562-1967
holand@lmengineering.bc.ca

DRAWN:	KLH
CHECKED:	HKO
ENGINEER:	DJM
PLANNER:	PRINCE GEORGE, BC
DRAWING FILE:	1107-08-00 NHP.dwg
CORRESPONDENCE:	
GRID:	
DATE:	10/11/05
SCALES HORZ. AS NOTED	VERT. AS NOTED

PROPOSED LAND USE

CONSULTANTS PROJECT No.
1107-08-00

DRAWING No.
01

SHEET No.	REV. No.
1 of 1	0

APPENDIX B

Woodlands Neighbourhood Plan
L&M Engineering Limited

TRITON ENVIRONMENTAL MEMO UPDATE - 2018

TRITON
Environmental Consultants

3990 22nd Avenue
Prince George, BC V2N 3A1

P 250.562.9155
F 250.562.9135

MEMORANDUM

TO:	Central Builders PG Ltd.; Mr. Grant Skelly c/o L&M Engineering Ltd.
FROM:	Neal Foord, Triton Environmental Consultants Ltd.
DATE:	17/08/2018
FILE #/NAME:	WP#4360 -10061 Woodlands Environmental Overview Assessment
RE:	Update to the Environmental Overview Assessment of the Woodlands Neighbourhood Project (2006)

1.0 Introduction

Triton Environmental Consultants Ltd. (Triton) was retained by L&M Engineering Ltd. to provide an environmental overview assessment (Triton, 2006) of a potential residential development located on District Lot (DL) 2425 REM SW 4, Cariboo District (PID 015 036 855). The property is located north of the intersection of Foothills Boulevard and Chief Lake Road in Prince George, BC. Since the 2006 environmental overview assessment no significant development has taken place within the Project area; however, there have been changes to the permitting and regulatory requirements, as well as the at-risk rankings for provincially designated ecological communities, plants and wildlife species that have potential to occur within the Project area.

The purpose of this memo is to provide a supplemental update to the Environmental Overview Assessment (EOA) completed in 2006. This memo should be utilized in conjunction with the detailed report completed and should not be considered a standalone document. Much of the information contained in the 2006 report remains valid, as documented in this memorandum. Information that has been updated due to site-level changes or re-assessment, or refinement based on Project planning is provided in this memorandum.

2.0 Aquatic Ecosystems

Fish sampling was completed as part of the 2006 assessment, including electrofishing and minnow trapping of the ponded areas within the wetland. No fish were captured and a lack of connectivity to known downstream fish habitat was noted. As such, the main stream connecting the two wetland areas (Drainage 2 in Triton 2006) was classified as non-fish bearing (S6 stream classification). Three other watercourses were noted (Drainages 1, 3, and 4 in Triton 2006), but lacked evidence of continuous surface flow and alluvium, and were assessed as non-classified drainages (NCD) that do not contain potential fish habitat.

The non-fish bearing stream, as well as drainages 1 and 3, appear on PG Map web-mapping utility (City of Prince George 2018). All are depicted as non-fish bearing streams, as is the outlet from the wetlands for at least 700 m downstream from the proposed development area. PG Map also indicates a discontinuous connection to other nearby watersheds, possibly indicating subsurface connectivity. The provincial 1:20,000 scale TRIM drainage network indicates the drainage is eventually connected to MacMillan Creek (a known fish-bearing watercourse), but much of the associated drainage path is via inferred non-fish bearing streams.

Given that stream classifications do not normally expire and should not change from non-fish bearing to fish bearing unless significant, unpredictable events (such as drainage path alterations and avulsions from landslides) occur, and the fact that the City of Prince George is currently managing the watershed as non-fish bearing, the conclusions in the 2006 report are considered to be valid and no additional fish sampling was conducted or proposed.

3.0 At-Risk Species and Ecological Communities

A desktop survey was completed for the Project area based on current information and at-risk rankings from the British Columbia Conservation Data Centre (CDC). The updated at-risk BC and *Species At-Risk Act* (SARA) rankings and potential for presence for at-risk ecological communities, vascular plants, bryophytes, fungi, amphibians, fish, mammals, and invertebrates are included in Appendix 1. A significant number of changes have occurred since 2006, including the addition of several species groups which were previously not assessed by the CDC (e.g., bryophytes, lichens, and invertebrates).

No at-risk species or ecological communities were observed in the original field surveys (Triton 2006); however, based on the current desktop survey and the updated at-risk rankings there is potential for environmentally sensitive species to be present. A follow-up survey was completed in August 2018 to look for occurrences of at-risk species that were not assessed in the 2006 assessment, especially those with moderate potential to occur based on the presence of suitable habitat (see Appendix 1). BEC site-series polygons were not re-assessed (except for the wetland polygons). None of the upland site-series that were identified in Triton (2006) have been re-classified as red- or blue-listed, and thus the site series interpretations from 2006 are considered valid.

3.1 Wetlands

The Ministry of Forests publication Wetlands of British Columbia: A Guide to Identification. (Mackenzie and Moran 2004) provides a description and means to classify wetlands in the province of British Columbia. The field guide contains written descriptions for wetland classifications and information regarding the corresponding Biogeoclimatic Ecosystem Classification (BEC) site associations.

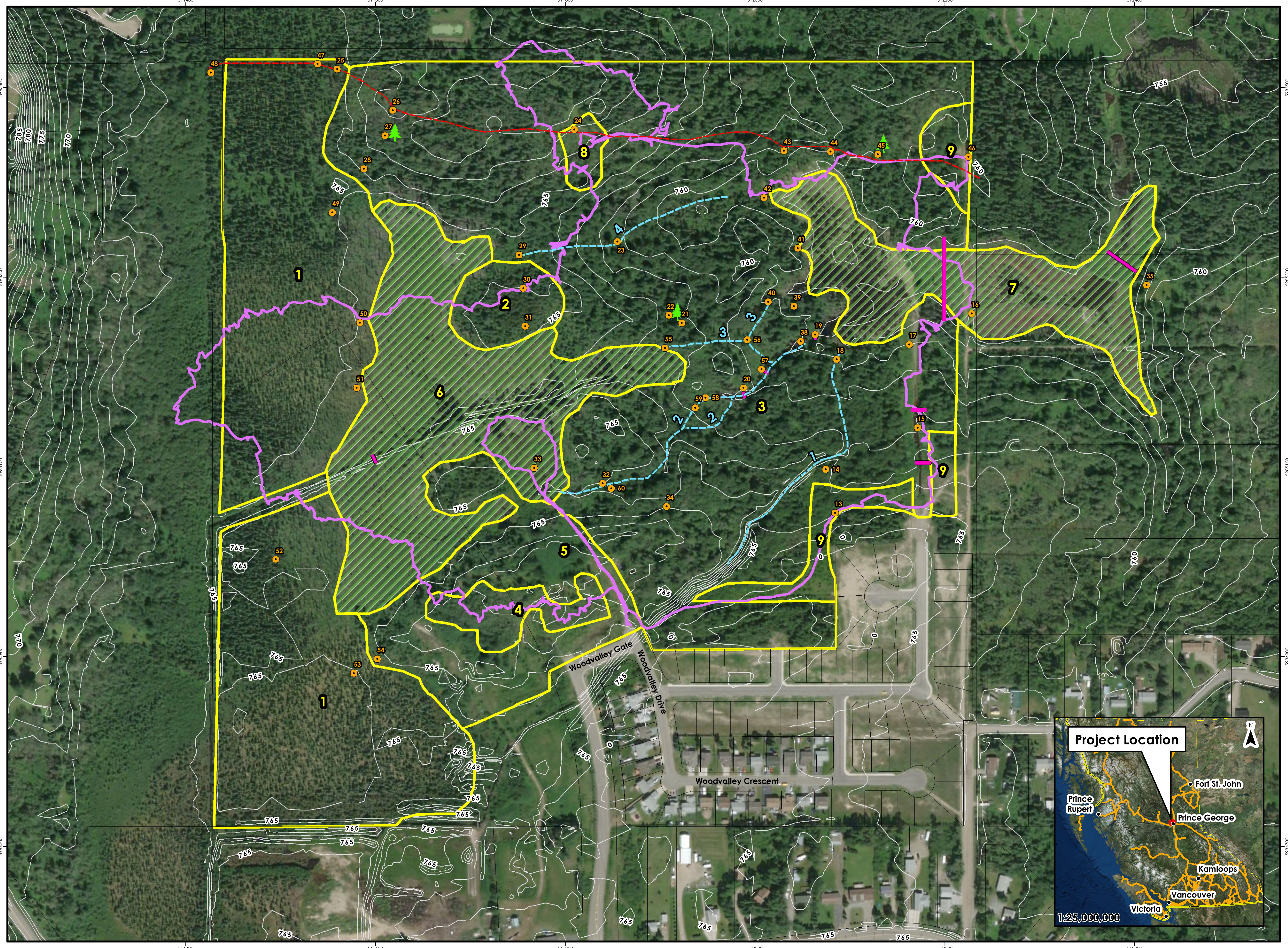
Using updated orthophotos and a site visit (June 19, 2018) to the Project area the wetland polygons (6 and 7) have been re-classified and re-delineated (Figure 1) to the site-series level. Classification to this level is essential to determine the provincial conservation status ranking of the wetlands that have been documented. Two of the wetland polygons (polygons 6 and 7) have been identified as fens (SBSmk1/Wf02 site series; scrub-birch – water sedge fen ecological community), and polygon 1 is classified as a bog (SBSmk1/Wb05; black spruce – water sedge – peat moss ecological community). The fen wetland polygons (6 and 7) have been slightly reduced in size with the Black Spruce bog and adjacent habitat extending into areas with less moisture content then was documented in the 2006 assessment.

3.1.1 Wf02 Scrub birch – Water sedge site series

The Wf02 wetland association is a fen wetland characterized by large peatlands where there is some water table fluctuation and shrubs present on elevated microsites. Soil consists of peat which frequently is found to a depth between 1 and 2 meters. Although the Wf02 is common in the interior it has been listed by the CDC as provincially blue listed, meaning the association is of special concern. The wetland may be considered vulnerable or sensitive with declining land base in the province. Changes to local hydrology resulting from ground disturbance and excavation within the proposed development has the potential to alter the hydrologic regime in these wetland areas, potentially driving them towards different site series/ecological communities. However, the Wf02 is representative of long-term peatland succession (e.g., as peat elevation rises above the local water table and provides habitat for upland plant species to colonize; Mackenzie and Moran 2004), and thus any long-term changes may be difficult to attribute solely to anthropogenic disturbance.

3.1.2 Wb05 Black spruce – Water sedge – Peat-moss site series

The Wb05 wetland association is a bog wetland characterized by small closed basins and large peatlands with small amounts of lateral and groundwater movement. Soils are deep (to 4 m) made up of organic sedge and wood peat. Sites have trees on hummocky areas with common bog species rooting on elevated sphagnum moss mounds (Mackenzie and Moran 2004). The Wb05 wetland association corresponds directly to the SBSmk1/09 upland site series as described in DeLong *et al* (1993). The CDC has the Wb05 wetland association provincially yellow-listed, meaning that this wetland association is not considered to be at risk.



Woodlands Neighbourhood Plan

Figure 1

Environmental Overview Site Assessment

Legend

- GPS Waypoint
- Wildlife Tree
- 2018 Survey
- Contours
- Beaver Dam
- Drainage
- Old Road
- Property Line
- TEM Polygon
- Wetland Area

Sources and Disclaimer

1. Base Data: Provided by Client
2. Basemap Orthophoto Source: ESRI World Imagery
3. Disclaimer: This map is a visual aid only to be used together with the accompanying report, including and incorporating any disclaimer contained therein. This map has been prepared to illustrate the results of our work, and is **not intended to be used for navigational purposes**. Information displayed on this map is based, in whole or in part, on geographic information that may have been provided by third parties, including government data. Triton Environmental Consutants Ltd. disclaims (without limiting the generality of the foregoing) all reponsibility for the accuracy of any such third party information, regardless of the source.

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Date: August 14, 2018 **Project Number:** 10061

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3.2 2018 at-risk species searches

A search for at-risk species identified in Appendix 1 was completed on August 13, 2018. Searches were focussed in areas with the highest potential to support rare plant species, such as riparian areas and wetlands, but all identified polygons were visited (Figure 1). Wildlife sightings and sign were also recorded but given that most wildlife species are mobile and occupy home ranges larger than the proposed development, specific searches for individuals of most species was not carried out. Critical habitat elements (e.g., caves, mineral licks, stick nests, key migration corridors) were searched for in 2006, and were also recorded in 2018 if observed while transiting to specific rare plant investigation sites (Appendix 3). However, the overall assessment of wildlife habitat attributes from Triton (2006) remains valid (see Section 4.0)

No rare or endangered plant species were collected during the survey, though searches were not exhaustive (i.e., the entire project area was not systematically searched), and the area has significant potential to support rare or endangered species, given the high amount of habitat diversity (including shallow open waters, fen and bog wetland types, riparian areas, early to mid-seral deciduous, mixed, and coniferous forest and disturbed areas with recent mineral soil exposure) present. A relatively high number of plant species (150+) were identified during the field visit over the course of several hours (Appendix 3). The upland habitat types are not generally unique or limited within the SBSmk1 BEC subzone, and thus development of these polygons would reduce these habitat types by only a small increment. Wetland ecosystems have a more limited distribution on the landscape, and thus development in these areas would have a greater impact to these habitat types on the local landscape (e.g., within the SBSmk1 BEC subzone).

Several exotic and invasive plant species were identified, which is common near urban areas. Canada thistle (*Cirsium arvense*) was distributed along the southern boundary of the Project area near the existing developments, extending into the upland and wetland polygons along roads and trails. This species is provincially-listed as a noxious weed under the *Weed Control Regulation*, and efforts should be made to control it's spread during development activities. One patch of marsh thistle (*Cirsium palustre*) was identified at the periphery of the beaver pond in polygon 7, at the eastern edge of the proposed development area (UTM coordinate Zone 10U, 512158 E 5985332 N). This species is regionally listed as noxious in the Regional District of Fraser – Fort George under the *Weed Control Regulation* and should also be managed during construction to limit its potential spread further into the wetland areas. The occurrence was reported to the Invasive Plant Program, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development via the reporting page of the BC Inter-ministry Invasive Species Working Group website (BC MFLNRORD 2018).

4.0 Wildlife and Wildlife Habitat Features

Terrestrial wildlife habitats were described in Triton (2006). Wildlife sightings and habitat features were recorded during the August 2018 re-assessment, but specific searches for features such as dens, mineral licks, game trails, and wildlife trees were not conducted (e.g., the search track was selected to intercept as many potential ecological communities as possible with the goal of identifying rare plants, and not on the identification of wildlife habitat features). High-value, stable features such as important mineral licks would likely have been identified in Triton (2006). Transient features such as wildlife trees, nests, and dens are best managed at small temporal scales, closer to actual construction as those identified during the assessment phase may no longer be present or active in the future, and additional features may develop. Significant evidence of wildlife traffic was noted, and several game trails were observed in Polygon 1, connecting upland forest types west of the Project area to the fen wetlands (polygons 6 and 7). Wildlife appear to primarily use existing, anthropogenic trails within all of the other polygons, based on observations of tracks and scat along these trails. Given that wildlife use appears to be widespread and patterns of wildlife movement may change as development occurs in the Project area, provision of movement corridors that connect wetland areas to upland forest types with the greatest potential buffer from development is likely to provide the greatest benefit compared to protection of discrete, existing game trails.

5.0 Permits and Approvals

The Federal Policy on Wetland Conservation, which only applies to wetlands on crown land, advocates for the following events (in this order) during developments potentially involving wetlands: avoidance, minimize, and compensation (Environment Canada 2005). Ultimately, development of this site should incorporate these wetland features into the plans. However, if this is not feasible, it is possible with effort and resources to engineer wetlands and other water storage facilities within the development area. The overall premise being that post-development flows are maintained at pre-development levels and that any negative impacts to habitat are compensated/mitigated.

The definition of a 'stream' under the *Water Sustainability Act* is 'a natural source of water supply' including a wetland. Wetland has been defined to include swamps, marshes, and fen habitats, but does not include bogs. Although the intent of the changes was to protect all wetlands, changes to bog wetlands may not require a 'Change Order' submission under the *Water Sustainability Act,* based on the wetland definition provided.

Works immediately in or within the riparian area (15 m) of a Wf02 wetland, or below the high-water mark of the streams located between the wetlands would require a submission under the *Water Sustainability Act,* as it would be considered works in and about a stream. If works were to take place within the Wf02 polygons, then a 'Change Approval' would be required which would likely include compensation for any lost wetland habitat. For works restricted to the riparian area the project may only require the submission of a notification.

Construction in the Wb05 wetland association (the bog) may be completed without notifying or applying for a Change Approval under the *Water Sustainability Act,* based on the wetland definition in the Act. This may be viewed differently from a government representative perspective. Some risk tolerance would be required as impacts to the adjacent Wf02 are inherently feasible, associated with drainage and construction waste, which would have implications under the *Water Sustainability Act*. To minimize the risk, the development and permitting route should be decided through consultation with a local Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) habitat officer. Soils in the Wb05 may consist of organic and peat for up to approximately 4 meters in depth.

Development of the Wb05 wetland in the southeast (Polygon 1) may be completed with minimal permitting but could have implications for constructability and impacts to the Wf02 wetlands. The Wf02 will need all applicable permits and if construction were to proceed would require substantial erosion and sediment control mitigation measures and possible compensation for the habitat lost.

6.0 Recommendations

Although some legislative changes have occurred since the Triton (2006) report, which include replacement of the provincial *Water Act* with the *Water Sustainability Act*, and major revisions to the federal *Fisheries Act* and *Species at Risk Acts*, the guidelines and recommendations in Triton (2006) remain valid. These recommendations include avoiding developing or altering the wetland areas (polygons 1, 6, and 7), maintaining natural drainage patterns, and creating buffers and leave strips around drainages and wetlands.

Retention and buffering of wildlife trees identified in Figure 1 for long-term development is not recommended, given that wildlife trees are often short-lived (due to advanced decay) and unstable and may pose a hazard to the public. Also, not all wildlife species that utilize wildlife trees are adapted to utilizing areas of human habitation and encouraging wildlife use in an area proposed to be developed may be detrimental. Wildlife trees should be surveyed to ensure that they do not contain active dens/nests before they are removed. It is recommended that wildlife movement corridors be considered in upland areas between the wetlands and forested edges of the proposed developments. Corridors retaining natural tree vegetation will develop wildlife trees if they are allowed to mature and snags are not removed as hazards to the public.

As noted in Section 5.0, the proponent should seek approval under the provincial *Water Sustainability Act* if development is contemplated within the fen wetland types (Polygons 6 and 7) or within or immediately adjacent to the drainages that occur within the Project area. Major near-surface drainage alterations, such as construction of drainage ditches, dikes, or conduits that have the potential to alter the wetland hydrology should also be submitted to the BC MFLNRORDfor consideration under the *Water Sustainability Act*.

Consideration should be given to developing an environmental management plan (EMP) that guides specific construction activities and management of environmental resources once the development plans are available and construction timing is known. The EMP may include (but is not necessarily limited to), guidance on:

- Timing and monitoring requirements for the removal of wildlife trees, if necessary
- Water quality monitoring protocols and thresholds, if surface water quality is anticipated to be affected;
- Spill and waste management plans
- Erosion and sediment control procedures;
- Requirements for wildlife surveys and salvages (e.g., breeding bird/nest surveys, amphibian salvages)

Development of an EMP ahead of advanced development plans and known construction timing is not recommended, as the EMP would be vague, bulky, and potentially provide redundant advice without these details.

7.0 Closing

If there is any question pertaining to the information described in this supplemental assessment, please contact the Project Manager at (w) 250-562-9155 or (c) 250-612-7916.

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Attachments: At-risk species tables

APPENDIX 1

AT RISK ECOSYSTEM AND SPECIES TABLES

Table 1: At-risk ecological communities in the SBSmk1 BEC Zone in the Prince George Forest District [1]

Latin Name	*Common Name*	*BC List*	*BEC Site Series*	*Ecosystem Group(s)*	*Potential to Occur*
Carex lasiocarpa / Drepanocladus aduncus	slender sedge / common hook-moss	Blue	SBSmk1 / Wf05	Wetland – Peatland: Fen Wetland	Moderate
***Carex limosa - Menyanthes trifoliata / Sphagnum* spp.**	**shore sedge - buckbean / peat-mosses**	**Blue**	**SBSmk1 / Wb13**	**Wetland – Peatland: Bog Wetland**	**Moderate**
Pseudotsuga menziesii - Picea engelmannii x glauca / Ptilium crista-castrensis	Douglas-fir - hybrid white spruce / knight's plume	Blue	SBSmk1 / 04	Terrestrial – Forest: Coniferous - dry	Low

Table 2: At-risk plant species in the SBS BEC Zone in the Prince George Forest District

Scientific Name	*Common Name*	*BC List*	*SARA Schedule 1*	*Comment*	*Potential to Occur*
Vascular Plants					
Acorus americanus	**American sweet-flag**	**Red**		**Found in shallow still water areas, such as marshes, swales, and edges of ponds and lakes in the montane zone (Klinkenberg 2018a).**	**Moderate**
Carex sprengelii	**Sprengel's sedge**	**Red**		**Found in moist to wet gravelly or sandy slopes and alluvial woodlands and open sites in the montane zone (Klinkenberg 2018a).**	**Low**
Nymphaea tetragona	pygmy waterlily	Red		Found in lakes, ponds, and slow-moving streams (Klinkenberg 2018a)	Moderate

[1] **Red Bold** indicates species or ecosystems that were not listed, and thus not included at the time the 2006 report was produced.

Scientific Name	Common Name	BC List	SARA Schedule 1	Comment	Potential to Occur
Oxytropis campestris var. davisii	Davis' locoweed	Blue		Found in dry to mesic sandy, gravelly, or rocky sites including grassy slopes, meadows, clearings, and roadsides in the steppe, montane, subalpine, and alpine zones (Klinkenberg 2018a).	Low
Pinus albicaulis	whitebark pine	Blue	Endangered (Jul 2012)	Frequent in southern BC east of the Coast-Cascade Mountains; associated with mesic to dry slopes in subalpine to alpine zones. (Klinkenberg, 2018a).	Low
Pyrola elliptica	shinleaf wintergreen	Blue		Dry to moist forests in the montane zone. Known to occur within 8 km of Prince George (Klinkenberg 2018a).	Moderate
Taraxia breviflora	short-flowered evening-primrose	Red		Found in dry open areas in the montane zones (Klinkenberg 2018a)	Low
Bryophytes *(mosses, liverworts and hornworts)*[2]					
Meesia longiseta		Blue		Calcareous fens or boggy woods, deep swamps and sphagnum bogs (BC CDC 2018). No recorded locations in BC.	Moderate
Myrinia pulvinata		Red		Found in places subject to flooding, on the bases of trees or shrubs, at the edges of ponds or stream valleys (Crum and Anderson, 1981b).	Moderate
Rhodobryum roseum		Blue		Found on shaded humus or soil over rocks, and old logs, humus, or at the base of trees (Crum and Anderson, 1981a).	Moderate
Sphagnum wulfianum		Blue		Found on mounds or ridges associated with rotting stumps or logs in boggy forests (Crum and Anderson, 1981a).	Moderate
Lichen					
Lobaria retigera	smoker's lung	Blue		Found over trees and mossy logs in rather shady coastal and intermontane (ICH zone) old-growth forests at lower elevations (Klinkenberg, 2018a).	Low

[2] No bryophyte or lichen species were listed by the CDC in 2006.

Scientific Name	*Common Name*	*BC List*	*SARA Schedule 1*	*Comment*	*Potential to Occur*
Nephroma isidiosum	**pebbled paw**	**Blue**		**Habitat information not available.**	**Low**
Nephroma occultum	**cryptic paw**	**Blue**	**Special Concern (Dec 2007)**	**Found over conifers in open old-growth maritime and intermontane (ICH zone) forests at lower elevations (Klinkenberg, 2018a).**	**Low**

Table 3: At-risk wildlife species in the SBS BEC Zone in the Prince George Forest District

Scientific Name	**Common Name**	**BC List**	**SARA Schedule 1**	**Habitat Preferences / Comments**	**Potential to Occur**
Amphibian					
Anaxyrus boreas	**Western Toad**	**Yellow**	**Special Concern (Jan 2005)**	**Western Toads can be observed in a variety of aquatic and terrestrial habitats. It breeds in shallow, littoral zones of lakes, temporary and permanent pools and wetlands, bogs and fens, and roadside ditches. Toads utilize riparian areas and lotic habitats with little to no flow. Small, moist depressions may be used for rehydration. Toads utilize a variety of terrestrial habitats in BC, including all forest and woodland types, shrubland/chaparral, savanna, cropland/ hedgerow, grassland/ herbaceous cover, old fields, and suburban/orchard. Hibernacula are located in areas with loose soils and burrows. (BC CDC, 2018; Klinkenberg, 2018b).**	**High**
Birds					
Ardea herodias herodias	Great Blue Heron, *herodias* subspecies	Blue		Frequently uses agricultural fields, grasslands, anthropogenic, lakes, riparian forests, and river habitats (BC CDC, 2018).	Low

Scientific Name	Common Name	BC List	SARA Schedule 1	Habitat Preferences / Comments	Potential to Occur
Asio flammeus	Short-eared Owl	Blue	Special Concern (Jul 2012)	"Identified wildlife" under BC's Identified Wildlife Management Strategy (BC MWLAP 2004); nests in open areas such as fallow fields, dry marshes, and grasslands with ground cover sufficient to cover nests (BC MWLAP 2004). In BC, nests tend to be found in shrubby fields within agricultural areas (BC CDC 2018).	Low
Botaurus lentiginosus	American Bittern	Blue		Habitat preferences include wetlands, lakeshores, and riparian areas, particularly with tall emergent vegetation such as cattail (BC CDC 2018).	Moderate
Buteo platypterus	**Broad-winged Hawk**	**Blue**		**Habitat includes deciduous forest and trembling aspen form an important component (BC CDC 2018)**	**Moderate**
Chordeiles minor	**Common Nighthawk**	**Yellow**	**Threatened (Feb 2010)**	**Found in a variety of habitats including mountains and plains in open and semi-open areas, coniferous forests, grasslands, and near cities/towns. Nesting occurs on bare sites in open areas (BC CDC, 2018).**	**Moderate**
Contopus cooperi	**Olive-sided Flycatcher**	**Blue**	**Threatened (Feb 2010)**	**Widely distributed in North America from Alaska to Newfoundland, and south to the Baja Peninsula. Preferred habitats are reported to be the edges of mature coniferous and mixed forests, especially when adjacent to water and dead standing snags are present (Campbell et al. 1997).**	**Moderate**
Cypseloides niger	**Black Swift**	**Blue**		**Breeds almost exclusively on small ledges or shallow crevices in steep rock faces or canyons, usually behind or near waterfalls. Foraging habitat ranges from forests, towns, lakes, rivers, alpine meadows, and mountain peaks (Campbell et al., 1990b).**	**Moderate**
Dolichonyx oryzivorus	Bobolink	Blue	Threatened (Nov 2017)	Breeding habitat includes tall grass areas, flooded meadows, prairie, deep cultivated grains, and hayfields (BC CDC, 2018). Nests typically located on the ground in hayfields, meadows, and open tall-grass fields (Campbell et al., 2001).	Low

Scientific Name	Common Name	BC List	SARA Schedule 1	Habitat Preferences / Comments	Potential to Occur
Euphagus carolinus	**Rusty Blackbird**	**Blue**	**Special Concern (Mar 2009)**	**Habitat includes moist woodlands (primarily coniferous), bushy bogs and fens, and wooded edges of watercourses and beaver ponds. Nests are in trees or shrubs, usually in or near water, frequently in conifers up to 6 m above ground (BC CDC 2018).**	**Moderate**
Hirundo rustica	**Barn Swallow**	**Blue**	**Threatened (Nov 2017)**	**Swallows can be found in diverse habitats including suburban areas, over water, beaches, wetlands, right-of-ways, fields, and orchards (Campbell et al. 1997). Breeding occurs primarily near human settlements and agricultural areas, where man-made structures are often used. They also utilize cliffs, tree cavities, caves, and other protected areas. They tend not to occur in dense forest or at high elevations (Campbell et al. 1997).**	**Moderate**
Numenius americanus	Long-billed Curlew	Blue	Special Concern (Jan 2005)	Prefers grassland habitat and agricultural fields, nests on flat ground with short grass (BC CDC, 2018).	Low
Pelecanus erythrorhynchos	American White Pelican	Red		Habitats include rivers, lakes, bays, estuaries, open marshes and reservoirs (BC CDC, 2018).	Low
Podiceps nigricollis	**Eared Grebe**	**Blue**		**Habitat includes marshes, ponds, and lakes. During migration and the winter will utilize sat lakes, bays, estuaries and seacoasts (BC CDC 2018).**	**Moderate**
Troglodytes hiemalis	**Winter Wren**	**Blue**		**Prefers mixed and coniferous forest with a closed canopy, dense shrubs, and coarse woody debris.**	**Moderate**
Tympanuchus phasianellus columbianus	**Sharp-tailed Grouse, *columbianus* subspecies**	**Blue**		**Native bunchgrass and shrub-steppe communities are the preferred habitat (BC CDC, 2018).**	**Low**

Scientific Name	Common Name	BC List	SARA Schedule 1	Habitat Preferences / Comments	Potential to Occur
Fish[3]					
Acipenser transmontanus pop. 3	White Sturgeon (Nechako River population)	Red	Endangered (Aug 2006)	Nechako River	Nil
Acipenser transmontanus pop. 5	White Sturgeon (Upper Fraser River population)	Red	Endangered (Aug 2006)	Upper Fraser River	Nil
Acipenser transmontanus pop. 6	White Sturgeon (Middle Fraser River population)	Red	-	Fraser River	Nil
Salvelinus confluentus	Bull Trout	Blue	-	Found at the bottom of deep pools in cold rivers and large tributary streams, often in fast currents with temperatures of 45-50°F; also large coldwater lakes and reservoirs (BC CDC, 2018).	Nil
Mammals					
Gulo gulo luscus	Wolverine, *luscus* subspecies	Blue		Wide ranging species that occupies wide variety of habitat types such as high elevation and remote wilderness areas. This species is generally associated with areas of high prey abundance (Klinkenberg 2018b).	Low
Myotis lucifugus	**Little Brown Myotis**	**Yellow**	**Endangered (Dec 2014)**	**Utilizes a wide range of habitats, including arid grasslands, humid coastal forests, and northern boreal forests; hibernate in caves and abandoned mines; Roosts in man-made structures, tree cavities, rock crevices and under tree bark (Klinkenberg 2018b).**	**Moderate**

[3] Fish species at risk were not identified in Triton 2006, as no fish habitat is present within the Project area.

Scientific Name	Common Name	BC List	SARA Schedule 1	Habitat Preferences / Comments	Potential to Occur
Myotis septentrionalis	**Northern Myotis**	**Blue**	**Endangered (Dec 2014)**	**Generally associated with old-growth forests with trees >100 years old. Forage in forests, along forest edges, over forest clearings and over ponds (BC CDC 2018). Associated with boreal forests (Klinkenberg 2018b).**	**Moderate**
Oreamnos americanus	**Mountain Goat**	**Blue**		**Most frequently occupy alpine and subalpine meadows, and steep forest slopes. They migrate seasonally between high and low elevations (Klinkenberg 2018b).**	**Nil**
Pekania pennanti	Fisher	Blue		Prefer late successional forests and riparian areas. Large-diameter balsam poplar trees are preferred den sites (BC CDC 2018).	Low
Rangifer tarandus pop. 15	Caribou (northern mountain population)	Blue	Threatened/ Special Concern (Jan 2005)	Winter in low elevation forests or windswept alpine ridges. Summer habitats include mountainous terrain (BC CDC 2018). Project area is unlikely to form core part of any home range due to a lack of ideal habitat.	Low
Ursus arctos	Grizzly Bear	Blue		Wide ranging species that occupies wide variety of habitat types (Klinkenberg, 2018b). Unlikely to use project area due to the proximity to anthropogenic activities.	Low
Invertebrates[4]					
Beetles					
Cicindela hirticollis	**Hairy-necked Tiger Beetle**	**Blue**		**Prefers beach habitat next to waterbodies, like the rest of us.**	**Low**
Butterflies and Moths					
Oeneis jutta chermocki	**Jutta Arctic, *chermocki* subspecies**	**Blue**		**Occurs in pine forest clearings, trails, forest edges, and in bogs; larvae feed on sedges and rushes (BC CDC, 2018).**	**Moderate**
Dragonflies and Damselflies					

[4] No invertebrate species were were listed by the CDC in 2006.

Scientific Name	Common Name	BC List	SARA Schedule 1	Habitat Preferences / Comments	Potential to Occur
Somatochlora forcipata	Forcipate Emerald	Blue		Shallow, spring-fed streamlets trickling through subalpine hillside fens, or in small pools associated with flowing groundwater (BC CDC, 2018).	Low
Snails, Mussels and Clams (Freshwater)					
Acroloxus coloradensis	Rocky Mountain Capshell	Blue		Mollusc. In rocky, exposed portions of oligotrophic and mesotrophic lakes; in shallow water on the underside of rocks and vegetation on wave-swept shores (BC CDC, 2018).	Moderate
Galba obrussa	Golden Fossaria	Blue		Snail. This species is found in both perennial lakes and vernal ponds with a mud substrate and macrophytes (BC CDC, 2018).	Low
Galba parva	Pygmy Fossaria	Blue		Snail. Found on wet mud flats, lakeshores and riverbanks; in marshes; among vegetation submerged in shallow water (BC CDC, 2018).	Moderate
Physella propinqua	Rocky Mountain Physa	Blue		Mollusc. Has been found in lakes and rivers (BC CDC, 2018).	Low
Physella virginea	Sunset Physa	Blue		Freshwater snail. Lives in freshwater rivers, streams, lakes, ponds, and swamps, anthropogenic reservoirs, occurring in warm water discharges (BC CDC, 2018).	Moderate
Pisidium fallax	River Peaclam	Blue		Sandy substrate in streams and lakes. Prefers larger waterbodies with wave-action (BC CDC 2018)	Low
Planorbula campestris	Meadow Rams-horn	Blue		Found in vegetated vernal ponds, swamps, and spring time flooded portions of permanent water bodies (BC CDC 2018).	Moderate
Sphaerium striatinum	Striated Fingernailclam	Blue		Live in both lotic and lenthic environments on mud, sand, gravel, and rock substrates (BC CDC 2018).	Low
Valvata tricarinata	Threeridge Valvata	Red		Found in vegetation only in perennial-water habitats including lakes, kettle lakes, rivers, streams, and muskeg ponds (BC CDC 2018).	Moderate

SARA Schedules
SARA schedule 1 is the official list of wildlife species at risk in Canada and includes species that are extirpated (extinct in Canada), endangered, threatened, and of special concern. Once a species is listed on Schedule 1, protection and recovery measures are developed and implemented.

Species that were designated at risk by COSEWIC (the Committee on the Status of Endangered Wildlife in Canada) before the creation of the *Species at Risk Act* must be reassessed according to the new criteria of the Act before they can be added to Schedule 1. These species are listed on Schedules 2 and 3 and are not yet officially protected under SARA.

SARA Listing Categories
Extirpated species: means a wildlife species that no longer exists in the wild in Canada but exists elsewhere in the wild.
Endangered species (E): means a wildlife species that is facing imminent extirpation or extinction.
Threatened species (T): means a wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
Species of special concern (SC): means a wildlife species that may become a threatened or endangered species because of a combination of biological characteristics and identified threats.
NAR (NAR): Assessed by COSEWIC and not found to be at risk.

Provincial Status
Red-listed (BC) = candidates for extirpated, endangered, or threatened status rankings
Blue-listed (BC) = species of special concern
Yellow-listed (BC) = secure

APPENDIX 2

WILDLIFE OBSERVATIONS (AUGUST 13, 2018)

Table 4: Wildlife Observations from August 13, 2018 field survey.

Latin Name	*Common Name*	*BC List*	*Comment*
Alces americanus	Moose	Yellow	Tracks and scat abundant throughout the area, particularly western portions. One animal believed to be a Moose (heard running away but not observed) was startled during the field survey.
Ursus americanus	American Black Bear	Yellow	Tracks and scat present throughout the area. Several wasp nests that had very recently been excavated (wasps still present and agitated) were also noted.
Corvus brachyrhynchos	American Crow	Yellow	Pair observed transiting Project area.
Gallinago delicata	Wilson's Snipe	Yellow	Observed near open water in Polygon 6
Anas platyrhynchos	Mallard	Yellow	Open water in Polygon 7. This area likely provides habitat for other waterfowl species as well
Dryobates villosus	Hairy Woodpecker	Yellow	Observed on trembling aspen snag in Polygon 3. Woodpecker sign abundant in upland areas throughout the project area.
Poecile atricapillus	Black-capped Chickadee	Yellow	Small flock (4-5 individuals) in Polygon 3
Sitta canadensis	Red-breasted Nuthatch	Yellow	Heard calling while in Polygon 4, but suspect bird was in Polygon 3.
Regulus satrapa	Golden-crowned Kinglet	Yellow	Pair observed in coniferous stand in Polygon 3.
Tamiasciurus hudsonicus	Red Squirrel	Yellow	Several individuals observed and abundant sign (middens and cone bract piles) throughout upland areas.
Rana luteiventris	Columbia Spotted Frog	Yellow	Observed in standing water on old access road between Polygon 3 and 9. High potential for other amphibian species (Wood Frog, Western Toad, Long-toed Salamander) to occur as well.
Bombycilla cedrorum	Cedar Waxwing	Yellow	Observed perched on snag near standing water in Polygon 7
Pinicola enucleator	Pine Grosbeak	Yellow	Pair observed perched in polygon 7 and 3.
n/a	dragonflies	n/a	Large number of dragonflies of several species observed at open water habitats in Polygon 7

APPENDIX 3

VEGETATION INVENTORY LIST

Table 5: Wildlife Observations from August 13, 2018 field survey.

Latin Name	Common Name	BC List	Growth Form	Note
Abies lasiocarpa var. *lasiocarpa*	subalpine fir	Yellow	Tree	
Betula papyrifera	paper birch	Yellow	Tree	
Picea engelmannii X glauca	hybrid white spruce	Yellow	Tree	
Picea mariana	black spruce	Yellow	Tree	
Pinus contorta var. *latifolia*	lodgepole pine	Yellow	Tree	
Populus tremuloides	trembling aspen	Yellow	Tree	
Populus trichocarpa	black cottonwood	Yellow	Tree	
Pseudotsuga menziesii var. *glauca*	Rocky Mountain Douglas-fir	Yellow	Tree	uncommon in area
Alnus incana ssp. *tenuifolia*	mountain alder	Yellow	Shrub	
Alnus viridis ssp. *sinuata*	Sitka alder	Yellow	Shrub	
Andromeda polifolia var. *polifolia*	bog-rosemary	Yellow	Shrub	
Betula nana	scrub birch	Yellow	Shrub	
Chimaphila umbellata	prince's-pine	Yellow	Shrub	
Cornus stolonifera	red-osier dogwood	Yellow	Shrub	
Kalmia microphylla var. *occidentalis*	western bog-laurel	Yellow	Shrub	note: poisonous
Linnaea borealis	twinflower	Yellow	Shrub	
Lonicera involucrata var. *involucrata*	black twinberry	Yellow	Shrub	
Oplopanax horridus	devil's club	Yellow	Shrub	uncommon in area
Rhododendron groenlandicum	Labrador-tea	Yellow	Shrub	
Ribes hudsonianum	northern blackcurrant	Yellow	Shrub	
Ribes lacustre	black gooseberry	Yellow	Shrub	
Rosa acicularis ssp. *sayi*	prickly rose	Yellow	Shrub	
Rubus idaeus ssp. *strigosus*	red raspberry	Yellow	Shrub	
Rubus parviflorus	thimbleberry	Yellow	Shrub	
Salix discolor	pussy willow	Yellow	Shrub	
Salix drummondiana	Drummond's willow	Yellow	Shrub	
Salix pedicellaris	bog willow	Yellow	Shrub	
Salix planifolia	plane-leaved willow	Yellow	Shrub	
Salix prolixa	Mackenzie willow	Yellow	Shrub	

Latin Name	Common Name	BC List	Growth Form	Note
Salix scouleriana	Scouler's willow	Yellow	Shrub	
Salix sitchensis	Sitka willow	Yellow	Shrub	
Sambucus racemosa	red elderberry	Yellow	Shrub	
Shepherdia canadensis	soopolallie	Yellow	Shrub	
Sorbus scopulina	western mountain-ash	Yellow	Shrub	
Spiraea douglasii var. *menziesii*	pink spirea	Yellow	Shrub	
Spirea lucida	birch-leaved spirea	Yellow	Shrub	
Vaccinium caespitosum	dwarf blueberry	Yellow	Shrub	
Vaccinium ovalifolium	oval-leaved blueberry	Yellow	Shrub	uncommon
Viburnum edule	highbush-cranberry	Yellow	Shrub	
Achillea millefolium	yarrow	Exotic	Herb	
Actaea rubra	baneberry	Yellow	Herb	note: poisonous
Alisma plantago-aquatica	European water-plantain	Exotic	Herb	Few remaining flowers pinkish, indicating non-native variety.
Anaphalis margaritacea	pearly everlasting	Yellow	Herb	
Angelica genuflexa	kneeling angelica	Yellow	Herb	
Aralia nudicaulis	wild sarsaparilla	Yellow	Herb	
Arnica cordifolia	heart-leaved arnica	Yellow	Herb	
Athyrium filix-femina	lady fern	Yellow	Herb	
Bidens cernua	nodding beggarticks	Yellow	Herb	
Calla palustris	wild calla	Yellow	Herb	dense growth in shallow waters throughout area
Canadanthus modestus	great northern aster	Yellow	Herb	
Castilleja miniata var. *miniata*	scarlet paintbrush	Yellow	Herb	
Chamerion angustifolium	fireweed	Yellow	Herb	
Chenopodium album	common lamb's-quarters	Exotic	Herb	
Cicuta bulbifera	bulbous water-hemlock	Yellow	Herb	note: poisonous
Cirsium arvense	Canada thistle	Exotic	Herb	Provincial Noxious under *Weed Control Regulation*.
Cirsium palustre	marsh thistle	Exotic	Herb	Regional Noxious in Fraser - Fort George Regional District under *Weed Control Regulation*.
Clintonia uniflora	queen's cup	Yellow	Herb	
Comarum palustre	marsh cinquefoil	Yellow	Herb	

Latin Name	Common Name	BC List	Growth Form	Note
Cornus canadensis	bunchberry	Yellow	Herb	
Drosera rotundifolia	round-leaved sundew	Yellow	Herb	
Epilobium ciliatum	purple-leaved willowherb	Yellow	Herb	
Equisetum arvense	common horsetail	Yellow	Herb	
Equisetum fluviatale	swamp horsetail	Yellow	Herb	
Equisetum pratense	meadow horsetail	Yellow	Herb	
Equisetum sylvaticum	wood horsetail	Yellow	Herb	
Euphrasia spp.	eyebright	Exotic	Herb	*Euphrasia nemerosa* based on Flora of British Columbia; but this species not currently recognized by BC CDC.
Eurybia conspicua	showy aster	Yellow	Herb	
Fragaria virginiana	wild strawberry	Yellow	Herb	
Galeopsis tetrahit	hemp-nettle	Exotic	Herb	
Galium boreale	northern bedstraw	Yellow	Herb	
Galium trflorum	sweet-scented bedstraw	Yellow	Herb	
Galium trifidum	small bedstraw	Yellow	Herb	
Gaultheria hispidula	creeping wintergreen	Yellow	Herb	
Geum macrophyllum	large-leaved avens	Yellow	Herb	
Geum rivale	water avens	Yellow	Herb	
Gymnocarpium disjunctum	western oak fern	Yellow	Herb	
Gymnocarpium dryopteris	oak fern	Yellow	Herb	
Heracleum maximum	cow-parsnip	Yellow	Herb	
Hieracium aurantiacum	orange-red king devil	Exotic	Herb	
Leucanthemum vulgare	oxeye daisy	Exotic	Herb	
Lotus corniculatus	birds-foot trefoil	Exotic	Herb	

Latin Name	*Common Name*	*BC List*	*Growth Form*	*Note*
Lupinus polyphyllus var. polyphyllus	large-leaved lupine	Yellow	Herb	* var. *pallidipes* is red-listed, but this variant is not included in regional keys, including Illustrated Flora of British Columbia. As such, the specific variant could not be identified. Var. *polyphyllus* commonly occurs in disturbed habitat, where the few located in the project area were found (on access trail just north of Woodvalley Gate)
Lycopodium annotinum	stiff clubmoss	Yellow	Herb	
Lycopodium clavatum	running clubmoss	Yellow	Herb	
Maianthemum racemosum ssp. *amplexicaule*	false Solomon's seal	Yellow	Herb	
Melilotus albus	white sweet-clover	Exotic	Herb	
Mentha arvensis	field mint	Yellow	Herb	
Monotropa uniflora	indian-pipe	Yellow	Herb	
Orthilia secunda	one-sided wintergreen	Yellow	Herb	
Petasites frigidus var. palmatus	sweet coltsfoot	Yellow	Herb	
Plantago major	common plantain	Exotic	Herb	
Platanthera aquilonis	northern green rein orchid	Yellow	Herb	
Platanthera dilatata	fragrant white rein orchid	Yellow	Herb	
Prunella vulgaris	self-heal	Yellow	Herb	
Pyrola asarifolia	pink wintergreen	Yellow	Herb	
Pyrola chlorantha	green wintergreen	Yellow	Herb	*Pyrola elliptica* is similar and blue-listed, and specimens were no longer in flower. ID was based on leaf blade stalk (long)
Ranunculus acris	meadow buttercup	Exotic	Herb	Provincial Noxious
Rhinanthus minor	yellow rattle	Yellow	Herb	
Rubus chamaemorus	cloudberry	Yellow	Herb	
Rubus pedatus	five-leaved bramble	Yellow	Herb	
Rubus pubescens	dwarf red raspberry	Yellow	Herb	

Latin Name	Common Name	BC List	Growth Form	Note
Rumex crispus	curled dock	Exotic	Herb	
Scirpus microcarpus	small-flowered bulrush	Yellow	Herb	
Scutellaria galericulata	marsh skullcap	Yellow	Herb	
Solidago lepida var. *lepida*	western Canada goldenrod	Yellow	Herb	
Sparganium natans	small bur-reed	Yellow	Herb	
Stellaria calycantha	northern starwort	Yellow	Herb	
Streptopus amplexifolius	clasping twistedstalk	Yellow	Herb	
Streptopus lanceolatus var. *curvipes*	rosy twistedstalk	Yellow	Herb	
Symphyotrichum ciliolatum	Lindley's aster	Yellow	Herb	
Taraxacum officinale	common dandelion	Exotic	Herb	
Tiarella trifoliata var. *unifoliata*	one-leaved foamflower	Yellow	Herb	
Trifolium hybridum	alsike clover	Exotic	Herb	
Trifolium pratense	red clover	Exotic	Herb	
Typha latifolia	common cattail	Yellow	Herb	
Urtica dioica	stinging nettle	Yellow	Herb	
Vaccinium oxycoccus	bog cranberry	Yellow	Herb	
Veronica beccabunga var. *americana*	American speedwell	Yellow	Herb	
Vicia americana	American vetch	Yellow	Herb	
Lemna minor	common duckweed	Yellow	Aquatic	
Persicaria amphibia	water smartweed	Yellow	Aquatic	Deep water and mod-pond areas not sampled for aquatic species.
Calamagrostis canadensis	bluejoint reedgrass	Yellow	Graminoid	
Carex arcta	northern clustered sedge	Yellow	Graminoid	
Carex disperma	soft-leaved sedge	Yellow	Graminoid	
Carex pauciflora	few-flowered sedge	Yellow	Graminoid	
Carex utriculata	beaked sedge	Yellow	Graminoid	
Deschampsia cespitosa	tufted hairgrass	Yellow	Graminoid	
Elymus glaucus	blue wildrye	Yellow	Graminoid	
Eriophorum scheuchzerii ssp. *scheuchzeri*	Scheuchzer's cotton-grass	Yellow	Graminoid	
Glyceria borealis	northern mannagrass	Yellow	Graminoid	
Glyceria elata	tall mannagrass	Yellow	Graminoid	

Latin Name	Common Name	BC List	Growth Form	Note
Hordeum jubatum	foxtail barley	Yellow	Graminoid	
Juncus effusus ssp. *pacificus*	Pacific soft rush	Yellow	Graminoid	
Juncus ensifolius	dagger-leaf rush	Yellow	Graminoid	
Luzula parviflora	small-flowered woodrush	Yellow	Graminoid	
Phalaris arundinacea var. *arundinacea*	reed canarygrass	Exotic	Graminoid	
Phleum pratense ssp. *pratense*	common timothy	Exotic	Graminoid	
Poa palustris	fowl bluegrass	Yellow	Graminoid	
Poa pratensis	Kentucky bluegrass	Exotic	Graminoid	
Hylocomium splendens	step moss	Yellow	Bryophyte	
Pleurozium schreberi	red-stemmed feathermoss	Yellow	Bryophyte	
Polytrichum commune	common haircap moss	Yellow	Bryophyte	
Ptilium crista-castrensis	knight's plume	Yellow	Bryophyte	
Rhytidiadelphus triquetrus	electrified cat's-tail moss	Yellow	Bryophyte	
Sphagnum spp.	sphagnum moss	n/a	Bryophyte	Several species noted. Not suspected to be *Sphagnum wulfianum* (Blue-listed), based on that species preference for relatively dry sites compared with the specimens in the Project area, which were in low-lying bog.
Timmia austriaca	false polytrichum	Yellow	Bryophyte	
Alectoria spp.	witch's hair	n/a	Lichen	
Bryoria spp.	horsehair lichen	n/a	Lichen	
Hypogymnia spp.	bone lichen	n/a	Lichen	
Peltigera aphthosa	silver-edge pelt	Yellow	Lichen	
Peltigera canina	felt pelt	Yellow	Lichen	
Usnea spp.	beard lichen	n/a	Lichen	

APPENDIX C

Woodlands Neighbourhood Plan
L&M Engineering Limited

TRITON ENVIRONMENTAL STREAM ASSESSMENT - 2019

January 9, 2019

Reference: 10061/P-4516

L&M Engineering Ltd.
1210 4th Ave.
Prince George, BC
V2L 3J4

Attn: Ashley Elliott, Jason Boyes

Re: Stream assessment results for Woodlands Neighbourhood

Dear Ms. Elliott and Mr. Boyes

Triton Environmental Consultants Ltd. (Triton) completed stream assessments that were requested by L&M Engineering Ltd. (L&M) within the proposed Woodlands Neighbourhood development on December 19, 2018. Streams within the proposed development were previously identified and classified in an environmental overview report produced by Triton in 2006. The streams were also noted in addendums that were prepared by Triton in June and August 2018, but additional field surveys were not conducted. The June addendum described new resources for identification and classification of wetlands and provided updated classification and delineation of fen wetland types that were previously identified in the Project area. The June addendum also identified that works within streams (which include most wetlands per the definitions in that act) would require approvals under the *Water Sustainability Act* (WSA), which replaced the *Water Act* in 2016. The August addendum spoke to the validity of the 2006 surveys and fish-bearing status of the drainages.

Drainages 1, 3, and 4 were mapped as non-classified drainages (NCD's) in the 2006 report (see updated version of that figure in Attachment 1). NCD status is assigned to streams that do not satisfy the definition of a "stream" provided in the *Fish-stream Identification Guidebook* (BC Ministry of Forests and BC Environment 1998), and therefore do not receive Riparian Management Area classifications. Although RMA classifications were developed under the now-defunct *Forest Practices Code,* the classifications have been widely adopted and continue to be used for management of streams; for example, under the *Forest Planning and Practices Regulation* under the *Forest and Range Practices Act* and the *Environmental Protection and Management Regulation* under the *Oil and Gas Activities Act.* The classifications are typically recognized by federal authorities (such as Fisheries and Oceans Canada) in BC as well.

The definition of a "stream" in the *Fish-stream Identification Guidebook* and the WSA differ; NCDs are sometimes considered streams under the WSA. The WSA also recognizes most wetlands (except for those classified as bog-types) as streams. The assessments completed in December 2018 focussed on determining if drainages 1, 3, and 4 were "streams" under the WSA (Drainage 2 was classified as an S6 and is considered a stream in both the WSA and *Fish-stream Identification Guidebook*).

<u>Drainage 1</u>

Drainage 1 is a ditch approximately 1-2 m deep, with historically excavated spoil sidecast on the south bank (Photo 1). The ditch now originates at Woodvalley Gate, but it appears that it historically extended further southwest through LT A DL 2425 PL PGP37227 and drained a bog along the northern periphery of LT 2 DL 2424 PL 20795. The well-defined ditch flows northeast before entering a deciduous swale, where ditching is no longer evident. Seepage flows and disorganized surface runoff was noted between the swale and fen Polygon 7 (Photo 2).

Evidence that a natural channel existed prior to the creation of this ditch was not found in the field. Historical imagery (2005 images in Google Earth) show that headwater areas were previously much wetter with significant ponding that appears to have since drained (ponds are no longer evident on 2012 imagery), but the connection to these headwater areas was disrupted by the construction of Foothills Blvd. North and Woodvalley Gate. Some water still accumulates in the ditch, but it does not appear to convey drainage from the bog (polygon 1). Thus, it is not interpreted as a "natural watercourse" or "natural source of water supply" per section 1(1) of the WSA. "Natural watercourse" is not defined in the WSA. However, the British Columbia Oil and Gas Commission (OGC), a provincial regulator with duties to regulate under the WSA, provides the following definition in the Oil and Gas Activity Application Manual (BC OGC 2018):

> "common usage indicates that a natural watercourse is a natural channel where water flows over a bed between defined banks. The flow of water does not need to be constant, but the channel must be a permanent and distinct feature on the landscape. The watercourse may also, at some point, spread over a level area without defined banks, before flowing again as a defined channel."

Given that no bed or banks that have been formed through natural waterflow exist within or downstream from the swale area, this lower non-ditched portion of the drainage is also not considered to be a WSA stream. However, Project planning and engineering should consider this existing drainage path and saturated soils in a drainage management plan.

<u>Drainage 3</u>

Drainage 3 was shown to be tributary to drainage 2 in the 2006 report, with a secondary distributary connecting directly to the fen polygon 7. Field surveys in December 2018 show that the main drainage remains north of drainage 2. Although no well-defined channel was observed, frequent sections of surface ponding and old beaver dams (Photo 3) suggest that the drainage is a "natural source of water supply", and it is recommended that it be considered a stream under the WSA. No surface connection between drainage 2 and 3 was observed, and this short section is not considered to be a WSA stream (this section of drainage has been removed from Attachment 1).

Drainage 4

Drainage 4 had some minor surface puddles near its downstream extent near its confluence with fen polygon 7 but lacked surface water overall and had no linear sequence of seepage flows. However, the topography is depressional and the presence of hydrophilic vegetation and saturated soils is suggestive of a swamp-type wetland (Photo 4). Floristically, the swamp is best described by the Drummond's willow – beaked sedge association (Ws04 site series), though Drummond's willow was not noted to be present (Scouler's willow was common) and the landscape position also does not closely match that described for the Ws04 (Mackenzie and Moran 2004). The Mountain alder-pink spirea-Sitka sedge association (Ws02 site series) more closely describes the area, but reportedly occurs in wet SBS subzones (the area falls within a moist SBS subzone). Both types are yellow-listed in BC (apparently secure). The wetland area contains only scattered, shallow surface waters and as such does not provide fish habitat and offers only low-value waterfowl habitat compared to the adjacent open waters in the fen wetlands. As such, permitting under the WSA within the swamp is likely to be less onerous compared to encroachment into adjacent fen wetland areas.

This area was not identified as a separate ecosystem polygon in the 2006 report (but was identified as a drainage). The wetland area has been added as a polygon to Attachment 1 (labelled Ws04). Portions of the drainage that were identified in the 2006 report that occur upslope from the boundary of the swamp were found to have minimal evidence of any significant surface flow and only minor amounts of seepage and is not considered to be a WSA stream. The wetland area would be considered a stream under the WSA. The extent of the wetland area perpendicular to drainage 4 is generally < 30 m, and as such the riparian boundaries, which were recommended to extend 15 m on either side of drainage 4 in the 2006 report (based on guidelines in Chilibeck et al 1993), differ very little.

Regards,
Triton Environmental Consultants Ltd.

Neal Foord, R.P. Bio.
Senior Biologist

References

BC Ministry of Forests and BC Environment. 1998. Fish-stream identification guidebook, second edition version 2.1. Forest Practices Code of British Columbia Guidebook. https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/fish/FishStream.pdf.

BC Oil and Gas Commission. 2018. Oil and gas activity application manual. Version 1.27; December 2018. https://www.bcogc.ca/node/13267/download

Chilibeck, B., Chislett, G., and Norris, G. 1993. Land development guidelines for the protection of aquatic habitat. Department of Fisheries and Oceans and the Ministry of Environment, Lands and Parks, Victoria, BC. http://www.dfo-mpo.gc.ca/Library/165353.pdf

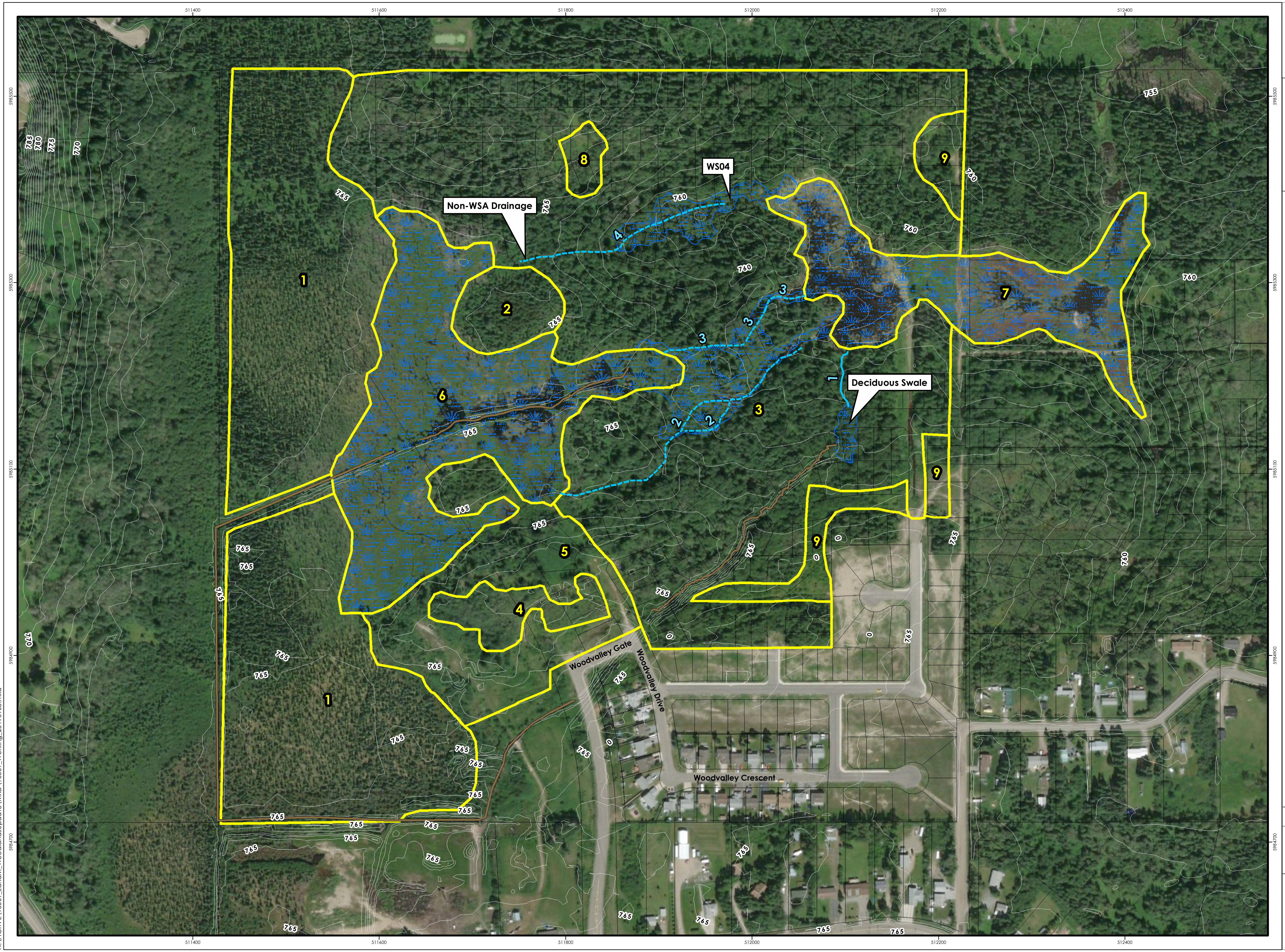
Mackenzie, W.H., and Moran, J.R. 2004 Wetlands of British Columbia: a guide to identification. Resources Branch, BC Ministry of Forests, Victoria, BC. Land Management Handbook No. 52.

Photo 1. Looking west (upstream) along ditched drainage 1. Spoil pile occurs on the south (photo right) bank.

Photo 2. Upstream view of drainage 1 downstream from the deciduous swale where ditching terminates. No defined stream channel occurs in this section.

Photo 3. Downstream view of drainage 3, showing significant ponding above an old beaver dam, but lacking a well-defined stream channel.

Photo 4. Downstream view of drainage 4, where no defined stream channel was noted but wetland characteristics predominate.



Woodlands Neighbourhood Plan

Attachment 1

Environmental Overview Site Assessment

Legend

- Contours
- Ditch
- Drainage (2006)
- Drainage (Re-mapped 2018)
- Property Line
- TEM Polygon

Sources and Disclaimer

1. Base Data: Provided by Client
2. Basemap Orthophoto Source: ESRI World Imagery
3. Disclaimer: This map is a visual aid only to be used together with the accompanying report, including and incorporating any disclaimer contained therein. This map has been prepared to illustrate the results of our work, and is **not intended to be used for navigational purposes**. Information displayed on this map is based, in whole or in part, on geographic information that may have been provided by third parties, including government data. Triton Environmental Consutants Ltd. disclaims (without limiting the generality of the foregoing) all reponsibility for the accuracy of any such third party information, regardless of the source.

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NAD 1983 UTM Zone 10N

Date: January 8, 2019 | **Project Number:** 10061

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Environmental Consultants

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APPENDIX D

Woodlands Neighbourhood Plan
L&M Engineering Limited

TRITON ENVIRONMENTAL RECOMMENDATIONS MEMO - 2019

TRITON
Environmental Consultants

3990 22nd Avenue
Prince George, BC V2N 3A1

P 250.562.9155
F 250.562.9135

MEMORANDUM

TO:	Ashley Elliott, L&M Engineering Ltd.
FROM:	Jen Bond, Triton Environmental Consultants Ltd.
DATE:	19/09/2019
FILE #/NAME:	10061/P4599
RE:	Environmental Recommendation for the Woodlands Development

Triton Environmental Consultants Ltd. (Triton) has been retained by L&M Engineering Ltd. (L&M) to provide general environmental recommendations in response to the City of Prince George's (the City) review of the first draft of the Woodlands Neighbourhood Plan developed by L&M (2019). Additional environmental information can be found in the following reports provided by Triton:

- Woodlands Neighbourhood Environmental Overview Report (2006)
- Woodlands Environmental Overview Assessment Update Report (2018)
- Stream Assessment for Woodlands Neighbourhood (2019)

The proposed development is approximately 20 hectares (ha) in size and includes single residential lots, road infrastructure, existing wetlands, and park/community spaces, and is located north of the intersection of Foothills Boulevard and Woodvalley Gate.

Environmental recommendations and additional details surrounding the Woodlands Neighbourhood Plan will include potential regulatory requirements, riparian setback recommendations, general stormwater management, beaver management, and proposed road works.

Site Conditions

Topography

The Woodlands Development area is fairly flat with elevations only ranging from 758 m to 768 m (PGMap 2019). Gentle slopes varying from 1 to 6% are found throughout most of the catchment area. Steeper slopes up to 20% are found in the northernmost section of the Woodlands Development area. Three small areas are designated as significant slopes within the Official Community Plan (City of Prince George 2019); one is located approximately 130 m north of the intersection of Foothills Boulevard and Woodvalley Gate, and the other two are along the eastern property boundary.

Terrestrial Resources

The area is located within the Mossvale variant, moist cool subzone of the Sub-boreal Spruce biogeoclimatic ecosystem classification zone (SBSmk1). Given the presence of large wetland features and riparian areas, a variety of vegetation exists. Overall, the drier areas are comprised of lodgepole pine (*Pinus contorta* var. *latifolia*) and trembling aspen (*Populus tremuloides*) forest. Late seral and early climax stands have more hybrid white spruce (*Picea engelmannii x glauca*) and scattered subalpine fir (*Abies lasiocarpa*). Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca*) appears on drier, warmer aspects. Black spruce (*Picea mariana*) occurs in wetland areas, while black cottonwood (*Populus trichocarpa*) occurs within riparian areas. Shrub species include prickly rose (*Rosa acicularis*), thimbleberry (*Rubus parviflorus*), highbush cranberry (*Viburnum edule*), and black twinberry *(Lonicera involucrate*: DeLong et al 1993). Additional details describing the terrestrial resources found within the development area can be found in the Triton reports from 2006 and 2018.

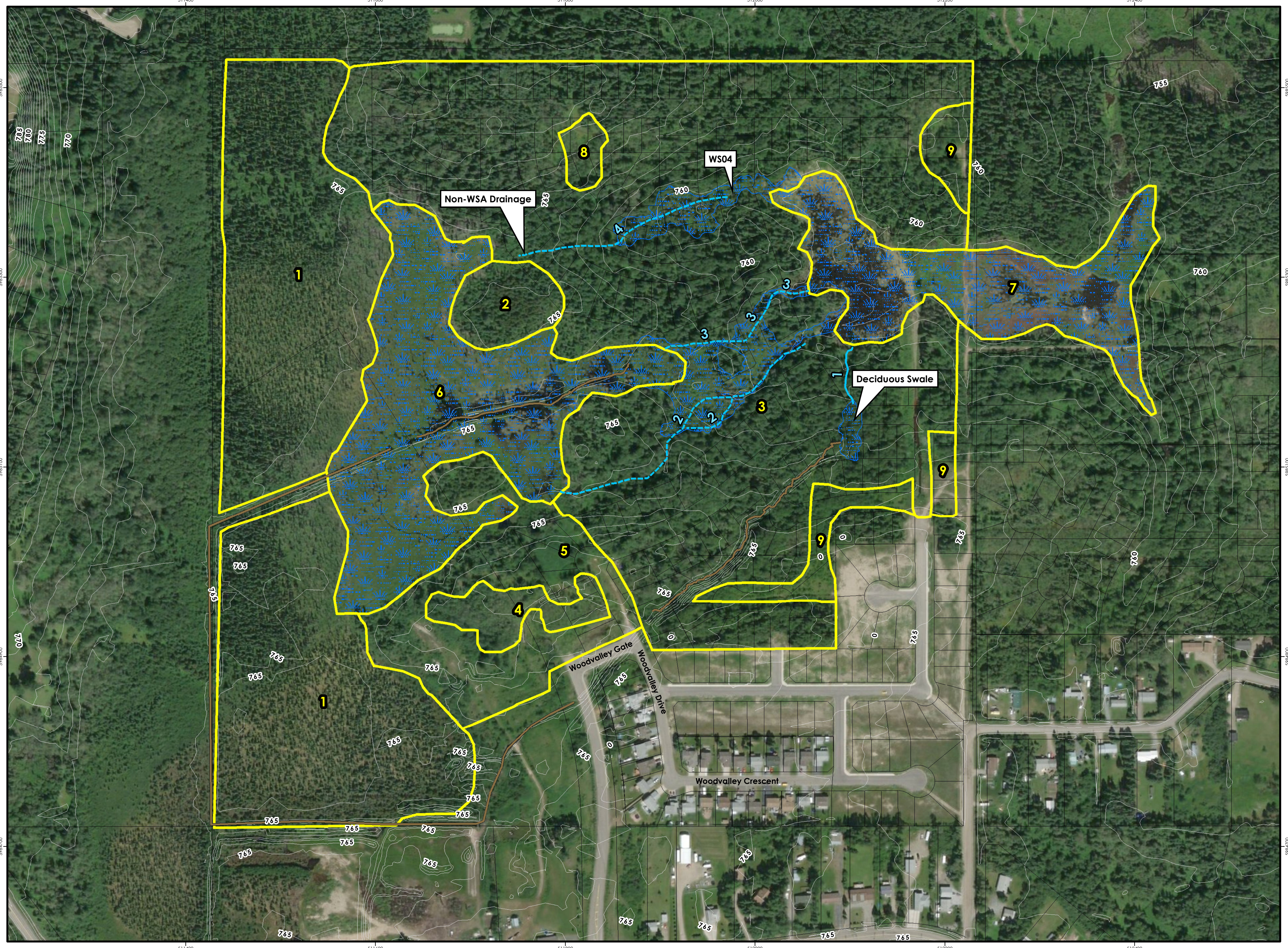
Aquatic Resources

Based on the results of the assessments completed by Triton in 2006, 2018 and 2019, four drainages have been identified within the development area and are listed below and shown Figure 1. Details on the assessed drainages can be found in the Triton reports completed in 2006, 2018, and 2019.

- Drainage 1 – Ditch, not a stream as defined by the *Water Sustainability Act* (WSA)
- Drainage 2 – WSA stream
- Drainage 3 – WSA stream
- Drainage 4 – Wetland portion is a WSA Stream, western portion of the drainage is not WSA stream

Wetlands

Based on the assessment conducted by Triton in 2018 and 2019, four wetland polygons have been classified within the proposed development area. Two of the wetlands have been identified as fens (Wf02), one classified as a bog (Wb05), and one as a swamp (Ws04). A detailed description of these wetlands can be found in the 2018 report completed by Triton.



Woodlands Neighbourhood Plan

Figure 1. Woodlands Neighbourhood Drainages and Wetlands

Legend

- Contours
- Ditch
- Drainage (2006)
- Drainage (Re-mapped 2018)
- Property Line
- TEM Polygon

Sources and Disclaimer

1. Base Data: Provided by Client
2. Basemap Orthophoto Source: ESRI World Imagery
3. Disclaimer: This map is a visual aid only to be used together with the accompanying report, including and incorporating any disclaimer contained therein. This map has been prepared to illustrate the results of our work, and is **not intended to be used for navigational purposes**. Information displayed on this map is based, in whole or in part, on geographic information that may have been provided by third parties, including government data. Triton Environmental Consutants Ltd. disclaims (without limiting the generality of the foregoing) all reponsibility for the accuracy of any such third party information, regardless of the source.

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Date: January 8, 2019 **Project Number:** 10061

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TRITON Environmental Consultants

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Regulatory Requirements

Section 11 of the *Water Sustainability Act* (WSA) requires anyone performing work "in and about a stream" to do so under an Approval or Notification, where required. The definition of a 'stream' under the WSA is 'a natural source of water supply' including a wetland. Wetland has been further defined to include swamps, marshes, and fen habitats, but does not include bogs.

Works immediately in or within the riparian area (15 m) of a Wf02 or Ws04 wetland, or below the high-water mark of the streams located between the wetlands, would require a submission under the WSA, as it would be considered works in and about a stream. If works were to occur within the Wf02 polygons, a 'Change Approval' would be required.

Construction in the Wb05 wetland association (the bog) may be completed without notifying or applying for a Change Approval under the WSA, based on the wetland definition in the Act. However, this may be viewed differently from a government representative perspective. Some risk tolerance would be required as impacts to the adjacent Wf02 are inherently feasible, associated with drainage and construction waste, which would have implications under the WSA. To minimize the risk, the development and permitting route should be decided through consultation with a local Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) habitat officer. Soils in the Wb05 may consist of organic and peat for up to approximately 4 meters in depth (Mackenzie and Moran 2004).

As no fish-bearing streams are present in the development area, an authorization under sections 34.4(2)(b) or 35(2)(b) of the *Fisheries Act* is not anticipated to be necessary, and no application to the Department of Fisheries and Oceans Canada is recommended.

Both the federal *Migratory Bird Convention Act* and provincial *Wildlife Act* prohibit activities that could affect breeding birds including disturbance of birds, nests, or eggs. If possible, any required vegetation clearing or brushing should be scheduled outside of the breeding bird season (April 25 to August 5; ECCC 2019); however, if vegetation clearing occurs during the bird breeding season, pre-clearing bird nest surveys conducted by a Qualified Environmental Professional (QEP) are recommended to ensure no actively breeding birds are present within the proposed clearing area.

Some areas of the Project area (e.g., drainages, wetlands and low-lying areas) are likely to provide habitat for amphibians. A *Wildlife Act* Permit should be acquired prior to construction to allow for the salvage and relocation of amphibians. The amphibian salvage permit would cover the entire project footprint to allow for salvages to be conducted as needed.

Riparian Setback Recommendations

The primary goal of riparian setback areas is to protect the riparian zone, which is critical to the maintenance of a healthy aquatic environment.

A minimum leave strip of 15 m is recommended for the wetlands and streams within the proposed neighbourhood development (Chilibeck 1993). Ensuring these setback areas remain free of disturbance after construction can be achieved by a number of methods, such as designating the areas as greenspace and/or parks, managing access to the areas by designing trails or other access points, and limiting access by installing fencing around sensitive features.

General recommendations and Best Management Practices for wetland habitats can be found within documents such as:

- Land Development Guidelines for the Protection of Aquatic Habitats (Chilibeck 1993);
- Standards and best practices for instream works (Ministry of Water, Land and Air Protection 2004);
- Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia (Wetland Stewardship Partnership 2009); and
- Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC MFLNRO 2014).

Specific recommendations can be addressed in an Environmental Management Plan (EMP) once a final design for the neighbourhood has been developed.

Stormwater Management

Due to the connectivity of the wetlands and associated drainages within the development to the McMillan Creek watershed, effective erosion and sediment control is required throughout construction activities to maintain water quality and to protect fish habitat downstream. The Department of Fisheries and Oceans Canada (DFO) and the Ministry of Environment and Climate Change Strategy (MOECCS) require that post-development runoff volumes are equal to the pre-development flows for a 2-year flood event (DFO 1993).

Stormwater runoff from developments often contains contaminants such as suspended solids, toxic metals, hydrocarbons, bacteria, and trace elements. Based on the construction approach, the primary concern is sediment-laden water entering natural watercourses. Recommended water quality guidelines for the maintenance of aquatic life state that:

> *Water leaving a site should contain less than 25 mg/l of suspended solids above the background levels during normal weather conditions and no more than 75 mg/l over background after design storm event (DFO 1993).*

The City of Prince George also requires that any runoff entering the storm system must be less than 500 parts per million (ppm, equivalent to mg/L) of total suspended solids as per the Storm Sewer System Bylaw (City of PG 2017).

As per L&M's Servicing Brief (2019), they are proposing to service all lots by gravity. To do this, additional headwall outlets that discharge into the wetlands will need to be installed. The conceptual catchment plan provided by L&M (Drawing 1631-01 CP) illustrates three additional headwall outlets discharging into the Wf02 on the east side of the development. Control measures for the headwall outlets (e.g. riprap energy dissipater, settling pool, vegetated swale, etc.) should be located to work with the natural topography and designed/engineered to avoid disturbance within the riparian setback zone of the wetlands. The primary objective of these measures is to develop settling systems that preserve the natural, vegetated condition of the downstream swale. The presence of rooted vegetation assists in the filtering of turbid water and encourages settling. Typical features, such as containment ponds and check dams, would require ground disturbance and the use of heavy machinery, resulting in conditions that are less favourable.

General recommendations regarding sediment controls for the headwall outlets and the flow path towards the wetlands include, but are not limited to:

- Prior to stormwater daylighting at the headwall outlets, a cistern-manhole (sump) should be in place to aide in capturing sediment.
- Scour protection/energy dissipating rock pad can be constructed to prevent outlet discharge from creating additional suspended solids. Sizing of the pad should be engineered based on the expected amount of discharge volume for each outlet.
- Construct settling ponds/water detention areas at each outlet location to slow water velocities and encourage deposition. Sizing of the settling areas should be engineered based on the expected amount of discharge volume for each outlet.
- Retain as much natural vegetation around the outfall locations as possible.
- Construct a drainage path from the outfall settling pond with passive features such as channel spanning large-woody debris (LWD), rock spurs, coir or erosion control matting rolls secured with live-stakes or willow wattles; these features should be designed and installed to increase the length of the water flow path, slow water velocities, encourage sediment deposition, and increase natural filtration/absorption of water.
- Within the drainage path and along the banks, plant native species that thrive in wetter environments such as Red-Osier Dogwood (*Cornus sericea*), Willow (*Salix spp*.), Cattail (*Typha latifolia*), and sedges (*Carex* spp.) that grow densely and can aide in slowing and absorbing water and encouraging sediment deposition.

Once a Stormwater Management Plan (SWP) is established based on the engineered specifications for the housing development (e.g. final outfall locations, culvert sizing, settling pond capacity and locations etc.), an environmental review of the SWP can be completed to provide more detailed recommendations and assist with identifying appropriate control features.

Regarding Drainage 1 (ditch), depending on the final design of the housing development the drainage could be incorporated into the SWP to assist with evacuating water from the development, towards the wetlands during rain events (e.g. stormwater headwall outlet to the deciduous swale which leads to Drainage 1; this would utilize natural vegetation to slow and absorb water, and encourage sediment deposition). If the drainage is within a development area that will be disturbed it may require in-filling and stabilization to reduce the potential for backwatering from the wetland during high-water events (e.g. freshet).

The stormwater modelling analysis separated the Woodland Development area into two catchments areas to determine approximate flows that could potentially be generated by the development. The two catchments are located on either side of the wetlands and are labelled as Catchment Area 4 and Catchment Area 5 on the catchment plan. Catchment Area 4 is 6.3 ha and is located on the south side of the wetlands. During a 10-year rainfall event, Catchment 4 generates a storm water run-off of 0.392 m^3/s. Catchment Area 5 is 13.8 ha and is located on the north side of the wetlands. During a 10-year rainfall event, Catchment 5 generates a storm water run-off of 0.865 m^3/s.

As per DFO and MOECCS requirements, a pre-development 2-year flood event run-off volume calculation should be completed. Post-development run-off volumes within the drainages should be equal to the pre-development 2-year flood event volume.

Once a detailed design and construction approach is available, an EMP, including a site-specific erosion and sediment control plan (ESCP), will be developed.

Beaver Management

Beavers prefer low gradient streams and ponds with dammable outlets that are surrounded by abundant deciduous tree and shrub communities (BC CDC 2019). Given the low gradient wetland and riparian areas within, and adjacent to, the proposed developments, there is moderate to high potential for beavers and beaver dams to affect the Woodlands Development area and drainage network.

Management strategies that could be implemented to limit the effect beavers will have on the development may include the following:

- Culvert Protection – It is recommended that all culverts constructed within the development that convey seasonal flows (e.g., convey flows for periods exceeding a few days following precipitation) be designed to include deterrents to prevent beavers from blocking the culverts. Several products are available and include types of fencing, gates, and other enclosures.

- Tree Protection – Fencing or metal sleeves can be placed around the trunks of individual trees to prevent beavers from damaging them. This is only effective on very small stands of trees or individual trees that warrant protection (eg., ornamentals or tall, large diameter trees that may damage infrastructure if felled).
- Dam Removal – Removal of a beaver dam may become necessary to protect roads or properties from flooding. As per Section 9 of the *Wildlife Act*, it is an offence to disturb, molest, or destroy a beaver or muskrat house, den, or dam. As such, a General Wildlife Permit from the MFLNRORD is required prior to dam removal. A Section 11 under the WSA would also be required as removal activities would be occurring in or about a stream, and activities would be required to adhere to instream work timing windows and other guidelines as stated in each permit. The work would also need to be monitored by a QEP. There is the potential that removing beaver dams may alter the water levels within the wetlands.
- Beaver Removal – Trapping and relocating or destroying beavers is generally viewed as a least-preferred option. Long-term success is variable; there is moderate risk that recolonization would happen quickly given the high-quality habitat and historic use, though recolonization may be deterred once residential development is completed and the landscape is urbanized, removing some of their preferred habitat elements such as the upland supply of deciduous shrubs and small trees) Should trapping be employed, it must be conducted by a registered trapper.

Road Development

Potential impacts from road development could include wetland loss, habitat fragmentation, changes to hydrology, sedimentation, and water quality.

The drawings provided by L&M in the Servicing Brief (2019) illustrate that two watercourse crossings will be required for the Neighbourhood Plan. General recommendations and best practices that should be considered during the design phase should, at a minimum, include the following:

- Maintain drainage patterns and ensure crossings have sufficient hydraulic capacity to convey stream flows without impounding flows.
- Reduce the number of stream crossings to the minimum practical.
- Discourage the use of impermeable surfaces during development and attempt to maintain natural flow regimes of the drainages, surface runoff, and groundwater.
- Ensure a minimum 15 m buffer is maintained around the wetlands and drainages.
- Minimize the length and steepness of slopes where possible.
- Create vegetated swales where possible to help filter pollutants from stormwater runoff.
- If possible, provide safe routes for wildlife crossings between the two wetlands.

Recommendations

An environmental management plan (EMP) that guides specific construction activities and management of environmental resources is recommended once the final development plans are available and construction timing is known. The EMP may include (but is not necessarily limited to) guidance on:

- Timing and monitoring requirements for the removal of wildlife trees, if necessary;
- Water quality monitoring protocols and thresholds, if surface water quality is anticipated to be affected;
- Spill and waste management plans;
- Erosion and sediment control procedures; and
- Requirements for wildlife surveys and salvages (e.g., breeding bird/nest surveys, amphibian salvages).

Closure

Triton has prepared this document for L&M Engineering Ltd. as part of the Woodlands Neighbourhood Plan. This document was reviewed by Trisha Merriman (RPBio, CPESC, PMP) and Neal Ford (RPBio), and was found to be consistent with Triton's internal quality assurance standards. Should you require any further information, or have any questions or comments, please do not hesitate to contact the undersigned.

Yours truly,

Triton Environmental Consultants Ltd.

Jen Bond, B.Sc.
Project Manager/Biologist

Reviewed by: Trisha Merriman, R.P.Bio., CPESC, PMP

COLLEGE OF APPLIED BIOLOGY
Trisha Merriman
R.P. Bio #1191
Oct. 3, 2019
CAB

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APPENDIX E

Woodlands Neighbourhood Plan
L&M Engineering Limited

GEONORTH ENGINEERING GEOTECHNICAL OVERVIEW ASSESSMENT - 2006

GEOTECHNICAL REPORT

GEOTECHNICAL OVERVIEW, PROPOSED WOODLANDS SUBDIVISION NEIGHBOURHOOD PLAN, PRINCE GEORGE, B.C.

Prepared for

GENESIS DEVELOPMENT CORP.
C/O L&M ENGINEERING LIMITED

Prepared by

GEONORTH ENGINEERING LTD.

1301 KELLIHER ROAD, PRINCE GEORGE, B.C., V2L 5S8

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PROJECT No. K-2020B

SEPTEMBER 18, 2006

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APPENDICES

1.0 INTRODUCTION

On behalf of Genesis Development Corp. L&M Engineering Limited is preparing a Neighbourhood Plan for a future phase of the Woodlands Subdivision, located in the northwest area of Prince George, B.C. The proposed development is located north of Chief Lake Road and east of Foothills Boulevard, within Prince George city limits. L&M, on behalf of Genesis, commissioned GeoNorth Engineering Ltd. to carry out a geotechnical overview assessment of the development. Our assessment follows the format of our proposal to L&M dated March 15, 2006. The location of the site is shown on Drawing 2020B-A1, in Appendix A.

The total area of the proposed development is 33.5 hectares. There are several beaver dams, swampy areas and watercourses through the area. The overview geotechnical study includes:

1. A review of aerial photos of the proposed subdivision area.
2. A field reconnaissance and discussion of potential physical constraints to residential development.
3. A discussion of probable soil types.
4. Determination of whether it is geotechnically feasible to fill in the swampy areas and construct residential houses over them.

The proposed development area is bordered by a proposed extension to Foothills Boulevard on the west, by Phases I, II, IIA and IIB of the existing and proposed Woodlands Subdivision on the south and by undeveloped property on the north and east. A plan showing the proposed development area is on Drawing 2020B-A2 in Appendix A. The legal description of the property is PID 015036855, D.L. 2425, REM SW4, Cariboo District. The site is presently undeveloped and partially covered with trees, grassy areas and standing water. Past logging activities have left several rough trails across the site.

GeoNorth Engineering Ltd. recently carried out a geotechnical investigation for Phases II, IIA and IIB of the Woodlands Subdivision, on behalf of Genesis Development Corp. (see our File No. K-2020). We used surface and subsurface information gathered from that investigation as part of our assessment.

2.0 METHODS

We commissioned Dr. J.M. Ryder, P.Geo., of J.M. Ryder & Associates, Terrain Analysis Inc. (JMRA) to review aerial photographs and carry out an overview terrain assessment. Dr. J.M. Ryder examined the following aerial photos:

Year	Flight Line	Photo Numbers
2005	30BCC05089	38-41
1996	15BCB96007	134-136
1985	BC85041	159-162
1977	BC7706	93-96
1963	BC5069	148-151, 190-193

Dr. Ryder outlined areas with similar genesis (geomorphology), slope and drainage characteristics on an aerial photo from 1985. These photos show site topography most clearly and are at a relatively large scale. A scanned copy of the mapped aerial photo is shown on Drawing 2020B-A2 in Appendix A. Features visible from photos from other years are incorporated on the mapped 1985 photo. To provide context for the aerial photo interpretation, Dr. Ryder reviewed geology reports and maps by Geological Survey of Canada.

A copy of Dr. Ryder's report is on Plates 2020B-B1 to B4, in Appendix B. A legend describing the symbols used in the aerial photo mapping is on Plates 2020B-B5 to B6, also in Appendix B.

On July 26 and 27, 2006, personnel from our office visited the site to carry out an overview field reconnaissance. We walked over the proposed development area, noted vegetation types, measured slopes, observed soil and moisture conditions in shallow, hand-dug test pits and natural exposures, and checked for previous disturbance. Notes summarizing field observations are on Plates 2020B-C1 and C3, in Appendix C. Photos taken during the field reconnaissance are on Plate 2020B-C4, also in Appendix C. The locations that correspond to each of the field note sites are shown on Drawing 2020B-A2.

3.0 GEOLOGICAL BACKGROUND

Background to the geology of the area is provided by Geological Survey of Canada in Bulletin 196, Glacial Geomorphology and Pleistocene History of Central British, 1971, and with the accompanying Map 1288A, Surficial Geology, Prince George. This map shows that the proposed development area is within an area underlain by deposits from Glacial Lake Prince George. Slightly higher elevation areas to the north are underlain by glacial till, which is typically a mixture of sand, gravel and cobbles in a silt or clay matrix, deposited by glacial ice.

At the end of the last glacial period, about 10,000 years ago, Glacial Lake Prince George developed due to the presence of unmelted glacial ice and glacial debris that blocked the present Fraser River channel. The lake existed for several hundred years and resulted in deposits of fine grained sand, silt and clay across the areas covered by the glacial lake. In the area of the proposed development, these glaciolacustrine sediments were deposited over the glacial till. This stratigraphy of fine grained silt and sand from the glacial lake over silt till was encountered in our test pits for Phases II, IIA and IIB.

The dam that contained the lake was eventually breached and the lake drained, likely catastrophically, with the resulting runoff eroding the accumulated glacial lake sediments. The erosion from this event is prominent along the river channels in Prince George, but did not affect the area of the proposed development.

4.0 AERIAL PHOTO STUDY RESULTS AND SURFACE CONDITIONS

The topography is typically flat to gently sloping towards the southeast. From the contours on the site plan provided by L&M and from our field reconnaissance, it appears that there are no slopes greater than about 10% on the site.

The most prominent feature from the aerial photo review and the field reconnaissance is the extent of surface water on the proposed development area. The ponds and standing water are primarily the result of several beaver dams, although logging roads on the east side of the site have also blocked natural drainage paths. Natural stream channels have also been altered by ditching. Low lying areas are unable to drain because of the low permeability of the subsoil. Beaver dams are first noted on 1985 photos, after the area had been logged. The 1996 and 2005 aerial photos show a progressive increase in the number of beaver dams and in the area of flooding.

Dr. Ryder notes that because the time the beaver dams have affected the area is short, it is unlikely that substantial thicknesses of organic material have accumulated on the areas covered by water.

During the field assessment, we outlined the approximate boundaries of the larger areas using hand-held GPS equipment. These areas are shown on Drawing 2020B-A2. There are several smaller ponds and wet areas too numerous to show on the drawing. The weather during and before our field assessment was warm and sunny, and rain was not a factor for our assessment. Ponds of standing water made traversing the area difficult. South and east of Field Check Site (FCS) 13, cutting northeast to southwest, is an old drainage ditch that has been cut off by the construction of Woodvalley Gate leading into the Woodlands Subdivision Phase I, and contains standing water. There are piles of strippings in this area, likely from the ditching. There is another manmade ditch along the east boundary of the site, east of FCS 11, that was constructed as temporary drainage channel for Phase I of the subdivision. This has been blocked with several beaver dams. Many areas with standing water have standing dead and dying spruce trees. There are several derelict automobiles near FCS 7.

5.0 OBSERVED AND ANTICIPATED SUBSURFACE CONDITIONS

As outlined in the report by JMRA and following from the geological history outlined above, we expect the proposed development area is underlain by silt, sand and clay glaciolacustrine deposits, over sandy, gravelly silt till. This stratigraphy was encountered during the geotechnical investigation for Phase II of the subdivision. Several test pits excavated for Phase II encountered subsurface seepage. Dr. Ryder notes that based on anticipated subsurface soil conditions and existing surface water conditions, subsurface seepage might be encountered throughout the proposed subdivision area, but particularly in the northwest part of the proposed development area.

Our hand dug test pits mostly encountered very stiff to hard silt layered with sand, or hard silt till. Four hand-dug test pits in the northwest corner of the property encountered at least 0.4 m of soft, wet organic soil.

6.0 DISCUSSION

Based on the aerial photo study, our field reconnaissance and the 2006 test pits for Phase II of the subdivision, the proposed development area is likely underlain by very stiff to hard glaciolacustrine silt and fine-grained sand, and glacially derived till. The glaciolacustrine deposits can be soft and easily disturbed where they are wet, while till and dry, overconsolidated glaciolacustrine deposits typically have relatively high shear strength. The soil will typically provide adequate support for lightly loaded structures, such as residential housing, and is suitable for road subgrades. Both soil types have and low to moderate permeability. The subsurface soil has poor drainage, and grade changes to the site will be required to prevent standing water and flooding by snow melt or rain. Silt and sand is also highly erodible requiring road cuts and ditches to be treated to control erosion and sedimentation.

The most significant geotechnical constraint to development is the amount of surface water at the site and the existing poor surface drainage. In addition to drainage by ditches, the site might have to be substantially raised to provide positive drainage for residential areas and roads. We believe that it is geotechnically feasible to fill in swampy areas for residential construction. In areas where the grade will be raised for roads or buildings, we recommend that all existing fill, organic materials and soft, wet or deleterious soil be removed before structural fill is placed. We recommend the beavers be removed well in advance of any construction, to prevent flooding and wet ground conditions. Due to the flat nature of the site, any damming of drainage paths can cause extensive areas to become flooded.

The aerial photo study suggests that part or all of the development area might have a high groundwater table or perched groundwater. High water tables can make installation of buried service utilities difficult.

The glaciolacustrine silt and sand and the silt till are moderately to highly frost susceptible. Foundations for buildings will likely require protection against frost heave, and below grade foundations will likely need perimeter drainage systems. There appears to be a low possibility for onsite subsurface disposal of storm water.

7.0 CONCLUSIONS

This report presents the results of a review of aerial photos and a field reconnaissance, and provides an overview of geological conditions across the proposed development area. Geotechnical conditions are favourable for development as a residential subdivision, with soil stratigraphy likely to consist of silt and sand over silt or clay till.

Some constraints exist, and we recommend these be investigated prior to design and construction of the proposed residential development. The potential constraints include the following:

1. The potential for flooding from beaver dams or from streams and artificial drainage channels that cross the site. These might be managed by removing the beavers and destroying the dams. In addition, low-lying areas will likely have to be filled to provide protection from seasonal high water. In areas of new construction, we recommend removing existing fill and organic, wet soft or disturbed soil and replacing it with compacted, structural fill. Structural fill is defined as mineral soil with a specified gradation, placed in uniform layers and compacted to a specified density.
2. The depth of organic material to be removed below areas of proposed roads or houses is not known. Areas that have been previous disturbed by logging practices, as well as areas of derelict cars and debris, will require remediation and, in areas of new construction, replacement with compacted, structural fill.
3. The depth to and seasonal variability of local groundwater levels is not known.

This report was prepared by GeoNorth Engineering Ltd. for the use of Genesis Development Corp. and their consultants. The material in it reflects GeoNorth Engineering's judgement in light of the information available to us at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such Third Parties. GeoNorth Engineering Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

Please call the writers if any parts of this report need to be clarified.

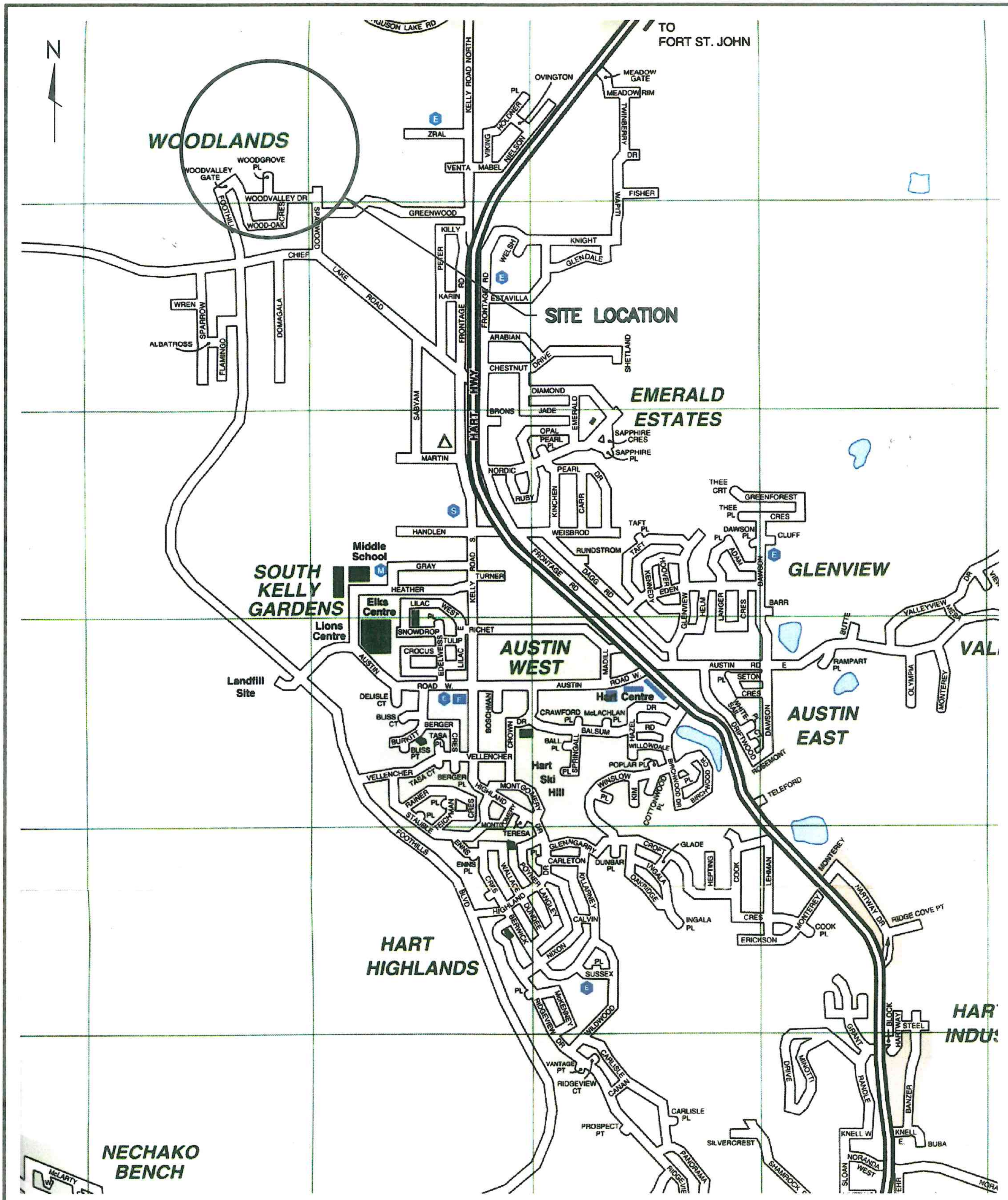
Respectfully submitted,
GeoNorth Engineering Ltd.

Per: S.M. Judge, P.Eng.

Reviewed by,
GeoNorth Engineering Ltd.

Per: D.J. McDougall, M.Eng., P.Eng.

APPENDIX A



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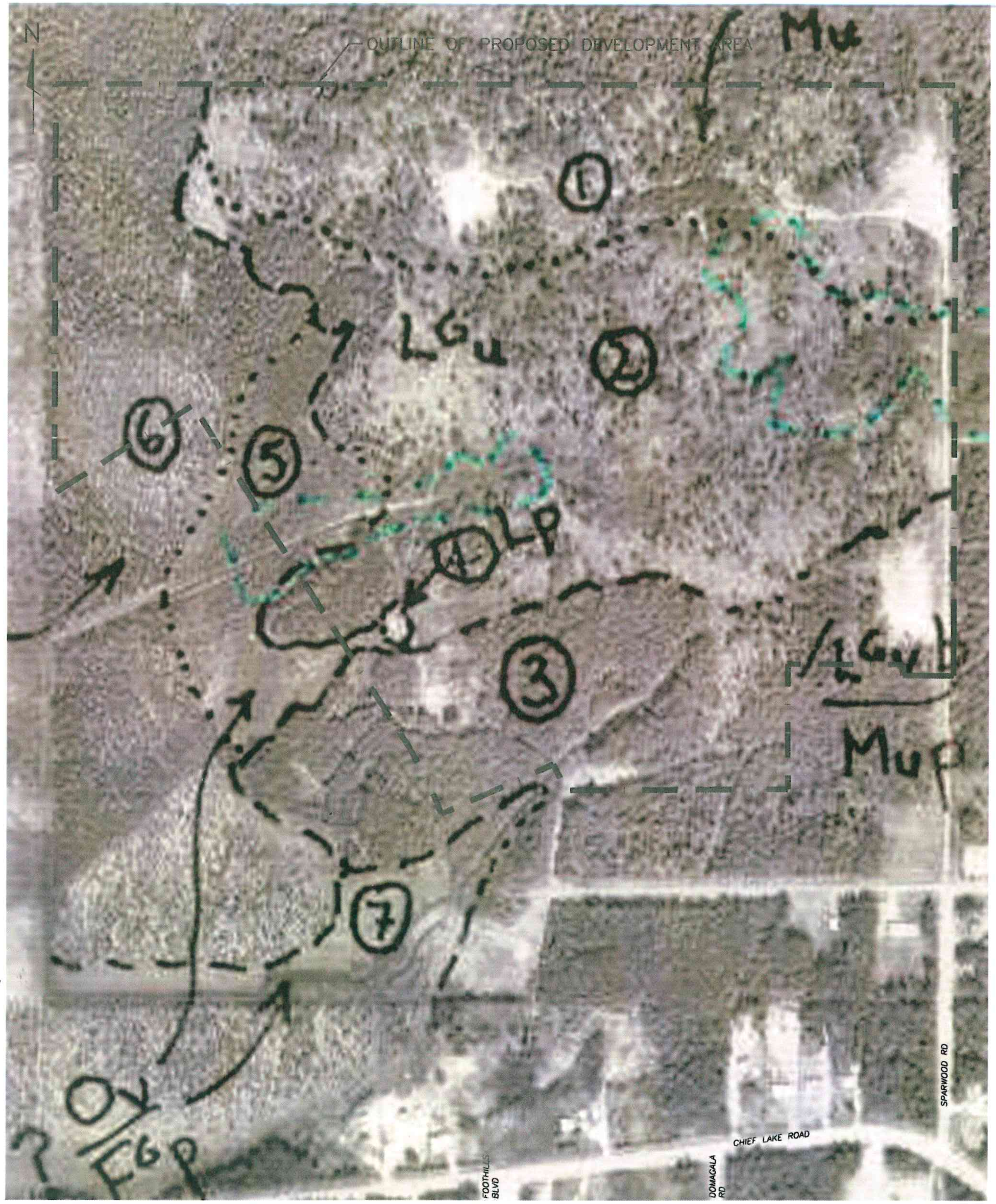
GENESIS DEVELOPMENT CORP.
c/o L&M ENGINEERING LIMITED
GEOTECHNICAL OVERVIEW
PROPOSED WOODLANDS SUBDIVISION – NEIGHBOURHOOD PLAN
PRINCE GEORGE, B.C.
SITE LOCATION PLAN

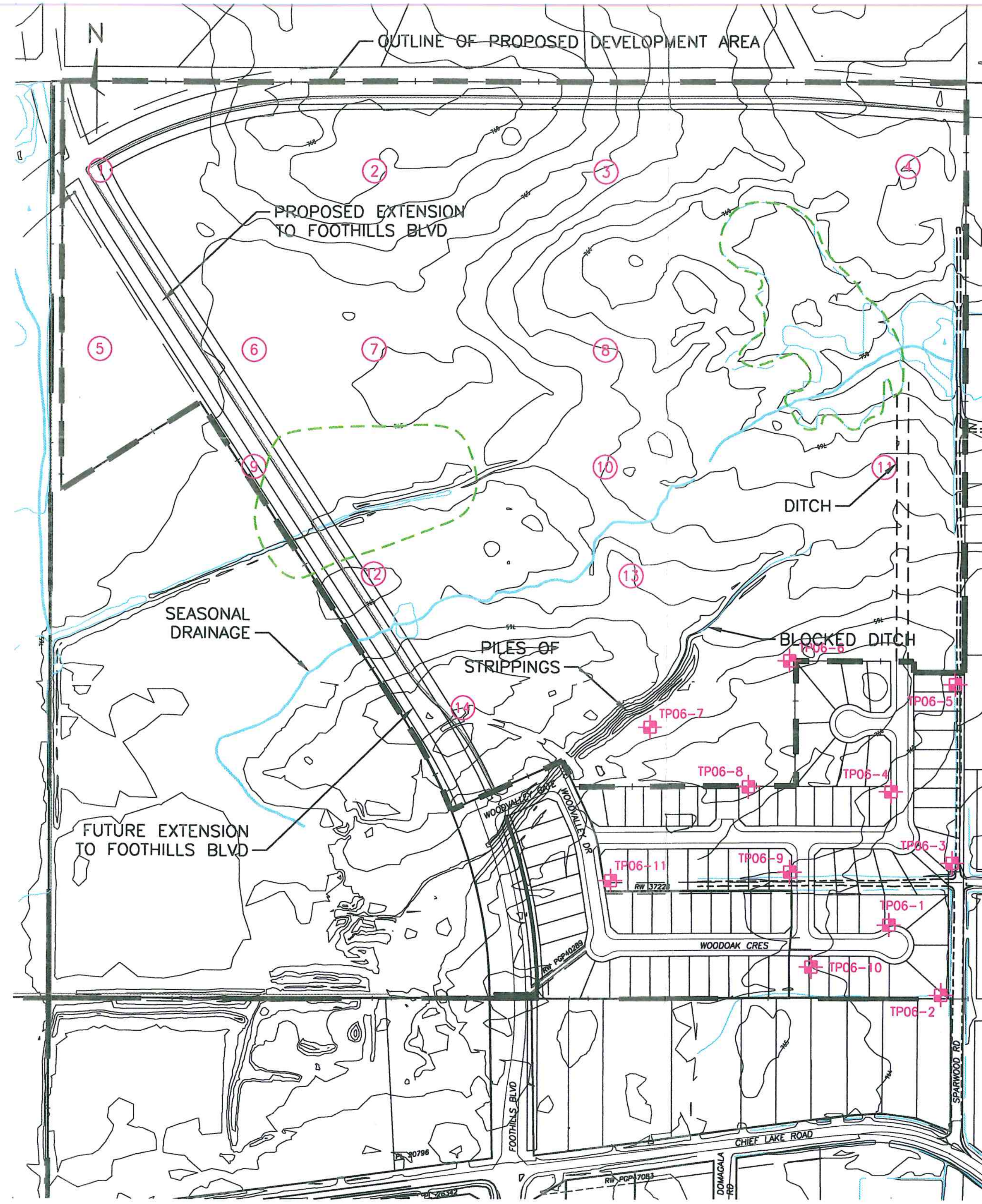
SCALE: ~1:25,000	DATE: 2006/09/18	DRAWN: LU	CHKD: –	PROJ: K-2020B	DWG: 2020B-A1



AERIAL PHOTO

NOTES:

1. AERIAL PHOTO FROM 1985, AND HAS NOT BEEN CORRECTED FOR PHOTOGRAPHIC DISTORTION.
2. TERRAIN UNITS MAPPED BY J.M. RYDER AND ASSOCIATES, TERRAIN ANALYSIS INC., AS DESCRIBED IN APPENDIX D.
3. GREEN DASHED LINE REPRESENTS ESTIMATED EDGE OF STANDING WATER FROM 2004 AIRPHOTOS, BY J.M. RYDER.



CONTOUR MAP

NOTES:

1. SITE PLAN BASED ON DIGITAL INFORMATION PROVIDED BY L&M ENGINEERING LIMITED.
2. (1) REPRESENTS APPROXIMATE LOCATIONS OF HAND DUG TEST PITS, DESCRIBED ON PLATES 2020-B1 TO B3, IN APPENDIX B.
3. TP06-1 REPRESENTS TEST PITS EXCAVATED MAY 17, 2006 FOR PHASE II INVESTIGATION (SEE GEONORTH ENGINEERING LTD. REPORT, FILE No. K-2020, DATED AUGUST 25, 2006)
4. GREEN DASHED LINE REPRESENTS EDGE OF STANDING WATER ESTIMATED FROM FIELD RECONNAISANCE, JULY 26-27, 2006.

SCALE:	1:5000
DATE:	2006/09/18
DWN BY:	LU
MAP REF:	-
DWG NO.	2020B-A2
REV.	-
PROJECT NO:	K-2020B
APPROVED:	

GENESIS DEVELOPMENT CORP.
c/o L&M ENGINEERING LIMITED
GEOTECHNICAL OVERVIEW
PROPOSED WOODLANDS SUBDIVISION - NEIGHBOURHOOD PLAN
PRINCE GEORGE, B.C.
SITE PLAN

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APPENDIX B

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Sue Judge, P.Eng.
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May 30, 2006
Our ref: GeoN 06-2
Your ref: K-2020

Woodlands Neighbourhood Plan

Air photos examined/mapped:

BC5069: 148-151, 190-193; 1963.
BC7706: 93-96; 1977
BC85041: 159-162; 1985; mapping on 161; 1985
15BCB96007: 134-136; 1996
30BCC05098: 38-41; 2005

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L and M Engineering, Prince George: maps of proposed development.

General

Tipper's maps show that the Woodland Subdivision is located within the area that was covered by Glacial Lake Prince George, close to the shoreline of a former island. (Tippr's shoreline is close to the 2500 ft contour (i.e., ~762 m.) This suggests that local relatively-low-lying areas are probably underlain by glacial lake sediments (resting on till) which become thinner upslope. Nearby higher areas may have been above the level of the main lake and if so, are probably underlain by till (or thin glacial lake sediments resting on till.) Leaming and Armstrong's mapping shows extensive sandy glacial lake sediments about 2 km south of the subdivision (at the northern boundary of their map), and these could well extend into the subdivision area.

Notes re. Air Photo Interpretation and Mapping

The subdivision and the surrounding area were examined under the stereoscope on air photos from 5 dates (see above). Then mapping was completed on the 1985 photos because they show topograpby most clearly and their scale is relatively large; features identified on photos of other dates were incorporated into this mapping. (Specific features mapped on photos of other dates are noted below.) For mapping purposes, the area of interest (AOI) was generalized to correspond with the ¼ x ¼ -mile unit clearly visible on most of the air photos (delimited in red).

Air photo interpretation was difficult in this area of low relief where visual criteria are ineffective in distinguishing gentle slopes underlain by glacial lake sediments (draped over till) from similar topography underlain by till. The mapping therefore has been based on a combination of visible relief and the likely distribution of surficial materials suggested by the area's location below, but close to, the shoreline of Glacial Lake Prince George (as noted above). It is very likely that sandy glacial lake sediments are extensive in this area however, the actual distribution of soils could be more complex and unrelated to topography.

1963 photos

- streams hard to see.
- no beaver dams or related flooding visible.
- some slope-breaks visible (mapped with black lines on photo 150).
- possible glacial outwash plain (FGp) in W and SW parts of AOI (red square) but outside subdivision area; probably relatively poor drainage here.

1977 photos

- no beaver dams or related flooding visible.
- some slope-breaks (i.e., terrain boundaries) visible (black lines on photo 96).
- some small lakes visible (not recognized on other photos) -- solid blue.
- streams – blue lines.

1985 photos

- partial logging since 1977
- topography seen more clearly here than on any other photos.
- the main stream has been dammed by beavers (since 1977) just east of the AOI; related inundation is backed up to eastern boundary of AOI; (N/S road is acting as a dam).
- stream channels have been artifically straightened (ditched) to promote drainage of the western
- area (the possible Ov/FGp terrain polygon).

1996 photos

- small scale.
- topography hard to see
- no new features identified.

2005 photos

- topography not clearly visible.
- since 1996, beaver-flooding has extended into the AOI; many more beaver dams than in 1996.
- on photo 38, beaver dams are marked by red lines and lodges by red circles; limit of beaver-relate inundation (flooding and "swamp") is indicated approximately by dotted blue line..

Terrain mapping (see 1985 air photos)

Photo 162: drainage lines are shown in blue (dotted where tentative – streams are very small and hard to see. The limit of beaver-related inundation (flooding and "swamp") is indicated approximately by green lines (from 2005 photos).

Photo 161: terrain mapping (black lines) with terrain symbols and limit of beaver-related inundation (green).

Terrain and soil information, drainage and constraints are summarized in Table 1 (following). This information represents the best interpretations that can be done with available information and application of general geomorphological principles. I have assumed that the glacial lake sediments are sand and silt, and that some higher areas were not covered by the glacial lake, as described above. The terms used to describe drainage indicate only the *relative* soil drainage conditions in the various polygons.

Constraints

The most significant constraint to development appears to be inundation – standing water and "swamp" as a result of damming of small streams by beavers. Comparison of the extent of flooding on various photos suggests that beavers have moved into the general area since 1977, but the AOI has been affected only since 1996 – less than 10 years. The most effective solution to this constraint would be removal of the beavers and their dams[1], and re-establishment of natural drainage lines. It is unlikely that organic material has accumulated in these areas due to the short time period for which wetlands have existed. If beaver dams were removed, soil drainage in the low-lying areas of polygon 2 would still be poorer than on adjacent higher ground: raising of the ground level by fill may be required to avoid temporary flooding due to high watertable during heavy rains or snowmelt.

Air photo interpretation suggests that relatively wet ground may be encountered in the NW part of the area (N part of polygons 6 and 5). Subsurface seepage could be encountered in polygons 5 and 6.

Potential erosion of silt and fine sand by water running across bare ground presents a minor constraint to development. Runoff and sediment movement (siltation) should be anticipated and controlled during road building and construction.

A review of experience with similar developments in adjacent areas at the same elevation a.s.l. with regard to potential problems could be useful if no test pits are to be investigated in the AOI.

Best regards

PROFESSIONAL J. M. RYDER OF BRITISH COLUMBIA GEOSCIENTIST

J.M.Ryder P.Geo

[1] But I'm not familiar with the local/provincial regulations that govern this type of wildlife control.

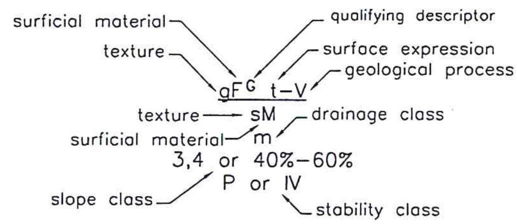
Table 1: Terrain, Soil Characteristics and Constraints

Poly #	*Terrain Symbol*	*Slope; Topography*	*Soil Type*	*Drainage*[1]	*Constraints*
1	/LGw over Mu	gentle; undulating	discont. sandy or silty glacial lake sediments of variable thickness over till; till at surface in higher areas	well-drained	LG
2	LGu	very gentle to flat	thicker glacial lake sediments, sand and/or silt	moderate	LG partly flooded due to beaver dams
3	/LGvb over Mup	gentle; undulating	discont. sandy or silty glacial lake sediments over till; till may be at surface in higher areas	well-mod.	LG
4	Lp	small lake or infilled lake	sand or silt	ephemeral lake	ephemeral lake
5	Ov over FGp?	flat	thin organic layer over outwash sediments, probably sandy. (but may be LGp)	poor	partly flooded due to beaver dams; drainage
6	FGp?	flat or very gentle slope	may be outwash sand; (but could be LGp)	mod-poor	drainage
7	Ov over FGp?	flat	thin organic layer over outwash sed., probably sandy. (but may be LGp)	poor	drainage

1. All drainage terms are relative to each other (not standard pedological definitions).

EXPLANATION OF TERRAIN UNIT SYMBOLS USED IN TERRAIN STABILITY ASSESSMENTS

TERRAIN UNIT SYMBOLS



Explanatory Note:

Two letters may be used to describe any characteristic other than surficial material. Letters or symbols may be omitted if information is lacking.

COMPOSITE UNITS

Two or three groups of letters are used to indicate that two or three types of terrain are present within a map unit:

Cv . Rs indicates "Cv" and "Rs" are of roughly equal extent.
Cv/Rs indicates that "Cv" is more extensive than "Rs" (about 2:1 or 3:2).
Cv//Rs indicates that "Cv" is much more extensive than "Rs" (about 3:1 or 4:1).

STRATIGRAPHIC UNITS

Groups of letters are arranged one above the other where one or more kinds of surficial materials overlie a different material or bedrock.

$\frac{\text{Mv}}{\text{Rr}}$ indicates "Mv" overlies "Rr". $\frac{\text{/Mv}}{\text{Rr}}$ indicates "Rr" is partially buried by "Mv".

SURFICIAL MATERIALS

A	anthropogenic	L	lacustrine
C	colluvium	L^G	glaciolacustrine
D	weathered bedrock	M	moraine (glacial till)
E	eolian	O	organic
F	fluvial	R	bedrock
F^A	"Active" fluvial	U	undifferentiated
F^G	glaciofluvial	W	marine
I	ice	W^G	glaciomarine

TEXTURE

a	angular blocks	g	gravel	s	sand
b	rounded boulders	r	angular rubble	z	silt
d	mixed fragments (g,b,r,a,)	k	cobbles	c	clay
p	pebbles	x	angular fragments	m	mud (silt and clay)

SURFACE EXPRESSION

Simple (unidirectional) Slopes

j	gentle slope(s) 8–27%
a	moderate slope(s) 28–49%
k	moderately steep slope(s) 50–70%
s	steep slope(s) >70%

Complex Slopes

m	rolling
u	undulating
h	hummocky
r	ridged

Material Thickness

b	blanket (greater than 1m)
v	veneer (less than 1m)
w	variable thickness

Shape

c	cone (slope greater than 26%)
f	fan (slope less than 26%)
l	lobe
p	plain
t	terrace
d	depression

EXPLANATION OF TERRAIN UNIT SYMBOLS USED IN TERRAIN STABILITY ASSESSMENTS

GEOLOGICAL PROCESSES

A	snow avalanching
A^0	avalanches: old tracks
A^1	avalanches: major tracks
A^2	avalanches: minor tracks
B	braiding
C	cryoturbation
D	deflation
E	channelling by glacial meltwater
EV	gullying by glacial meltwater
F	slow mass movement
F''	slow mass movement (inititation zone)
Fc	soil creep
Fj	lateral spread in surficial materials
Fe	earthflow
Fg	rock creep
Fp	lateral spread in bedrock
Fu	slump in surficial materials
Fx	slump–earthflow
H	kettled
I	irregular sinuous channel
J	anastomosing channel
K	karst processes
L	seepage
M	meandering channel
N	nivation
P	piping
R	rapid mass movement
R''	rapid mass movement (initiation zone)
Rb	rock fall
Rd	debis flow
Rf	debris fall
Rr	rockslide
Rs	debris slide
Rt	debris torrent
S	solifluction
U	innundated
V	gully erosion
W	washing
X	permafrost processes
Y	catastrophic flood
Z	periglacial processes

SLOPE DRAINAGE CLASSES

r	rapidly drained
w	well drained
m	moderately well drained
i	imperfectly drained
p	poorly drained
v	very poorly drained

SLOPE STEEPNESS CLASSES

Class	1	2	3	4	5
Degrees	0–3	4–15	16–26	27–35	Over 35
%	0–5	6–27	28–49	50–70	Over 70

TERRAIN STABILITY CLASSES

RECONNAISSANCE CLASSES		DETAILED CLASSES	
		I	No stability problems expected.
		II	No significant stability problems expected.
(Not Marked)	Stable. There is negligible to low likelihood of landslides following timber harvesting or road–building.	III	Minor problems of instability might develop in some areas; treat wet areas with caution.
P	Potentially Unstable. There is moderate likelihood of landslides following timber harvesting or road construction.	IV	Marginally stable ground due to steep slopes, high moisture or weak soil. Special precautions neccesary.
U	Unstable. There is a high likelihood of landslides following timber harvesting or road construction.	V	Areas containing natural landslide scars. Very steep, poorly drained, deeply gullied or weak soil deposits.

ON–SITE SYMBOLS AND BOUNDARY LINES

Ice flow direction indicators:
- crag and tail
- drumlins
- striations
- grooves
- lineations

Scarps: escarpments, bluffs

Location of Ground Traverse and Field–Check Site —⑮—

Terrain Unit Boundary Lines:
- definite boundary
- indefinite, appoximate or gradational boundary
- assumed or arbitrary boundary

Mass Movement and Erosion Features:
- scar of recent small slide
- scar of recent larger slide
- scar of old landslide or
- recent debris flow or ⓓ

Cirque

Glacial meltwater channels (small, large)

Eskers (known, unknown)

GeoNorth Engineering Ltd.

PLATE 2020B–B6

APPENDIX C

FIELD TRAVERSE NOTES - July 26 and 27, 2006

LOCATION	DESCRIPTION
1	• Site: Northwest corner of property. • Slope: Flat. • Soil conditions: Organic material to at least 0.4 m depth. • Vegetation: Spruce, azalea, grass • Drainage: Poorly drained.
2	• Site: Near north edge of property. • Slope: Gently towards the south. • Soil conditions: Silt, trace sand, trace gravel, occasional cobble, no visible structure, very stiff, low plasticity, grey, damp (Till-Like). • Vegetation: Juvenile mixed stand, thick underbrush. • Drainage: Imperfectly drained.
3	• Site: Near north edge of property. • Slope: Gentle towards the south east. • Soil conditions: Silt, some sand, trace gravel, structureless, stiff to very stiff, low plasticity, brown, damp (Till-Like). • Vegetation: Mixed juvenile stand. • Drainage: Imperfectly drained.
4	• Site: Northeast corner of property. • Slope: Flat. • Soil conditions: Silt, no visible structure, very stiff, low plasticity, brown damp (glaciolacustrine) • Vegetation: Mixed open stand. • Drainage: Imperfectly drained.
5	• Site: West edge of property. • Slope: Flat. • Soil conditions: Organic material to at least 0.4 m depth • Vegetation: Spruce trees, azalea, grass. • Drainage: Imperfectly to poorly drained.
6	• Site: West side of inundated area. • Slope: Flat. • Soil conditions: Organic material to at least 0.4 m depth. • Vegetation: Dead spruce trees. • Drainage: Poorly drained, areas of standing water.

PLATE 2020B-C1

LOCATION	DESCRIPTION
7	• Site: Centre of property, eastern edge of inundated area. • Slope: Flat, gentle towards the west. • Soil conditions: Silt, trace sand, some gravel, structureless, very stiff, low plasticity, moist, grey (Till). • Vegetation: Juvenile mixed stand to east, many dead trees, grassy, swampy to west. • Drainage: Poorly drained. • Comments: Derilict automobiles nearby.
8	• Site: Centre of property • Slope: Flat to gentle towards the south • Soil conditions: Silt, trace gravel, no visible structure, stiff, low plasticity, brown, damp (glaciolacustrine with drop stones). • Vegetation: Juvenile mixed stand, dense underbrush. • Drainage: Imperfectly drained, some areas of standing water.
9	• Site: West portion of property, old beaver dams to east, beaver pond to west. • Slope: Flat. • Soil conditions: Groundwater at surface, penetration with shovel indicates loose organic material to at least 0.4 m. • Vegetation: Dead spruce. • Drainage: Poorly drained, standing water at surface.
10	• Site: Centre of property. • Slope: Flat, gentle towards the north. • Soil conditions: Silt, trace sand and gravel, occasional cobble, no visible structure, stiff to very stiff, low plasticity, grey - mottled, moist (Till-Like) • Vegetation: Juvenile stand, dense underbrush. • Drainage: Imperfectly drained.
11	• Site: West side of drainage ditch • Slope: Landscape slopes gently to north. • Soil conditions: Layers of silt some sand, compact, brown, moist, and clayey silt, stiff, grey - mottled, moist. Layer thickness > 0.3 m. • Vegetation: Thistle, grass, bushes. • Drainage: Imperfectly drained

LOCATION	DESCRIPTION
12	• Site: West side of property, inundated areas to north and east. • Slope: Flat. • Soil conditions: Silt, some gravel, no visible structure, stiff, low plasticity, brown, damp (glaciolacustrine with drop stones). • Vegetation: Bushes and grass. • Drainage: Poorly drained.
13	• Site: Centre of property. • Slope: Flat, gentle towards the north. • Soil conditions: Silt, some sand, no visible structure, stiff, low plasticity, brown, damp (glaciolacustrine) • Vegetation: Juvenile mixed stand. • Drainage: Imperfectly drained.
14	• Site: Flat area, possibly re-worked. • Slope: Flat. • Soil conditions: Silt, trace sand, some gravel, no visible structure, very stiff, low plasticity, brown, damp (Till-Like) • Vegetation: Grassy. • Drainage: Imperfectly drained.


FIELD CHECK SITE 1


FIELD CHECK SITE 11


FIELD CHECK SITE 12


FIELD CHECK SITE 13


FIELD CHECK SITE 5


NEAR FIELD CHECK SITE 7

GENESIS DEVELOPMENT CORP.
c/o L&M ENGINEERING LIMITED
GEOTECHNICAL OVERVIEW
PROPOSED WOODLANDS SUBDIVISION – NEIGHBOURHOOD PLAN
PRINCE GEORGE, B.C.
SITE PHOTOGRAPHS TAKEN JULY 26 & 27, 2006
FILE NO. K-2020B PLATE No. 2020B-C4

GEONORTH ENGINEERING LTD.
1301 Kelliher Road
Prince George, B.C. V2L 5S8
Tel. (250) 564-4304 Fax (250) 564-9323

APPENDIX F

Woodlands Neighbourhood Plan
L&M Engineering Limited

ARCHAEOLOGICAL BRANCH OF BRITISH COLUMBIA DATA REQUEST - 2018

Received Via Email September 21, 2018

Hello Ashley,

Thank you for your archaeological data request regarding the property legally described as SW 1/4 OF DL 2425 CARIBOO EXC PLS 29255 PGP37227 & PGP40290, PID 015036855. According to Provincial records there are no known archaeological sites recorded on the subject property. However, the presence of the creeks that travel through the parcel and the surrounding area indicates there is potential for unknown/unrecorded archaeological sites to exist on the property. Fresh water sources were an important resource for indigenous people in the past.

Archaeological sites (both recorded and unrecorded, disturbed and intact) are protected under the *Heritage Conservation Act* and must not be altered or damaged without a permit from the Archaeology Branch.

Prior to any land alterations (*e.g.,* addition to home, property redevelopment, extensive landscaping, service installation), an Eligible Consulting Archaeologist should be contacted to review the proposed activities and, where warranted, conduct a walk over and/or detailed study of the property to determine whether the work may impact protected archaeological materials.

An Eligible Consulting Archaeologist is one who is able to hold a Provincial heritage permit that allows them to conduct archaeological studies. Ask an archaeologist if he or she can hold a permit, and contact the Archaeology Branch (250-953-3334) to verify an archaeologist's eligibility. Consulting archaeologists can be contacted through the BC Association of Professional Archaeologists (www.bcapa.ca) or through local directories.

If the archaeologist determines that development activities will not impact any archaeological deposits, then a permit is not required. Occupying an existing dwelling or building without any land alterations does not require archaeological study or permitting.

In the absence of a confirmed archaeological site, the Archaeology Branch cannot require the proponent to conduct an archaeological study or obtain a permit prior to development. In this instance it is a risk management decision for the proponent.

If any land-altering development is planned and proponents choose not to contact an archaeologist prior to development, owners and operators should be notified that if an archaeological site is encountered during development, activities **must** be halted and the Archaeology Branch contacted at 250-953-3334 for direction. If an archaeological site is encountered during development and the appropriate permits are not in place, proponents will be in contravention of the *Heritage Conservation Act* and likely experience development delays while the appropriate permits are obtained.

Please review the screenshot of the property below (outlined in yellow). If this does not represent the property listed in the data request please contact me.

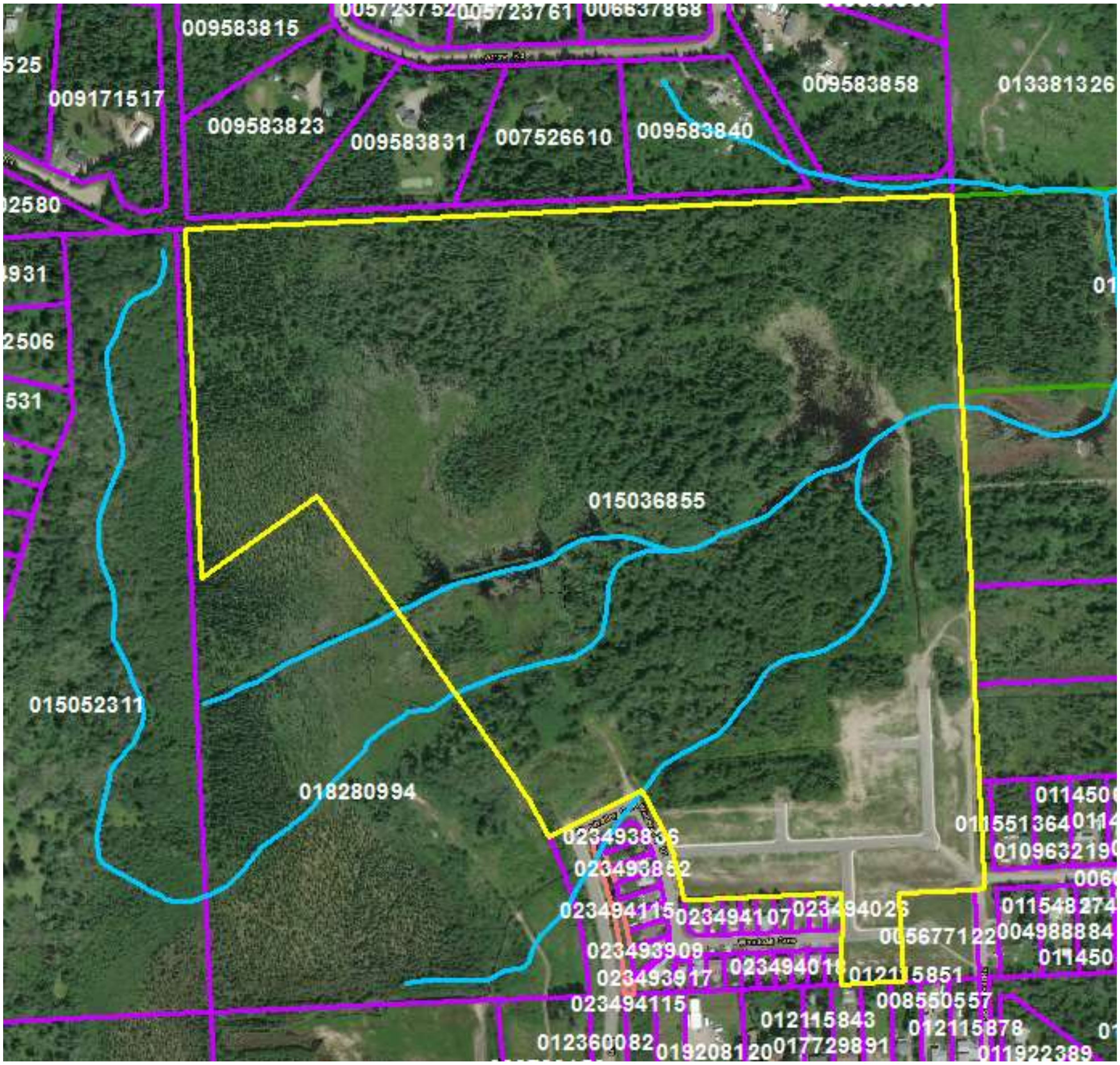
Kind regards,
Diana
Diana Cooper | Archaeologist/Archaeological Site Inventory Information and Data Administrator
Archaeology Branch|Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Unit 3 – 1250 Quadra Street, Victoria, BC V8W2K7| PO Box 9816 Stn Prov Govt, Victoria BC V8W9W3
Phone: 250-953-3343 | Fax: 250-953-3340 | Website: http://www.for.gov.bc.ca/archaeology/

Received Via Email September 21, 2018

From: aelliott@lmengineering.bc.ca [mailto:aelliott@lmengineering.bc.ca] **On Behalf Of** ArchDataRequest@gov.bc.ca
Sent: Thursday, September 20, 2018 2:35 PM
To: Arch Data Request FLNR:EX
Subject: Data Request: Ashley Elliott - L&M Engineering Limited

Terms and Conditions Accepted	Yes
Name	Ashley Elliott
Email	aelliott@lmengineering.bc.ca
I am a	Private Sector Consultant
Affiliation	L&M Engineering Limited
Address	1210 4th Avenue
City	Prince George
Province	BC
Postal Code	V2L3J4
Phone Number	250-562-1977
Information Requested	I request information and advice about archaeological sites on the parcel(s) described below (include civic address, PID, legal description; attach maps below if available):
	PID: 015-036-855 Legal: The South West 1/4 of District Lot 2425 Cariboo District Except Plans 29255, PGP37227, PGP40290 and EPP55596 Civic: 9500 Woodvalley Drive.
Why Site Information is Required	Other (describe below):
	I am a consultant hired by the property owner to identify if any archaeological significant areas overlap with the subject property for the purposes of a new Neighbourhood Plan and subsequent subdivision.
Third Party Access	The following person(s) may have access to this information:
	The property owner, WPD Corp. The City of Prince George
Format Required	PDF, Excel, Access, Shapefile (ESRI, NAD 83, BC Albers Projection), Map(s)
Who Prompted	My local government
File Attachment#1	Woodlands Boundary_20 Sept 2018.dxf

Received Via Email September 21, 2018



APPENDIX G

Woodlands Neighbourhood Plan
L&M Engineering Limited

SERVICING DESIGN BRIEF

L&M ENGINEERING LIMITED
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

October 10th, 2019

WOODLANDS NEIGHBOURHOOD PLAN SERVICING BRIEF

Client: Woodlands Property Development Corp.

L&M Project No.: 1631-01

L&M ENGINEERING LIMITED

1210 Fourth Avenue, Prince George, BC V2L 3J4

Phone: (250) 562-1977

TABLE OF CONTENTS

Page No.

1.0 INTRODUCTION

L&M Engineering is pleased to provide you with this Servicing Brief for the development of the Woodlands Neighbourhood Plan Area, which is located north of the Foothills Boulevard and Chief Lake Road intersection. The Neighbourhood Plan Area is a single parcel owned by Woodlands Property Development Corp. This Servicing Brief has been prepared to summarize the existing utilities in the surrounding area and demonstrate how each property can be serviced with municipal water, sanitary, and storm sewer servicing.

2.0 BACKGROUND DATA AND REPORTS

L&M Engineering has reviewed the following reports in relation to the development of the subject area:

- City of Prince George – 2017 Sanitary Sewer Services Master Plan prepared by AECOM;
- City of Prince George – 2014 Water Service Network Plan prepared by Opus Dayton Knight;
- City of Prince George – Development Services Department: Design Guidelines;
- City of Prince George – Zoning Bylaw No. 7850, 2007;
- City of Prince George – Official Community Plan Bylaw No. 8383, 2011;
- PG Map – Zoning and Land Use; and
- GeoNorth Geotechnical Report (PR# K-5107, February 25, 2019).

3.0 SUBJECT PROPERTIES

Woodlands Property Development Corp.

PID: 015-036-855: This property is approximately 40.2 hectares in size and is entirely contained within the Woodlands Neighbourhood Plan area. The property is presently zoned AG: Greenbelt, AF: Agriculture & Forestry, RS1: Suburban Residential, RS2: Single Residential, RM1: Multiple Residential, and P1: Parks and Recreation within the *City of Prince George Zoning Bylaw No. 7850, 2007* and is designated for future Neighbourhood Residential and Parks & Open Space land uses in the *City of Prince George Official Community Plan Bylaw No. 8383, 2011.*

4.0 TOPOGRAPHY

The subject areas terrain has a gentle rolling topography generally sloping from west to east. This terrain produces slight changes in elevation with a high point of 769m and a low point of 758m. The majority of the lands are forested predominately with white spruce, subalpine fir, and lodgepole pine. The subject property contains two wetland areas which are interconnected with several water courses.

5.0 DESIGN POPULATION

For the purpose of this Servicing Brief, the design populations for the Single Residential developable area were calculated using the Design Population by Household Size table (Table 2.10.1) in the City of Prince Georges Draft Design Guidelines. The average number of persons per household is identified to be 3.0 for single-family dwellings in the Hart/Nechako Sector. Table 1 below demonstrates the population for the Woodlands Neighbourhood Plan will be approximately 570 people.

Table 1: Woodlands Estimated Population

Housing Form	Developable Area (ha)	Dwelling Units/ha	Number of Dwelling Units	Persons/ Dwelling Unit	Estimated Population
Single Family	20.7	9.2	190	3.0	570

6.0 WATER DISTRIBUTION SYSTEM

6.1 Existing System

L&M conducted a review of the existing municipal watermain infrastructure in the vicinity of the subject properties. Watermains exist adjacent to the site as follows:

- Woodvalley Drive Ex. 350mm diameter watermain stub, PVC
- Woodvalley Drive Ex. 150mm diameter watermain stub, PVC

The system is part of Pressure Zone 11 which obtains its static pressure from the Vellencher Reservoir (PW817) at a Top Water Elevation (TWL) = 803.0m.

6.2 Domestic Water Demands

The domestic water demands have been calculated utilizing rates published in the City of Prince George Draft Design Guidelines. Table 2 below, outlines the calculation of the anticipated domestic water demand for the development of the Woodlands Neighbourhood Plan Area based on the location, size, number of units, and population. The domestic water demands calculated include Average Day Demand (ADD), Max Day Demand (MDD), and Peak Hour Demand (PHD).

Table 2: Future Domestic Water Demands						
Location	**No. of Units**	**Population**	**ADD**	**MDD**	**PHD**	**Node Elevation**
1	16	48	0.26	0.82	1.12	767.17
2	22	66	0.36	1.12	1.54	764.51
3	23	69	0.38	1.18	1.61	761.90
4	28	84	0.46	1.43	1.96	767.00
5	24	72	0.40	1.23	1.68	760.03
6	25	75	0.41	1.28	1.75	762.38
7	24	72	0.40	1.23	1.68	767.98
8	24	72	0.40	1.23	1.68	763.77
9	22	66	0.36	1.12	1.54	760.00
10	163	489	2.69	8.33	11.43	761.71

**Population was calculated using # of dwelling units/ha per Development Regulations found in the CoPG Zoning Bylaw*

6.3 Fire Protection Demands

In addition to the domestic water demand, an allowance for fire protection must be made. The City of Prince George Draft Design Guidelines recommends minimum fire protection design flows based on land use. Table 6.2 below summarizes the fire flow requirements outlined in Table 3 of the City of Prince George Draft Design Guidelines.

Table 3: Fire Flow Requirements	
Land Use	**Required Fire Flow (L/s)**
Single Family Residential	60

The reference document titled *Water Supply for Public Fire Protection*, produced by the Fire Underwriters Survey is the de-facto standard throughout Canada for establishing fire protection requirements when designing municipal water works system design. This document presents a fire flow estimate that accounts for factors such as building construction, total floor area, material combustibility, automatic sprinkling, building separation, and occupancy. The design fire flow requirements for each development will need to be calculated at the time of detailed design to ensure an adequate design fire flow is utilized for each individual site.

6.4 Water Modelling Results and Proposed Servicing

L&M Engineering submitted design parameters to the City of Prince George for water modelling. The City's Water Model was analyzed under Average Day Demand (ADD), Maximum Day Demand (MDD) and Peak Hour Demand (PHD) conditions. Maximum Day conditions represent the highest recorded daily demand on the water system and Peak

Hour flow conditions represent the highest demand on the system during the course of any given day.

The objective of the water modelling was to determine how much of the subject area could be serviced via the Vellencher Reservoir (PW817). The results of the City's water modelling indicated that the entirety of the subject area could be serviced via PW817 and that with a 200mm water main and one section of 250mm water main the available fire flow during the MDD scenario is sufficient for the proposed land uses. The lowest available fire flows for the lands was found to be 77.5 L/s at node 7, which is greater than the required 60 L/s for single family development. The section of 250mm water main is required across the wetland as the modelling indicated a formation of a chokepoint in that area. The City water modelling also indicated that a minimum pressure of 44.0 psi and a maximum pressure of 54.0 psi will be provided to the subject property during max day demand operating conditions. This also meets the Cities minimum and maximum operating pressures.

Refer to Appendix B for the full Water Modelling Report prepared by the City of Prince George. Further modelling or adjustments will be required at the time of the detailed design stage for each project to account for the site-specific building elevations and friction losses.

Based on the modelling results, the provision of adequate and reliable municipal water (Fire flow + MDD) can be achieved at this site without any additional offsite improvements.

7.0 SANITARY COLLECTION SYSTEM

7.1 Existing System

There are three sanitary mains that can be used to collect flow from the Woodlands Neighbourhood Plan Area. The three existing sanitary connections points are as follows:

1. Woodvalley Drive — 200mm diameter PVC sanitary main
2. Venta Drive — 200mm diameter PVC sanitary main
3. Zral Road — 200mm diameter PVC sanitary main

The existing sanitary main located on Woodvalley Drive flows into the trunk main on Chief Lake Road/Highway 97, which ultimately flows to lift station PW117. In addition, a force main exists parallel to the gravity sanitary main on the northeast section of Woodvalley Drive. The force main ties into the City manhole (AssetID: 47) located within the City's utility right-of-way at the southeast corner of Woodvalley Drive and extends north into the Neighbourhood Plan Area. The force main was installed in anticipation of future development on the Woodlands property.

The existing sanitary mains on Zral Road and Venta Drive ultimately flow in to lift station PW126, which is located at the end of Twinberry Drive. Lift station PW126 pumps flows into the sanitary trunk main on Highway 97, which flows to lift station PW117.

7.2 Existing Capacity

L&M Engineering reviewed the *City of Prince George 2017 Sanitary Sewer Services Master Plan (prepared by AECOM)* AND PGMap for information related to the capacity of the existing sanitary system. Table 4, 5, and 6 below illustrates the available downstream sanitary flows.

Table 4: Available Downstream Sanitary Flows (Woodvalley Drive)

Pipe: Asset ID	Location	Diameter (mm)	Total Capacity (L/s)	Existing Fow (L/s)	Available Capacity (L/s)
8640	Woodvalley Drive	200	30.68	0.00	21.48
8444	Woodvalley Drive	200	21.40	0.06	14.92
9844	Woodvalley Drive	200	21.21	0.07	14.99
9845	Woodvalley Drive	200	20.51	0.07	14.29
9846	Woodvalley Drive	200	21.99	0.07	15.32
8528	Woodvalley Drive	200	18.89	0.78	12.44
8529	Woodvalley Drive	200	25.90	0.78	17.35
8524	Woodvalley Drive	200	31.10	0.78	20.99
9848	Sparwood Road	250	44.70	1.13	30.16
9849	Sparwood Road	250	49.00	1.52	32.79

Table 5: Available Downstream Sanitary Flows (Venta Drive)

Pipe: Asset ID	Location	Diameter (mm)	Total Capacity (L/s)	Existing Fow (L/s)	Available Capacity (L/s)
8641	Venta Drive	200	27.40	0.09	23.50
1409	Kelly Road N	200	38.00	0.10	33.00
10415	Kelly Road N	200	52.86	0.99	36.02
10416	Kelly Road N	200	44.55	5.09	26.09
10417	Kelly Road N	200	35.92	5.43	19.71
10423	Kelly Road N	200	23.36	5.63	10.72
10422	Kelly Road N	200	25.05	6.03	11.50
10425	Kelly Road N	200	30.78	7.72	13.96
8487	Estavilla Drive	200	42.87	7.72	22.29
8488	Estavilla Drive	200	46.45	9.14	23.38
8401	Estavilla Drive	200	32.70	9.32	13.57
8493	Estavilla Drive	200	38.74	9.73	17.38

8496	Estavilla Drive	200	39.87	9.77	18.14
8497	Estavilla Drive	200	25.84	9.84	8.25
8498	Glendale Drive	200	32.22	10.19	12.36
8500	Glendale Drive	200	37.56	10.29	26.89
8503	Glendale Drive	200	47.91	10.47	27.05
8504	Glendale Drive	200	43.10	10.55	19.62
8502	Glendale Drive	250	56.47	10.55	28.98
8506	Glendale Drive	250	41.22	10.62	18.24
8507	Knight Crescent	250	44.89	13.22	18.20
8515	Wapiti Road	250	42.54	13.26	39.51
8523	Wapiti Road	250	46.51	13.26	19.30
8533	Wapiti Road	250	41.80	13.26	16.00
8534	Wapiti Road	250	41.84	13.25	16.03
10413	Wapiti Road	250	52.82	13.25	23.72
8537	Wapiti Road	250	56.35	13.25	39.50
8546	Wapiti Road	250	54.63	13.25	25.00
8547	To Lift Station	250	32.04	15.14	7.29

Table 6: Available Downstream Sanitary Flows (Zral Road)

Pipe: Asset ID	Location	Diameter (mm)	Total Capacity (L/s)	Existing Flow (L/s)	Available Capacity (L/s)
8756	Zral Road	200	22.45	0.10	15.61
8757	Zral Road	200	65.77	1.23	44.82
8541	Zral Road	200	63.09	1.36	42.80
8540	Zral Road	200	32.64	1.64	21.21
8549	Kelly Road N	200	42.45	2.56	27.00
8552	Kelly Road N	200	56.52	3.17	36.39
8566	Kelly Road N	200	30.36	3.35	17.90
8567	PID: 004-989-368	200	59.57	3.44	38.25
8565	PID: 004-989-368	200	56.74	4.21	35.50
8564	PID: 004-989-368	200	32.32	4.21	18.41
8563	PID: 004-989-368	200	48.55	4.42	29.56
8562	PID: 004-989-368	200	38.70	6.39	20.70
8560	PID: 004-989-368	200	36.02	6.55	18.66
8559	Burgess Road	200	22.56	8.09	7.71
8557	Burgess Road	200	26.74	8.09	10.63
10281	Meadow Rim Way	200	23.73	8.14	8.47
8554	Meadow Rim Way	200	44.14	6.55	24.35
8555	Twinberry Drive	300	36.99	6.79	19.11
9630	Twinberry Drive	300	51.52	6.94	29.12
9631	To Lift Station	300	103.89	6.94	65.78

It is our understanding that the City of Prince George is currently completing a review of the current capacity of the lift station (PW126) located to the south end of Twinberry

Drive. The review will look at the current capacity of the lift station in relation to all of the upstream development plans including the Woodlands Neighbourhood Plan area. Based on our understanding, the existing lift station may be upgraded to accommodate future development flows or relocated to a more suitable location in order to service future development lands within the lift stations catchment area.

A review of the CoPG Sanitary Sewer Services Master Plan was completed to determine if any infrastructure downstream of the existing lift station (PW126) will be affected by the proposed development or if any existing deficiencies exist. The existing model (Figure 4.2) within the master plan indicates that all of the pipes between PW 126 and PW 117 have available capacity and all but five of those pipes are under 50% capacity.

7.3 Sanitary Design Flows

The City of Prince George Draft Design Guidelines (Section 4.2) outline the procedure required to determine the sanitary sewer design flows. Sanitary design flows are calculated below for both the Woodlands Neighbourhood Plan Area and the neighbouring future development to the east of the subject property (PID: 011-882-760, PID: 011-715-413, PID: 025-500-902).

Table 7: Sanitary Sewage Flow Calculations

Flow Scenario	Service Area (ha)	Number of Units	People / lot	Population	Average Flow (L/s)	Infiltration	Peak Factor	Peak Flow (L/s)
Woodlands NHP Area	21	190	3	570	2.51	2.72	3.94	12.61
PID: 011-882-760 PID: 011-715-413 PID: 025-500-902	19	160	3	480	2.11	2.46	3.98	10.87
Total	40	350	3	1050	4.62	5.19	N/A	23.48

7.4 Proposed Sanitary Servicing

Based on the design flows calculated in Table 7, none of the sanitary networks can accommodate all of the sanitary flows on its own without requiring upgrades to the existing system or installing a sanitary lift station. A few options exist to split the flows between the three systems in order to reduce the total number of improvements to the existing sanitary sewer networks. Due to the subject property's topography, only 16 of the 190 proposed lots will be able to flow into the Woodlands sanitary network by gravity (1.08 L/s). The 16 lots will be located at the northwest end of Woodvalley Drive.

Option 1

The 1.08 L/s (5% of total flow) generated by the 16 lots at the northwest end of Woodvalley Drive could flow by gravity into the Woodlands sanitary network. In order for the remainder of the Woodlands Neighbourhood Plan Area to flow by gravity the system would need to tie into the existing mains on Zral Road and Venta Drive. The sanitary mains would need to be installed through the future neighbouring development located at PID: 025-500-902, 011-715-413, and 011-882-760. Therefore, the proposed sanitary flows generated by the neighbouring development will be included in this study.

The remaining flow (22.4 L/s) would be directed east through the neighbouring properties where the flows could be split between the Zral Road and Venta Drive sanitary networks. In order to optimize the system and limit the number of offsite pipes upgrades the flow split would need to be 7.28 L/s (31% of total flow) to the Venta system and 15.12 L/s (64% of total flow) to the Zral system. This option would require upgrades to 3 pipes (AssetID's: 8557, 8559 & 10281) between Zral Road and PW126.

Option 2

A sanitary lift station could be installed within the neighbourhood plan area and pump sanitary sewage into the Woodlands sanitary network. The lift station could tie into the existing force main on Woodvalley Drive and service all of the dwelling units (190 units) within the neighbourhood plan area. The sewage would bypass the majority of the Woodlands sanitary network and would discharge into the manhole (Asset ID: 47) located within the City right-of-way at the southeast corner of Woodvalley Drive. Based on the sanitary flow calculations illustrated in Table 7, the 190 units will generate a peak flow of 12.66 L/s. This option requires no offiste pipe upgrades.

8.0 STORM WATER SYSTEM

8.1 Existing System

The existing storm system in the vicinity of the subject area consists of a pipe network that traverses through the existing Woodlands subdivision and discharges into a storm detention trench at the northeast end of Woodvalley Drive. The water collected by the detention trench then drains north, into the wetlands located in the center of the neighbourhood plan area. There is also a 250mmø storm stub extends into the subject property at the northwest end of Woodvalley Drive.

8.2 Proposed Storm Servicing

The proposed storm servicing will discharge all of the site's storm water run-off into the onsite wetlands. Similar to the sanitary servicing, the existing storm network in the Woodlands subdivision can only service the proposed 16 lots at the northwest end of Woodvalley Drive by gravity. When the original phases of the Woodlands subdivision were designed and constructed, the City of Prince George Design Guidelines only required the storm sewer infrastructure to be designed to a 5-year rainfall event instead of the current 10-year rainfall event requirement. The 5-year design accounted for the gravity flows generated by the neighbourhood plan area. Table 8 summarizes the 5 and 10-year storm water run-off flows generated by the site.

Table 8: Existing Sewer System Analysis			
Pipe Description	**Pipe Diameter (mm)**	**Water Depth at Peak Storage (mm) 5-Yr Storm**	**Water Depth at Peak Storage (mm) 10-Yr Storm**
DMH2983 to DMH2982	375	190	230
DMH2982 to DMH2981	375	220	270
DMH2981 to D689403	450	280	380
D689403 to D689404	450	240	310
D689404 to D689405	450	250	330
D689505 to D689504	450	330	Full
D689504 to D689503	525	360	Full
D689503 to D689502	525	380	Full
D689502 to D689501	525	390	Full
D689501 to DMH	525	390	Full

In order to service the remaining lots by gravity, it is proposed to install additional headwall outlets that discharge into the wetlands. The exact size and location of the storm infrastructure have not yet been confirmed. The modelling analysis separated the property into two catchments to determine the approximate flows that will be generated by the development. The two catchments are located on either side of the wetlands and are labelled as Catchment Area 4 and Catchment Area 5 on the catchment plan. Catchment Area 4 is 6.3ha and is located on the south side of the wetlands. During a 10-year rainfall event Catchment 4 generates a storm water run-off of 0.392m^3/s. Catchment Area 5 is 13.8ha and is located on the north side of the wetlands. During a 10-year rainfall event Catchment 5 generates a storm water run-off of 0.865m^3/s.

Triton Environmental Consultants Ltd. prepared an Environmental Recommendation Memorandum (Memo) to provide general environmental recommendations for the Neighbourhood Plan development. The memo provides recommendations for the riparian setback, stormwater management, beaver management and road development. Refer to Appendix E, for the Environmental Recommendation Memorandum. Environmental Management Plans (EMP) will be completed as required during the detailed design stages of Woodlands development. The EMP may evaluate the following:

- Timing and monitoring requirements for the removal of wildlife trees, if necessary;
- Water quality monitoring protocols and thresholds, if surface water quality is anticipated to be affected;
- Spill and waste management plans;
- Erosion and sediment control procedures; and
- Requirements for wildlife surveys and salvages (e.g., breeding bird/nest surveys, amphibian salvages).

9.0 SUMMARY

In summary, the site located to the north of the existing Woodlands subdivision, in Prince George BC, appears to be situated such that it can be adequately serviced with the nearby municipal water, sanitary and storm sewer infrastructure. The proposed water infrastructure can tie into both of the existing water main stubs located at the northwest and northeast ends of Woodvalley Drive. It was determined that 16 lots located at the northwest end of Woodvalley Drive can be serviced by extending the existing sanitary and storm stubs into the Neighbourhood Plan area. The remaining lots will require the sanitary sewage to flow east across the neighbouring property and tie into one of two manholes located on Kelly Road North. Another option for the remaining lots would be to install a sanitary lift station on the property and have the sewage pumped into the existing Woodlands sanitary network. Depending on which option is chosen for the sanitary servicing, offsite mains may need to be upgraded to accommodate the flows. The proposed plan for the storm drainage is to install additional headwalls that discharge into the wetlands. The exact locations of the headwall outlets will be determined during the detailed design stage. Site investigations and design calculations should be conducted at the beginning of the detailed design process to confirm the presence and condition of the existing services, as well as, confirm the actual design demands can be met by utilizing the nearby municipal servicing.

10.0 CLOSURE

This Servicing Brief has been prepared for the City of Prince George and Woodlands Development Corporation as the intended users. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it are the responsibility of such third parties. L&M Engineering Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this study. The information and data contained within this document represents L&M Engineering Limited's professional judgement in accordance with the knowledge and information available to L&M Engineering Limited at the time of the report preparation. No other warranty, expressed or implied, is made.

Sincerely,

L&M ENGINEERING LTD

Prepared by:

Tanner Fjellstrom, EIT
Project Engineer

Reviewed by:

PROFESSIONAL
PROVINCE OF
J. R. BOYES
31146
BRITISH COLUMBIA
ENGINEER

Oct 10th, 2019

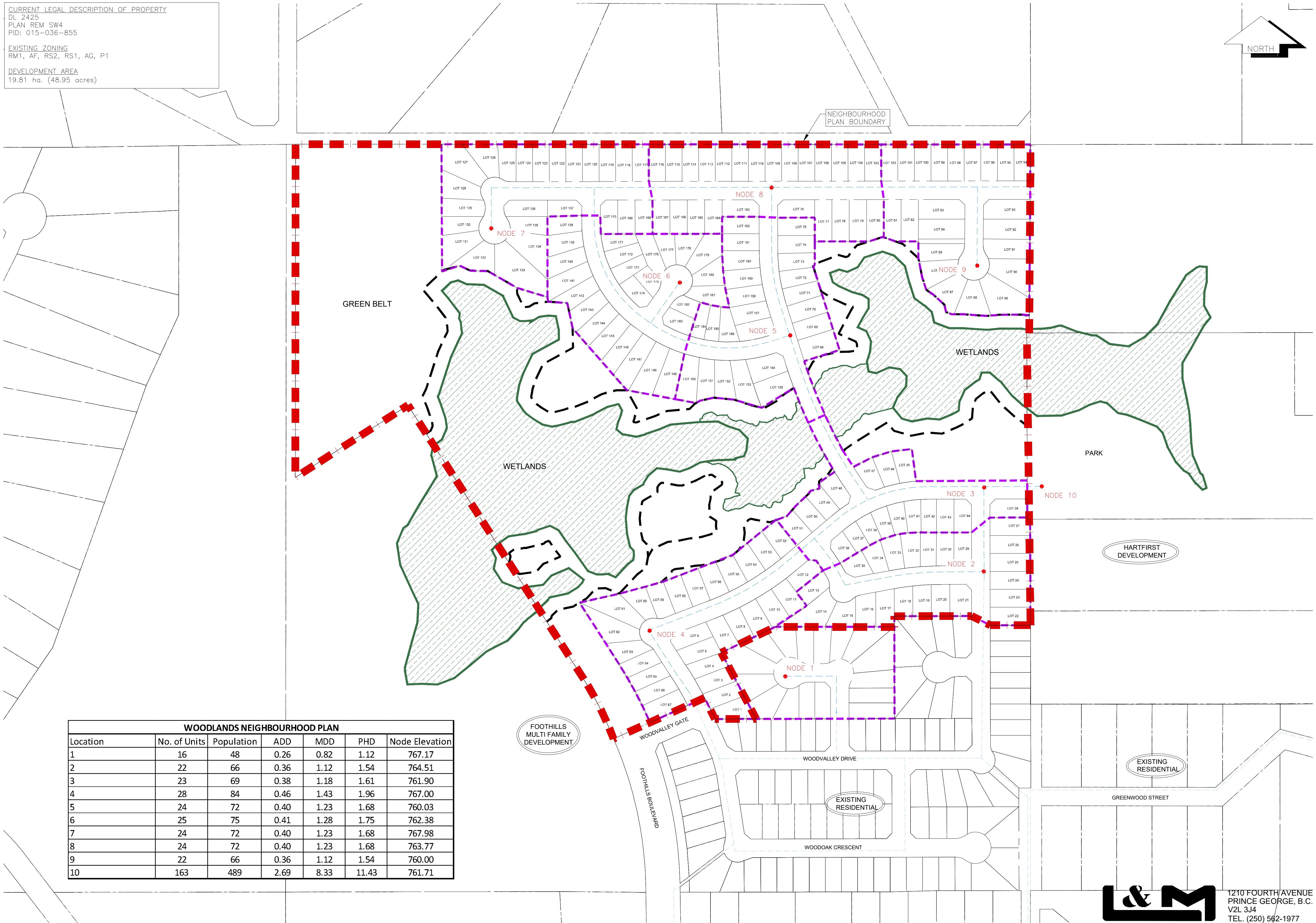
Jason Boyes, P.Eng.
Principal

Appendix A
Water Modelling

CURRENT LEGAL DESCRIPTION OF PROPERTY
DL 2425
PLAN REM SW4
PID: 015-036-855

EXISTING ZONING
RM1, AF, RS2, RS1, AG, P1

DEVELOPMENT AREA
19.81 ha. (48.95 acres)



WOODLANDS NEIGHBOURHOOD PLAN						
Location	No. of Units	Population	ADD	MDD	PHD	Node Elevation
1	16	48	0.26	0.82	1.12	767.17
2	22	66	0.36	1.12	1.54	764.51
3	23	69	0.38	1.18	1.61	761.90
4	28	84	0.46	1.43	1.96	767.00
5	24	72	0.40	1.23	1.68	760.03
6	25	75	0.41	1.28	1.75	762.38
7	24	72	0.40	1.23	1.68	767.98
8	24	72	0.40	1.23	1.68	763.77
9	22	66	0.36	1.12	1.54	760.00
10	163	489	2.69	8.33	11.43	761.71

LEGEND
NEIGHBOURHOOD PLAN BOUNDARY
WETLAND
15.0 m RIPARIAN SETBACK
NODE BOUNDARIES
PROPOSED WATER MAIN
EXISTING WATER MAIN

NO.	DATE	REVISION	DR.

CITY OF PRINCE GEORGE
Development Services

DRAWN: MM
CHECKED: DDS
ENGINEER: JRB
SURVEY FILE:
DRAWING FILE: ACAD18 1631-02 SB.dwg
CORRESPONDENCE: CPG
GRID:
DATE: JANUARY 2019
SCALES: FULL 1:2000 HALF 1:4000

WOODLANDS PROPERTY DEVELOPMENT CORP.
EXPANDED NEIGHBOURHOOD

WATER MODELING PLAN

CONSULTANTS PROJECT No. 1631-01
DRAWING No. WAT

SHEET No. 1 OF 1
REV. No. 0

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CITY OF PRINCE GEORGE
Engineering and Public Works

[illegible] Patricia Boulevard Prince George [illegible]
Telephone [illegible]

MEMO

To: **Tanner Fjellstrom**
[illegible]M Engineering
[illegible]

From: **Charlie Elliott, EIT**
[illegible]
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Date: **20 Feb 19**

Subject: **WM000057 Water Modelling for Woodlands Subdivision #1 9500 Woodvalley**
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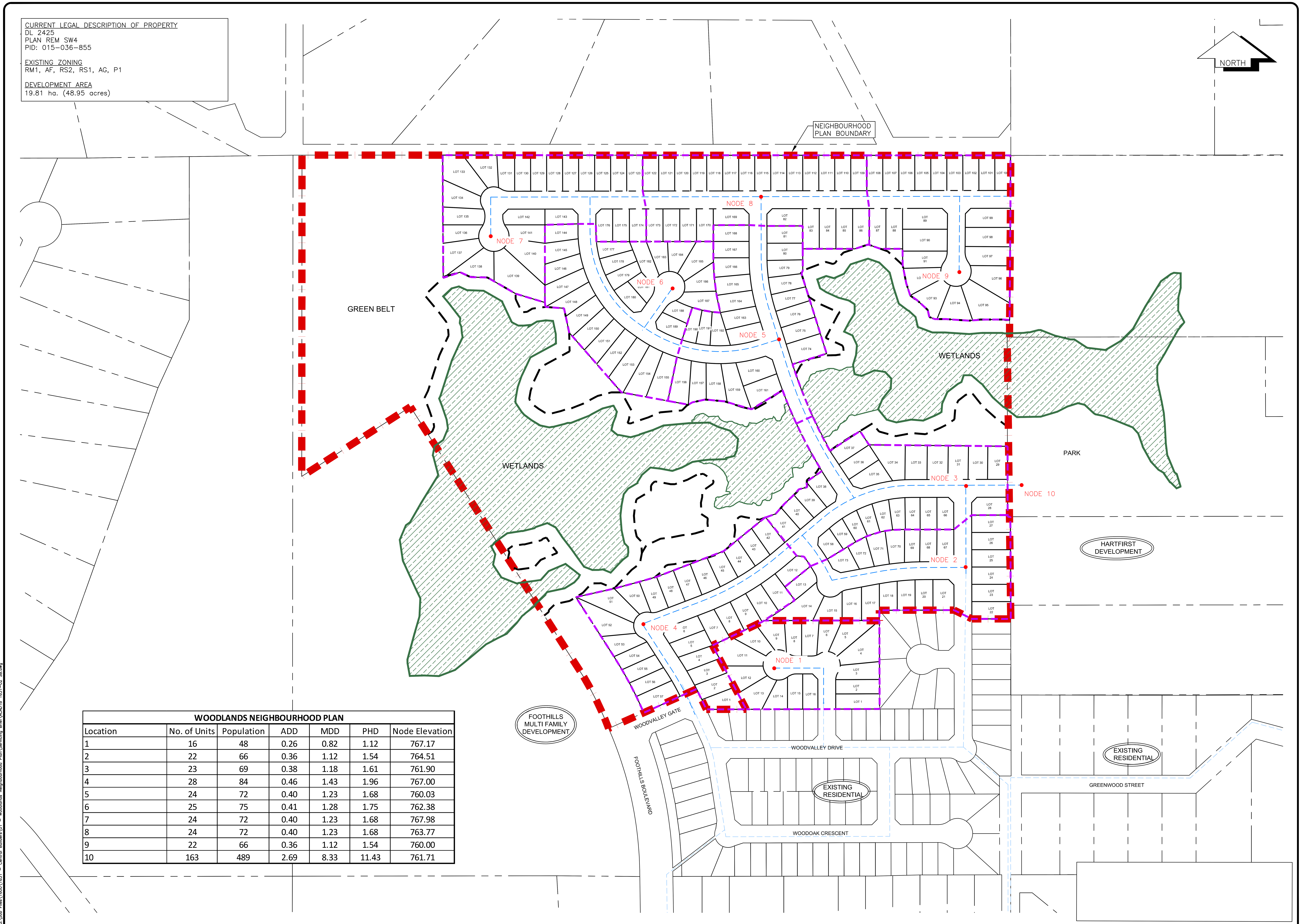

WOODLANDS NEIGHBOURHOOD PLAN						
Location	No. of Units	Population	ADD	MDD	PHD	Node Elevation
1	16	48	0.26	0.82	1.12	767.17
2	22	66	0.36	1.12	1.54	764.51
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4	28	84	0.46	1.43	1.96	767.00
5	24	72	0.40	1.23	1.68	760.03
6	25	75	0.41	1.28	1.75	762.38
7	24	72	0.40	1.23	1.68	767.98
8	24	72	0.40	1.23	1.68	763.77
9	22	66	0.36	1.12	1.54	760.00
10	163	489	2.69	8.33	11.43	761.71

LEGEND

- NEIGHBOURHOOD PLAN BOUNDARY
- WETLAND
- 15.0 m RIPARIAN SETBACK
- NODE BOUNDARIES
- PROPOSED WATER MAIN
- EXISTING WATER MAIN

NO.	DATE	REVISION	DR.

CITY OF
PRINCE GEORGE
Development Services

DRAWN:	MM
CHECKED:	DDS
ENGINEER:	JRB
SURVEY FILE:	
DRAWING FILE:	ACAD18 1631-02 SB.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	JANUARY 2019
SCALES:	FULL 1:2000 HALF 1:4000

CENTRAL BUILDERS

EXPANDED NEIGHBOURHOOD

WATER MODELING PLAN

CONSULTANTS PROJECT No.
1631-01
DRAWING No.
WAT

SHEET No. 1 OF 1
REV. No. 0

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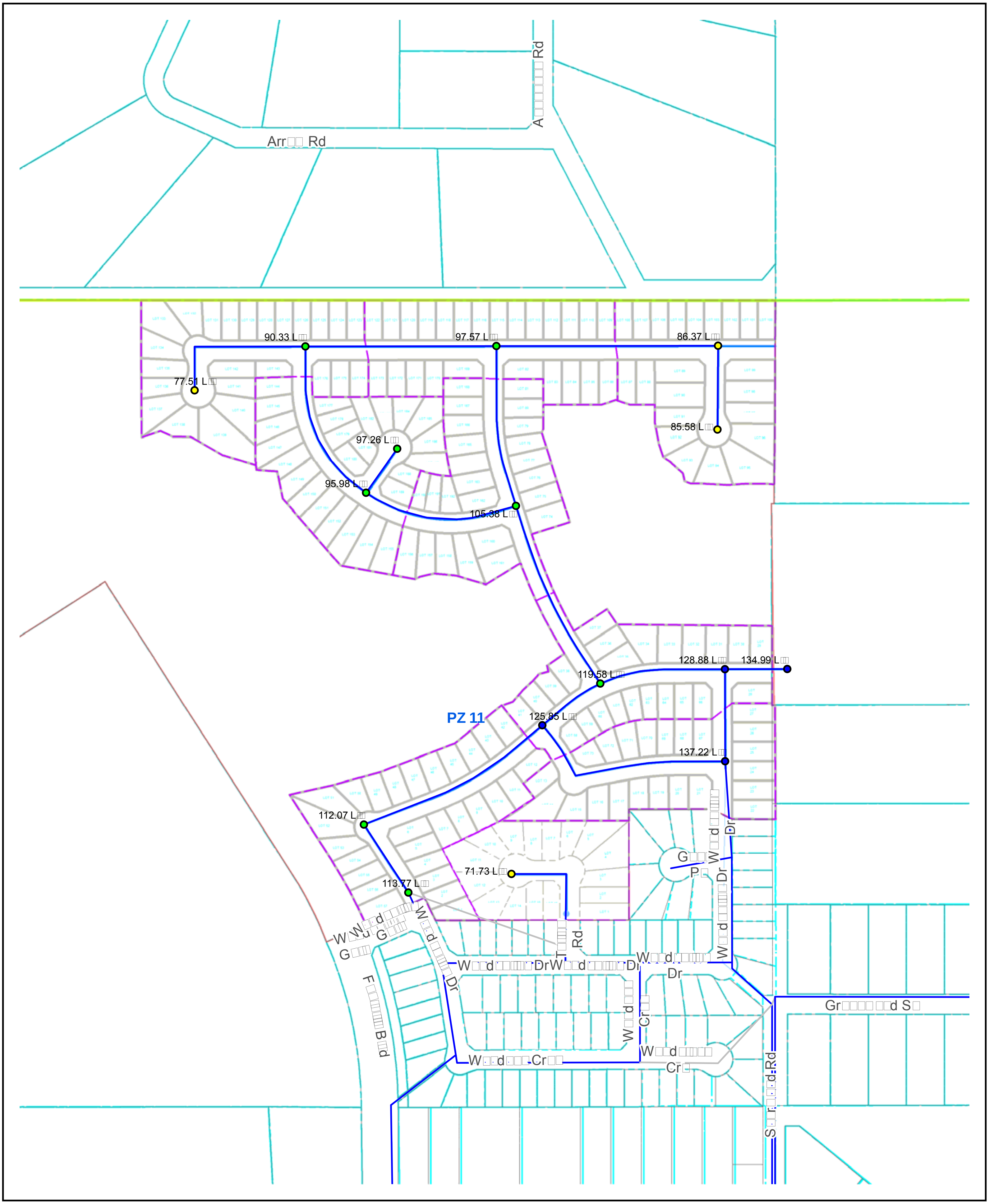

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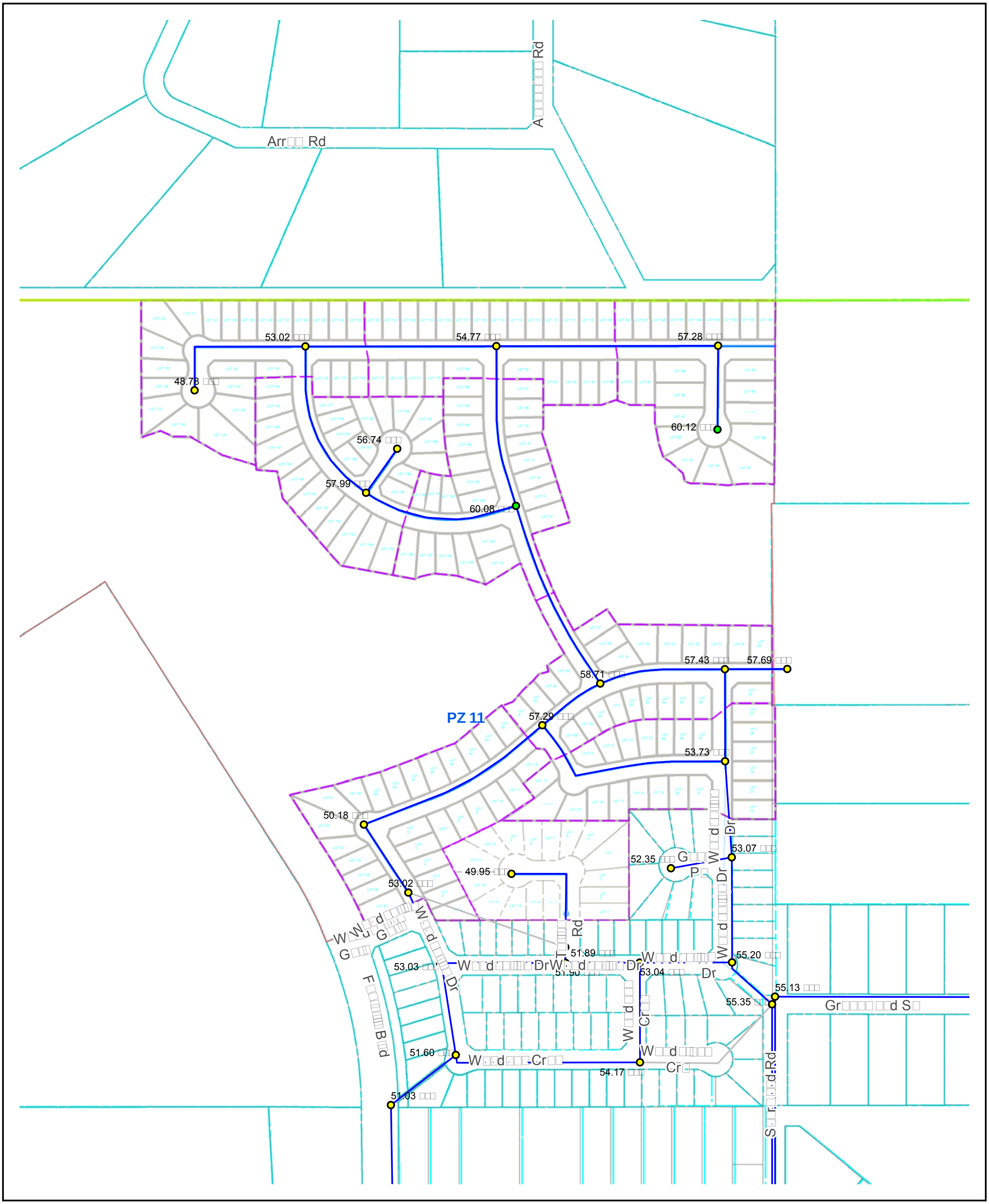

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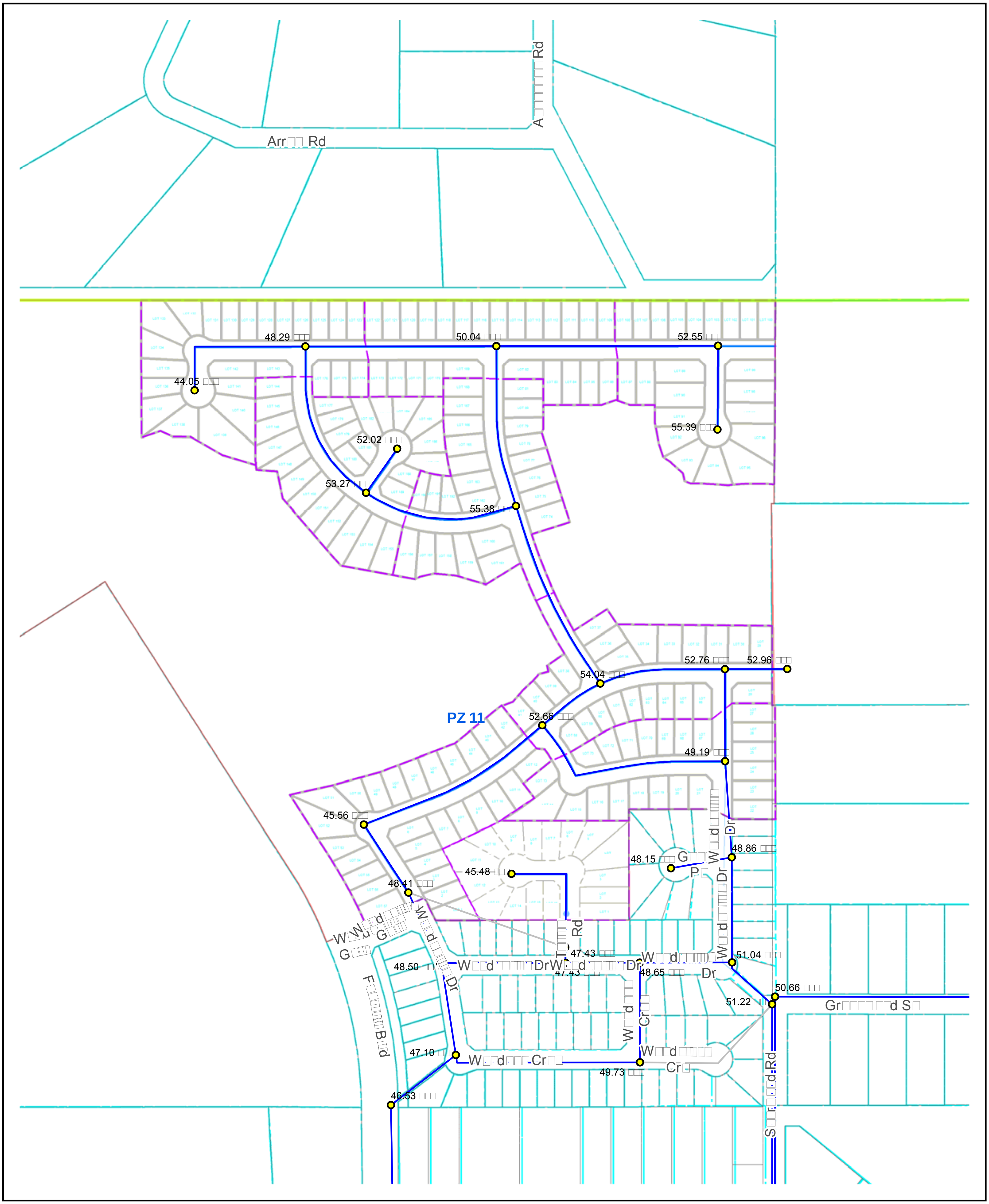
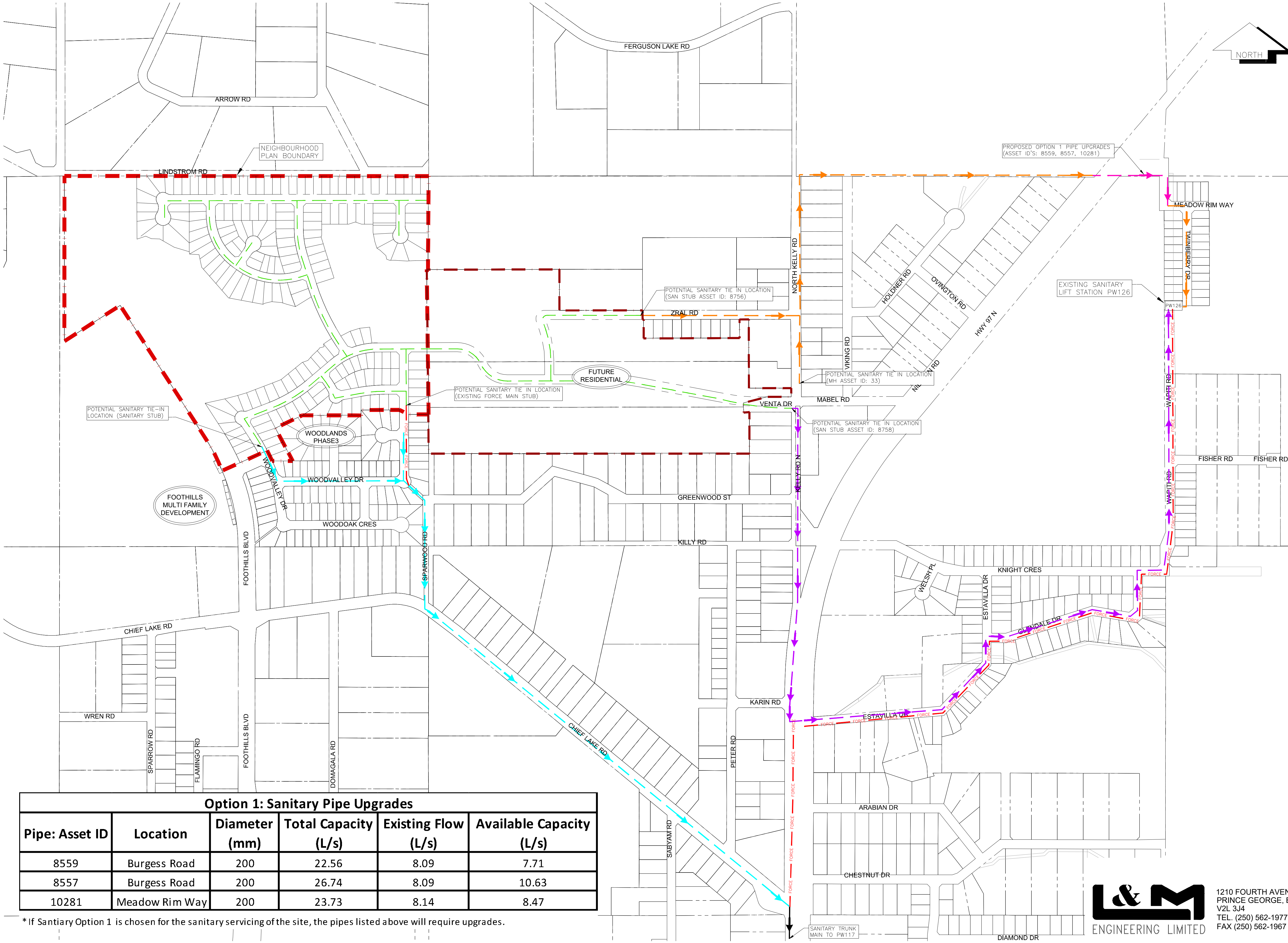


CITY OF PRINCE GEORGE

Appendix B
Sanitary



Option 1: Sanitary Pipe Upgrades

Pipe: Asset ID	Location	Diameter (mm)	Total Capacity (L/s)	Existing Flow (L/s)	Available Capacity (L/s)
8559	Burgess Road	200	22.56	8.09	7.71
8557	Burgess Road	200	26.74	8.09	10.63
10281	Meadow Rim Way	200	23.73	8.14	8.47

* If Santiary Option 1 is chosen for the sanitary servicing of the site, the pipes listed above will require upgrades.

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LEGEND

- NEIGHBOURHOOD PLAN BOUNDARY
- FUTURE NEIGHBOURING PROPERTY BOUNDARY
- PROPOSED ONSITE SANITARY SYSTEM
- OPTION 1 PIPE UPGRADES
- ZRAL ROAD SANITARY SYSTEM
- VENTRA DRIVE SANITARY SYSTEM
- WOODLANDS SANITARY SYSTEM
- EXISTING SANITARY FORCE MAIN

NO.	DATE	REVISION	DR.

CITY OF
PRINCE GEORGE
Development Services

DRAWN:	KP
CHECKED:	TF
ENGINEER:	JRB
SURVEY FILE:	
DRAWING FILE:	ACAD18 1631-02 SB.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	JULY 2019
SCALES:	FULL 1:4000 HALF 1:8000

WOODLANDS PROPERTY DEVELOPMENT CORP.

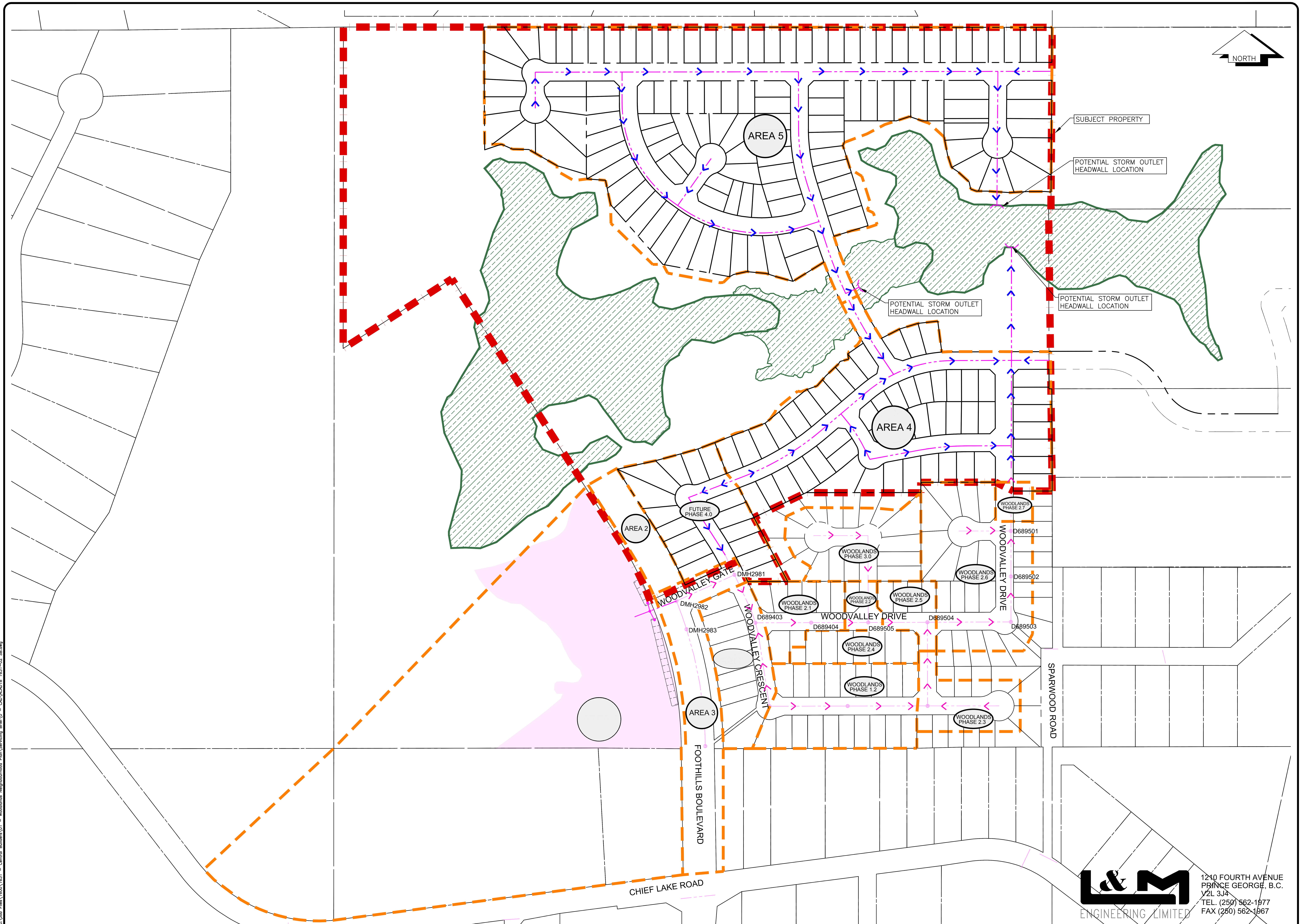
EXPANDED NEIGHBOURHOOD EXISTING SANITARY ROUTE

CONSULTANTS PROJECT No. 1631-01

DRAWING No. SERV:01

SHEET No.	REV. No.
1 OF 1	0

Appendix C
Storm



LEGEND

- SUBJECT PROPERTY
- CATCHMENT AREA BOUNDARY
- EXISTING STORM MAIN FLOW DIRECTION
- EXISTING STORM MANHOLE
- PROPOSED STORM MAIN FLOW DIRECTION
- PROPOSED STORM MANHOLE
- POTENTIAL STORM OUTLET HEADWALL LOCATION
- DEVELOPMENT AREA

NO.	DATE	REVISION	DR.

CITY OF
PRINCE GEORGE
Development Services

DRAWN:	MM
CHECKED:	TF
ENGINEER:	JRB
SURVEY FILE:	
DRAWING FILE:	ACAD18 1631-02 SB.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	JULY 2019
SCALES:	FULL 1:2000 HALF 1:4000

WOODLANDS PROPERTY DEVELOPMENT CORP.
NEIGHBOURHOOD PLAN

CATCHMENT PLAN

CONSULTANTS PROJECT No.
1631-01
DRAWING No.
CP

SHEET No.	REV. No.
1 OF 1	0

L&M ENGINEERING LIMITED
1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
V2L 3J4
TEL. (250) 562-1977
FAX (250) 562-1967

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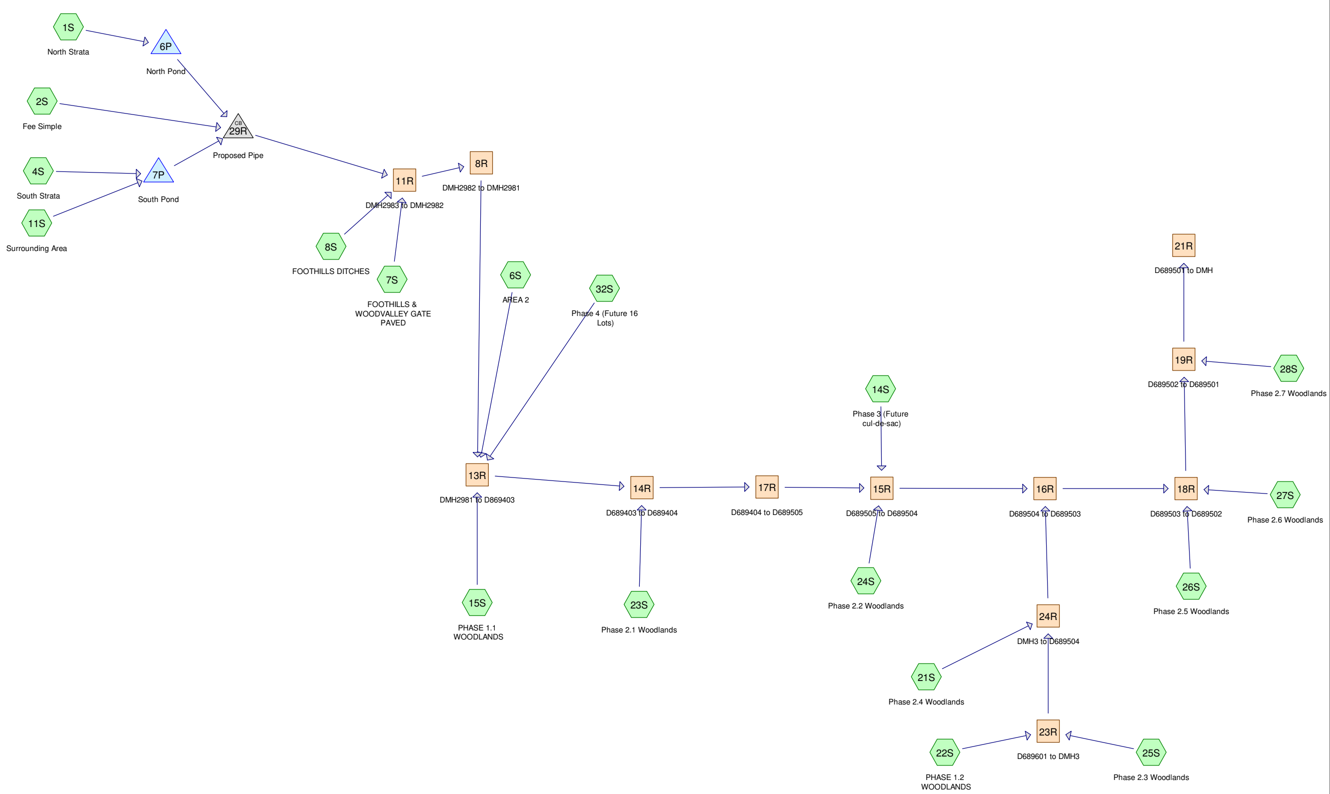
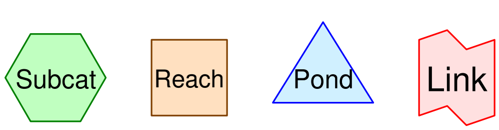




Routing Diagram for HydroCad 5yr HGC D
Prepared by {enter your company name here}, Printed 7/29/2019
HydroCAD® 10.00-19 s/n 03055 © 2016 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (hectares)	CN	Description (subcatchment-numbers)
10.2600	87	1/4 acre lots, 38% imp, HSG D (2S, 14S, 15S, 22S, 23S, 24S, 25S, 26S, 27S, 28S, 32S)
2.4400	92	1/8 acre lots, 65% imp, HSG D (1S, 4S)
0.3770	84	50-75% Grass cover, Fair, HSG D (21S)
0.5000	98	Paved parking, HSG D (7S)
0.1274	98	Roofs, HSG D (21S)
11.1800	79	Woods, Fair, HSG D (6S, 11S)
0.6000	82	Woods/grass comb., Fair, HSG D (8S)
25.4844	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
25.4844	HSG D	1S, 2S, 4S, 6S, 7S, 8S, 11S, 14S, 15S, 21S, 22S, 23S, 24S, 25S, 26S, 27S, 28S, 32S
0.0000	Other	
25.4844		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchmen Numbers
0.0000	0.0000	0.0000	10.2600	0.0000	10.2600	1/4 acre lots, 38% imp	2
0.0000	0.0000	0.0000	2.4400	0.0000	2.4400	1/8 acre lots, 65% imp	1
0.0000	0.0000	0.0000	0.3770	0.0000	0.3770	50-75% Grass cover, Fair	2 1
0.0000	0.0000	0.0000	0.5000	0.0000	0.5000	Paved parking	7
0.0000	0.0000	0.0000	0.1274	0.0000	0.1274	Roofs	2 1
0.0000	0.0000	0.0000	11.1800	0.0000	11.1800	Woods, Fair	6
0.0000	0.0000	0.0000	0.6000	0.0000	0.6000	Woods/grass comb., Fair	8
0.0000	**0.0000**	**0.0000**	**25.4844**	**0.0000**	**25.4844**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (meters)	Out-Invert (meters)	Length (meters)	Slope (m/m)	n	Diam/Width (mm)	Height (mm)	Inside-Fill (mm)
1	8R	762.450	762.165	71.30	0.0040	0.010	375	0	0
2	11R	762.710	762.500	33.60	0.0063	0.010	375	0	0
3	13R	762.110	761.870	58.60	0.0041	0.010	450	0	0
4	14R	761.690	761.228	62.40	0.0074	0.010	450	0	0
5	15R	760.827	760.543	67.70	0.0042	0.010	450	0	0
6	16R	760.543	760.200	83.60	0.0041	0.010	525	0	0
7	17R	761.220	760.827	62.39	0.0063	0.010	450	0	0
8	18R	760.200	759.940	50.86	0.0051	0.010	525	0	0
9	19R	759.940	759.690	51.60	0.0048	0.010	525	0	0
10	21R	759.690	759.258	96.00	0.0045	0.010	525	0	0
11	23R	761.090	760.810	49.12	0.0057	0.010	300	0	0
12	24R	760.810	760.550	45.61	0.0057	0.010	300	0	0
13	29R	762.900	762.730	25.00	0.0068	0.013	375	0	0

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: North Strata Runoff Area=1.1600 ha 65.00% Impervious Runoff Depth>18 mm
Tc=10.0 min CN=92 Runoff=0.0658 m³/s 0.206 Ml

Subcatchment 2S: Fee Simple Runoff Area=0.9800 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0292 m³/s 0.112 Ml

Subcatchment 4S: South Strata Runoff Area=1.2800 ha 65.00% Impervious Runoff Depth>18 mm
Tc=10.0 min CN=92 Runoff=0.0726 m³/s 0.227 Ml

Subcatchment 6S: AREA 2 Runoff Area=0.5000 ha 0.00% Impervious Runoff Depth>5 mm
Flow Length=100.0 m Slope=0.0050 m/m Tc=15.5 min CN=79 Runoff=0.0026 m³/s 0.026 Ml

Subcatchment 7S: FOOTHILLS & Runoff Area=0.5000 ha 100.00% Impervious Runoff Depth>29 mm
Tc=5.0 min CN=98 Runoff=0.0597 m³/s 0.147 Ml

Subcatchment 8S: FOOTHILLS DITCHES Runoff Area=0.6000 ha 0.00% Impervious Runoff Depth>7 mm
Flow Length=270.0 m Slope=0.0100 m/m Tc=9.8 min CN=82 Runoff=0.0077 m³/s 0.043 Ml

Subcatchment 11S: Surrounding Area Runoff Area=10.6800 ha 0.00% Impervious Runoff Depth>5 mm
Flow Length=300.0 m Slope=0.0200 m/m Tc=13.0 min CN=79 Runoff=0.0597 m³/s 0.552 Ml

Subcatchment 14S: Phase 3 (Future Runoff Area=1.1400 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0339 m³/s 0.131 Ml

Subcatchment 15S: PHASE 1.1 Runoff Area=1.0200 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0304 m³/s 0.117 Ml

Subcatchment 21S: Phase 2.4 Runoff Area=0.5044 ha 25.26% Impervious Runoff Depth>13 mm
Tc=10.0 min CN=88 Runoff=0.0173 m³/s 0.063 Ml

Subcatchment 22S: PHASE 1.2 Runoff Area=1.5800 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0471 m³/s 0.181 Ml

Subcatchment 23S: Phase 2.1 Runoff Area=0.5500 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0164 m³/s 0.063 Ml

Subcatchment 24S: Phase 2.2 Runoff Area=0.3100 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0092 m³/s 0.036 Ml

Subcatchment 25S: Phase 2.3 Runoff Area=0.6900 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0205 m³/s 0.079 Ml

Subcatchment 26S: Phase 2.5 Runoff Area=0.4100 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0122 m³/s 0.047 Ml

Subcatchment 27S: Phase 2.6 Runoff Area=1.9000 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0566 m³/s 0.218 Ml

Subcatchment 28S: Phase 2.7 Runoff Area=0.1100 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0033 m³/s 0.013 Ml

Subcatchment 32S: Phase 4 (Future 16 Runoff Area=1.5700 ha 38.00% Impervious Runoff Depth>11 mm
Tc=10.0 min CN=87 Runoff=0.0468 m³/s 0.180 Ml

Reach 8R: DMH2982 to DMH2981 Avg. Flow Depth=0.22 m Max Vel=1.38 m/s Inflow=0.0913 m³/s 1.060 Ml
375 mm Round Pipe n=0.010 L=71.30 m S=0.0040 m/m Capacity=0.1441 m³/s Outflow=0.0900 m³/s 1.059 Ml

Reach 11R: DMH2983 to DMH2982 Avg. Flow Depth=0.19 m Max Vel=1.64 m/s Inflow=0.0921 m³/s 1.061 Ml
375 mm Round Pipe n=0.010 L=33.60 m S=0.0063 m/m Capacity=0.1802 m³/s Outflow=0.0913 m³/s 1.060 Ml

Reach 13R: DMH2981 to D869403 Avg. Flow Depth=0.28 m Max Vel=1.61 m/s Inflow=0.1669 m³/s 1.381 Ml
450 mm Round Pipe n=0.010 L=58.60 m S=0.0041 m/m Capacity=0.2372 m³/s Outflow=0.1649 m³/s 1.380 Ml

Reach 14R: D689403 to D689404 Avg. Flow Depth=0.24 m Max Vel=2.07 m/s Inflow=0.1812 m³/s 1.443 Ml
450 mm Round Pipe n=0.010 L=62.40 m S=0.0074 m/m Capacity=0.3189 m³/s Outflow=0.1791 m³/s 1.442 Ml

Reach 15R: D689505 to D689504 Avg. Flow Depth=0.33 m Max Vel=1.71 m/s Inflow=0.2176 m³/s 1.606 Ml
450 mm Round Pipe n=0.010 L=67.70 m S=0.0042 m/m Capacity=0.2401 m³/s Outflow=0.2134 m³/s 1.605 Ml

Reach 16R: D689504 to D689503 Avg. Flow Depth=0.36 m Max Vel=1.85 m/s Inflow=0.2934 m³/s 1.928 Ml
525 mm Round Pipe n=0.010 L=83.60 m S=0.0041 m/m Capacity=0.3581 m³/s Outflow=0.2892 m³/s 1.925 Ml

Reach 17R: D689404 to D689505 Avg. Flow Depth=0.25 m Max Vel=1.93 m/s Inflow=0.1791 m³/s 1.442 Ml
450 mm Round Pipe n=0.010 L=62.39 m S=0.0063 m/m Capacity=0.2942 m³/s Outflow=0.1758 m³/s 1.440 Ml

Reach 18R: D689503 to D689502 Avg. Flow Depth=0.38 m Max Vel=2.08 m/s Inflow=0.3473 m³/s 2.190 Ml
525 mm Round Pipe n=0.010 L=50.86 m S=0.0051 m/m Capacity=0.3997 m³/s Outflow=0.3446 m³/s 2.189 Ml

Reach 19R: D689502 to D689501 Avg. Flow Depth=0.39 m Max Vel=2.03 m/s Inflow=0.3473 m³/s 2.201 Ml
525 mm Round Pipe n=0.010 L=51.60 m S=0.0048 m/m Capacity=0.3892 m³/s Outflow=0.3439 m³/s 2.200 Ml

Reach 21R: D689501 to DMH Avg. Flow Depth=0.39 m Max Vel=1.96 m/s Inflow=0.3439 m³/s 2.200 Ml
525 mm Round Pipe n=0.010 L=96.00 m S=0.0045 m/m Capacity=0.3750 m³/s Outflow=0.3376 m³/s 2.197 Ml

Reach 23R: D689601 to DMH3 Avg. Flow Depth=0.19 m Max Vel=1.46 m/s Inflow=0.0676 m³/s 0.260 Ml
300 mm Round Pipe n=0.010 L=49.12 m S=0.0057 m/m Capacity=0.0949 m³/s Outflow=0.0666 m³/s 0.260 Ml

Reach 24R: DMH3 to D689504 Avg. Flow Depth=0.22 m Max Vel=1.51 m/s Inflow=0.0836 m³/s 0.323 Ml
300 mm Round Pipe n=0.010 L=45.61 m S=0.0057 m/m Capacity=0.0949 m³/s Outflow=0.0823 m³/s 0.323 Ml

Pond 6P: North Pond Peak Elev=763.423 m Storage=67.7 m³ Inflow=0.0658 m³/s 0.206 Ml
Outflow=0.0090 m³/s 0.204 Ml

Pond 7P: South Pond Peak Elev=763.586 m Storage=0.312 Ml Inflow=0.1122 m³/s 0.778 Ml
Outflow=0.0102 m³/s 0.555 Ml

Pond 29R: Proposed Pipe Peak Elev=763.095 m Inflow=0.0415 m³/s 0.871 Ml
375 mm Round Culvert n=0.013 L=25.00 m S=0.0068 m/m Outflow=0.0415 m³/s 0.871 Ml

Total Runoff Area = 25.4844 ha Runoff Volume = 2.439 Ml Average Runoff Depth = 10 mm
76.02% Pervious = 19.3722 ha 23.98% Impervious = 6.1122 ha

Summary for Subcatchment 1S: North Strata

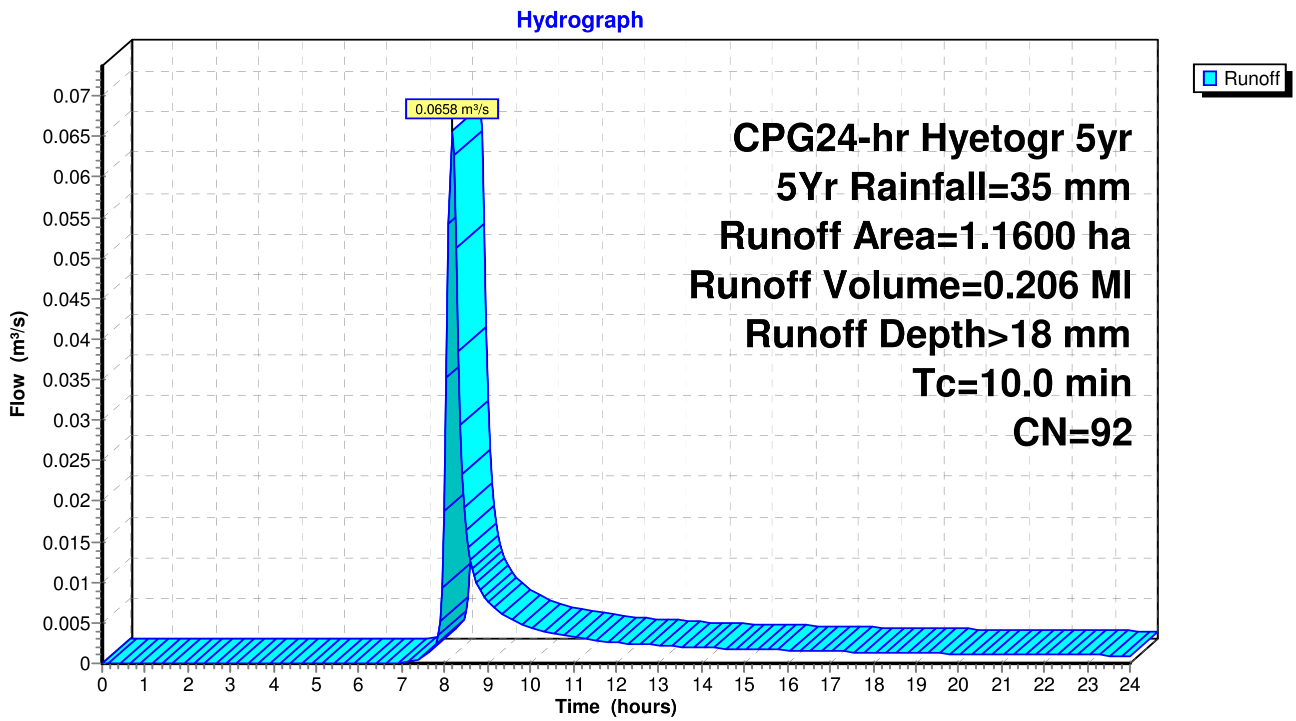
Runoff = 0.0658 m³/s @ 8.17 hrs, Volume= 0.206 Ml, Depth> 18 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
1.1600	92	1/8 acre lots, 65% imp, HSG D
0.4060		35.00% Pervious Area
0.7540		65.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 1S: North Strata



Summary for Subcatchment 2S: Fee Simple

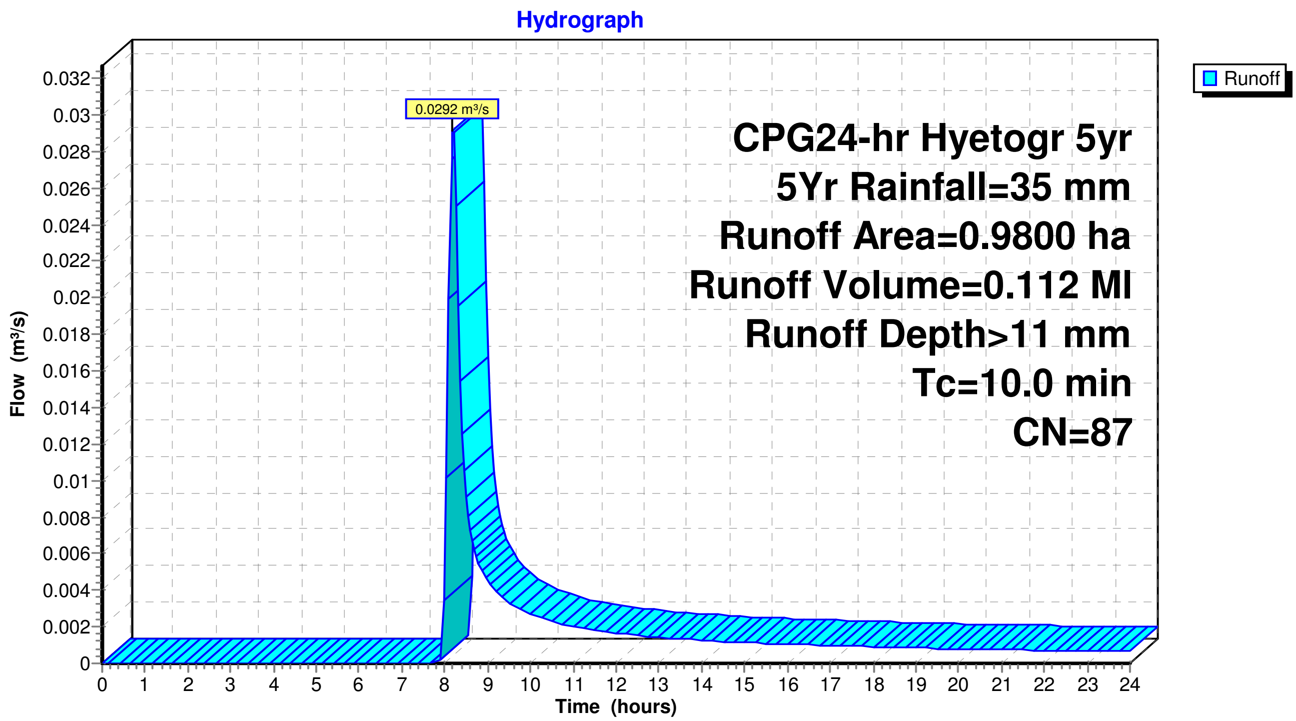
Runoff = 0.0292 m³/s @ 8.19 hrs, Volume= 0.112 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.9800	87	1/4 acre lots, 38% imp, HSG D
0.6076		62.00% Pervious Area
0.3724		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 2S: Fee Simple



Summary for Subcatchment 4S: South Strata

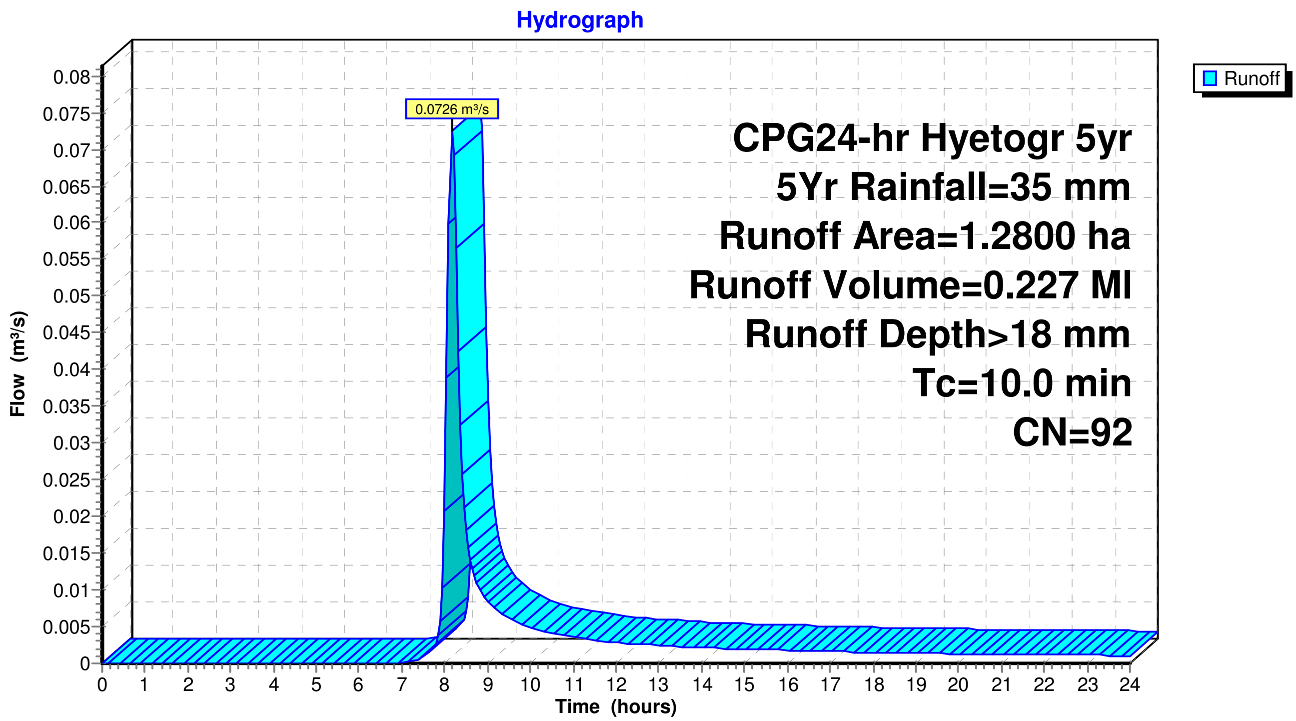
Runoff = 0.0726 m³/s @ 8.17 hrs, Volume= 0.227 Ml, Depth> 18 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
1.2800	92	1/8 acre lots, 65% imp, HSG D
0.4480		35.00% Pervious Area
0.8320		65.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 4S: South Strata



Summary for Subcatchment 6S: AREA 2

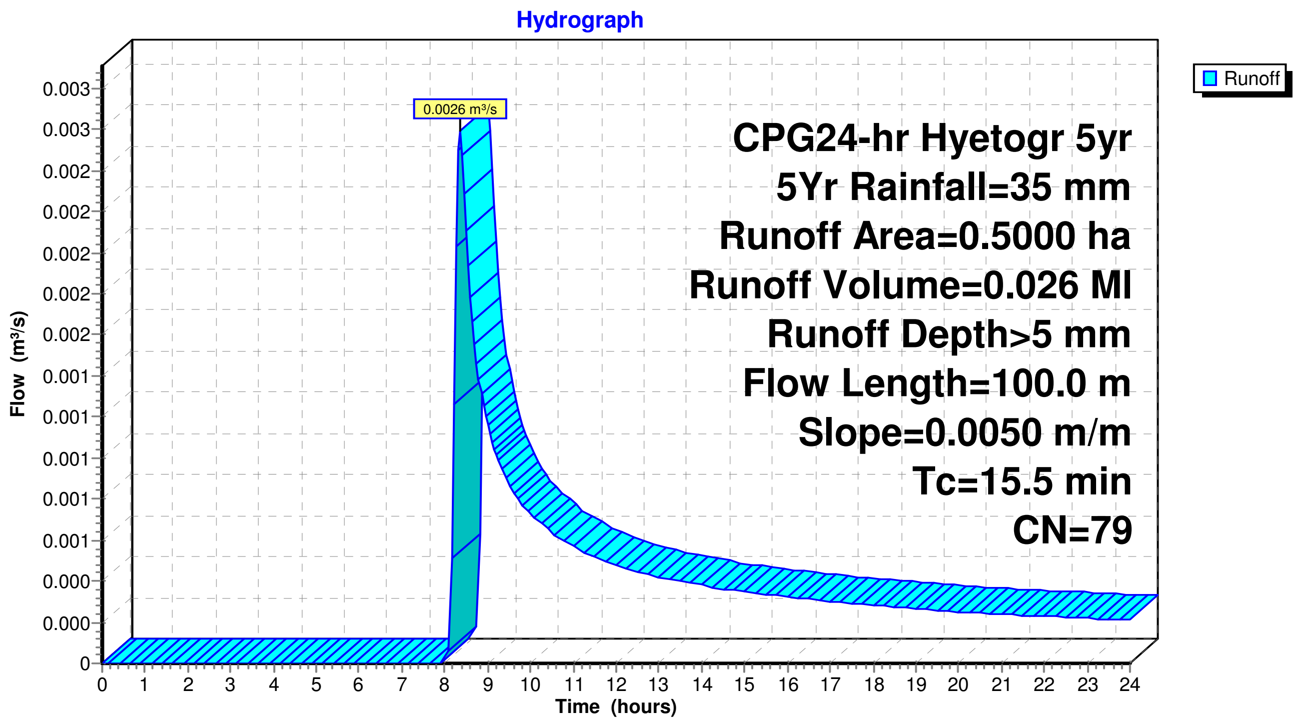
Runoff = 0.0026 m³/s @ 8.35 hrs, Volume= 0.026 Ml, Depth> 5 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.5000	79	Woods, Fair, HSG D
0.5000		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.5	100.0	0.0050	0.11		**Shallow Concentrated Flow,** Woodland Kv= 1.52 m/s

Subcatchment 6S: AREA 2



Summary for Subcatchment 7S: FOOTHILLS & WOODVALLEY GATE PAVED

[49] Hint: Tc<2dt may require smaller dt

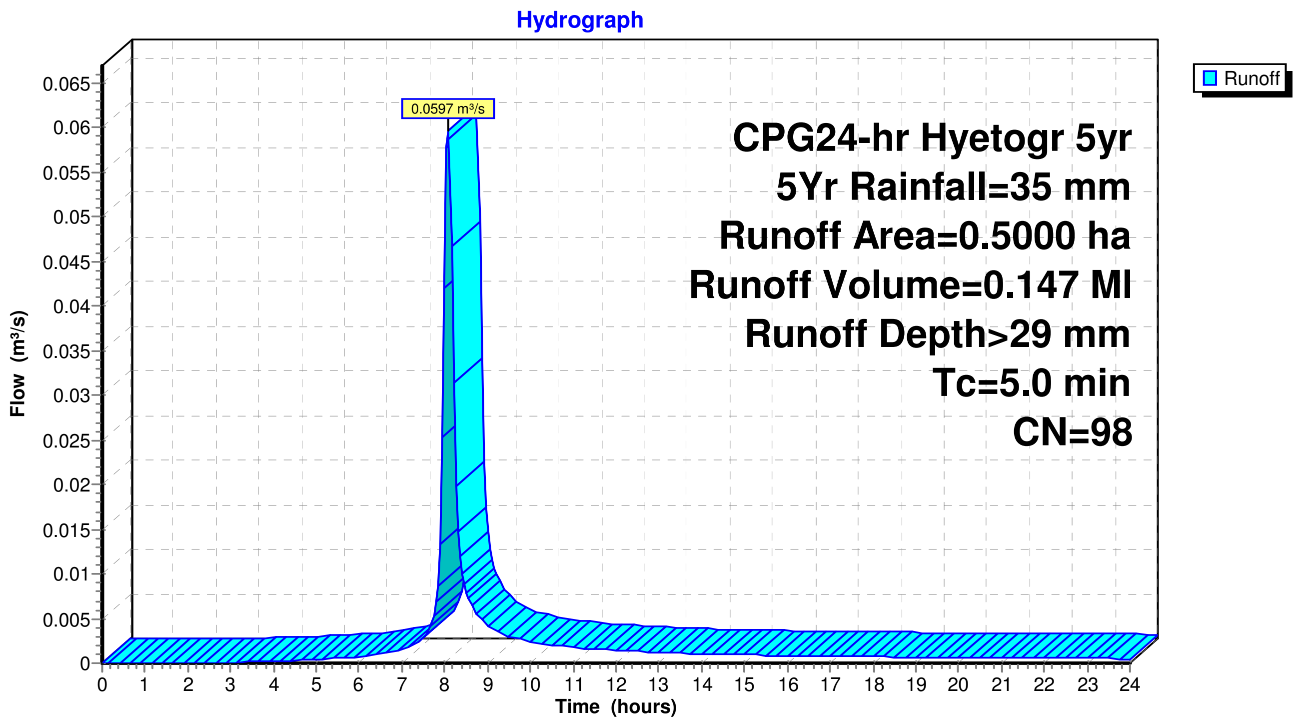
Runoff = 0.0597 m³/s @ 8.08 hrs, Volume= 0.147 Ml, Depth> 29 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.5000	98	Paved parking, HSG D
0.5000		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
5.0					**Direct Entry,**

Subcatchment 7S: FOOTHILLS & WOODVALLEY GATE PAVED



Summary for Subcatchment 8S: FOOTHILLS DITCHES

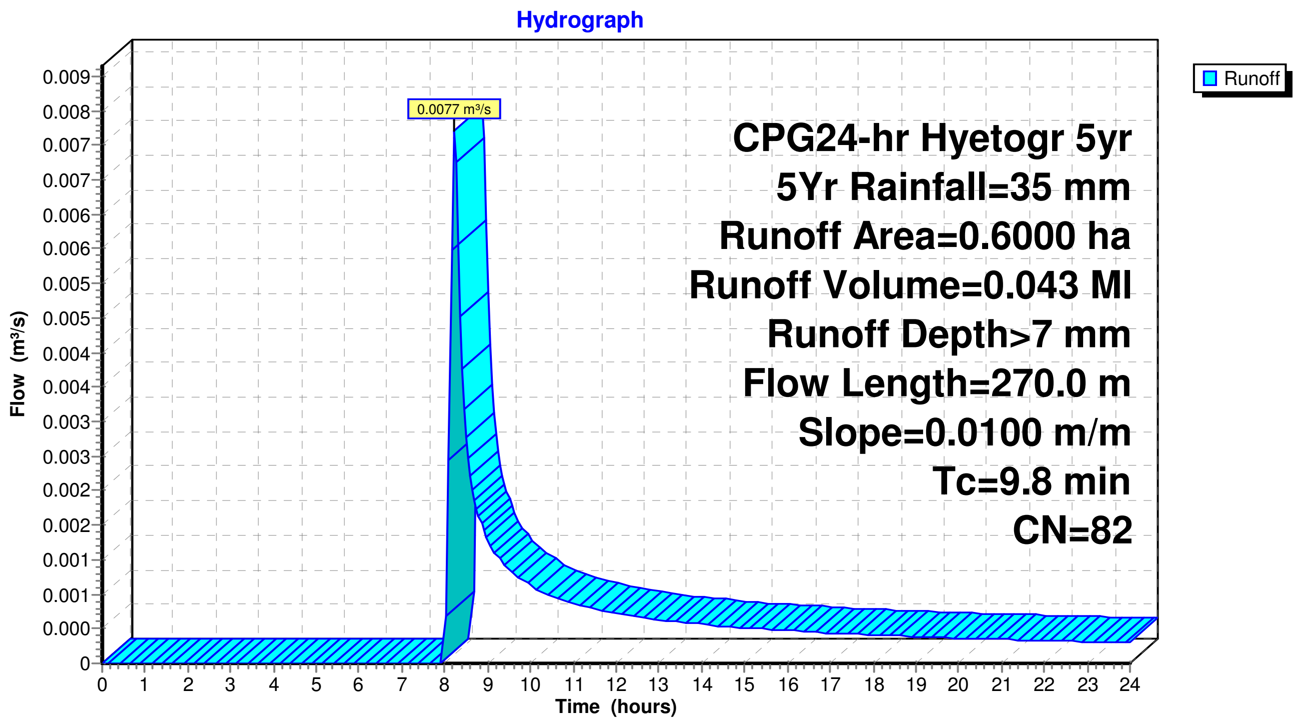
Runoff = 0.0077 m³/s @ 8.22 hrs, Volume= 0.043 Ml, Depth> 7 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.6000	82	Woods/grass comb., Fair, HSG D
0.6000		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
9.8	270.0	0.0100	0.46		**Shallow Concentrated Flow,** Grassed Waterway Kv= 4.57 m/s

Subcatchment 8S: FOOTHILLS DITCHES



Summary for Subcatchment 11S: Surrounding Area

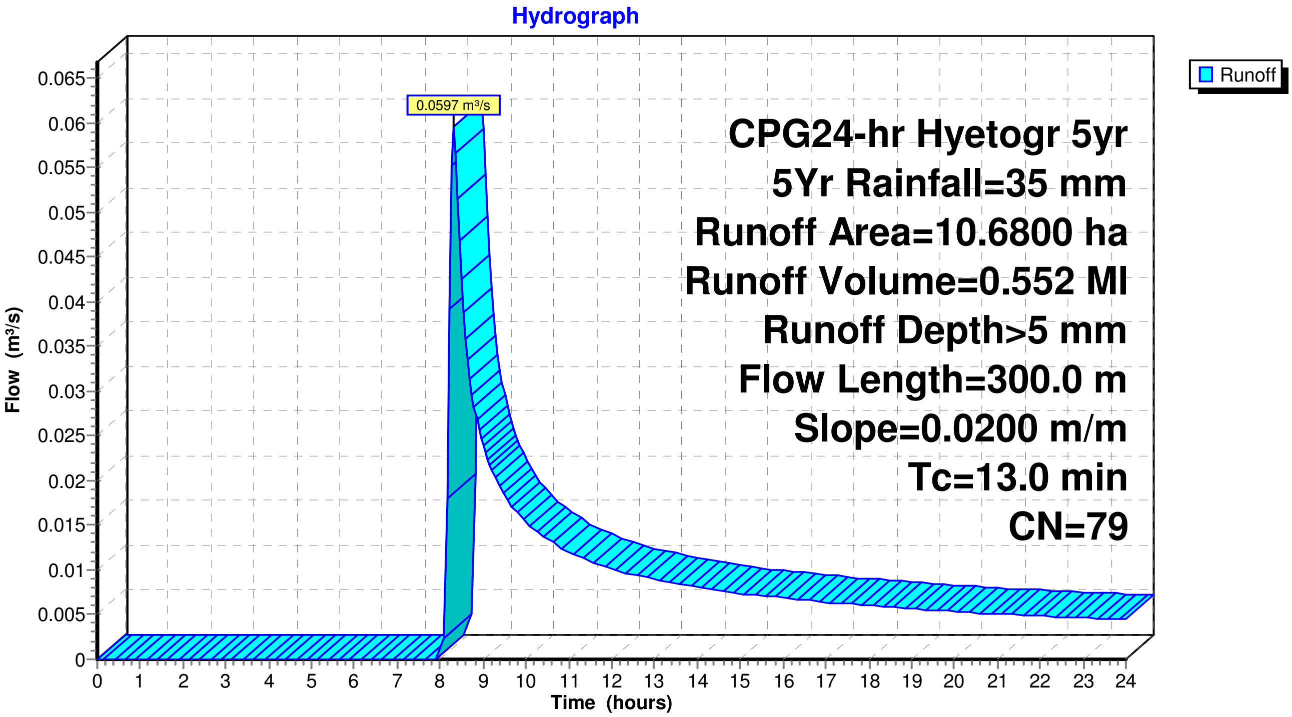
Runoff = 0.0597 m³/s @ 8.30 hrs, Volume= 0.552 Ml, Depth> 5 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
10.6800	79	Woods, Fair, HSG D
10.6800		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
5.2	200.0	0.0200	0.65		**Shallow Concentrated Flow,** Grassed Waterway Kv= 4.57 m/s
7.8	100.0	0.0200	0.21		**Shallow Concentrated Flow,** Woodland Kv= 1.52 m/s
13.0	300.0	Total			

Subcatchment 11S: Surrounding Area



Summary for Subcatchment 14S: Phase 3 (Future cul-de-sac)

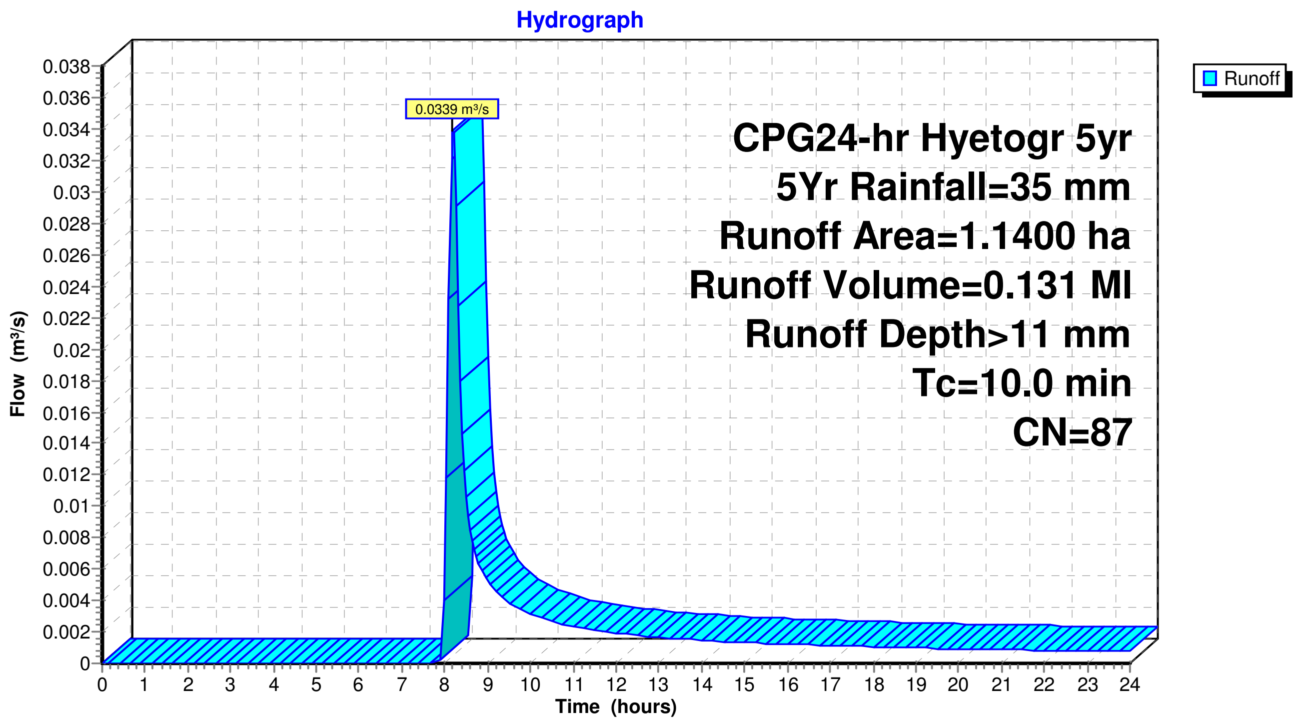
Runoff = 0.0339 m³/s @ 8.19 hrs, Volume= 0.131 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
1.1400	87	1/4 acre lots, 38% imp, HSG D
0.7068		62.00% Pervious Area
0.4332		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 14S: Phase 3 (Future cul-de-sac)



Summary for Subcatchment 15S: PHASE 1.1 WOODLANDS

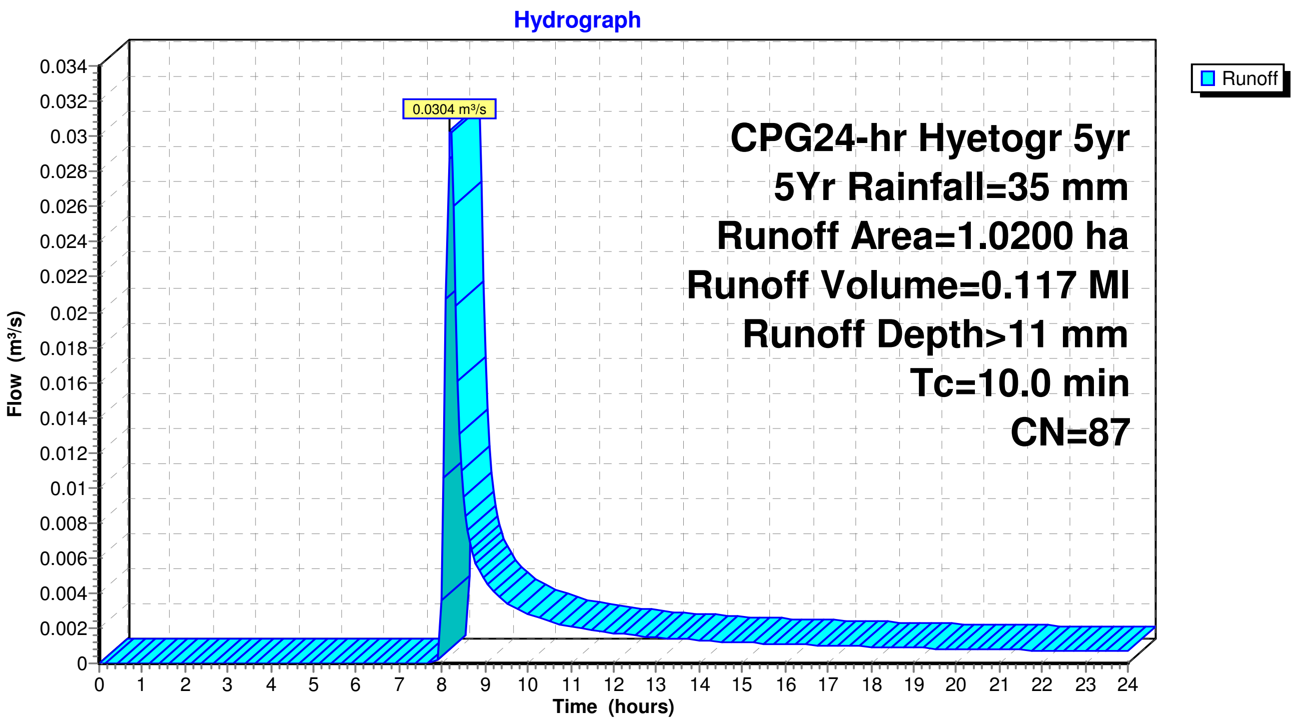
Runoff = 0.0304 m³/s @ 8.19 hrs, Volume= 0.117 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
1.0200	87	1/4 acre lots, 38% imp, HSG D
0.6324		62.00% Pervious Area
0.3876		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 15S: PHASE 1.1 WOODLANDS



Summary for Subcatchment 21S: Phase 2.4 Woodlands

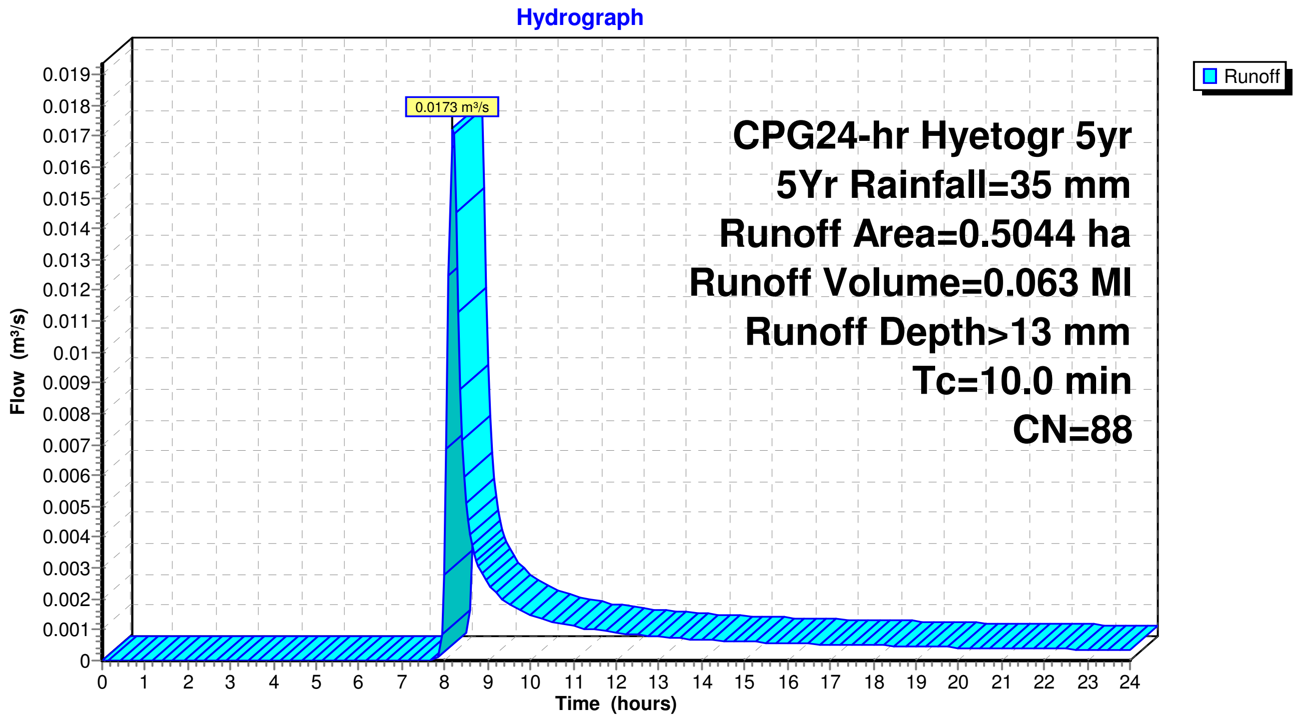
Runoff = 0.0173 m³/s @ 8.18 hrs, Volume= 0.063 Ml, Depth> 13 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.1274	98	Roofs, HSG D
0.3770	84	50-75% Grass cover, Fair, HSG D
0.5044	88	Weighted Average
0.3770		74.74% Pervious Area
0.1274		25.26% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 21S: Phase 2.4 Woodlands



Summary for Subcatchment 22S: PHASE 1.2 WOODLANDS

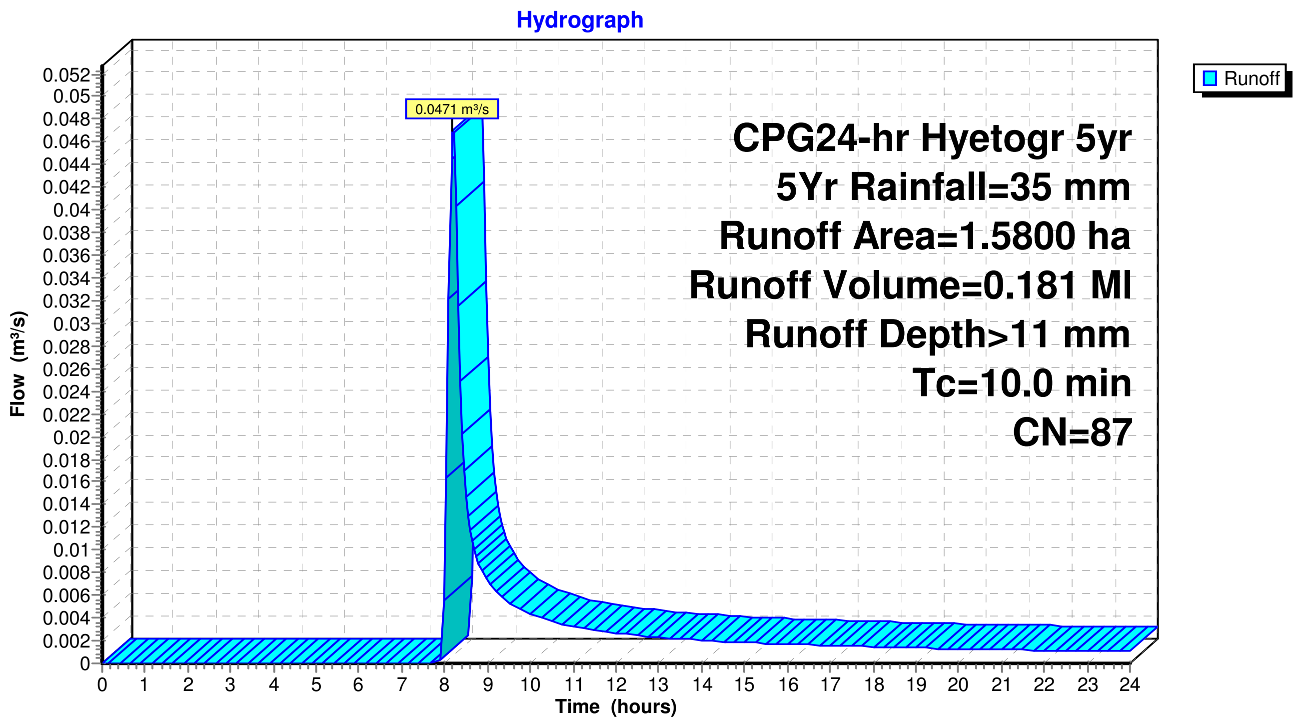
Runoff = 0.0471 m³/s @ 8.19 hrs, Volume= 0.181 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
1.5800	87	1/4 acre lots, 38% imp, HSG D
0.9796		62.00% Pervious Area
0.6004		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 22S: PHASE 1.2 WOODLANDS



Summary for Subcatchment 23S: Phase 2.1 Woodlands

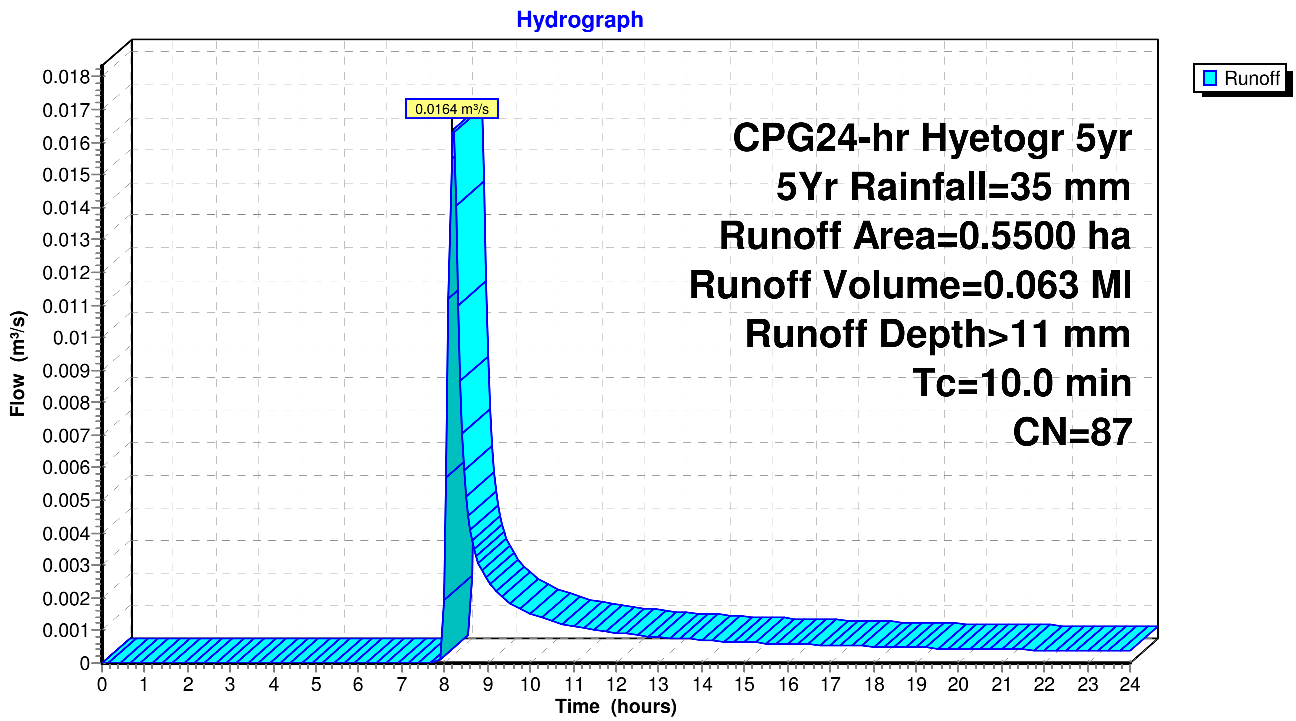
Runoff = 0.0164 m³/s @ 8.19 hrs, Volume= 0.063 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.5500	87	1/4 acre lots, 38% imp, HSG D
0.3410		62.00% Pervious Area
0.2090		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 23S: Phase 2.1 Woodlands



Summary for Subcatchment 24S: Phase 2.2 Woodlands

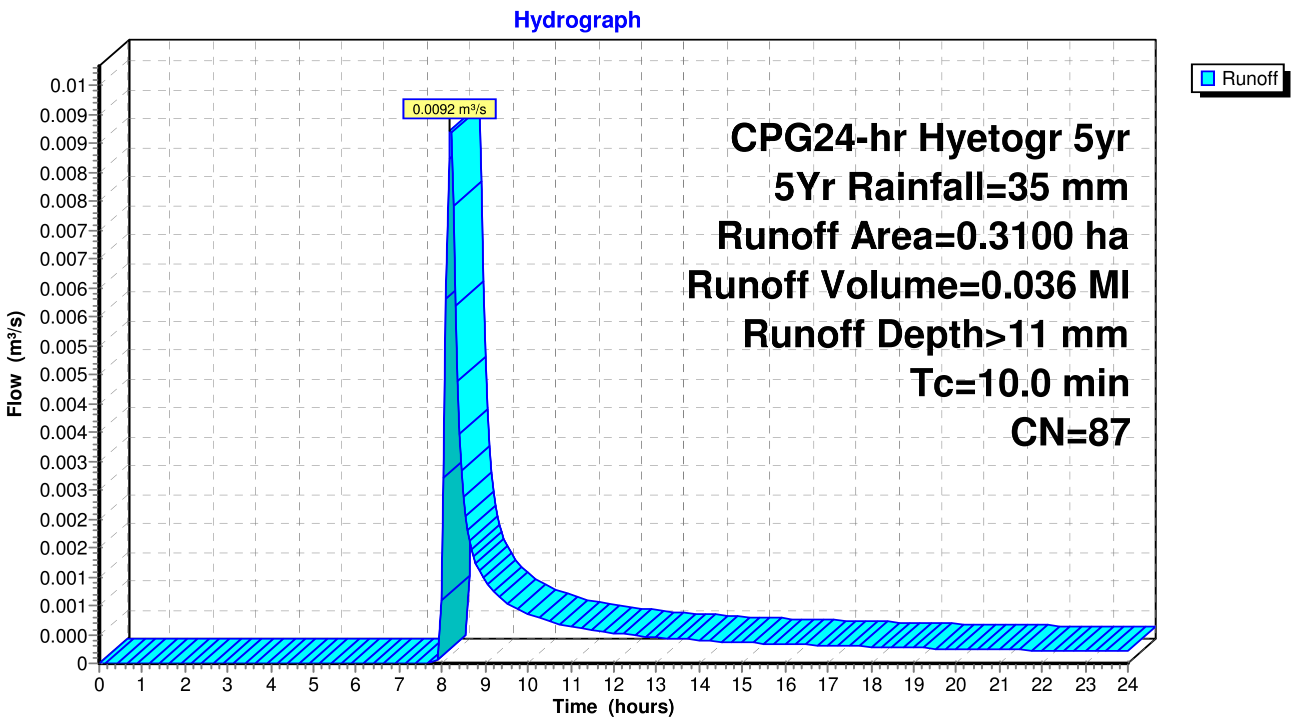
Runoff = 0.0092 m³/s @ 8.19 hrs, Volume= 0.036 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.3100	87	1/4 acre lots, 38% imp, HSG D
0.1922		62.00% Pervious Area
0.1178		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 24S: Phase 2.2 Woodlands



Summary for Subcatchment 25S: Phase 2.3 Woodlands

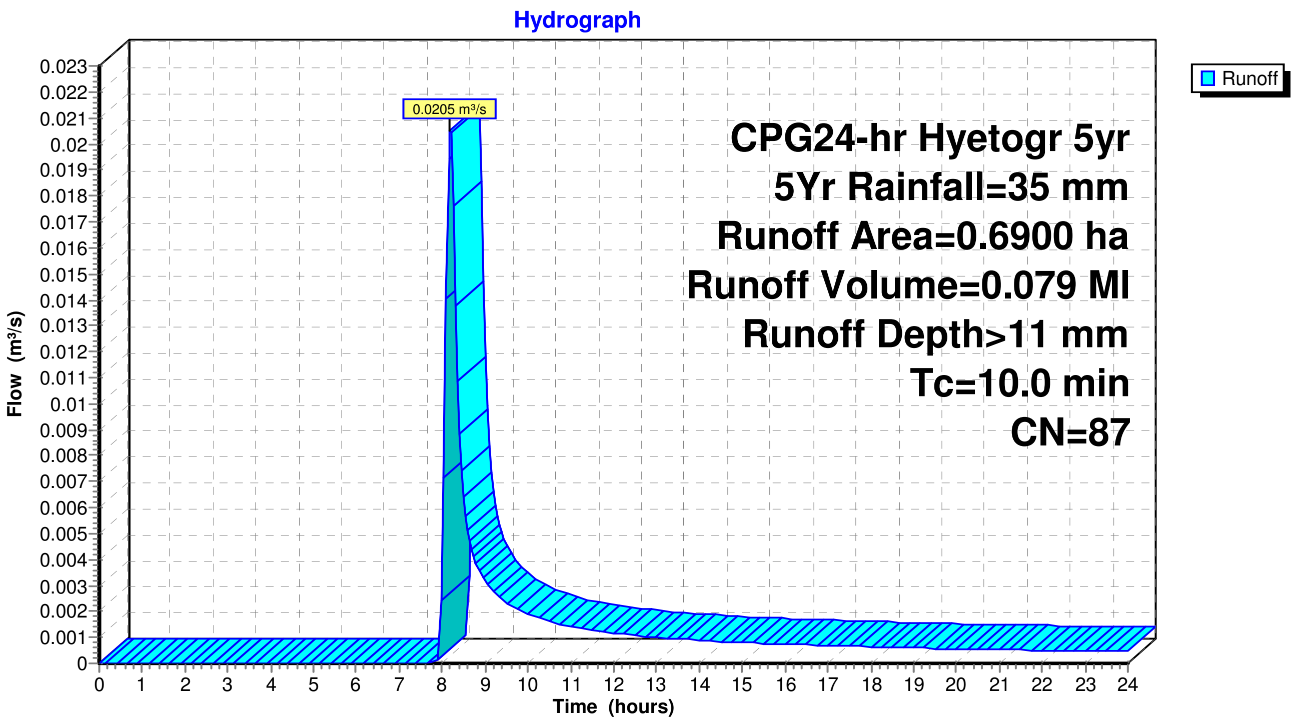
Runoff = 0.0205 m³/s @ 8.19 hrs, Volume= 0.079 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.6900	87	1/4 acre lots, 38% imp, HSG D
0.4278		62.00% Pervious Area
0.2622		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 25S: Phase 2.3 Woodlands



Summary for Subcatchment 26S: Phase 2.5 Woodlands

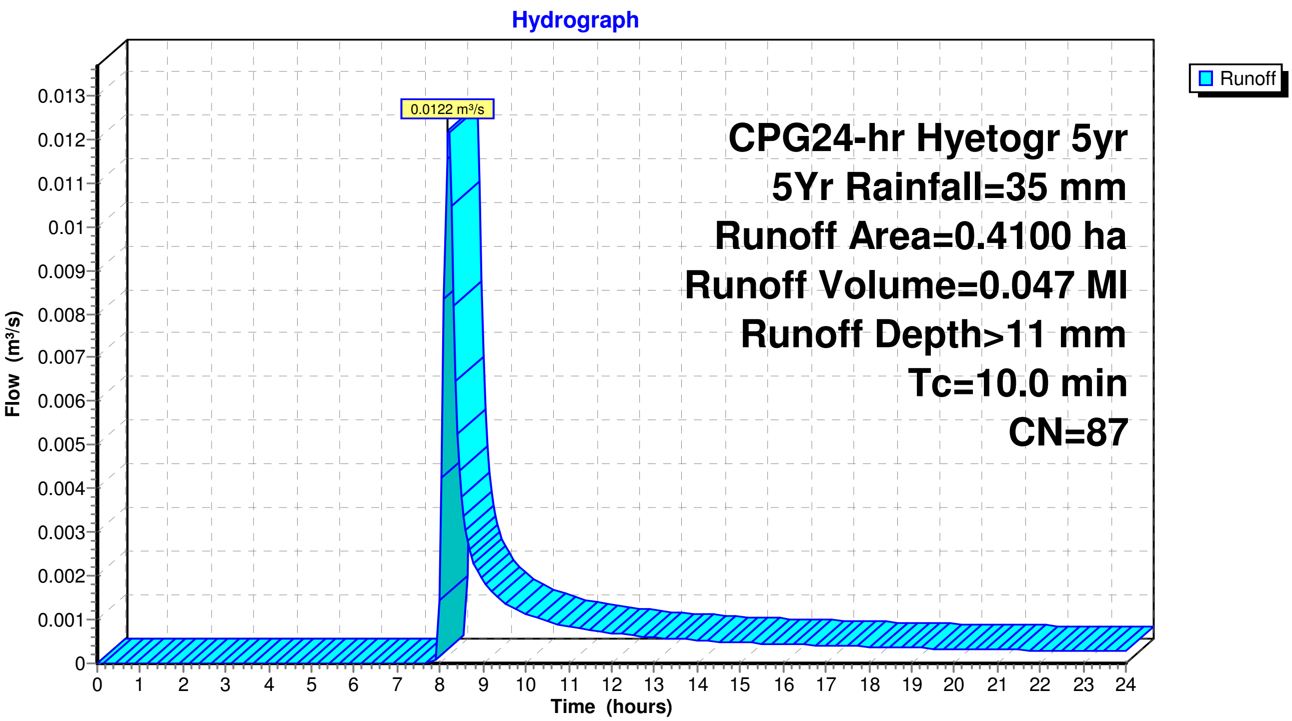
Runoff = 0.0122 m³/s @ 8.19 hrs, Volume= 0.047 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.4100	87	1/4 acre lots, 38% imp, HSG D
0.2542		62.00% Pervious Area
0.1558		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 26S: Phase 2.5 Woodlands



Summary for Subcatchment 27S: Phase 2.6 Woodlands

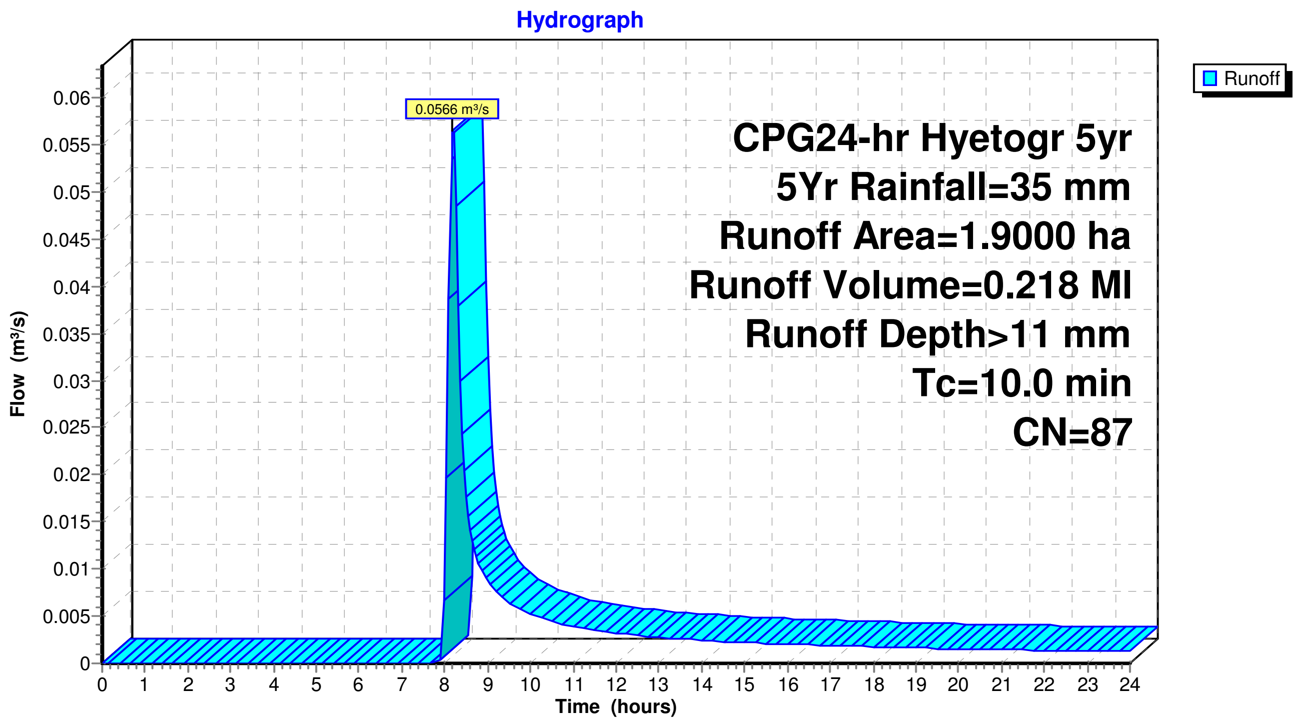
Runoff = 0.0566 m³/s @ 8.19 hrs, Volume= 0.218 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
1.9000	87	1/4 acre lots, 38% imp, HSG D
1.1780		62.00% Pervious Area
0.7220		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 27S: Phase 2.6 Woodlands



Summary for Subcatchment 28S: Phase 2.7 Woodlands

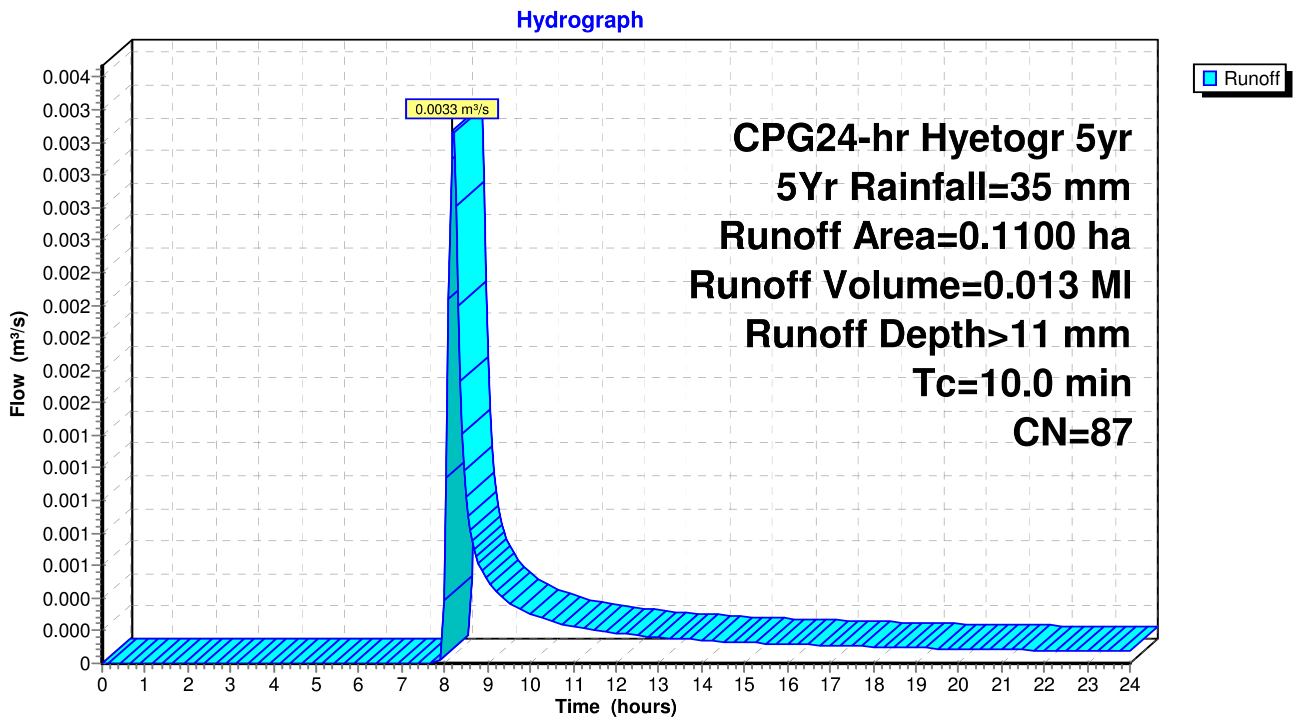
Runoff = 0.0033 m³/s @ 8.19 hrs, Volume= 0.013 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
0.1100	87	1/4 acre lots, 38% imp, HSG D
0.0682		62.00% Pervious Area
0.0418		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 28S: Phase 2.7 Woodlands



Summary for Subcatchment 32S: Phase 4 (Future 16 Lots)

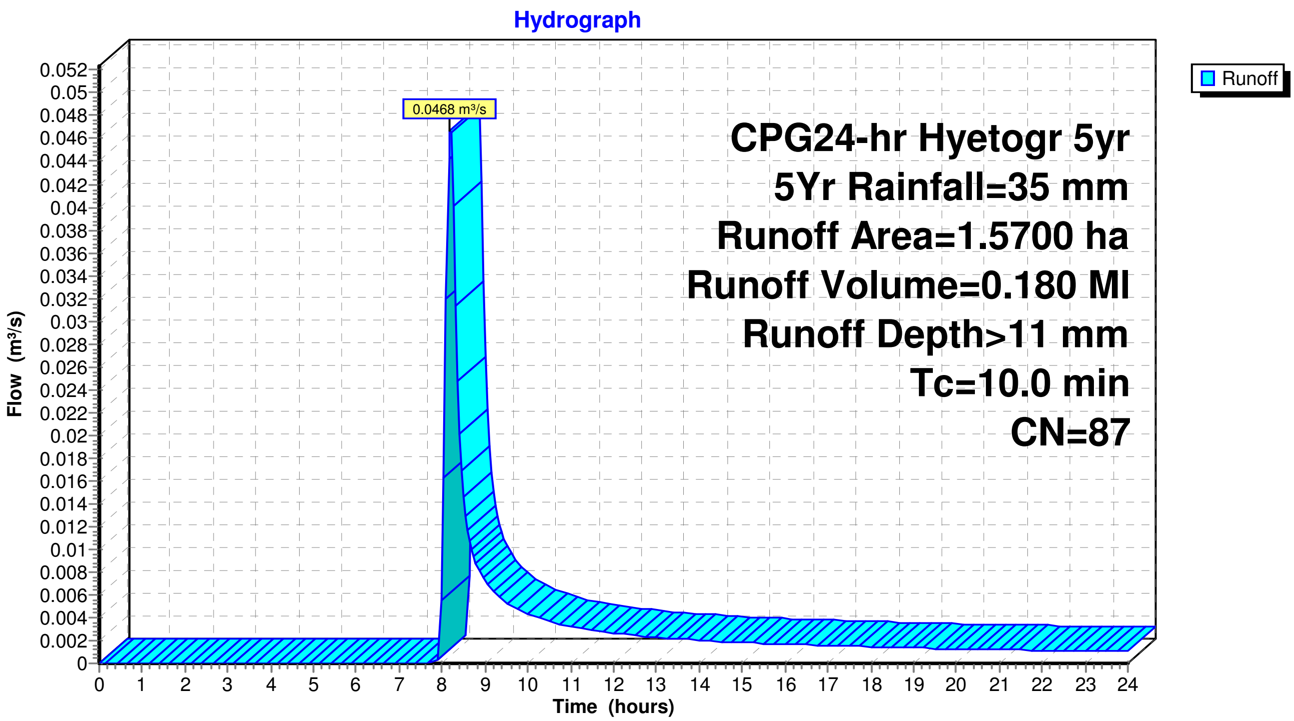
Runoff = 0.0468 m³/s @ 8.19 hrs, Volume= 0.180 Ml, Depth> 11 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 5yr 5Yr Rainfall=35 mm

Area (ha)	CN	Description
1.5700	87	1/4 acre lots, 38% imp, HSG D
0.9734		62.00% Pervious Area
0.5966		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 32S: Phase 4 (Future 16 Lots)



Summary for Reach 8R: DMH2982 to DMH2981

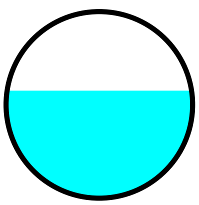
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 11R outlet invert by 0.167 m @ 8.15 hrs

Inflow Area = 15.2000 ha, 16.17% Impervious, Inflow Depth > 7 mm for 5Yr event
Inflow = 0.0913 m^3/s @ 8.14 hrs, Volume= 1.060 Ml
Outflow = 0.0900 m^3/s @ 8.17 hrs, Volume= 1.059 Ml, Atten= 1%, Lag= 1.6 min

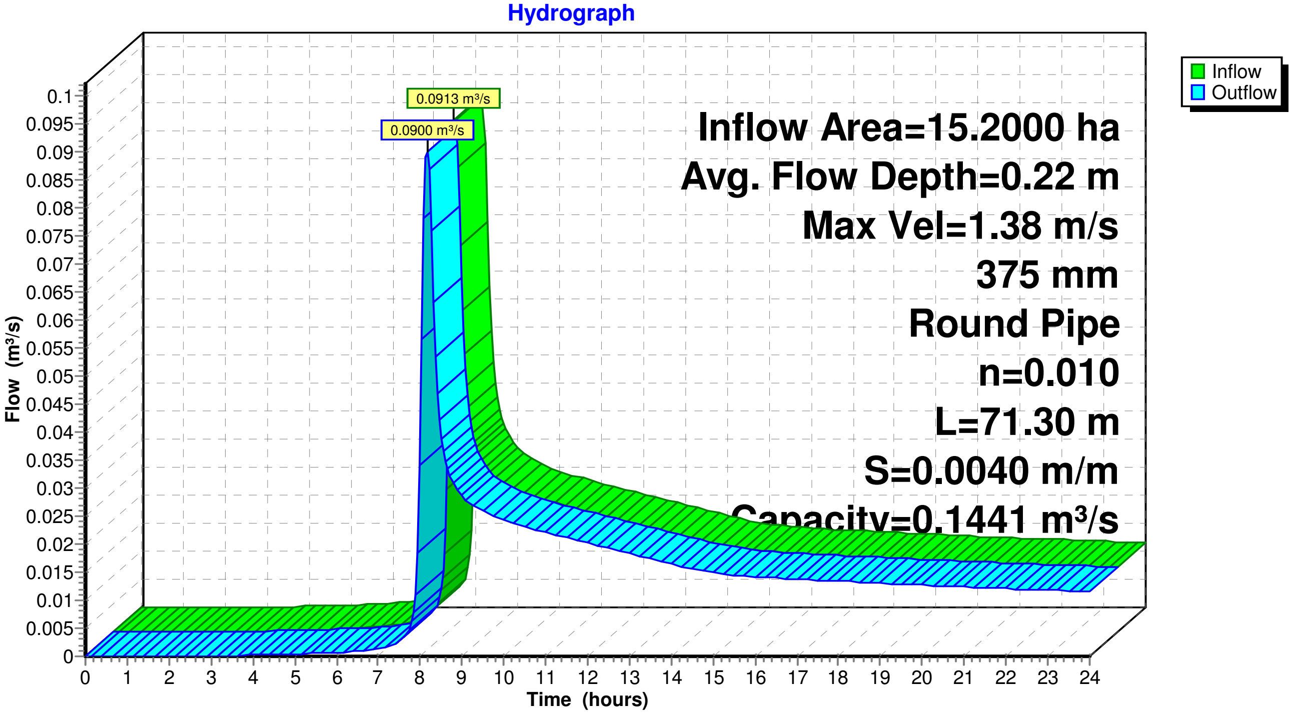
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.38 m/s, Min. Travel Time= 0.9 min
Avg. Velocity = 0.74 m/s, Avg. Travel Time= 1.6 min

Peak Storage= 4.7 m^3 @ 8.15 hrs
Average Depth at Peak Storage= 0.22 m
Bank-Full Depth= 0.38 m Flow Area= 0.11 m^2, Capacity= 0.1441 m^3/s

375 mm Round Pipe
n= 0.010
Length= 71.30 m Slope= 0.0040 m/m
Inlet Invert= 762.450 m, Outlet Invert= 762.165 m



Reach 8R: DMH2982 to DMH2981



Summary for Reach 11R: DMH2983 to DMH2982

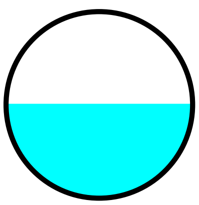
[52] Hint: Inlet/Outlet conditions not evaluated
[79] Warning: Submerged Pond 29R Primary device # 1 OUTLET by 0.169 m

Inflow Area = 15.2000 ha, 16.17% Impervious, Inflow Depth > 7 mm for 5Yr event
Inflow = 0.0921 m³/s @ 8.13 hrs, Volume= 1.061 Ml
Outflow = 0.0913 m³/s @ 8.14 hrs, Volume= 1.060 Ml, Atten= 1%, Lag= 0.7 min

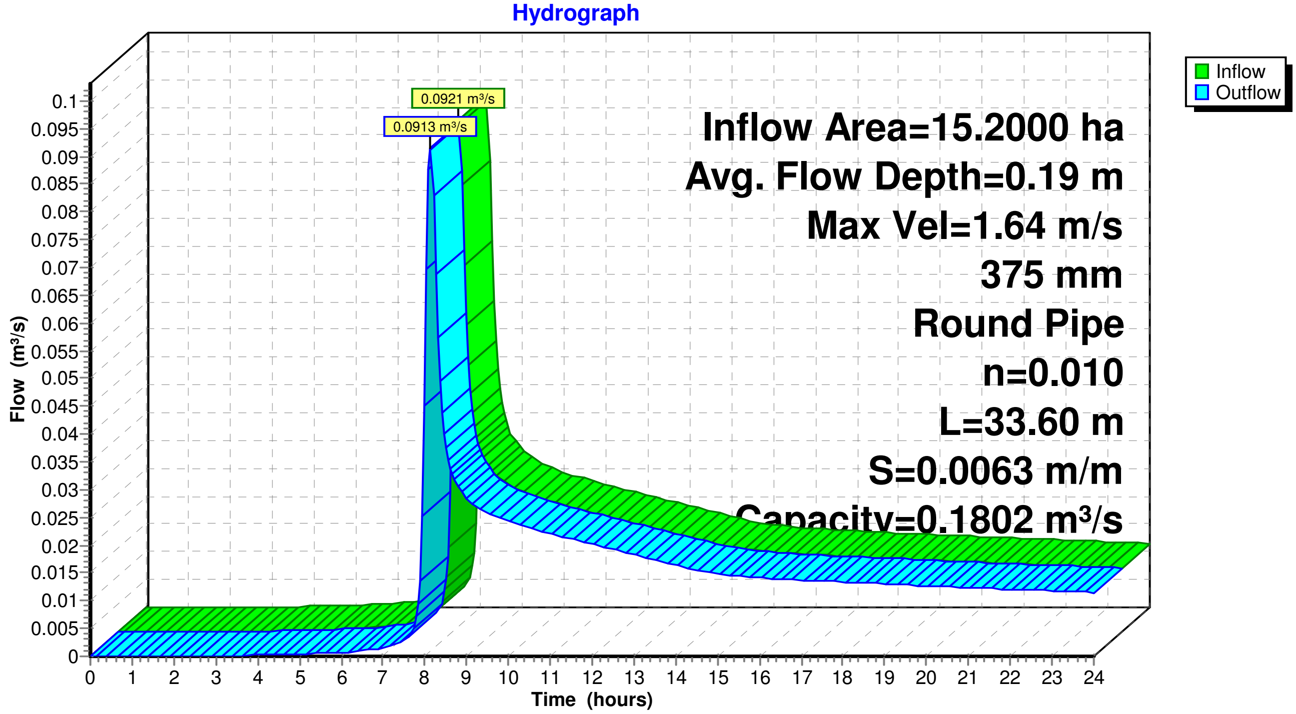
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.64 m/s, Min. Travel Time= 0.3 min
Avg. Velocity = 0.87 m/s, Avg. Travel Time= 0.6 min

Peak Storage= 1.9 m³ @ 8.13 hrs
Average Depth at Peak Storage= 0.19 m
Bank-Full Depth= 0.38 m Flow Area= 0.11 m², Capacity= 0.1802 m³/s

375 mm Round Pipe
n= 0.010
Length= 33.60 m Slope= 0.0063 m/m
Inlet Invert= 762.710 m, Outlet Invert= 762.500 m



Reach 11R: DMH2983 to DMH2982



Summary for Reach 13R: DMH2981 to D869403

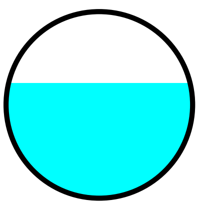
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 8R OUTLET depth by 0.015 m @ 8.25 hrs

Inflow Area = 18.2900 ha, 18.82% Impervious, Inflow Depth > 8 mm for 5Yr event
Inflow = 0.1669 m^3/s @ 8.18 hrs, Volume= 1.381 Ml
Outflow = 0.1649 m^3/s @ 8.20 hrs, Volume= 1.380 Ml, Atten= 1%, Lag= 1.2 min

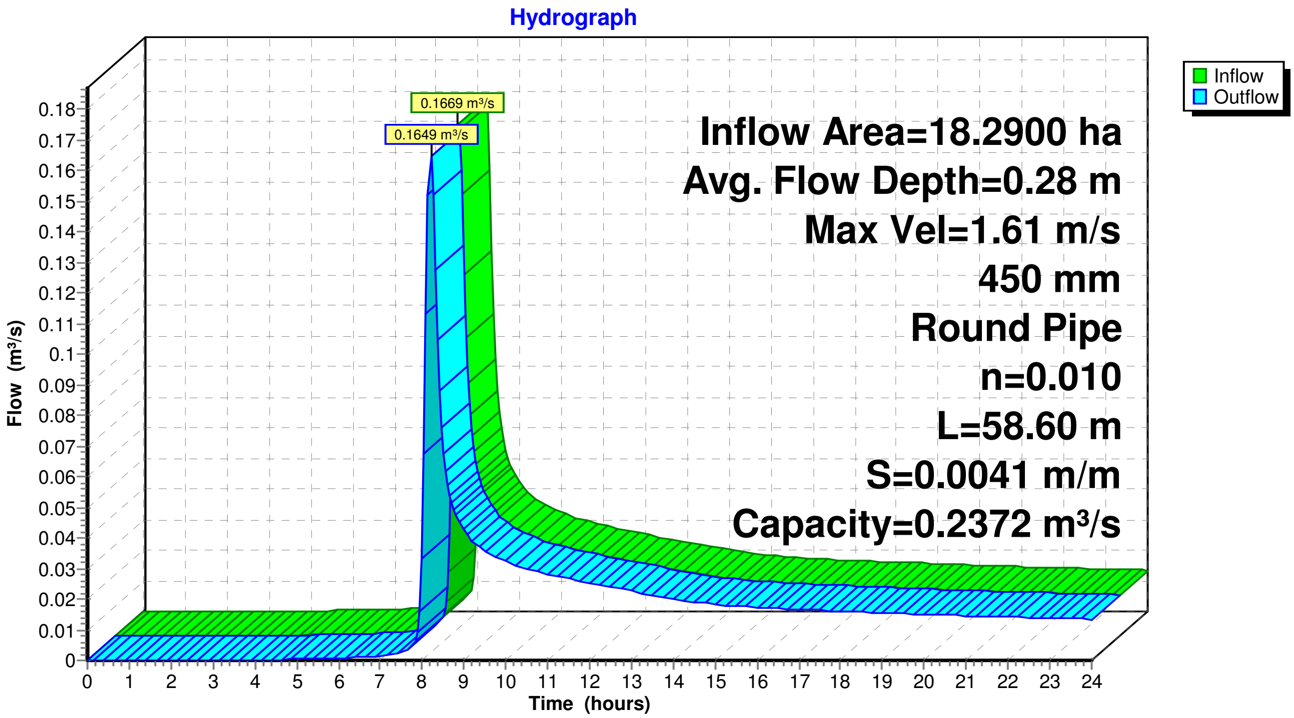
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.61 m/s, Min. Travel Time= 0.6 min
Avg. Velocity = 0.78 m/s, Avg. Travel Time= 1.2 min

Peak Storage= 6.1 m^3 @ 8.19 hrs
Average Depth at Peak Storage= 0.28 m
Bank-Full Depth= 0.45 m Flow Area= 0.16 m^2, Capacity= 0.2372 m^3/s

450 mm Round Pipe
n= 0.010 PVC, smooth interior
Length= 58.60 m Slope= 0.0041 m/m
Inlet Invert= 762.110 m, Outlet Invert= 761.870 m



Reach 13R: DMH2981 to D869403



Summary for Reach 14R: D689403 to D689404

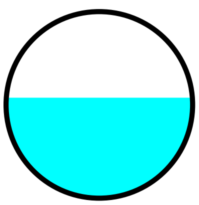
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 13R outlet invert by 0.063 m @ 8.20 hrs

Inflow Area = 18.8400 ha, 19.38% Impervious, Inflow Depth > 8 mm for 5Yr event
Inflow = 0.1812 m^3/s @ 8.20 hrs, Volume= 1.443 Ml
Outflow = 0.1791 m^3/s @ 8.21 hrs, Volume= 1.442 Ml, Atten= 1%, Lag= 0.9 min

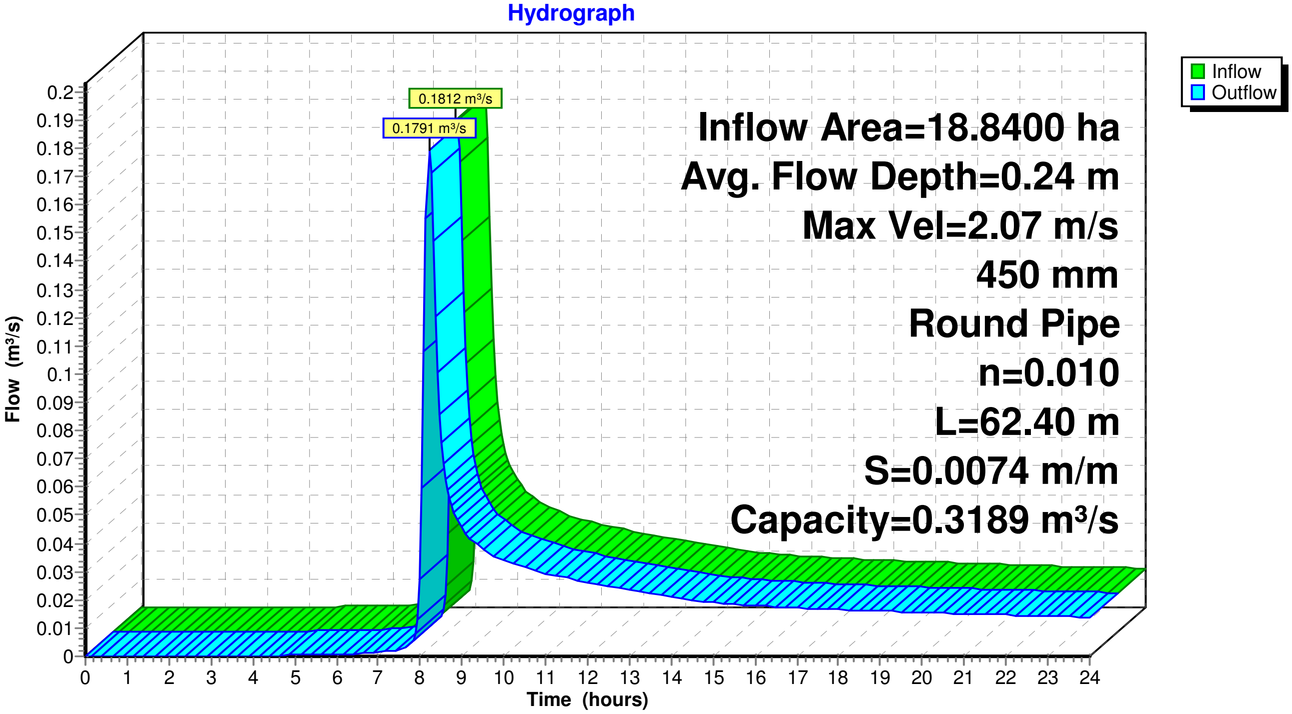
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.07 m/s, Min. Travel Time= 0.5 min
Avg. Velocity = 0.98 m/s, Avg. Travel Time= 1.1 min

Peak Storage= 5.5 m^3 @ 8.21 hrs
Average Depth at Peak Storage= 0.24 m
Bank-Full Depth= 0.45 m Flow Area= 0.16 m^2, Capacity= 0.3189 m^3/s

450 mm Round Pipe
n= 0.010
Length= 62.40 m Slope= 0.0074 m/m
Inlet Invert= 761.690 m, Outlet Invert= 761.228 m



Reach 14R: D689403 to D689404



Summary for Reach 15R: D689505 to D689504

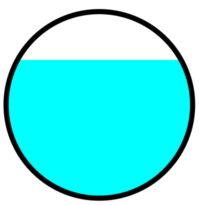
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 17R OUTLET depth by 0.082 m @ 8.25 hrs

Inflow Area = 20.2900 ha, 20.71% Impervious, Inflow Depth > 8 mm for 5Yr event
Inflow = 0.2176 m³/s @ 8.22 hrs, Volume= 1.606 Ml
Outflow = 0.2134 m³/s @ 8.24 hrs, Volume= 1.605 Ml, Atten= 2%, Lag= 1.4 min

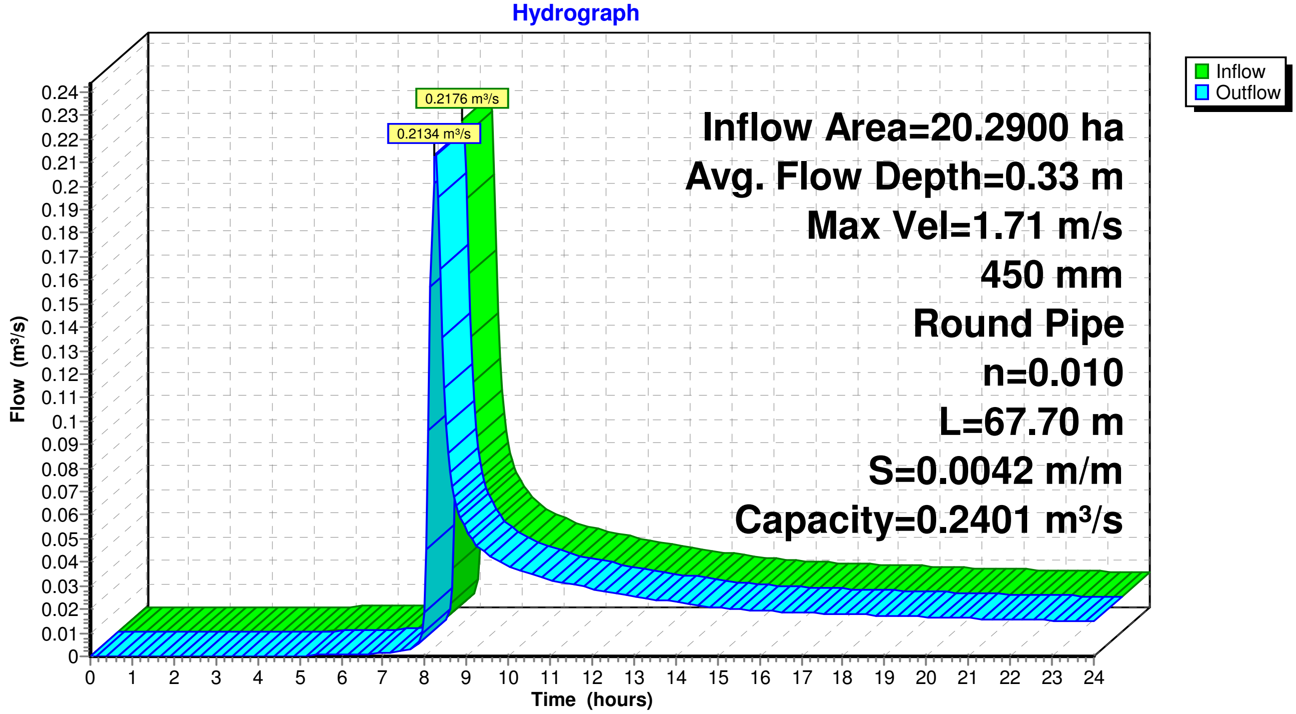
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.71 m/s, Min. Travel Time= 0.7 min
Avg. Velocity = 0.82 m/s, Avg. Travel Time= 1.4 min

Peak Storage= 8.6 m³ @ 8.23 hrs
Average Depth at Peak Storage= 0.33 m
Bank-Full Depth= 0.45 m Flow Area= 0.16 m², Capacity= 0.2401 m³/s

450 mm Round Pipe
n= 0.010
Length= 67.70 m Slope= 0.0042 m/m
Inlet Invert= 760.827 m, Outlet Invert= 760.543 m



Reach 15R: D689505 to D689504



Summary for Reach 16R: D689504 to D689503

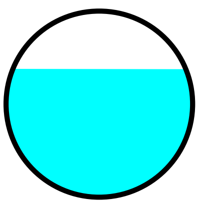
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 15R OUTLET depth by 0.038 m @ 8.30 hrs
[62] Hint: Exceeded Reach 24R OUTLET depth by 0.154 m @ 8.30 hrs

Inflow Area = 23.0644 ha, 22.51% Impervious, Inflow Depth > 8 mm for 5Yr event
Inflow = 0.2934 m³/s @ 8.24 hrs, Volume= 1.928 Ml
Outflow = 0.2892 m³/s @ 8.26 hrs, Volume= 1.925 Ml, Atten= 1%, Lag= 1.5 min

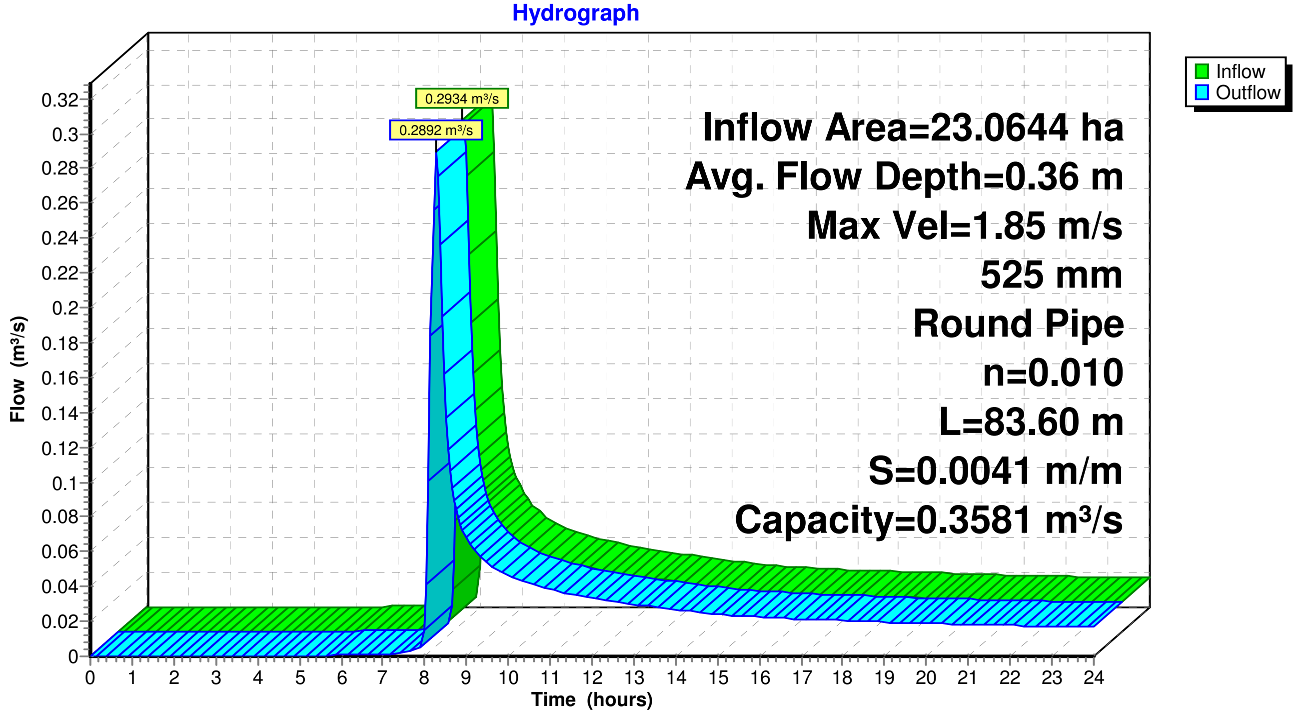
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.85 m/s, Min. Travel Time= 0.8 min
Avg. Velocity = 0.84 m/s, Avg. Travel Time= 1.7 min

Peak Storage= 13.3 m³ @ 8.25 hrs
Average Depth at Peak Storage= 0.36 m
Bank-Full Depth= 0.53 m Flow Area= 0.22 m², Capacity= 0.3581 m³/s

525 mm Round Pipe
n= 0.010 PVC, smooth interior
Length= 83.60 m Slope= 0.0041 m/m
Inlet Invert= 760.543 m, Outlet Invert= 760.200 m



Reach 16R: D689504 to D689503



Summary for Reach 17R: D689404 to D689505

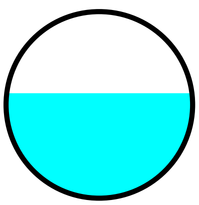
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 14R OUTLET depth by 0.010 m @ 8.30 hrs

Inflow Area = 18.8400 ha, 19.38% Impervious, Inflow Depth > 8 mm for 5Yr event
Inflow = 0.1791 m³/s @ 8.21 hrs, Volume= 1.442 Ml
Outflow = 0.1758 m³/s @ 8.23 hrs, Volume= 1.440 Ml, Atten= 2%, Lag= 1.0 min

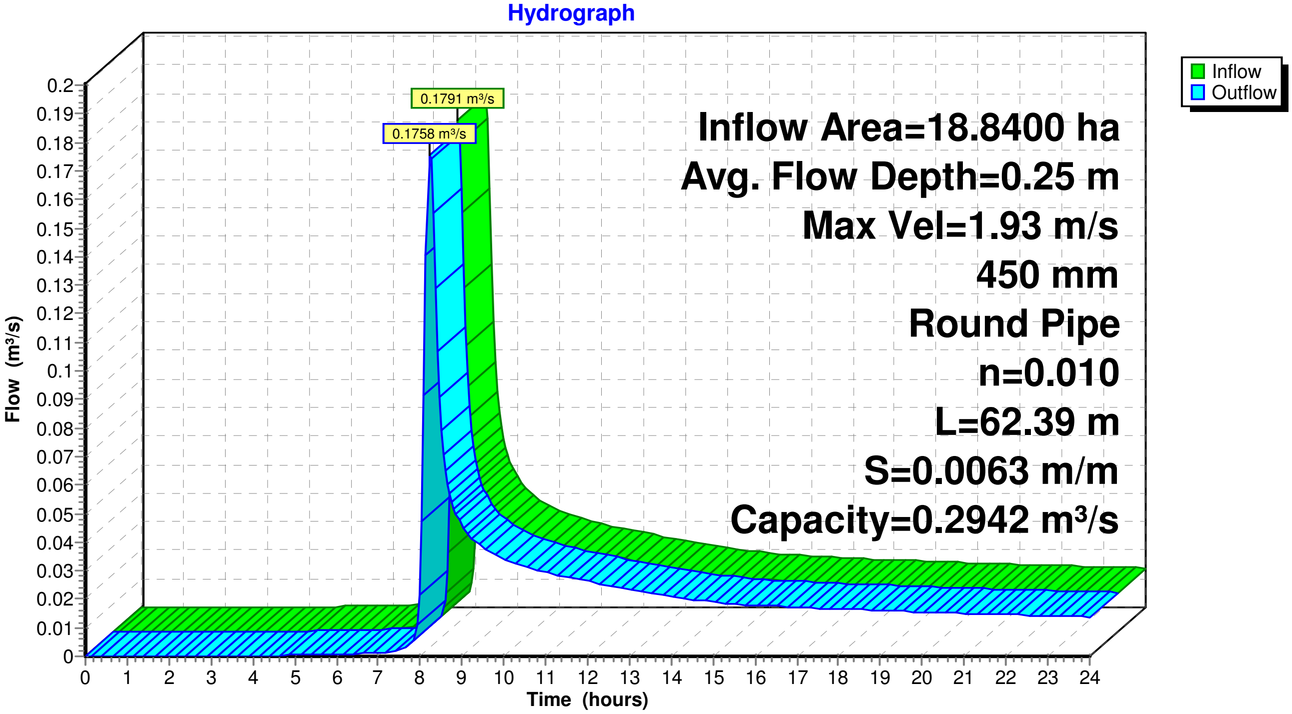
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.93 m/s, Min. Travel Time= 0.5 min
Avg. Velocity = 0.92 m/s, Avg. Travel Time= 1.1 min

Peak Storage= 5.8 m³ @ 8.22 hrs
Average Depth at Peak Storage= 0.25 m
Bank-Full Depth= 0.45 m Flow Area= 0.16 m², Capacity= 0.2942 m³/s

450 mm Round Pipe
n= 0.010
Length= 62.39 m Slope= 0.0063 m/m
Inlet Invert= 761.220 m, Outlet Invert= 760.827 m



Reach 17R: D689404 to D689505



Summary for Reach 18R: D689503 to D689502

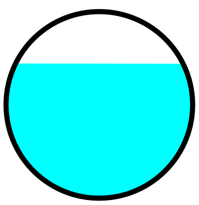
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 16R OUTLET depth by 0.021 m @ 8.35 hrs

Inflow Area = 25.3744 ha, 23.92% Impervious, Inflow Depth > 9 mm for 5Yr event
Inflow = 0.3473 m³/s @ 8.25 hrs, Volume= 2.190 Ml
Outflow = 0.3446 m³/s @ 8.26 hrs, Volume= 2.189 Ml, Atten= 1%, Lag= 0.8 min

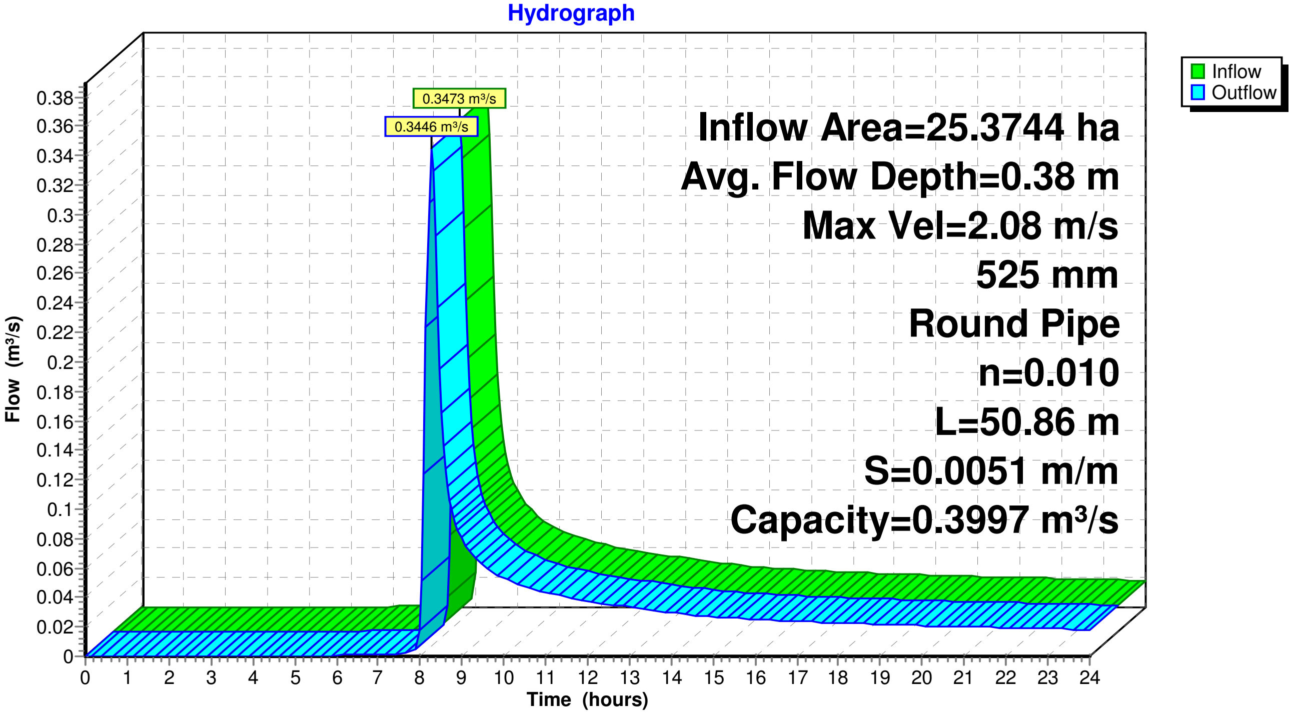
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.08 m/s, Min. Travel Time= 0.4 min
Avg. Velocity = 0.94 m/s, Avg. Travel Time= 0.9 min

Peak Storage= 8.5 m³ @ 8.25 hrs
Average Depth at Peak Storage= 0.38 m
Bank-Full Depth= 0.53 m Flow Area= 0.22 m², Capacity= 0.3997 m³/s

525 mm Round Pipe
n= 0.010 PVC, smooth interior
Length= 50.86 m Slope= 0.0051 m/m
Inlet Invert= 760.200 m, Outlet Invert= 759.940 m



Reach 18R: D689503 to D689502



Summary for Reach 19R: D689502 to D689501

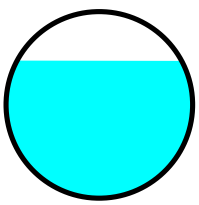
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 18R OUTLET depth by 0.017 m @ 8.35 hrs

Inflow Area =	25.4844 ha,	23.98% Impervious,	Inflow Depth > 9 mm	for 5Yr event
Inflow =	0.3473 m³/s @	8.26 hrs, Volume=	2.201 Ml	
Outflow =	0.3439 m³/s @	8.27 hrs, Volume=	2.200 Ml,	Atten= 1%, Lag= 0.8 min

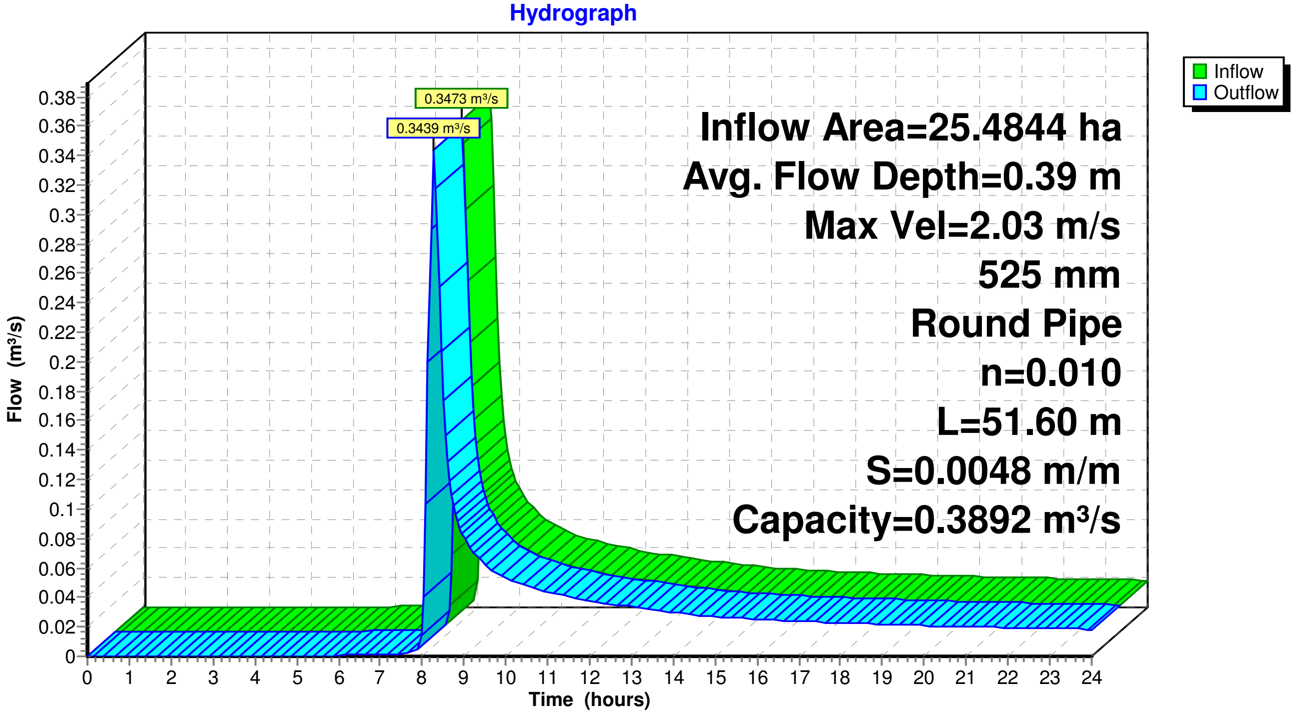
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.03 m/s, Min. Travel Time= 0.4 min
Avg. Velocity = 0.92 m/s, Avg. Travel Time= 0.9 min

Peak Storage= 8.8 m³ @ 8.27 hrs
Average Depth at Peak Storage= 0.39 m
Bank-Full Depth= 0.53 m Flow Area= 0.22 m², Capacity= 0.3892 m³/s

525 mm Round Pipe
n= 0.010 PVC, smooth interior
Length= 51.60 m Slope= 0.0048 m/m
Inlet Invert= 759.940 m, Outlet Invert= 759.690 m



Reach 19R: D689502 to D689501



Summary for Reach 21R: D689501 to DMH

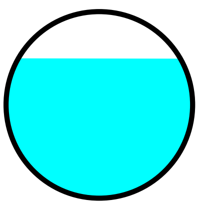
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 19R OUTLET depth by 0.024 m @ 8.35 hrs

Inflow Area = 25.4844 ha, 23.98% Impervious, Inflow Depth > 9 mm for 5Yr event
Inflow = 0.3439 m³/s @ 8.27 hrs, Volume= 2.200 Ml
Outflow = 0.3376 m³/s @ 8.30 hrs, Volume= 2.197 Ml, Atten= 2%, Lag= 1.7 min

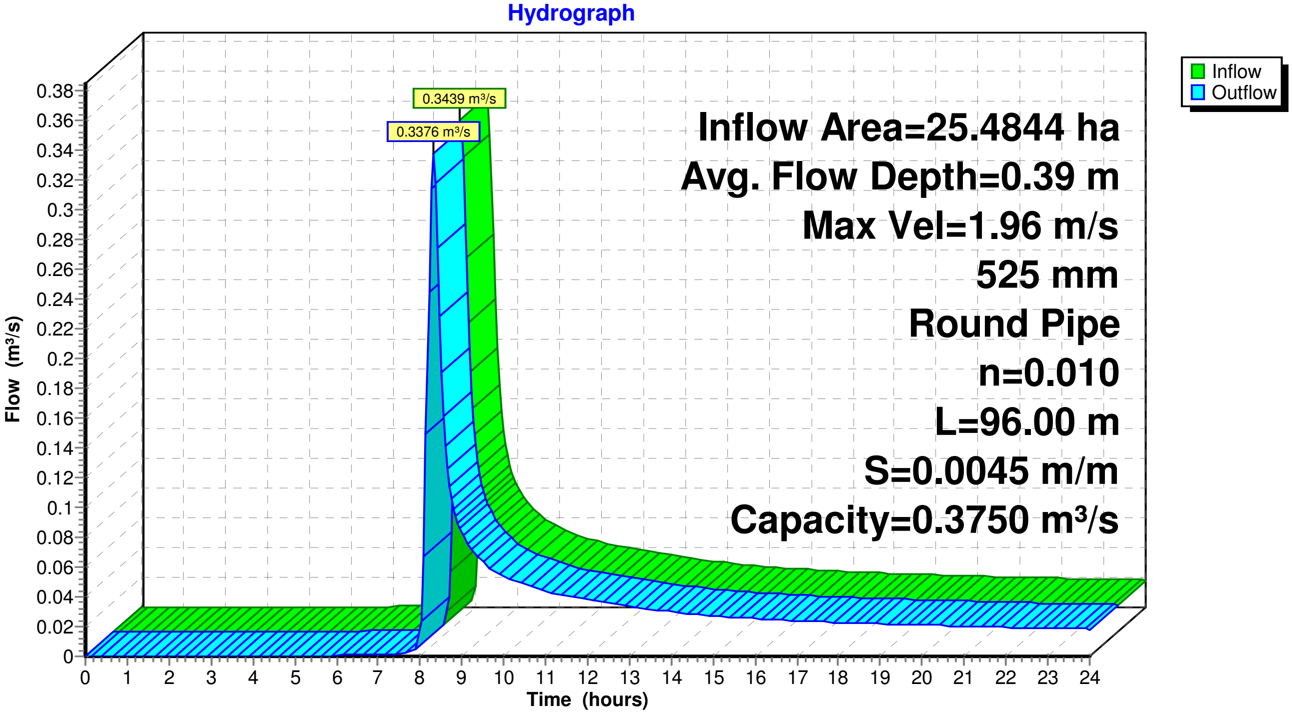
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.96 m/s, Min. Travel Time= 0.8 min
Avg. Velocity = 0.90 m/s, Avg. Travel Time= 1.8 min

Peak Storage= 16.7 m³ @ 8.29 hrs
Average Depth at Peak Storage= 0.39 m
Bank-Full Depth= 0.53 m Flow Area= 0.22 m², Capacity= 0.3750 m³/s

525 mm Round Pipe
n= 0.010 PVC, smooth interior
Length= 96.00 m Slope= 0.0045 m/m
Inlet Invert= 759.690 m, Outlet Invert= 759.258 m



Reach 21R: D689501 to DMH



Summary for Reach 23R: D689601 to DMH3

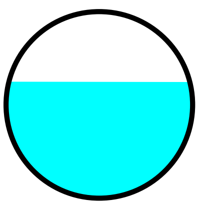
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 2.2700 ha, 38.00% Impervious, Inflow Depth > 11 mm for 5Yr event
Inflow = 0.0676 m³/s @ 8.19 hrs, Volume= 0.260 Ml
Outflow = 0.0666 m³/s @ 8.21 hrs, Volume= 0.260 Ml, Atten= 1%, Lag= 1.1 min

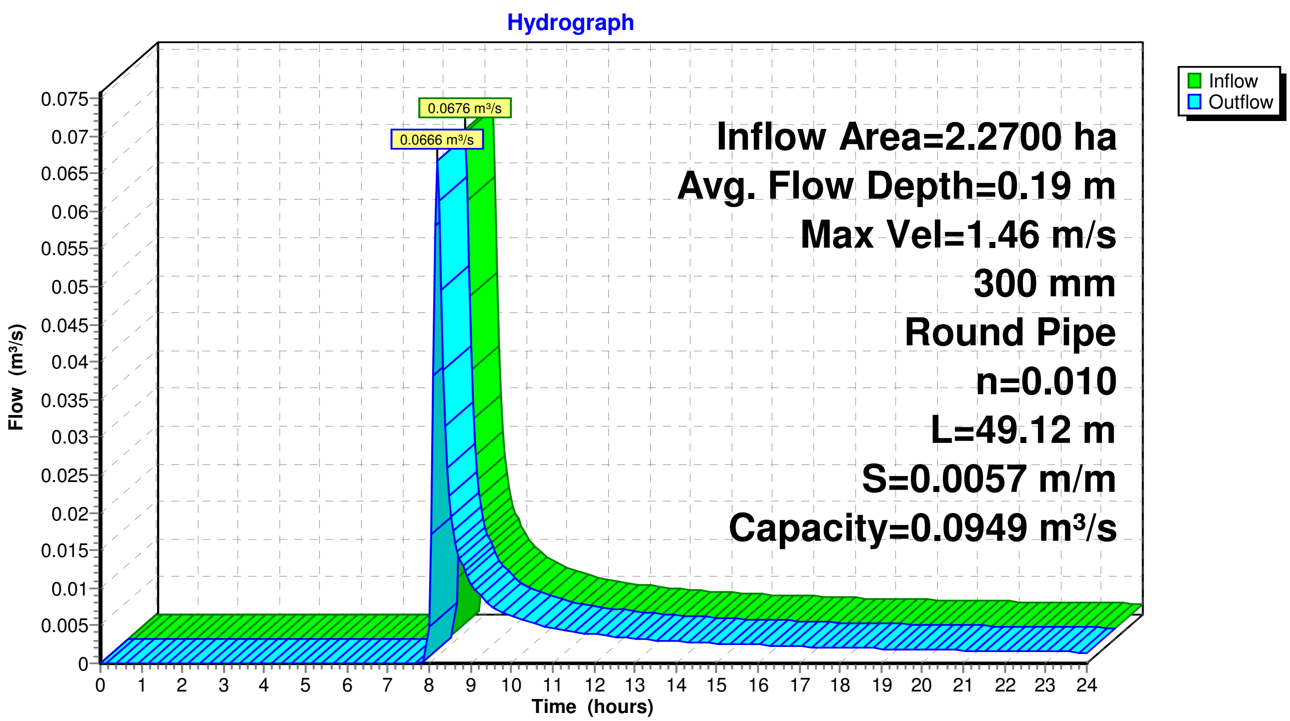
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.46 m/s, Min. Travel Time= 0.6 min
Avg. Velocity = 0.62 m/s, Avg. Travel Time= 1.3 min

Peak Storage= 2.3 m³ @ 8.20 hrs
Average Depth at Peak Storage= 0.19 m
Bank-Full Depth= 0.30 m Flow Area= 0.07 m², Capacity= 0.0949 m³/s

300 mm Round Pipe
n= 0.010
Length= 49.12 m Slope= 0.0057 m/m
Inlet Invert= 761.090 m, Outlet Invert= 760.810 m



Reach 23R: D689601 to DMH3



Summary for Reach 24R: DMH3 to D689504

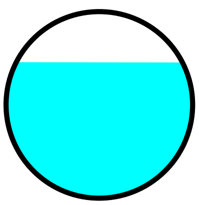
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 23R OUTLET depth by 0.034 m @ 8.25 hrs

Inflow Area = 2.7744 ha, 35.68% Impervious, Inflow Depth > 12 mm for 5Yr event
Inflow = 0.0836 m^3/s @ 8.20 hrs, Volume= 0.323 Ml
Outflow = 0.0823 m^3/s @ 8.22 hrs, Volume= 0.323 Ml, Atten= 2%, Lag= 0.9 min

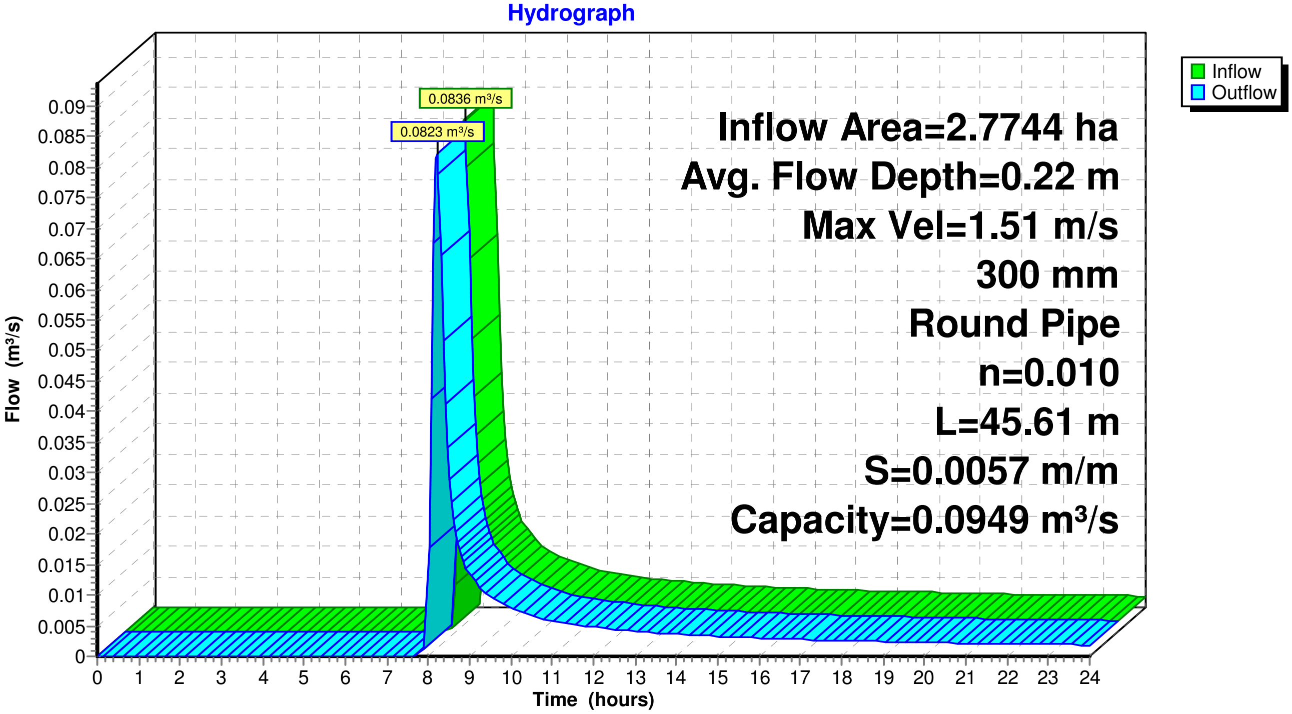
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.51 m/s, Min. Travel Time= 0.5 min
Avg. Velocity = 0.66 m/s, Avg. Travel Time= 1.1 min

Peak Storage= 2.5 m^3 @ 8.21 hrs
Average Depth at Peak Storage= 0.22 m
Bank-Full Depth= 0.30 m Flow Area= 0.07 m^2, Capacity= 0.0949 m^3/s

300 mm Round Pipe
n= 0.010 PVC, smooth interior
Length= 45.61 m Slope= 0.0057 m/m
Inlet Invert= 760.810 m, Outlet Invert= 760.550 m



Reach 24R: DMH3 to D689504



Summary for Pond 6P: North Pond

Inflow Area = 1.1600 ha, 65.00% Impervious, Inflow Depth > 18 mm for 5Yr event
Inflow = 0.0658 m³/s @ 8.17 hrs, Volume= 0.206 Ml
Outflow = 0.0090 m³/s @ 8.84 hrs, Volume= 0.204 Ml, Atten= 86%, Lag= 40.7 min
Primary = 0.0090 m³/s @ 8.84 hrs, Volume= 0.204 Ml

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 763.423 m @ 8.84 hrs Surf.Area= 176.8 m² Storage= 67.7 m³

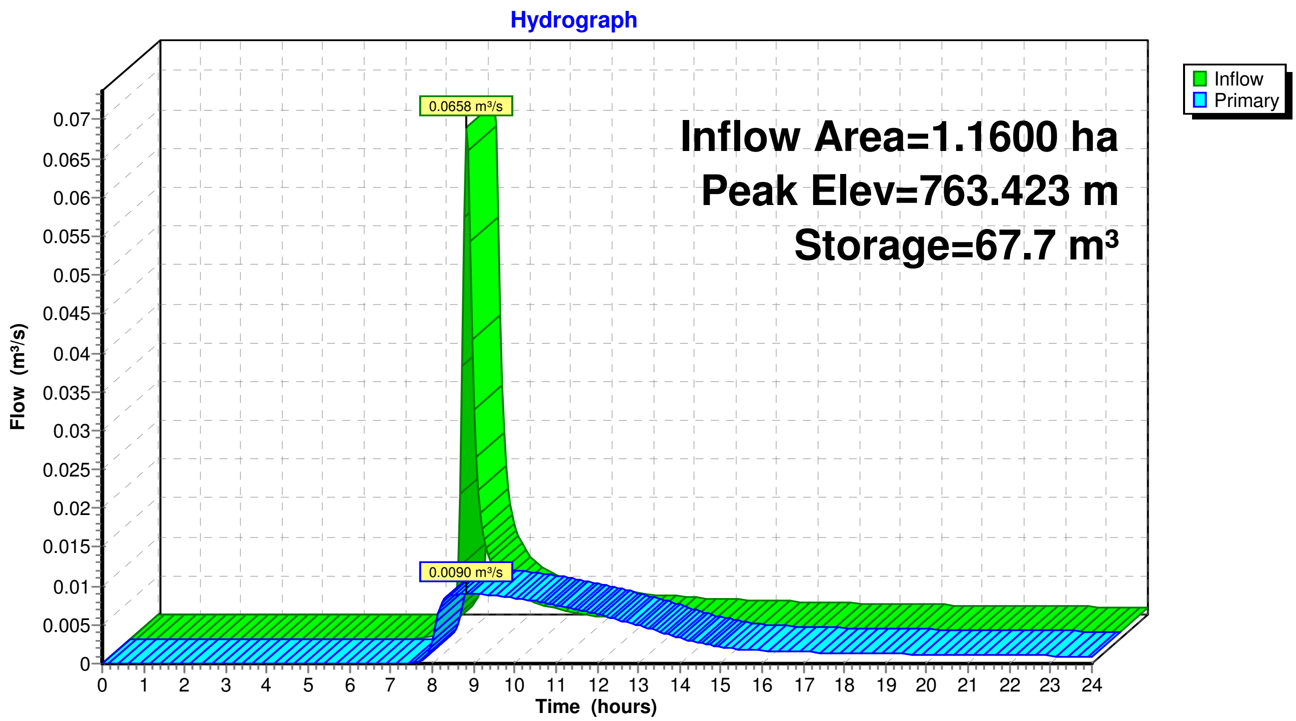
Plug-Flow detention time= 75.3 min calculated for 0.203 Ml (99% of inflow)
Center-of-Mass det. time= 67.9 min (752.4 - 684.5)

Volume	Invert	Avail.Storage	Storage Description
#1	762.800 m	151.5 m³	**1.50 mW x 30.00 mL x 1.00 mH Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	762.800 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0090 m³/s @ 8.84 hrs HW=763.423 m (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.0090 m³/s @ 2.03 m/s)

Pond 6P: North Pond



Summary for Pond 7P: South Pond

Inflow Area = 11.9600 ha, 6.96% Impervious, Inflow Depth > 7 mm for 5Yr event
Inflow = 0.1122 m³/s @ 8.24 hrs, Volume= 0.778 Ml
Outflow = 0.0102 m³/s @ 14.06 hrs, Volume= 0.555 Ml, Atten= 91%, Lag= 349.5 min
Primary = 0.0102 m³/s @ 14.06 hrs, Volume= 0.555 Ml

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 763.586 m @ 14.06 hrs Surf.Area= 0.0651 ha Storage= 0.312 Ml

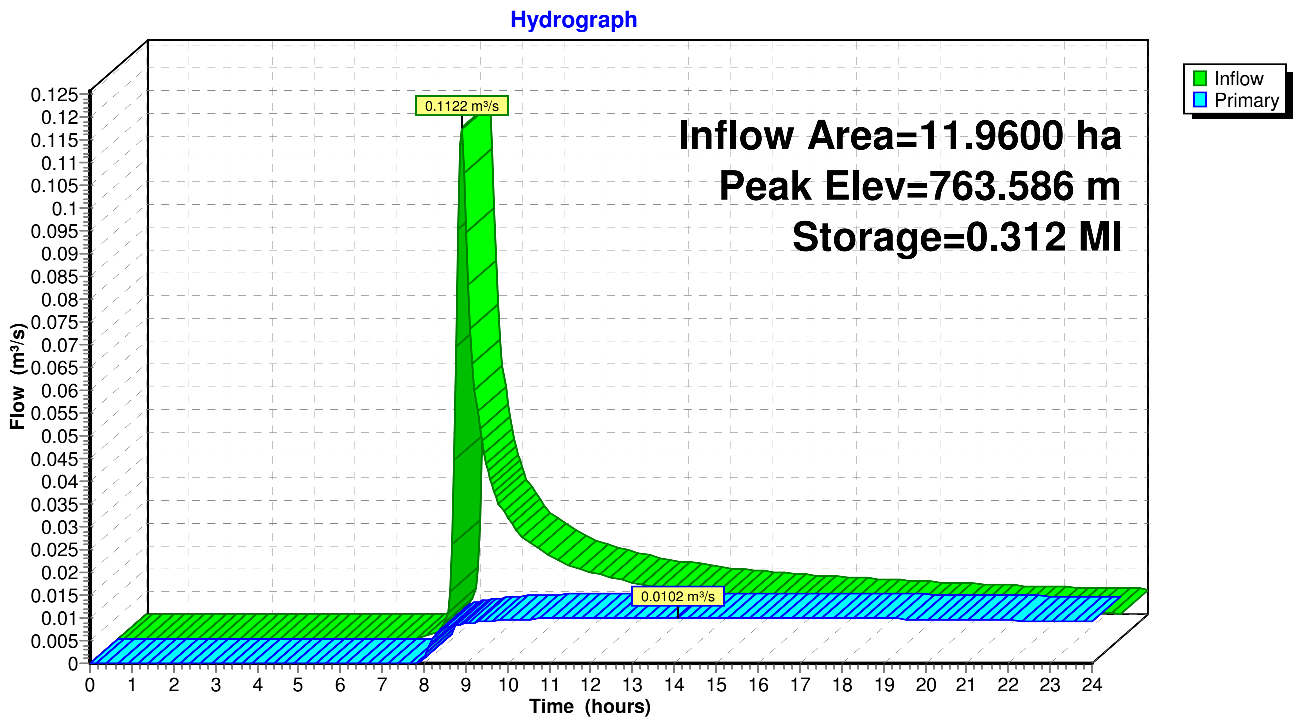
Plug-Flow detention time= 352.1 min calculated for 0.555 Ml (71% of inflow)
Center-of-Mass det. time= 197.4 min (965.8 - 768.4)

Volume	Invert	Avail.Storage	Storage Description
#1	762.800 m	0.549 Ml	**1.50 mW x 100.00 mL x 1.10 mH Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	762.800 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0102 m³/s @ 14.06 hrs HW=763.586 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.0102 m³/s @ 2.30 m/s)

Pond 7P: South Pond



Summary for Pond 29R: Proposed Pipe

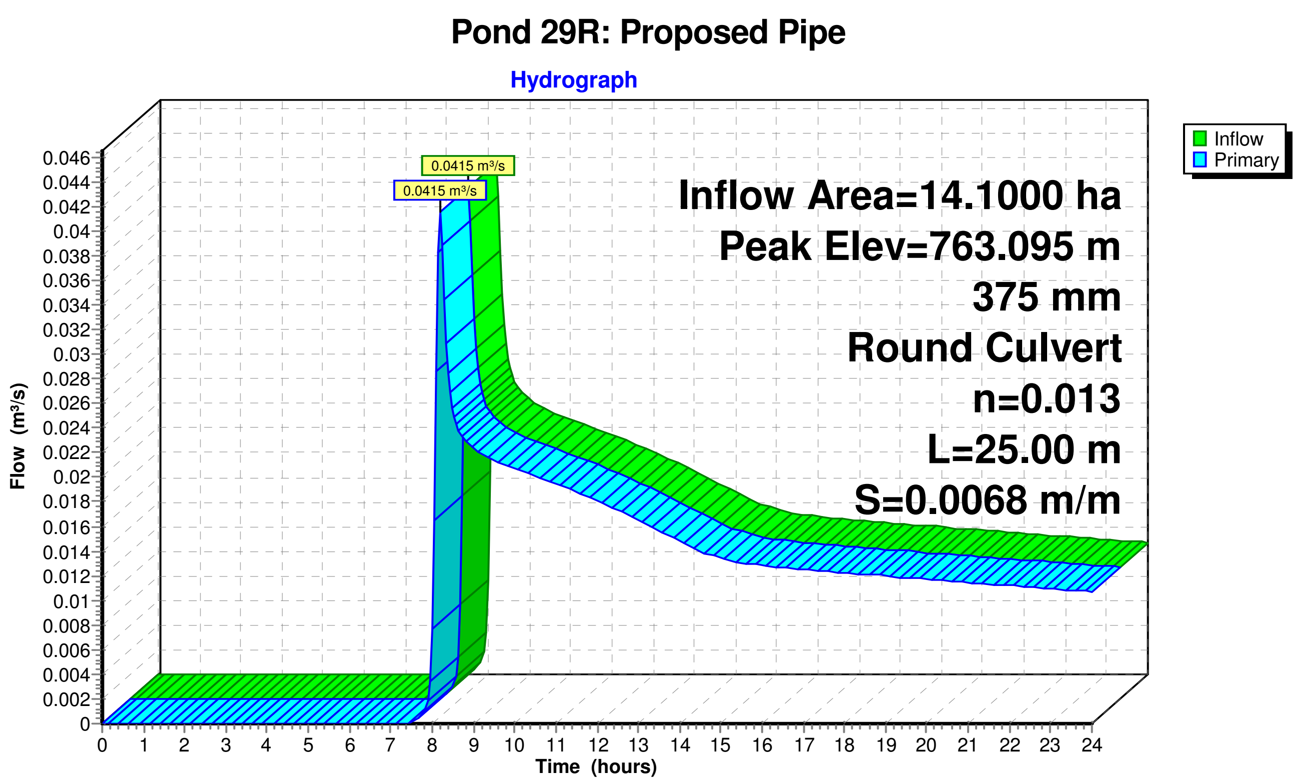
[57] Hint: Peaked at 763.095 m (Flood elevation advised)
[81] Warning: Exceeded Pond 6P by 0.153 m @ 23.95 hrs
[81] Warning: Exceeded Pond 7P by 0.145 m @ 8.05 hrs

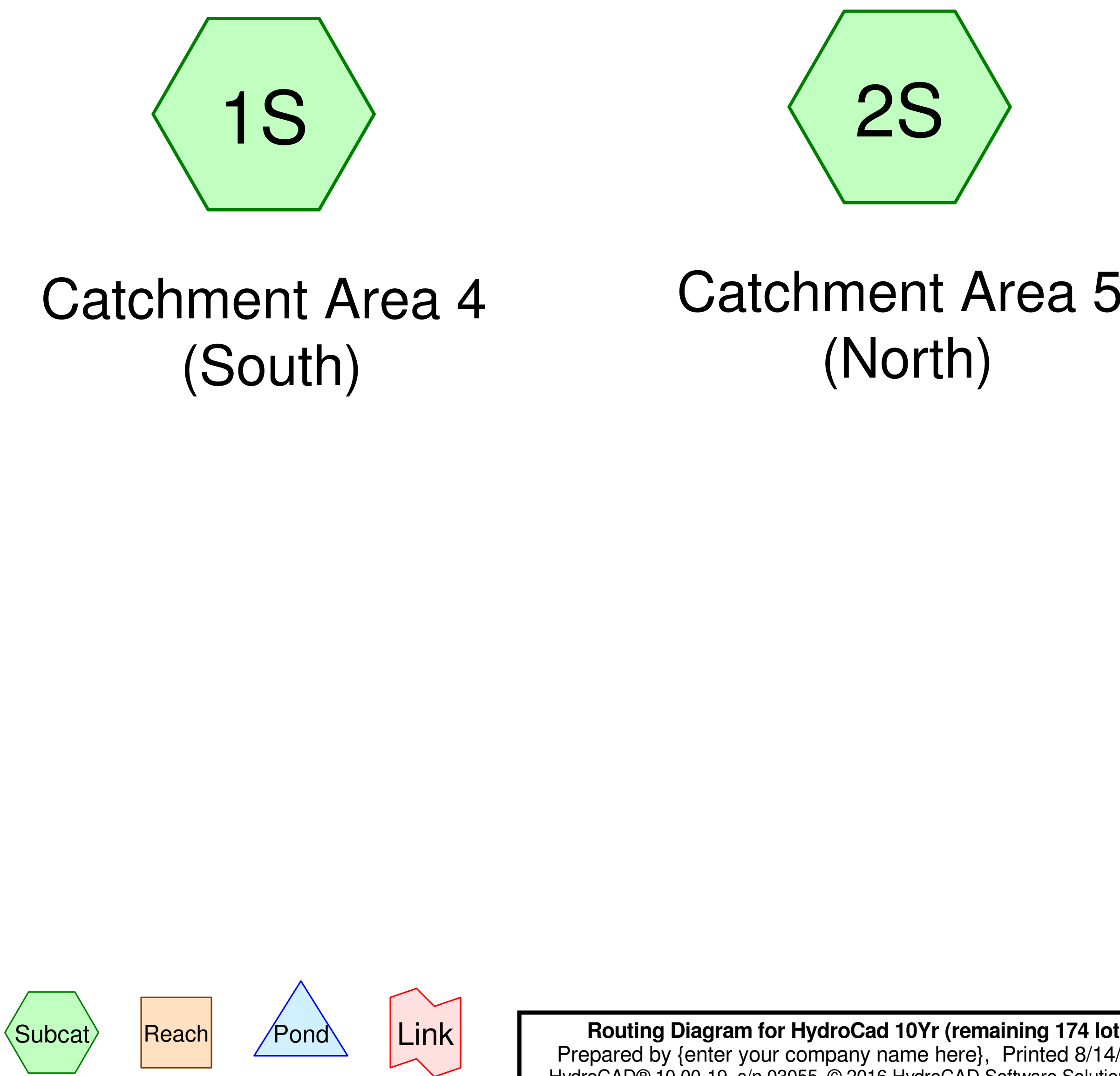
Inflow Area = 14.1000 ha, 13.89% Impervious, Inflow Depth > 6 mm for 5Yr event
Inflow = 0.0415 m³/s @ 8.20 hrs, Volume= 0.871 Ml
Outflow = 0.0415 m³/s @ 8.20 hrs, Volume= 0.871 Ml, Atten= 0%, Lag= 0.0 min
Primary = 0.0415 m³/s @ 8.20 hrs, Volume= 0.871 Ml

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 763.095 m @ 8.20 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	762.900 m	**375 mm Round Culvert** L= 25.00 m Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 762.900 m / 762.730 m S= 0.0068 m/m Cc= 0.900 n= 0.013, Flow Area= 0.110 m²

Primary OutFlow Max=0.0414 m³/s @ 8.20 hrs HW=763.095 m (Free Discharge)
1=Culvert (Barrel Controls 0.0414 m³/s @ 1.04 m/s)





Routing Diagram for HydroCad 10Yr (remaining 174 lots)
Prepared by {enter your company name here}, Printed 8/14/2019

Area Listing (all nodes)

Area (hectares)	CN	Description (subcatchment-numbers)
12.7000	89	Custom 1/6 Lot HSG D (2S)
5.7000	89	Custom 1/6 Lots HSG D (1S)
0.2200	98	Paved roads w/curbs & sewers, HSG D (1S, 2S)
18.6200	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
18.6200	HSG D	1S, 2S
0.0000	Other	
18.6200		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatc Numbers
0.0000	0.0000	0.0000	12.7000	0.0000	12.7000	Custom 1/6 Lot	
0.0000	0.0000	0.0000	5.7000	0.0000	5.7000	Custom 1/6 Lots	
0.0000	0.0000	0.0000	0.2200	0.0000	0.2200	Paved roads w/curbs & sewers	
0.0000	**0.0000**	**0.0000**	**18.6200**	**0.0000**	**18.6200**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Catchment Area 4 Runoff Area=58,100.0 m² 1.89% Impervious Runoff Depth>17 mm
Tc=5.0 min CN=89 Runoff=0.3922 m³/s 1.014 Ml

Subcatchment 2S: Catchment Area 5 Runoff Area=12.8100 ha 0.86% Impervious Runoff Depth>17 mm
Tc=5.0 min CN=89 Runoff=0.8648 m³/s 2.235 Ml

Total Runoff Area = 18.6200 ha Runoff Volume = 3.249 Ml Average Runoff Depth = 17 mm
98.82% Pervious = 18.4000 ha 1.18% Impervious = 0.2200 ha

Summary for Subcatchment 1S: Catchment Area 4 (South)

[49] Hint: Tc<2dt may require smaller dt

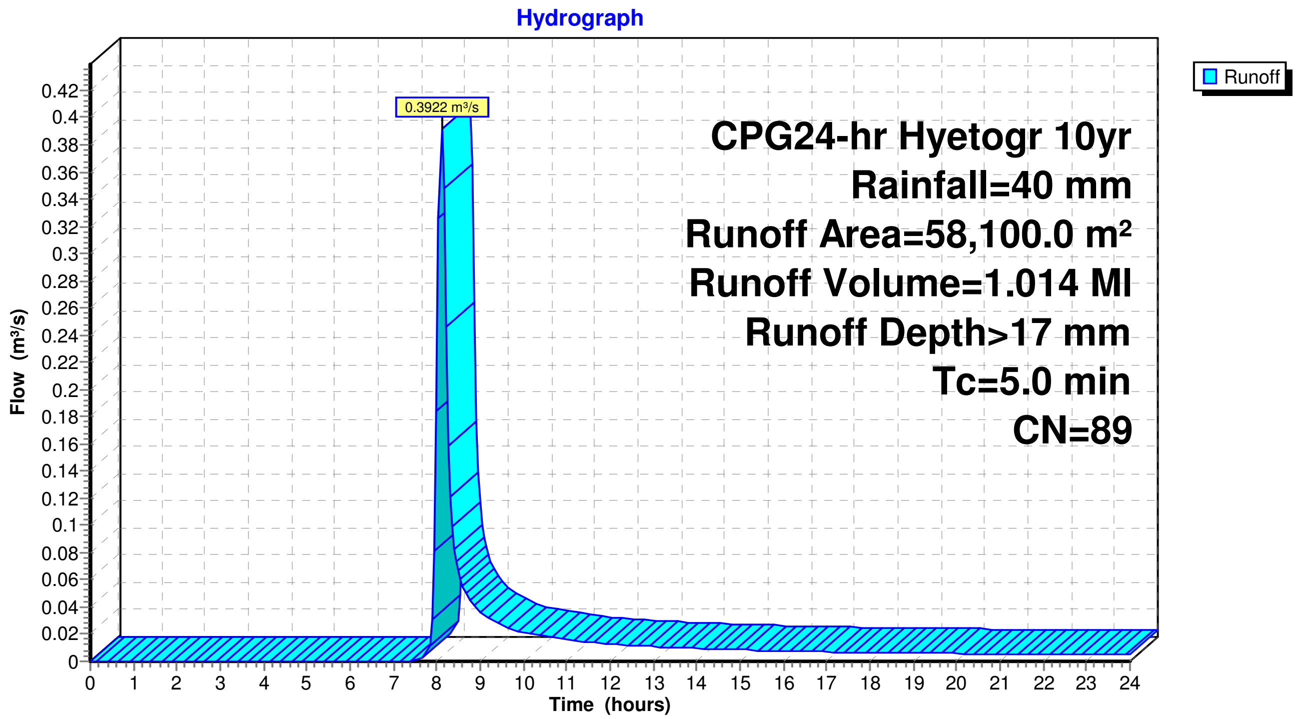
Runoff = 0.3922 m³/s @ 8.10 hrs, Volume= 1.014 Ml, Depth> 17 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr Rainfall=40 mm

	Area (m²)	CN	Description
*	57,000.0	89	Custom 1/6 Lots HSG D
	1,100.0	98	Paved roads w/curbs & sewers, HSG D
	58,100.0	89	Weighted Average
	57,000.0		98.11% Pervious Area
	1,100.0		1.89% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
5.0					**Direct Entry,**

Subcatchment 1S: Catchment Area 4 (South)



Summary for Subcatchment 2S: Catchment Area 5 (North)

[49] Hint: Tc<2dt may require smaller dt

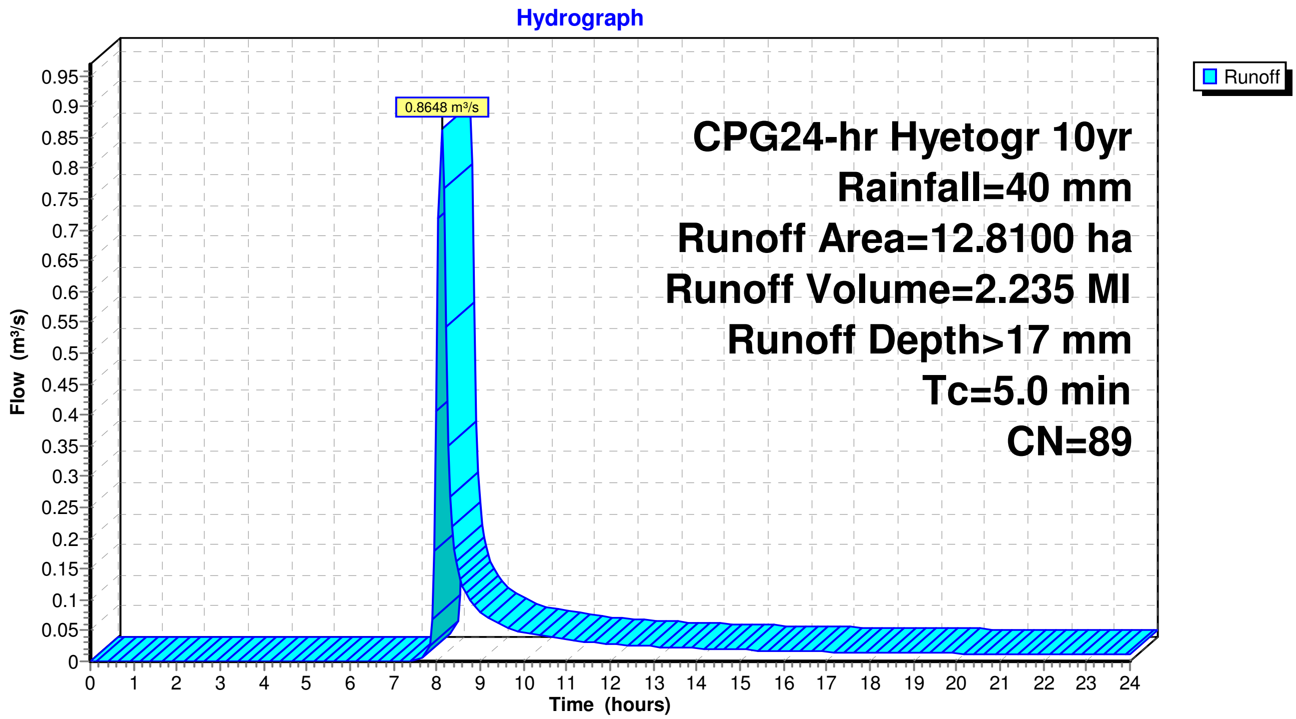
Runoff = 0.8648 m³/s @ 8.10 hrs, Volume= 2.235 Ml, Depth> 17 mm

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr Rainfall=40 mm

	Area (ha)	CN	Description
*	12.7000	89	Custom 1/6 Lot HSG D
	0.1100	98	Paved roads w/curbs & sewers, HSG D
	12.8100	89	Weighted Average
	12.7000		99.14% Pervious Area
	0.1100		0.86% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
5.0					**Direct Entry,**

Subcatchment 2S: Catchment Area 5 (North)



Appendix D
Geotechnical Assessment

GEONORTH ENGINEERING LTD.

3975 18th Avenue
Prince George, B.C., V2N 1B2
Phone 250-564-4304
Fax 250-564-9323
E-mail mail@geonorth.ca

February 25, 2019

Mr. Jason Boyes, P.Eng
WPD Woodlands Property Limited
c/o L&M Engineering Ltd.
1210 4th Avenue
Prince George BC V2L 3J4

File No. K-5107

Dear Mr. Boyes:

Re: Geotechnical Recommendations,
Woodlands Subdivision Phase 3, Tatlow Road, Prince George, B.C.

Introduction

WPD Woodlands Property Limited (WPD) plans to construct Phase 3 of the Woodlands Subdivision located about 350 m northeast of the Chief Lake Road and Foothills Boulevard intersection in Prince George, B.C. L&M Engineering Ltd. (L&M), civil engineering design consultant for the project, commissioned GeoNorth Engineering Ltd. (GeoNorth), on behalf of WPD, to provide geotechnical recommendations for the project.

Phases I, II, IIA, and IIB of the subdivision border the proposed Phase 3 of the development on the south and east sides. Phase I was constructed in 1996 and consisted of the partial completion of Woodvalley Drive and Woodoak Crescent. Development phases II, IIA, and IIB were constructed in 2007. They included the completion of Woodvalley Drive and Woodoak Crescent as well as the construction of two roads leading to cul-de-sacs, Gable Place and Woodstock Court, and one stubbed road, Tatlow Road, about 40 m long extending north from Woodvalley Drive, about 125 m east of its intersection with Woodoak Crescent. The previous phases of the development included paved roads and buried water, sanitary sewer, and stormwater sewer lines.

Preliminary design drawings provided by L&M dated January 29, 2019, show the proposed Phase 3 subdivision area is approximately 1.6 ha, and will be subdivided into 16 single family residential building lots. The development will include about 95 m of new road, extending about 50 m north from Tatlow Road and then 45 m west to a cul-de-sac. Water and sanitary and storm sewer mains will be installed below the new road, and services will be provided to each residential lot. A site plan showing a conceptual subdivision layout is on Drawing 5107-A1, attached.

In 2006, on behalf of Genesis Development Corporation (Genesis), GeoNorth completed a geotechnical report for Phases II, IIA and IIB of the Woodlands subdivision, our file number K-2020. As part of the investigation, GeoNorth personnel observed soil conditions in eleven test pits across the subdivision area and provided recommendations for the following:

- New service trench excavation and backfill;
- Road and sidewalk construction;
- Building foundations and grade-supported floor slabs; and
- Lateral earth pressures and perimeter drains.

Additionally in 2006, GeoNorth completed a geotechnical overview report, our file number K-2020B, for the proposed Woodlands subdivision neighbourhood plan. The study included a review of aerial photographs by Dr. J.M. Ryder, P.Geo., of J.M. Ryder & Associates and a field reconnaissance by GeoNorth personnel. The extents of the study encompassed the entire 40 ha parcel of land north of the previous development phases, which includes 9500 Woodvalley Drive and the proposed Phase 3 development area.

This letter summarizes our review of the reports mentioned above and discusses the applicability of the geotechnical recommendations to Phase 3 of the subdivision.

Review

We used test pit data from the 2006 geotechnical report as background for our assessment. TP06-7 is located at the end of the proposed Tatlow Road cul-de-sac and inside the Phase 3 development area. TP06-6 and TP06-8 are located on the Phase 3 development boundary, on the east and south sides respectively. Soil conditions encountered in these three test pits vary but are similar to those encountered within the Phase II, IIA, and IIB development areas.

TP06-6 encountered 0.2 m of topsoil, over loose to compact silt with some sand and gravel, a till deposit, to the bottom of the hole at 3.8 m depth. TP06-7 encountered 0.05 m of topsoil, over very stiff silt with some fine-grained sand, a glaciolacustrine deposit, to the bottom of the hole at 4.2 m depth. TP06-8 encountered silt and sand fill with some gravel below the topsoil to 0.4 m depth, over natural, stratified sand and gravel to 0.7 m depth, over silt and sand till to the bottom of the hole at 4.0 m depth.

Minor seepage was encountered in TP06-6, 7, & 8 at depths of 0.4, 4.1, and 0.6 m, respectively.

The aerial photograph review and field reconnaissance completed in 2006 as part of the geotechnical overview report, noted several areas of standing water on the property north of the proposed Phase 3 development area. The ponds and standing water were primarily the result of beaver dams and blocked drainage paths. Low lying areas on the property are unable to drain because of the low permeability of the soil. An old drainage ditch running through the northwest corner of the Phase 3 development area was noted to be cut-off by the construction of Woodvalley Gate leading into the Woodlands Subdivision Phase I, and contained standing water at the time of the field reconnaissance. Piles of strippings were also noted in the ditch at the time of the site visit.

Discussion

Based on our review of the reports mentioned above, soil conditions at the site are adequate for the proposed subdivision development. The geotechnical recommendations outlined in our report for the Woodland Phases II, IIA, and IIB, our file number K-2020, completed for Genesis, can be extended to Phase 3 of the subdivision to be constructed by WPD.

The proposed development is likely underlain by very stiff to hard glaciolacustrine silt and fine-grained sand, and glacial till. The glaciolacustrine deposits can be soft and easily disturbed where they are wet, while the till and dry, overconsolidated glaciolacustrine deposits typically have relatively high shear strength. Both soil types will typically provide adequate support for lightly loaded structures, are suitable for road subgrades, and have a low permeability.

The subsurface soil has poor drainage and changes to the site grade will be required to prevent standing water and flooding by runoff from snow melt or rainfall. We understand that the ditch crossing the north side of lots 8 to 12 will be filled in with structural fill.

We recommend the following procedures to bring the ditch up to grade:

- Remove all existing strippings, fill, organic and disturbed soil, roots and construction debris from the ditch to expose the natural silt with some fine-grained sand or the silt and sand till.
- After the excavation has been reviewed and approved by the geotechnical engineer, cover the excavated surface using a non-woven geotextile that has a tensile strength of at least 700 N and an apparent opening size of 0.22mm +/- 0.02mm.
- Bring the excavation to grade using structural fill that meets the gradation for Select Granular Subbase (SGSB), defined in Table 1, below. Place the fill in uniform layers and compact each layer to at least 100% Standard Proctor Density (SPD)(ASTM D698).

Layer thickness will depend on several factors, including size and weight of compactor, and the moisture content and temperature of the soil, but do not exceed a layer thickness of 300 mm.

- Construct sumps and pump any water from the base of the excavation. If the soil in the base of the excavation is sensitive or wet, place at least 400 mm of Drain Rock that meets the gradation in Table 1 in the bottom of the excavation, then bring to grade using SGSB as described above.

Table 1 - Specified Gradation for Granular Fill

Sieve Size (mm)	Percentage Passing	
	Select Granular Subbase	Drain Rock
100	100	100
75	95-100	-
40	-	30-100
25	-	-
19	35-100	0-100
9.5	-	-
4.75	15-60	0-10
2.36	-	0-5
1.18	-	-
0.300	3-15	-
0.075	0-5	0-2

Construction Review

We recommend that we review the construction drawings prior to final design to check that the intent of our recommendations has been adequately communicated and applied to the design and that the level of investigation is adequate for the project.

We recommend that an experienced geotechnical engineer or their representative, or a Building Official review foundation excavations to confirm that ground conditions are as expected or to provide additional recommendations if necessary to suit actual site conditions.

We also recommend that a geotechnical engineer or their representative review the following components of the work:

- Any road subgrade surface that is too soft or wet to be compacted to the specified density.
- The excavations for construction of trench drains or in areas where structural fill is required to raise road or building lot grades, prior to any fill being placed.
- The placement and compaction of all structural fill, starting with the first layer, to confirm that the fill materials and soil density meet the project specifications.

Closure

This report was prepared by GeoNorth Engineering Ltd. for the use of the L&M, WPD Woodlands Property Limited, and their consultants. The material in it reflects GeoNorth Engineering's judgement in light of the information available to us at the time of preparation. Any use which Third Parties make of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. GeoNorth Engineering Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Please contact the writers if any part of this report needs to be clarified.

Yours truly,
GeoNorth Engineering Ltd.

Per: L. MacPhail, EIT

Reviewed by,
GeoNorth Engineering Ltd.

PROVINCE OF
D.J. McDOUGALL
14614
BRITISH COLUMBIA
ENGINEER

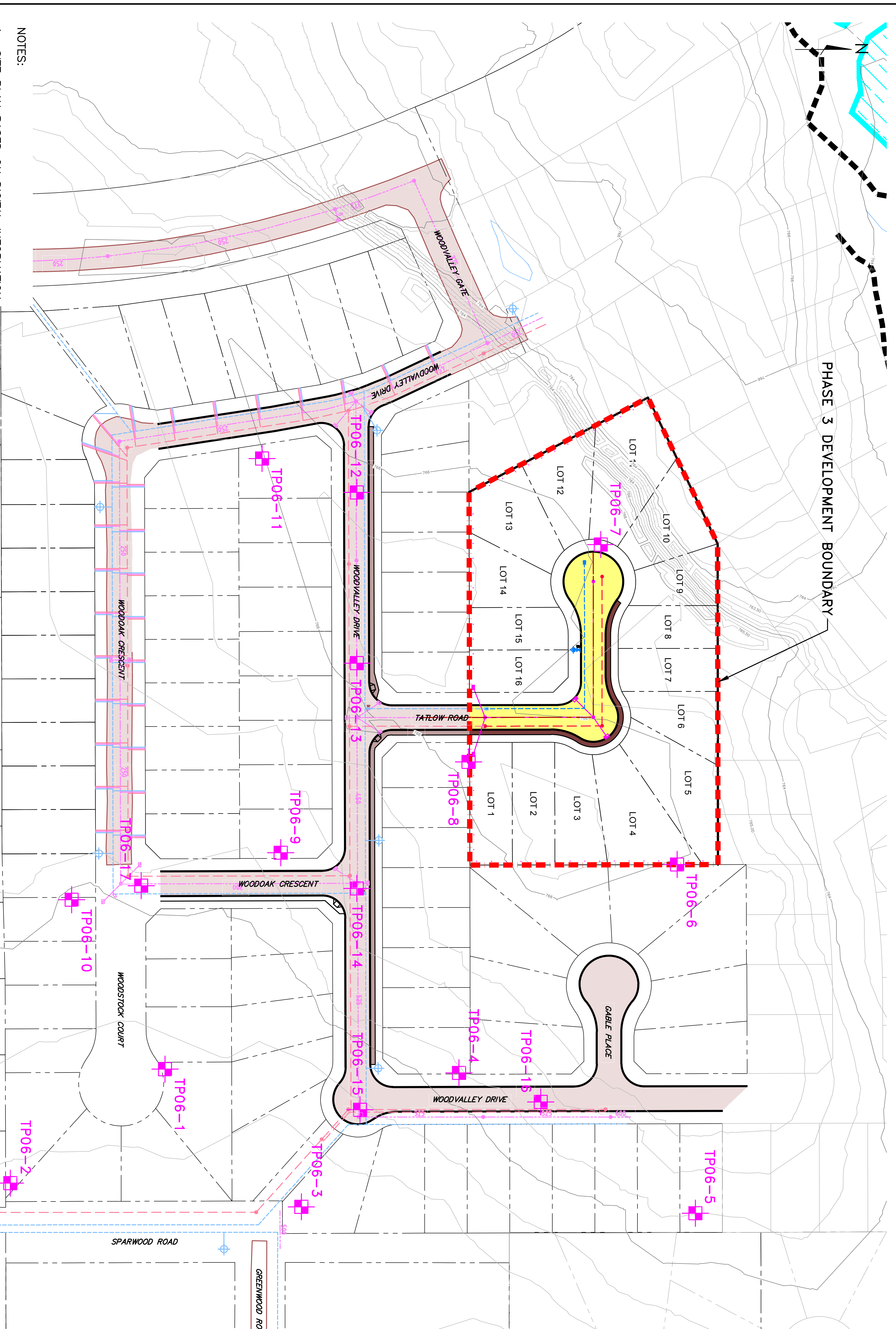
Per: D.J. McDougall, M.Eng., P.Eng.

Attachments: Drawing 5107-A1, Site Plan

NOTES:

1. SITE PLAN BASED ON DIGITAL INFORMATION PROVIDED BY L&M ENGINEERING LIMITED.
2. TEST PIT LOCATIONS ARE APPROXIMATE.

Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.



Scale - 1:1500

0 10 20 30 40 50

SCALE: 1:1500	APPROVED:	WPD WOODLANDS PROPERTY LIMITED c/o L&M ENGINEERING LIMITED WOODLANDS SUBDIVISION - PHASE 3 TATLOW ROAD, PRINCE GEORGE, B.C. SITE PLAN SHOWING TEST PIT LOCATIONS	GEONORTH ENGINEERING LTD 3975 18th Avenue Prince George, B.C. V2N 1B2 Tel. 250-564-4304 Fax 250-564-9323
DATE: 2019/02/25			
DRAWN BY: LU			
REVIEWED BY: DJM			
DRAWING NO: 5107-A1	REVISION: -	PROJECT NO: K-5107	

Appendix E
Environmental Recommendations Memorandum

3990 22nd Avenue
Prince George, BC V2N 3A1
P 250.562.9155
F 250.562.9135

MEMORANDUM

TO:	Ashley Elliott, L&M Engineering Ltd.
FROM:	Jen Bond, Triton Environmental Consultants Ltd.
DATE:	19/09/2019
FILE #/NAME:	10061/P4599
RE:	Environmental Recommendation for the Woodlands Development

Triton Environmental Consultants Ltd. (Triton) has been retained by L&M Engineering Ltd. (L&M) to provide general environmental recommendations in response to the City of Prince George's (the City) review of the first draft of the Woodlands Neighbourhood Plan developed by L&M (2019). In addition to the environmental recommendations found below, direct responses to the comments provided by the City can be found in Appendix 1. Additional environmental information can also be found in the following reports provided by Triton:

- Woodlands Neighbourhood Environmental Overview Report (2006)
- Woodlands Environmental Overview Assessment Update Report (2018)
- Stream Assessment for Woodlands Neighbourhood (2019)

The proposed development is approximately 20 hectares (ha) in size and includes single residential lots, road infrastructure, existing wetlands, and park/community spaces, and is located north of the intersection of Foothills Boulevard and Woodvalley Gate.

Environmental recommendations and additional details surrounding the Woodlands Neighbourhood Plan will include potential regulatory requirements, riparian setback recommendations, general stormwater management, beaver management, and proposed road works.

Site Conditions

Topography

The Woodlands Development area is fairly flat with elevations only ranging from 758 m to 768 m (PGMap 2019). Gentle slopes varying from 1 to 6% are found throughout most of the catchment area. Steeper slopes up to 20% are found in the northernmost section of the Woodlands Development area. Three small areas are designated as significant slopes within the Official Community Plan (City of Prince George 2019); one is located approximately 130 m north of the intersection of Foothills Boulevard and Woodvalley Gate, and the other two are along the eastern property boundary.

Terrestrial Resources

The area is located within the Mossvale variant, moist cool subzone of the Sub-boreal Spruce biogeoclimatic ecosystem classification zone (SBSmk1). Given the presence of large wetland features and riparian areas, a variety of vegetation exists. Overall, the drier areas are comprised of lodgepole pine (*Pinus contorta* var. *latifolia*) and trembling aspen (*Populus tremuloides*) forest. Late seral and early climax stands have more hybrid white spruce (*Picea engelmannii x glauca*) and scattered subalpine fir (*Abies lasiocarpa*). Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca*) appears on drier, warmer aspects. Black spruce (*Picea mariana*) occurs in wetland areas, while black cottonwood (*Populus trichocarpa*) occurs within riparian areas. Shrub species include prickly rose (*Rosa acicularis*), thimbleberry (*Rubus parviflorus*), highbush cranberry (*Viburnum edule*), and black twinberry *(Lonicera involucrate*: DeLong et al 1993). Additional details describing the terrestrial resources found within the development area can be found in the Triton reports from 2006 and 2018.

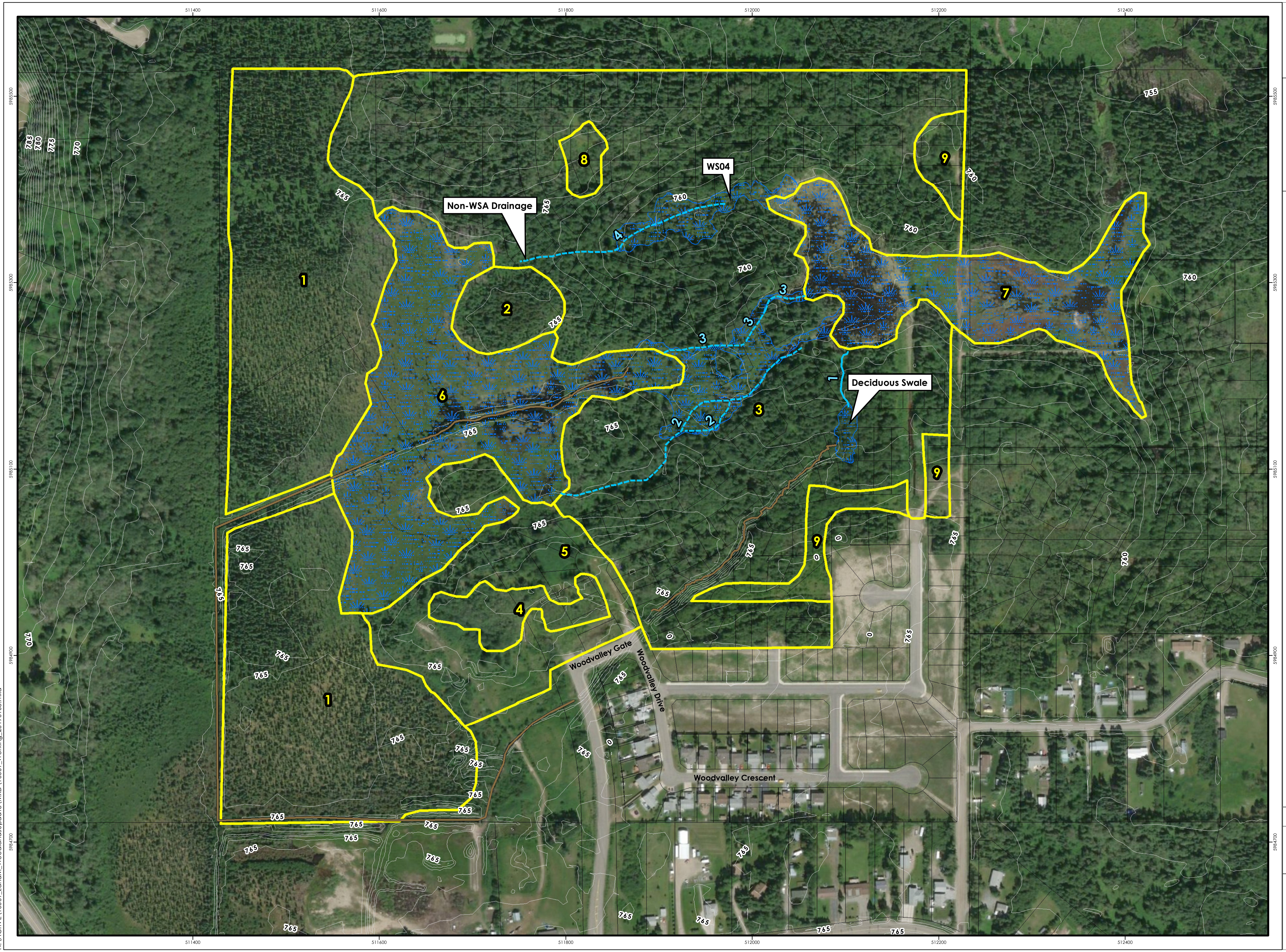
Aquatic Resources

Based on the results of the assessments completed by Triton in 2006 and 2018, four drainages have been identified within the development area and are listed below and shown Figure 1. Details on the assessed drainages can be found in the Triton reports completed in 2006, 2018, and 2019.

- Drainage 1 – Ditch, not a stream as defined by the *Water Sustainability Act* (WSA)
- Drainage 2 – WSA stream
- Drainage 3 – WSA stream
- Drainage 4 – Wetland portion is a WSA Stream, western portion of the drainage is not WSA stream

Wetlands

Based on the assessment conducted by Triton in 2018, four wetland polygons have been classified within the proposed development area. Two of the wetlands have been identified as fens (Wf02), one classified as a bog (Wb05), and one as a swamp (Ws04). A detailed description of these wetlands can be found in the 2018 report completed by Triton.



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Woodlands Neighbourhood Plan

Figure 1. Woodlands Neighbourhood Drainages and Wetlands

Legend

- Contours
- Ditch
- Drainage (2006)
- Drainage (Re-mapped 2018)
- Property Line
- TEM Polygon

Sources and Disclaimer

1. Base Data: Provided by Client
2. Basemap Orthophoto Source: ESRI World Imagery
3. Disclaimer: This map is a visual aid only to be used together with the accompanying report, including and incorporating any disclaimer contained therein. This map has been prepared to illustrate the results of our work, and is **not intended to be used for navigational purposes**. Information displayed on this map is based, in whole or in part, on geographic information that may have been provided by third parties, including government data. Triton Environmental Consutants Ltd. disclaims (without limiting the generality of the foregoing) all reponsibility for the accuracy of any such third party information, regardless of the source.

N W E S

1:4,000

NAD 1983 UTM Zone 10N

Date: January 8, 2019 | **Project Number:** 10061

Meters

0 25 50 100 150 200

TRITON
Environmental Consultants

Regulatory Requirements

Section 11 of the *Water Sustainability Act* (WSA) requires anyone performing work "in and about a stream" to do so under an Approval or Notification, where required. The definition of a 'stream' under the WSA is 'a natural source of water supply' including a wetland. Wetland has been further defined to include swamps, marshes, and fen habitats, but does not include bogs.

Works immediately in or within the riparian area (15 m) of a Wf02 or Ws04 wetland, or below the high-water mark of the streams located between the wetlands, would require a submission under the WSA, as it would be considered works in and about a stream. If works were to occur within the Wf02 polygons, a 'Change Approval' would be required.

Construction in the Wb05 wetland association (the bog) may be completed without notifying or applying for a Change Approval under the WSA, based on the wetland definition in the Act. However, this may be viewed differently from a government representative perspective. Some risk tolerance would be required as impacts to the adjacent Wf02 are inherently feasible, associated with drainage and construction waste, which would have implications under the WSA. To minimize the risk, the development and permitting route should be decided through consultation with a local Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) habitat officer. Soils in the Wb05 may consist of organic and peat for up to approximately 4 meters in depth (Mackenzie and Moran 2004).

As no fish-bearing streams are present in the development area, an authorization under sections 34.4(2)(b) or 35(2)(b) of the *Fisheries Act* is not anticipated to be necessary, and no application to the Department of Fisheries and Oceans Canada is recommended.

Both the federal *Migratory Bird Convention Act* and provincial *Wildlife Act* prohibit activities that could affect breeding birds including disturbance of birds, nests, or eggs. If possible, any required vegetation clearing or brushing should be scheduled outside of the breeding bird season (April 25 to August 5; ECCC 2019); however, if vegetation clearing occurs during the bird breeding season, pre-clearing bird nest surveys conducted by a Qualified Environmental Professional (QEP) are recommended to ensure no actively breeding birds are present within the proposed clearing area.

Some areas of the Project area (e.g., drainages, wetlands and low-lying areas) are likely to provide habitat for amphibians. A *Wildlife Act* Permit should be acquired prior to construction to allow for the salvage and relocation of amphibians. The amphibian salvage permit would cover the entire project footprint to allow for salvages to be conducted as needed.

Riparian Setback Recommendations

The primary goal of riparian setback areas is to protect the riparian zone, which is critical to the maintenance of a healthy aquatic environment.

A minimum leave strip of 15 m is recommended for the wetlands and streams within the proposed neighbourhood development (Chilibeck 1993). Ensuring these setback areas remain free of disturbance after construction can be achieved by a number of methods, such as designating the areas as greenspace and/or parks, managing access to the areas by designing trails or other access points, and limiting access by installing fencing around sensitive features.

General recommendations and Best Management Practices for wetland habitats can be found within documents such as:

- Land Development Guidelines for the Protection of Aquatic Habitats (Chilibeck 1993);
- Standards and best practices for instream works (Ministry of Water, Land and Air Protection 2004);
- Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia (Wetland Stewardship Partnership 2009); and
- Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC MFLNRO 2014).

Specific recommendations can be addressed in an Environmental Management Plan (EMP) once a final design for the neighbourhood has been developed.

Stormwater Management

Due to the connectivity of the wetlands and associated drainages within the development to the McMillan Creek watershed, effective erosion and sediment control is required throughout construction activities to maintain water quality and to protect fish habitat downstream. The Department of Fisheries and Oceans Canada (DFO) and the Ministry of Environment and Climate Change Strategy (MOECCS) require that post-development runoff volumes are equal to the pre-development flows for a 2-year flood event (DFO 1993).

Stormwater runoff from developments often contains contaminants such as suspended solids, toxic metals, hydrocarbons, bacteria, and trace elements. Based on the construction approach, the primary concern is sediment-laden water entering natural watercourses. Recommended water quality guidelines for the maintenance of aquatic life state that:

> *Water leaving a site should contain less than 25 mg/l of suspended solids above the background levels during normal weather conditions and no more than 75 mg/l over background after design storm event (DFO 1993).*

The City of Prince George also requires that any runoff entering the storm system must be less than 500 parts per million (ppm, equivalent to mg/L) of total suspended solids as per the Storm Sewer System Bylaw (City of PG 2017).

As per L&M's Servicing Brief (2019), they are proposing to service all lots by gravity. To do this, additional headwall outlets that discharge into the wetlands will need to be installed. The conceptual catchment plan provided by L&M (Drawing 1631-01 CP) illustrates three additional headwall outlets discharging into the Wf02 on the east side of the development. Control measures for the headwall outlets (e.g. riprap energy dissipater, settling pool, vegetated swale, etc.) should be located to work with the natural topography and designed/engineered to avoid disturbance within the riparian setback zone of the wetlands. The primary objective of these measures is to develop settling systems that preserve the natural, vegetated condition of the downstream swale. The presence of rooted vegetation assists in the filtering of turbid water and encourages settling. Typical features, such as containment ponds and check dams, would require ground disturbance and the use of heavy machinery, resulting in conditions that are less favourable.

General recommendations regarding sediment controls for the headwall outlets and the flow path towards the wetlands include, but are not limited to:

- Prior to stormwater daylighting at the headwall outlets, a cistern-manhole (sump) should be in place to aide in capturing sediment.
- Scour protection/energy dissipating rock pad can be constructed to prevent outlet discharge from creating additional suspended solids. Sizing of the pad should be engineered based on the expected amount of discharge volume for each outlet.
- Construct settling ponds/water detention areas at each outlet location to slow water velocities and encourage deposition. Sizing of the settling areas should be engineered based on the expected amount of discharge volume for each outlet.
- Retain as much natural vegetation around the outfall locations as possible.
- Construct a drainage path from the outfall settling pond with passive features such as channel spanning large-woody debris (LWD), rock spurs, coir or erosion control matting rolls secured with live-stakes or willow wattles; these features should be designed and installed to increase the length of the water flow path, slow water velocities, encourage sediment deposition, and increase natural filtration/absorption of water.
- Within the drainage path and along the banks, plant native species that thrive in wetter environments such as Red-Osier Dogwood (*Cornus sericea*), Willow (*Salix spp*.), Cattail (*Typha latifolia*), and sedges (*Carex* spp.) that grow densely and can aide in slowing and absorbing water and encouraging sediment deposition.

Once a Stormwater Management Plan (SWP) is established based on the engineered specifications for the housing development (e.g. final outfall locations, culvert sizing, settling pond capacity and locations etc.), an environmental review of the SWP can be completed to provide more detailed recommendations and assist with identifying appropriate control features.

Regarding Drainage 1 (ditch), depending on the final design of the housing development the drainage could be incorporated into the SWP to assist with evacuating water from the development, towards the wetlands during rain events (e.g. stormwater headwall outlet to the deciduous swale which leads to Drainage 1; this would utilize natural vegetation to slow and absorb water, and encourage sediment deposition). If the drainage is within a development area that will be disturbed it may require in-filling and stabilization to reduce the potential for backwatering from the wetland during high-water events (e.g. freshet).

The stormwater modelling analysis separated the Woodland Development area into two catchments areas to determine approximate flows that could potentially be generated by the development. The two catchments are located on either side of the wetlands and are labelled as Catchment Area 4 and Catchment Area 5 on the catchment plan. Catchment Area 4 is 6.3 ha and is located on the south side of the wetlands. During a 10-year rainfall event, Catchment 4 generates a storm water run-off of 0.392 m^3/s. Catchment Area 5 is 13.8 ha and is located on the north side of the wetlands. During a 10-year rainfall event, Catchment 5 generates a storm water run-off of 0.865 m^3/s.

As per DFO and MOECCS requirements, a pre-development 2-year flood event run-off volume calculation should be completed. Post-development run-off volumes within the drainages should be equal to the pre-development 2-year flood event volume.

Once a detailed design and construction approach is available, an EMP, including a site-specific erosion and sediment control plan (ESCP), will be developed.

Beaver Management

Beavers prefer low gradient streams and ponds with dammable outlets that are surrounded by abundant deciduous tree and shrub communities (BC CDC 2019). Given the low gradient wetland and riparian areas within, and adjacent to, the proposed developments, there is moderate to high potential for beavers and beaver dams to affect the Woodlands Development area and drainage network.

Management strategies that could be implemented to limit the effect beavers will have on the development may include the following:

- Culvert Protection – It is recommended that all culverts constructed within the development that convey seasonal flows (e.g., convey flows for periods exceeding a few days following precipitation) be designed to include deterrents to prevent beavers from blocking the culverts. Several products are available and include types of fencing, gates, and other enclosures.

- Tree Protection – Fencing or metal sleeves can be placed around the trunks of individual trees to prevent beavers from damaging them. This is only effective on very small stands of trees or individual trees that warrant protection (eg., ornamentals or tall, large diameter trees that may damage infrastructure if felled).
- Dam Removal – Removal of a beaver dam may become necessary to protect roads or properties from flooding. As per Section 9 of the *Wildlife Act*, it is an offence to disturb, molest, or destroy a beaver or muskrat house, den, or dam. As such, a General Wildlife Permit from the MFLNRORD is required prior to dam removal. A Section 11 under the WSA would also be required as removal activities would be occurring in or about a stream, and activities would be required to adhere to instream work timing windows and other guidelines as stated in each permit. The work would also need to be monitored by a QEP. There is the potential that removing beaver dams may alter the water levels within the wetlands.
- Beaver Removal – Trapping and relocating or destroying beavers is generally viewed as a least-preferred option. Long-term success is variable; there is moderate risk that recolonization would happen quickly given the high-quality habitat and historic use, though recolonization may be deterred once residential development is completed and the landscape is urbanized, removing some of their preferred habitat elements such as the upland supply of deciduous shrubs and small trees) Should trapping be employed, it must be conducted by a registered trapper.

Road Development

Potential impacts from road development could include wetland loss, habitat fragmentation, changes to hydrology, sedimentation, and water quality.

The drawings provided by L&M in the Servicing Brief (2019) illustrate that two watercourse crossings will be required for the Neighbourhood Plan. General recommendations and best practices that should be considered during the design phase should, at a minimum, include the following:

- Maintain drainage patterns and ensure crossings have sufficient hydraulic capacity to convey stream flows without impounding flows.
- Reduce the number of stream crossings to the minimum practical.
- Discourage the use of impermeable surfaces during development and attempt to maintain natural flow regimes of the drainages, surface runoff, and groundwater.
- Ensure a minimum 15 m buffer is maintained around the wetlands and drainages.
- Minimize the length and steepness of slopes where possible.
- Create vegetated swales where possible to help filter pollutants from stormwater runoff.
- If possible, provide safe routes for wildlife crossings between the two wetlands.

Recommendations

An environmental management plan (EMP) that guides specific construction activities and management of environmental resources is recommended once the final development plans are available and construction timing is known. The EMP may include (but is not necessarily limited to) guidance on:

- Timing and monitoring requirements for the removal of wildlife trees, if necessary;
- Water quality monitoring protocols and thresholds, if surface water quality is anticipated to be affected;
- Spill and waste management plans;
- Erosion and sediment control procedures; and
- Requirements for wildlife surveys and salvages (e.g., breeding bird/nest surveys, amphibian salvages).

Closure

Triton has prepared this document for L&M Engineering Ltd. as part of the Woodlands Neighbourhood Plan. This document was reviewed by Trisha Merriman (RPBio, CPESC, PMP) and Neal Ford (RPBio), and was found to be consistent with Triton's internal quality assurance standards. Should you require any further information, or have any questions or comments, please do not hesitate to contact the undersigned.

Yours truly,

Triton Environmental Consultants Ltd.

Jen Bond, B.Sc.
Project Manager/Biologist

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Appendix 1

Responses to the City of Prince George's Comment to the Woodlands Neighbourhood Plan – Draft

Page Number	City's Comment	Triton's Response
3	Red-listed means that the ecosystem is at risk of becoming endangered or extirpated. Should we be allowing development in such a vulnerable location?	No red-listed ecosystems have been documented in the development area. The Wf02 wetland associations are provincially blue-listed, meaning special concern (Triton 2018).
3	I am assuming there is no development within the actual red-listed areas, but this concern should still be explicitly addressed within the Plan – how the red-listed area will be protected and impacts mitigated.	No red-listed ecosystems will be impacted by the development. The Wf02 wetland associations are provincially blue-listed, meaning special concern (Triton 2018).
15	Environmental Context – this section could be bulked out a bit more. Pretty limited info.	Additional information regarding leave strips and permitting requirements have been addressed in the regulatory requirements and riparian setback recommendations of this memo. Additional details surrounding the environmental context of the area can be found in the Triton Reports from 2006, 2018, and 2019.
15	Maybe a definition of incompatible development?	Ensure that the riparian areas remain free of disturbance during and after construction. This can be achieved by a number of methods such as installing temporary fencing during construction, designating the areas as greenspace and/or parks, managing access to the areas by designing trails or other access points, and limiting access by installing fencing around sensitive features.
16	Concerns about stormwater – where will it be discharged? If we're trying to limit negative impacts to the wetland, we should not be directing stormwater to it.	Wetlands can be used effectively to filter stormwater discharge when managed and designed properly. Examples of this can be found throughout the City where stormwater is discharged to wetlands or streams (i.e. Hudson's Bay Slough, McMillan Creek, Parkridge Creek) The wetlands may be affected due to the increase in water and sedimentation; however, these wetland features are not limiting within the area and minimal impact if managed properly is anticipated. An EMP, including a detailed ESCP will be developed once a final design and construction approach is completed.

19	Integrated wildlife habitat into designs. Consider beaver-friendly drainage systems, and retain natural trees rather than clearing and planting new ones.	Options regarding beaver-friendly design can be found in the beaver management section of this document. Tree retention in the riparian set-back areas is recommended.
19	How will this be done? (Re: Environmental stewardship to be promoted at all stages of development)	Environmental input is anticipated at all stages of the neighbourhood design (planning, design, construction, and post construction). Development of an EMP and ESCP and environmental monitoring during construction will ensure all best management practices are implemented.
19	Installation of permanent fences to protect setbacks and sensitive environmental features	Recommendations for the riparian setback areas include: designating the areas as greenspace and/or parks, or by managing access to the areas by designing trails or other access points.
19	This should be worded better . . . (Wetland ecosystems are to be protected from development unless otherwise permitted by designated authorities.	Any works in and about a stream (including wetlands) cannot occur unless approval is received by the designated authorities. Additional details on the requirements can be found in the Regulatory Requirements section of this memo.
27	Environmental considerations for the road crossing should be acknowledged in this section, with recommendations in the Transportation section. Things to consider, why was this location picked for the road, is it the best from an environmental perspective? What mitigation strategies are needed to reduce impact. City Environmental staff have previously stated that bridges are preferred in this type of scenario, as culverts tend to clog/fail.	The current location of the main road that connects Area 4 and Area 5 crosses two of the drainages (Drainage 2 and 3) and will not impact the two wetland polygons. The location was chosen as it was the narrowest point between to the two drainages and will have the least amount of impact to the surrounding aquatic resources. No crossings of the Wf02 polygons have been proposed in the Neighbourhood Plan. As no fish are present in the development area, the installation of appropriately sized culverts within the development would be in compliance with the WSA. It is recommended that any culverts be installed with appropriate beaver deterrents/screens to reduce the amount of maintenance and/or replacements.
27	Please include information on the stormwater system as well, and how the design will include modifications for	A Stormwater Plan has not been developed yet; however general recommendations have been provided in this document. Once a detailed plan

	wildlife habitat. To protect the red listed wetland, stormwater shouldn't be discharged there.	has been developed, an environmental review and recommendations can be completed. No red-listed wetland is located within the proposed neighbourhood development.
29	Are there instances in the plan where this isn't happening? If the 35 m setback isn't maintained, what mitigation techniques/strategies are required?	A minimum 15 m setback is recommended for both the wetlands and drainages within the development area (Chilibeck 1993).
29	or Wetland?	See above comment
29	Erosion and Sediment Control Plan	An erosion and sediment control plan will be created once a detailed design of the Neighbourhood Plan is available. This can be submitted as a separate document or be included within the EMP.

APPENDIX H

Woodlands Neighbourhood Plan
L&M Engineering Limited

TRAFFIC IMPACT STUDY

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August 14th, 2019

WOODLANDS NEIGHBOURHOOD PLAN

TRAFFIC IMPACT STUDY

Client: Central Builders
L&M Project No.: 1631-01

L&M ENGINEERING LIMITED
1210 Fourth Avenue, Prince George, BC V2L 3J4
Phone: (250) 562-1977

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1.0 INTRODUCTION

On behalf of Central Builders, L&M is pleased to submit a Traffic Impact Study (TIS) in support of the Woodlands Neighbourhood Plan. The developer is proposing to expand the existing Woodlands Subdivision by constructing approximately 190 new residential lots within the Neighbourhood Plan area. The proposed development is located to the north of the existing subdivision and will require both ends of Woodvalley Drive to be extended in order to access the site. In addition, it is proposed that the property to the east will start being developed in the near future and there are plans to build a collector road from Kelly Road North to the Woodlands Subdivision. This would improve the City road network by providing an alternative access route for vehicles in the event of an emergency and will also provide more convenient access to Springwood Elementary School.

This TIS report has been requested by the City of Prince George to determine the potential impact on the surrounding road network and to provide guidance to future detailed design works for this development.

2.0 SCOPE OF STUDY

A Scope Development meeting was held on September 27, 2018. The meeting was used to develop the scope for this TIS.

2.1 Study Intersection(s)

- Foothills Boulevard & Chief Lake Road
- Kelly Road N & Venta Drive/Mabel Road

2.2 Study Horizons

- 2022 Existing Background
- 2037 Projected Background (15 years post development)
- 2022 Opening Day
- 2037 Total Traffic (15 years post development)

2.3 Peak Study Periods

- Weekday AM peak 7:00am to 9:00am
- Weekday PM peak 2:30pm to 6:00pm (adjusted due to school traffic peak)

2.4 Background Traffic Growth Rates

- The background growth rate will consider the data available from nearby MoTI count stations in Prince George.

2.5 Seasonal Adjustment

- No seasonal adjustment will be applied to the traffic counts as the majority of the traffic in the area is commuter traffic and will remain consistent throughout the year.

2.6 Trip Generation

- The Institute of Traffic Engineers (ITE) Trip Generation rates will be used.

2.7 Trip Distribution

- Determine the trip distribution based upon the proposed land use and local traffic patterns.

2.8 Analysis

- Analysis to be prepared using Trafficware Synchro software.
- Review Signal Warrants, if applicable.
- Use 95th percentile for queue lengths. Compare to TAC equation queue lengths.
- 15 min intervals.

2.9 Geometrics

- If required, geometry of recommended improvements will be provided.

2.10 Active Transportation

- Review pedestrian linkages.

2.11 Transit Connectivity

- Determine if internal bus route is required.

2.12 Report

- Summarize findings in a report to be submitted to the CoPG.

3.0 EXISTING BACKGROUND TRAFFIC

The following background traffic counts were conducted for the Weekday AM and PM Peak Hours:

- Chief Lake Road & Foothills Boulevard

- Kelly Road N & Venta Drive/Mabel Road

The counts were conducted from 6:00am to 9:00am (AM Peak) and 2:30pm to 6:00pm (PM Peak). The counts were conducted in 15-minute increments and were categorized by vehicle class (see Appendix A).

The existing background volumes for the peak study periods are shown in Figure 2.

4.0 PROJECTED BACKGROUND TRAFFIC

A review of the Annual Average Daily Traffic data from the permanent Count Station P-42NS indicates that there is not a consistent trend of population growth in the Prince George area. The annual growth rates over the past eight years have fluctuated up and down, but the average annual population growth over that period has been -0.31%. To be conservative, a background growth rate of 1.5% was chosen for the analysis. This rate is used to project the 2022 existing background traffic 15 years into the future to the year 2037. This growth represents general background development and population increase. This growth rate is conservative and, if applied to Prince George, would represent the current population increasing from 74,000 (Source: Statistics Canada 2016 Census Data) to 97,310 by the year 2037. The projected background traffic is illustrated in Figure 3.

5.0 DEVELOPMENT TRAFFIC

The peak hour trip generation for the development site was established using the published Institute of Traffic Engineers (ITE) Trip Generation Rates (10th Edition), using the maximum traffic generating uses allowable under the proposed zone.

5.1. Trip Generation

The proposed trip generation for the Woodlands Subdivision site was developed using the Institute of Transportation Engineers (ITE) Trip Generation Manual 10th Edition rate according to the proposed land use. The Opening Day scenario assumes the following developments will be constructed and occupied:

- 10 currently vacant lots in the existing Woodlands subdivision
- 16 lots in Woodlands Phase 3 (Tatlow Road)
- 16 lots in Woodlands Phase 4 (Northwest end of Woodland Drive)
- **Summary: Total of 42 Dwelling Units**

The Total Traffic scenario assumes the following developments will be constructed and occupied:

- 10 currently vacant lots in the existing Woodlands subdivision
- 16 lots in Woodlands Phase 3 (Tatlow Road)
- 16 lots in Woodlands Phase 4 (Northwest end of Woodland Drive)
- 174 lots on the remainder of the Woodlands Subdivision
- 162 lot on property to the east (Owned by: Balthazar Group)
- 75 lots on property to the west of Woodvalley Gate (Owned by: Kidd Real Estate Holdings)
- **Summary: Total of 453 Dwelling Units**

The trip generation is summarized in Table 1.

Table 1 – Peak Hour Trip Generation Rates

Land use	ITE #	Peak Period	Traffic Trip Generation Variable	Units	Trip Gen. Avg. Rate	In %	Out %	Total Trip Gen.	Entry (vph)	Exit (vph)
OPENING DAY										
Single-Family Detached Housing	210	AM	Dwellings Units	42	T=0.71(X)+4.8	25	75	**35**	9	26
		PM			Ln(T)=0.96Ln(X)+0.2	63	37	**44**	28	16
TOTAL TRAFFIC										
Single-Family Detached Housing	210	AM	Dwellings Units	453	T=0.71(X)+4.8	25	75	**326**	81	245
		PM			Ln(T)=0.96Ln(X)+0.2	63	37	**433**	273	160

* *Trip Generation for AM & PM Peaks were calculated using the methods and equations outlined in the ITE Trip Generation Manual (10Th Ed).*

5.2. Trip Distribution

To obtain specific development traffic volumes, the trip distribution in and out of the proposed development site must be established. This is accomplished by examining the existing traffic counts and adding the new ingress and egress trip generation traffic in the same percentage distribution to each of the movements. The distribution percentages shown are a percentage of the total development traffic during the peak hour.

It is projected that the distribution patterns for the residential traffic will change in the future once Venta Drive is extended and provides access to the Woodlands

Subdivision; hence the distributions for the 2022 Opening Day and 2037 Total Traffic design scenario have been created using different traffic pattern percentages.

The trip distribution percentages for the ingress and egress movements during the Opening Day and Total Traffic scenarios are illustrated in Figures 4 and 7, respectively.

5.3. Trip Assignment Volumes

Based on the trip distribution percentages and utilizing the trip generation volumes illustrated in Table 1, the Trip Assignment volumes can be calculated. The Trip Assignment volumes for the sites Opening Day and Total Traffic scenarios are shown in Figures 5 and 8, respectively.

5.4. 2022 Opening Day Volumes

Adding the trip assignment traffic (Figure 5) to the existing background traffic (Figure 2) results in the 2022 Opening Day Traffic shown in Figure 6.

5.5. 2037 Total Traffic Volumes

Adding the trip assignment traffic (Figure 8) to the projected background traffic (Figure 3) results in the 2037 Total Traffic shown in Figure 9.

6.0 HEAVY VEHICLE PERCENTAGE

The percentage of heavy vehicles on the municipal roads was calculated using the existing percentage of heavy vehicle traffic obtained from the traffic counts. Where the heavy vehicle volumes were zero or less, a default level of 2% was entered into the Synchro model (see Appendix C).

7.0 CAPACITY ANALYSIS

7.1. Method of Analysis

To analyze the performance of the study intersections and calculate the capacity and "level of service" (LOS) of each intersection, the Synchro Studio Software has been used. This software was developed by Trafficware Ltd. and is based on the methods and procedures in the Highway Capacity Manual. Computer printouts showing the detailed calculation for each individual movement at each study intersection are provided in Appendix B.

The concept of "Level of Service" is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists. A level of service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

The six levels of service are defined in the Highway Capacity Manual as follows:

- **Level of Service A** represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist is excellent.
- **Level of Service B** is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from Level of Service A. The level of comfort and convenience provided is somewhat less than at Level of Service A, because the presence of others in the traffic stream begins to affect individual behavior.
- **Level of Service C** is the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interaction with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.
- **Level of Service D** represents high-density, but stable, traffic flow. Speed and freedom to maneuver are severally restricted, and the driver experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.
- **Level of Service E** represents operating conditions at, or near, the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely

difficult, and is generally accomplished by forcing a vehicle to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow and minor perturbations within the traffic stream will cause breakdowns.

- **Level of Service F** is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queues are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, and then be required to stop in a cyclic fashion. The Level of Service F is used to describe the operating conditions within the queue, as well as the point of the breakdown.

Levels of Service Criteria, as defined by the Highway Capacity Manual, are illustrated in Table 2.

Table 2 – Level of Service Definitions

Level of Service	Impact on Street Traffic	Unsignalized Intersection Delay(s)	Signalized Intersection Delay(s)
A	Little or no delays	0 – 10	0 – 10
B	Minor delays	10 – 15	10 – 20
C	Average delays	15 – 25	20 – 35
D	Long delays	25 – 35	35 – 55
E	Very long delays	35 – 50	55 – 80
F	Undesirable	> 50	> 80

The study intersections can be viewed in Exhibit 1.

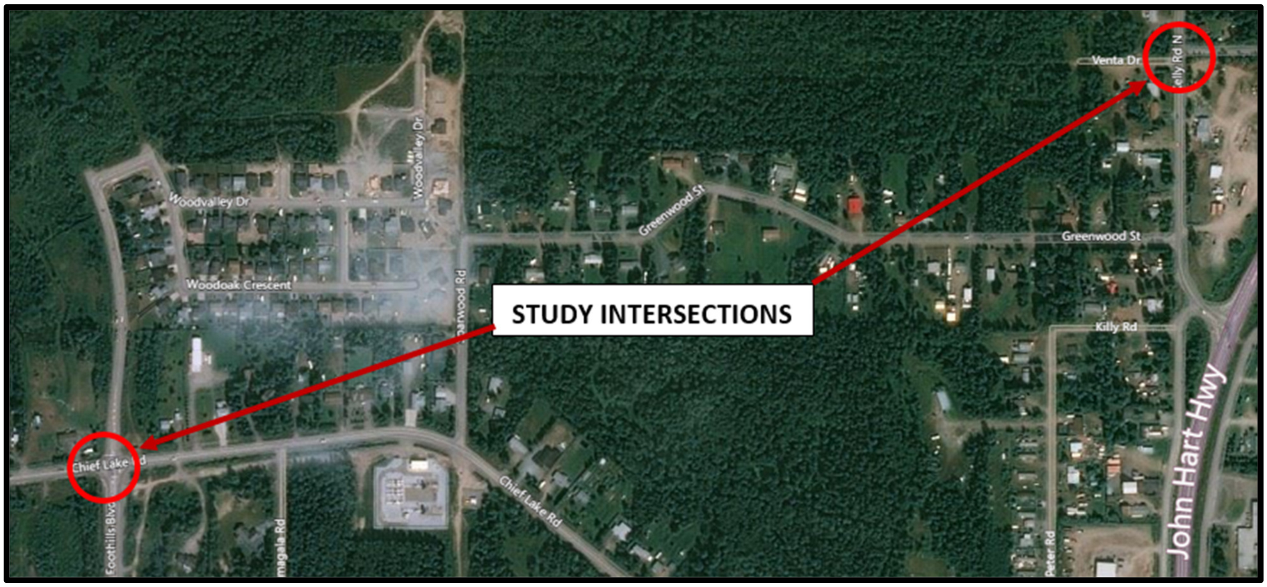

Exhibit 1: Study Intersections

7.2. Foothills Boulevard & Chief Lake Road

The Foothills Boulevard (north/southbound) & Chief Lake Road (west/eastbound) intersection is an unsignalized four-way intersection. Foothills Boulevard and Chief Lake Road are both two-lane arterials with speed limits of 60km/hr at this intersection location. The northbound and southbound approaches are both stop controlled and have designated left-turn lanes. The northbound approach also has a channelized right turn lane. The eastbound and westbound approaches each have a single full movement lane. In addition to the stop signs for the northbound and southbound movements, the intersection contains a flashing beacon above the center of the intersection. The beacon flashes red for the northbound and southbound (Foothills Boulevard) movements and flashes yellow for the eastbound and westbound (Chief Lake Road) movements. The installation warrant for flashing beacons states that the beacons can be used to emphasize caution when at least two reportable accidents a year occur over a minimum of a three-year period.

A summary of the Synchro analysis for this intersection is shown in Table 3. The analysis shows that during the Weekday AM and PM Peaks all intersection movements operate at LOS D (long delays) or better during all design horizons, with the exception of the northbound left movement during the 2037 Total Traffic scenario. Even though the intersection operates at a LOS F in the 2037 full build out scenario, the intersection still does not meet the requirements to warrant a traffic signal. Refer to Section 9.0 for the breakdown of the traffic signal warrants.

Table 3 – Foothills Blvd & Chief Lake Rd												
	Chief Lake Rd				Foothills Blvd							
Approach	Eastbound		Westbound		NBL		NBT/NBR		SBL		SBT/SBR	
	LOS	Delay(s)	LOS	Delay(s)	LOS	Delay(s)	LOS	Delay(s)	LOS	Delay(s)	LOS	Delay(s)
AM PEAK												
2022 Existing Background	A	0.0	A	3.5	C	15.6	B	10.9	B	13.9	B	14.4
2022 Opening Day	A	0.0	A	3.3	C	16.4	B	11.2	B	14.6	B	14.8
2037 Projected Background	A	0.0	A	3.7	C	20.1	B	11.7	C	16.5	C	16.8
2037 Total Traffic	A	0.0	A	3.1	D	32.6	B	11.8	C	21.7	C	22.7
PM PEAK												
2022 Existing Background	A	0.1	A	1.7	C	19.5	B	10.8	C	15.5	B	13.6
2022 Opening Day	A	0.1	A	1.7	C	20.4	B	11.6	C	16.8	B	13.9
2037 Projected Background	A	0.0	A	1.9	D	32.1	B	11.6	C	19.1	C	15.3
2037 Total Traffic	A	0.2	A	1.6	F	117.8	C	22.8	F	55.5	C	23.3

7.3. Kelly Road N. & Venta Drive / Mabel Road

The Kelly Road N. & Venta Drive intersection is an unsignalized four-way intersection. Currently the east/west roads (Venta Drive & Mabel Road) are offset by approximately 12 metres. It is proposed that when Venta Drive is extended to the west, it will also be realigned to be directly across from Mabel Road. This will improve the safety of intersection by reducing the amount of traffic conflict points and will ensure that queue lengths will not block the opposing left turning traffic. All of the roads have a design speed limit of 50km/hr. The northbound and southbound lanes each have a single lane with no movement restrictions. The eastbound and westbound lanes have a single lane with stop control.

A summary of the Synchro analysis for this intersection is shown in Table 4. The analysis shows that during the Weekday AM and PM Peaks all intersection movements operate at LOS B (minor delays) or better during all design horizons.

Table 4 – Kelly Road N. & Venta Drive								
	Venta Dr		Mabel Rd		Kelly Road N.			
Approach	Eastbound		Westbound		Northbound		Southbound	
	LOS	Delay(s)	LOS	Delay(s)	LOS	Delay(s)	Los	Delay(s)
AM PEAK								
2022 Existing Background	B	10.8	B	10.7	A	0.1	A	0.1
2037 Projected Background	B	11.4	B	11.4	A	0.1	A	0.1
2037 Total Traffic	B	11.4	B	14.1	A	1.3	A	0.1
PM PEAK								
2022 Existing Background	B	10.1	B	10.5	A	0.0	A	0.2
2037 Projected Background	B	10.6	B	11.1	A	0.0	A	0.3
2037 Total Traffic	A	9.7	B	14.4	A	2.4	A	0.3

8.0 GEOMETRICS

8.1. Sight Distance

The concept of sight distance applies both to vehicles approaching a potential conflict point (typically an intersection) and vehicles departing from a stop at the intersection. Sufficient sight distance should be provided in the design of roads so that drivers can perceive potential conflicts and respond by maneuvering appropriately. The proposed available sight distances were reviewed to determine if they meet current standards.

The *Transportation Association of Canada (TAC) Geometric Design Guide* outlines the criteria for several different types of sight distance, including *stopping sight distance*, *crossing sight distance*, *turning sight distance, passing sight distance,* and *decision sight distance*. When these criteria apply depends on the specific vehicle maneuvers being considered. At a *minimum*, sufficient stopping sight distance should be provided so that drivers can perceive, react, and bring the vehicle to a stop or avoid conflicts.

The sight distance criterion is outlined in Table 5 for the posted 50 and 60 km/hr speed limits at the subject intersections:

TABLE 5 – SIGHT DISTANCE CRITERIA		
	Design Speed (Main Road)	
	50 km/hr	*60 km/hr*
Sight Distance Type	*Minimum Distance Required (m)*	
Stopping Sight Distance	65	85
Turning Sight Distance	120	160
Passing Sight Distance	n/a	n/a
Minimum Decision Sight Distance	135	165
Desirable Decision Sight Distance	195	235

L&M personnel used a combination of PGMap and field measurements to approximate the available vehicle sightline distances of the intersection locations. Table 6 illustrates a summary of the survey findings.

TABLE 6 – AVAILABLE SIGHT DISTANCE				
Intersection	**Location**	**Direction**	**Measured Sight Distance (m)**	
			Looking West	*Looking East*
Foothills & Chief Lake Rd	Stop Bar	SB	≈225	>235m
	4m ahead of Stop Bar		>235m	>235m
	Stop Bar	NB	≈120*	≈200
	2m Ahead of Stop Bar		>235m	>235
	Channelized Right Turn Lane		>235m	
			Looking North	*Looking South*
Kelly Road N & Venta Rd	Road Edge	EB	130	240

The sightlines at both of the study intersections meet or exceed the stopping sight distance and turning sight distance requirements outlined in the TAC Guidelines.

8.2. AUXULIARY LANES

Auxiliary lanes, as defined by the Transportation Association of Canada (TAC), “serve as storage lanes, deceleration lanes, or a combination of the two.” They can be used to minimize hazard and inconvenience, to increase capacity, and to promote operating efficiency where vehicles exit or enter the roadway.

8.2.1. Left Turn Warrants

The "Harmelink" charts found in the Ministry of Transportation and Highways – Site Impact Analysis Requirements Manual are used to identify if a left turn lane is warranted at an unsignalized intersection. The charts utilize advancing traffic volumes, opposing traffic volumes and left turning percentage to determine if the left turn lane is warranted and how much storage length is required. Due to low left turning traffic volumes, the eastbound movement at Foothills Boulevard and Chief Lake Road and the southbound movement at Kelly Road N. and Venta Drive were not plotted on the Harmelink plots. The 2037 Total Traffic scenarios (worst-case scenario) for the westbound movement at Foothills Boulevard and Chief Lake Road and the northbound movement at Kelly Road N. and Venta Drive were plotted and it was determined that neither movement met the warrant for a separate left turn lane.

8.2.2. Left Turn Storage

To analyze the left turn storage length, the available (existing) length was first measured from an aerial map. The distance was then compared with the computed Synchro 95th percentile queue storage lengths in addition to the published TAC calculation guidelines. The following TAC equations were utilized:

Unsignalized: $S = N*L/30$

Where: S= Storage Length (m)
N= Left Turn Volumes (veh/hr)
L= Average Vehicle Length (7.5m)

Signalized: $S = (N*L*SF*C)/3600$

Where: S= Storage Length (m)
N= Left Turn Volumes (veh/hr)
L= Average Vehicle Length (8.0m)
SF=Safety Factor. Used 1.5 for ≤ 60km/hr

8.2.2.1. Foothills Boulevard Left Turn Storage

The existing southbound (Foothills Boulevard) left turn lane has a storage length of 20m and a bay taper length of 23m. The TAC Guide recommends a minimum of a 30m storage length. However, the volumes from the traffic counts do not warrant a left turn lane and the movement is stop controlled, which means no additional deceleration length is required. In this case it is not recommended to extend the storage lane length from 20m to 30m.

The northbound left turn lane has a 40m long storage lane and a 30m bay taper. The synchro results indicate that 70m of storage length is required during the 2037 PM Peak Total Traffic scenario. The current available storage is approximately 30m shorter than the Synchro results indicate is required. Since all of the 2022 scenarios indicate that the current storage length is adequate, the City should monitor this left turn slot to determine if lengthening the left turn storage is required in the future. No traffic was added to this movement as a part of the trip generation.

Table 7 – Foothills Boulevard Left Turn Storage

Left Turn Storage Length						
Design Year Total Traffic	**Northbound LT**			**Southbound LT**		
	VOL (vph)	SYN (m)	TAC (m)	VOL (vph)	SYN (m)	TAC (m)
Weekday AM Peak						
2022 Existing Background	63	5.9	16.8	18	1.4	4.8
2022 Opening Day	63	6.4	16.8	31	2.7	8.3
2037 Projected Background	77	10.1	20.5	22	2.3	5.9
2037 Total Traffic	77	17.2	20.5	84	24.2	22.4
Weekday PM Peak						
2022 Existing Background	154	15.2	41.1	19	1.8	5.1
2022 Opening Day	154	20.4	41.1	29	16.8	7.7
2037 Projected Background	188	30.9	50.1	23	2.9	19.1
2037 Total Traffic	188	70.7	50.1	55	20.3	14.7

*TAC Guidelines recommend a minimum storage length of 30m.

8.2.3. Right Turn Warrants

The right turn movements were evaluated to determine if a separate right turn taper or lane was warranted. In B.C., the widely accepted method for evaluating right turns is to utilize the "Warrants for Right Turn Treatment", a chart published in the Virginia Department of Transportation Access Management Design Standards for Entrances and Intersections manual. Based on this criterion, the Foothills Boulevard and Chief Lake Road intersection warranted right turn treatment for the eastbound and westbound movements. The following results were obtained:

- A warrant for a full-width turn lane and taper is met at the Foothills Boulevard and Chief Lake Road intersection during the following design horizons:

  Westbound
    - 2037 Total Traffic PM Peak

  Eastbound
    - 2022 Existing Background AM Peak
    - 2022 Opening Day AM Peak
    - 2037 Projected Background AM Peak
    - 2037 Total Traffic AM Peak
    - 2037 Projected Background PM Peak
    - 2037 Total Traffic PM Peak

The westbound right turn lane warrant was met during the 2037 Total Traffic scenario and was impacted substantially by the trips generated by the proposed developments. It was determined that the warrant for a right turn taper is triggered once approximately 57 dwelling units are constructed. The 57 units is in addition to the unoccupied lots in the existing Woodlands Subdivision and the soon to be constructed Phase 3 lots on Tatlow Road. It was determined that the warrant for a full width westbound right turn lane and taper is triggered once approximately 167 dwelling units are constructed. Similar to the taper warrant, the 167 units is in addition to the unoccupied lots in the existing Woodlands Subdivision and the soon to be constructed Phase 3 lots on Tatlow Road.

The eastbound right turn lane warrant was met during all of the AM Peak design scenarios, including the existing background scenario. The trips generated by the development had virtually no affect on the warrant being met.

The TAC Guidelines recommend the parallel lane for a 60km/hr road to be a minimum of 40m long and the taper to have a minimum taper ratio of 14:1. Assuming a lane width of 3.6m would result in a minimum taper length of 50m. If it is decided to construct the westbound right turn taper at an earlier date than constructing the full width turn lane and taper, then the TAC Guidelines recommend an 18:1 taper ratio for 60km/hr design speeds. Assuming a taper width of 3.6m would result in a 65m long taper.

9.0 SIGNAL WARRANTS

The Ministry of Transportation and Infrastructure has published a set of "Signal Warrants" to evaluate the need to install traffic signals at roadway intersections. These warrants can be found in the MoTI publication "Electrical and Traffic Engineering Manual - Section 400 Signal Design." For the purposes of this study, three warrants were deemed appropriate:

- Warrant #1: Minimum Vehicular Volume;
- Warrant #2: Interruption of Continuous Traffic; and,
- Warrant #3: Combination Warrant.

The signal warrants were not met for the 2037 Total Traffic scenario at the Foothills Boulevard and Chief Lake Road intersection. The intersection does not require signalization during the study horizon time period.

TABLE 8 – Traffic Signal Warrants
Foothills Boulevard and Chief Lake Road

Design Horizon	Warrant 1			Warrant 2			Warrant 3
	Major St % Filled	Minor St % Filled	Satisfied	Major St % Filled	Minor St % Filled	Satisfied	80 % Satisfied
2037 Total Traffic	**61%**	**108%**	**No**	**41%**	**216%**	**No**	**No**

10.0 PEDESTRIAN NETWORK

The roads within the Neighbourhood Plan area and the development to the east (Owned by Balthazar Group) will be built to the City of Prince George's urban road standards, which include concrete sidewalks on every road. In addition, Phase 2 of the existing Woodlands Subdivision was built with concrete sidewalks. This will provide a safe and efficient pedestrian network through the entirety of the subdivision. The pedestrian network will also connect both the Woodlands Subdivision and the Balthazar development to Springwood Elementary School without forcing pedestrians to use Chief Lake Road, Highway 97, or Kelly Road N.

11.0 TRANSIT CONNECTIVITY

The City of Prince George's Transit Future Plan indicates that bus stops should be located within 400m of 90% of residents. There are currently no bus stops or bus routes that come within 400m of any of the proposed lots in the Woodlands Subdivision. The bus route that is nearest the site is Route 91, which travels north along Highway 97, approximately 400m past the Chief Lake Road intersection, before circling back and taking Highway 97 to Foothills Boulevard, and then arriving at the Spruceland Shopping Centre. The nearest bus stop on this route is located on the Hart Highway Frontage Road, near the intersection of Chief Lake Road and Highway 97 which is over 1800m from the proposed development, as shown in Exhibit 2.

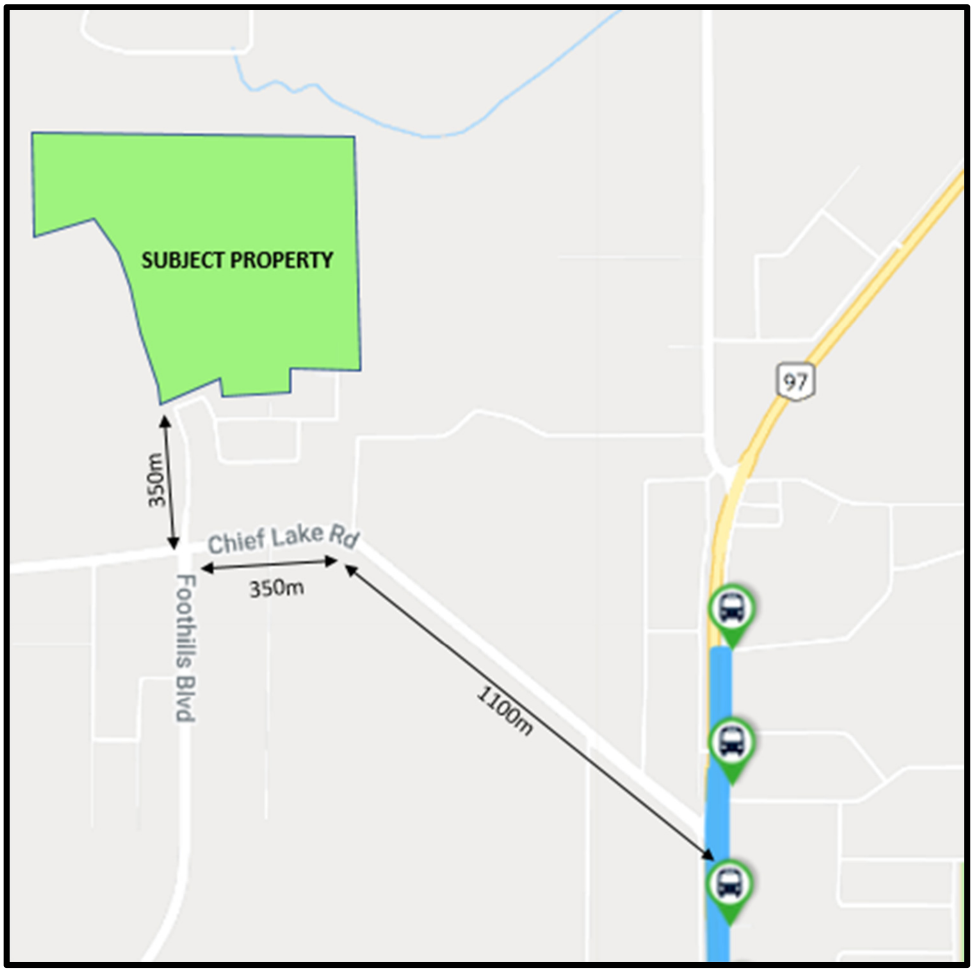

Exhibit 2: BC Transit Bus Route 91

The next two closest bus routes are Route 96 and 97, which travel as far north as Kelly Road Secondary School. Both of these route's final destination is the Spruceland Shopping Centre, with one travelling via Foothills Boulevard and the other travelling via Highway 97. In order to remain consistent with the City of Prince George's transit policies, a transit route should be considered after the full buildout of the site as transit demands are warranted.

12.0 CONCLUSIONS AND RECOMMENDATIONS

12.1. CONCLUSIONS

Foothills Boulevard and Chief Lake Road

1. The Foothills Boulevard and Chief Lake Road intersections northbound left lane operates at a LOS D (long delays) or better for all AM and PM Peak design horizons, with the exception of the 2037 Total Traffic scenario which operates at a LOS F (undesirable delays). The southbound lane also operates at a LOS F during the 2037 Total Traffic scenario.

2. The available sight distances at Foothills Boulevard and Chief Lake Road intersection are greater than 235m when looking both east and west. This exceeds all sight distance requirements outlined in the TAC Guidelines.

3. The warrant for a full-width westbound right turn lane and taper is met on Chief Lake Road at Foothills Boulevard during the 2037 Total Traffic scenario.

4. The warrant for a full-width eastbound right turn lane and taper is met on Chief Lake Road at Foothills Boulevard during all AM Peak design scenarios including the 2022 Existing Background scenario. The traffic generated by the subject development has virtually no impact on the warrant being met.

5. The Synchro results indicate that the northbound left turn lane requires a storage length of 70m during the 2037 Total Traffic scenario. The existing lane only has an available storage length of 40m.

6. The Ministry of Transportation and Infrastructure's Traffic Signal Warrants were not met at Foothills Boulevard and Chief Lake Road during any of the design horizon scenarios.

Kelly Road N. and Venta Drive / Mabel Drive

1. The Kelly Road N. and Venta Drive intersections operates at a LOS B (minor delays) or better for all AM and PM Peak design horizons.

2. The available sight distances at Kelly Road N. and Venta Drive intersection are approximately 130m when looking north and approximately 240m when looking south. This exceeds the stooping sight distance and turning sight distance requirements outlined in the TAC Guidelines.

12.2. RECOMMENDATIONS

Foothills Boulevard and Chief Lake Road

1. A westbound (on Chief Lake Road) right turn taper should be installed at the Foothills Boulevard and Chief Lake Road intersection once 57 additional dwelling units get constructed (excludes property owned by the Balthazar Group). The 57 dwelling units are in addition to the unoccupied lots in the existing Woodlands Subdivision and the soon to be constructed Phase 3 lots (16 lots) on Tatlow Road. The TAC Guidelines recommend the taper to be 65m long.
2. A westbound (on Chief Lake Road) deceleration lane and taper should be installed at the Foothills Boulevard and Chief Lake Road intersection once 167 additional dwelling units are constructed (excludes property owned by the Balthazar Group). The 167 dwelling units are in addition to the unoccupied lots in the existing Woodlands Subdivision and the soon to be constructed Phase 3 lots (16 lots) on Tatlow Road.The TAC Guidelines recommend the parallel length to be a minimum of 40m long with a 50m long taper.
3. The City should monitor the northbound left turn lane at the Foothills Boulevard and Chief Lake Road intersection to determine if the left turn lane storage length needs to be lengthened from 40m to 70m in the future.

Kelly Road N. and Venta Drive / Mabel Road

1. Venta Drive should be realigned to be directly across from Mabel Road.

2. No other road upgrades are required at this intersection.

13.0 CLOSURE

This Traffic Impact Study has been prepared for the exclusive use of the Central Builders Ltd. and the City of Prince George. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it are the responsibility of such third parties. L&M Engineering Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this study. The information and data contained within this document represents L&M Engineering Limited's professional judgment in accordance with the knowledge and information available to L&M Engineering Limited at the time of the report preparation. No other warranty, expressed or implied, is made.

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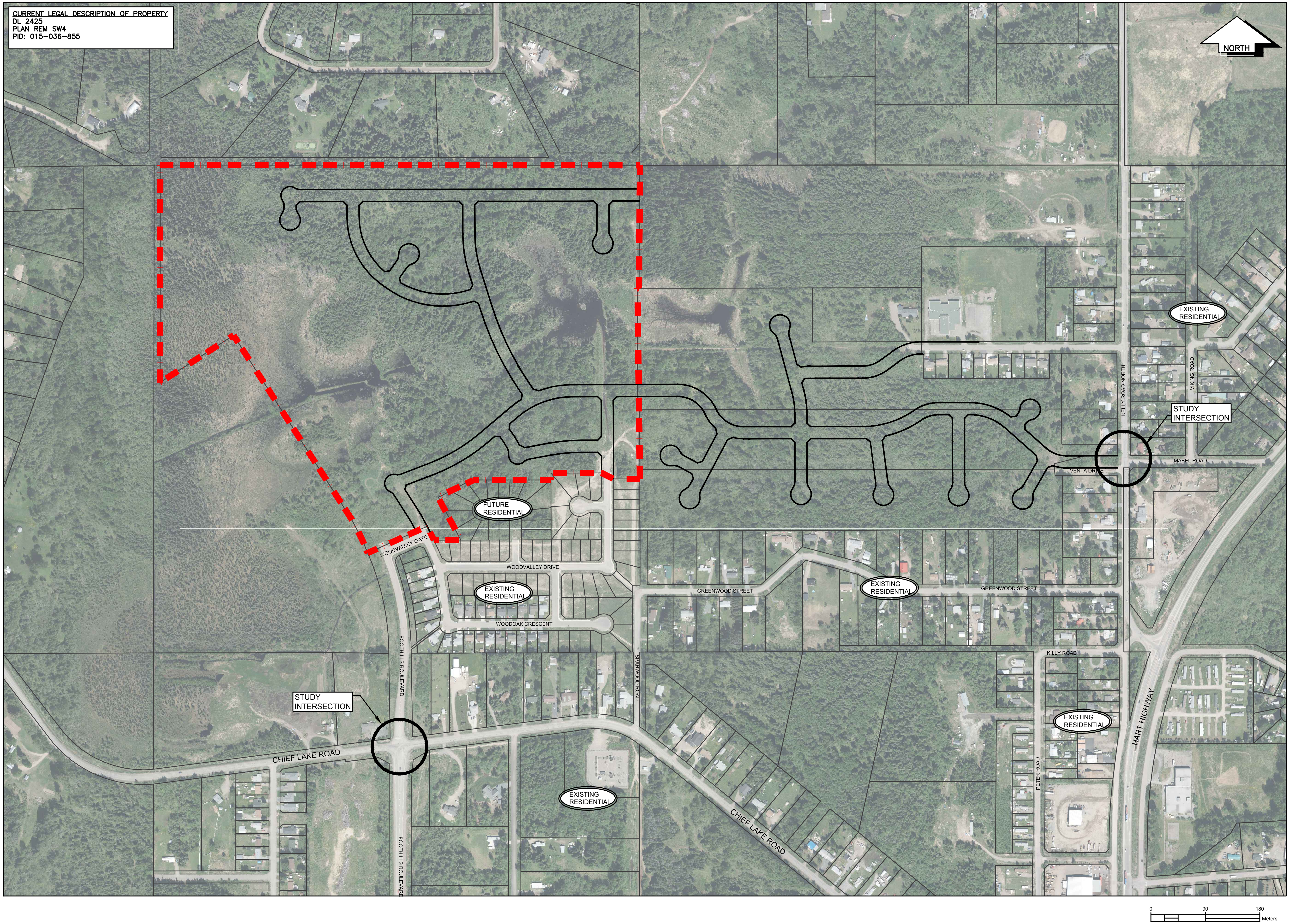
Figures



LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED

1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
V2L 3J4
TEL. (250) 562-1977
FAX (250) 562-1967

DRAWN:	MM
CHECKED:	TF
ENGINEER:	TF
SURVEY FILE:	
DRAWING FILE:	CAD18 1631-01TS.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	MARCH 2019
SCALES:	1:3000

WOODLANDS PROPERTY DEVELOPMENT CORP.

OVERALL SITE PLAN

CONSULTANTS PROJECT No.
1631-01

DRAWING No.
FIG 1

SHEET No. 1 OF 9 | REV. No. 0

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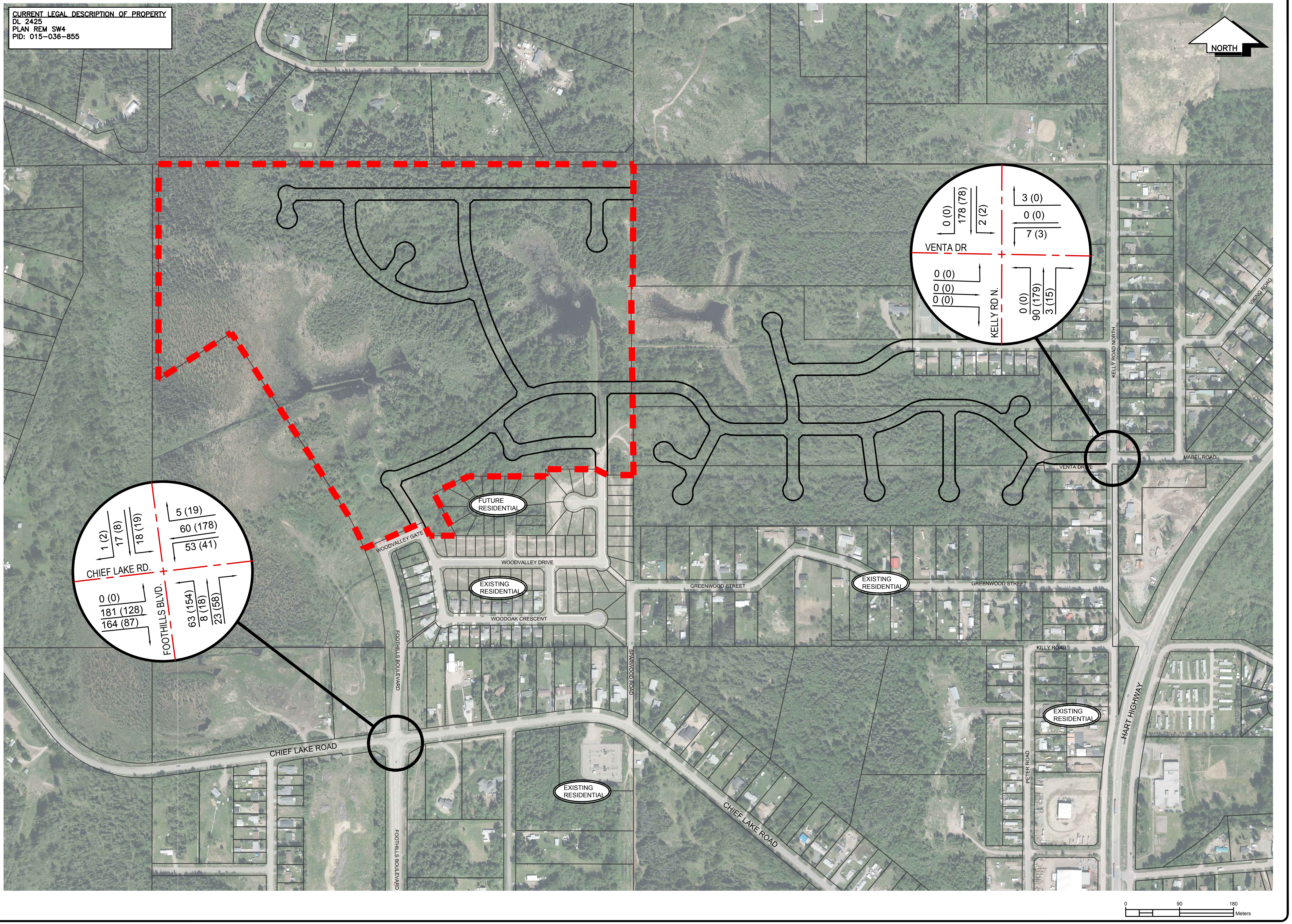

LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

xxx AM TRAFFIC

(xxx) PM TRAFFIC

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED

1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
V2L 3J4
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DRAWN:	MM
CHECKED:	TF
ENGINEER:	TF
SURVEY FILE:	
DRAWING FILE:	CAD18 1631-01TS.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	MARCH 2019
SCALES:	1:3000

WOODLANDS PROPERTY DEVELOPMENT CORP.
TRAFFIC IMPACT STUDY

2022 EXISTING BACKGROUND

CONSULTANTS PROJECT No. 1631-01

DRAWING No. FIG 2

SHEET No. 2 OF 9

REV. No. 0

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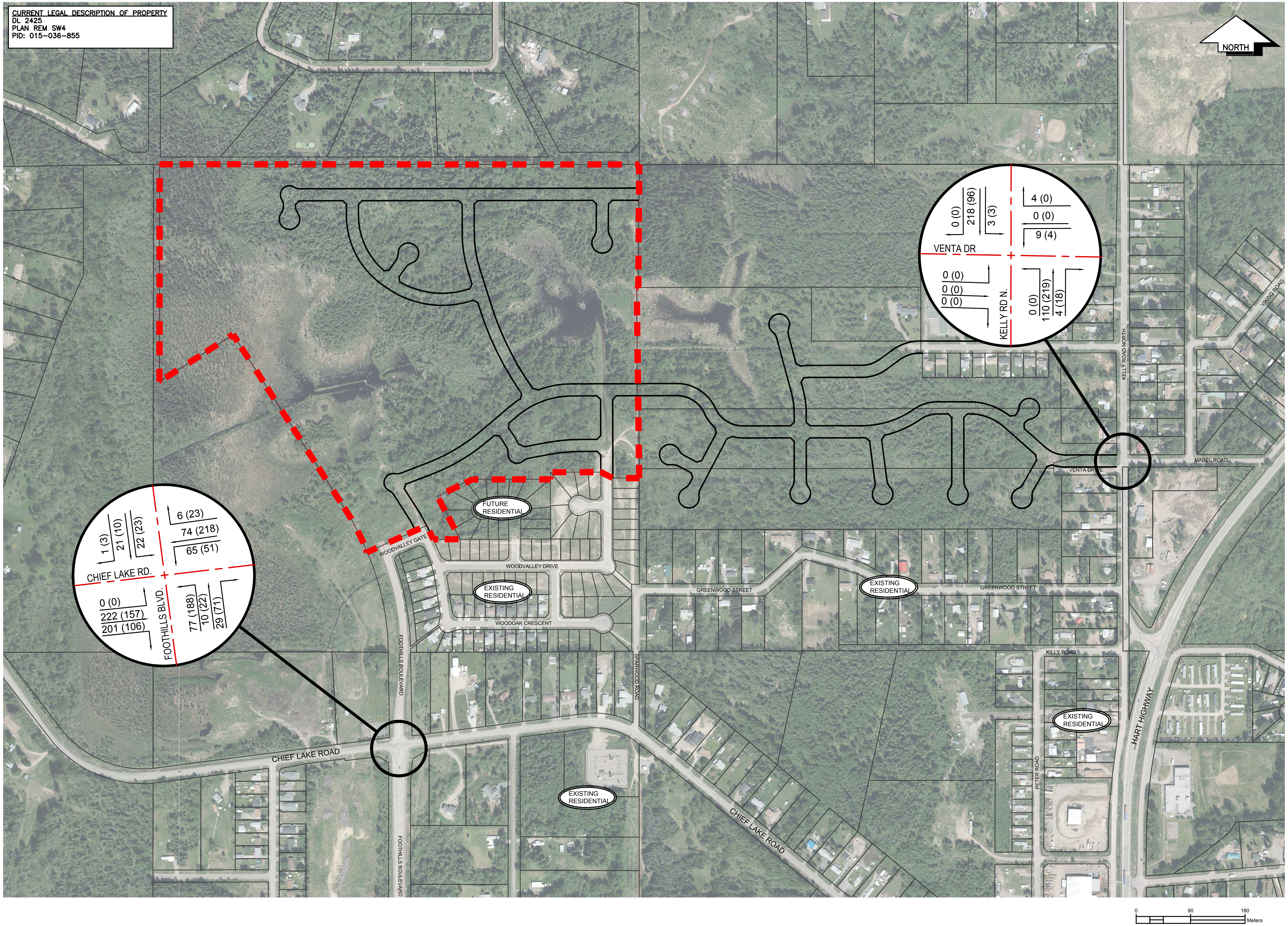

LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

xxx AM TRAFFIC
(xxx) PM TRAFFIC

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED
1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
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DRAWN:	MM
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GRID:	
DATE:	MARCH 2019
SCALES:	1:3000

WOODLANDS PROPERTY DEVELOPMENT CORP.
TRAFFIC IMPACT STUDY

2037 PROJECTED BACKGROUND

CONSULTANTS PROJECT No.
1631–01

DRAWING No.
FIG 3

SHEET No.	REV. No.
3 OF 9	0

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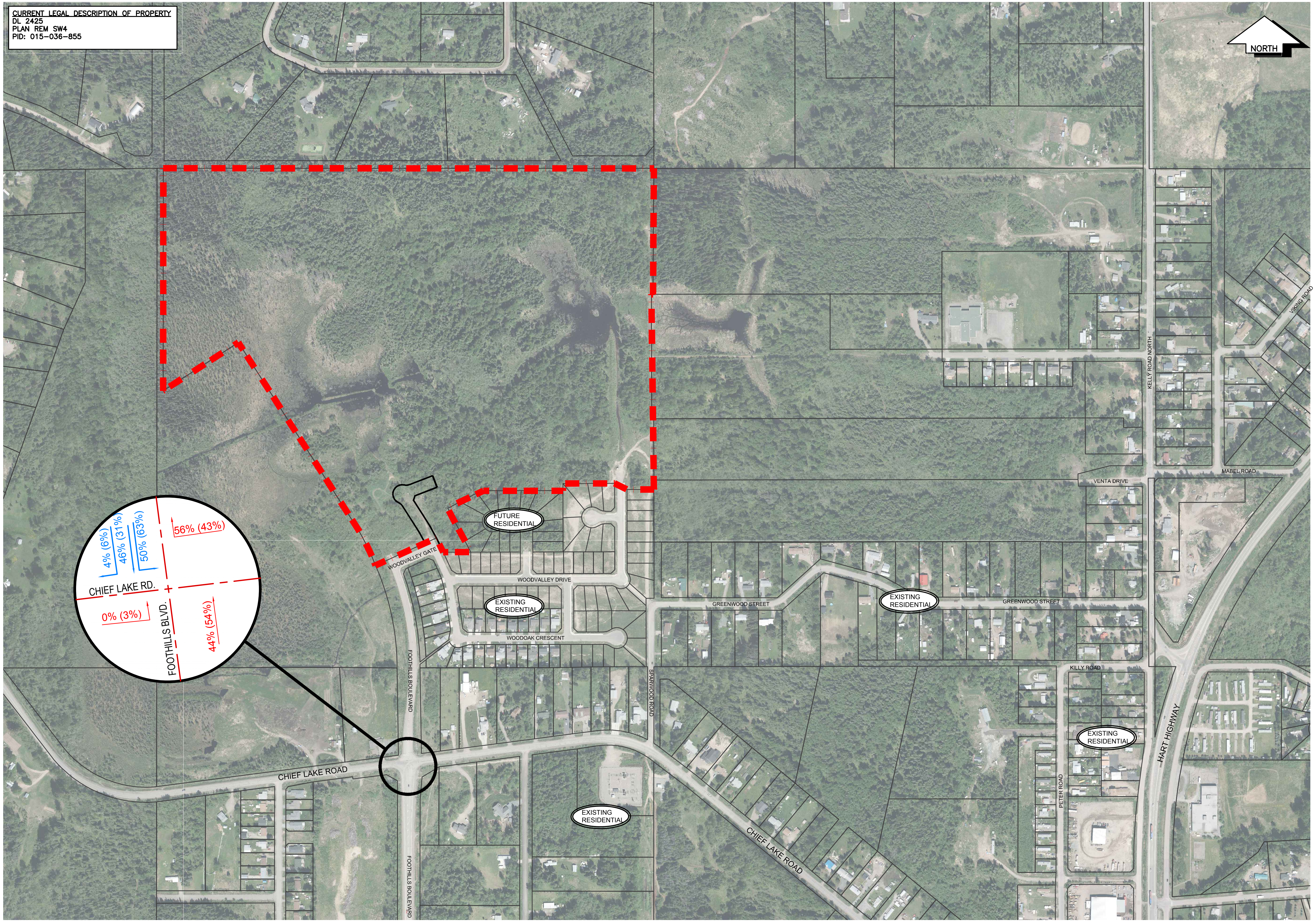

LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

EGRESS

xxx AM TRAFFIC %
(xxx) PM TRAFFIC %

INGRESS

xxx AM TRAFFIC %
(xxx) PM TRAFFIC %

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED

1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
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DRAWN:	MM
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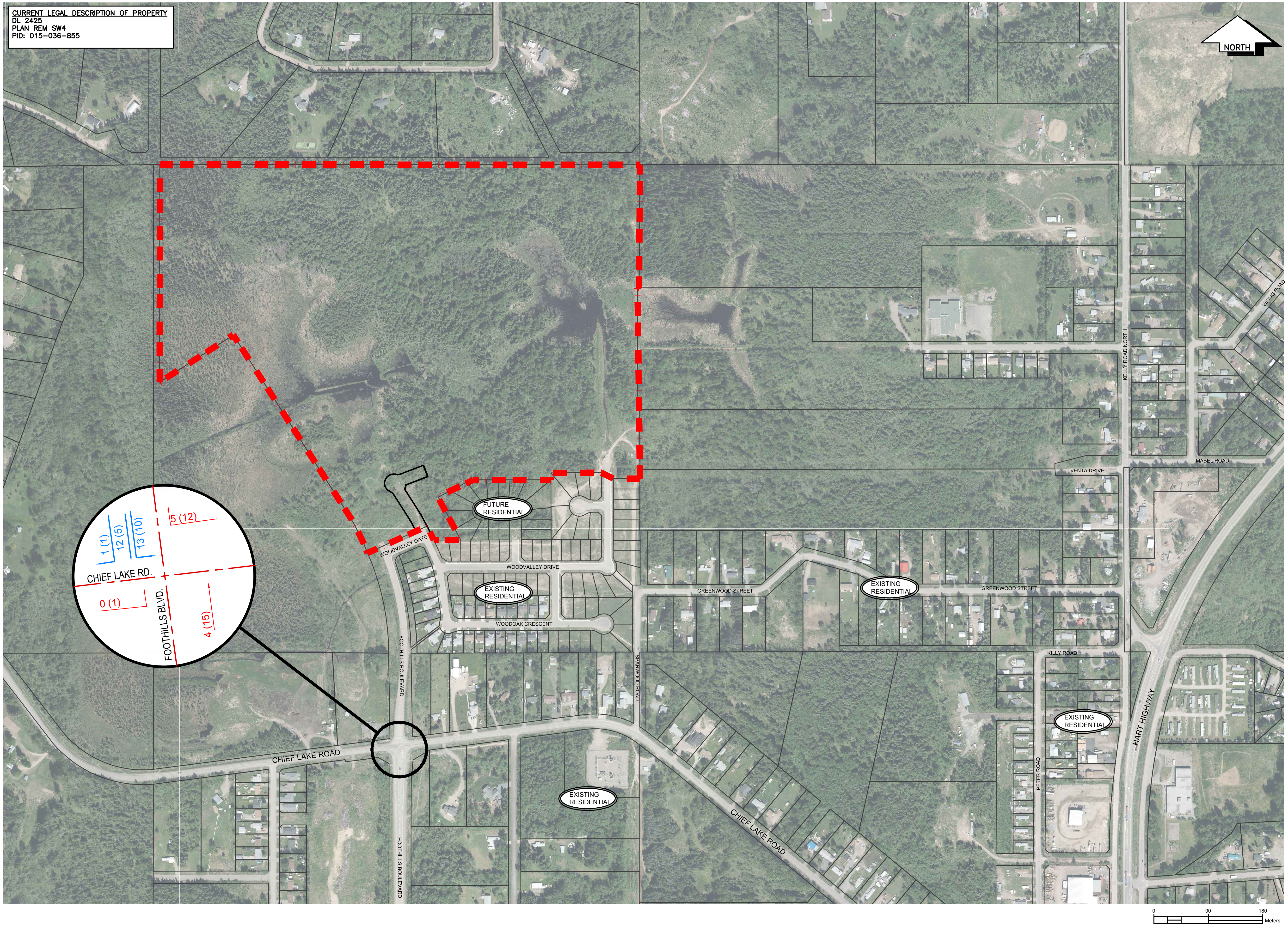
WOODLANDS PROPERTY DEVELOPMENT CORP.
TRAFFIC IMPACT STUDY
TRIP DISTRIBUTION – OPENING DAY

CONSULTANTS PROJECT No.
1631–01

DRAWING No.
FIG 4

SHEET No.	REV. No.
4 OF 9	0



G:\Job Files\1600\1631 - Central Builders\01 - Woodlands Neighbourhood Plan\Traffic Study\CAD18 1631-01TS.dwg

LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

EGRESS

xxx AM TRAFFIC %
(xxx) PM TRAFFIC %

INGRESS

xxx AM TRAFFIC %
(xxx) PM TRAFFIC %

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED

1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
V2L 3J4
TEL. (250) 562-1977
FAX (250) 562-1967

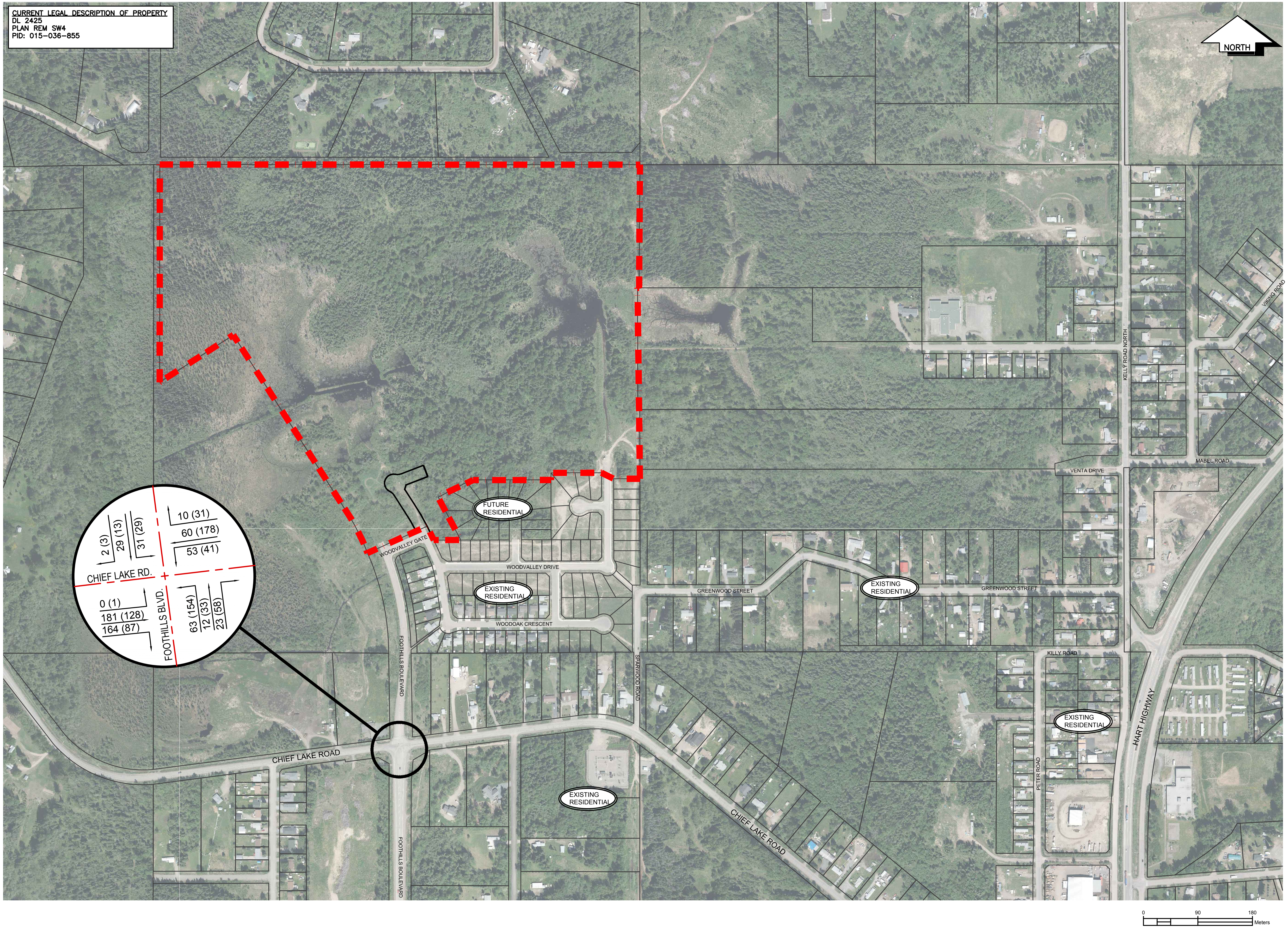
DRAWN:	MM
CHECKED:	TF
ENGINEER:	TF
SURVEY FILE:	
DRAWING FILE:	CAD18 1631-01TS.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	MARCH 2019
SCALES:	1:3000

WOODLANDS PROPERTY DEVELOPMENT CORP.
TRAFFIC IMPACT STUDY
TRIP ASSIGNMENT – OPENING DAY

CONSULTANTS PROJECT No.
1631-01

DRAWING No.
FIG 5

SHEET No. 5 OF 9
REV. No. 0



O:\Job Files\1600\1631 – Central Builders\01 – Woodlands Neighbourhood Plan\Traffic Study\CAD18 1631–01TS.dwg

LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

xxx AM TRAFFIC
(xxx) PM TRAFFIC

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED
1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
V2L 3J4
TEL. (250) 562-1977
FAX (250) 562-1967

DRAWN:	MM
CHECKED:	TF
ENGINEER:	TF
SURVEY FILE:	
DRAWING FILE:	CAD18 1631–01TS.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	MARCH 2019
SCALES:	1:3000

WOODLANDS PROPERTY DEVELOPMENT CORP.
TRAFFIC IMPACT STUDY

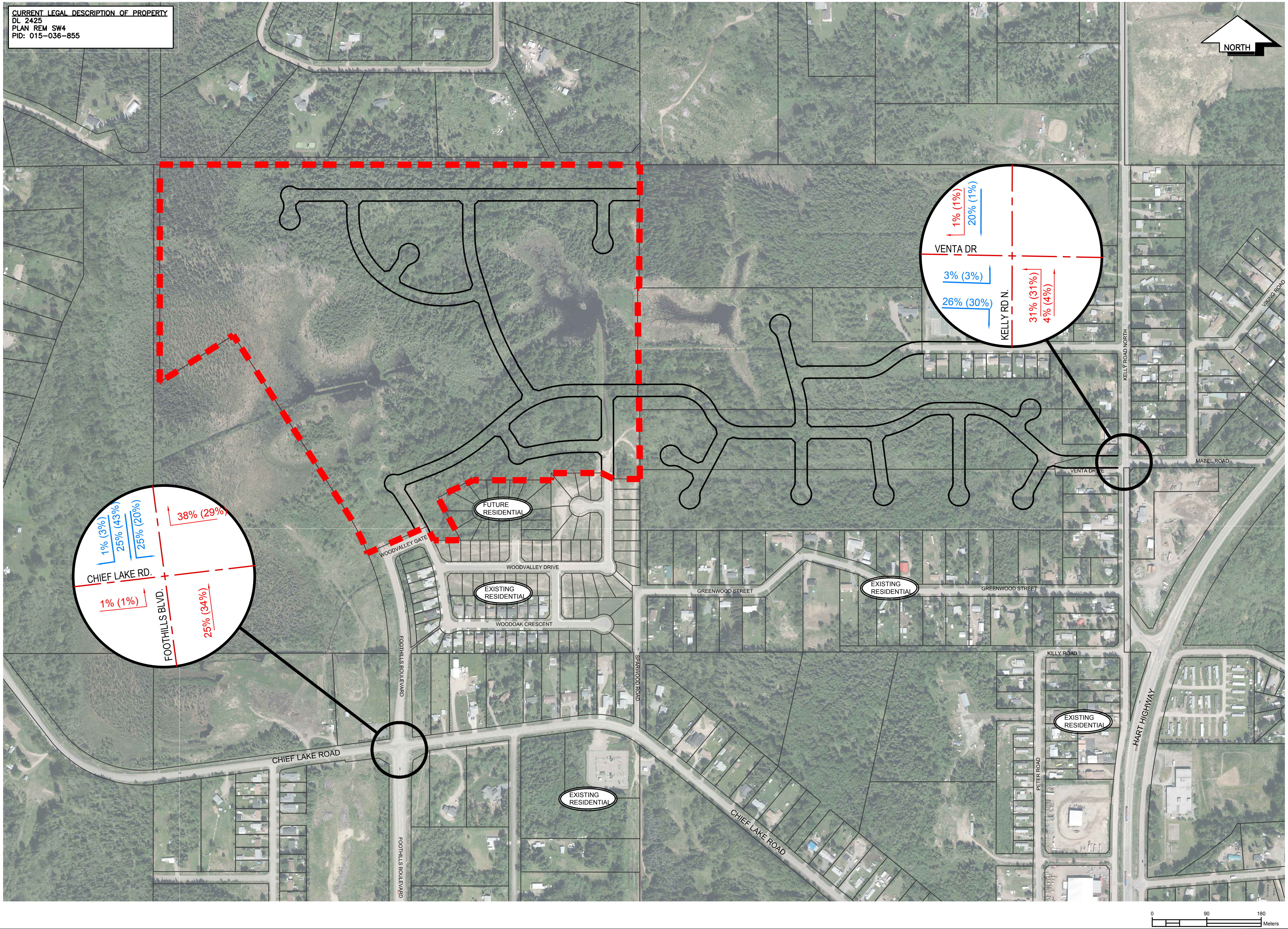
2022 OPENING DAY

CONSULTANTS PROJECT No. 1631–01

DRAWING No. FIG 6

SHEET No. 6 OF 9

REV. No. 0



LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

EGRESS

xxx AM TRAFFIC %
(xxx) PM TRAFFIC %

INGRESS

xxx AM TRAFFIC %
(xxx) PM TRAFFIC %

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED
1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
V2L 3J4
TEL. (250) 562-1977
FAX (250) 562-1967

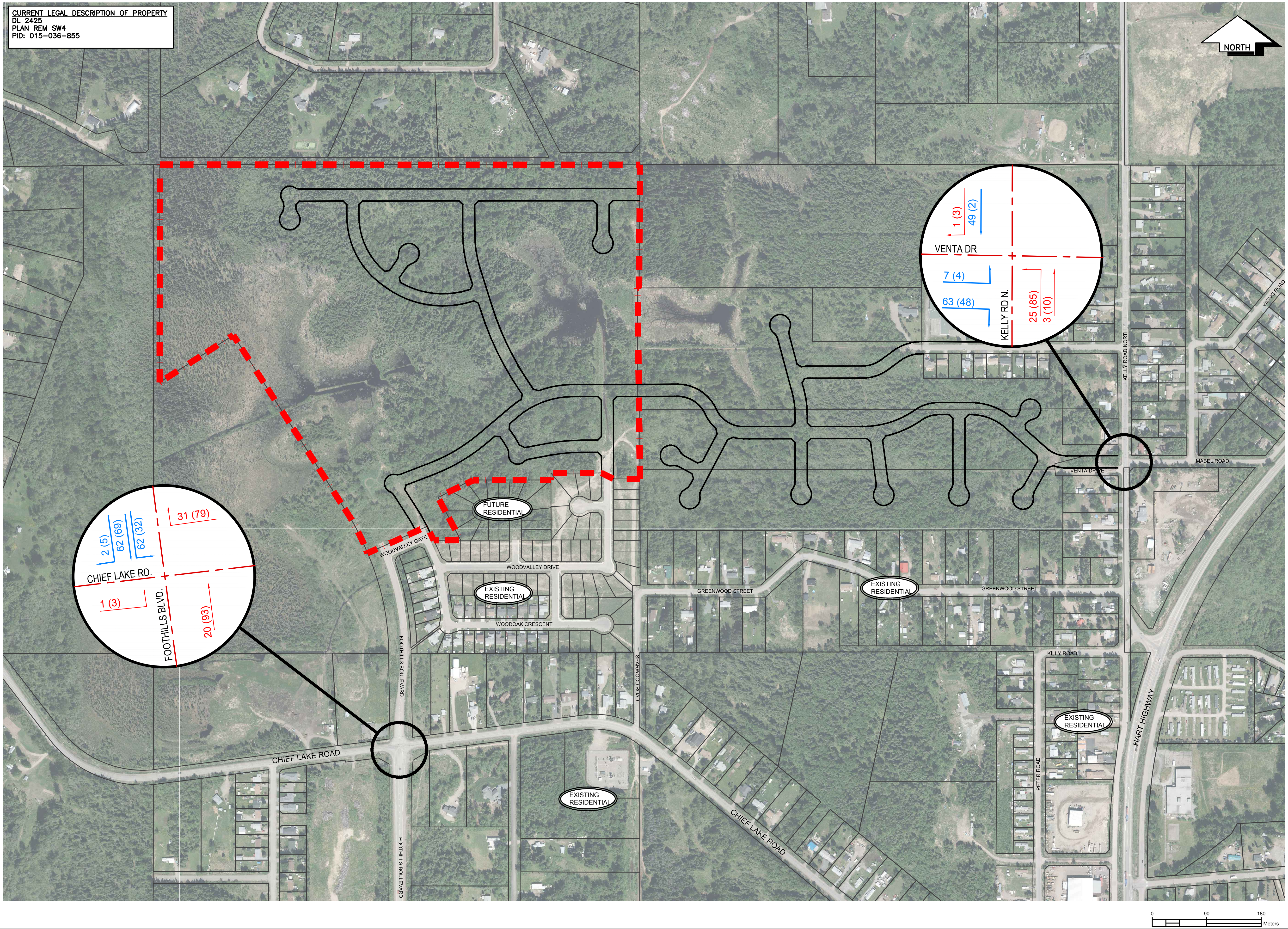
DRAWN:	MM
CHECKED:	TF
ENGINEER:	TF
SURVEY FILE:	
DRAWING FILE:	CAD18 1631–01TS.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	MARCH 2019
SCALES:	1:3000

WOODLANDS PROPERTY DEVELOPMENT CORP.
TRAFFIC IMPACT STUDY
TRIP DISTRIBUTION – TOTAL TRAFFIC

CONSULTANTS PROJECT No. 1631–01

DRAWING No. FIG 7

SHEET No. 7 OF 9 | REV. No. 0



LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

EGRESS
xxx AM TRAFFIC %
(xxx) PM TRAFFIC %

INGRESS
xxx AM TRAFFIC %
(xxx) PM TRAFFIC %

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED

1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
V2L 3J4
TEL. (250) 562-1977
FAX (250) 562-1967

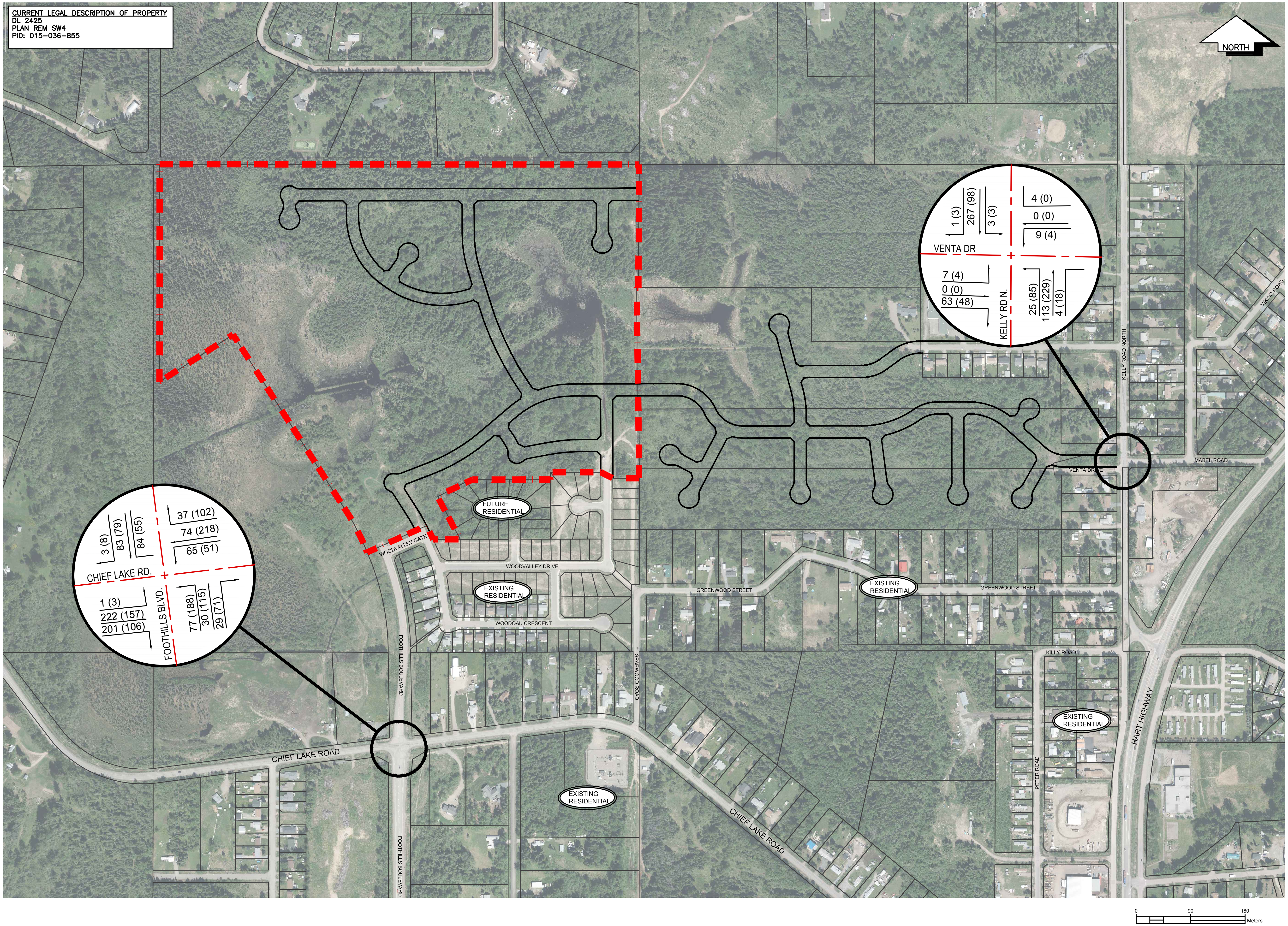
DRAWN:	MM
CHECKED:	TF
ENGINEER:	TF
SURVEY FILE:	
DRAWING FILE:	CAD18 1631-01TS.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	MARCH 2019
SCALES:	1:3000

WOODLANDS PROPERTY DEVELOPMENT CORP.
TRAFFIC IMPACT STUDY
TRIP ASSIGNMENT – TOTAL TRAFFIC

CONSULTANTS PROJECT No.
1631-01

DRAWING No.
FIG 8

SHEET No.	REV. No.
8 OF 9	0



LEGEND

NEIGHBOURHOOD PLAN BOUNDARY

xxx AM TRAFFIC
(xxx) PM TRAFFIC

NO.	DATE	REVISION	DR.

L&M ENGINEERING LIMITED
1210 FOURTH AVENUE
PRINCE GEORGE, B.C.
V2L 3J4
TEL. (250) 562-1977
FAX (250) 562-1967

DRAWN:	MM
CHECKED:	TF
ENGINEER:	TF
SURVEY FILE:	
DRAWING FILE:	CAD18 1631-01TS.dwg
CORRESPONDENCE:	CPG
GRID:	
DATE:	MARCH 2019
SCALES:	1:3000

WOODLANDS PROPERTY
DEVELOPMENT CORP.
TRAFFIC IMPACT STUDY

2037 TOTAL TRAFFIC

CONSULTANTS PROJECT No.
1631-01

DRAWING No.
FIG 9

SHEET No.	REV. No.
9 OF 9	0

Appendix A
Traffic Counts

Vehicle Turning Movement Survey

PASSENGER VEHICLES

N/S Street: ***Foothills Boulevard***

E/W Street: ***Chief Lake Roade***

LOCATION: ***Prince George***

DATE: ***5/17/2018***

WEATHER: ***Sunny***

TOTAL HOURS= ***HRS***

Observer: ***Robbie Sims***

Notes:

Speed Limit Major Street	***60***
Speed Limit Minor Street	***60***

	SOUTHBOUND *(North Approach)*			**NORTHBOUND** *(South Approach)*			**WESTBOUND** *(East Approach)*			**EASTBOUND** *(West Approach)*			Total	Hourly
TIME	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	Volume	Volume
6:00 - 6:15						1		2			12	6	21	
6:15 - 6:30	1			1		1	4	4	1		22	9	43	
6:30 - 6:45	2	1		3	2	2	4	6	1		24	22	67	
6:45 - 7:00	2			2	5	3	6	1	3	1	21	18	62	193
7:00 - 7:15	2	4		6	2	4	6	4	1		20	27	76	248
7:15 - 7:30		3		10		4	10	13			21	32	93	298
7:30 - 7:45	4	3		22	1	4	14	20			41	43	152	383
7:45 - 8:00	7	3		13	2	2	10	9	1		43	38	128	449
8:00 - 8:15	1	9		6	3	5	12	11	1		42	38	128	501
8:15 - 8:30	4	1	1	16	1	10	14	12	3		37	33	132	540
8:30 - 8:45	1	4		20	1	13	5	15	1	1	33	38	132	520
8:45 -9:00		3		13	2	6	9	17			15	25	90	482
SUB TOTAL	**24**	**31**	**1**	**112**	**19**	**55**	**94**	**114**	**12**	**2**	**331**	**329**	**1124**	

14:30 - 14:45														
14:45 - 15:00														
15:00 - 15:15	2	3		32	2	12	9	25	2		24	16	127	
15:15 - 15:30	1	5	1	15	4	20	15	29	2		18	14	124	251
15:30 - 15:45		3		24	5	9	7	36	3	1	23	20	131	382
15:45 - 16:00	3	3	1	20	1	13	13	21	4		20	15	114	496
16:00 - 16:15	3	4		26	2	14	12	34			10	8	113	482
16:15 - 16:30	3	3		33	9	16	13	39	1	3	27	21	168	526
16:30 - 16:45	2			41	7	12	6	33	5		26	17	149	544
16:45 - 17:00	3	2	1	30	4	18	7	36	4		31	25	161	591
17:00 - 17:15	9	1	1	33	2	16	10	40	6		31	18	167	645
17:15 - 17:30	4	5		39	4	9	13	50	3		29	19	175	652
17:30 - 17:45	5	4		27	3	17	8	34			21	15	134	637
17:45 - 18:00	1	1		22	2	15	9	32	1		12	9	104	580
SUB TOTAL	**36**	**34**	**4**	**342**	**45**	**171**	**122**	**409**	**31**	**4**	**272**	**197**	**1667**	

Vehicle Turning Movement Survey

LT + Bus + RV

N/S Street: Foothills Boulevard
E/W Street: Chief Lake Roade
LOCATION: Prince George
DATE: 43237
WEATHER: Sunny
TOTAL HOURS= HRS

Observer: Robbie Sims
Notes:

Speed Limit Major Street	60
Speed Limit Minor Street	60

	SOUTHBOUND (North Approach)			NORTHBOUND (South Approach)			WESTBOUND (East Approach)			EASTBOUND (West Approach)			Total	Hourly
TIME	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	Volume	Volume
6:00 - 6:15											1		1	
6:15 - 6:30							1	1				1	3	
6:30 - 6:45								1				1	2	
6:45 - 7:00				1									1	7
7:00 - 7:15											2		2	8
7:15 - 7:30				1									1	6
7:30 - 7:45				1							1	1	3	7
7:45 - 8:00					1			2					3	9
8:00 - 8:15	1					1		1			2		5	12
8:15 - 8:30				1							1		2	13
8:30 - 8:45				4		1						1	6	16
8:45 -9:00				1								2	3	16
SUB TOTAL	**1**			**9**	**1**	**2**	**1**	**5**			**7**	**6**	**32**	

14:30 - 14:45														
14:45 - 15:00														
15:00 - 15:15							1	3			3		7	
15:15 - 15:30							1	3			2		6	13
15:30 - 15:45				1			1	2					4	17
15:45 - 16:00				1			1	1				2	5	22
16:00 - 16:15												1	1	16
16:15 - 16:30				1									1	11
16:30 - 16:45												3	3	10
16:45 - 17:00							1	1			1		3	8
17:00 - 17:15							1	2					3	10
17:15 - 17:30				1				1					2	11
17:30 - 17:45							1					1	2	10
17:45 - 18:00								1				1	2	9
SUB TOTAL				**4**			**7**	**14**			**6**	**8**	**39**	

Vehicle Turning Movement Survey

HEAVY TRUCKS

N/S Street: Foothills Boulevard
E/W Street: Chief Lake Roade
LOCATION: Prince George
DATE: 43237
WEATHER: Sunny
TOTAL HOURS= HRS

Observer: Robbie Sims
Notes:

Speed Limit Major Street	60
Speed Limit Minor Street	60

	SOUTHBOUND (North Approach)			NORTHBOUND (South Approach)			WESTBOUND (East Approach)			EASTBOUND (West Approach)			Total	Hourly
TIME	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	Volume	Volume
6:00 - 6:15														
6:15 - 6:30														
6:30 - 6:45				1							1	1	3	
6:45 - 7:00							1				3		4	7
7:00 - 7:15							1	1			1		3	10
7:15 - 7:30								2					2	12
7:30 - 7:45								1			2		3	12
7:45 - 8:00								1			1	1	3	11
8:00 - 8:15											1		1	9
8:15 - 8:30												1	1	8
8:30 - 8:45								1			2		3	8
8:45 -9:00								1			1		2	7
SUB TOTAL				**1**			**2**	**7**			**12**	**3**	**25**	

14:30 - 14:45														
14:45 - 15:00														
15:00 - 15:15						1	1				1		3	
15:15 - 15:30							2	2			1		5	8
15:30 - 15:45														8
15:45 - 16:00							1	2			2		5	13
16:00 - 16:15				2				1					3	13
16:15 - 16:30				1			1	1			1		4	12
16:30 - 16:45								1			1		2	14
16:45 - 17:00							1						1	10
17:00 - 17:15								2			2		4	11
17:15 - 17:30				1				2					3	10
17:30 - 17:45								2			2		4	12
17:45 - 18:00								1					1	12
SUB TOTAL				**4**		**1**	**6**	**14**			**10**		**35**	

Vehicle Turning Movement Survey

PEDESTRIAN

N/S Street: Foothills Boulevard
E/W Street: Chief Lake Roade
LOCATION: Prince George
DATE: 43237
WEATHER: Sunny
TOTAL HOURS= HRS

Observer: Robbie Sims
Notes:

Speed Limit Major Street	60
Speed Limit Minor Street	60

TIME	SOUTHBOUND (North Approach)	NORTHBOUND (South Approach)	WESTBOUND (East Approach)	EASTBOUND (West Approach)	Total Volume	Hourly Volume
6:00 - 6:15		1			1	
6:15 - 6:30						
6:30 - 6:45						
6:45 - 7:00						1
7:00 - 7:15						
7:15 - 7:30	1				1	1
7:30 - 7:45						1
7:45 - 8:00						1
8:00 - 8:15						1
8:15 - 8:30		1			1	1
8:30 - 8:45						1
8:45 -9:00						1
SUB TOTAL	**1**	**2**			**3**	

14:30 - 14:45						
14:45 - 15:00						
15:00 - 15:15	1				1	
15:15 - 15:30	1				1	2
15:30 - 15:45						2
15:45 - 16:00						2
16:00 - 16:15						1
16:15 - 16:30						
16:30 - 16:45	2				2	2
16:45 - 17:00						2
17:00 - 17:15						2
17:15 - 17:30						2
17:30 - 17:45						
17:45 - 18:00		1	1		2	2
SUB TOTAL	**4**	**1**	**1**		**6**	

Vehicle Turning Movement Survey

TOTAL

N/S Street: Foothills Boulevard
E/W Street: Chief Lake Roade
LOCATION: Prince George
DATE: 5/17/2018
WEATHER: Sunny

TOTAL HOURS = HRS

Observer: Robbie Sims
Notes:

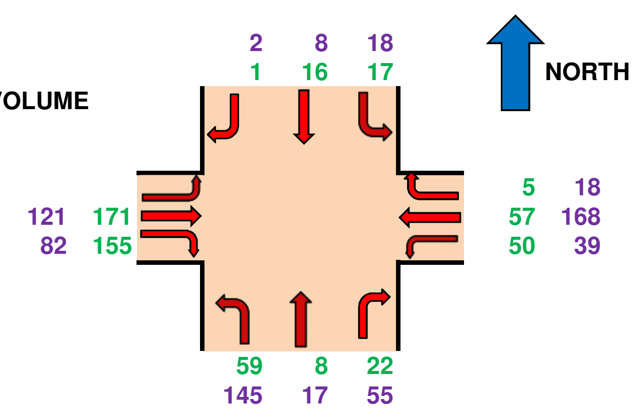
Speed Limit Major Street	60
Speed Limit Minor Street	60

	SOUTHBOUND (North Approach)			NORTHBOUND (South Approach)			WESTBOUND (East Approach)			EASTBOUND (West Approach)			Total	Hourly	Pedestrian			
TIME	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	Volume	Volume	N	S	E	W
6:00 - 6:15						1		2			13	6	22			1		
6:15 - 6:30	1			1		1	5	5	1		22	10	46					
6:30 - 6:45	2	1		4	2	2	4	7	1		25	24	72					
6:45 - 7:00	2			3	5	3	7	1	3	1	24	18	67	207				
7:00 - 7:15	2	4		6	2	4	7	5	1		23	27	81	266				
7:15 - 7:30		3		11		4	10	15			21	32	96	316	1			
7:30 - 7:45	4	3		23	1	4	14	21			44	44	158	402				
7:45 - 8:00	7	3		13	3	2	10	12	1		44	39	134	469				
8:00 - 8:15	2	9		6	3	6	12	12	1		45	38	134	522				
8:15 - 8:30	4	1	1	17	1	10	14	12	3		38	34	135	**561**		1		
8:30 - 8:45	1	4		24	1	14	5	16	1	1	35	39	141	544				
8:45 -9:00		3		14	2	6	9	18			16	27	95	**505**				
SUB TOTAL	**25**	**31**	**1**	**122**	**20**	**57**	**97**	**126**	**12**	**2**	**350**	**338**	**1181**		1	2		
PEAK HOUR	**17**	**16**	**1**	**59**	**8**	**22**	**50**	**57**	**5**		**171**	**155**	**561**			1		
PHF	**0.61**	**0.44**	**0.25**	**0.64**	**0.67**	**0.55**	**0.89**	**0.68**	**0.42**	**#DIV/0!**	**0.95**	**0.88**						

	SOUTHBOUND LEFT	SOUTHBOUND THRU	SOUTHBOUND RIGHT	NORTHBOUND LEFT	NORTHBOUND THRU	NORTHBOUND RIGHT	WESTBOUND LEFT	WESTBOUND THRU	WESTBOUND RIGHT	EASTBOUND LEFT	EASTBOUND THRU	EASTBOUND RIGHT	Total Volume	Hourly Volume	N	S	E	W
14:00 - 14:15																		
14:15 - 14:30																		
14:30 - 14:45	2	3		32	2	13	11	28	2		28	16	137		1			
14:45 - 15:00	1	5	1	15	4	20	18	34	2		21	14	135	272	1			
15:00 - 15:15		3		25	5	9	8	38	3	1	23	20	135	407				
15:15 - 15:30	3	3	1	21	1	13	15	24	4		22	17	124	531				
15:30 - 15:45	3	4		28	2	14	12	35			10	9	117	511				
15:45 - 16:00	3	3		35	9	16	14	40	1	3	28	21	173	549				
16:00 - 16:15	2			41	7	12	6	34	5		27	20	154	568	2			
16:15 - 16:30	3	2	1	30	4	18	9	37	4		32	25	165	**609**				
16:30 - 16:45	9	1	1	33	2	16	11	44	6		33	18	174	666				
16:45 - 17:00	4	5		41	4	9	13	53	3		29	19	180	**673**				
17:00 - 17:15	5	4		27	3	17	9	36			23	16	140	659				
17:15 - 17:30	1	1		22	2	15	9	34	1		12	10	107	601		1	1	
SUB TOTAL	**36**	**34**	**4**	**350**	**45**	**172**	**135**	**437**	**31**	**4**	**288**	**205**	**1741**		4	1		
PEAK HOUR	**18**	**8**	**2**	**145**	**17**	**55**	**39**	**168**	**18**		**121**	**82**	**673**		**2**			
PHF	**0.50**	**0.40**	**0.50**	**0.88**	**0.61**	**0.76**	**0.75**	**0.79**	**0.75**	**#DIV/0!**	**0.92**	**0.82**						

PEAK HOUR VOLUME

AM PEAK
PM PEAK



Vehicle Turning Movement Survey

PASSENGER VEHICLES

N/S Street: ***Kelly Road N***

E/W Street: ***Mabel Rd / Venta Drive***

LOCATION: ***Prince George***

DATE: ***March 5, 2019***

WEATHER: ***Clear***

TOTAL HOURS= ***5.5***

Observer: ***Diane Allen***

Notes:

Speed Limit Major Street	***50***
Speed Limit Minor Street	***50***

	SOUTHBOUND (North Approach)			NORTHBOUND (South Approach)			WESTBOUND (East Approach)			EASTBOUND (West Approach)			Total	Hourly
TIME	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	Volume	Volume
6:00 - 6:15														
6:15 - 6:30														
6:30 - 6:45														
6:45 - 7:00														
7:00 - 7:15	1	17			1		1						20	20
7:15 - 7:30		27			1								28	48
7:30 - 7:45		30			4		1						35	83
7:45 - 8:00		31			13	1	2						47	130
8:00 - 8:15		46			16	1	5						68	178
8:15 - 8:30	1	56			31				2				90	240
8:30 - 8:45	1	33			20	1			1				56	261
8:45 -9:00		18			13	1							32	246
SUB TOTAL	**3**	**258**			**99**	**4**	**9**		**3**				**376**	

14:30 - 14:45	3	47			24							1	75	
14:45 - 15:00	1	19			26	1							47	
15:00 - 15:15		19			21		1						41	
15:15 - 15:30		9			34	4	1						48	211
15:30 - 15:45		17			28	1	1		1				48	184
15:45 - 16:00		21			30	2			1				54	191
16:00 - 16:15	1	22			27	2							52	202
16:15 - 16:30		17			23	2	2						44	198
16:30 - 16:45	2	15			37	1	1						56	206
16:45 - 17:00		21			33	4							58	210
17:00 - 17:15		14			46	5	2						67	225
17:15 - 17:30		22			50	4							76	257
17:30 - 17:45		10			34	5							49	250
17:45 - 18:00		15			25				1				41	233
SUB TOTAL	**7**	**268**			**438**	**31**	**8**		**3**			**1**	**756**	

Vehicle Turning Movement Survey

LT + Bus + RV

N/S Street: Kelly Road N

E/W Street: Mabel Rd / Venta Drive

LOCATION: Prince George

DATE: March 5, 2019

WEATHER: Clear

TOTAL HOURS= 5.5

Observer: Diane Allen

Notes:

Speed Limit Major Street	50
Speed Limit Minor Street	50

	SOUTHBOUND (North Approach)			NORTHBOUND (South Approach)			WESTBOUND (East Approach)			EASTBOUND (West Approach)			Total	Hourly
TIME	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	Volume	Volume
6:00 - 6:15														
6:15 - 6:30														
6:30 - 6:45														
6:45 - 7:00														
7:00 - 7:15		2											2	2
7:15 - 7:30		3							1				4	6
7:30 - 7:45		1			1								2	8
7:45 - 8:00		1			1								2	10
8:00 - 8:15		1											1	9
8:15 - 8:30					3								3	8
8:30 - 8:45		1			2								3	9
8:45 -9:00						1							1	8
SUB TOTAL		**9**			**7**	**1**			**1**				**18**	

14:30 - 14:45		3											3	
14:45 - 15:00														
15:00 - 15:15														
15:15 - 15:30					4								4	7
15:30 - 15:45														4
15:45 - 16:00		2			3								5	9
16:00 - 16:15					2								2	11
16:15 - 16:30					2								2	9
16:30 - 16:45														9
16:45 - 17:00		2											2	6
17:00 - 17:15		1			1								2	6
17:15 - 17:30					1								1	5
17:30 - 17:45					1								1	6
17:45 - 18:00		1			3								4	8
SUB TOTAL		**9**			**17**								**26**	

Vehicle Turning Movement Survey

HEAVY TRUCKS

N/S Street: Kelly Road N
E/W Street: Mabel Rd / Venta Drive
LOCATION: Prince George
DATE: March 5, 2019
WEATHER: Clear
TOTAL HOURS= 5.5

Observer: Diane Allen
Notes:

Speed Limit Major Street	50
Speed Limit Minor Street	50

	SOUTHBOUND (North Approach)			NORTHBOUND (South Approach)			WESTBOUND (East Approach)			EASTBOUND (West Approach)			Total	Hourly
TIME	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	Volume	Volume
6:00 - 6:15														
6:15 - 6:30														
6:30 - 6:45														
6:45 - 7:00														
7:00 - 7:15														
7:15 - 7:30		1											1	1
7:30 - 7:45					1								1	2
7:45 - 8:00														2
8:00 - 8:15		1											1	3
8:15 - 8:30														2
8:30 - 8:45														1
8:45 -9:00														1
SUB TOTAL		**2**			**1**								**3**	

14:30 - 14:45					1								1	
14:45 - 15:00					1								1	
15:00 - 15:15														
15:15 - 15:30					2								2	4
15:30 - 15:45					3								3	6
15:45 - 16:00														5
16:00 - 16:15					1								1	6
16:15 - 16:30														4
16:30 - 16:45					1								1	2
16:45 - 17:00					1								1	3
17:00 - 17:15														2
17:15 - 17:30					1								1	3
17:30 - 17:45														2
17:45 - 18:00					2								2	3
SUB TOTAL					**13**								**13**	

Vertical Turning Movement Survey **PEDESTRIAN**

N/S Street: Kelly Road N
E/W Street: Mabel Rd / Venta Drive
LOCATION: Prince George
DATE: March 5, 2019
WEATHER: Clear
TOTAL HOURS= 5.5

Observer: Diane Allen
Notes:

Speed Limit Major Street	50
Speed Limit Minor Street	50

TIME	SOUTHBOUND (North Approach)	NORTHBOUND (South Approach)	WESTBOUND (East Approach)	EASTBOUND (West Approach)	Total Volume	Hourly Volume
6:00 - 6:15						
6:15 - 6:30						
6:30 - 6:45						
6:45 - 7:00						
7:00 - 7:15						
7:15 - 7:30						
7:30 - 7:45						
7:45 - 8:00						
8:00 - 8:15						
8:15 - 8:30	1			2	3	3
8:30 - 8:45			1		1	4
8:45 -9:00						4
SUB TOTAL	**1**		**1**	**2**	**4**	

14:30 - 14:45				2	2	
14:45 - 15:00						
15:00 - 15:15						
15:15 - 15:30						2
15:30 - 15:45						
15:45 - 16:00				3	3	3
16:00 - 16:15						3
16:15 - 16:30	1			1	2	5
16:30 - 16:45	1			1	2	7
16:45 - 17:00	1			1	2	6
17:00 - 17:15						6
17:15 - 17:30						4
17:30 - 17:45						2
17:45 - 18:00						
SUB TOTAL	**3**			**8**	**11**	

Vehicle Turning Movement Survey

TOTAL

N/S Street: Kelly Road N

E/W Street: Mabel Rd / Venta Drive

LOCATION: Prince George

DATE: March 5, 2019

WEATHER: Clear

TOTAL HOURS = 5.5

Observer: Diane Allen

Notes:

Speed Limit Major Street	50
Speed Limit Minor Street	50

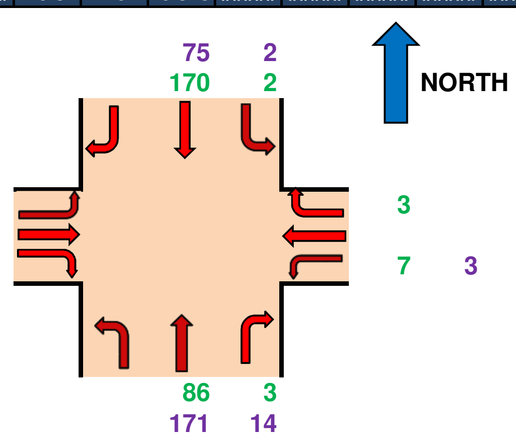
	SOUTHBOUND (North Approach)			NORTHBOUND (South Approach)			WESTBOUND (East Approach)			EASTBOUND (West Approach)			Total	Hourly	Pedestrian			
TIME	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	Volume	Volume	N	S	E	W
6:00 - 6:15																		
6:15 - 6:30																		
6:30 - 6:45																		
6:45 - 7:00																		
7:00 - 7:15	1	19			1		1						22	22				
7:15 - 7:30		31			1				1				33	55				
7:30 - 7:45		31			6		1						38	93				
7:45 - 8:00		32			14	1	2						49	142				
8:00 - 8:15		48			16	1	5						70	190				
8:15 - 8:30	1	56			34				2				93	250	1			2
8:30 - 8:45	1	34			22	1			1				59	**271**			1	
8:45 -9:00		18			13	2							33	**255**				
SUB TOTAL	**3**	**269**			**107**	**5**	**9**		**4**				**397**		**1**		**1**	**2**
PEAK HOUR	**2**	**170**			**86**	**3**	**7**		**3**				**271**		**1**		**1**	**2**
PHF	**0.5**	**0.76**	**#DIV/0!**	**#####**	**0.63**	**0.75**	**0.35**	**#####**	**0.375**	**#####**	**#####**	**#####**						

TIME	SB LEFT	SB THRU	SB RIGHT	NB LEFT	NB THRU	NB RIGHT	WB LEFT	WB THRU	WB RIGHT	EB LEFT	EB THRU	EB RIGHT	Total Volume	Hourly Volume	N	S	E	W
14:30 - 14:45	3	50			25							1	79					2
14:45 - 15:00	1	19			27	1							48					
15:00 - 15:15		19			21		1						41					
15:15 - 15:30		9			40	4	1						54	222				
15:30 - 15:45		17			31	1	1		1				51	194				
15:45 - 16:00		23			33	2			1				59	205				3
16:00 - 16:15	1	22			30	2							55	219				
16:15 - 16:30		17			25	2	2						46	211	1			1
16:30 - 16:45	2	15			38	1	1						57	217	1			1
16:45 - 17:00		23			34	4							61	**219**	1			1
17:00 - 17:15		15			47	5	2						69	233				
17:15 - 17:30		22			52	4							78	**265**				
17:30 - 17:45		10			35	5							50	258				
17:45 - 18:00		16			30				1				47	244				
SUB TOTAL	**7**	**277**			**468**	**31**	**8**		**3**			**1**	**795**		**3**			**8**
PEAK HOUR	**2**	**75**			**171**	**14**	**3**						**265**		**2**			**2**
PHF	**0.25**	**0.82**	**#DIV/0!**	**#####**	**0.82**	**0.7**	**0.375**	**#####**	**#####**	**#####**	**#####**	**#####**						

PEAK HOUR VOLUME

AM PEAK

PM PEAK



Appendix B
Synchro

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	181	164	53	60	5	63	8	23	18	17	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.92	0.88	0.89	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	1	197	186	60	86	7	90	11	33	26	24	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	93			383			515	505	290	507	594	89
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	93			383			515	505	290	507	594	89
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			79	97	96	94	94	100
cM capacity (veh/h)	1502			1175			430	446	749	429	396	969

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	385	152	90	44	26	26
Volume Left	1	60	90	0	26	0
Volume Right	186	7	0	33	0	1
cSH	1502	1175	430	1010	429	410
Volume to Capacity	0.00	0.05	0.21	0.04	0.06	0.06
Queue Length 95th (m)	0.0	1.2	5.9	1.0	1.4	1.5
Control Delay (s)	0.0	3.5	15.6	10.9	13.9	14.4
Lane LOS	A	A	C	B	B	B
Approach Delay (s)	0.0	3.5	14.0		14.2	
Approach LOS			B		B	

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	1	1	7	1	3	1	90	3	2	178	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.70	0.92	0.70	0.92	0.70	0.80	0.70	0.76	0.92
Hourly flow rate (vph)	1	1	1	10	1	4	1	129	4	3	234	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	378	375	235	375	374	130	235			132		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	378	375	235	375	374	130	235			132		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	98	100	100	100			100		
cM capacity (veh/h)	575	554	804	580	555	919	1332			1453		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	3	15	133	238
Volume Left	1	10	1	3
Volume Right	1	4	4	1
cSH	627	644	1332	1453
Volume to Capacity	0.01	0.02	0.00	0.00
Queue Length 95th (m)	0.1	0.6	0.0	0.0
Control Delay (s)	10.8	10.7	0.1	0.1
Lane LOS	B	B	A	A
Approach Delay (s)	10.8	10.7	0.1	0.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	181	164	53	60	10	63	12	23	31	29	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.92	0.88	0.89	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	1	197	186	60	86	14	90	17	33	44	41	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	100			383			528	512	290	513	598	93
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	100			383			528	512	290	513	598	93
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			78	96	96	89	89	100
cM capacity (veh/h)	1493			1175			406	441	749	420	394	964

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	385	160	90	50	44	44
Volume Left	1	60	90	0	44	0
Volume Right	186	14	0	33	0	3
cSH	1493	1175	406	1140	420	410
Volume to Capacity	0.00	0.05	0.22	0.04	0.11	0.11
Queue Length 95th (m)	0.0	1.2	6.4	1.0	2.7	2.7
Control Delay (s)	0.0	3.3	16.4	11.2	14.6	14.8
Lane LOS	A	A	C	B	B	B
Approach Delay (s)	0.0	3.3	14.5		14.7	
Approach LOS			B		B	

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	222	201	65	74	6	77	10	29	22	21	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.92	0.88	0.89	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	1	241	228	73	106	9	110	14	41	31	30	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	114			470			631	619	356	622	729	110
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	114			470			631	619	356	622	729	110
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			93			68	96	94	91	91	100
cM capacity (veh/h)	1475			1092			347	377	688	346	326	943

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	471	187	110	56	31	31
Volume Left	1	73	110	0	31	0
Volume Right	228	9	0	41	0	1
cSH	1475	1092	347	926	346	336
Volume to Capacity	0.00	0.07	0.32	0.06	0.09	0.09
Queue Length 95th (m)	0.0	1.6	10.1	1.5	2.3	2.3
Control Delay (s)	0.0	3.7	20.1	11.7	16.5	16.8
Lane LOS	A	A	C	B	C	C
Approach Delay (s)	0.0	3.7	17.3		16.6	
Approach LOS			C		C	

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	1	1	9	1	4	1	110	4	3	218	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.70	0.92	0.70	0.92	0.70	0.80	0.70	0.76	0.92
Hourly flow rate (vph)	1	1	1	13	1	6	1	157	5	4	287	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	464	460	287	459	458	160	288			162		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	464	460	287	459	458	160	288			162		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	97	100	99	100			100		
cM capacity (veh/h)	503	496	752	509	497	886	1274			1417		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	3	20	163	292
Volume Left	1	13	1	4
Volume Right	1	6	5	1
cSH	562	580	1274	1417
Volume to Capacity	0.01	0.03	0.00	0.00
Queue Length 95th (m)	0.1	0.8	0.0	0.1
Control Delay (s)	11.4	11.4	0.1	0.1
Lane LOS	B	B	A	A
Approach Delay (s)	11.4	11.4	0.1	0.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	23.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	222	201	65	74	37	77	30	29	84	83	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.92	0.88	0.89	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	1	241	228	73	106	53	110	43	41	120	119	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	159			470			700	663	356	658	751	132
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	159			470			700	663	356	658	751	132
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			93			54	88	94	61	63	100
cM capacity (veh/h)	1421			1092			238	356	688	306	317	917

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	471	232	110	84	120	123
Volume Left	1	73	110	0	120	0
Volume Right	228	53	0	41	0	4
cSH	1421	1092	238	700	306	324
Volume to Capacity	0.00	0.07	0.46	0.12	0.39	0.38
Queue Length 95th (m)	0.0	1.6	17.2	3.1	13.7	13.0
Control Delay (s)	0.0	3.1	32.6	13.6	24.2	22.7
Lane LOS	A	A	D	B	C	C
Approach Delay (s)	0.0	3.1	24.3		23.5	
Approach LOS			C		C	

Intersection Summary				
Average Delay	9.8			
Intersection Capacity Utilization	55.1%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	1	63	9	1	4	25	113	4	3	267	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.70	0.92	0.70	0.92	0.70	0.80	0.70	0.76	0.92
Hourly flow rate (vph)	8	1	68	13	1	6	27	161	5	4	351	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	585	581	352	648	579	164	352			166		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	585	581	352	648	579	164	352			166		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	90	96	100	99	98			100		
cM capacity (veh/h)	411	414	692	338	415	881	1206			1412		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	77	20	194	357
Volume Left	8	13	27	4
Volume Right	68	6	5	1
cSH	642	417	1206	1412
Volume to Capacity	0.12	0.05	0.02	0.00
Queue Length 95th (m)	3.1	1.1	0.5	0.1
Control Delay (s)	11.4	14.1	1.3	0.1
Lane LOS	B	B	A	A
Approach Delay (s)	11.4	14.1	1.3	0.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	128	87	41	178	19	154	18	58	19	8	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.92	0.82	0.75	0.79	0.75	0.88	0.70	0.76	0.70	0.70	1.00
Hourly flow rate (vph)	1	139	106	55	225	25	175	26	76	27	11	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	251			245			550	555	192	555	595	238
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	251			245			550	555	192	555	595	238
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			58	94	91	93	97	100
cM capacity (veh/h)	1315			1303			421	421	849	371	399	801

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	247	305	175	102	27	13
Volume Left	1	55	175	0	27	0
Volume Right	106	25	0	76	0	2
cSH	1315	1303	421	1136	371	431
Volume to Capacity	0.00	0.04	0.42	0.09	0.07	0.03
Queue Length 95th (m)	0.0	1.0	15.2	2.2	1.8	0.7
Control Delay (s)	0.1	1.7	19.5	10.8	15.5	13.6
Lane LOS	A	A	C	B	C	B
Approach Delay (s)	0.1	1.7	16.3		14.8	
Approach LOS			C		B	

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	1	1	3	1	1	1	179	15	2	78	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.70	0.92	0.92	0.92	0.92	0.92	0.70	0.82	0.70
Hourly flow rate (vph)	1	1	1	4	1	1	1	195	16	3	95	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	308	315	96	308	307	203	97			211		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	308	315	96	308	307	203	97			211		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	99	100	100	100			100		
cM capacity (veh/h)	641	599	961	641	605	838	1497			1360		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	3	6	212	99
Volume Left	1	4	1	3
Volume Right	1	1	16	1
cSH	703	661	1497	1360
Volume to Capacity	0.00	0.01	0.00	0.00
Queue Length 95th (m)	0.1	0.2	0.0	0.0
Control Delay (s)	10.1	10.5	0.0	0.2
Lane LOS	B	B	A	A
Approach Delay (s)	10.1	10.5	0.0	0.2
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	20.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	128	87	41	178	31	154	33	58	29	13	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.92	0.82	0.75	0.79	0.75	0.88	0.70	0.76	0.70	0.70	1.00
Hourly flow rate (vph)	1	139	106	55	225	41	175	47	76	41	19	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	267			245			563	571	192	574	603	246
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	267			245			563	571	192	574	603	246
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			57	89	91	88	95	100
cM capacity (veh/h)	1297			1303			406	412	849	345	395	793

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	247	321	175	123	41	22
Volume Left	1	55	175	0	41	0
Volume Right	106	41	0	76	0	3
cSH	1297	1303	406	1080	345	425
Volume to Capacity	0.00	0.04	0.43	0.11	0.12	0.05
Queue Length 95th (m)	0.0	1.0	16.1	2.9	3.1	1.2
Control Delay (s)	0.1	1.7	20.4	11.6	16.8	13.9
Lane LOS	A	A	C	B	C	B
Approach Delay (s)	0.1	1.7	16.8		15.8	
Approach LOS			C		C	

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	157	106	51	218	23	188	22	71	23	10	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.92	0.82	0.75	0.79	0.75	0.88	0.70	0.76	0.70	0.70	1.00
Hourly flow rate (vph)	1	171	129	68	276	31	214	31	93	33	14	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	307			300			676	681	235	681	730	291
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	307			300			676	681	235	681	730	291
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			37	91	88	89	96	100
cM capacity (veh/h)	1254			1244			339	352	804	287	330	748

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	301	375	214	125	33	17
Volume Left	1	68	214	0	33	0
Volume Right	129	31	0	93	0	3
cSH	1254	1244	339	1074	287	365
Volume to Capacity	0.00	0.05	0.63	0.12	0.11	0.05
Queue Length 95th (m)	0.0	1.3	30.9	3.0	2.9	1.1
Control Delay (s)	0.0	1.9	32.1	11.6	19.1	15.3
Lane LOS	A	A	D	B	C	C
Approach Delay (s)	0.0	1.9	24.5		17.8	
Approach LOS			C		C	

Intersection Summary			
Average Delay	9.3		
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	1	1	4	1	1	1	219	18	3	96	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.70	0.92	0.92	0.92	0.92	0.92	0.70	0.82	0.70
Hourly flow rate (vph)	1	1	1	6	1	1	1	238	20	4	117	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	378	386	118	378	377	248	119			258		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	378	386	118	378	377	248	119			258		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	99	100	100	100			100		
cM capacity (veh/h)	576	546	934	576	552	791	1470			1307		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	3	8	259	123
Volume Left	1	6	1	4
Volume Right	1	1	20	1
cSH	647	595	1470	1307
Volume to Capacity	0.01	0.01	0.00	0.00
Queue Length 95th (m)	0.1	0.3	0.0	0.1
Control Delay (s)	10.6	11.1	0.0	0.3
Lane LOS	B	B	A	A
Approach Delay (s)	10.6	11.1	0.0	0.3
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	157	106	51	218	102	188	115	71	55	79	8
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.92	0.82	0.75	0.79	0.75	0.88	0.70	0.76	0.70	0.70	1.00
Hourly flow rate (vph)	4	171	129	68	276	136	214	164	93	79	113	8
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	412			300			788	792	235	806	788	344
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	412			300			788	792	235	806	788	344
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			0	46	88	46	63	99
cM capacity (veh/h)	1147			1244			208	303	804	146	304	699

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	304	480	214	258	79	121
Volume Left	4	68	214	0	79	0
Volume Right	129	136	0	93	0	8
cSH	1147	1244	208	475	146	316
Volume to Capacity	0.00	0.05	1.03	0.54	0.54	0.38
Queue Length 95th (m)	0.1	1.3	70.7	24.2	20.3	13.2
Control Delay (s)	0.2	1.6	117.8	22.8	55.5	23.3
Lane LOS	A	A	F	C	F	C
Approach Delay (s)	0.2	1.6	65.9		36.0	
Approach LOS			F		E	

Intersection Summary			
Average Delay	26.9		
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	1	48	4	1	1	85	229	18	3	98	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.70	0.92	0.92	0.92	0.92	0.92	0.70	0.82	0.70
Hourly flow rate (vph)	4	1	52	6	1	1	92	249	20	4	120	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	575	583	122	626	576	259	124			268		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	575	583	122	626	576	259	124			268		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	94	98	100	100	94			100		
cM capacity (veh/h)	406	396	930	354	400	780	1463			1295		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	58	8	361	128
Volume Left	4	6	92	4
Volume Right	52	1	20	4
cSH	828	390	1463	1295
Volume to Capacity	0.07	0.02	0.06	0.00
Queue Length 95th (m)	1.7	0.5	1.5	0.1
Control Delay (s)	9.7	14.4	2.4	0.3
Lane LOS	A	B	A	A
Approach Delay (s)	9.7	14.4	2.4	0.3
Approach LOS	A	B		

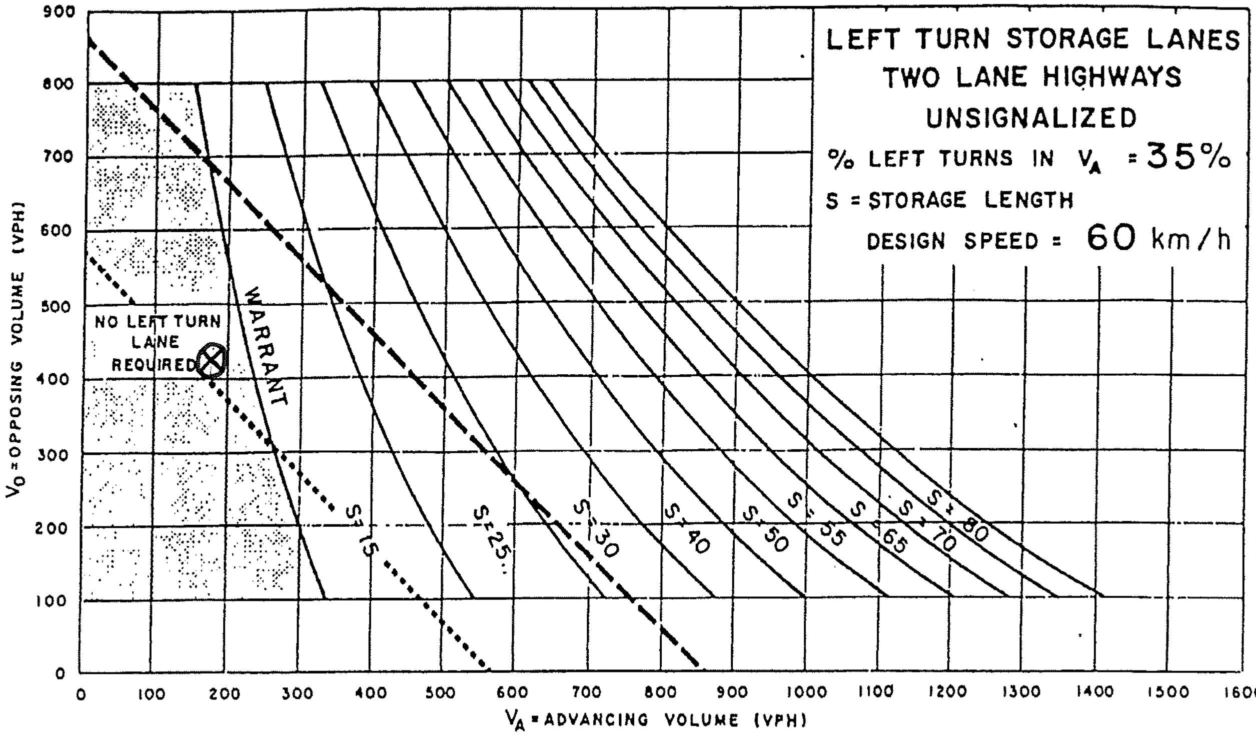
Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	34.5%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix C

Calculations

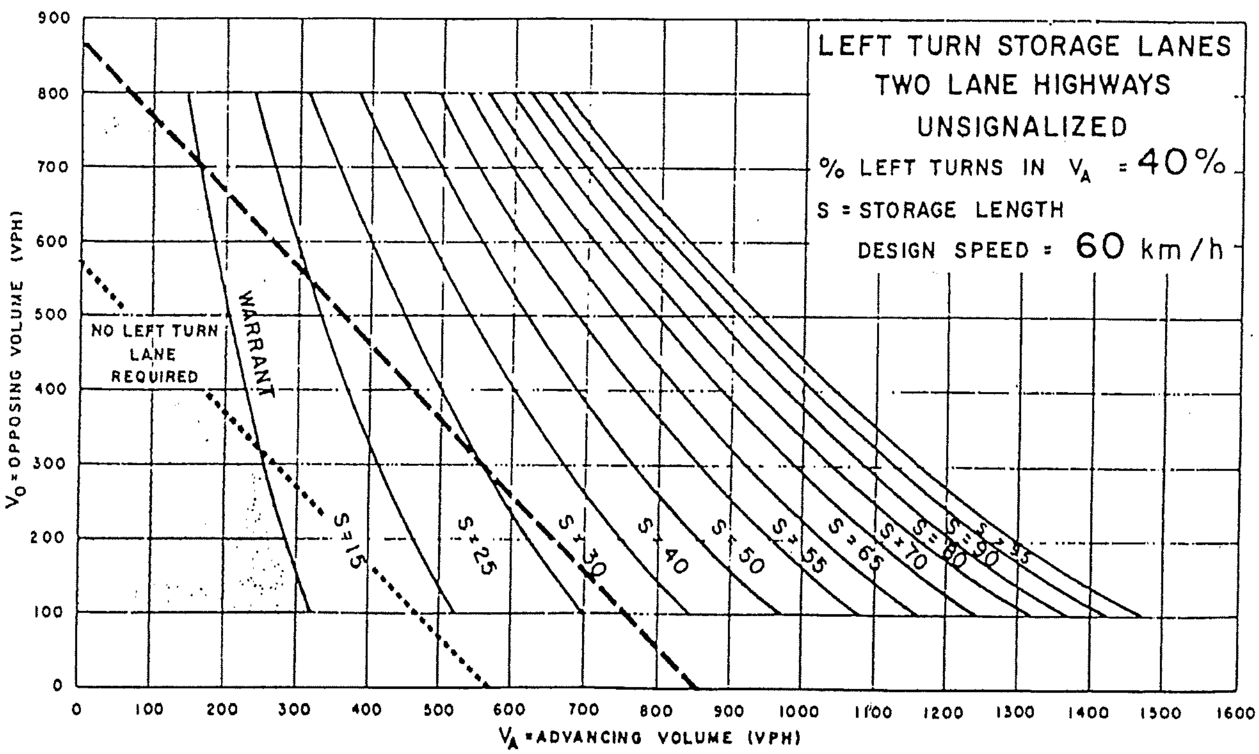
FOOTHILLS BLVD. & CHIEF LK RD

⊗ - 2037 TOTAL TRAFFIC AM PEAK (WB)



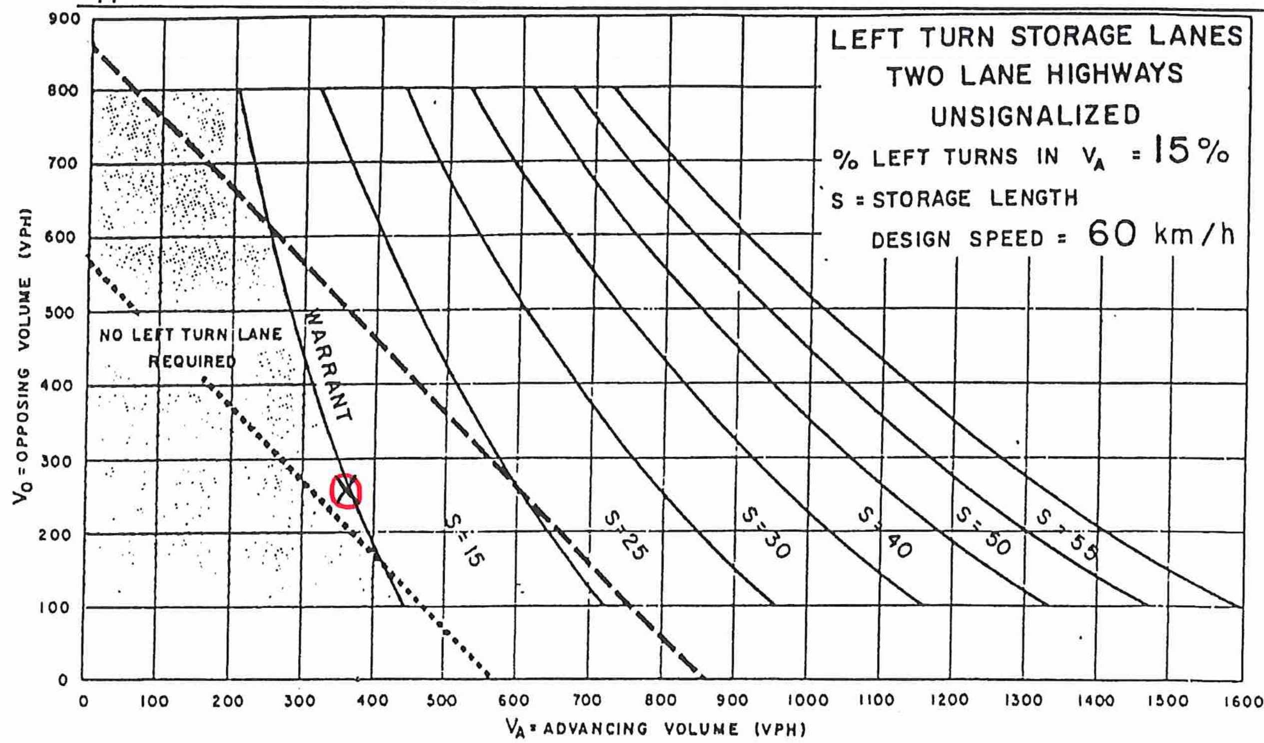
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS



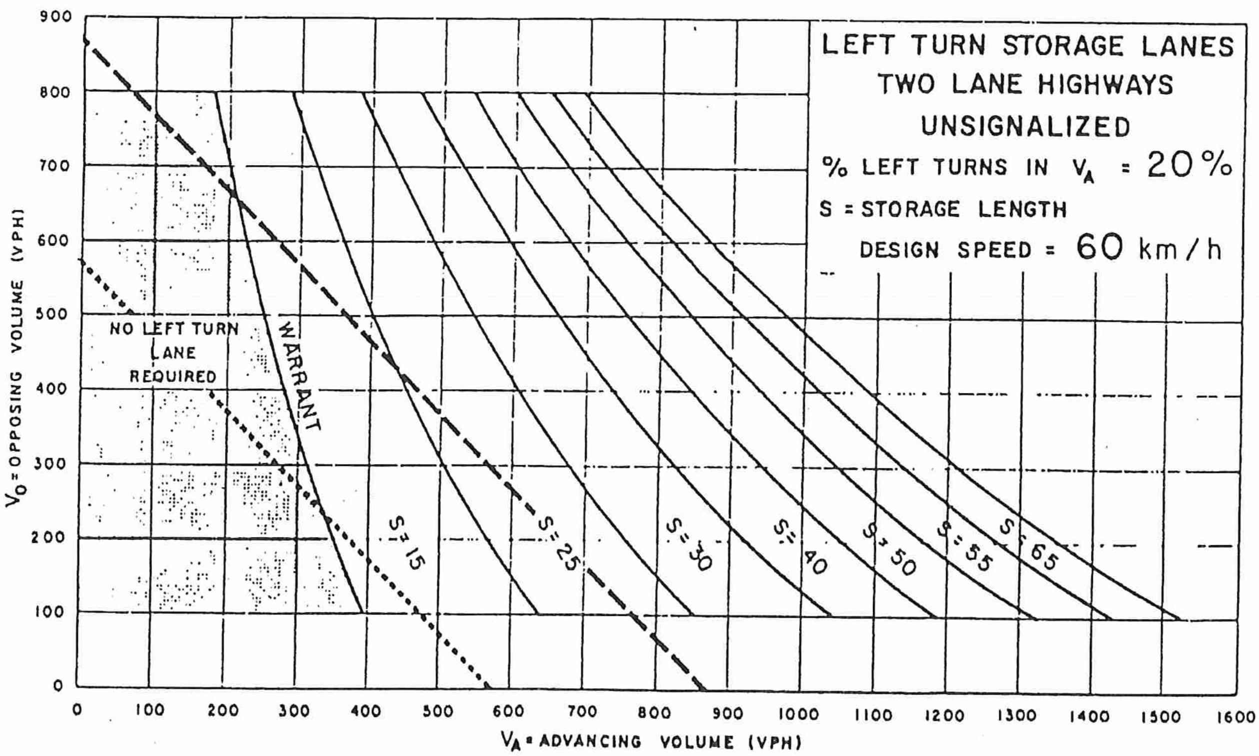
FOOTHILLS BLVD & CHIEF LK RD

X - 2037 TOTAL TRAFFIC PM PEAK (WB)



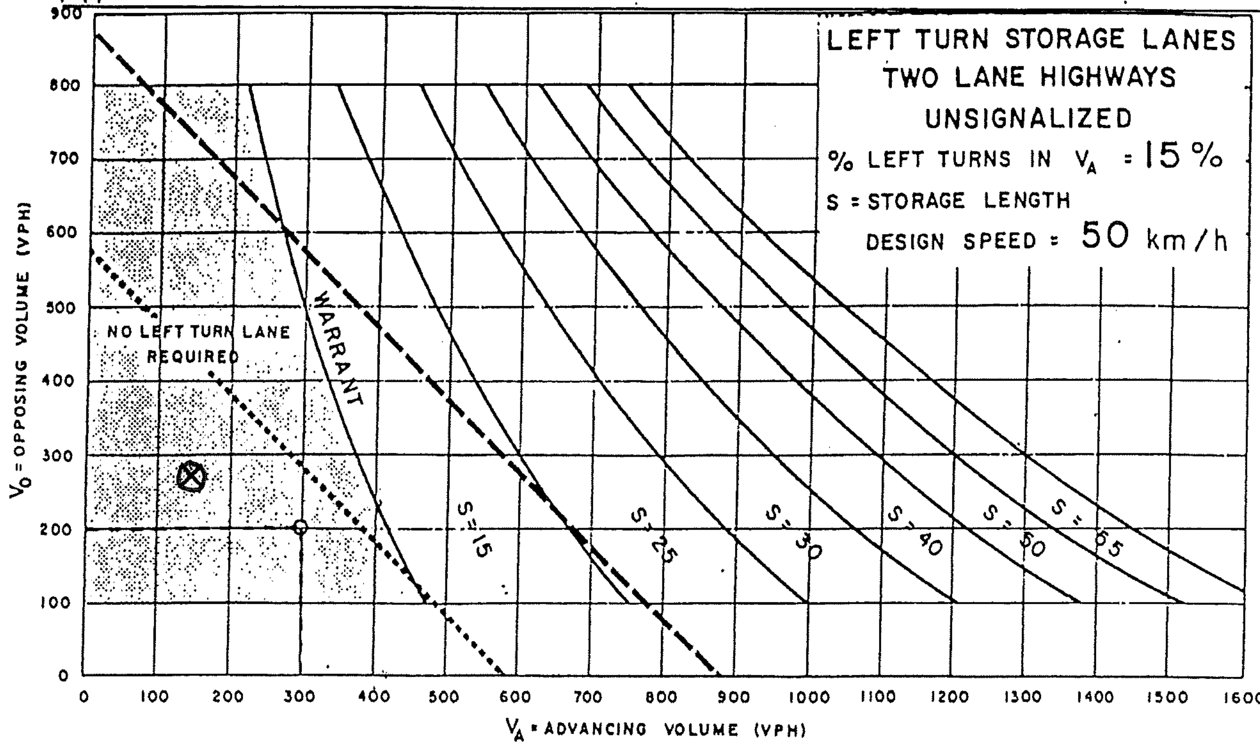
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS



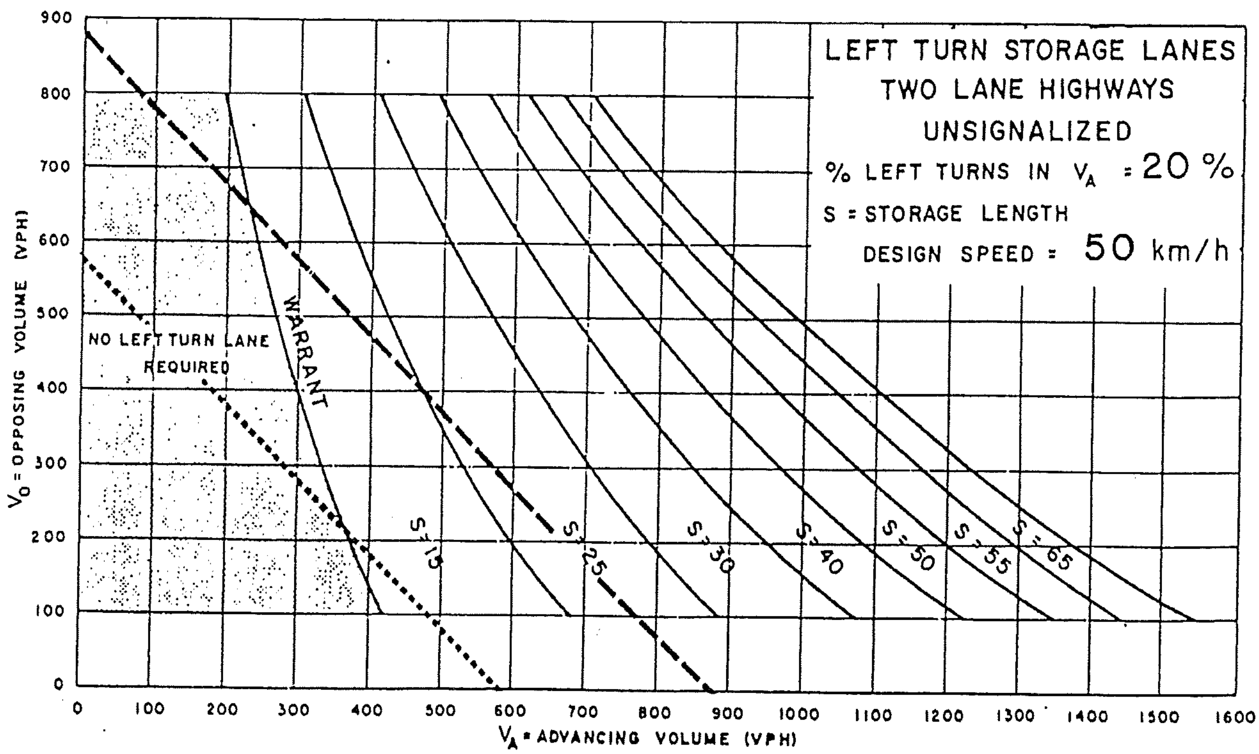
KELLY RD N & VENTA DRIVE

⊗ - 2037 TOTAL TRAFFIC AM PEAK (NORTHBOUND)



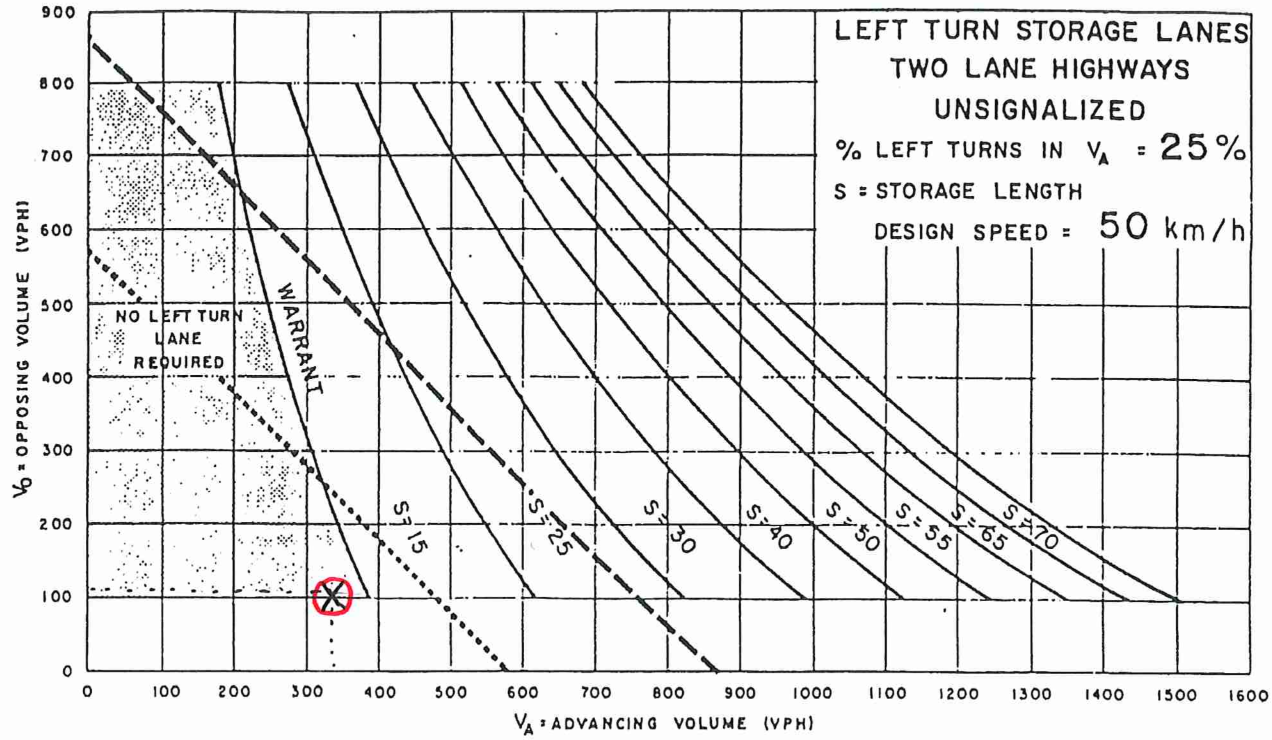
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW (dashed line)

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS (dotted line)



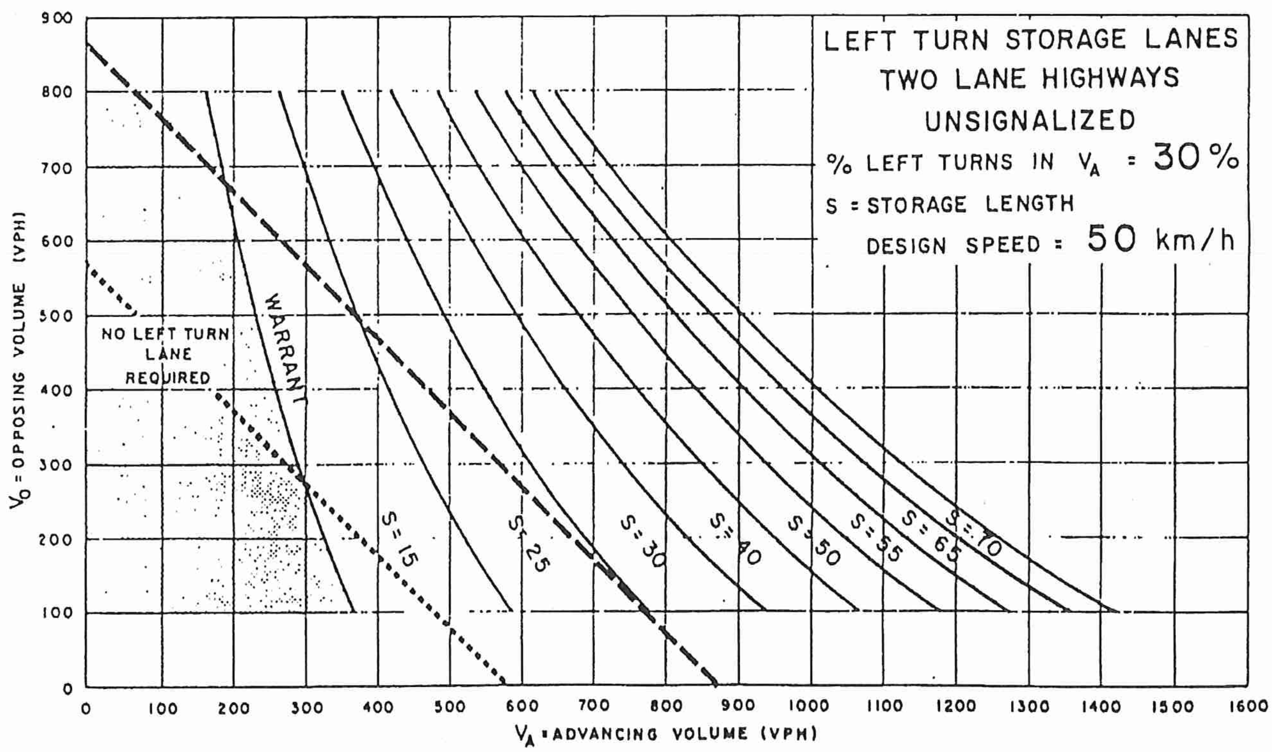
KELLY RD N Ė VENTA DRIVE

⊗ - 2037 TOTAL TRAFFIC PM PEAK (NORTHBOUND)

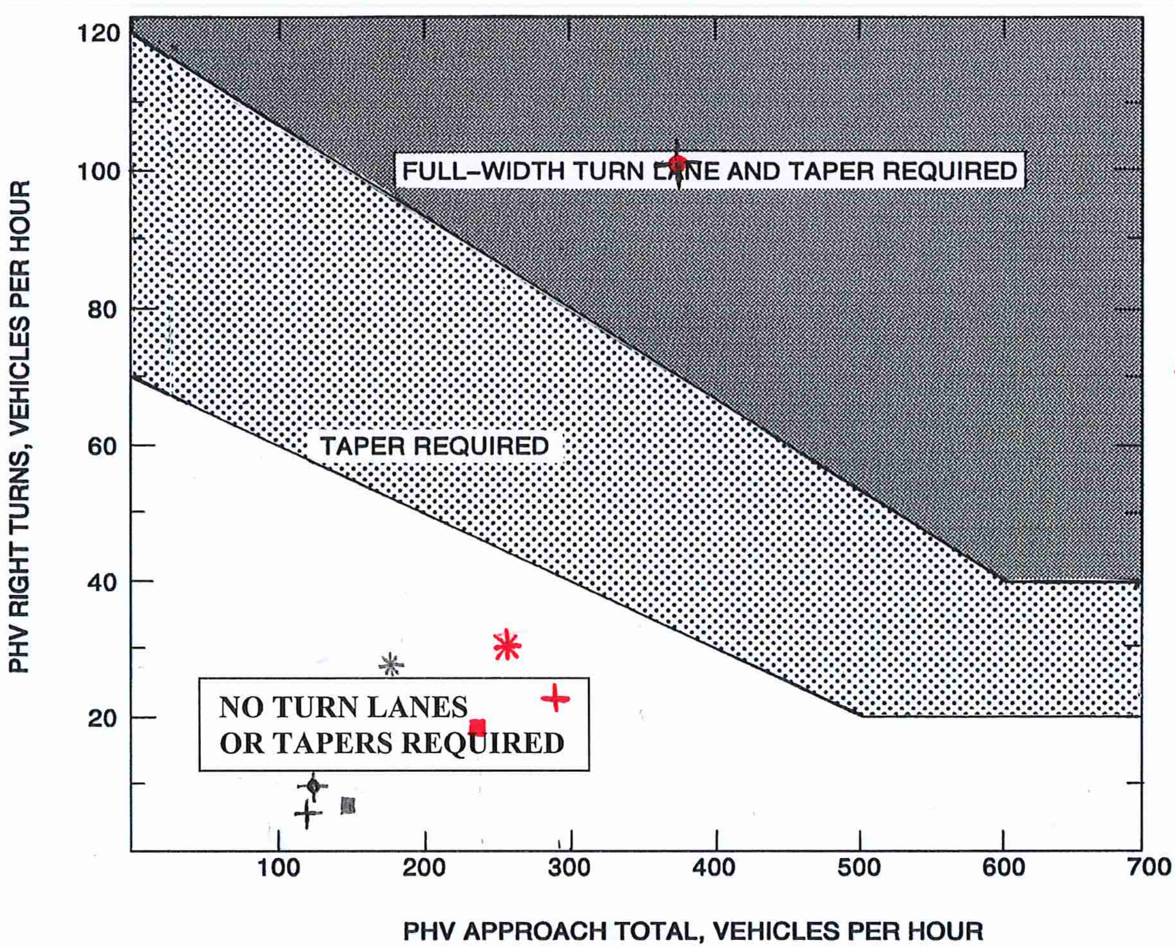


TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS



FOOTHILLS & CHIEF LK RD WESTBOUND



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

LEGEND

PHV - Peak Hour Volume (also Design Hourly Volume equivalent)

Adjustment for Right Turns

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

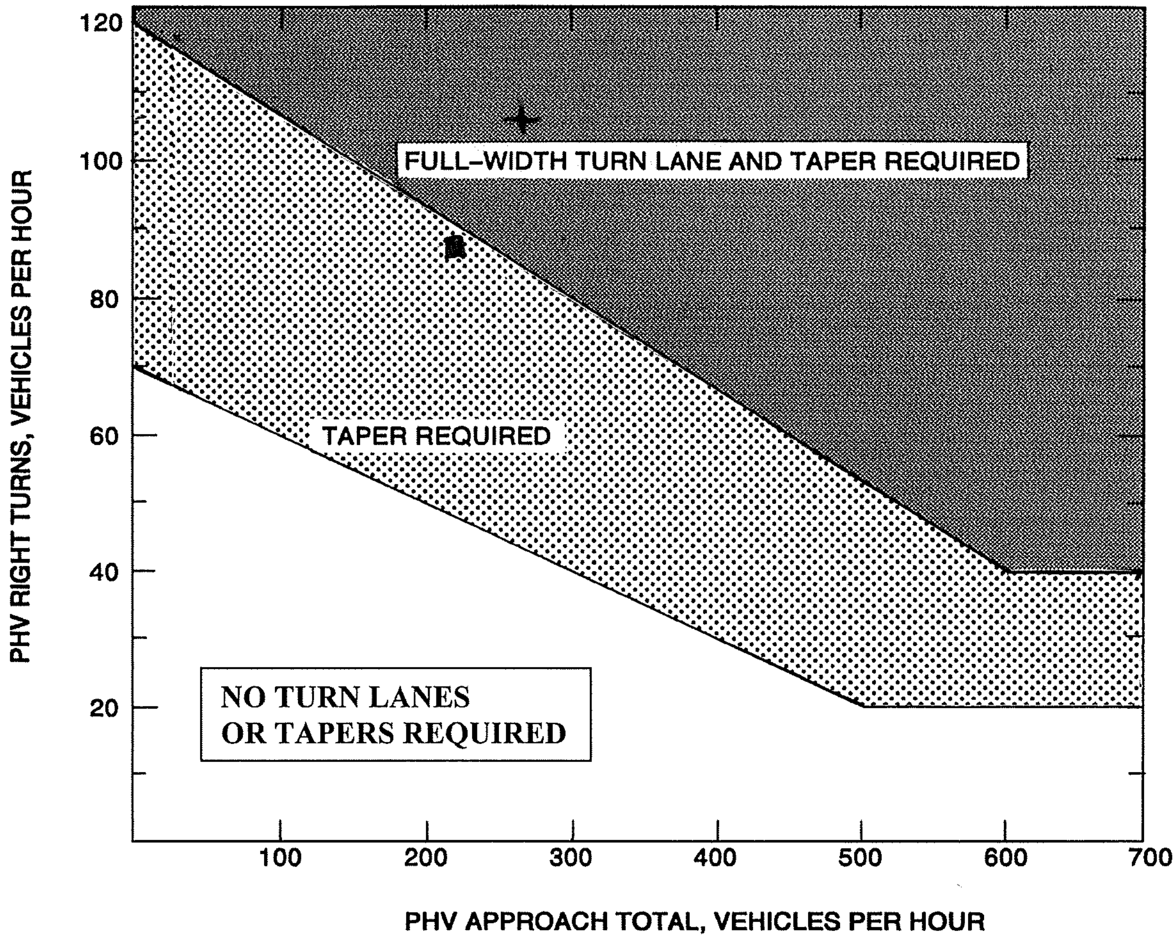
Note: An average of 11% for K x D will suffice.

FIGURE 3-23 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)

+ 2022 EXISTING BACKGROUND AM
+ 2022 OPENING DAY AM
■ 2037 PROJECTED BACKGROUND AM
* 2037 TOTAL TRAFFIC AM

■ 2022 EXISTING BACKGROUND PM
* 2022 OPENING DAY PM
+ 2037 PROJECTED BACKGROUND PM
● 2037 TOTAL TRAFFIC (FULL WIDTH TURN LANE AND TAPER REQUIRED)

FOOTHILLS & CHIEF LK RD EASTBOUND



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

LEGEND

PHV - Peak Hour Volume (also Design Hourly Volume equivalent)

Adjustment for Right Turns

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

FIGURE 3-23 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)

■ 2022 EXISTING BACKGROUND & OPENING DAY PM (TAPER REQUIRED)

+ 2037 PROJECTED BACKGROUND & TOTAL TRAFFIC PM (FULL WIDTH TURN LANE AND TAPER REQUIRED)

* ALL AM PEAK SCENARIOS WARRANT A FULL WIDTH TURN LANE AND TAPER. THE RIGHT TURN VOLUMES WERE TO HIGH TO PLOT. *

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS

TRAFFIC SIGNAL WARRANTS

INTERSECTION LOCATION FOOTHILLS / CHIEF LK HIGHWAY REGION
CALCULATED BY TF CHECKED BY
TRAFFIC COUNT DATE WARRANT DATE

- O Posted Speed or 85 Percentile Speed of Major Street Traffic > 70km/h
- O The Population in Built up Area of Isolated Community < 10,000
- O Distance to Nearest Signal Less Than 1000 Meters

WARRANT 1. MIMIMUM VEHICULAR VOLUME

O Satisfied ● Not Satisfied

Number of Lanes for Moving Traffic on Each Approach		Vehicles per Hour Approaching on Major Street (Total of Both Approaches)			Vehicles per Hour Approaching on Higher Volume Minor Street Approach (One Direction Only)		
Major Street	Minor Street	Requirements	Field Value	Percent Filled	Requirements	Field Value	Percent Filled
1	1	500(350)	304	61%	150(105)	162	108%
2 or more	1	600(420)			150(105)		
2 or more	2 or more	600(420)			200(140)		
1	2 or more	500(350)			200(140)		

WARRANT 2. INTERRUPTION OF CONTINUOUS TRAFFIC

O Satisfied ● Not Satisfied

Number of Lanes for Moving Traffic on Each Approach		Vehicles per Hour Approaching on Major Street (Total of Both Approaches)			Vehicles per Hour Approaching on Higher Volume Minor Street Approach (One Direction Only)		
Major Street	Minor Street	Requirements	Field Value	Percent Filled	Requirements	Field Value	Percent Filled
1	1	750(525)	304	41%	75(53)	162	216%
2 or more	1	900(630)			75(53)		
2 or more	2 or more	900(630)			100(70)		
1	2 or more	750(525)			100(70)		

WARRANT 3. COMBINATION OF WARRANTS

O Satisfied ● Not Satisfied

Requirement	Warrants	80% Satisfied	Number of Warrants 80% Satisfied
Warrants 1 & 2 80% satisfied	1 – Minimum Vehicular Volume	Yes O No ●	0
	2 – Interruption of Continuous Traffic	Yes O No ●	

WARRANT 4. ACCIDENT EXPERIENCE

O Satisfied O Not Satisfied

Accident Type : Accident Severity:

Requirement		
All of A, B, and C Satisfied	A – Adequate trial of less restrictive remedies with satisfactory observance and enforcement has failed to reduce the accident frequency;	Yes O No O
	B – Five or more reported accidents, of types susceptible to correction by traffic signal control, have occurred within a 12-month period, each accident involving personal injury or property damage to an extent of $1000 or more;	Yes O No O
	C – The signal installation will not seriously disrupt progressive traffic flow	No O Yes O

WARRANT 5. PEAK HOUR LEFT TURN VOLUMES

O Satisfied O Not Satisfied

Requirement	Warrants	Requirements	Field Value	Fulfilled
One or More Warrants Satisfied	Product of Left Turn Vehicles and Opposing Through Vehicles	100,000 (2 Lane)		Yes O No O
		150,000 (4 Lane)		Yes O No O
	Left Turn Volumes	150 Vehicle per Hour, or		Yes O No O
		100 vph for 70 km/h or more		Yes O No O

Notes

1. The right turn traffic is excluded in the traffic count for all warrants.
2. Bracketed figurs are 70% of normal warrant figures. Use when the posted speed or 85 percentile speed of major street traffic exceeds 70 km/h, or when the surrounding areas population is less than 10,000.

APPENDIX I

Woodlands Neighbourhood Plan
L&M Engineering Limited

WOODLANDS NEIGHBOURHOOD OPEN HOUSE #1 SUMMARY

L&M ENGINEERING LIMITED
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

City of Prince George
1100 Patricia Boulevard
Prince George BC V2L 3V9

Date: December 17, 2018
L&M Project: 1631-01

Public Open House Summary Report

Meeting Date:	November 6th, 2018
Meeting Location:	Springwood Elementary School Gym 4600 Zral Road
Meeting Duration:	5:50 pm – 8:00 pm
Number of Neighbours in Attendance:	Approximately 36

Introduction

Enclosed please find a summary package for the first of two Woodlands Neighbourhood Plan public open houses. Included with this public open house summary package you will find the following information:

- Appendix A: Invitation to Neighbours;
- Appendix B: Public Open House Mail-Out Distribution Map;
- Appendix C: Mind Map Image Result;
- Appendix D: Sticky Note Responses from Public Open House Stations;
- Appendix E: Entrance Survey Summary of Responses;
- Appendix F: Public Open House Comment Sheets.

November 6th, 2018 Public Open House

On Friday October 20th, 2018, L&M Engineering mailed-out over 300 invitations via Canada Post (see Appendix A) to residents surrounding the proposed Woodlands Neighbourhood Plan boundary. Of these invitations, only two were returned to L&M due to changed addresses. Please refer to Appendix B for a map of the public open house distribution area for the mailed-out invitations.

Present at the public open house to represent L&M Engineering were Jason Boyes (Professional Engineer), Terry Fjellstrom (President of L&M Engineering and Professional Engineer), Tanner Fjellstrom (Project Engineer), Dylan deSousa (Project Engineer), Ashley Thandi (Community Planner) and Ashley Elliott (Project Planner). Tiina Schaeffer (Manager of Sustainable Community Development), Tristin Deveau (Planner, Sustainable Community Development), Al Clark (Infrastructure Engineer) and Laurie-Ann Kosec (Parks Planner) were present to represent the City of Prince George. The Developers for the Woodlands Neighbourhood Plan were also present.

The public open house was attended by approximately 36 neighbours, who began to arrive shortly after 5:45 pm and were offered coffee, tea, donuts, and cookies from Tim Hortons. The public open house was arranged in an open house format where neighbours were presented with multiple interactive stations and a variety of engagement methods in order to ensure that we were able to effectively collect as much feedback from the neighbourhood as possible. The stations provided opportunities to discuss topics such as transportation, servicing & infrastructure, parks & trails as well as land use and the environment. Interactive stations were also provided where neighbours were invited to share their thoughts about their likes/dislikes about their current neighbourhood, to share their vision for the neighbourhood in 25 years and to participate in a mind mapping exercise, which was intended to create a visual representation of the information collected during the public open house (See Appendix C).

At each station, neighbours were invited to use post-it notes to share their comments related to that specific station. These notes have been organized, scanned and have been provided, in Appendix D. Neighbours were also encouraged to provide their email on the sign-in-sheet so that a group email list could be generated as a means of providing project updates and so that neighbours could remain in contact with L&M Engineering throughout the duration of the Plan process.

Entrance Survey

Entrance surveys were included with the mailed-out invitations so that baseline information about the current state of the neighbourhood and preferences for future development in the area could be identified. The data collected through the entrance survey will be used in conjunction with the feedback from the public open house to identify core themes about the neighbourhood and to identify key entry level preferences held by the neighbours. Neighbours were provided with the month of November to complete and return their completed entrance surveys. Entrance surveys were returned to L&M in a variety of ways including in-person at the November 6, 2019 public open house, via email, Canada Post and also by hand delivery to the L&M Engineering office. To protect the personal information provided in the entrance surveys, the individual surveys are not included with this summary; however, a summary of the responses is provided in Appendix E. As of November 30th, 2018 a total of 19 entrance surveys were received by L&M.

The most common responses to the entrance survey suggest that the neighbours value that their neighbourhood is quiet, safe and family oriented and that it provides access to greenspace and recreational opportunities such as trails. The most frequent concerns identified with respect to the future development within the Neighbourhood Plan boundary were an increase to traffic along arterial roads where issues for pedestrians already exist, loss of greenspace as well as impacts to wildlife and the environment. The amenities identified in the survey that neighbours would be the **most** likely to utilize included sidewalks, a naturalized park space and trails, whereas the options voted the **least** likely to be utilized included increased bus services, an off-leash dog park and using the new roads as shortcuts within the current traffic network.

The demographic of respondents included people from all provided age ranges, with the most frequently occurring response falling within the 65+ age range (37%), followed by the 25-35 range (26%). 42% of returned surveys were from households with at least one minor living in the home. The average number of years that respondents have lived in their current neighbourhood is 13 years.

Written Comment Submissions

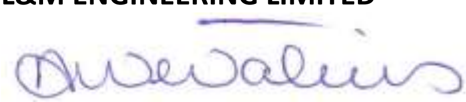
Comment forms were provided at the public open house and included dedicated comment space for each station at the public open house, as well as room for general comments on the back of the form. Neighbours were provided with the opportunity to take the comment forms home and had until November 30th, 2018 to return their completed forms to L&M Engineering. As of November 30th, a total of 2 completed comment forms and 2 emails with written comments were received by L&M Engineering and have been included with this report in Appendix F.

Summary

The purpose of the first public open house was to gather public opinion early in the planning process about the current state of the neighbourhood and to identify a vision for the future of the Woodlands Neighbourhood Plan area. The information collected during the first public open house and the written feedback received as of November 30th, 2018 will be used to develop draft plans and drawings for the Woodlands Neighbourhood Plan. Once the draft plans have been developed, a second public open house will be held to share draft policies and plans with the neighbours to ensure that the feedback collected as of November 30th, 2018 was correctly interpreted to shape the land use vision for the neighbourhood. Neighbours will be notified of the second public open house via the group email list that was generated by the sign-in sheet and via mail-outs to the same distribution area utilized for the first public open house. This notification strategy is designed to ensure consistency and transparency in the Neighbourhood Plan notification process.

Sincerely,

L&M ENGINEERING LIMITED



Ashley Elliott, MCIP, RPP
Community Planner

APPENDIX A:

INVITATION TO NEIGHBOURS

You're Invited!

WHAT?

The City of Prince George and L&M Engineering are hosting a public engagement open house for interested members of the community to help create a new Neighbourhood Plan for the future phases of the Woodlands Neighbourhood.

WHEN?

6pm – 8 pm, November 6th, 2018 in the Springwood Elementary School Gym.

4600 Zral Rd, Prince George, BC V2K 5X9

WHAT CAN YOU EXPECT?

Multiple interactive stations to discuss the various elements of the design process for a new neighbourhood plan including: transportation, pedestrian connectivity, land use & parks planning, environmental considerations and more! See the attached letter for details.

L&M ENGINEERING LIMITED
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

Date: October 19, 2018
L&M Project: 1631-01

Attention: Owner or Resident

Reference: The Woodlands Neighbourhood Plan
An Opportunity to Provide Comment & Input on a New Neighbourhood Plan

Dear Neighbour,

The L&M Engineering Limited Planning Centre is in the process of creating a Neighbourhood Plan for the future expansion to the Woodlands area, located in the north end of the City of Prince George, within the Hart community. In recent years, the Hart community has experienced a rise in new subdivisions and developments featuring a range of housing types, new parks and amenities. To aid in the planning process for this Neighbourhood Plan we are pleased to invite you, your family, and fellow neighbours to attend a public open house where we will be discussing relevant features of the plan including, but not limited to:

- Environmentally sensitive areas;
- Transportation networks;
- Phasing of City services;
- Residential planning;
- Development phasing;
- Parks; and
- Trail linkages.

Neighbourhood Plans

Neighbourhood Plans are community-based documents that outline a variety of goals, objectives and respective policies that act as the guiding principles for all future development within a specified area. Typically, Neighbourhood Plans are created for an area of at least 40 hectares so that all new development within the Plan's boundaries can be comprehensively planned with input from the surrounding neighbourhoods. The target outcome of a successful Neighbourhood Plan is to ensure that the future developments meet the community's collective needs while avoiding negative impacts with the surrounding neighbourhoods wherever possible.

Neighbourhood Plan processes are different than a Rezoning or Official Community Plan process because a Neighbourhood Plan represents a unique overarching vision for development of the lands within its boundaries. Further, a Neighbourhood Plan is put in place before a new

Rezoning or Official Community Plan amendment occurs. This is why the public engagement process is so important, as it will ultimately help to inform the future land use decisions for the area. The success of any Neighbourhood Plan will largely be determined through the public engagement process.

Your Invitation to the Public Open House

The upcoming public open house will be the first step toward gathering feedback from local residents to help shape a vision for the future of this neighbourhood. Once defined, this vision will help to guide the creation of the Neighbourhood Plan which, once complete, will provide certainty for residents, land owners, and developers regarding how the area will look and feel in the future. An important part of the neighbourhood planning process is the public participation and there are a number of ways you can provide input, including:

- Attending the public open house to be held in the Springwood Elementary School Gym on Tuesday November 6th, 2018 between 6:00 and 8:00 pm. The meeting will be held in an open house format featuring multiple interactive stations with a variety of opportunities to participate and provide feedback. Representatives from the City of Prince George and L&M Engineering will be available throughout the meeting to answer questions and engage in meaningful discussion about the Neighbourhood Plan and its respective process.
- The enclosed questionnaire will also be available at the public open house on November 6th, 2018, which we hope you will be able to attend; however even if you are unable to attend, please consider completing the survey and submitting it to the L&M Planning Centre. Your responses will assist the Project Team by ensuring that public input is incorporated into the development of the Neighbourhood Plan. Copies of all public responses will also be forwarded to the City of Prince George for their review.
- Contact information for the leading Project Team members is provided below. Please feel free to reach out with questions, concerns or, if desired, to schedule a one-on-one meeting at a time of your convenience. Team members will be available to all interested individuals by email, phone, and mail or to meet as requested throughout the duration of the Woodlands Neighbourhood Plan process.

Next Steps

After all the feedback has been collected, the draft Woodlands Neighbourhood Plan will be completed and submitted to the City of Prince George for review. A second public open house will then be held in mid-March, 2019 in order to provide another opportunity for public consultation to ensure the draft Neighbourhood Plan accurately represents the community vision for the area. Once the final draft has been completed, the Woodlands Neighbourhood Plan will be presented to Prince George City Council for consideration and adoption during the spring of 2019.

Closure

We look forward to welcoming you at the public open house scheduled for Tuesday November 6, 2018 at the Springwood Elementary School so that you can participate in an exciting opportunity to help shape the vision of the Woodlands Neighbourhood Plan.

If you have any questions that you would like addressed prior to the public open house please feel free to contact Ashley Elliott at L&M Engineering to discuss project specifics or Tristin Deveau from the City of Prince George to discuss City related matters at the contact information provided below. Further, if you would like to receive digital or paper copies of the drawings that will be on display at the public open house, please feel free to contact Ashley Elliott. At your convenience, please return the enclosed survey to L&M at the public open house or, if you are unable to attend, please feel free to email, mail, fax, or hand deliver it to:

L&M Engineering Limited
Planning Centre
ATTN: Ashley Elliott, MCIP RPP
1210 Fourth Avenue
Prince George, BC V2L 3J4
Phone: 250-562-1977
Fax: 250-562-1967
Email: aelliott@lmengineering.bc.ca

OR

City of Prince George
Sustainable Community Development
ATTN: Tristin Deveau
1100 Patricia Boulevard
Prince George, BC V2L 3V9
Phone: 250-561-7657
Fax: 250-561-7721
Email: tristin.deveau@princegeorge.ca

We would also like to thank you in advance for any and all feedback you provide in whichever capacity you feel the most comfortable throughout this process.

Yours very truly,

L&M ENGINEERING LIMITED

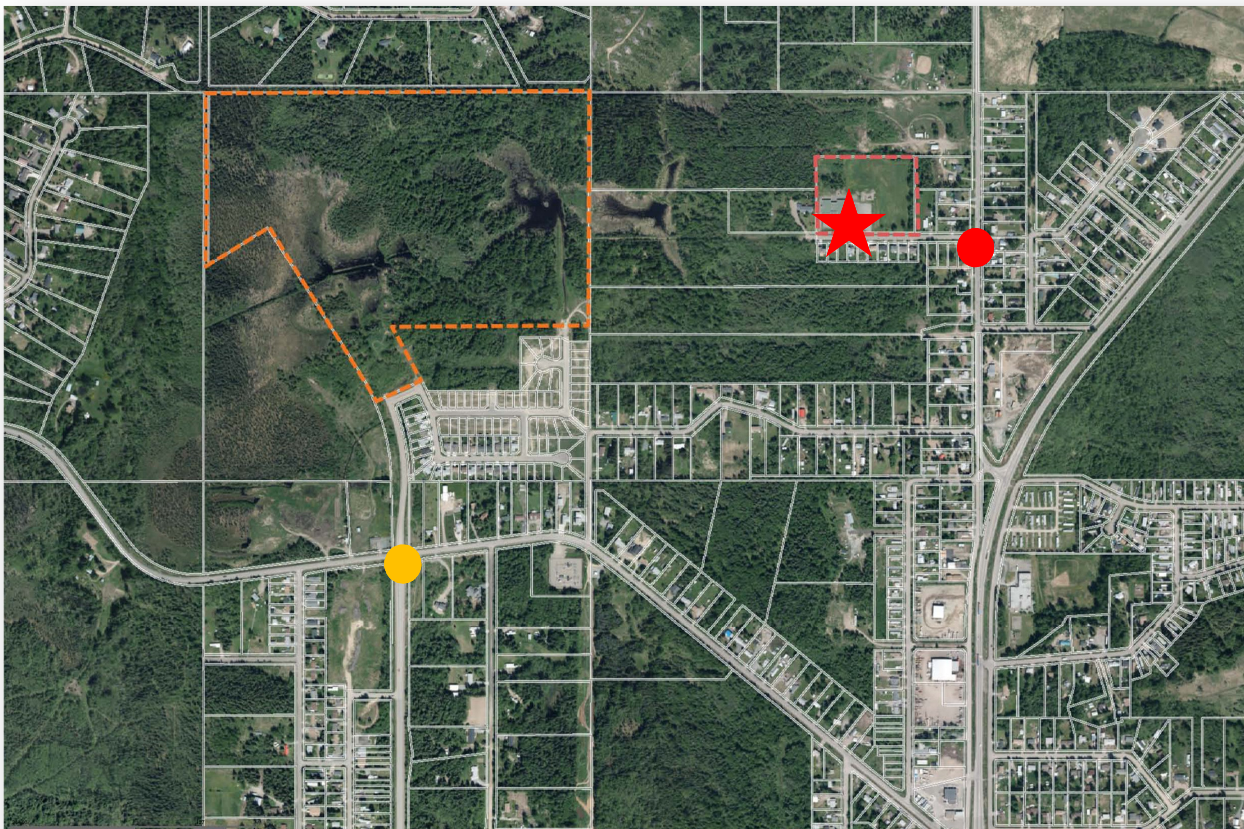
Ashley Elliott, MCIP, RPP
Community Planner

G:\Job Files\1600\1631 - Central Builders\01 - Woodlands Neighbourhood Plan\Public Engagement\Community Meeting\Woodlands mail out DRAFT.doc (Autosaved).docx

PUBLIC OPEN HOUSE

Meeting Location: The Springwood Elementary School Gymnasium
4600 Zral Rd, Prince George (see map below)

Time: **6:00 pm – 8:00 pm**
Date: Tuesday November 6th, 2018
Purpose: To provide feedback and engage in meaningful discussions regarding a new Neighbourhood Plan for the future expansion to the Woodlands Subdivision.

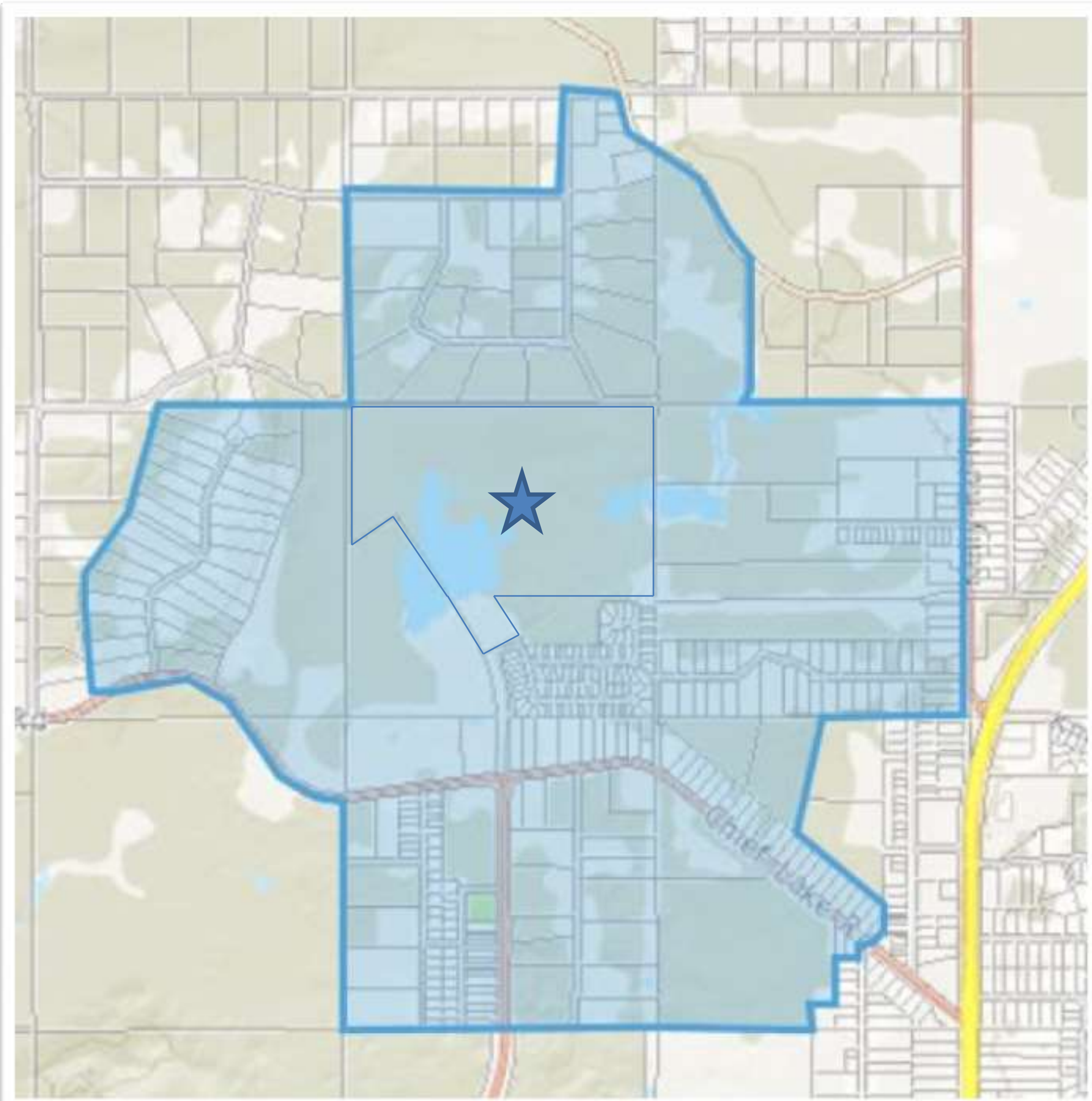


LEGEND

★	Meeting location: Springwood Elementary School
– – –	Neighbourhood Plan Boundary
● (yellow)	Chief Lake Rd. & Foothills Blvd. Intersection
● (red)	Zral Rd. & N. Kelly Rd. Intersection

APPENDIX B:

PUBLIC OPEN HOUSE MAIL-OUT DISTRIBUTION MAP

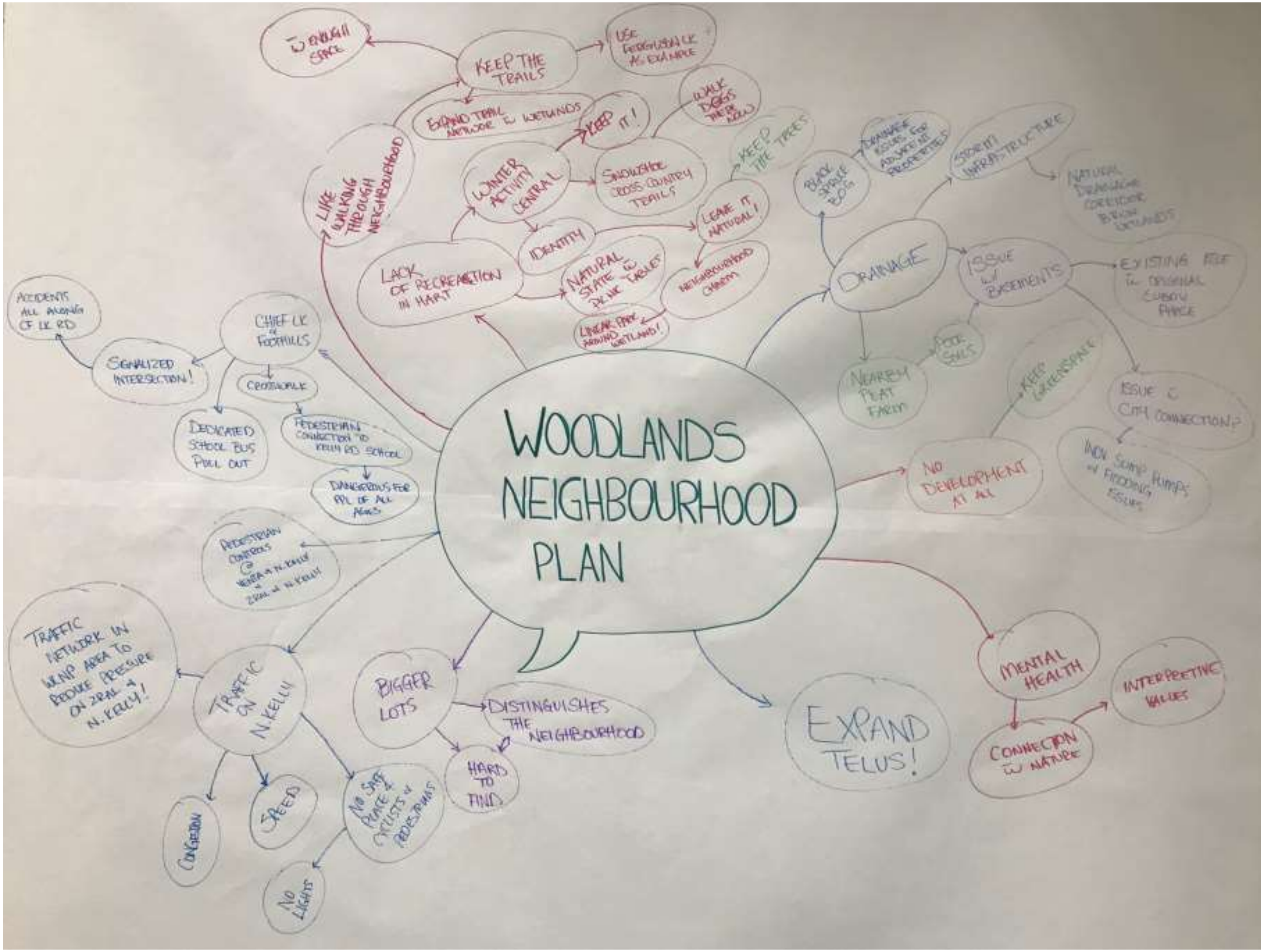


Subject property

Mail-out distribution area

APPENDIX C:

MIND MAP IMAGE RESULT


WOODLANDS NEIGHBOURHOOD PLAN
KEEP THE TRAILS
ENOUGH SPACE
USE FERGUSON LK AS EXAMPLE
EXPAND TRAIL NETWORK W WETLANDS
KEEP IT!
WALK DOGS THERE NOW
LIKE WALKING THROUGH NEIGHBOURHOOD
WINTER ACTIVITY CENTRAL
SNOWSHOE CROSS-COUNTRY TRAILS
KEEP THE TREES
LEAVE IT NATURAL!
IDENTITY
LACK OF RECREATION IN HART
NATURAL STATE & PICNIC TABLES
NEIGHBOURHOOD CHARM
LINEAR PARK AROUND WETLANDS!
BLACK SPRUCE BOG
DRAINAGE ISSUES FOR ADJACENT PROPERTIES
STORM INFRASTRUCTURE
DRAINAGE
ISSUE W/ BASEMENTS
POOR SOILS
NEARBY PEAT FARM
KEEP GREENSPACE
ISSUE C CITY CONNECTION?
NO DEVELOPMENT AT ALL
INDV SUMP PUMPS W FLOODING ISSUES
MENTAL HEALTH
INTERPRETING VALUES
CONNECTION W NATURE
EXPAND TELUS!
BIGGER LOTS
DISTINGUISHES THE NEIGHBOURHOOD
HARD TO FIND
TRAFFIC ON N.KELLY
CONGESTION
SPEED
NO SAFE PLACE 4 CYCLISTS & PEDESTRIANS
NO LIGHTS
PEDESTRIAN CONTROLS
CHIEF LK & FOOTHILLS
SIGNALIZED INTERSECTION!
CROSSWALK
DEDICATED SCHOOL BUS PULL OUT
PEDESTRIAN CONNECTION TO KELLY RD SCHOOL
DANGEROUS FOR PPL OF ALL AGES

APPENDIX D:

STICKY NOTE RESPONSES FROM PUBLIC OPEN HOUSE STATIONS

NEIGHBOURHOOD VALUES

quietness!
low traffic

I drive to this neighbourhood for the NATURAL greenspace!

Green space with moose

park / family neighbourhood

park / open space

Safe walkways

Park / playground

trails

low traffic volume during non-school drop ~~off~~ /pick up on Zral

Large plot size
– Not College Hts. size lots

Sparrow road traffic
wetlands want to be preserved.
red is areas of no further development

park / greenspace

green space

NEIGHBOURHOOD CHALLENGES (1 OF 2)

Bussing

Sidewalks & street lights on chief lk rd & Sparwood

park

trail system for walking & biking

Turning left off Hwy 97 onto Cheif Lk Rd is SKETCHY! with that lane ending there!

Traffic Control

traffic too fast

playground! / park

Do not use Sparwood as an access Rd - Too much traffic no control - used as an access Rd and ~~turnabout~~. Please contact ICBC as to accidents in area

TRAFFIC LIGHT @ FOOTHILLS & CHIEF LK

PLAYGROUND FOR KIDS

Wetland restoration - Get quad trails out!

Sidewalks on Chief LK Rd by Hwy.

New School

Traffic light on chief lace!

sidewalks for kids walking to school

NEIGHBOURHOOD CHALLENGES (2 OF 2)

Machine Free areas! (No quads / sleds!)

Nature reserve around the wetlands (Ferguson Lake idea!) BIG BUFFERS!

increased traffic routes

don't use Sparwood as an acess rd

You need an access Rd to the school from the new area. NOT using SPARWOOD which is not a road with proper pavement or sidewalks

*Traffic-speeding on N. Kelly Rd

*No sidewalks / safe place to walk on N. Kelly

traffic light at chief lake rd +

↑ school capacity

New Element. School

No ~~R~~ ATV / Quad / etc

trails - foot traffic only

No Street lights on N. Kelly / Zral

Zral
No safe walking area for families / children as no sidewalks and narrow road. Especial during drop off + pick

Street lights and full lights at Chieflake & Foothills

New school

EXISTING NEIGHBOURHOOD PHOTOS

BEAVER DAM

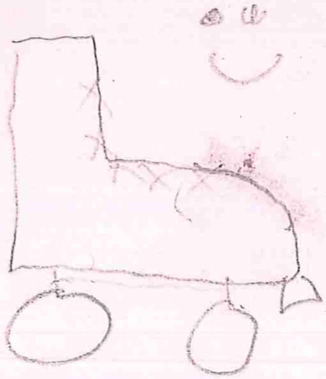
Protect me!

WETLAND

Restore me

STREET VIEW

smooth pavement :)



Protect / enhance western toad habitat!

wetland + upland (over winter)

KEEP

TRANSPORTATION

SOUTH SHOULDER ALONG CHIEF LAKE RD. IS ERODING.

- CONTROLLED PEDESTRIAN CROSSING @ FOOTHILLS & CHIEF LAKE RD.

OFF STREET TRAIL ALONG CHIEF LAKE RD. TO GET KIDS TO / FROM KELLY ROAD HIGH SCHOOL

PARKS & TRAILS

SW CORNER OF
CHIEF LAKE RD.
& FOOTHILLS
→ PREVIOUS DEVELOPER
LEFT PILES OF LOGS
& DEBRIS (UNSIGHTLY
& FIRE HAZARD)

TOBAGGAN HILL
IS USED @
END OF
FOOTHILLS

PEOPLE SNOW-
SHOE A LOT
AROUND THE
WETLANDS

WILL NEED
A LARGER
SCHOOL -
SPRINGWOOD IS
OVER CAPACITY

NATURAL PARK ↓

The best
possible option

LAND USE & ENVIRONMENT

~~Cte~~ ~~Cpted~~ CPTED

Block off Sparwood Rd.
→ theft.

ATVs

Lots of Greenspace
lots of wildlife

Consistent
no smaller than woodlands.
or larger.

Beaver Dams - Drainage concerns

14 dams connecting wetlands

priority - walking/~~ski~~ snowshoe/ ski trails

Park by wetland - how usable is that?

rather see smaller park at other end than one big one

wildlife corridor need to be maintained

preserve sensitive landscapes

Minimize invasive species! (Jenni Adams)

Invasive plant species council can help

Western toads not observed by Triton but are definitely there

Concerns with swales failing in existing neighbourhood
People not respecting easements

larger lots preferred
doesn't want to see tall housing due to small lots - overpowers neighbours

Not interested in trailer parks
↳ like single family

Incorporate trees
called woodlands for a reason

Consistent form with existing

More access Roads

25 YEAR VISION

lots of trees/ nature still

Huge Trail Network - still keep old trails.

New school!!

Retain mature trees

- in natural spaces, parks and private lots

NOT A TYPICAL DEVELOPMENT

KEEP TREES

SAME AS COTTONWOOD PARK

USEABLE TRAIL NETWORK

Docks on Wetlands

PARKS & GREEN SPACE

New School

I want it to Feel like the Hart

APPENDIX E:

ENTRANCE SURVEY SUMMARY OF RESPONSES

L&M ENGINEERING LIMITED
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

Woodlands Neighbourhood Plan – Introduction Survey Responses

Responses are indicated in red in the tables below:

1. In terms of neighbourhood identity, when you think about your personal neighbourhood, what is the first thing that comes to mind?

Neighbourhood Identity	
Response	**Frequency** (number of times the comment or concern was repeated)
Quiet/peaceful	8
Family oriented	5
Safe	5
Access to greenspace	4
Location	3
Private	2
Trails	1
Good Neighbours	1
Friendly	1

2. Next, please rate each of the following aspects of life in your neighbourhood using a scale of 1 to 5 where 1 means "poor" and 5 means "excellent".

	Poor	..	..	..	**Excellent**
	1	2	3	4	5
As a place to raise a family		1	1	6	8
As a safe place to live		1	2	7	7
Access to nature			1	9	6
Access to recreation opportunities		3	3	10	
Efficient traffic network	1	4	5	5	1
Good pedestrian connectivity	8	3	2	2	1

3. In your opinion, what would you say are the three most significant factors contribute to a **higher** quality of life in your neighbourhood?

Response	Frequency (number of times the comment or concern was repeated)
Access to greenspace/nature/trails/rec areas	10
Spacious lots/private/quiet	7
Safe	6
Less traffic	3
Small neighbourhood feeling/good neighbours	3
Owner occupied homes	2
City services	2
Affordable	2
Close to schools	1
Close to shopping	1
Smaller homes	1
Access to bus routes	1
No fences	1
Paved roads	1

4. And, what would you say are the three most significant factors that contribute to a **lower** quality of life in your neighbourhood?

Response	Frequency (number of times the comment or concern was repeated)
Unsightly properties	5
Traffic	7
Use of ATVs & parking them on roads	3
Overcrowding/noise	3
Chief Lake & Foothills intersection	2
Poor roads & few services	2
High taxes	2
Lack of transit	3
Poor pedestrian connectivity	2
Crime from overcrowding/bad neighbours	2
Loss of trees	2
Low Income Housing/multi family	2
Illegal dumping of garbage	1
Development	1
No play area for the kids	1

5. New development can bring new infrastructure and benefits to a neighbourhood. Please rate how likely you would be to use the following potential improvements on a scale of 1 to 5 where 1 means it is "not at all likely" that you would use potential improvement and 5 means it is "very likely" that you would use the potential improvement.

	Not at all Likely	..	..	..	Very Likely
	1	2	3	4	5
Sidewalks	2	1	2	2	10
Bus service with stop for the Prince George public transit network	8	1	3	3	3
School bus stop	6		2	3	7
Park space (see options below)					
• **Playground equipment**	3		3	4	8
• **Off leash dog park**	7	1		3	7
• **Naturalized park space**	2	3		3	10
• **Outdoor fitness (basketball, pickleball, tennis)**	2	2	2	3	7
Trails		2	1	4	11
Home businesses such as daycare, nail salon, seamstress, etc.	4	3	7	1	3
Roads as an alternative traffic route through subdivision	6		6	4	2

6. What style of new housing (if any) do you want to see built within the Neighbourhood Plan boundary? (please tick all that apply)

Housing Forms	Frequency of Responses
Starter homes (1-2 bedrooms)	5
Family homes (2-4 bedrooms)	15
Carriage/Cottage homes	1
Universally accessible/visitable housing	3
None	1
Other, Please Specify	Seniors (2) Non-rentals (2) Larger lots like Valleyview (1)

7. What worries you most (if anything) about further development within the Woodlands Neighbourhood Plan area? (please tick up to 5)

Concerns	Frequency of Responses
Loss of greenspace	11
Impact on views	4
Impact on wildlife	12
Environmental impact	7
Increased traffic	17
Impacts to property values	6
Lack of school/childcare spaces	5
Unsafe for pedestrians	10
Inconsistency with current neighbourhood	4
Impact on existing City services	6
Parking congestion	3
Other, Please Specify	Small lot sizes (2) Overcrowding (1) Access to trails (2)

8. If applicable, at what locations do you feel concerned with safety and what is the problem (road, pedestrian, lighting etc.)?

(a) Locations (please detail):

Locations

Response	Frequency (number of times the comment or concern was repeated)
Chief Lake Rd & Foothills Blvd. Intersection	10
General Area	9
Chief Lake Road (pedestrian usage)	5
Zral & North Kelly (pedestrian usage)	1
Sparwood Road	1
Foothills Blvd. & Woodlands Entrance	1
Chief Lake Rd. & Hart Highway	1
Greenwood & North Kelly	1

(b) Safety problems (please provide details):

Concerns	Frequency of Responses
Traffic (industrial traffic, busses, increased residential)	8
No traffic lights at major intersections	7
Pedestrian safety + no sidewalks	9
Poor street maintenance	4
Flashing lights (Chief Lake & Foothills) are confusing = accidents	3
Location of school bus stop	2
Irregular pavement	1
No road lines	1
No crosswalks at Chief Lake	1
Visibility issues	1
Parking congestion	1
Poor lighting	1
“S” Curves on Chief Lake	1

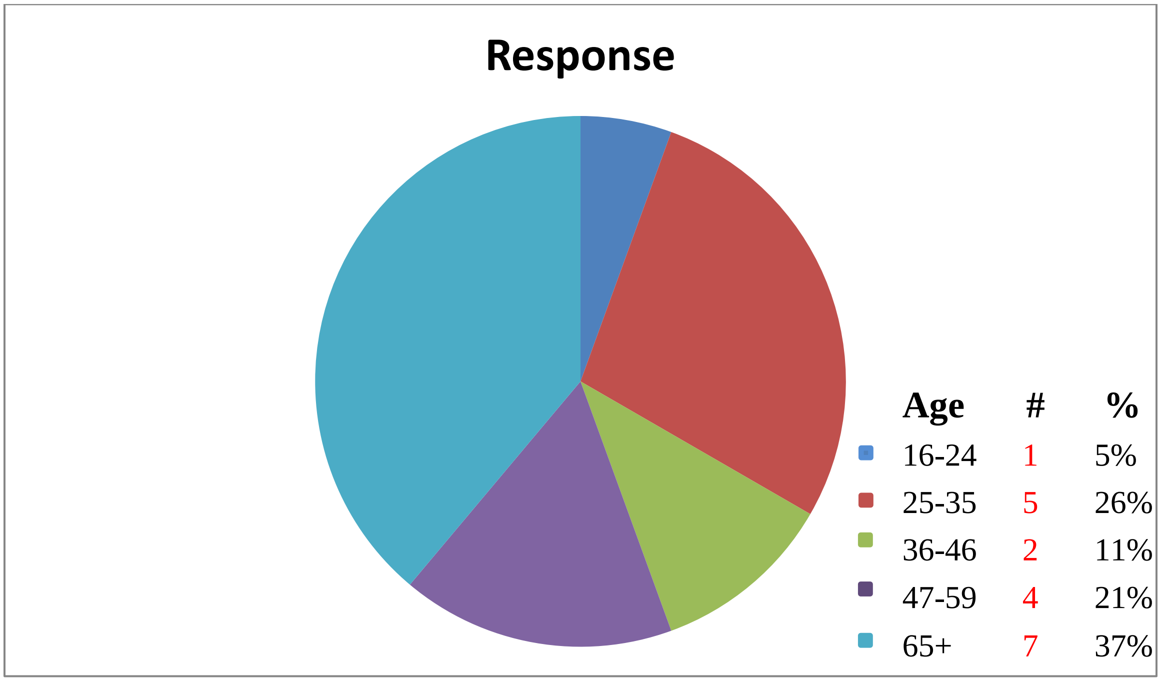
9. If applicable, what gaps in the current servicing infrastructure (roads, water, internet etc.) exist in your neighbourhood?

Servicing Gaps	Frequency of Responses
Slow internet & T.V.	7
Poor sidewalk connectivity	5
No Telus	4
Storm management	2
Irregular pavement/road improvements needed	3
Wells and septic fields	2
City water capacity	1
No crosswalk at Chief Lake Road intersection	1
Sparwood needs upgrading	1
Limited amenities	1
No Skip The Dishes service	1
Poor lighting as you come into neighbourhood	1

10. What street do you live on?

Key	Road Name	Number of Residents in Attendance
Purple line	Fox Drive	3
Green line	Chief Lake Road	1
Orange line	Woodoak Crescent	2
Red line	Woodvalley Drive	4
Blue line	Sparwood Street	3
Yellow line	Zral Road	1
Dashed light blue line	Sparrow Road	2
Black line	Greenwood	1

11. What is your age?



12. Including yourself, how many people in each of the following age groups live in your household?

Under 13 years old					**2**				**2**	**2**	**2**	**1**				**1**		**2**
Between 13 and 18 years old							1											
Between 19 and 44 years old				2	2			2	2	2	2	2	1			1	2	
Between 45 and 64 years old	1	2				2	2					1		1		1		2
65 years of age or older	1	1	2					1					2	1	2			

13. How long have you lived in Prince George?

Number of Years	**32**	**47**	**65+**	**29**	**2**	**37**	**20**	**35**	**16+**	**26**	**28**	**15+**	**70 & 48**	**50**	**82**	**17**	**24**	**life**

14. How long have you lived in your current neighbourhood?

Number of Years	**32**	**31**	**30**	**1.5**	**.8**	**37**	**3**	**30**	**7**	**5**	**5**	**1+**	**7**	**16**	**6**	**.5**	**.8**	**20+**

If you would like to provide additional comments about the Neighbourhood Plan or if you would like to expand on any of your earlier comments then please do so below (or write a letter to us, the more feedback we receive the better!):

Comments	Frequency of Responses
Keep the greenspace	4
Don't want increased traffic	3
Keep it safe	2
Provide access to trails	3
Provide better bus service	2
No development within plan boundary	1
Sparwood used as a shortcut to Foothills	1
Avoid increased traffic to Springwood Elementary	1
Springwood Elementary is at capacity	1
Area needs better snow removal	1
Avoid 2 storey houses next to ranchers	1
The area needs a new family pool	1
The area needs a skateboard/BMX park	1
More shopping opportunities	1
Extend City services to old neighbourhoods	1
New development will raise surrounding property taxes	1
Protect wildlife	1
The area is over run by ATV users	1
No multi-family housing	1
No street light at Chief Lake Rd (safety issue)	1
Upgrade Chief Lake Rd. to make it safer for pedestrians	1
Limit pedestrian connections to prevent crime	1
Block off access from Woodlands to North Kelly Rd	1
Keep the area family oriented	1
Make the housing accessible (no 2 storey houses without an elevator	1
Keep it affordable	1
Maintain access for ATVs/sleds	2
Larger lots	1
Builders leave nails & garbage when building houses	1

APPENDIX F:

PUBLIC OPEN HOUSE COMMENT SHEETS

L&M ENGINEERING LIMITED
PLANNING CENTRE
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

November 6th, 2018

Woodlands Property Development Corp.

Woodlands Neighbourhood Plan Public Open House Comment Sheet

STATION #1 – Evaluate Your Neighbourhood

WE LOVE THE NEIGHBOURHOOD - NEED A PLAYGROUND FOR THIS FAMILY ORIENTED NEIGBOURHOOD

STATION #2 – City Process/ Current State of Your Neighbourhood

DEVELOPING FAST - GOOD TO SEE EXPANSION

STATION #3 – Transportation

NEED TRAILS TO LINK ZAREL TO WOODVALLEY

STATION #4 – Servicing/ Infrastructure

NEED TO GET TELUS OPTIK - POOR CELL SERVICE

STATION #5 – Parks & Trails

WALKING TRAILS

Preference for Park Options (Circle One)

Playground (Figure #1)   Natural (Figure #2)   Fitness (Figure #3)   Dog Park (Figure #4)

STATION #6 – Land Use & Environment

L&M ENGINEERING LIMITED PLANNING CENTRE
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

November 6th, 2018

Woodlands Property Development Corp.

Woodlands Neighbourhood Plan Public Open House Comment Sheet

STATION #1 – Evaluate Your Neighbourhood

Sparwood + Chief Lk - accidents & heavy, heavy traffic
- lots of speeding on Sparwood

STATION #2 – City Process/ Current State of Your Neighbourhood

STATION #3 – Transportation

lots of foot traffic no sidewalks or wide enough
Shoulders

STATION #4 – Servicing/ Infrastructure

STATION #5 – Parks & Trails

Need as much greenspace as possible.

Preference for Park Options (Circle One)

Playground (Figure #1) Natural (Figure #2) Fitness (Figure #3) Dog Park (Figure #4)

STATION #6 – Land Use & Environment

APPENDIX J

Woodlands Neighbourhood Plan
L&M Engineering Limited

WOODLANDS NEIGHBOURHOOD PLAN OPEN HOUSE #2 SUMMARY

L&M ENGINEERING LIMITED
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

City of Prince George
1100 Patricia Boulevard
Prince George BC V2L 3V9

Date: July 30th, 2019
L&M Project: 1631-01

Public Open House Summary Report

Meeting Date:	June 4th, 2019
Meeting Location:	Springwood Elementary School Gym 4600 Zral Road
Meeting Duration:	6:00 pm – 8:00 pm
Number of Neighbours in Attendance:	Approximately 12

Introduction

Enclosed please find a summary package for the second Woodlands Neighbourhood Plan public open house. Included with this public open house summary package you will find the following information:

- Appendix A: Invitation to Neighbours;
- Appendix B: Public Engagement Mail-Out Distribution Map;
- Appendix C: Public Open House Comment Sheets; and
- Appendix D: Public Open House Email Feedback.

June 4th, 2019 Public Open House

On Friday June 25th, 2019, L&M Engineering mailed-out over 300 invitations via Canada Post (see Appendix A) to residents surrounding the proposed Woodlands Neighbourhood Plan boundary. Of these invitations, four unopened invitations were returned to L&M due to changed addresses. Please refer to Appendix B for a map of the public open house distribution area for the mailed-out invitations.

Present at the public open house to represent L&M Engineering were Jason Boyes (Professional Engineer), Terry Fjellstrom (President of L&M Engineering and Professional Engineer), Tanner

Fjellstrom (Project Engineer), Ashley Thandi (Community Planner), Ashley Elliott (Project Planner) and Benjamin Baxter (Engineering Technician). Tristin Deveau (City of Prince George Planner, Sustainable Community Development), and Laurie-Ann Kosec (City of Prince George Parks Planner) as well as Jennifer Bond (Triton Environmental Consultants) were present to answer questions and collect feedback regarding the Plan from the neighbours.

The public open house was attended by approximately 12 neighbours, who began to arrive shortly before 6:00 pm and were offered coffee, tea, donuts, and cookies from Tim Hortons. The public open house was arranged in an open house format where neighbours were presented with multiple interactive stations where draft Design Guidelines, Policy Recommendations and Principles from the Plan were on display so that we could have discussions and collect as much feedback as possible to help finalize the Plan. The stations provided opportunities to discuss topics such as the vision and guiding principles for the Plan, transportation, servicing & infrastructure, parks & trails as well as land use and the environment.

Neighbours were encouraged to provide their email on the sign-in-sheet so that anyone who missed the first public open house (November 6th, 2018) could have their contact information added to the group email list to receive project updates and so that neighbours could remain in contact with L&M Engineering throughout the remainder of the Plan process.

Feedback Received at the Second Public Open House

During the meeting, the majority of feedback received was positive stating support for the amount of greenspace that was preserved around the wetlands and the location of the neighbourhood park. Only one person expressed a disappointment with the lack of trails stating that without the trails the development would be no benefit to the surrounding neighbourhood. In response, we identified the City's preference for the dedication of a 1 hectare park adjacent to zoned park space that was previously dedicated to the City as part of a separate rezoning process. By dedicating the parkland at the proposed location, the goal is to create a large 2 hectare park for the surrounding neighbourhood to enjoy that would connect to a greater green network that could be used for snow shoeing etc. during the winter months. Due to the high water table in the area, the City explained that trails would be difficult to maintain to a usable standard over the long term.

Comments regarding the development itself were expressed at the meeting including support for single family housing, support for not providing an access to lands beyond to the north of the development and a recommendation to consider the snow load of buildings due to the volume of snow that accumulates north of the wetlands. Developability of the area was also discussed including comments about the poorly draining soils and wildlife presence within the Plan area.

Written Comment Submissions

Comment forms were provided at the public open house and included questions intended to measure the level of satisfaction with the draft Plan, Policies and Design Guidelines shared at each station. The comment forms also included dedicated comment spaces for each station as well as room for general comments on the back of the form. Neighbours were provided with the opportunity to take the comment forms home and were provided a deadline of June 28th, 2019 to return their completed forms to L&M Engineering. As of the time of preparing this summary report a total of 2 completed comment forms and 3 emails with written comments were received by L&M Engineering, which have been included with this report in Appendix C.

Summary

The purpose of this second public open house was to share the draft vision, guiding principles, design guidelines and policy recommendations that have been prepared in response to the feedback received during the first public open house together with the development goals of the City of Prince George and the property owners. The information collected during the second public open house will be used to fine-tune the drafted Woodlands Neighbourhood Plan. Neighbours will be notified of upcoming project milestones such as Council meetings and future rezonings via the group email list that was generated by the sign-in sheet. This notification strategy is designed to ensure consistency and transparency in the Neighbourhood Plan notification process and in the future development of the Woodlands Neighbourhood.

Sincerely,

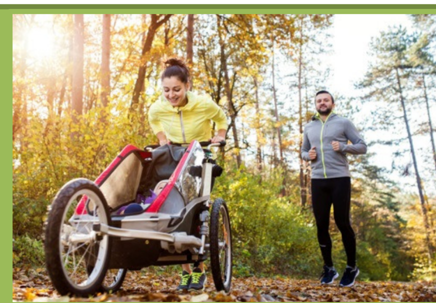
L&M ENGINEERING LIMITED

Ashley Elliott, MCIP, RPP
Community Planner

APPENDIX A:

INVITATION TO NEIGHBOURS

WOODLANDS
Nature's Place



Planning the Future Woodlands Neighbourhood Continues…

You spoke, we listened. This is what we heard:

Since the planning process began for the Woodlands Neighbourhood Plan, many ideas were suggested by the community via a wide variety of public engagement opportunities such as an open house, a questionnaire, a survey as well as correspondence over the phone and email. Some of the core values identified by the community included:

- A pedestrian friendly street design
- Accessible parks and trails
- Low density housing
- Environmentally responsible design
- Maintain the safe, family oriented neighbourhood
- New development should be low impact to existing surrounding neighbourhoods
- New development should balance the lifestyle in the Hart while meeting the needs of new residents

Public Open House:

Tuesday June 4th, 2019 from 6:00 pm to 8:00 pm

Place: Springwood Elementary School Gymnasium

Upcoming Open House June 4, 2019

What can you expect at the 2nd Public Open House?

New Opportunities to Create a Diverse and Complete Neighbourhood

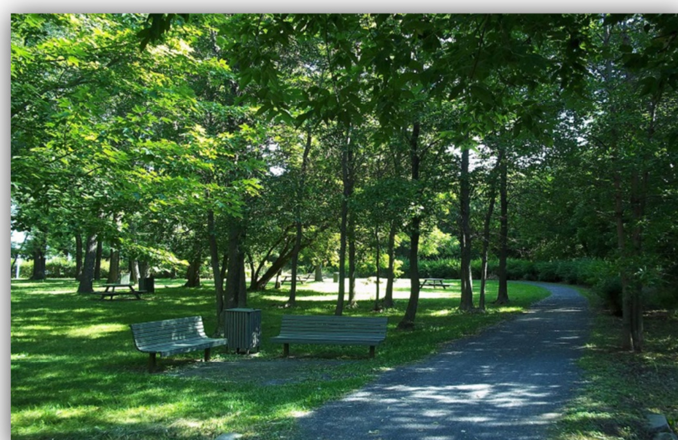
Great neighbourhoods provide housing for present and future residents at all stages in life in harmony with the surrounding environment. Come see and discuss:

- Neighbourhood Plan policies and design guidelines for low density single-family housing.
- Neighbourhood Plan Objectives for a family oriented neighbourhood design.
- Neighbourhood Plan design guidelines to maintain the "Hart" identity

New Park and Outdoor Recreation Experiences

Vibrant and livable neighbourhoods provide recreational opportunities through access to parks and the natural environment:

- Neighbourhood Plan policies for a new park that creates a unique and safe public place.
- Opportunities for broader recreational opportunities through the strategic location of a new neighbourhood park.



Upcoming Open House June 4, 2019

New Transportation Networks

The way that road spaces are designed and allocated strongly influence how people in a neighbourhood choose to get around. Come see and discuss:

- Neighbourhood Plan policies for an efficient and sustainable transportation network that supports people of all ages and abilities.
- Opportunities to promote a safe and pedestrian friendly transportation network through proposed new sidewalks within the Plan area.

New Approaches to Responsible Environmental Design

The way that environmental features are preserved and incorporated into a neighbourhood design from the outset sets the tone for responsible environmental design. Come see and discuss:

- Neighbourhood Plan policies to ensure the sensitive natural features within the Plan area are protected into the future.
- Opportunities to create a neighbourhood that respects and protects the environment and the ecosystems found there.

Be Part of the Plan!

Can't make it to the Public Open House? Please consider getting involved by joining our email service or by contacting L&M Engineering or the City of Prince George.

Get involved through our e-mail service

Join the Woodlands Neighbourhood Plan direct e-mail service by emailing Ashley Elliott at aelliott@lmengineering.bc.ca for regular project updates that come straight to your e-mail inbox.

Get involved by contacting L&M Engineering & City Staff

If you would like to discuss the Neighbourhood Plan prior to the 2nd Public Open House, please feel free to contact Ashley Elliott at L&M Engineering to discuss project specifics or Tristin Deveau from the City of Prince George to discuss City related matters at the contact information provided below:

L&M Engineering Limited
Planning Centre
Ashley Elliott, MCIP, RPP
1210 Fourth Avenue
Prince George, BC V2L 3J4
Phone: 250-562-1977
Email: aelliott@lmengineering.bc.ca

OR

City of Prince George
Sustainable Community Development
Tristin Deveau
1100 Patricia Boulevard
Prince George, BC V2L 3V9
Phone: 250-561-7657
Email: tristin.deveau@princegeorge.ca

We look forward to welcoming you at the 2nd Public Open House scheduled for Tuesday June 4th, 2019 at the Springwood Elementary School Gym so that you can continue to participate in an exciting opportunity to help shape the vision of the Woodlands Neighbourhood Plan.

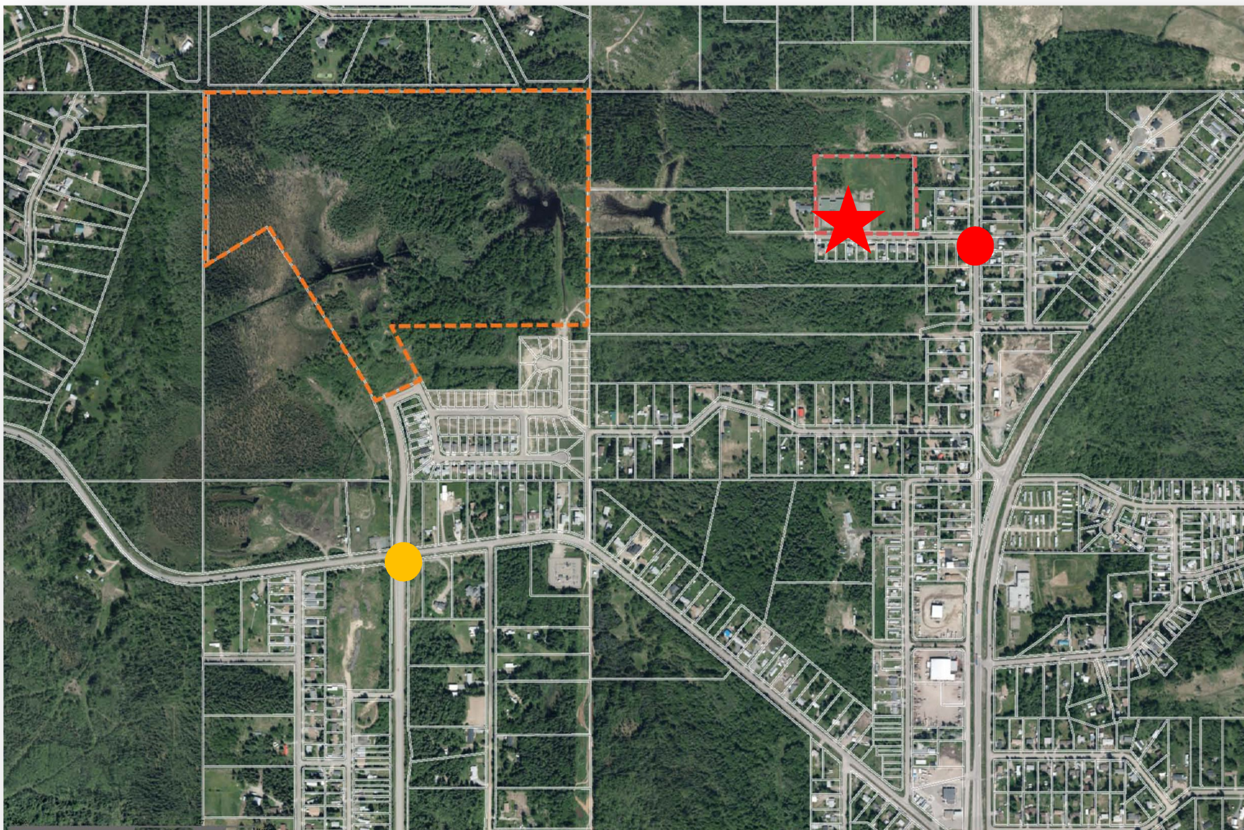
Sincerely,

L&M Engineering Limited

Ashley Elliott, MCIP, RPP
Community Planner

Public Open House Location Map

Location: Springwood Elementary School Gym (4600 Zral Road)
Time: 6:00 pm to 8:00 pm
Date: Tuesday June 4th, 2019



LEGEND

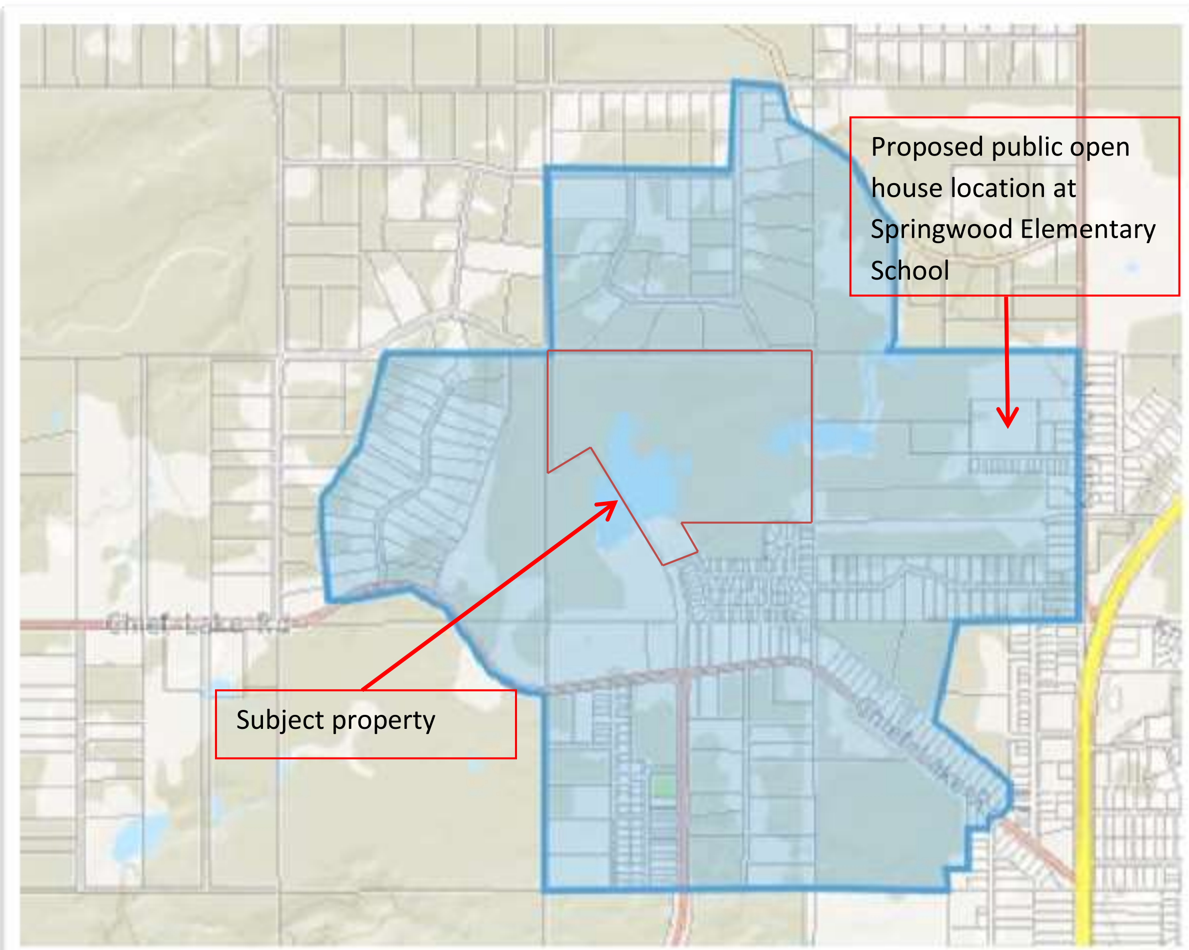
- Location: Springwood Elementary School
- Neighbourhood Plan Boundary
- Chief Lake Rd. & Foothills Blvd. Intersection
- Zral Rd. & N. Kelly Rd. Intersection

APPENDIX B:

PUBLIC ENGAGEMENT MAIL-OUT DISTRIBUTION MAP

Figure 1: Public Engagement Distribution Map

Woodlands Neighbourhood Plan



APPENDIX C:

PUBLIC OPEN HOUSE COMMENT SHEETS

L&M ENGINEERING LIMITED
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

June 04, 2019

WOODLANDS NEIGHBOURHOOD PLAN

Second Public Open House Questionnaire

For each statement, please circle the box that best describes your agreement or disagreement and/or provide additional comments in the spaces provided.

STATION #2 CITY STATION

1. Comments:

Pleasant, informative

STATION #3 NEIGHBOURHOOD PLAN PRINCIPLES AND VISION

1. The "Vision" for the Neighbourhood Plan sums up how I feel about my community.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

2. The Guiding Principles meets the "Vision" for the Neighbourhood Plan.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #4 LAND USE

1. The proposed land uses (single-family residential, park, greenbelt) make sense for the development area.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

may need more Parking
RV's and Toys

2. The purpose of the draft Residential Design Guidelines is to create a quality residential subdivision.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

3. The draft Residential Policies meets the purpose of the proposed draft Residential Design Guidelines.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #5 ENVIRONMENTAL

1. The need to protect environmentally sensitive areas is identified in the draft Environmental Policies.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #6 PARKS AND OPEN SPACE

1. The proposed draft Parks and Open Space Design Guidelines will support the development of safe and usable recreational opportunities within easy walking distance of most houses.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

lighting and openess
important

2. The draft Parks and Open Space Policies meets the purpose of the draft Parks and Open Space Design Guidelines.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

3. I am happy with the park as proposed.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #7 INFRASTRUCTURE

Comments:

STATION #8 TRANSPORTATION NETWORK

1. The proposed road network will be safe when driving in the neighbourhood.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Looks good

2. The proposed location of the sidewalks is pedestrian friendly.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #9 MEETING WRAP UP

1. Overall, the proposed draft Policies and Design Guidelines align with the proposed "Vision" and Guiding Principles.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

2. Overall, the feedback you shared during the first public open house for the Woodlands Neighbourhood Plan has been reflected in the draft "Vision", Guiding Principles, Policies and Design Guidelines.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

You appear to be listening

Your involvement is important to us. Thank you for taking the time to respond.

Please return your completed survey by mail, hand deliver, email or fax by to:

L&M Engineering Planning Centre, ATTN: Ashley Elliott

1210 4th Avenue

Prince George, BC, V2L3J4

Email: aelliott@lmengineering.bc.ca

Phone: 250-562-1977

Fax: 250-562-1967

The deadline for survey submissions for inclusion in the Neighbourhood Plan is June 28, 2019.

L&M ENGINEERING LIMITED
1210 Fourth Avenue
Prince George, B.C. V2L 3J4
Tel. (250) 562-1977
Fax (250) 562-1967

June 04, 2019

WOODLANDS NEIGHBOURHOOD PLAN

Second Public Open House Questionnaire

For each statement, please circle the box that best describes your agreement or disagreement and/or provide additional comments in the spaces provided.

STATION #2 CITY STATION

1. Comments:

- would like to see public transportation extended further into our area
- Woodlands seems like a natural spot for a bus turn-around.
- sidewalks needed on Chief Lake to make it safer for kids – walkers, cyclists + drivers
- off-set trail/sidewalk on Chief Lake Rd would be great.

STATION #3 NEIGHBOURHOOD PLAN PRINCIPLES AND VISION

1. The "Vision" for the Neighbourhood Plan sums up how I feel about my community.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

2. The Guiding Principles meets the "Vision" for the Neighbourhood Plan.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

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STATION #4 LAND USE

1. The proposed land uses (single-family residential, park, greenbelt) make sense for the development area.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

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2. The purpose of the draft Residential Design Guidelines is to create a quality residential subdivision.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

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3. The draft Residential Policies meets the purpose of the proposed draft Residential Design Guidelines.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #5 ENVIRONMENTAL

1. The need to protect environmentally sensitive areas is identified in the draft Environmental Policies.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #6 PARKS AND OPEN SPACE

1. The proposed draft Parks and Open Space Design Guidelines will support the development of safe and usable recreational opportunities within easy walking distance of most houses.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

2. The draft Parks and Open Space Policies meets the purpose of the draft Parks and Open Space Design Guidelines.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

3. I am happy with the park as proposed.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #7 INFRASTRUCTURE

Comments:

STATION #8 TRANSPORTATION NETWORK

1. The proposed road network will be safe when driving in the neighbourhood.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

· need public transportation and more sidewalks along Chief Lake Rd

2. The proposed location of the sidewalks is pedestrian friendly.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

STATION #9 MEETING WRAP UP

1. Overall, the proposed draft Policies and Design Guidelines align with the proposed "Vision" and Guiding Principles.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

2. Overall, the feedback you shared during the first public open house for the Woodlands Neighbourhood Plan has been reflected in the draft "Vision", Guiding Principles, Policies and Design Guidelines.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

____

____

____

____

____

Your involvement is important to us. Thank you for taking the time to respond.

Please return your completed survey by mail, hand deliver, email or fax by to:

L&M Engineering Planning Centre, ATTN: Ashley Elliott

1210 4th Avenue

Prince George, BC, V2L3J4

Email: aelliott@lmengineering.bc.ca

Phone: 250-562-1977

Fax: 250-562-1967

The deadline for survey submissions for inclusion in the Neighbourhood Plan is June 28, 2019.

APPENDIX D:

PUBLIC OPEN HOUSE EMAIL FEEDBACK

Ashley Elliott

From: [redacted]
Sent: Friday, June 07, 2019 11:35 AM
To: 'Ashley Elliott'
Subject: RE: Thank you - 2nd Public Open House - Woodlands Neighbourhood Plan

Ashley,

Thanks for a thorough recap once again. Well done. It is nice to get a feel for things through your emails.

I talked to Ms. Kosec [redacted]. She filled me in on how the meeting went.

I realize development is inevitable and I didn't come to the open house because it will be tough for me to not be a NIMBY! Lol. I really appreciate living in "the bush" if you will.

Anyways, I hope you have a great weekend!

[redacted]

From: Ashley Elliott [mailto:aelliott@lmengineering.bc.ca]
Sent: Friday, June 07, 2019 10:27 AM
To: [redacted]
Cc: mayorandcouncil; Schaeffer, Tiina; Deveau, Tristin
Subject: Thank you - 2nd Public Open House - Woodlands Neighbourhood Plan

Good Afternoon,

On behalf of Woodlands Property Development Corporation, we wanted to thank those neighbours who were able to attend the second public open house for the Woodlands Neighbourhood Plan process this past Tuesday evening. We recognize the value of everyone's time so we appreciate the time taken away from families, work and homelife to participate and give feedback for this project.

The success of a Neighbourhood Plan includes meaningful public input, so we wanted to provide as much opportunity as possible for people to participate and have their input included. To this end, we have attached all of the posters shared at the meeting to this email together with the questionnaire that was provided at the meeting as a hand out. We hope that the questionnaire will be completed while reviewing the information from each station and provide feedback as you go. The deadline for survey responses to be included in the second public engagement summary is June 28th, 2019. If you have any questions or would like to discuss the attached information in greater detail please don't hesitate to contact me at 250-562-1977, reply to this email or to request a one-on-one meeting before the deadline for comments.

As a brief overview, the Neighbourhood Plan document begins with a vision statement and by identifying the guiding principles. The vision and the guiding principles were both created out of the feedback we received during the first round of public engagement through the month of November 2018. These are then used throughout the Plan as the foundation upon which the draft design guidelines and draft policy recommendations are made. When reviewing the attached posters for each station, we hope you will consider how well the draft policies will help to make the design guidelines a realty. The design guidelines are meant to guide future development within the Plan area so that the final development is consistent with the "vision" and "guiding principles" identified by the neighbourhood. The plan will include: land use, environmental, parks and open space, infrastructure and transportation sections and each section will include their own set of policy recommendations so it is important to make sure that the sections are consistent with one another. The overall goal of the Plan is to create a low impact family friendly neighbourhood that provides easy, walkable access to recreational opportunities within the neighbourhood. With the retention of a significant amount of greenspace, we hope this goal becomes the reality for you.

As explained in my previous emails, we are still looking for photos taken of the area that you'd like to see included in the final copy of the Woodlands Neighbourhood Plan. If you have any photos, please send them to us so that we can make sure that the Plan is truly representative of the neighbourhood.

We look forward to hearing back from you and appreciate any time that you are able to invest into the draft Woodlands Neighbourhood Plan.

Yours Truly,

Ashley

Ashley Elliott, MCIP, RPP
Planner

L&M Engineering Limited
1210 4th Avenue
Prince George, BC V2L3J4

Work: 250-562-1977 (ext. 123)
Fax: 250-562-1967
Cell: 250-981-2558
Email: aelliott@lmengineering.bc.ca

Ashley Elliott

From: [redacted]
Sent: Thursday, June 06, 2019 11:12 AM
To: aelliott@lmengineering.bc.ca
Subject: Woodlands continues

Ashley Elliott,

Specifically, I am interested in the transportation plan for the movement of traffic from the proposed subdivision.

At this point, all the traffic from the current project area is via Foothills and Chief Lake Road. The mail out information doesn't indicate a secondary access in the proposed continuation of the project area.

Please send me a transportation document regarding this question.

[redacted]

Ashley Elliott

From: [redacted]
Sent: Wednesday, June 05, 2019 10:34 AM
To: aelliott@lmengineering.bc.ca
Subject: Pictures for the Woodlands Community Plan
Attachments: [redacted]

Hi Ashley, good talking to you last night, here are some pics for your community plan.

We really do love getting out in this area for walks, bike rides, sledding, cross country skiing, snowmobiling and snowshoeing. Anyone in PG can find these options by car but having them steps away was my main draw to the area. Therefore I was very happy to hear some areas will remain undeveloped and there will be a trail system maintained. Please keep this in mind for the plan!

What you won't find me lobbying for is the preservation/restoration of the haunted playground! I feel sorry for the people that unknowingly build on that lot!

Cheers,
[redacted]

APPENDIX K

Woodlands Neighbourhood Plan
L&M Engineering Limited

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