

Trilogy Properties
VI Corporation

Bioinventory for the Cayet Lands



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Executive Summary

Trilogy Properties VI Corporation (Trilogy) has filed a development permit application with the Village of Cumberland (Cumberland) for a development project under the name Cayet. The purpose of the development permit application is to subdivide 4 existing land parcels into 13 smaller lots for future development. The Cumberland Official Community Plan (OCP) calls for a biological site inventory (bioinventory) to support a development permit application. McElhanney Consulting Services Ltd. (McElhanney) was engaged by Trilogy to complete the bioinventory.

The Cayet subdivision application includes no physical development activities and the current application will result in no environmental impacts. With no impacts, it is not possible to provide an environmental impact assessment or mitigation plans for implementation at this time. Future detailed development plans are anticipated for the lots resulting from this subdivision. Detailed bioinventories associated with future development will be required and they will need to include detailed environmental impact assessments and associated mitigation strategies and implementation plans.

The OCP provides guidelines for all stages of the assessment process. The current study delineates in detail which OCP guidelines can be fulfilled based on currently available data and which guidelines will need to be fulfilled during future development stages. This study provides terrestrial ecosystem mapping, a hydrological assessment, and a detailed assessment of the existing biophysical conditions.

Biophysical elements that are independent of development plan details include the delineation of environmentally sensitive areas, definition of associated buffer areas, and delineation of requirements for habitat connectivity within and through the subject properties. These items are identified and mapped as restricted development zones. While no environmental impacts result from the current development permit application, a template is provided for mitigation planning at future development stages.

The current study provides the foundation for future studies that will complete the fulfillment of the OCP guidelines. It is compliant with the regulatory environment and environmental features in place at the time of writing. As regulatory environments and biotic and physical features can change with time, future applications will need to interpret both the data and the advice provided herein in the context of regulatory, biotic, and physical features in place at the time of those future development applications.

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List of Acronyms & Abbreviations Used

asl	above sea level
BMPs	Best Management Practices
Bioinventory	biological site inventory
CDC	Conservation Data Centre (BC)
CDFmm	Coastal Douglas-fir, moist maritime
CVNS	Comox Valley Naturalists Society
CWHxm	Coastal Western Hemlock very dry maritime
CXRD	Comox Valley Regional District
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
Cumberland	Village of Cumberland
DPA	Development Permit Area
ESA	Environmentally Significant Area
ESC	Erosion and Sediment Control
FLNRO	Ministry of Forest, Lands, and Natural Resource Operations and Rural Development
HAT	Habitat Acquisition Trust
MBCA	<i>Migratory Birds Convention Act</i> (Canada 1994)
McElhanney	McElhanney Consulting Services Ltd
MELP	Ministry of Environment, Lands and Parks
MOE	Ministry of Environment
MOF	Ministry of Forests
OCP	Official Community Plan
QEP	Qualified Environmental Professional
RAR	Riparian Areas Regulation
RISC	Resources Inventory Standards Committee
SEI	Sensitive Ecosystem Inventory
SAR	Species at Risk
SARA	<i>Species at Risk Act</i>
SPEA	Streamside Protection and Enhancement Area
TEM	Terrestrial Ecosystem Mapping
Trilogy	Trilogy Properties VI Corporation
VRI	Vegetation Resource Inventory

1. Introduction

Trilogy Properties VI Corporation (Trilogy) is proposing a development called Cayet in the Village of Cumberland (Cumberland). A combination of commercial, retail and residential land development is proposed.

Trilogy is currently applying to subdivide 4 existing land parcels into 13 smaller lots for future development. Within Cumberland Bylaw 990, the Official Community Plan (OCP), protocols for the required development permit application to support this subdivision call for the completion of a biological site inventory (bioinventory). McElhanney Consulting Services Ltd. (McElhanney) was engaged by Trilogy to complete the bioinventory.

1.1. Project Location

Cumberland is in the Comox Regional District, between Comox Lake to the west and the hamlet of Royston and City of Courtenay to the east. The proposed development of Cayet is located within the eastern municipal boundaries of Cumberland. The Cayet Study Area consists of several parcels of land along the Inland Island Highway 19 corridor and along the Comox Valley Parkway (Figure 1), described as the Interchange Lands in the OCP (Cumberland 2014).

1.1.1. Site Description and Land Use

The Study Area is rural in character and much of the natural forest landscape has been modified through logging or mining. Working forests and gravel removal operations have been the prominent features modifying the landscape throughout the Study Area.

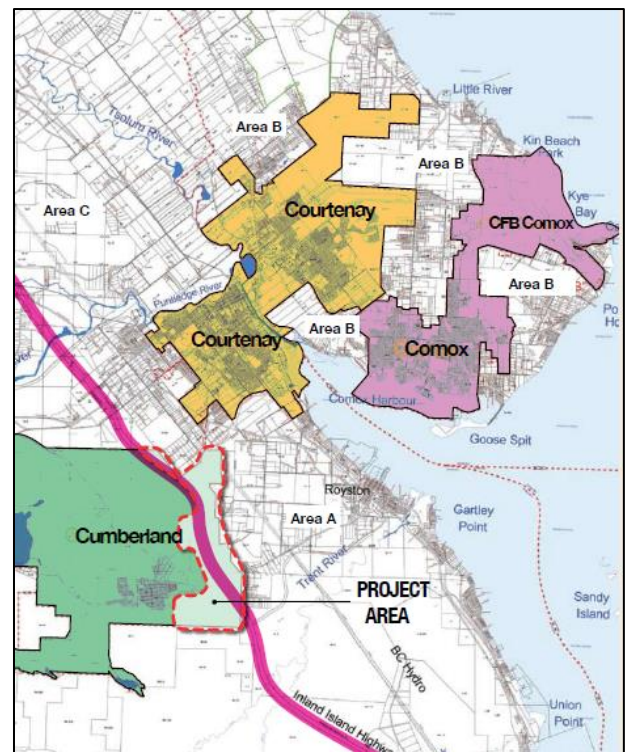


Figure 1. Regional context - location of Cumberland Interchange Lands. (outlined in red) (Civitas 2006).

1.2. Project Description

The lands under application are currently zoned as four master parcels (*Table 1*). The purpose of the current development permit application is to subdivide the four major parcels into 13 smaller lots for subsequent development (*Table 1*, *Figure 2*). All preparation of detailed development plans will occur subsequent to the completion of the current subdivision application.

Table 1. Legal descriptions and locations of the four master parcels of the Cumberland Interchange Lands which make up the Study Area.

Parcel Number	Legal Description	UTM Location
Master Parcel 1: Lots 4, 6, 10b, and 11	Part of Section 25, Township 10, Comox District, Plan 552H except that part Commencing at the Northeast corner of said Section thence South 24 degrees 10 minutes East 252 feet to the centre of Comox and Union Road thence following the road South 25 degrees 50 minutes West 691 feet, thence South 35 degrees 50 minutes West 541 feet, thence South 18 degrees 30 minutes West 496 feet, thence South 15 degrees 30 minutes East 1921 feet thence South 51degrees 50 minutes West 195 Feet to post No. 1 of Chinese Cemetery being the point of commencement thence South 71 degrees West 179 feet thence North 20 degrees 20 minutes West 295 feet thence North 78 degrees 30 minutes East 348 feet thence South 15 degrees East 160 feet thence South 39 degrees 50 minutes West 165 feet more or less to the point of commencement and except those parts in Plans 4222, 11052, 11072, 17828, 24989, 25688, 23092, VIP64546 VIP65968, VIP67267, VIP67596, VIP69148, VIP72564, VIP78656, and VIP83684; PID 006-686-010	10 U 355096.93 m E 5499566.49 m N
Master Parcel 2: Lots 8a and 8b	Lot A, DL 24, Nelson Land District, Plan VIP76956 • PID 025-946-358	10 U 355793.27 m E 5498538.37 m N
Master Parcel 3: Lots 7, 9a, 9b, 10a.	Part of Lot 1 District Lot 24 Nelson District Plan VIP65482 Except Parts in Plans VIP66935 and VIP76956 • PID 023-970-260	10 U 355244.52 m E 5498118.56 m N
Master Parcel 4: Lots 3a, b, c	Lot A, Section 36, Township 10, Comox District, Plan 11052, except part in Plans VIP52361 and VIP69910; PID 005-116-961	10 U 355185.15 m E 5501693.55 m N

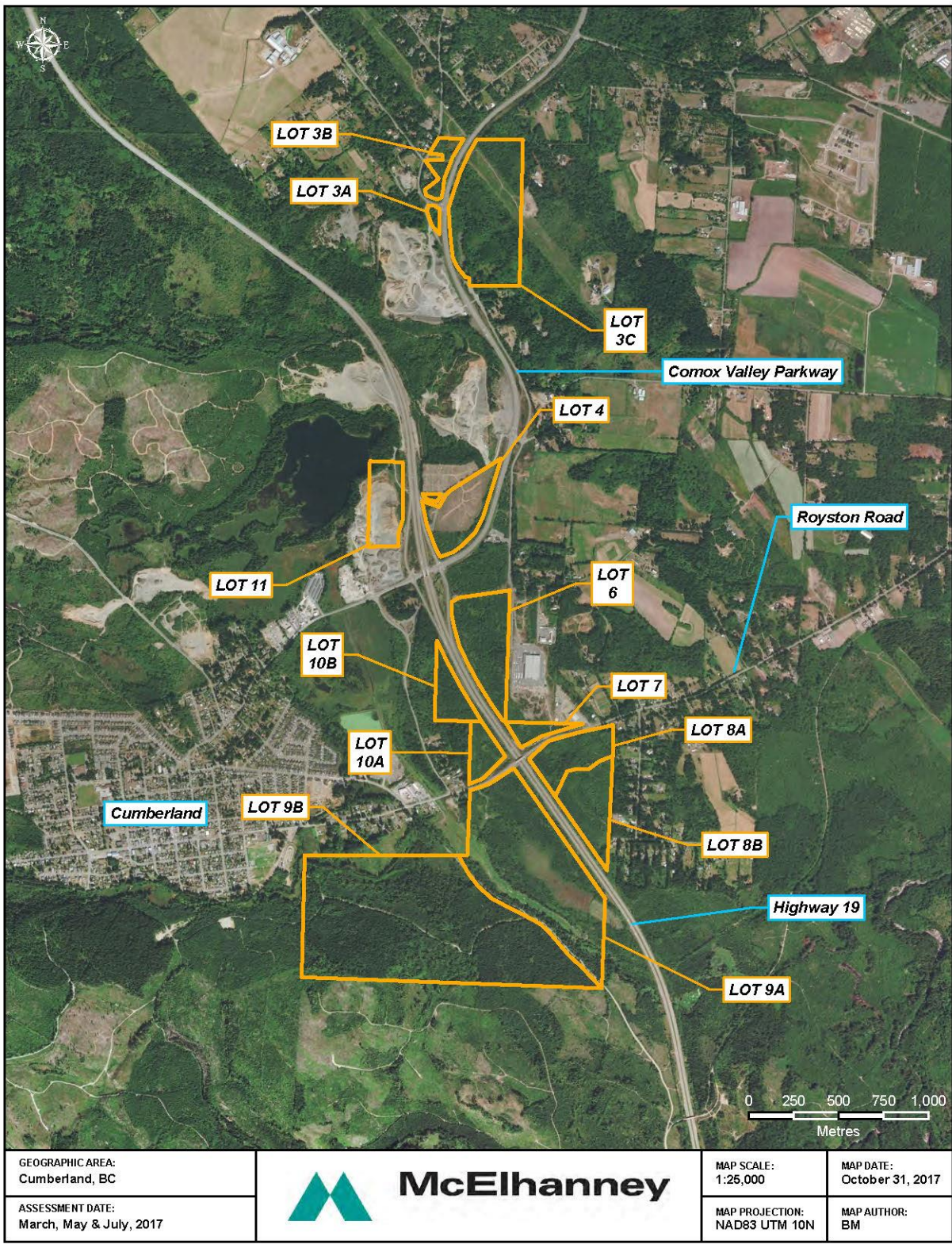


Figure 2. Location of Cayet lots at Cumberland, BC, included in this Study Area.

2. Regulatory Context

All development plans must be compliant with federal, provincial and municipal legislation for the protection of the environment.

Environmental statutes, regulations, and bylaws were utilized to determine environmental protections applicable to this Study Area and its future development. These legal instruments are referenced below by jurisdiction with an explanation of the targeted environmental protections and associated mitigations to reduce potential development impacts.

2.1. Federal

The following is a list of environmentally related federal legislation reviewed with respect to the proposed site development.

- The federal *Migratory Birds Convention Act* (MBCA) (Canada 1994) protects migratory birds and their nests during the bird breeding season. This Act prohibits the disturbance, destruction, or possession of migratory birds, their nests, or eggs. In addition, migratory bird habitat is protected under the MBCA which prohibits the deposit of oil, oily waters, or other substances harmful to migratory birds in any areas that they frequent.
- The federal *Fisheries Act* (Canada 1985, amended 2013) protects fish and fish habitat. The *Fisheries Act* and supporting policies aim to protect and manage fish habitats that support freshwater and marine fisheries associated with commercial, recreational or Aboriginal fisheries. The *Fisheries Act* regulates activities that affect fish or fish habitat including permanent alteration or destruction of habitat and deposition of deleterious substances into fish-bearing waters.
- The federal *Species at Risk Act* (SARA) (Canada 2002) protects aquatic species and species of birds protected by the MBCA on all lands throughout Canada, and protects other wildlife and wildlife habitat located on federal lands within Canada. Protection is provided for species listed as extirpated, endangered or threatened under Schedule 1 of SARA (Canada 2002). It is an offence to kill, harm, harass, capture or take an individual of a listed species and legal protection is also provided for their residences and critical habitat as specified in SARA.

2.2. Provincial

The following is a list of environmentally related provincial legislation reviewed with respect to the proposed site development.

- The provincial *Wildlife Act* (BC 1996b), Section 34, protects birds, eggs and occupied nests as well as the nests of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl at all times. The provincial *Wildlife Act* Designation and Exemption Regulation (BC 2014) indicates exemptions from permitting required under the *Wildlife Act* for nuisance wildlife.
- The provincial *Water Sustainability Act* (BC 2014) governs works in or about a stream, surface and ground water use, and diversions of water.

- The provincial Riparian Area Regulation B.C. Reg. 376 / 2004 (BC 2004a) (Section 12 of the *Riparian Areas Protection Act*) establishes protective riparian areas or streamside protection areas to support fish life processes. The province requires local governments to protect streamside areas from development activities through adherence to the provincial requirements, at a minimum, at a local level and provides a standardized methodology to determine the size of these areas (BC 2004b).
- The *BC Weed Control Act* and Weed Control Regulations requires control of designated noxious plants (BC 1996a).

2.3. Municipal

The Cumberland OCP outlines policies and bylaws with respect to the environment and protection from development.

- Village of Cumberland OCP Bylaw No. 990, 2014 guides planning and decision making for development in Cumberland. As a municipal bylaw, it establishes policy and requirements concerning protection of the natural environment which is outlined in OCP Section 10: Development Permit Areas.

The OCP provides protocols for environmental study requirements to accompany development permit applications. It also directs developers to follow the provincial Develop with Care 2012 (or the most current revision) Appendix B guidelines in designing studies required for environmental support documentation (MOE 2012).

OCP Section 10 calls for a detailed bioinventory to provide a thorough biophysical inventory and a detailed environmental impact assessment including mitigation strategies and implementation protocols. The purpose of the impact assessment and mitigation protocols is to fulfill biodiversity, terrestrial, watercourse, and riparian ecological protection requirements defined in the OCP. The OCP also states that all OCP guidelines may not be applicable in every permit; and where a guideline is not appropriate to the circumstances, Council may issue a development permit that varies or supplements regulations of the Subdivision or Zoning Bylaw.

3. Scope

The purpose of the current application is to subdivide four master parcels into smaller units for potential future development. Since the purpose of the current application is subdivision, no physical development is planned at the current stage. Each of these newly zoned lots will be the subject of a development permit application at some future date and detailed development plans will be parts of those applications. Those are anticipated to be several years in the future, likely spanning a period of 10 to 15 years.

The current bioinventory was conducted per the terms of OCP Section 10.0 Development Permit Areas (DPAs). Within Section 10, DPA 1 – Environmental Protection Section 10.1.5 Guidelines-General Requirements provides the protocols required for completion of environmental studies to support development permit applications. Section 10.1.5 contemplates all stages of development for conceptual design through to construction and commissioning of development projects, and therefore contemplates development processes beyond the scope of the current development application.

Biotic features (e.g. wildlife / cavity trees) as well as environmental legislation, regulations and standards change with time. Given the period anticipated before development permit applications are likely to be submitted, collection of detailed descriptive environmental data during the current study would result in stale data for future DPAs, rendering such data out of date and requiring its rework at the time of the future DPAs. To avoid this, the current detailed bioinventory was structured based on:

- providing a comprehensive inventory of data that will inform regional context for the environmental impact assessments for future DPAs, and
- deferring collection of detailed site-specific information until the future development permit application stage to provide timely completion of the fulfillment of the terms of OCP S. 10.1.5.

The current scope will:

- map / inventory Environmentally Sensitive Areas (ESAs) identified during the current and previous studies including Sensitive Ecosystem Inventories (SEIs) (MOE 1998, Juniper 2014),
- recommend buffers for protection to minimize impacts for future development, and
- provide a detailed bioinventory baseline to delineate the developable areas within these lands and to inform future data collection and reporting needs to support impact assessments and mitigation plans to accompany anticipated lot-by-lot development permit applications.

OCP Section 10.1.5 and parts of Section 10.1.6 provides a detailed catalogue of the environmental information required to support development permit applications. *Table 2* below itemizes pertinent information from those sections and identifies which items have been completed within the current study and what areas have been deferred to provide timely data to support future submissions.

This current study includes guidance regarding future data collection; however, time-appropriate completion of studies for future applications needs be based on standards and legislation / regulations in place at those future dates and guidance provided here-in needs to be interpreted accordingly.

Table 2. Village of Cumberland Bylaw 990 requirement for bioinventory of the Study Area addressed in the current study or deferred until future application dates.

OCP Section 10.1.5 Guidelines – General Requirements		Addressed in this report	To be addressed when developing future development permit applications
S. 10.1.5 by paragraph and sub-paragraph			
1)	Biological site inventory (bioinventory) according to the procedures described in Develop with Care 2012–Environmental Guidelines for Urban and Rural Land Development in British Columbia, Appendix B and amendments thereto.	Develop with Care 2014 is the current amendment and it was followed during the current study.	Use the amendment of Develop with Care current at the time of application.
2)	The bioinventory should be prepared by a qualified professional biologist together with other professionals of different and relevant expertise, as the project warrants.	All components of the current study were completed by professionals qualified within the appropriate discipline areas.	Employ appropriately qualified professionals
3)	The bioinventory shall:		
a.	Be in accordance with Develop with Care 2012: Appendix B: Bio-inventory Terms of Reference or most current edition.	Develop with Care 2014 is the current amendment and it was followed during the current study.	Use the Develop with Care amendment current at the time of application.
b.	Locate the parcel relative to watershed area(s) and describe the hydrological features of the parcel—including water shedding, collecting and conveyance areas.	A comprehensive hydrology report describing the hydrological features of the overall Trilogy properties was completed and is included here as Appendix A.	Further detailed hydrology reports including impact assessment and mitigation plans and implementation strategies will be required at the development permit application stage for each lot.
c.	Examine the natural environmental features within the parcel—including rare and threatened plant communities, endangered species listed under the Provincial <i>Wildlife Act</i> and the Federal SARA and any identified critical habitats for those species, and other important habitat features.	Species at risk (SAR) and ESA studies were completed during March, May and July 2017. SAR were recorded as encountered. Defer detailed SAR inventories to next phase.	Conduct detailed SAR and ESA studies and include in bioinventories to accompany future development permit applications.
d.	Provide a description and map(s) showing the boundaries of ESAs—including 30.0 m from the natural boundary of terrestrial areas, and 30.0 m from the natural boundary of watercourses, wetlands and lakes, and 30.0 m from the top of the bank of a watercourse, where a bank is within 15.0 m of the natural boundary of the watercourse).	ESA Mapping has been completed including buffers as specified.	Detailed bioinventory reports required at the time of each development permit application should update all ESA and buffer mapping to meet standards in place at the time of application. Ephemeral wetland mapping should be reviewed at a finer scale at the next stage.
e.	Determine the restricted development and buffer zones on the parcel through an explanatory, reference or legal survey plan prepared by a BC Land Surveyor that shows these boundaries (refer to Section 4, Table 4.1 Develop with Care for recommended target buffer distances for biodiversity conservation).	Conceptual mapping of restricted development and buffer zones at the current stage.	Detailed mapping and legal survey of these zones is deferred to the development permit application stage.

OCP Section 10.1.5 Guidelines – General Requirements		Addressed in this report	To be addressed when developing future development permit applications
f.	Examine the impact of the proposed development on the soils, vegetation, watercourses, wildlife, and hydrology in all restricted development and buffer zones; and provide development pattern and servicing recommendations to minimize these impacts.	No physical development planned at this phase. Defer to next phase.	Protective buffer recommendations should avoid impacts rather than needing to examine impacts. Identify opportunities to enhance disturbed areas with ESAs and their buffers.
g.	Examine pre-development water quality and quantity on the site and provide mitigation and enhancement strategies to maintain pre-development water quality and quantity for the restricted development zones and buffer areas.	The above referenced hydrology report provides a baseline of hydrological features of the overall Trilogy properties. Additional detailed work, impact assessment and mitigation planning are deferred to the next phase.	Site scale differences including infiltration rates need to be assessed for post-development runoff calculations as lot-by-lot development plan emerge. Future phases should include minimum discharge rates and flows. Future assessments will also need to consider climate change according to regulatory guidelines in place at the time of development plan submissions
h.	Examine the impact of the proposed development on the larger watershed area(s) including watercourses, habitat connectivity, water quality and quantity upstream and downstream, and possible cumulative hydrological impacts that may result; and provide development pattern and servicing recommendations to minimize them.	No physical development planned at this phase. Defer to next phase.	Low Impact Development concepts such as infiltration galleries, rain gardens and/or ponds should be incorporated into future plans, each site will need to be assessed and designed once a development plan is made. Groundwater tables and subsurface soil types will dictate the best options. Complete according to standards in place at the time of application.
i.	Recommend appropriate timing of works associated with development to minimize impacts to wildlife during migration, breeding, birthing, and rearing seasons.	No works planned at this phase. Defer to next phase.	Employ timing window standards in place at the time of application.
4)	The detailed bio-inventory is used to create the site plan. The site plan and development design requirements are laid out in detail in subparagraphs (a) through (j).	Defer to next phase.	Complete plans according to standards in place at the time of development application submissions.
5)	Deals with monitoring during development	Relevant at stage subsequent to future development permit applications.	Recommend appropriate monitoring levels in future development permit applications.
6)	Addresses remedies available to address environmental damage caused during development	Relevant at stage subsequent to future development permit applications.	Can only be addressed subsequent to issuance of future development permits.
7)	Addresses use of standards and best management practices to be employed in development design.	Defer to next phase.	Employ standards and best management practices as recommended, subject to any revisions in place at the time of development.

OCP Section 10.1.5 Guidelines – General Requirements		Addressed in this report	To be addressed when developing future development permit applications
8)	Plan, design, and implement land development and subdivision in a manner that:		
a.	Supports the maintenance and restoration of natural system functions including watercourse hydrology and groundwater recharge.		
b.	Preserves natural features including soil, watercourses, groundwater, and native shrubs, groundcover and tree cover.		
c.	Maintains connectivity and linkages with adjacent sensitive ecosystems and other habitat areas and minimizes fragmentation.	The current study provides a baseline for use in future assessments in each of these technical areas.	Future development permit applications will need to be supported by detailed bioinventory reports that address these areas in detail, including impact assessment and mitigation planning and implementation. All should be prepared in accordance with standards in place at the time of application.
d.	Protects endangered, threatened, or vulnerable species or plant communities by avoiding disturbance to sites where rare plants are growing and where rare natural plant communities occur.		
e.	Maintains critical habitat structures such as old trees, snags, trees with cavities, and ephemeral wetlands.		
9 -22	All subsequent sections deal with aspects of physical development.	The current study provides baseline information relevant to many but not all of these items. Defer implementation to next phase	Complete in accordance with standards at the time of application.
Relevant paragraphs and sub-paragraphs of S. 10.1.6.1			
1)	Requirements for development permit applications in all aquatic ecosystem areas (watercourses, wetlands, and riparian areas).		
a.	Report fish presence data and whether Riparian Areas Regulation (RAR) needs to be followed	Fish presence data and general protective buffer requirements included in the current report.	Application of RAR to determine the applicable Streamside Protection and Enhancement Area (SPEA) width including measures to be determined at future phases of development.
2)	Site Analysis		
a.	Land uses upstream and downstream in watersheds & evaluation of conflicts.	Upstream and downstream uses are reviewed. Since no development at this stage, no conflicts will result from the existing application	Proposed development in the next phase should be based on achieving "Low Impact Development". Pre-development targets for run-off should be achieved post development, and avoid impacts on downstream water uses.
8)	Avoid development on slopes >30%.	The Terrestrial Ecosystem Mapping report (TEM) maps all slopes >25%.	Each future development permit application will need to map slopes and avoid development on slopes >30%.

OCP Section 10.1.5 Guidelines – General Requirements		Addressed in this report	To be addressed when developing future development permit applications
Relevant parts of S. 10.1.6.2			
6)	Identify snags and wildlife trees.	Snags, wildlife trees, and trees with cavities were recorded as encountered in the present study and mapped in the results section.	Detailed mapping of snags, wildlife trees, and trees with cavities is needed at the future development phases to provide timely data for development.
7)	Identify nest sites and breeding areas.	Bird inventory surveys were conducted during the breeding season. Individual nests were identified and mapped. General breeding areas are discussed. Large mammal sightings suggest habitat use and movement through the area, but no specific breeding areas were identified.	Detailed bioinventories conducted at the future development permit application stage will need to focus on these areas to provide timely data for appropriate project design.
Relevant parts of S. 10.1.6.3			
1)	Requirements for development permit applications re: Connectivity Areas.		
a.	Map / identify wildlife corridors and habitat connectivity areas	Done at a regional scale to connect through properties to adjacent habitats.	This will need to be brought current during studies associated with the subsequent development application phase. Lot-by-lot studies will need to provide local as well as regional context.
g.	Identify disturbed sensitive ecosystems for restoration and enhancement	Sensitive ecosystems are identified in TEM study. Opportunities for restoration will occur at the next phase.	Studies at the next stage will need to provide current data on sensitive ecosystems for use in detailed project planning.

4. Methodology

McElhanney reviewed reports and published studies conducted on these lands over the past several years. Data gaps were identified, and appropriately qualified professionals engaged to fulfill the information needs identified to provide a site-specific inventory of ESAs.

4.1. Desktop Review

A desktop search was conducted of federal, provincial, regional, and municipal web databases to identify any known ESAs in the area or the regional context. Web based sources of provincial information reviewed included:

- iMapBC 2.0 fish and wildlife habitat records (CDC 2017a),
- BC Species and Ecosystems Explorer (CDC 2017b),
- BC Conservation Data Centre (CDC) species summary records (CDC 2017c)
- SEI (East Vancouver Island) (MOE 1998),
- BC Water Resource Atlas (MOE 2013), and
- BC Ministry of Environment (MOE) web-based documents.

Environmental, geotechnical, hydrogeotechnical, civil engineering (drainage, stormwater and sanitary, roadways) and socio-economic studies have been conducted for the Cayet development. Previous environmental studies reviewed for background information include:

- Amphibian Assessment of Lot 6 within Trilogy Properties (Elke Wind Consulting 2007)
- Preliminary ecological assessment of Trilogy Properties (Mimulus 2005)
- Amphibian Assessment of Lot 4C Trilogy Properties. Prepared for Trilogy properties VI (Mimulus 2006)

The methodologies used for the field and desktop studies are described in the following sections.

4.2. Bioinventory Protocols Employed

The OCP calls for a bioinventory prepared in accordance with the procedures described in Develop with Care 2012–Environmental Guidelines for Urban and Rural Land Development in British Columbia, Appendix B and amendments thereto (MOE 2012). Develop with Care 2014: Appendix B was the most current amendment and it was utilized in the current study (MOE 2014b).

Transects were utilized as the primary method to collect encounter data for the environmental parameters studied here-in. Data collected in this manner included:

- bird and wildlife habitat,
- bird and wildlife surveys,
- wildlife trees,
- species at risk,

- mammal and amphibian encounters through pit-fall traps,
- fish and amphibian encounters through minnow trapping,
- watercourse and wetland identification.

Habitat types present varied from lot to lot. Transects were located to pass through the habitat types present on each lot. Transect locations reflected access (i.e. existing and decommissioned logging roads, hiking and mountain bike trails). Where existing access was not available, transects were located based on data collection requirements and access was by overland hiking.

4.3. Terrain, Soils and Land Use

A surficial geology map for the area, published as the Soil Survey of Southeast Vancouver Island and Gulf Islands, BC report (Day et al. 1959) was reviewed. Updated soil maps published by the Province and their corresponding soil survey report (MOE Technical Report 17: Soil of Southern Vancouver Island Report No. 44 and map sheets 5 and 6) (MOE 1989, 1985) were further reviewed to determine soil types in the Study Area.

4.4. Hydrology

A comprehensive hydrology report describing the hydrological features of the overall Cayet properties including water shedding, collecting and conveyance areas was completed here as [Appendix A](#).

4.5. Terrestrial Ecosystem and Vegetation Resources

Terrestrial Ecosystem Mapping (TEM) procedures were employed to identify and map vegetation and ecosystem resources within the Study Area.

The Ministry of Forests, Lands and Natural Resource Operation and Rural Development vegetation resource inventory (VRI) (FLNRO 2016a) and SEI (CWS 1998, MOE 2004) mapping provided provincial baseline data to assist in the vegetation and habitat analysis.

4.5.1. Vegetation Resources

The ecological databases reviewed in the assessment of vegetation resources included the following:

- Biogeoclimatic Ecosystem Classification Subzone / Variant Map for the Campbell River Resource District West Coast Region (FLNRO 2016b),
- A Guide to Site Identification and Interpretations for the Vancouver Forest Region. Land Management Handbook Number 28, British Columbia Ministry of Forests (Green and Klinka 1994),
- Comox Valley Sensitive Ecosystems Inventory Disturbance Assessment (Juniper 2014)

- BC Conservation Data Centre (CDC 2017a) iMapBC 2 database of ecosystems at risk and provincially listed plant species including information from the federal *Species at Risk Act* (Canada 2002) and the Committee on the Status of Endangered Wildlife in Canada [COSEWIC],
- BC Species and Ecosystems Explorer (CDC 2017b),
- E-Flora BC: Electronic Atlas of the Plants of British Columbia (E-Flora BC 2015),
- *Weed Control Act* (BC 1996b) and Schedule A of the BC Weed Control Regulation (BC 2011)

The MOE BC Species and Ecosystems Explorer database was accessed to determine the biogeoclimatic zone and vegetation resources for the area. Queries were performed for ecological communities, vascular and non-vascular listed species located for the Coastal Western Hemlock very dry maritime (CWHxm1) biogeoclimatic zone within the Comox Valley Regional District (CXRD). The British Columbia Ministry of Forests Field Guide for Site Identification and Interpretation for the Vancouver Forest Region (Green and Klinka, 1994) was consulted to identify species typically associated with this biogeoclimatic zone. Provincial web databases were consulted to provide information on the general distribution and status of vegetation species and ecological communities in the Study Area.

Seasonal vegetation sampling was undertaken in spring and summer to provide in-field verification of plant species at risk presence.

4.6. Terrestrial Wildlife, Wildlife Habitat and Resources

4.6.1. Desktop Literature Review

A desktop literature review was completed to describe wildlife habitat in terms of habitat suitability for wildlife, potential presence of wildlife species at risk and potential wildlife movement corridors, in and around the Study Area. The provincial database and previous studies of the area inform which target species are to be the focus of inventory work.

The web based databases considered in the assessment of wildlife presence and use of the area and wildlife habitat preferences include the following:

- CDC database of provincially listed wildlife species (CDC 2017a, b), as well as species listed under the federal *Species at Risk Act* (Canada 2002) and COSEWIC.
- BC Species and Ecosystems Explorer (CDC 2017b).
- E-Fauna BC: Electronic Atlas of the Wildlife of British Columbia (E-Fauna BC 2015).

The desktop review of known species within the Study Area assisted in selection of wildlife inventory methodologies to be employed in the course of this study.

4.6.2. Terrestrial Wildlife, Wildlife Habitat and Resource Field Inventory

Visual observations were conducted during site visits for evidence of wildlife including nests, scat, tracks and burrows for all species potentially occurring in the Study Area. Wildlife and wildlife habitat were assessed for listed mammals, amphibians, fish, reptiles, and terrestrial birds.

Field procedures were implemented as follows:

- Documentation of wildlife species occurrences were completed by visual surveys and the habitat characteristics as per Species Inventory Fundamentals (MELP 1998b);
- General visual surveys were conducted and wildlife species occurrences noted;
- Results of the field observations were compiled into a species list for the Study Area;
- Species / habitat associations were determined; and
- Locations of wildlife trees, active dens, nests, or wildlife houses identified during the field assessment were geo-referenced and mapped in ArcGIS with other ESA features.

Wildlife habitat conditions were assessed in terms of habitat suitability, wildlife movement, and/or level of disturbance. Observations were completed covertly to avoid eliciting a response from individual specimens or altering wildlife behavior. Caution was taken when in the proximity of a den, nest, or house of a wildlife species to avoid causing abandonment of the site should an animal be present.

Methodology used to conduct the surveys was based on the time-constrained search protocols outlined in Resources Inventory Standards Committee (RISC) biodiversity database. Time-constrained searches are conducted when the primary objective to determine species presence. Surveys were conducted during the active breeding season for most animals to increase potential for detection.

4.6.3. Targeted Species

Biophysical presence / not detected surveys were conducted to ground-truth or supplement previous studies and undertaken in general accordance with the methodologies listed in [Table 3](#).

Table 3. RISC standard methodologies applied to this study.

Biophysical Element	Applicable RISC Standard	Target Species
Raptors, Owls	Inventory Methods for Raptors (SRM 2001) Inventory Methods for Owl Survey (MOE 2006)	Bald Eagles (<i>Haliaeetus leucocephalus</i>) and other raptors Western Screech Owl (<i>Megascops kennicottii</i>) and others
Song birds	Inventory Methods for Forest and Grassland Songbirds (MELP 1999a)	Various bird species
Pond-breeding Amphibians	Inventory Methods for Pond-breeding Amphibians and Painted Turtle (MELP 1998c)	Northern Red-legged Frog (<i>Rana aurora</i>) and Western Painted Turtle (<i>Chrysemys picta bellii</i>).
Lung-less Salamanders	Inventory Methods for Plethodontid Salamanders (MELP 1999b)	Western Redback Salamander (<i>Plethodon vehiculum</i>) and others
Small Mammals	Inventory Methods for Small Mammals: Shrews, Voles, Mice & Rats (MELP 1998d)	Various

Surveys for species occurrence in the Study Area were conducted utilizing procedures outlined in RISC biodiversity inventory methods for presence detection (as detailed in Table 3) were reviewed to inform field study design. Modified inventory methodologies were employed to assist in determining presence and habitat use by the various animal groups. Call-playback methods were utilized to detect raptors. Songbirds were identified by their song or by visual identification as encountered along transects. Amphibians were surveyed by nocturnal night survey, use of drift nets and pitfall traps, and minnow trapping in ponds.

Surveys took place at different times during the active breeding season and at different times of day to account for diurnal variation in wildlife activity. Seasonal sampling was undertaken in March for potential amphibian activity and for raptor inventory during their active breeding season. In July field sampling included other wildlife inventories including small mammal use and migratory and local bird use of the Study Area. Biophysical survey efforts were undertaken during appropriate target species life history stages.

Bird species encounter transects and observations were conducted three times during the 2017 bird breeding season during the weeks of March 27, May 8, and July 23. Birds were identified primarily through their singing, calls or noise patterns. Surveys were conducted only when the weather was appropriate for encounter surveys. Surveys were only conducted under acceptable conditions, which included calm to light breeze, little to no precipitation, and air temperatures over 7°C (MELP 1999a) from sunrise to 4 hours past sunrise. Several times wind and rain required that the survey be postponed to another day. Stations were paced out every 50m, surveyors waited one minute so that bird activity could resume and calls identified for 5 minutes before continuing onto the next station.

Raptor surveys, particularly for owls, were conducted pre-dawn, using call-playback for several species expected to be in the area including the great horned owl and the western screech owl.

Locations of snags, trees with cavities, wildlife trees, active dens, nests, or wildlife houses identified during the field assessment were georeferenced and mapped using ArcGIS software.

Wildlife habitat conditions were assessed in terms of habitat suitability, wildlife movement, and/or potential level of disturbance.

Identification guides were utilized to identify animal scat, markings and remains. Identification of bear or cougar tracks and scat, deer tracks and droppings were informed reviewing published web keys and photo information (Cabrera 2016).

4.6.4. Species at Risk

Federal and provincial wildlife web databases were consulted to provide information on the general distribution and status of wildlife species

Listed Species / Ecosystem Designations

Federal Rankings for Species at Risk

COSEWIC was established under Section 14 of SARA (Canada 2002). COSEWIC is a committee that assesses and designates which wild species of animal, plant, or other organisms are at risk of loss from the

wild in Canada. Below is a listing of the federal status categories used by COSEWIC and SARA to rank or list a species:

- Endangered (E) – a species facing imminent extirpation or extinction.
- Threatened (T) – a species likely to become endangered if limiting factors are not reversed.
- Special Concern (SC) – a species that is particularly sensitive to human activities or natural events, but is not endangered or threatened.
- Data Deficient (DD) – a species for which there is insufficient scientific information to support status designation.
- Not at Risk (NAR) – a species that has been evaluated and found not to be at risk.
- Extirpated (XT) – a species that no longer exists in the wild in Canada, but occurring elsewhere in the world.

Federally listed species and their critical habitats are protected under SARA. The above designations used in this report indicate the status of wildlife species observed as per the provincial and federal listings of species at risk provided in the Appendices.

Provincial Rankings for Species at Risk

The CDC compiles and maintains information on wildlife and plant populations in BC. As part of this system, the CDC assigns a provincial rank or listing that ascribes to each species a 'red', 'blue' or 'yellow' designation based on its population status within BC (CDC 2017 a, b). The provincial rankings, described below, highlight the wildlife and plant species as well as natural plant communities that are at risk:

- Red – any indigenous species, subspecies or ecological community that is extirpated (X), endangered (E), or threatened (T) in BC.
- Blue – any indigenous species, subspecies or ecological community considered to be vulnerable or of special concern in BC. Blue-listed elements are at risk, but are not extirpated, endangered, or threatened.
- Yellow – any indigenous species, subspecies or ecological communities that are apparently secure and not at risk.

These designations were used in this report to indicate the status of species and ecosystems observed relative to the provincial and federal listings of species at risk.

Database queries for the known provincially mapped locations for species at risk were conducted to determine if known species at risk are located within the Study Area (CDC 2017a, b).

The BC Species and Ecosystems Explorer database were accessed to determine vertebrate and invertebrate at risk species in the Study Area. Habitat preferences were noted for each listed species within the database for CWHxm1 (CDC 2017a&b, E-Fauna BC 2015, E-Flora BC 2015). During field investigations, the Study Area was assessed for the presence of habitat for regionally identified federally and provincially listed species at risk.

4.7. Watercourses, Wetlands and Aquatic Resources

Previous studies provided an inventory of watercourses and wetlands (Mimulus 2005, MOE 1998).

Watercourse and wetland presence and delineation has been further investigated during previous McElhanney studies (McElhanney, unpublished data) and the current TEM mapping of the present study (*Appendix B*). The

hydrology study conducted as a part of the present bioinventory also provided information regarding watershed and drainage features (*Appendix A*). The study results presented here represent a refinement of provincially and regional mapped SEIs (MOE, 1998, CXRD 2017, Juniper 2014), and supersede the mapping presented in those broader-based studies.

This was supplemented with a review of iMapBC 2.0 (CDC 2017a), CXRD iMap viewer (2017) and BC Water Resource Atlas (MOE 2013) to confirm and refine known mapped drainages and potential water features in the Study Area. Appropriate protective buffers on all identified watercourses and wetlands were recommended as per the RAR (BC 2005a, b).

Watercourses were identified by channel scour, indications of rafted vegetative material and observed water flow. Wetlands are defined as areas that are inundated with surface or groundwater at such a frequency and duration that they support vegetation adapted to saturated soil conditions (MacKenzie and Moran 2004). Wetlands include a broad range of ecosystem types from permanently flooded with open water to forested sites with wet soils. Wetlands retain their wetland characteristics even during dry periods of the summer when there may be no water present. Field confirmation of wetlands were confirmed based on the following indicator vegetation and soil characteristics: 1) presence of gleying or mottling (determined by auguring soil cores to look for prominent grey colour or mottles within 30 cm of the surface in sandy soils (MacKenzie and Moran 2004), the presence of characteristic indicator wetland vegetation (such as rushes and sedges), and the presence of water.

4.7.1. Aquatic Species at Risk

The Study Area lies within three different watersheds, 1) the Millard / Piercy watershed on the northside of the study, 2) the Roy Creek watershed towards the middle of the study, and 3) the Maple Creek / Trent River watershed to the south. All three watersheds are salmon and trout bearing systems. The provincial database (CDC 2017a) provided a report of fish species found in these watersheds.

5. Results

5.1. Physical Environment

This section synthesizes information from historical area photographs, provincial databases and published reports on the area.

5.1.1. Terrain

The terrain is generally subdued, with undulating to gentle slopes, intersected in places by riparian areas, wetlands and roads. Localized steeper slopes were found in Lots 9A, 9B and 11 (Williams & Wright, 2017). Unusual or unique landforms include a large gravel deposit in Lot 11; currently an active gravel pit.

A review of the provincial reference material for unique landforms suggested that karst is a valuable, non-renewable resource that can be highly sensitive to disturbance, and that well-developed and highly significant karst areas associated with temperate rainforest occur on Vancouver Island (MOF. 2003). A review of the provincial karst mapping showed no indication of Karst land-forms near the Study Area (DataBC, 2017). No other unique landforms were observed in the Study Area.

5.1.2. Soils

The provincial surficial geology maps (Day et al. 1959, MOE 1985, 1989) depict several soil types in the Study Area, classified primarily as Dashwood Soils being composed of 60% Dashwood, 20% Hawarth soils, and 20% Ronald soils. The soils identified for the area are presented in Figure 3, while the soil descriptions for the site are presented in Table 4 and following text.

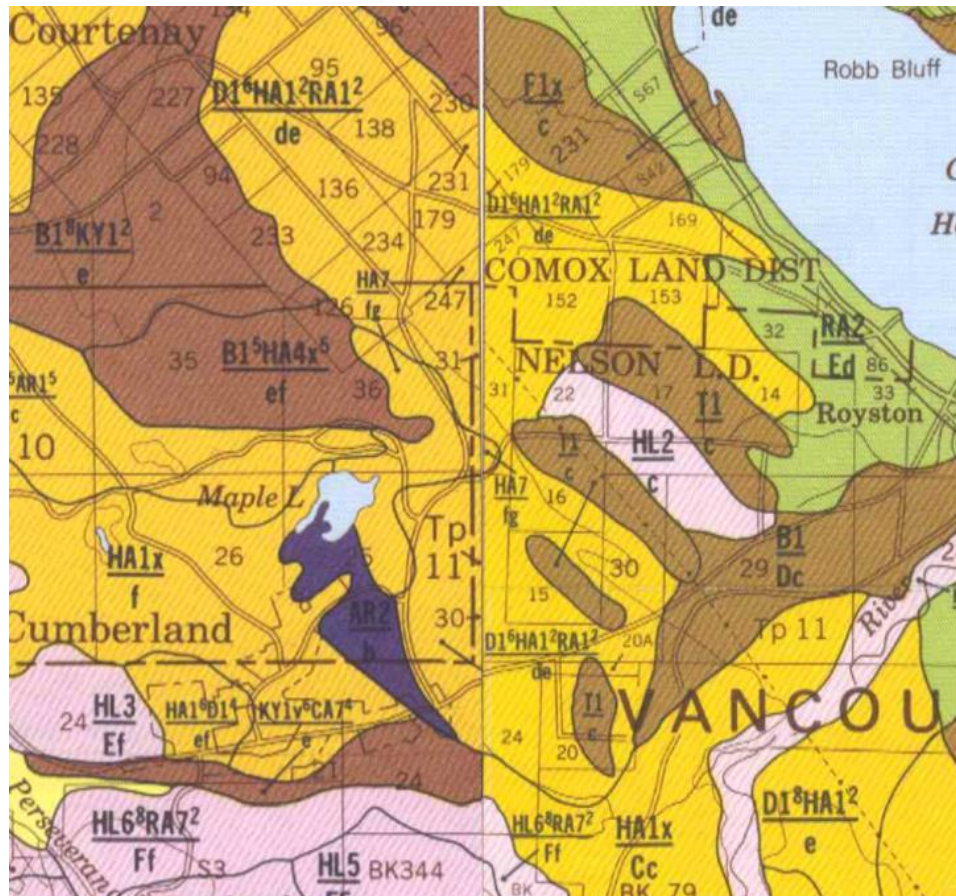


Figure 3. Soils mapped in the Study Area (Day et al. 1959, MOE 1989).

Table 4. Key to soil map presented in Figure 3. Description of the character of each soil type.
(MOE 1985,1989).

Map Symbol	Name	Typical soils	Parent Material	Common texture	Common drainage	Common soils	Comments
CA	Cassidy	CA7	fluvial	Very gravelly loamysand (vgls)	Rapidly drained (r)	O. DYB	Gravelly floodplain deposits Lot 9b
D	Dashwood	D1	marine	Very gravelly loamysand (vgls) or gravelly sandyloam (gsl)	Well drained (w)	O.DYB	With shallow fluvial deposits Included lots 11, Lots 10 a and 10b Lot 4a,b,c Lot 5, lot 6 Lot 7, lot 8
HA	Hawarth	HA1	fluvial	Very gravelly loamysand (vgls)	Rapidly drained (r)	DU.HFP	Level gravelly soils Included lots 11, Lots 10 a and 10b Lot 4a,b,c Lot 5, lot 6 Lot 7, lots 8a&b
KY	Kye	KY1	marine	Loamy sand (ls)	Rapidly drained (r)	O.DYB	Includes Fluvial depositions. Tributary creek to Maple Creek north of Lot 9b
AR	Arrowsmith	AR2	organic	Mesic Organic (m)	Very poorly drained (vp)	T.M.	Moderately decomposed Organic matter at Maple Creek through Lot 9a and Lot 9b
HL	Hiller	HL5 HL6	colluvial	Gravelly loamy sand (gls)	Well drained (w)	O.DYB - shli	Sandstone or conglomerate Lot 9a, 9b
RA	Ronald	RA1 RA7	moraine	Cobbly / gravelly loam (gl)	Well drained (w)	DU.HFP (typic)	Weak to moderately cemented

Dashwood

Dashwood soils are found on gently to strongly sloping areas developed in shallow well to moderately well drained, coarse textured fluvial or marine deposits which overlie compact morainal deposits. Upper horizons are characterized by high coarse fragments of gravel within a loam sand matrix. Often less than 1m thick. Till

located at 60m to 100m depth is cemented gravelly sandy loam which has low permeability. Found on slopes less than 20% from 0m to 200m elevation (MOE 1985).

Symbol	Classification	Drainage	Comments
D1	Duric Humo-Ferric Podzol	Well drained	Coarse fragment content 40 to over 50%. A cemented duric layer occurs at 75 to 100 cm depth over unweathered PM

Hawarth

Hawarth soils, were in previous soils mapping called Qualicum soils, they are most common the drier subzones of the CWH. Developed in deep sandy gravelly fluvial, glaciofluvial or marine deposits. Develop on slope less than 5% in elevations between 0m and 700m (MOE 1985).

Symbol	Classification	Drainage	Comments
Ha1 (MOE 1985)	Duric Humo-Ferric Podzol	Rapid	Coarse fragment content is at 35% but more commonly above 50%. A cemented duric layer is present at 50 to 90 cm depth.

Kye

Kye soils are found in drier subzones of the CWH stone free seep loamy sand post-glacial marine or fluvial depositions. Rapidly well drained soils on nearly level to moderate slopes within gently undulating landscapes. Topography is 0 to 6% slopes between 0m and 130m above sea level (asl)s developing under Douglas-fir dominated forest. These soils are easily erodible but are usually less than 5% and found 0m to 500m elevation (MOE 1985).

Symbol	Classification	Drainage	Comments
KY1	Orthic Humo-Ferric Podzol	Rapidly drained Loamy sand	Coarse fragment content is less than 15%. Unweathered PM at 80 to 120 cm

Arrowsmith

Arrowsmith soils occur in very poorly drained depressional areas throughout the CWH they occur mostly in the Nanaimo lowland (0m to 500m) (MOE 1985). These level soils (no slope) have a year-round water table within 1 m of the soil surface and consist of mostly mesic organic materials between 40cm to 160cm in depth. Below 160cm depth there is usually an accumulation of peat over mineral silts and clays.

Symbol	Classification	Drainage	Comments
AR2	Terric Mesisol	Very poorly drained	A less common soil with > 160 cm deep organic accumulations

Hiller (HL)

Hiller soils occur in the drier zones of the CWH (MOE 1985) and have developed on colluvial or morainal deposits less than 1m thick overlying sandstone or conglomerate bedrocks. slopes vary between 5% and 100%

from sea level to 700m elevation. Hiller soils are rapidly drained gravelly loam sand and coarse fragment content is between 30 to 60%.

Symbol	Classification	Drainage	Comments
HL 5	Orthic dystic Brunisol: shallow lithic phase	Rapidly drained	Coarse fragment content is usually between 30 and 60%. Less common soil between 10 and 50 cm thick over bedrock
HL 6	Orthic dystic Brunisol: shallow lithic phase	Rapidly drained	The most common soil 10 to 50 cm thick over bedrock with inclusions to 100 cm over bedrock.

Ronald (RA)

Ronald soils are common in the CWH xm1 zone. They develop in deep, gravelly, morainal deposits and are associated with extrusive bedrock areas. Slopes range from 5 to 40% in elevations between sea level and 700m (MOE 1985).

Symbol	Classification	Drainage	Comments
RA 1	Duric Humo Ferric Podzol	Moderately well	Coarse fragment content between 20 and 50% with cobbles and stones. Soils develop to 80 cm and a strongly cemented layer is presented between 60 and 100 cm.
RA 7 (bc44)	Orthic Humo-Ferric Podzol	Moderately well drained	Develops in forested areas, soils less than 80 cm thick with unweathered parent material between 100 cm and 130 cm in depth. No cemented layer like the typical soil

Cassidy (CA)

Cassidy soils are common in the CWHxm1 subzone having developed from deep recently deposited sandy gravelly fluvial material along creeks and rivers subject to flooding (MOE 1985). Slopes are less than 5% and they range from sea level to 700m.

Symbol	Classification	Drainage	Comments
CA7	Gleyed Regosol	Imperfect drainage / fluctuating water table	Coarse fragment content is at least 35% often more than 50% by vol. Soil is less than 60 cm thick over unweather parent material encountered between 50 to 100 cm depth.

5.1.3. Hydrology

The hydrology results of the current study are presented in a separate report prepared by McElhanney and is included here as [Appendix A](#). Refer to the appendix for the hydrological assessment of the Study Area. The following narrative describes the hydrological setting of the various lots.

Appendix A confirms that the Study Area lies within the Maple Creek (see *Figure 4*), the Roy Creek and the Millard Creek / Piercy Creek watersheds.

Lot 3a, b & c lie in the Millard Creek / Piercy Creek watershed and the position of these lots place them very near the upper limits of the watershed headwaters; Appendix A Map 2 shows that the watershed boundary lies ~250m to 300m west of the western boundary of Lot 3c. Downstream of these lots Millard Creek flows through forested and agricultural lands to the southeast of the Comox Valley Parkway to its estuary ~2.5 km northeast of Lot 3c. It's tributary, Piercy Creek, joins Millard Creek roughly 0.8 kilometers above tidewater, and drains residential neighbourhoods to the northwest of the Comox Valley Parkway. Lots 3a and c drain towards Millard Creek while Lot 3b drains toward Piercy Creek.

Lots 4, 6, 7 and 8a & b are located within the Roy Creek watershed. Similarly, these properties are in the headwater perimeters of this watershed (*Appendix A, Lot 4, 6, 7, 8a and 8b* drawings). Those drawings show that Highway 19 is adjacent to their western perimeters of these lots, and that the western watershed boundary lies primarily along the western perimeter of the Highway 19 corridor, occasionally varying by $\pm 50\text{m}$ to the west of the highway corridor. That variance to the west renders a very small portion of Lot 9a within the Roy Creek watershed.

The headwaters of Roy Creek mostly consist of natural springs and seeps. A number of these are located mostly to the east of Small Road from Minto Road in the north to Kentwood Road in the south, as well as one spring on the west side of Small Road, immediately south of the North-Central Island Discovery Centre and roughly 200 m east of Highway 19. Most of these seeps and springs are seasonal, contributing to flows primarily during the rainy season from mid-autumn until late spring. However, the spring on the west side of Small Road provides constant year-round flow and is the principal headwater source of Roy Creek (McElhanney 2010, McElhanney unpublished data).

The position of Lot 4 to the north of the Discovery Centre and Lots 6, 7 and 8 to its south place them on the perimeter of the headwaters. Flows from these properties into the Roy Creek watershed are ephemeral and contribute to Roy Creek flow intermittently. Downstream of the subject lots, Roy Creek flows north-easterly from Small Road for roughly 2 km, then trending to the southeast to its estuary roughly 4.6 km east of the subject properties. Roy Creek flows through agricultural properties for most of its course, flowing through residential properties near its mouth (McElhanney 2010).

Most of Lot 9a, and all of Lots 9b, 10a, 10b and 11 lie within the Maple Creek watershed (*Appendix A, Lots 9a&9b, Lots 10a&10b and Lot 11* drawings). In this case the watershed extends beyond the Study Area to the west and includes most of Cumberland as well as recently logged areas to north of the village centre and west of Maple Lake (Figure 4). Watercourses within the image and upstream of the Study Area include Maple Creek draining Maple Lake to the south and it unnamed tributary which runs west to east along the southern perimeter of the village. All other drainage in the area upstream of the Lots 9a&b, 10a&b and 11 is by seeps or municipal drainage.

Maple Creek exits the Study Area near the southeast corner of Lot 9a, flowing roughly 350m southeast to Highway 19 and then flowing roughly 1.4 km east by northeast to join Trent River. Downstream of its confluence with Maple Creek, Trent River meanders through a forested valley to its estuary 5 km northeast of the confluence.

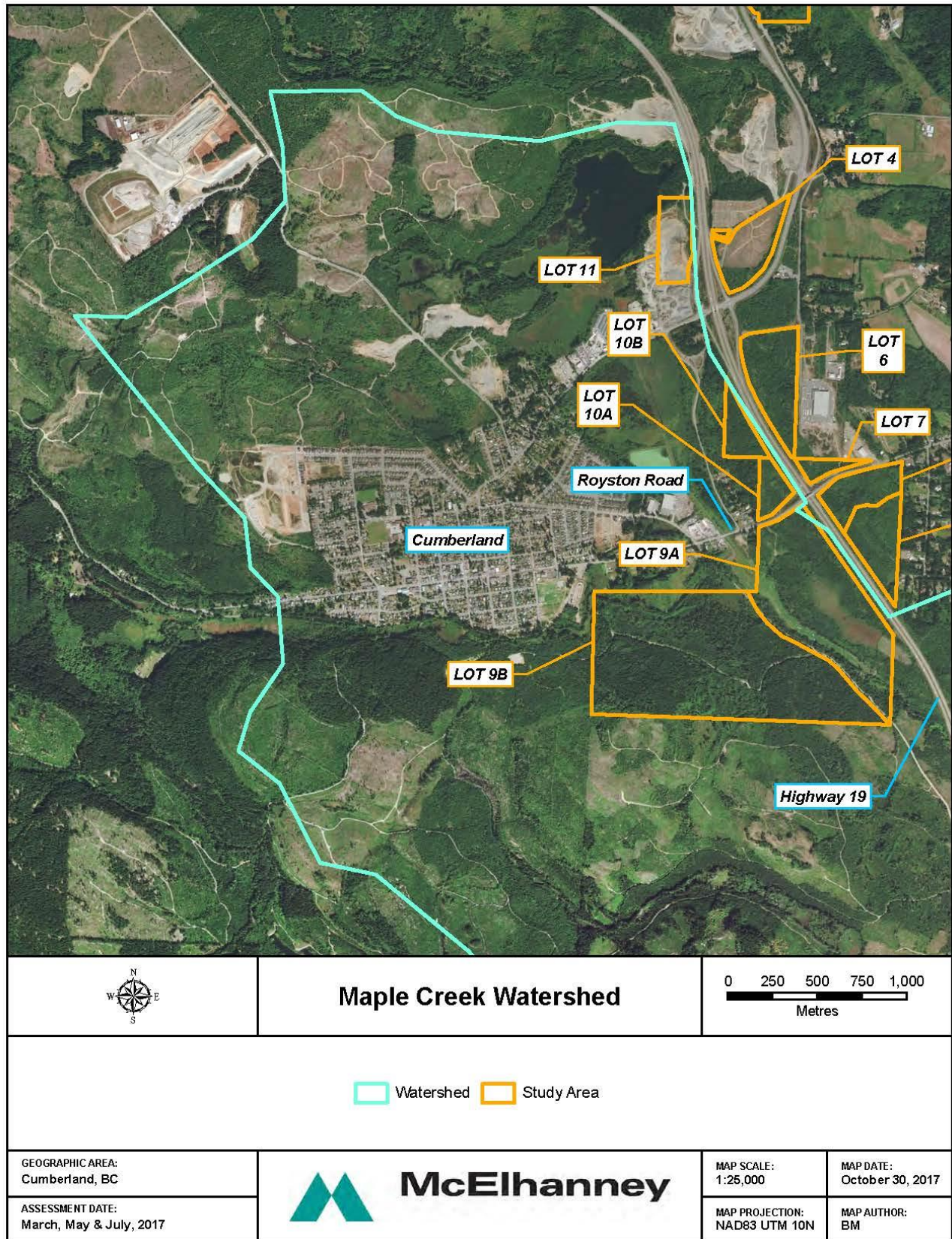


Figure 4. Aerial photo showing the Maple Creek watershed area in relation to the Study Area

5.1.4. Land Use and Disturbance

Hancock Forest Management privately owns the forested areas that are proposed by Trilogy for the Cayet Development. Hancock Forest Management has managed these forests for timber production and logged them over many years. All lots proposed for the Cayet Development have been disturbed by logging activity between 1986 and 2017. *Table 5* provides a description of the years in which logging activity occurred on the Cayet Development lands.

Table 5. Cayet Lots – year of logging disturbance.

Lot Number	Year of Disturbance ¹
3a, 3b	Logged 1999
3c	Partially logged adjacent to the Cumberland Parkway in 2015
4a	Mature forest: unlogged and maintained as highway buffer
4	Partially logged 1995 along Cumberland Parkway, remainder of mature forest logged 2016
6	Portion logged 1995, logging completed 1997; retained a patch of mature forest
7	All Lot 7 completely logged in 1995
8	Portion logged 1995 – entire lot completely logged by 1998
9a	Highway side of Lot 9a logged in 1995, large wetland left undisturbed
9b	East side area logged 1986, west side area logged 1987, large wetlands, swamps and creeks remained undisturbed with a 30m forested buffer.
10a, b	Logged 1995
11	Gradually logged for gravel mining until 2017, 30 m strip of mature forest was left along the shoreline of Maple Lake adjacent to Lot 11.

¹ Analysis from historical aerial photography.

Disturbances

Logging and other disturbances to the Cayet lands and adjacent areas are presented in *Figure 5*. Other disturbances include the development of infrastructure such roads and highways, transmission lines, cell towers, sewage treatment, residential and commercial development, farming, as well as industries that disturb the land such as gravel extraction. An historic railway grade, mapped within the OCP, was removed many years ago. This passes through Lot 9b. A major portion of that alignment appears to be the base of the Trent Main logging road, with the southern end of it trending to the east of the road base (Cumberland 2014).

Recreation

Lot 9b has been used for recreational purposes (hiking, mountain biking, etc.) for many years and many trails have been developed through the area. A link to a map of these trails (on the Trailforks website) can be found in the reference section of this report (Trailforks 2017).

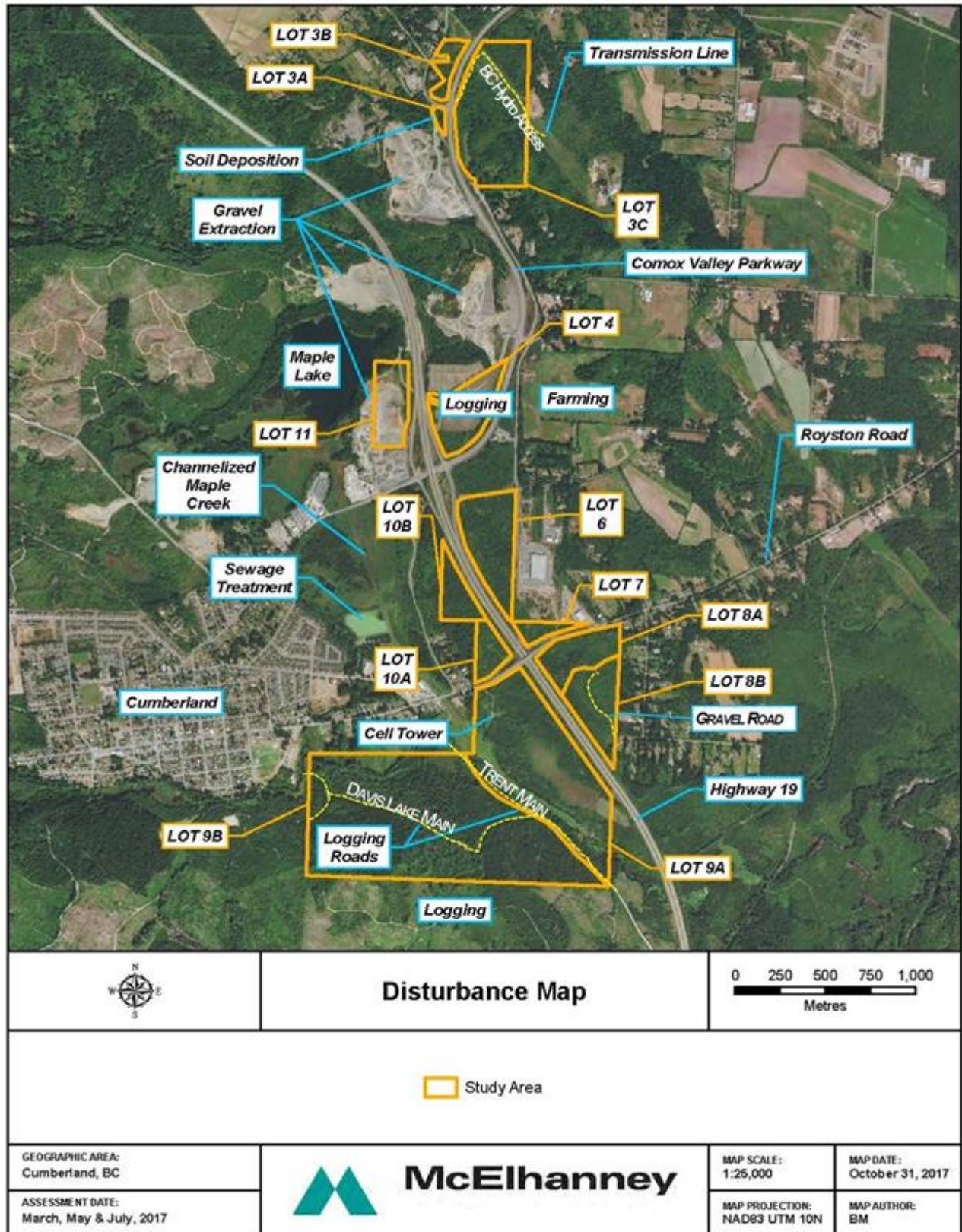


Figure 5. Disturbances found in and around the study area.

5.2. Terrestrial Vegetation and Ecosystems

The Study Area lies within the Coastal Western Hemlock dry moist (CWHxm) biogeoclimatic zone which occurs at lower elevations along the east side of Vancouver Island as far north as Kelsey Bay. Elevational limits range from sea level (or above the Coastal Douglas-fir, moist maritime (CDFmm) where present) to approximately 700m. The CWHxm has warm, dry summers and moist, mild winters with relatively little snowfall.

5.2.1. Vegetation

Forests on typical zonal sites are dominated by Douglas fir (*Pseudotsuga menziesii*), accompanied by western hemlock and minor amounts of western redcedar (*Thuja plicata*). Major understory species include salal (*Gaultheria shallon*), dull Oregon-grape (*Mahonia nervosa*), red huckleberry (*Vaccinium parvifolium*), step moss (*Hylocomium splendens*), and Oregon beaked moss (*Kindbergia oregana*) (Pojar et al. 1998). [Appendix C](#) lists plant species that have been reported in and around the Study Area.

5.2.2. Plant Species at Risk

Observations of available habitat in the Study Area combined with the provincial database search indicated there may be potentially suitable habitat for a number of listed plant species. Those species are listed in [Table 6](#). The CDC database review was further utilized to compile a list of at risk plant species and plant communities with potential to occur in the Study Area (CDC 2017b) and those are provided in [Appendix D](#). These species were not observed during the TEM study ([Appendix B](#)) or the during the field visits and only one species was recorded by the Comox Valley Naturalists Society (CVNS) ([Table 6](#), [Appendix C](#)). Bioinventory surveys were conducted at times that fell across the window for plant species at risk observations, while the TEM survey timing fell outside this window. The results reported here reflect a reconnaissance level of SAR survey. Detailed SAR surveys will be required at the next phase of development application.

*Table 6. Provincially listed plant species potentially occurring in the Study Area.
(based on provincial data for the CXRD database for forest, wetland and riparian habitat only).*

English Name	Scientific Name	BC List	SARA / General Status Canada	Habitat Subtype Available On Site
Carolina meadow-foxtail	<i>Alopecurus carolinianus</i>	Red		Vernal Pools / Seasonal Seeps;Wet Meadow
chaffweed	<i>Anagallis minima</i>	Blue	3 - Sensitive (2010)	Stream or River, Meadow, Pond or Open Water
coastal wood fern	<i>Dryopteris arguta</i>	Blue	1-SC (Jun 2003) / 3-Sensitive (2010)	Stream / River; Mixed Forest (deciduous / coniferous mix)
phantom pixie-cup fungus	<i>Cladonia prolifica</i>	Red		Lichen (near Courtenay)
flowering quillwort	<i>Lilaea scilloides</i>	Blue	3- Sensitive (2010)	Marsh; Pond or Open Water

English Name	Scientific Name	BC List	SARA / General Status Canada	Habitat Subtype Available On Site
least moonwort	<i>Botrychium simplex</i> var. <i>compositum</i>	Blue		Moist to wet vernal pools and ephemeral seepages in the lowland and montane zones. Reported at Comox Lake.
Menzies' burnet	<i>Sanguisorba menziesii</i>	Blue	3- Sensitive (2010)	Bog; Fen; Swamp; Marsh; Meadow. Recorded by the CVNS stewardship group (Appendix C).
Nuttall's quillwort	<i>Isoetes nuttallii</i>	Blue		Vernal Pools / Seasonal Seeps; Stream / River
poverty clover	<i>Trifolium depauperatum</i> var. <i>depauperatum</i>	Blue		Low elevation vernal pools / seasonal seeps; wet meadow; grassland
purple sanicle	<i>Sanicula bipinnatifida</i>	Blue	1-T (Jun 2003) / 1-At Risk (2010)	Deciduous / Broadleaf Forest
riparian beaked-moss	<i>Platyhypnidium riparioides</i>	Blue		Moss reported near Comox Lake
rareflower heterocodon	<i>Heterocodon rariflorum</i>	Blue		Vernal Pools / Seasonal Seeps Conifer Forest - Mesic Conifer Forest - Moist / wet;
Schimper's ditrichum moss	<i>Ditrichum schimperi</i>	Blue		Moss near Comox lake
western cowbane	<i>Oxypolis occidentalis</i>	Red	2 - May be at risk (2010)	Bog, Meadow
western wahoo	<i>Euonymus occidentalis</i> var. <i>occidentalis</i>	Blue		Riparian Forest; Conifer Forest - Moist / wet; Mixed Forest (deciduous / coniferous mix)
white-top aster	<i>Sericocarpus rigidus</i>	Red	1-SC (Jun 2003) / 3- Sensitive (2010)	Mixed Forest (deciduous / coniferous mix)
yellow montane violet	<i>Viola praemorsa</i> ssp. <i>praemorsa</i>	Red		Pasture, Old Field, Meadow
Macoun's meadow-foam	<i>Limnanthes macounii</i>	Red	1-T (Aug 2006)	Meadow; Deciduous / Broadleaf Forest; Garry Oak Vernal Pool; Garry Oak Maritime Meadow

5.2.3. Sensitive and Rare Ecosystems

Some ecosystems found in the CWHxm1 BGC zone have been provincially blue and red-listed as threatened or endangered ecosystems at risk (CDC 2017b). Sensitive terrestrial ecosystems within the CWHxm1 zone that have the potential to be found at or around the Study Area are listed in [Table 7 and Appendix E](#). Other ecosystems or ecosystem features found in the Study Area are listed in [Table 8](#).

The locations of mapped and provincially listed ecosystems in the Study Area are presented in the TEM report presented in [Appendix B](#).

Table 7. Listed Ecological Communities in the Provincial database for CWHxm1 within the CXRD.*

English Name	Scientific Name	BC List	Ecosystem Group	Reported in TEM (Appendix B)
black cottonwood - red alder / salmonberry	<i>Populus trichocarpa</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i>	Blue	Terrestrial - Flood: Flood Midbench (Fm); Terrestrial - Forest: Broadleaf - moist / wet	No
black cottonwood / Sitka willow	<i>Populus trichocarpa</i> / <i>Salix sitchensis</i>	Blue	Terrestrial - Flood: Flood Midbench (Fm); Terrestrial - Forest: Broadleaf - moist / wet	Yes. Found on Lot 9a and Lot 9b
common cattail Marsh	<u><i>Typha latifolia</i> Marsh</u>	Blue	Wetland - Mineral: Wetland Marsh (Wm)	Occurs on Lot 9a and Lot 3c
Douglas-fir - western hemlock / salal Dry Maritime	<u><i>Pseudotsuga menziesii</i> - <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> Dry Maritime</u>	Blue	Terrestrial - Forest: Coniferous - dry sites, with shallow or coarse soils over bedrock on steep upper slopes, often on warm aspects.	Yes. Found on Lot 9b
Sitka sedge - Pacific water-parsley	<u><i>Carex sitchensis</i> - <i>Oenanthe sarmentosa</i></u>	Blue	Wetland - Mineral: Wetland Marsh (Wm)	Yes, Lot 9a, Lot 6
Sitka spruce / salmonberry Very Dry Maritime	<i>Picea sitchensis</i> / <i>Rubus spectabilis</i> Very Dry Maritime	Red	Terrestrial – Flood, highbench, mixed forest.	Yes. Lot 9a, 9b
western hemlock - Douglas-fir / Oregon beaked-moss	<i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> / <i>Eurhynchium oreganum</i>	Red	Terrestrial - Forest: Coniferous - mesic	Yes. Common throughout Study Area
western hemlock - western redcedar / deer fern	<i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Blechnum spicant</i>	Red	Terrestrial - Forest: Coniferous - moist / wet	Yes. Occurs on Lots 3c and 9b
western redcedar - Sitka spruce / skunk cabbage	<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	Blue	Terrestrial - Forest: Coniferous - moist / wet	Yes. Abundant on Lot 3c
western redcedar / black twinberry	<i>Thuja plicata</i> / <i>Lonicera involucrata</i>	Red	Terrestrial - Forest: Coniferous - moist / wet	Yes. Lot 8a
western redcedar / salmonberry	<i>Thuja plicata</i> / <i>Rubus spectabilis</i>	Red	Terrestrial - Forest: Coniferous - moist / wet	Yes. Common throughout Study Area.
western redcedar / slough sedge	<i>Thuja plicata</i> / <i>Carex obnupta</i>	Blue	Terrestrial - Forest: Coniferous - moist / wet	Yes. Lot 9b and 3c
western redcedar / sword fern - skunk cabbage	<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>	Blue	Terrestrial - Forest: Coniferous - moist / wet	Yes. Lot 3c
western redcedar / sword fern Very Dry Maritime	<i>Thuja plicata</i> / <i>Polystichum munitum</i> Very Dry Maritime	Blue	Terrestrial - Forest: Coniferous - mesic	Common throughout Study Area
western redcedar / three-leaved foamflower Very Dry Maritime	<i>Thuja plicata</i> / <i>Tiarella trifoliata</i> Very Dry Maritime	Blue	Terrestrial - Forest: Coniferous - moist / wet	Yes. Occurs on Lots 9b, 3a, 3c

*CDC. 2017. *BC Species and Ecosystems Explorer*. B.C. MOE Victoria, B.C. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed November 2017)

Table 8. Other ecosystems or ecosystem features mapped in the TEM (Appendix B)

English Name	Scientific Name	BC List	Ecosystem Group	Observed in Lot
Hard hack – Sitka sedge swamp	<i>Spiraea douglasii</i> / <i>Carex sitchensis</i>	Yellow	Wetland - Mineral: Wetland Swamp (Ws)	Lot 9a, Lot 9b, Lot 3c
red alder / skunk cabbage	<i>Alnus rubra</i> / <i>Lysichiton americanus</i>	Unlisted for CWH, Red in CDF ¹	Wetland - Mineral: Wetland Swamp (Ws)	Lot 3c
Reed canarygrass marsh	<i>Phalaris arundinaceae</i> marsh	Unlisted	Wetland - Mineral: Wetland Marsh (Wm)	Lot 9a
Lakes			Non-forested ecosystem	A small portion of Maple Lake occurs at Lot 11
Rivers / creeks gazetted and ungazetted by the province.			Non-forested ecosystem	Occur on Lot 9a, Lot 9b, Lot 3c
Shallow open water (ephemeral)			Non-forested ecosystem	Lot 9a, Lot 9b, Lot 3a, Lot 8a, Lot 8b, Lot 6
Transmission Line			Non-forested ecosystem	Through Lot 3c.

¹ CDF – Coastal Douglas fir Biogeoclimatic zone

Sensitive ecosystems provide habitat for a variety of wildlife and are biologically diverse. SEI was conducted on a regional basis by the Province (MOE 2004) and the CXRD (CXRD 2017). Examples of sensitive ecosystems include streams and rivers, floodplain, wetlands, and old forest (Williams and Wright 2017).

ESAs in the Study Area were mapped by Madrone and presented in the TEM report (Appendix B). ESAs in the Study Area include streams and their riparian areas, wetlands, and mature and old forests. Setbacks for these features are 30 m per the OCP (Cumberland 2014) and are mapped within the subject properties. The ESA map was excerpted from that report and presented here as Figure 6.

Best management practices recommend that ESAs are linked to greenspace and wildlife corridors. Buffers on ESAs were considered with respect to the creation and enhancement of wildlife corridors through the Study Area.

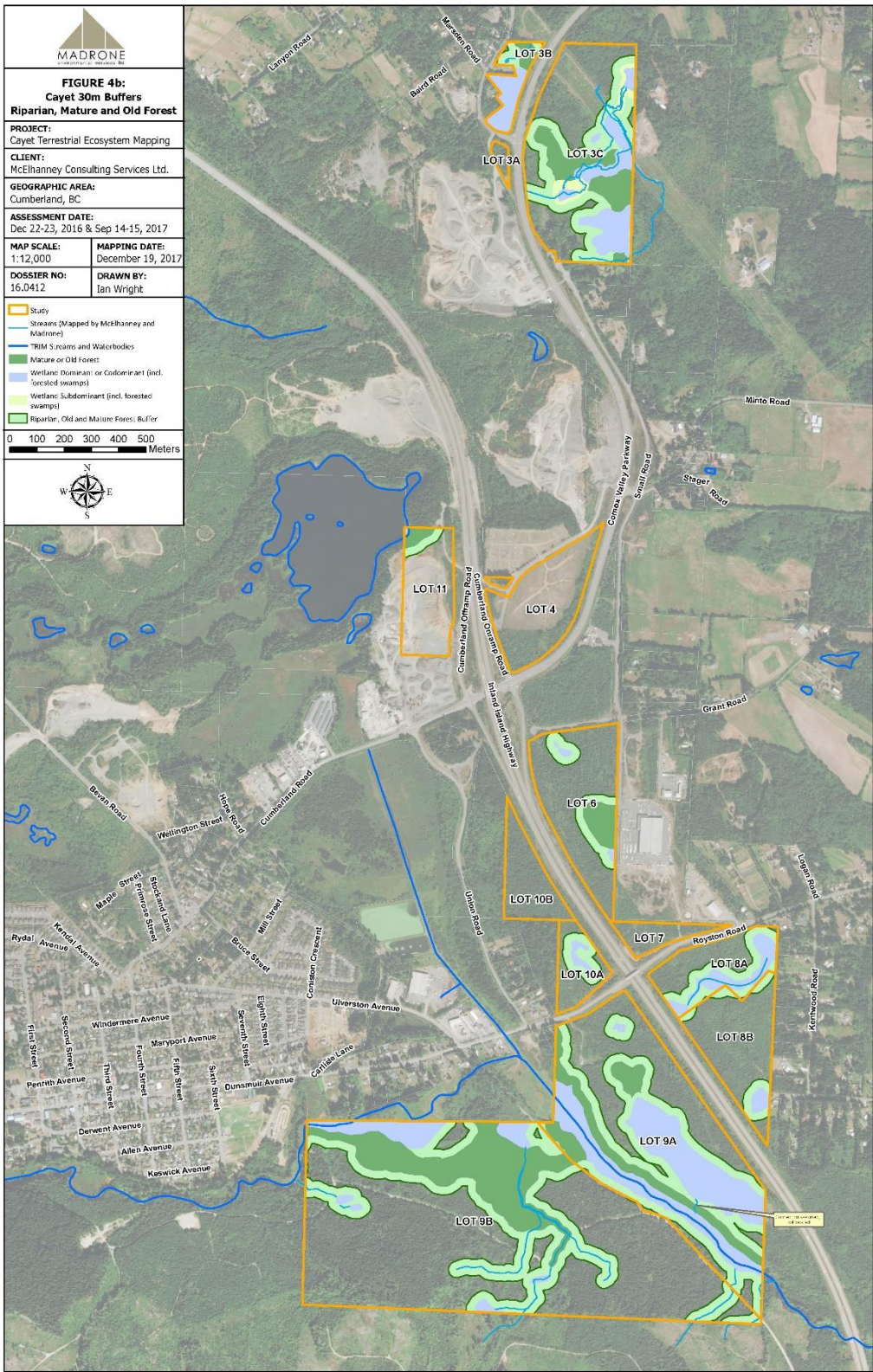


Figure 6. ESA map from the Madrone Report (Appendix B).

5.3. Terrestrial Wildlife, Wildlife Habitat and Resources

During the extensive field review conducted over the course of the 2017 field season, field surveys examined wildlife, wildlife use, and signs of critical breeding habitat. Observations and signs of wildlife are reported below.

5.3.1. Mammals

Local area naturalists have reported the presence of blacktailed deer (*Odocoileus hemionus columbianus*), and red squirrel (*Tamiasciurus hudsonicus*) in the area (CXRD 2011). An incidental observation of a North American river otter (*Lontra canadensis*) was reported in a turtle inventory conducted at Maple Lake (Engelstoft 2016).

Species observed during the seasonal field inventory are listed in [Table 9](#). The locations of these wildlife encounters are presented in [Figure 7](#).

With use of the Study Area by blacktailed deer and Roosevelt elk (*Cervus elaphus roosevelti*), provincial mapping was reviewed to determine if ungulate winter range habitat was present. No ungulate winter range habitat was mapped in the vicinity of the Study Area (CDC 2017a).

A general review of site characteristics was completed in relation to winter habitat for Columbia Black-tailed deer and Roosevelt Elk. While some mature and old-growth conifer stands were identified in Lots 3c, 6 and 9b, black-tailed deer preferentially utilize forests on moderate to steep slopes, with warm aspects ranging from southeast to west during the winter. None of the mature or old-growth forests identified showed such characteristics. Evidence of elk presence within the study area was restricted to pellets identified in forests adjacent to the wetland swamp in Lot 9a. Roosevelt elk will utilize open areas with suitable forage, such as wetlands and meadows, during mild winters; however, as snow depths increase, they require mature coniferous stands along major watersheds, or on moderate to steep, south-aspect slopes. No such forests were identified within the study area, and no evidence of elk use was identified during field assessments, aside from the pellets in Lot 9a. This suggests that potential for impacts to elk winter range values is low. (G. Kerr, personal communication). Bioinventory studies prepared in support of future development permit applications will need to give further attention to potential ungulate winter range habitat within Lots 3c, 6, 9a and 9b.

Wildlife species at risk (mammals) are discussed in [Section 5.4.5](#).

[Table 9. Summary of mammals observed during field inventory and mapped on Figure 7.](#)

English Name	Scientific Name	BC / Canada Status	Observed Location in Study Area*
Bat	<i>Unidentified</i>		Lot 9b
Beaver	<i>Castor canadensis</i>	Yellow	Lot 3, Lot 9b
Black bear	<i>Ursus americanus</i>	Yellow	Lot 9b
Columbian Black-tailed deer	<i>Odocoileus hemionus columbianus</i>	Yellow	Lot 3, Lot 4, Lot 6, Lot 9a, 9b
Cougar	<i>Puma concolor</i>	Yellow	Lot 9b

English Name	Scientific Name	BC / Canada Status	Observed Location in Study Area*
Eastern cottontail	<i>Sylvilagus floridanus</i>	Exotic	Lot 3c
Raccoon	<i>Procyon lotor</i>	Yellow	Lot 3
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	Yellow	Lot 4
Roosevelt Elk	<i>Cervus elaphus roosevelti</i>	Blue	Lot 9a

*Note: Observations made during earlier McElhanney studies or reported by Mimulus (2005). ¹ efauna 2017

Wildlife Habitat

Breeding habitat for mammals, particularly deer (indicated by evidence such as antler rub, wallows, signs of rutting), was not found in the Study Area.

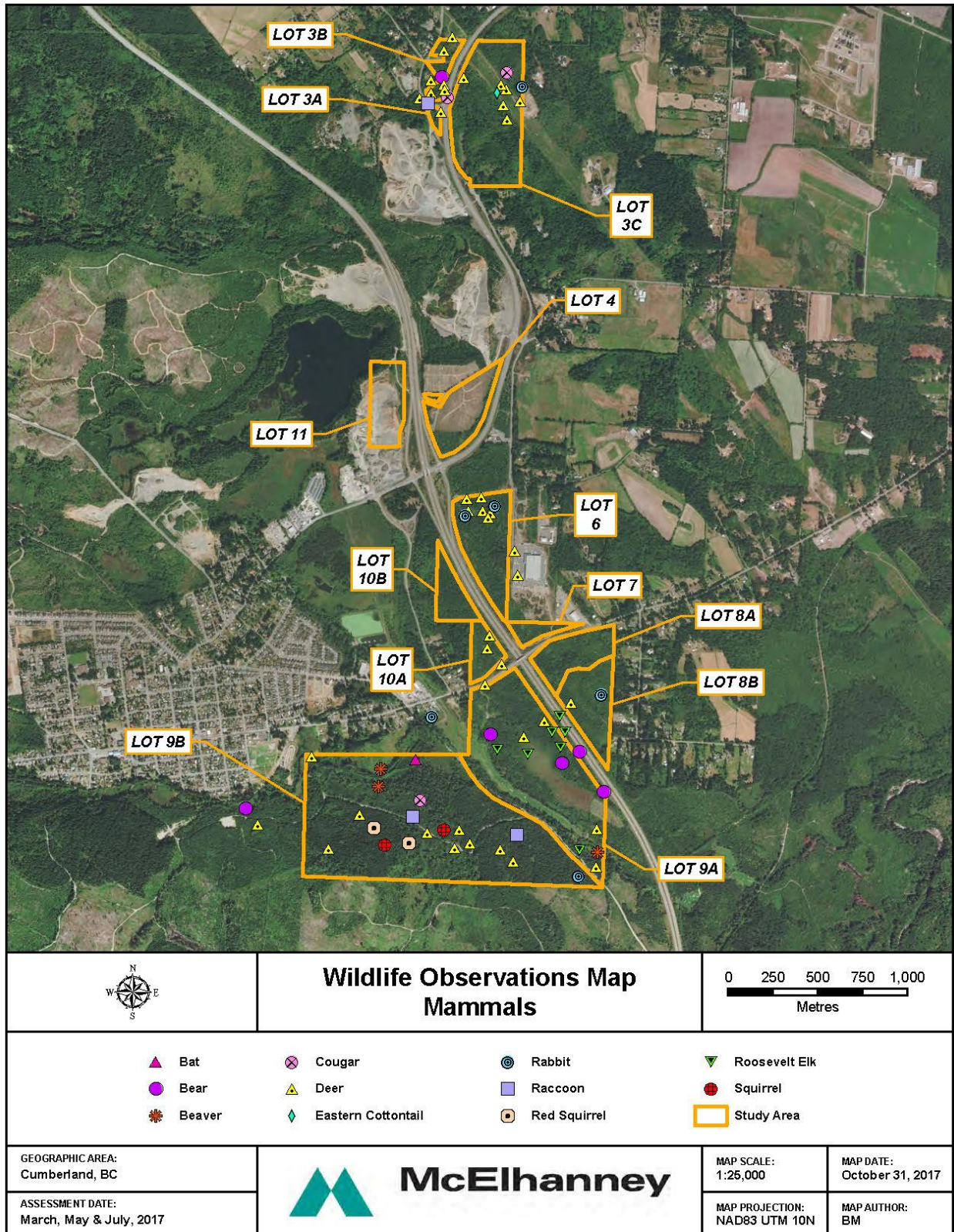


Figure 7. Mapped location of mammal observations throughout the Study Area during the 2017 field study.

5.3.2. Amphibians and Reptiles

Western Painted Turtle inventories were conducted on Vancouver Island by the Ministry of Forests, Lands, and Natural Resource Operations in 2015 (Engelstoft 2016a) and the Habitat Acquisition Trust (HAT) which included Maple Lake (Engelstoft 2016b). Painted turtle was observed at Maple Lake in 2015 (Engelstoft 2016a). Species observed during the survey for HAT resulted in incidental observations of the following provincially yellow listed species at Maple Lake: the Northwestern Salamander (*Ambystoma gracile*), the Pacific Tree frog (*Pseudacris regilla*), and Western Toad (*Anaxyrus boreas*).

Table 10 presents a combined list of provincially listed species, those encountered in the current study and those from studies cited above. Provincially listed species include amphibians (frogs, salamanders, and newts), and reptiles (turtles and snakes) that may be found within the Study Area. Field observations of amphibian species encountered are presented in Figure 8.

Table 10. Amphibian and reptile species provincially reported for CXRD (CDC 2017 a, b, c) that have been found in the wetlands, streams and ponds within the Study Area.

Common Name	Scientific Name	BC Status	COSEWIC	SARA ¹	Distribution and Habitat
Amphibians					
Ensatina	<i>Ensatina eschscholtzii</i>	Yellow			Breeding occurs primarily in spring and fall and has no aquatic larval stage
Northern Pacific Tree Frog	<i>Pseudacris regilla</i>	Yellow			Migrates to water to breed March through May. Observed in several lots (Lot 4C prior to logging), Lot 6, 9a, 9b, Lot 3) in the Study Area (Mimulus 2006). Breeding habitat requires shallow open water and occurs in winter or early spring (CDC 2017c, MWLAP 2004a). Terrestrial habitat preferences include wetlands, riparian forests, meadows, deciduous forests, open ponds and lakes.
Northern Red-legged Frog	<i>Rana aurora</i>	Blue		1-SC (Jan 2005)	Breeds in small ponds March through April (MWLAP 2004a, CDC 2017d). Observed in Lot 9b (Mimulus 2005). Requires large (greater than 20 inches in diameter) down logs of mid-decay classes with sloughing bark). Logs are primary microhabitat in spring, summer, and fall on Vancouver Island. Sometimes climbs high into trees. Lays eggs in cavities in rotten logs, in rock crevices, under bark, or among vegetation. The pond in Lot 6 was determined not to have a suitable hydroperiod due to requiring long development period for this species (Wind 2007).
Northwestern Salamander	<i>Ambystoma gracile</i>	Yellow			Migrates to water to breed in March and April (MWLAP 2004a).
Rough-skinned Newt	<i>Taricha granulosa</i>	Yellow			Migrates to ponds to breed February through April (MWLAP 2004a).
Wandering Salamander	<i>Aneides vagrans</i>	Blue	SC (2014)	SC (2014)	Preference of moist / wet conifer forests under bark or rotting logs. High probability at Lot 6 (Wind 2007), Observed on Lot 4C (Mimulus 2005) which was logged in 2017.
Western Toad	<i>Anaxyrus boreas</i>	Yellow (2016)		1-SC (Jan 2005)	Breeds in small ponds, pools and lakes during spring and early summer (MWLAP 2004a) Migrates May through June. Found in Bog; Fen; Swamp; Marsh; Riparian Forest; Riparian Shrub;

Common Name	Scientific Name	BC Status	COSEWIC	SARA ¹	Distribution and Habitat
					Stream / River; Lake; Meadow; Deciduous / Broadleaf Forest; Pond / Open Water; Riparian Herbaceous Cover
Western Red-backed Salamander	<i>Plethodon vehiculum</i>	Blue			On Vancouver Island, small individuals were found under small rocks and away from discrete cover objects in leaf litter and under moss more frequently than were larger individuals. Lays eggs on land in moist retreats. On Vancouver Island, adults active on surface mainly March-June and September-November (also in mild winter weather); juveniles remained above ground in midsummer (CDC 2017b,c). Forest, riparian, grassland. High probability at Lot 6 (Wind 2007).
Reptiles					
Common Gartersnake	<i>Thamnophis sirtalis</i>	Yellow			Common gartersnakes inhabit a very wide range of aquatic, wetland, and upland habitats; habitat preference exhibits rather pronounced regional differences (CDC 2017 b,c). Mating occurs March to July.
Western Painted Turtle	<i>Chrysemys picta</i> , Pacific coast population	Red		1-E / SC (Dec 2007)	Nesting occurs between late May and early July requiring open water with muddy bottoms and slow-moving water (WMLAP 2004, MELP 1998c). Found in Bog; Fen; Swamp; Marsh; Riparian Forest; Riparian Shrub; Stream / River; Lake; Meadow; Deciduous / Broadleaf Forest; Pond / Open Water; Riparian Herbaceous Cover habitats (CDC 2017 b,c)
Pond Slider	<i>Trachemys scripta</i>	Exotic			Nesting mid-March to August in quiet water with abundant aquatic vegetation, soft bottom and basking sites (CDC 2017 b,c, WMLAP 2004).

¹ SARA designations SC – species of special concern, E-endangered species.

Amphibian habitat

Amphibian habitat was found primarily in Lot 9a and Lot 9b along the edges of the swamp and large wetland areas including Lot 3C and at Maple Lake. These areas potentially provide habitat for breeding of frogs, toad, newts and salamanders. Other wetlands in the Study Area dry up in the early summer and may have a hydroperiod that cannot support all the sensitive life stages of amphibians (Wind 2007).

Western Painted Turtle was found at Maple Lake by Engelstoft (2016a). We would expect that Maple Lake provides critical habitat for the breeding of this species. The core activity area for this species may be on the west side of the Lake where there are an abundance basking sites. The core area at Maple Lake will need to be identified as the recovery plan for this species identified use of terrestrial habitat 80m on either side of the waterbody or watercourse, and an additional adjacent terrestrial area that incorporates 260m of habitat beyond the 80m terrestrial buffer (MOE 2017).

Turtle and amphibian breeding studies should be conducted during the bioinventories required for the preparation of development permit applications at the next stage of development.

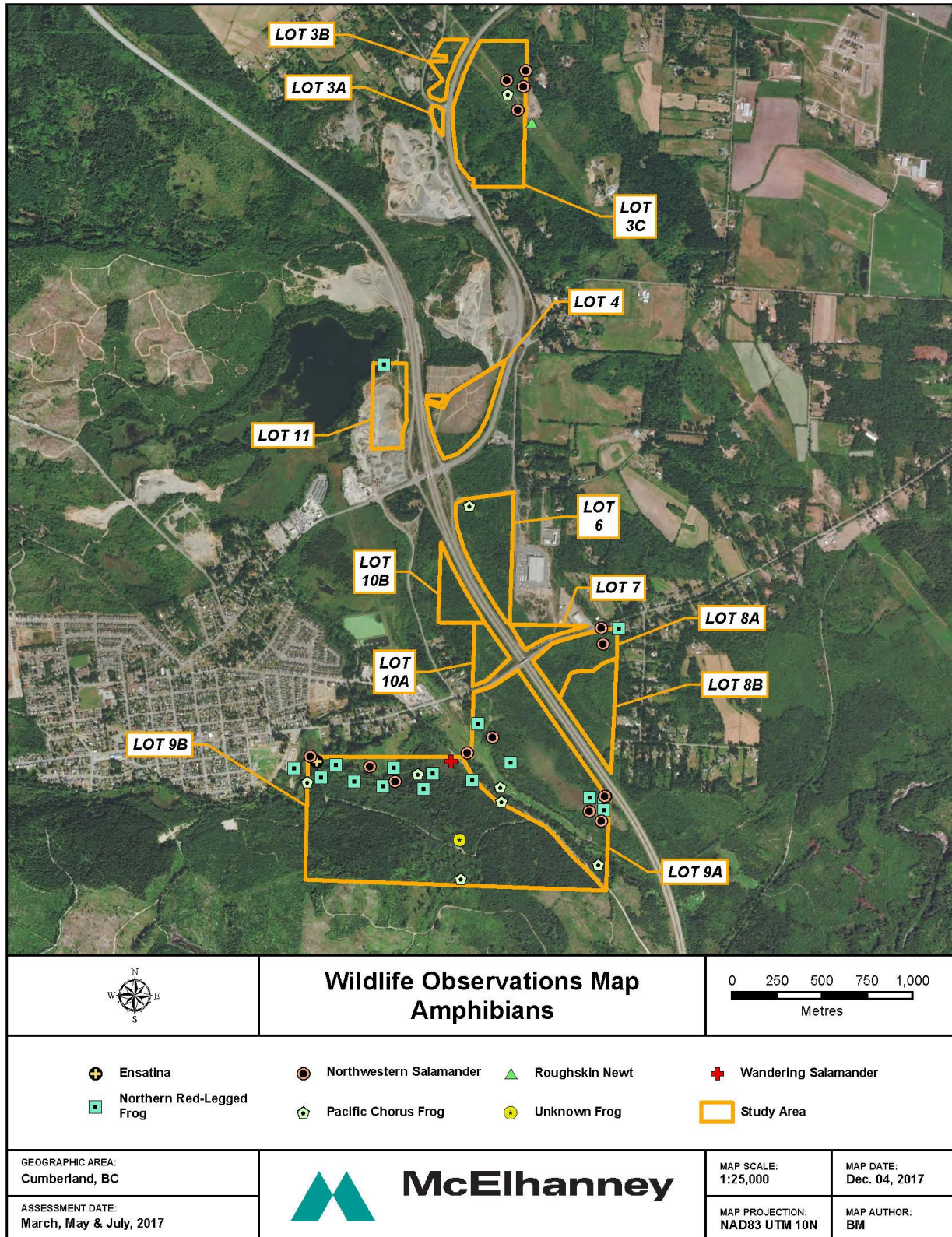


Figure 8. Location of amphibians encountered during the 2017 field studies.

5.3.3. Birds

A list of birds encountered during the bird surveys conducted in March, May and July 2017 was compiled ([Table 11](#)). The bird species encountered were common to the area and provincially listed as secure (yellow-coded). Wetlands, riparian habitat and forest habitat were the three main habitat types in which bird species were encountered and efforts were made to ensure that each of these habitats were surveyed several times during the field season.

Maps of the distribution of bird species encountered during the field season in the Study Area are presented below in generally related family groupings or as individual species ([Figures 9 to 20](#)).

Many bird species require specific habitat types (conifer forests, deciduous woodlands, riparian areas) for breeding. While nesting observations were made throughout the Study Area, no specific nesting locations were observed to suggest preferred breeding habitats beyond the description following. [Table 11](#) also provides a list of preferred habitats for the species of breeding birds encountered. Nests encountered in this study were mapped with the species identified ([Figures 9 to 20](#)).

Table 11. Bird species encountered during the 2017 field season.

English Name	Scientific Name	BC list ¹	Preferred Habitat ²
Raptors			
Bald Eagle	<i>Haliaeetus leucocephalus</i>	yellow	Breeding habitat most commonly includes areas close to coastal areas, bays, rivers, lakes, reservoirs, or other bodies of water that reflect the general availability of primary food sources including fish, waterfowl, or seabirds. Nesting typically occurs in tall trees, or on cliffs by the water.
Barred Owl	<i>Strix varia</i>	yellow	Dense woodland and forest (coniferous or hardwood), swamps, wooded river valleys, cabbage palm-live oak hammocks; often in areas bordering streams, marshes, and meadows, but also commonly in upland areas. Nests in tree cavity, in abandoned nest of squirrel, crow, or hawk, or in top of hollow tree stub, usually at least 7-8 m above ground. Uses both living and dead trees.
Great Horned Owl	<i>Bubo virginianus</i>	yellow	Various forested habitats, moist or arid, deciduous or evergreen lowland forest to open temperate woodland, including second-growth forest, swamps, orchards, riverine forest, brushy hillsides, and desert. Very local in tropical lowlands.
Northern Pygmy-Owl	<i>Glaucidium gnoma</i>	yellow	Habitat consist of forests or open woodlands in foothills and mountains, including adjacent meadows while foraging (AOU 1983). Specific nesting habitat is variable across the large range; pure and mixed species coniferous forests, mixed coniferous-deciduous riparian forests, aspen stands in pine forests, and highland pine and cloud forests
Red-tailed Hawk	<i>Buteo jamaicensis</i>	yellow	Wide variety of open woodland and open country with scattered trees, rarely in denser forest.
Turkey Vulture	<i>Cathartes aura</i>	yellow	Forested and open situations, more commonly in the latter, from lowlands to mountains. May roost in large flocks at night in trees; roosts often near or over water.
Corvids			
Common Raven	<i>Corvus corax</i>	yellow	Various situations from lowlands to mountains, open country to forested regions, and humid regions to desert; most frequently in hilly or mountainous areas, especially in vicinity of cliffs.
Northwestern Crow	<i>Corvus caurinus</i>	yellow	Coastal tidelands near coniferous woodland or forest edge, foraging also in adjacent croplands and around human habitation. Nests in crotches of low trees and bushes, 2.5-6 m above ground. May also nest under rocks, bushes, or fallen trees near the ocean.
Steller's Jay	<i>Cyanocitta stelleri</i>	yellow	Coniferous and mixed coniferous-deciduous forest; humid coniferous forest, and arid pine-oak; open woodland, campsites, orchards, and gardens. Nests in conifers or shrubs from 2.5-30 m above ground.
Finches			
House Finch	<i>Haemorhous mexicanus</i>	yellow	Arid scrub and brush, thornbush, oak-juniper, pine-oak association, chaparral, open woodland, towns, cultivated lands, savanna (Subtropical and Temperate zones). Nests on ledge; on branch of tree, shrub, and cactus; and in hole in tree or wall.
Purple Finch	<i>Haemorhous purpureus</i>	yellow	Open coniferous forest (especially fir and spruce), mixed forest, forest edge, open woodland, second growth, cultivated areas with trees, swamp openings, city parks, suburbs. In migration and winter also in deciduous forest, weedy areas, bird feeders in residential areas. BREEDING: Nests usually high in conifers in the east, in both conifers and deciduous trees in the west.
Pine Siskin	<i>Spinus pinus</i>	yellow	Habitats include various forests and woodlands, parks, and gardens and yards in suburban areas. In migration and winter, this species occurs in a variety of woodland and forest habitats, partly open situations with scattered trees, open fields, pastures, and savanna

English Name	Scientific Name	BC list ¹	Preferred Habitat ²
Flycatchers			
Least Flycatcher	<i>Empidonax minimus</i>	yellow	Open woodland and brushy areas, forest borders, thinned woodland, tall second growth. In maple forests in Quebec, occurred where trees were the tallest, sugar maple was in nearly pure stand, and subcanopy was sparse.
Olive-sided Flycatcher	<i>Contopus cooperi</i>	blue	Breed in various forest and woodland habitats: taiga, subalpine coniferous forest, mixed coniferous-deciduous forest, burned-over forest, spruce or tamarack bogs and other forested wetlands, and along the forested edges of lakes, ponds, and streams. Most nesting sites contain dead standing trees, which are used as singing and feeding perches.
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	yellow	Nesting habitat includes humid coniferous forest (mostly coastal), pine-oak forest and other mixed coniferous-deciduous forests, broadleaf evergreen forest, dense second-growth woodland, and riparian woodlands, often where open areas exist under the canopy of large trees and favoring shady ravines in some areas.
Willow Flycatcher	<i>Empidonax traillii</i>	yellow	Strongly tied to brushy areas of willow and similar shrubs. Found in thickets, open second growth with brush, swamps, wetlands, streamsides, and open woodland.
Sparrows			
Chipping Sparrow	<i>Spizella passerina</i>	yellow	Habitat includes open woodlands, forest and woodland edges, edges of lakes and streams, grassy fields, parks, farm yards, orchards, and areas with similar vegetation structure. Nests usually are in trees or shrubs, usually within 1-6 meters of the ground but may be higher.
Dark-eyed Junco	<i>Junco hyemalis</i>	yellow	Habitats include various sorts of coniferous, mixed, and deciduous forest; forest edge; forest clearings; bogs; open woodland; brushy areas adjacent to forest; and burned-over lands. In migration and winter the species occurs in a wide range of openly wooded and brushy and grassy habitats (AOU 1983). Nests are in scrapes on the ground and usually are concealed by logs, rocks, tree roots, leaves, or ground vegetation.
Fox sparrow	<i>Passerella iliaca</i>	yellow	Dense thickets in coniferous or mixed woodlands, chaparral, parks, and gardens, wooded bottomlands along rivers and creeks. Requires dense brushy cover during the nesting season.
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	yellow	Subalpine meadows; thickets along streams; boreal bogs. Montane thickets and shrubbery, dwarf conifers and brushy canyons; in migration and winter in dense brush, thickets, chaparral and gardens (AOU 1983). BREEDING: Usually nests on or near ground, in bank beneath overhanging plants or at base of shrub.
Lincoln sparrow	<i>Melospiza lincolni</i>	yellow	Bogs, wet meadows, riparian thickets, shrubby forest edge, marshes, brushy fields; mostly in northern and montane area and jack pine plain barrens. BREEDING: Nests on ground in area of concealing vegetation; sometimes in low bush.
Song Sparrow	<i>Melospiza melodia</i>	yellow	Brushy, shrubby, and deep grassy areas along watercourses and seacoasts; marshes (cattail, bulrush, and salt); and, mostly in the northern and eastern portions of range, forest edge, bogs, brushy clearings, thickets, hedgerows, gardens. Nests on ground, especially early in season, among clumps of dead grasses, weeds; later often 0.5-10 m up in small conifer, thorny bush, willows, cattails, cordgrass.
Spotted Towhee	<i>Pipilo maculatus</i>	yellow	Found in shrubby riparian thickets along streams, rivers and coulees, also in woodland undergrowth. In interior mountains and plateaus, uses riparian thickets, open south-facing slopes of ridges, and canyon bottoms.
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	yellow	Open woodlands, burnt over areas in forests, brushy areas, brushy subalpine meadows, willow thickets along streams or lakes, parks, farmland.

English Name	Scientific Name	BC list ¹	Preferred Habitat ²
Thrushes			
American Robin	<i>Turdus migratorius</i>	yellow	Use a wide range of habitats, including forest, woodland, scrub, parks, thickets, gardens, cultivated lands, savanna, swamps, and suburbs. They are attracted to areas with damp ground or small fruits. Nests are in forks or on branches of trees or shrubs, on building ledges, sometimes on fences, posts, or cliff ledges, or rarely on the ground.
Hermit thrush	<i>Catharus guttatus</i>	yellow	Open humid coniferous and mixed forest and forest edge, dry sandy and sparse jackpine, less frequently in deciduous forest and thickets; in migration and winter also chaparral, riparian woodland, arid pine-oak, desert scrub.
Swainson's Thrush	<i>Catharus ustulatus</i>	yellow	Breeding habitat includes dense vegetation in coniferous forests, mixed hardwood-conifer forests (e.g., across Canada and northern New England, predominantly hardwood forests (e.g., in Northeast), riparian woodland and thickets of willow or alder
Varied Thrush	<i>Ixoreus naevius</i>	yellow	Humid coastal and interior montane coniferous forest, deciduous forest with dense understory, and tall shrubs (especially alder); in migration and winter- open woodland and chaparral.
Vireos			
Cassin's Vireo	<i>Vireo cassinii</i>	yellow	Open coniferous or mixed coniferous-deciduous woodland, pine-oak association, oak woodland; in migration and winter, a variety of wooded habitats.
Hutton's Vireo	<i>Vireo huttoni</i>	yellow	Prefers mixed conifer-dominated woodland with a moderate to heavy shrub understory
Red-eyed vireo	<i>Vireo olivaceus</i>	yellow	Open deciduous (less frequently coniferous) forest (especially with sapling undergrowth), mixed forest with deciduous understory, second-growth woodland, scrub, thickets, gardens, mangroves. Most abundant in mature stands.
Warbling Vireo	<i>Vireo gilvus</i>	yellow	Open deciduous and mixed deciduous-coniferous woodland, riparian forest and thickets, pine-oak association, orchards, and parks; in migration and winter in a wide variety of forest, woodland and scrub habitats. In winter seems to prefer light woodlands and savanna groves.
Warblers			
Common Yellowthroat	<i>Geothlypis trichas</i>	yellow	Marshes (especially cattail), thickets near water, bogs, brushy pastures, old fields, and, locally, undergrowth of humid forest. In migration and winter also in brushy and shrubby areas in both moist and arid regions
MacGillivray's Warbler	<i>Oporornis tolmiei</i>	yellow	Breeding habitat consists of dense shrubby areas, such as coniferous forest undergrowth and edge, brushy hillsides, riparian thickets, and chaparral, often in cut-over or burned areas.
Northern Waterthrush	<i>Parkesia noveboracensis</i>	yellow	Breeds in cool, wooded swamps, ponds and slow-moving rivers; thickets of bogs, and rivers bordered with willow and alder.
Orange-crowned warbler	<i>Oreothypis celata</i>	yellow	Various open, shrubby deciduous and mixed woodlands, chaparral, riparian thickets, and aspen groves.
Wilson's Warbler	<i>Cardellina pusilla</i>	yellow	Habitat includes semi-open areas in moist woodlands, bogs with scattered trees, willow and alder thickets, and areas with similar vegetation structure.
Yellow rumped Warbler	<i>Setophaga coronata</i>	yellow	Nests in forests or open woodlands. In migration and winter found in open forests, woodlands, savanna, roadsides, pastures, and scrub habitat. May be seen in parks and gardens. Nests on branches 1-15 m above ground.

English Name	Scientific Name	BC list ¹	Preferred Habitat ²
Yellow Warbler	<i>Setophaga petchia</i>	yellow	Habitat includes open scrub, second-growth woodland, thickets, farmlands, and gardens, especially near water; riparian woodlands, especially of willows, are typical habitat in the West.
Other Passerines			
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	yellow	Deciduous forest and woodland, pine-oak association, oak scrub, pinyon-juniper woodland and deciduous thickets. Often found on edges of ponds, streams, or forests. Usually nests in open woodlands or in trees and shrubs near streams and swamps, usually 1 to 8 m above ground.
Bushtit	<i>Psaltiriparus minmus</i>	yellow	Woodlands and scrub habitat with scattered trees and shrubs. Brushy stream sides.
Cedar Waxwing	<i>Bombycilla cedrorum</i>	yellow	Inhabits a wide variety of open woodland types, either deciduous or coniferous, forest edge, second growth, parks, orchards and gardens.
Chestnut-backed Chickadee	<i>Poecile rufescens</i>	yellow	Coniferous and mixed forest, primarily in humid regions, less frequently in pine forest, oak woodland, pine-oak association, and thickets. Strongly associated with Douglas-fir in most areas. Characteristic of moist coniferous forests, deciduous and mixed forests, and suburban or rural residential areas. Nests in tree cavities; natural, dug by pair, or old woodpecker hole, usually less than 3 m above ground.
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	yellow	Coniferous (primarily spruce and fir) and mixed coniferous- deciduous woodland, second growth, and occasionally parks; in migration and winter in a variety of forest and woodland habitats, and around human habitation (AOU 1983).
Hammond's Flycatcher	<i>Empidonax hammondii</i>	yellow	In Pacific Northwest Cascade forests, optimum habitat is dry or mesic old-growth or mature Douglas-fir.
Northern Rough Winged Swallow	<i>Stelgidopteryx serripennis</i>	yellow	Open and partly open situations, especially along watercourses with steep banks, and roadside cuts. Nests in burrows in cliffs, riverbanks, roadside cuts, culverts, drain pipes, holes in walls, under bridges; locally in caves and old buildings.
Pacific Wren	<i>Troglodytes pacificus</i>	yellow	Most common in old-growth evergreen forests. They also live in deciduous forests, treeless islands in Alaska, and in mixed-species forests near streams.
Red-breasted Nuthatch	<i>Sitta canadensis</i>	yellow	Coniferous and mixed forest, aspen woodland; in migration and winter also in deciduous forest, open woodland, parks, scrub, and riparian woodland. Nests usually in excavated cavity in tree stub or branch of dead tree, or dead top of live tree, also in abandoned woodpecker hole, natural cavity, or bird box; average of 4-5 m above ground.
Red-winged blackbird	<i>Agelaius phoeniceus</i>	yellow	Habitat includes freshwater and brackish marshes, bushes and small trees along watercourses, and upland cultivated fields. In migration and winter, this blackbird also occurs in open cultivated lands, plowed fields, pastures, and prairies. Nests usually are near water, in cattails, rushes, or sedges, occasionally in shrubs or trees.
Western Tanager	<i>Piranga ludoviciana</i>	yellow	Breeds mostly in coniferous and mixed mountain woodlands. Migrates and winters in a variety of forest, woodland, scrub and partly open habitats. Usually nests in conifer, on outer portion of limb, 3-20 m above ground.
Western Wood-Pewee	<i>Contopus sordidulus</i>	yellow	Forest, forest edge, and woodland, especially coniferous or mixed coniferous-deciduous forest, and poplar or riparian woodland.
Starling	<i>Sturnis vulgaris</i>	exotic	Found in a wide variety of habitats including open wood- lands, agricultural and urban areas. Roosts in trees, shrubs, or buildings, forages in open areas.

English Name	Scientific Name	BC list ¹	Preferred Habitat ²
Woodpeckers			
Hairy Woodpecker	<i>Picoides villosus</i>	blue	Forest, open woodland, swamps, well-wooded towns and parks, open situations with scattered trees. Most abundant in mature woods with large old trees suitable for cavity nesting; common in medium-aged forests; prefers woods with a dense canopy.
Northern Flicker	<i>Colaptes auratus</i>	yellow	Open forest, both deciduous and coniferous, open woodland, open situations with scattered trees and snags, riparian woodland, pine-oak association, parks (AOU 1983). Nests in dead tree trunk, or stump, or dead top of live tree; sometimes nests in wooden pole, building or earth bank. Digs a nest hole cavity or reuses old one. Holes usually 2.5-7.5 m above ground.
Pileated Woodpecker	<i>Dryocopus pileatus</i>	yellow	Dense deciduous (favored in southeast), coniferous (favored in north, northwest and west), or mixed forest, open woodland, second growth, and (locally) parks and wooded residential areas of towns. Prefers woods with a tall closed canopy and a high basal area. Most often in areas of extensive forest or minimal isolation from extensive forest.
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	yellow	Aspen-pine association and coniferous forest, including humid coastal lowlands; in migration and winter also in open woodland and parks. Nests in trees; bores its own nest-hole cavity.
Other Birds			
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	blue	Found in temperate and mountain coniferous and mixed forests and woodlands, especially pine-oak woodlands, and locally in southern lowlands; also forage in cultivated areas, suburban gardens and parks. Nests in a tree or shrub 4-10 m from the ground, usually near the bole in dense foliage, and often next to an opening or above a slope or precipice.
Common Nighthawk	<i>Chordeiles minor</i>	yellow	Frequents mountains and plains in open and semi-open areas: open coniferous forests, savanna, grasslands, fields, vicinity of cities and towns. Nesting occurs on the ground on a bare site in an open area. In some areas, this species also nests on flat gravel roofs of buildings, perhaps related to prey availability at artificial lights. It prefers areas with sandy soil in the southern United States.
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	exotic	Open woodland to scrub and desert, and around human habitation.
European Starling	<i>Sturnis vulgaris</i>	exotic	Found in a wide variety of habitats including open wood- lands, agricultural and urban areas. Roosts in trees, shrubs, or buildings, forages in open areas
Mourning Dove	<i>Zenaida macroura</i>	yellow	Habitats include open woodland, forest edge, cultivated lands with scattered trees and bushes, parks and suburban areas, arid and desert country (generally near water), and second growth (Tropical to Temperate zones). Nests are in trees or shrubs, sometimes on stumps or rocks or on building ledges, or on the ground. Individuals may nest in an old nest of another species or build its own platform of twigs.
Ruffed grouse	<i>Bonasa umbellus</i>	yellow	Dense forest with some deciduous trees, in both wet and relatively dry situations from boreal forest (especially early seral stages dominated by aspen) and northern hardwood ecotone to eastern deciduous forest and oak-savanna woodland. Young forest provides optimum conditions.
Rufous hummingbird	<i>Selasphorum rufus</i>	yellow	Breeding habitat includes coniferous forest, second growth, thickets, and brushy hillsides, with foraging extending into adjacent scrubby areas and meadows with abundant nectar flowers; habitat is chiefly secondary succession communities and forest openings.
Waterbirds			
Belted Kingfisher	<i>Megasceryle alcyon</i>	yellow	Primarily along water, both freshwater and marine, including lakes, streams, wooded creeks and rivers, seacoasts, bays, estuaries, and mangroves. Perches in trees, on over hanging branches, posts and utility wires. At night, roosts high in a leafy tree near water.

English Name	Scientific Name	BC list ¹	Preferred Habitat ²
Canada Goose	<i>Branta canadensis</i>	yellow	Various habitats near water, from temperate regions to tundra. In migration and winter, coastal and freshwater marshes, lakes, rivers, fields, etc. On Admiralty Island, Alaska, commonly perches in trees.
Common Loon	<i>Gavia immer</i>	yellow	Habitat includes usually clear lakes containing both shallow and deep-water areas. In studies comparing lakes with and without loons, higher turbidity was suggested as a factor influencing lack of occupancy. Nest sites are on small islands, quiet backwaters, or mainland shores.
Mallard Duck	<i>Anas platyrhynchos</i>	yellow	Primarily shallow waters such as ponds, lakes, marshes, and flooded fields; in migration and in winter mostly in fresh water and cultivated fields, less commonly in brackish situations (AOU 1983).
Pied-billed Grebe	<i>Podilymbus podiceps</i>	yellow	Occurs in ponds, sloughs, and marshes, in marshy inlets and along edges of rivers, lakes, and reservoirs, and occasionally in estuarine wetlands

¹ BC list: yellow coded indicates that the species is secure; BC list: Blue code indicates that the species is vulnerable or threatened.

². All species descriptions sourced from CDC 2017c

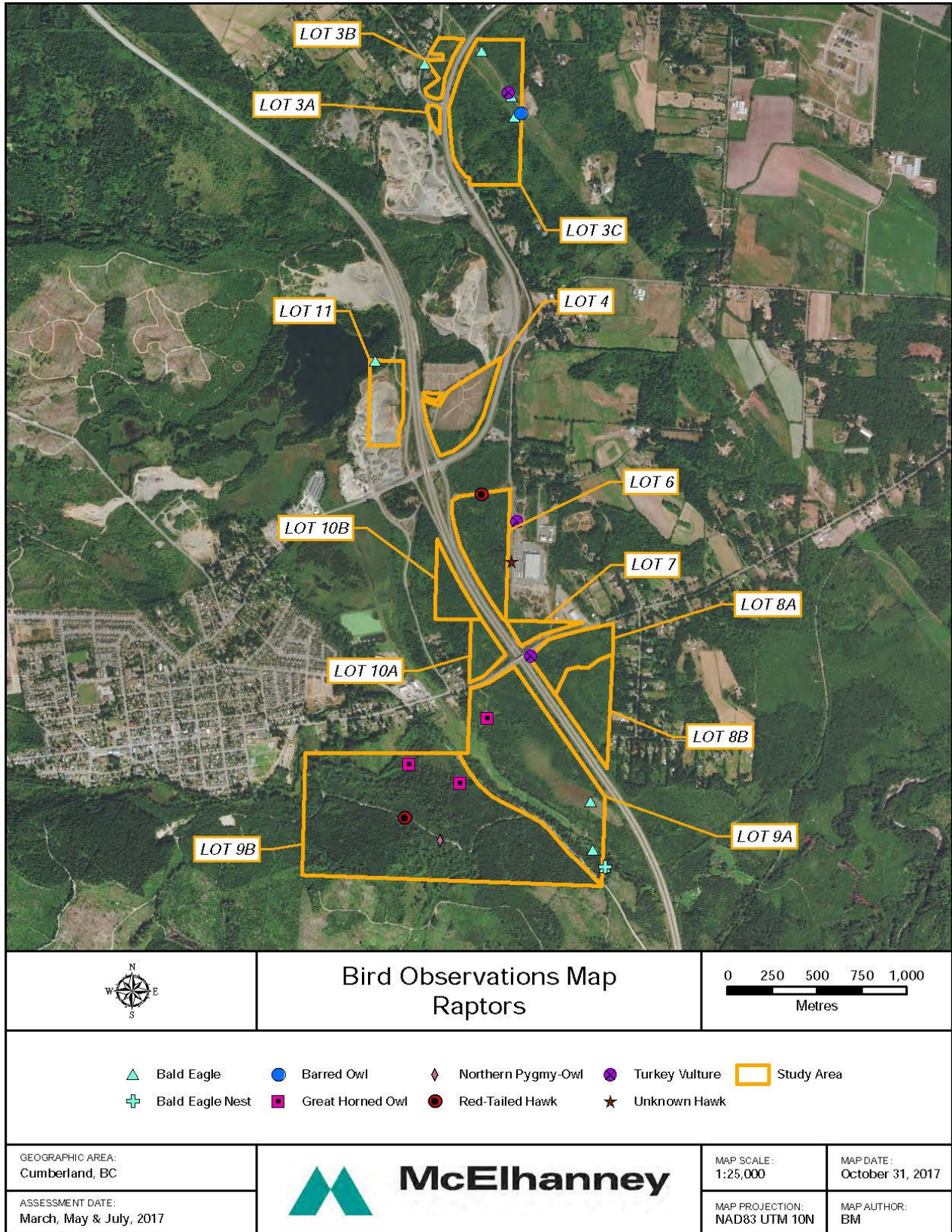


Figure 9. Distribution of Raptors observed in the Study Area during the field season.

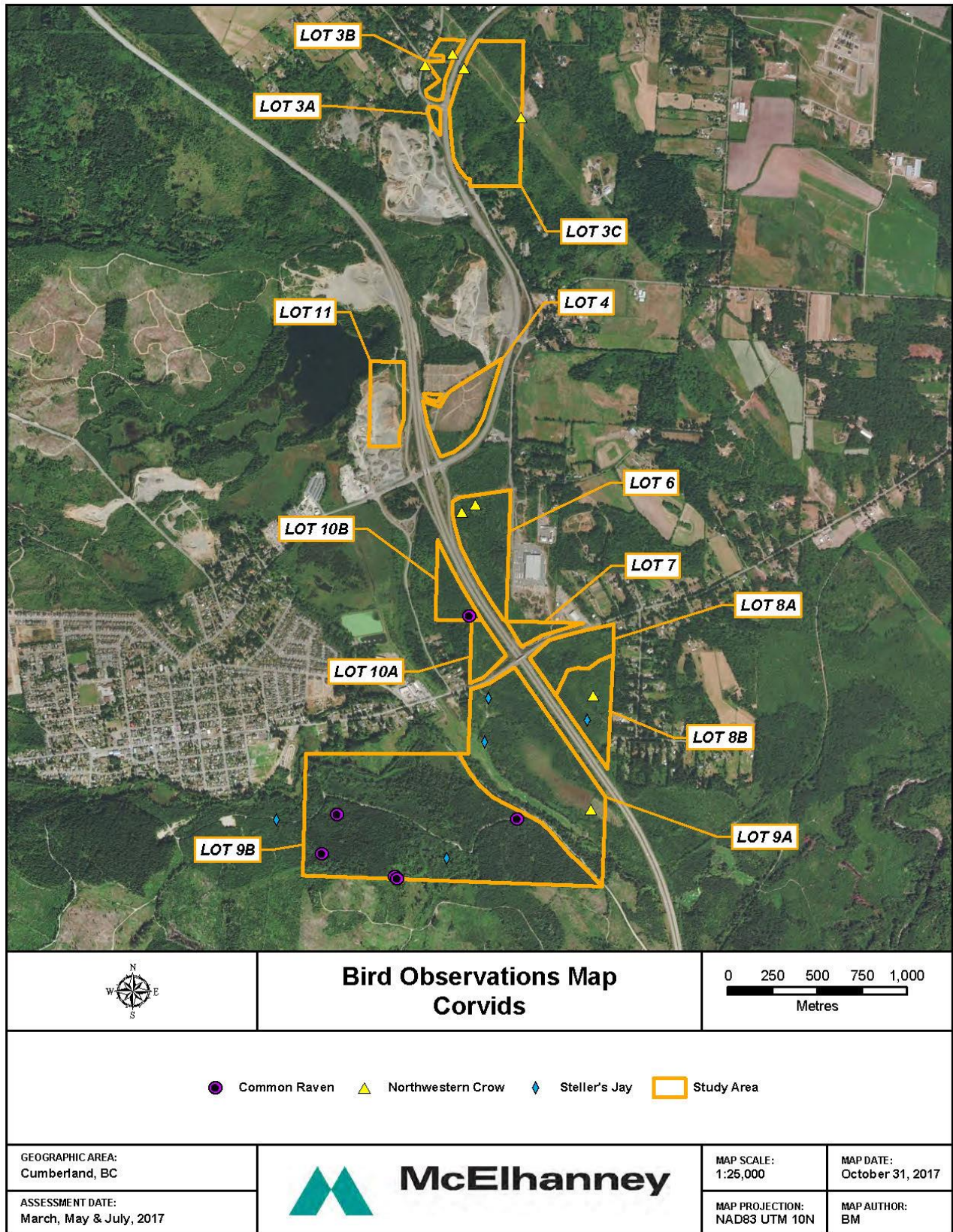


Figure 10. Distribution of Corvids observed in the Study Area during the field season.

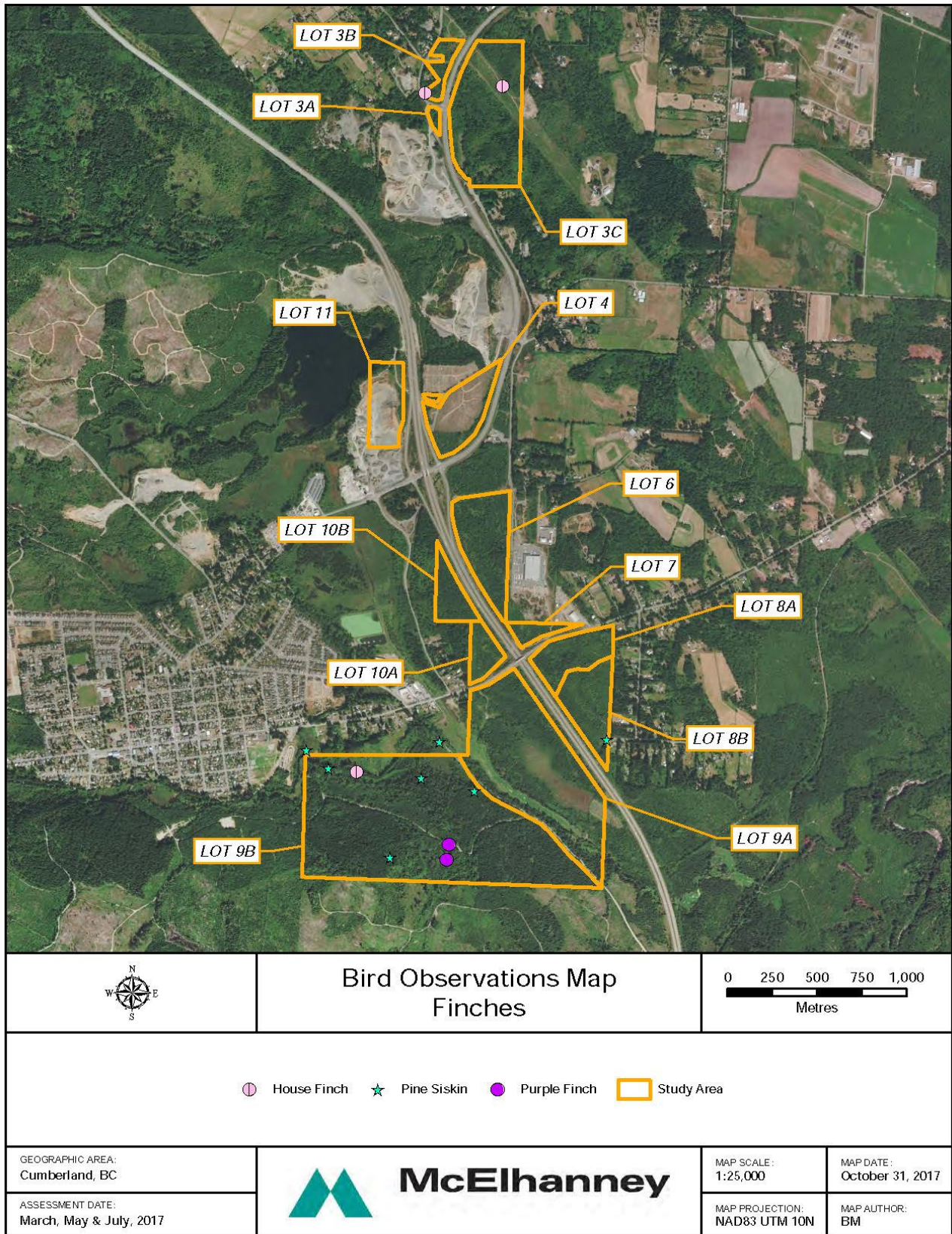


Figure 11. Distribution of species of the Finch group observed in the Study Area during the field season.

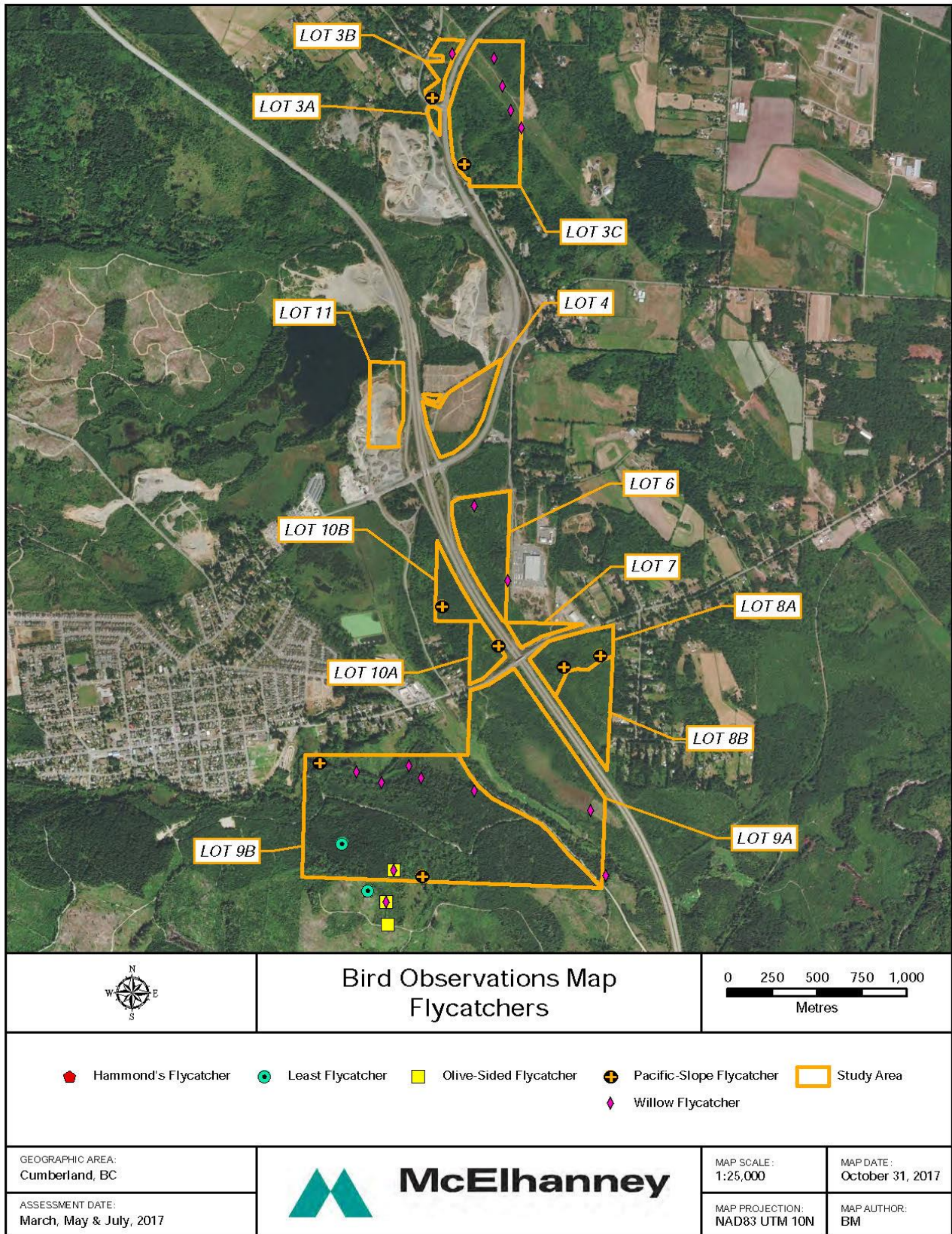


Figure 12. Distribution of species of the Flycatchers observed during the field season.

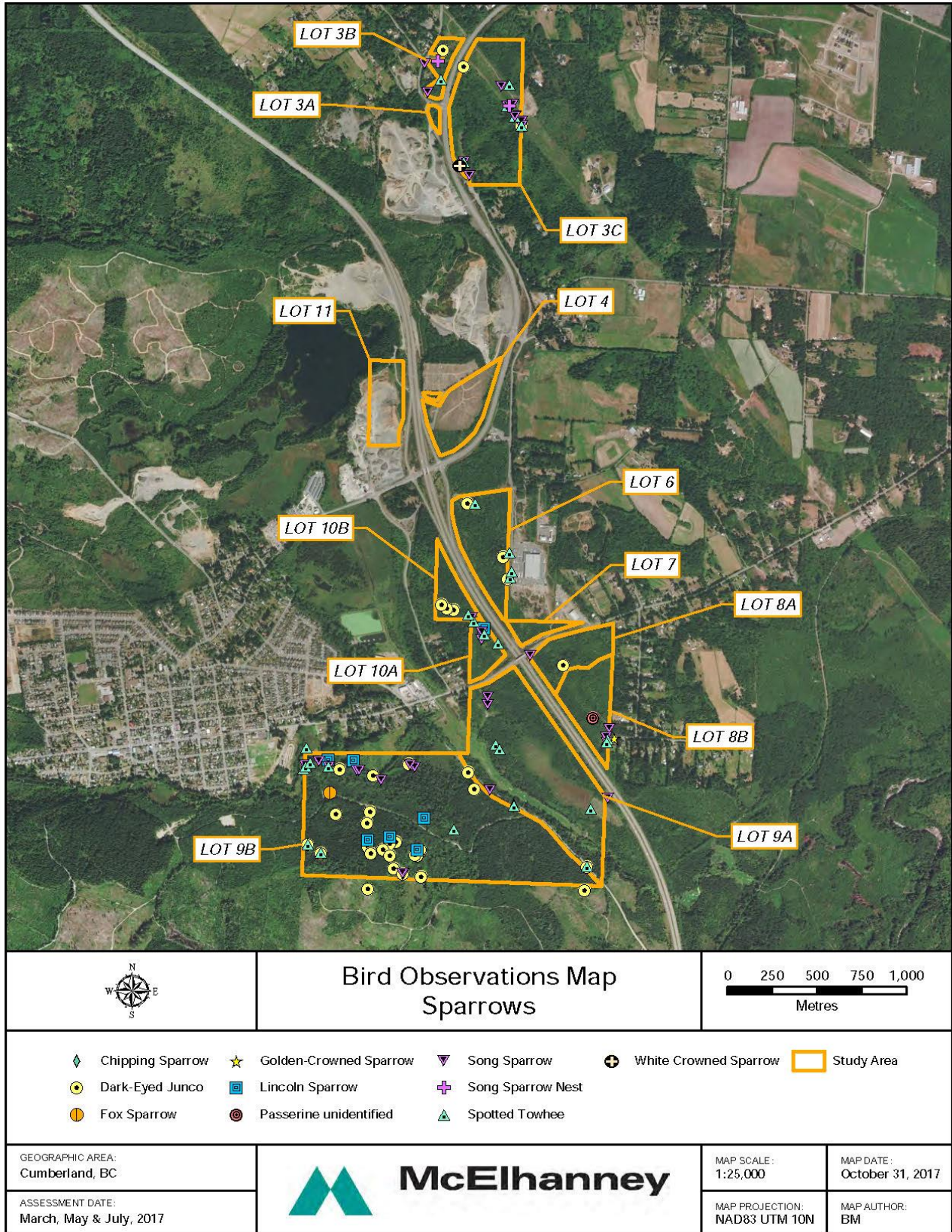


Figure 13. Distribution of species of the Sparrow group observed during the field season.

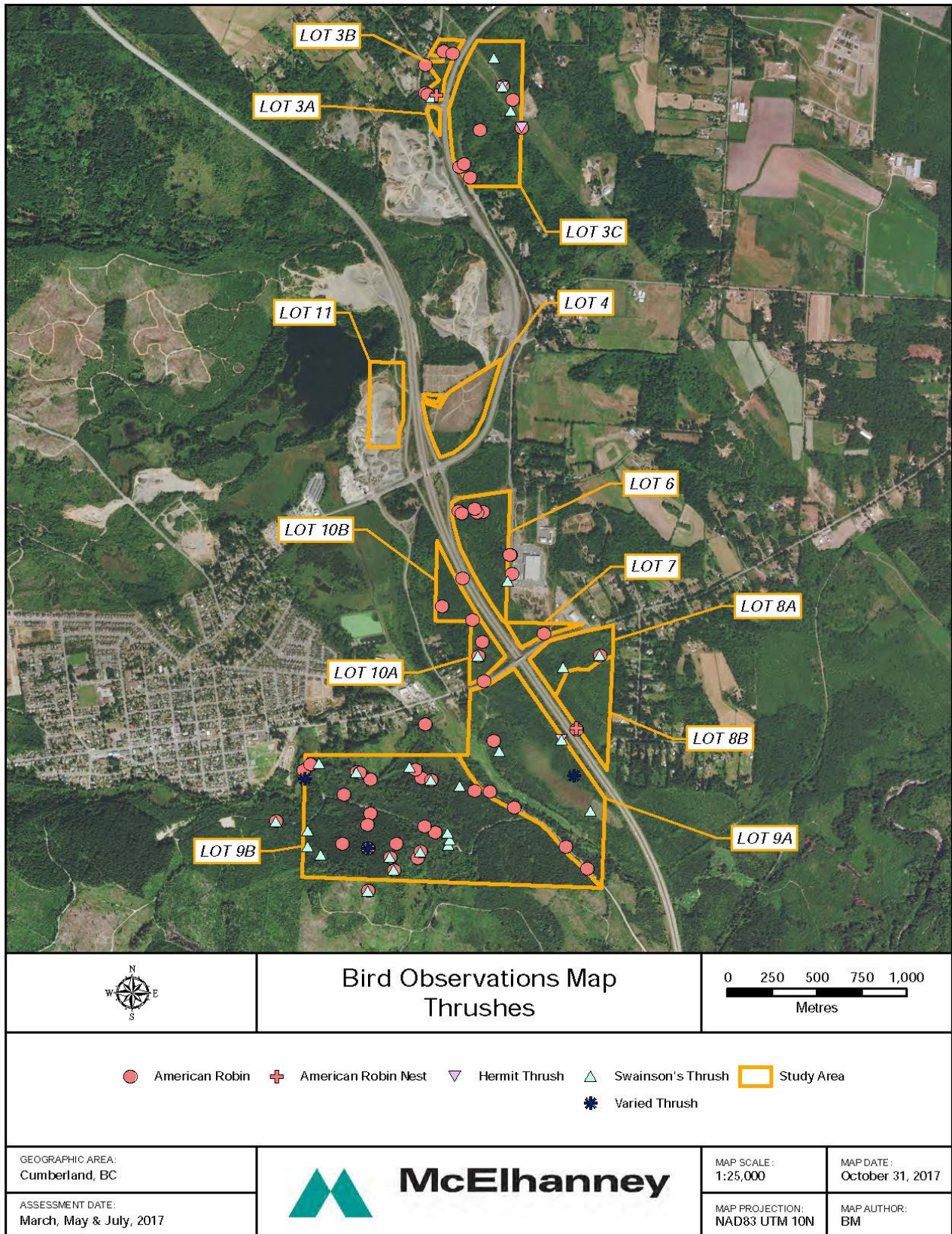


Figure 14. Distribution of species of the Thrush group observed during the field season.

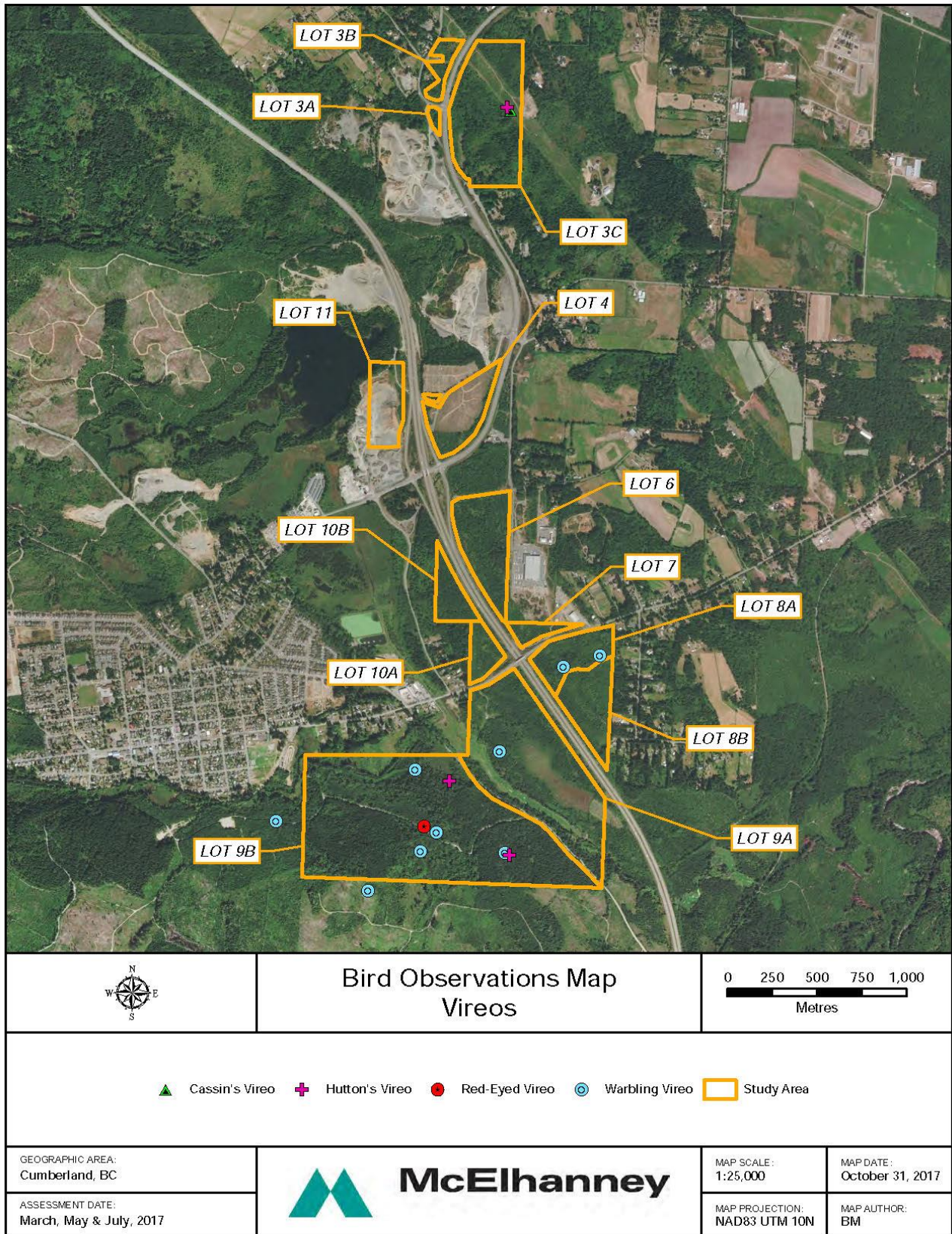


Figure 15. Distribution of species of Vireo's observed during the field season.

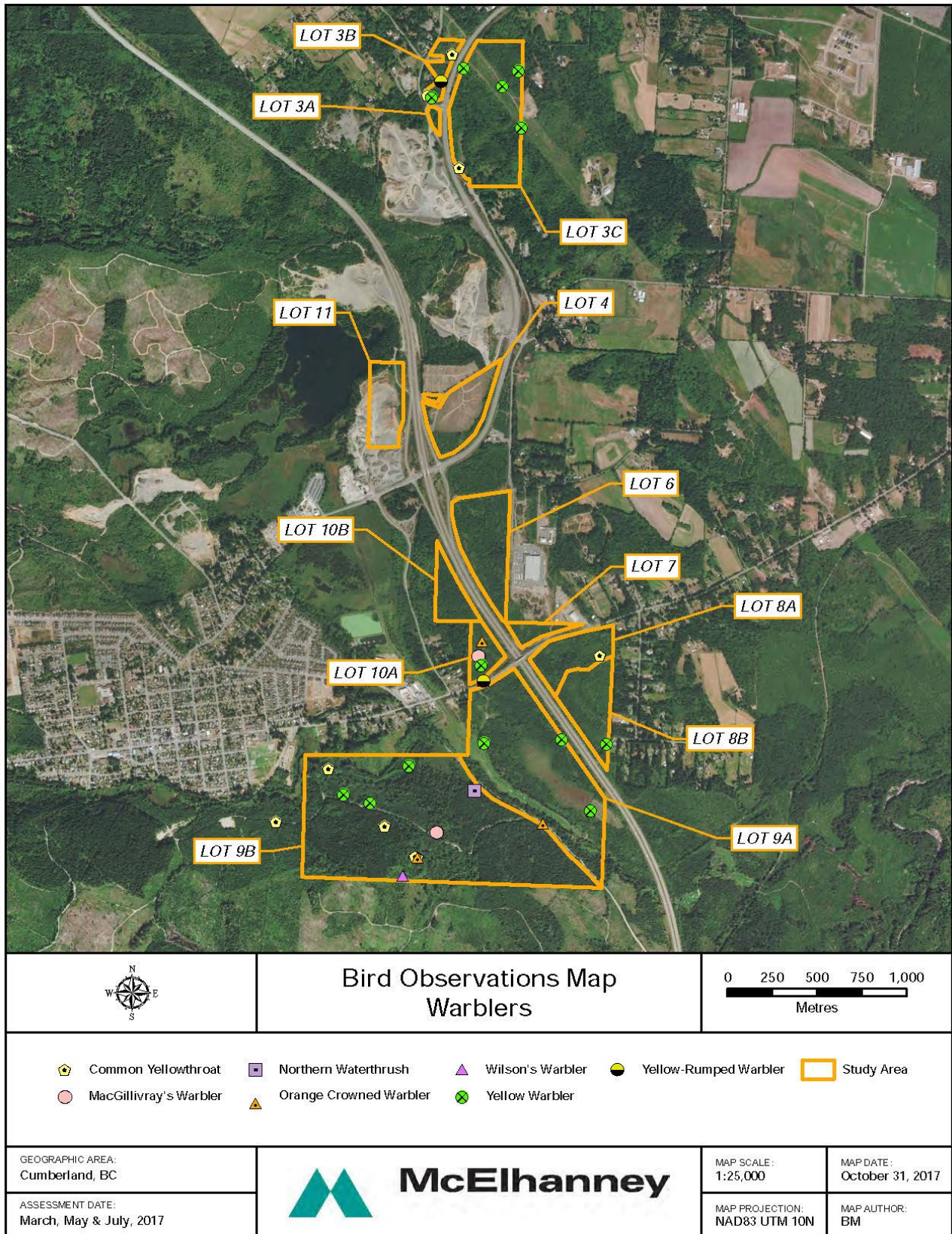


Figure 16. Distribution of species of Warblers observed during the field season.

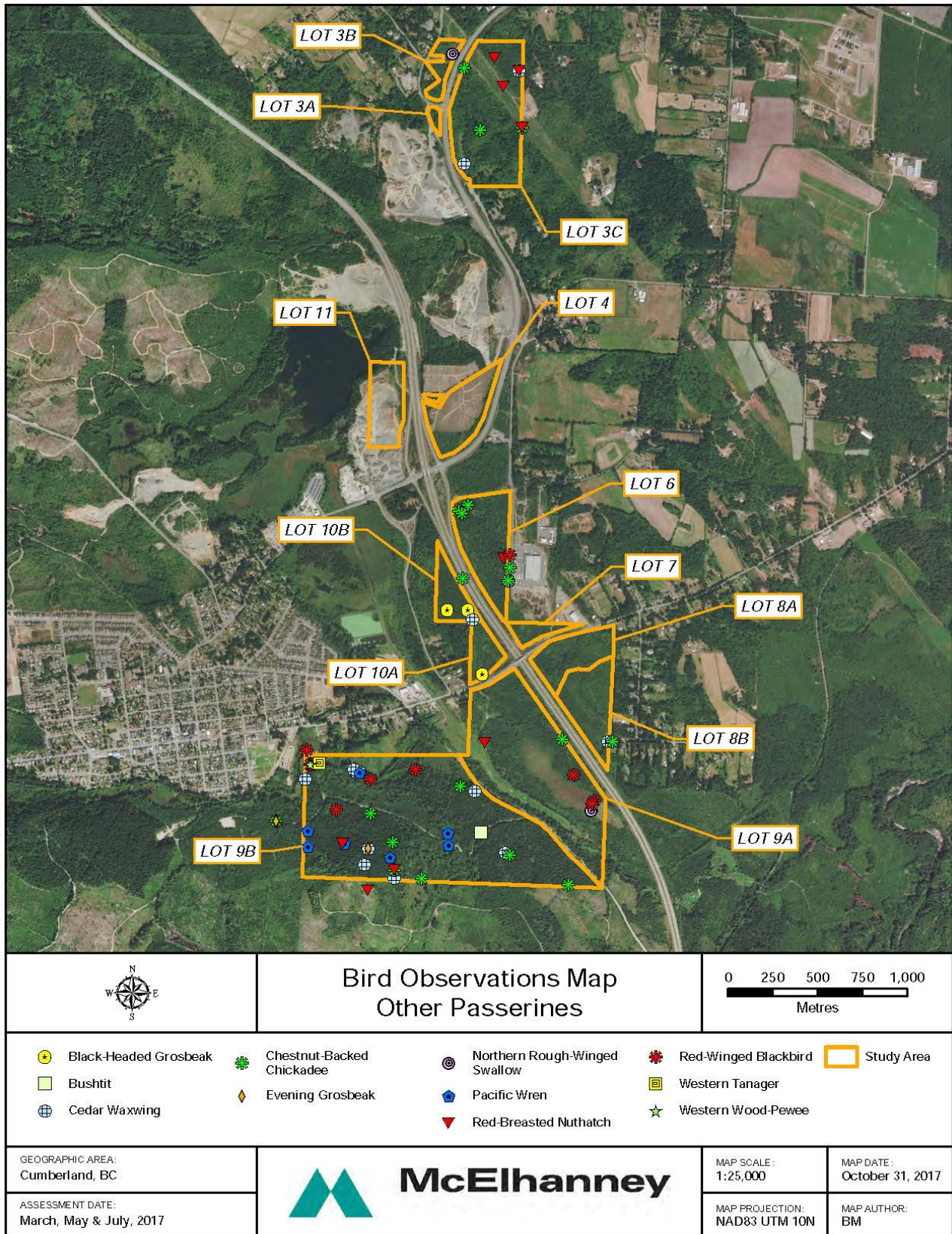


Figure 17. Distribution of other passerines observed in Study Area during the field season.

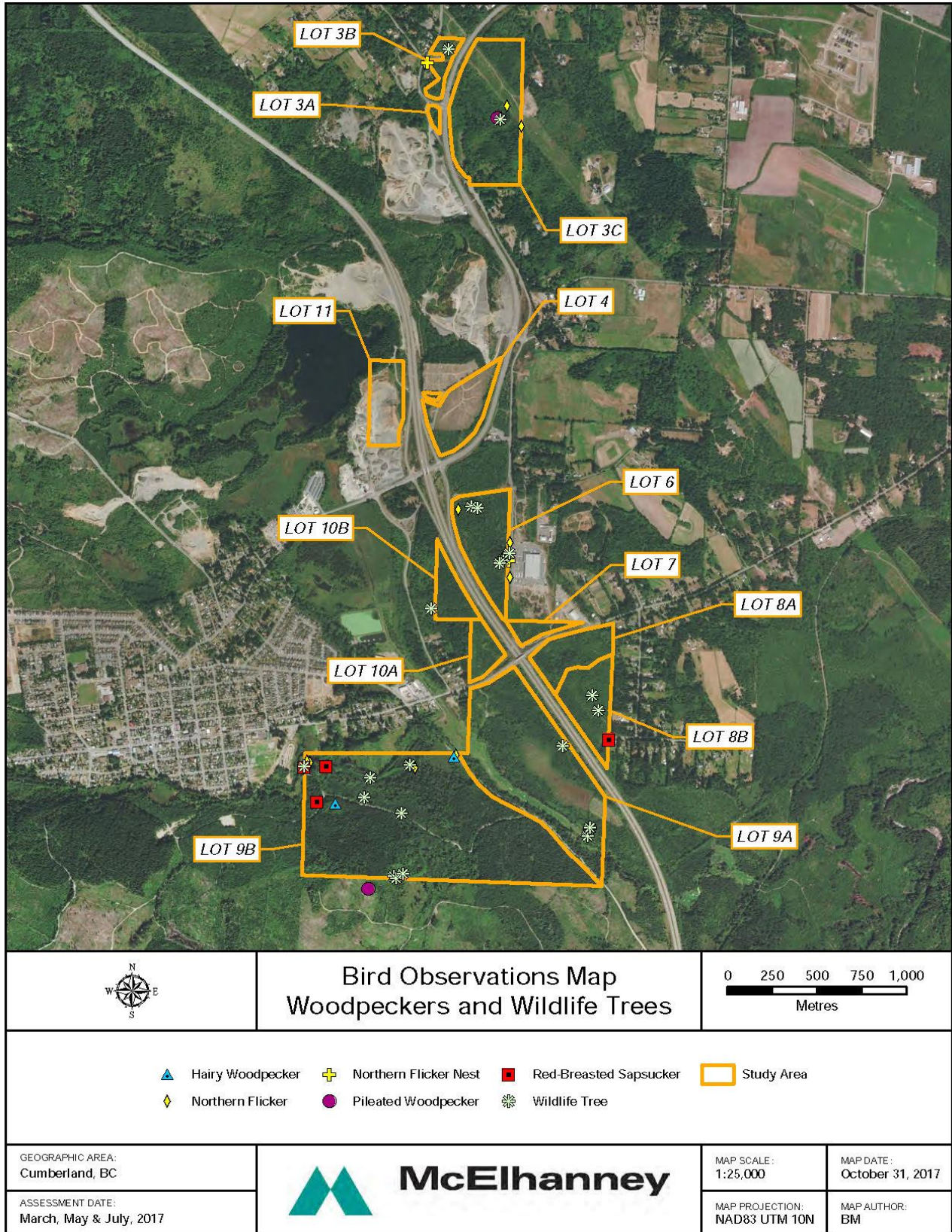


Figure 18. Distribution of Woodpeckers encountered and Wildlife trees (snags, foraging activity) observed in the Study Area during the field season.

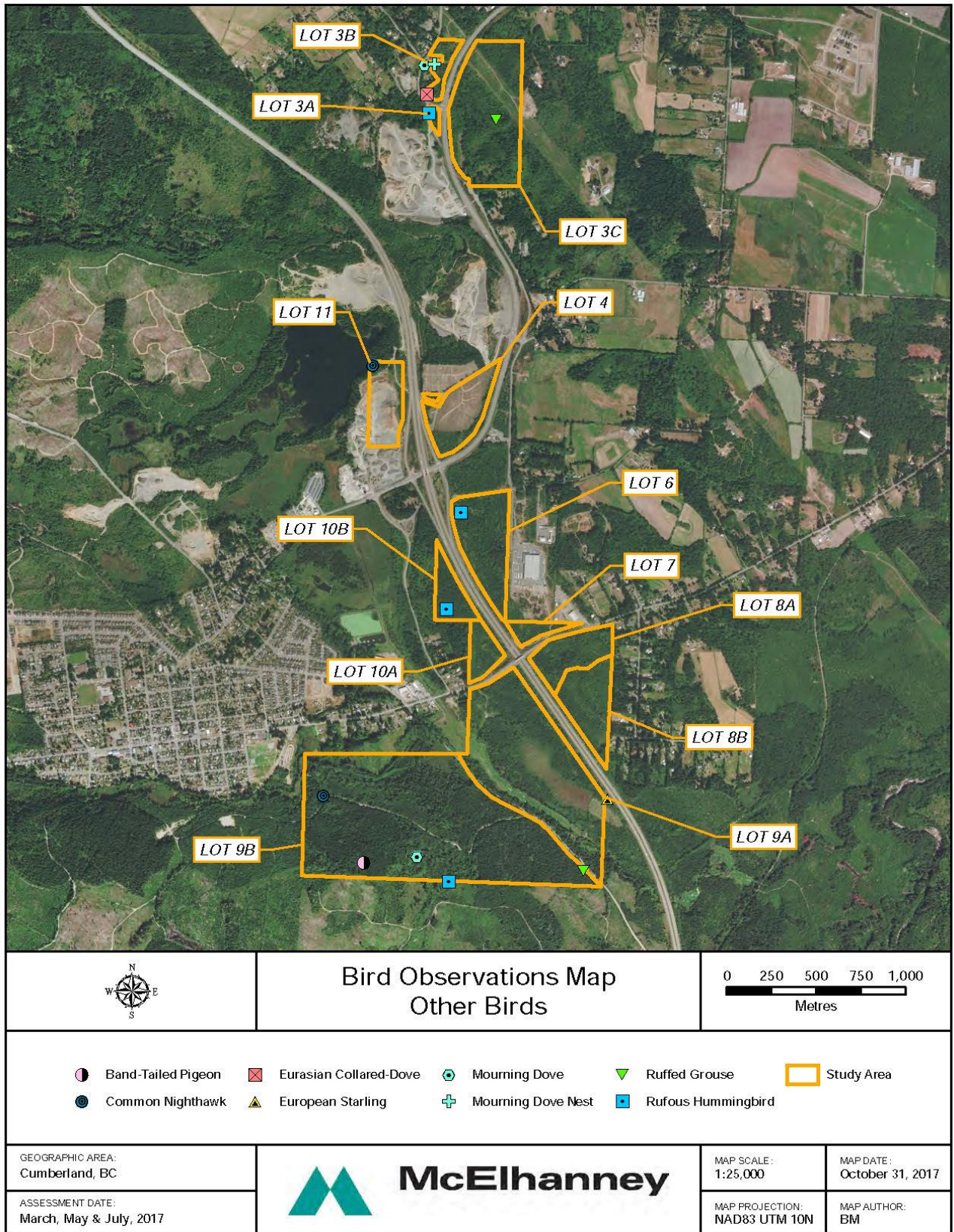


Figure 19. Distribution of some species of birds observed during the field season.

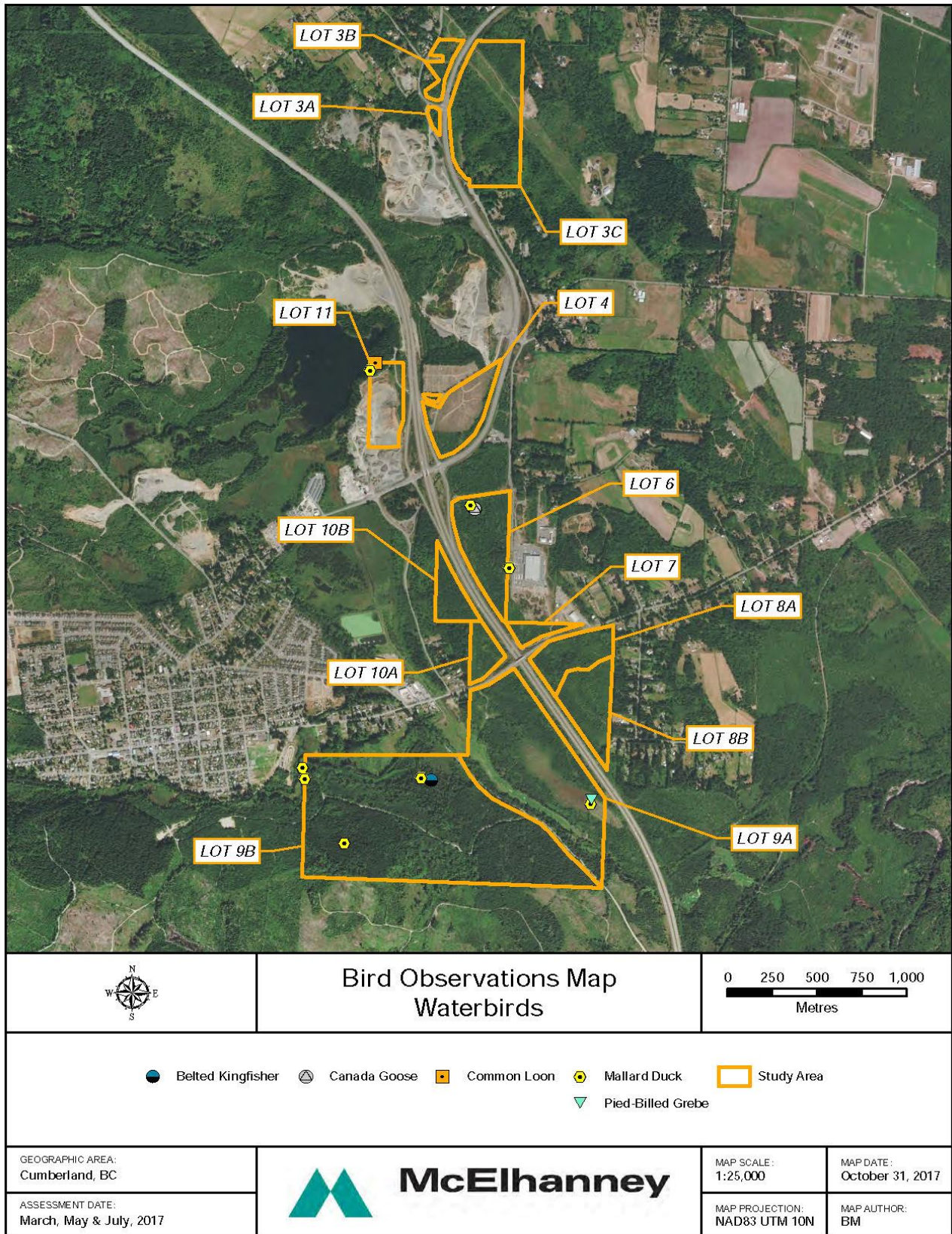


Figure 20. Distribution of species of bird often associated with open water, observed during the 2017 field season.

Lists of bird species observed in the Comox Valley area were compiled from reports of the local CVNS and incidental reporting of biologists working the area. [Table 12](#) provides a list of avian species found in the Comox Valley Area as reported by local naturalist groups. This list includes species that utilize open water areas such as Maple Lake and Comox Lake.

*Table 12. Avian species reported for the CXRD by the CVNS.
(CVNS 2014, 2011)*

English Name	Scientific Name	BC List	SARA ¹	MBCA ²	Habitat Preference
Trumpeter Swan	<i>Cygnus buccinator</i>	Yellow	-	Y	Observed at Maple Lake. Habitat includes bogs, fen, swamps, marshes, lakes and streams, pastures, old field, hedgerow, conifer forest
Mallard	<i>Anas platyrhynchos</i>	Yellow	-	Y	Observed at Maple Lake. Habitat includes bogs, fen, swamps, marshes, streams, pastures, old field, hedgerow
Lesser Scaup	<i>Aythya affinis</i>	Yellow	-	Y	Observed at Maple Lake. Habitat includes bogs, fen, swamps, marshes, lakes and streams, pastures, old field, Pond and Open Water
Harlequin Duck	<i>Histrionicus histrionicus</i>	Yellow	-	Y	Observed at Maple Lake. Habitat includes riparian forest lake and riparian edges.
Bufflehead	<i>Bucephala albeola</i>	Yellow	-	Y	Riparian Forest, Stream, River, Lake, Pasture, Old Field, Hedgerow, Deciduous Forest, Conifer Forest, Mixed Forest
Hooded Merganser	<i>Lophodytes cucullatus</i>	Yellow	-	Y	Observed at Maple Lake. Habitat includes bogs, fen, swamps, marshes, lakes and streams, pastures, old field, hedgerow, conifer forest, deciduous forest, mixed forest
Common Merganser	<i>Mergus merganser</i>	Yellow	-	Y	Observed at Maple Lake. Habitat includes bogs, fen, swamps, marshes, lakes and streams, pastures, old field, hedgerow, conifer forest, mixed forest, deciduous forest.
Common Loon	<i>Gavia immer</i>	Yellow	-	Y	Breeding habitat includes clear lakes containing both shallow and deep water areas. In winter and during migration, common loons use inland lakes and rivers.
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Yellow	-	Y	Marsh; Stream / River; Lake; Pond / Open Water
Red-necked Grebe	<i>Podiceps grisegena</i>	Yellow	-	Y	Winters along seacoasts, bays, and estuaries. In migration, found on lakes, ponds, and rivers. Nests mainly on shallow, freshwater lakes (>2 ha.) or shallow protected marsh areas and secluded bays of larger lakes, usually with at least some emergent vegetation and fish populations.
Turkey Vulture	<i>Cathartes aura</i>	Yellow	-	-	Riparian Forest; Pasture / Old Field; Cultivated Field; Hedgerow; Conifer Forest;
Osprey	<i>Pandion haliaetus</i>	Yellow	-	-	Estuary; Riparian Forest; Stream / River; Lake; Intertidal Marine; Deciduous Forest, Conifer Forest, Mixed Forest,
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Yellow	-	-	Estuary; Bog; Fen; Swamp; Marsh; Riparian Forest; Stream / River; Lake; Pasture / Old Field; Cultivated Field; Hedgerow; Deciduous Forest, Conifer Forest, Mixed Forest,
American Coot	<i>Fulica americana</i>	Yellow	-	Y	Estuary; Bog; Fen; Swamp Marsh; Stream / River; Lake; Pond / Open Water

English Name	Scientific Name	BC List	SARA ¹	MBCA ²	Habitat Preference
Rufous Hummingbird	<i>Selasphorus rufus</i>	Yellow	-	Y	Swamp; Riparian Forest; Riparian Shrub; Pasture / Old Field; Cultivated Field; Hedgerow; Meadow; Grassland; Deciduous Forest, Conifer Forest, Mixed Forest, Riparian Herbaceous
Belted Kingfisher	<i>Megasceryle alcyon</i>	Yellow	-	-	Estuary; Bog; Fen; Swamp; Marsh; Riparian Forest; Riparian Shrub; Stream / River; Lake; Cliff; Intertidal Marine; Subtidal Marine; Urban / Suburban; Pond / Open Water; Riparian Herbaceous
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	Yellow	-	Y	Aspen-pine association and coniferous forest, including humid coastal lowlands; in migration and winter also in open woodland. Nests in trees; bores its own nest-hole cavity.
Northern Flicker	<i>Colaptes auratus</i>	Yellow	-	Y	Riparian Forest; Pasture / Old Field; Cultivated Field; Hedgerow; Deciduous Forest, Conifer Forest, Mixed Forest,
Hammond's Flycatcher	<i>Empidonax hammondii</i>	Yellow	-	Y	Breeds in cool forest and woodland, primarily in dense fir; found in western hemlock / western redcedar / grand fir forests, red fir, mixed conifer, Douglas-fir, ponderosa pine, lodgepole pine, spruce-fir and aspen.
Common Raven	<i>Corvus corax</i>	Yellow	-	-	Various situations from lowlands to mountains, open country to forested regions, and humid regions to desert; most frequently in hilly or mountainous areas, especially in vicinity of cliffs.
Chestnut-backed Chickadee	<i>Poecile rufescens</i>	Yellow	-	Y	Riparian Forest, Deciduous Forest, Conifer Forest, Mixed Forest
Pacific Wren	<i>Troglodytes pacificus</i>	Yellow	-	Y	Coniferous and mixed forests throughout much of the province, rarely occurring in areas of abundant deciduous trees except where small deciduous stands occur adjacent to coniferous forests. This species is typically restricted to moist, closed forests and forest edge habitats, although migrants and wintering birds are often found in habitats away from forests such as brushy habitats (rights-of-ways, clearcuts, etc.), plantations, hedgerows, riparian strips, and suburban parks and gardens.
Golden-crowned Kinglet	<i>Regulus satrapa</i>	Yellow	-	Y	Coniferous forest and woodland (especially spruce), in migration and winter also deciduous woodland, scrub and brush. Nests usually in an evergreen, most often in crown 9-18 m above ground.
American Robin	<i>Turdus migratorius</i>	Yellow	-	Y	American robins use a wide range of habitats, including forest, woodland, scrub, parks, thickets, gardens, cultivated lands, savanna, swamps, and suburbs. They are attracted to areas with damp ground or small fruits. Nests are in forks or on branches of trees or shrubs, on building ledges, sometimes on fences, posts, or cliff ledges, or rarely on the ground; usually 1-6 meters above ground.
Varied Thrush	<i>Ixoreus naevius</i>	Yellow	-	Y	Humid coastal coniferous forest, deciduous forest with dense understory, and tall shrubs (especially alder). Usually nests in a small conifer, sometimes a deciduous tree, 3-4.5 m above ground.
Western Tanager	<i>Piranga ludoviciana</i>	Yellow	-	Y	Breeds mostly in coniferous and mixed mountain woodlands. Migrates and winters in a variety of forest, woodland, scrub and partly open habitats. Usually nests in conifers, on outer portion of limb, 3-20 m above ground.

English Name	Scientific Name	BC List	SARA ¹	MBCA ²	Habitat Preference
Song Sparrow	<i>Melospiza melodia</i>	Yellow	-	Y	Brushy, shrubby, and deep grassy areas along watercourses and seacoasts; marshes (cattail, bulrush, and salt); and, mostly in the northern and eastern portions of range, forest edge, bogs, brushy clearings, thickets, hedgerows, gardens, brushy past. Nests on ground, especially early in season, among clumps of dead grasses, weeds; later often 0.5-10 m up in small conifer, thorny bush, willows, and cattails.
Dark-eyed Junco	<i>Junco hyemalis</i>	Yellow	-	Y	Habitats include various sorts of coniferous, mixed, and deciduous forest; forest edge; forest clearings; bogs; open woodland; brushy areas adjacent to forest; and burned-over lands. In migration and winter, the species occurs in a wide range of openly wooded and brushy and grassy habitat. Nests are in scrapes on the ground and usually are concealed by logs, rocks, tree roots, leaves, or ground vegetation.
Pine Siskin	<i>Spinus pinus</i>	Yellow	-	Y	Riparian Forest; Pasture / Old Field; Cultivated Field; Hedgerow; Meadow; Shrub - Natural; Conifer Forest - Mesic (average); C Deciduous Forest, Conifer Forest, Mixed Forest,
Spotted Towhee	<i>Pipilo maculatus</i>	Yellow			Conifer and mixed forests.

1. SARA Federally listed species at risk, 2. MBCA Federally protected as a migratory bird

5.3.4. Wildlife Trees and Bird Nest Trees

Several passerine nests and an eagle's nest were encountered during the 2017 field season and these observations were mapped on the figures above. Snags, trees with cavities, trees with woodpecker, sapsucker or other species foraging marks encountered during field surveys were mapped as wildlife trees in [Figure 18](#).

Published data from the Wildlife Tree Stewardship program (WiTS 2017) was reviewed for the location of known Bald Eagle and Osprey nests in British Columbia. Active nests were generally found along the coastline of Vancouver Island though a few nest trees have been reported inland (WiTS 2010). One active Bald eagle nest was observed during the field season ([Figure 9](#)).

5.3.5. Wildlife Species at Risk

[Table 13](#) presents wildlife species at risk within the Study Area based on observations during our field reviews, the provincial database reports and desktop study results including incidental sightings reported by Mimulus (2005).

[Appendix D](#) outlines all the species at risk potentially located in the CXRD based on provincial and federal databases.

Table 13. Terrestrial, Amphibian and Avian Wildlife Species at Risk observed during this study or reported for the vicinity of the study area within the CXRD in the BC Species Explorer (CDC 2017b).

English Name	Scientific Name	BC List	SARA ¹	MBCA ²	Type of animal	Habitat Preference
American Water Shrew, <i>brooksi</i> ssp	<i>Sorex palustris brooksi</i>	Red			Mammal	Wetlands and riparian habitat on Vancouver Island.
Band-tailed Pigeon ³	<i>Patagioena s fasciata</i>	Blue	1-SC (Feb 2011)	Y	Bird	Found in temperate and mountain coniferous and mixed forests and woodlands, especially pine-oak woodlands, and locally in southern lowlands; also forage in cultivated areas, suburban gardens and parks. Nests in a tree or shrub 4-10 m from the ground, usually near the bole in dense foliage, and often next to an opening or above a slope or precipice.
Ermine, <i>anguinae</i> subsp	<i>Mustela erminea anguinae</i>	Blue			Mammal	Riparian forests, coniferous or mixed forests (CDC 2017c)
Great Blue Heron, <i>fannini</i> subspecies ³	<i>Ardea herodias fannini</i>	Blue	1-SC		Bird	Nests colonially in tall Sitka spruce, western red cedar, western hemlock, pine, red alder and black cottonwood. Foraging habitat includes aquatic areas generally less than 0.5 m deep (CDC 2017c).
Hairy Woodpecker ³	<i>Picoides villosus</i>	Blue			Bird	Forest, open woodland, swamps, well-wooded towns and parks, open situations with scattered trees. Most abundant in mature woods with large old trees suitable for cavity nesting; common in medium-aged forests; prefers woods with a dense canopy.
Northern Red-legged Frog ³	<i>Rana aurora</i>	Blue	1-SC (Jan 2005)		Amphibian	Breeds in small ponds March through April (MWLAP 2004a, CDC 2017d). Observed in Lot 9b (Mimulus 2005). Requires large (greater than 20 inches in diameter) down logs of mid-decay classes with sloughing bark). Logs are primary microhabitat in spring, summer, and fall on Vancouver Island. Sometimes climbs high into trees. Lays eggs in cavities in rotten logs, in rock crevices, under bark, or among vegetation. The pond in Lot 6 was determined not to have a suitable hydroperiod due to requiring long development period for this species (Wind 2007).
Olive-sided Flycatcher ³	<i>Contopus cooperi</i>	Blue	1-SC- T	Y	Bird	Prefer nesting in conifer forests near wetlands, rivers, or lakes, are migratory (CDC 2017c). Breed May to late July, young regularly observed in July.
Roosevelt Elk	<i>Cervus elaphus roosevelti</i>	Blue			Mammal	Observed in the Maple Lake area and forested habitat of Lot 11 and Lot 9a. Found in conifer, deciduous and mixed forests, riparian areas and wetlands, grassland and shrubby habitat (CDC 2017c).
Wandering Salamander ³	<i>Aneides vagrans</i>	Blue	SC (2014)		Amphibian	Preference of moist / wet conifer forests under bark or rotting logs. High probability at Lot 6 (Wind 2007), Observed on Lot 4C (Mimulus 2005) which was logged in 2017.
Western Red-backed Salamander ³	<i>Plethodon vehiculum</i>	Blue			Amphibian	On Vancouver Island, small individuals were found under small rocks and away from discrete cover objects in leaf litter and under moss more frequently than were larger individuals. Lays eggs on land in moist retreats. On

English Name	Scientific Name	BC List	SARA ¹	MBCA ²	Type of animal	Habitat Preference
						Vancouver Island, adults active on surface mainly March-June and September-November (also in mild winter weather); juveniles remained above ground in midsummer (CDC 2017b, c). Forest, riparian, grassland. High probability at Lot 6 (Wind 2007).
Western Screech Owl ssp. Kennicottii ³	<u>Megascops kennicottii kennicottii</u>	Blue	T (2012)		Bird	Observed at the western edge of Cumberland Village (CXRD 2017). Associated with conifer forests or mixed forests but often found in riparian areas with broadleaf maple or black cottonwood (COSEWIC 2012) and is a year-round resident (CDC 2017c)

1. SARA Federally listed species at risk,
2. MBCA Federally protected as a migratory bird
3. Observed during present study.

Species at Risk Habitat

The CDC maps two of these species in and around the Study Area: the Great Blue Heron (*Ardea herodias fannini*) and the Western Screech-Owl (CDC 2017a, b). The provincially mapped locations of these species are presented in *Figure 21*.

The provincial record for the Great Blue Heron at this mapped locale indicates there are 2 to 11 active nests, though successful reproduction has only been observed in 2007 and 2013 (CDC 2017a). The location of this nest colony was not verified during the field study. With respect to the Western Screech-Owl, the provincial record is of several owls that have been heard in the vicinity over several years. Nesting sites and their current status are unknown.

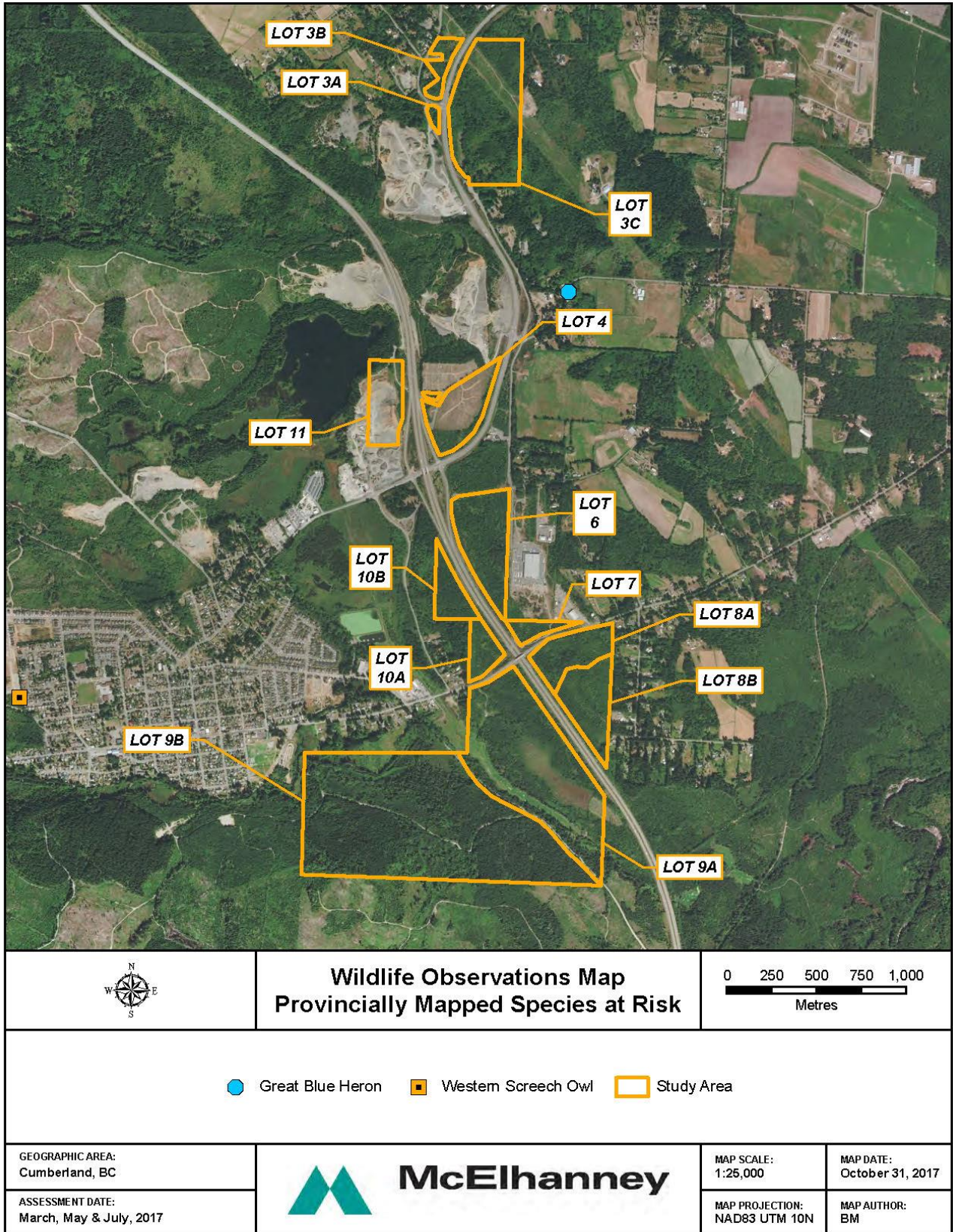


Figure 21. Locations of provincially mapped species at risk around the Study Area (CDC 2017a).

5.4. Watercourses, Wetlands and Aquatic Species Habitat

5.4.1. Wetlands and Watercourses

Wetlands and watercourses located within the Study Area were mapped based on results from previous studies, TEM results and information from the provincial databases. *Table 14* combines information from the provincial database with data from previous on-site studies. This table was updated and revised based on the results of the concurrent TEM and hydrology studies and field work scheduled for March and July.

Table 14. Wetlands identified in the Study Area from the provincial database (CDC 2017a) and from site visits.

Lot #	Feature	Area
9a	Wetland Swamp connected to Maple Creek. ¹	4.24 ha
9b	Connected Wetlands (Swamp) Watershed code: 920-553164-209901 ¹	3.92 ha
10a	Isolated wetland	
8a / 8b	Wetland (connected to drainage) ²	5.7 ha / 2.6 ha
6	Isolated wetlands ²	0.11 ha / 0.16 ha
3c	Swamp to south, Wetlands to the east. ²	
11	Maple Lake Watershed Code: 920-545800-21500 ¹	201.3 ha

1. CDC 2017a, 2. Williams and Wright 2017

Wetlands were identified and classified according to MacKenzie and Moran (2004) by Madrone (*Appendix B*). Wetlands and riparian areas were mapped with setbacks as per the OCP and presented here in the *Appendix B*.

Several watercourses were encountered in the study and are represented by riparian areas in *Figure 22* excerpted from the Madrone report. Ephemeral creeks generally flowed from late fall to late spring. The only permanently flowing watercourses were Maple Creek and its tributary and watercourses in Lot 3C.

5.4.2. Fish and Fish Habitat

The three major watersheds, Maple Lake / Trent River, Piercy / Millard, and Roy Creek, all support fish habitat. The Interchange Lands lie at the headwaters of several creeks within these watersheds. The following is a description of the provincial database of the fish resources in these watersheds.

Maple Creek / Trent River

Maple Lake provides the headwaters for Maple Creek so that the creek maintains water flow all through the year.

Provincial records for the stocking of Maple Lake begin in 1958 with records of rainbow trout (*Oncorhynchus mykiss*) and cutthroat trout (*O. clarkii clarkii*) (FISS 2017). The Fisheries Information Summary System (FISS 2017) data and iMapBC (CDC 2017a) reported observations of Coho salmon (*O. kisutch*), Chum salmon (*O. keta*) and anadromous Cutthroat Trout (*O. clarkii*) in Maple Creek during a study conducted in 1994.

Maple Creek is a tributary of the Trent River. Pink Salmon (*O. gorbuscha*) have been found near at the mouth of the Trent River. The resident time of Pink Salmon within freshwater systems is fairly short as eggs laid during fall spawning hatch between December and February then the fry move downstream to the ocean (SFN 2015). Pink Salmon have not yet been reported for Maple Creek.

Fish species reported in iMapBC for Maple Lake, Maple Creek and the Trent River are listed in [Table 15](#) (CDC 2017a). Stickleback was the only fish species observed during minnow trap sampling in the current study.

[Table 15. Fish species known to occur in Maple Creek and Maple Lake / Trent River System \(FISS 2017, CDC 2017a\)](#)

Common Name	Scientific Name	Condition
Coho Salmon	<i>Oncorhynchus kisutch</i>	Observed
Chum Salmon	<i>Oncorhynchus keta</i>	Observed
Cutthroat Trout	<i>Oncorhynchus clarkii clarkii</i>	Stocked
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	Observed near mouth of the Trent River
Rainbow Trout	<i>Oncorhynchus mykiss</i>	Stocked
Steelhead	<i>Oncorhynchus mykiss</i>	Stocked
Three-spined Stickleback	<i>Gasterosteus aculeatus</i>	Observed

A study conducted on the tributary to Maple Creek (the Hancock Forest Stream Classification-2010) reported observations of Three-spined Stickleback (*Gasterosteus aculeatus*) (CDC 2017a). Three-spined Stickleback was the only fish observed in this tributary by both our study and the Hancock Forest Stream Classification-2010.

Roy Creek

The headwaters of Roy Creek (Watershed Code: 920-547200 (FISS 2017)) lie between Lot 4 and Lot 6. Roadside drainages and culverts along the perimeters of these lots contribute a small amount of water to the Roy Creek drainage. Seeps, drainages and ditched outflow points at wetlands contribute water from Lot 8.

Provincial records for Roy Creek ([Table 16](#)) report the presence of rainbow trout, cutthroat trout (anadromous), and Chum Salmon (FISS 2017, CDC 2017a).

[Table 16. Fish species known to occur in Roy Creek \(FISS 2017, CDC 2017a\)](#)

Common Name	Scientific Name	Condition
Coho Salmon	<i>Oncorhynchus kisutch</i>	Stocked and Observed
Cutthroat Trout	<i>Oncorhynchus clarkii clarkii</i> (anadromous)	Observed

Common Name	Scientific Name	Condition
Chum Salmon	<i>Oncorhynchus keta</i>	Observed in low reaches of watershed

The fisheries resources of the Roy Creek watershed were studied by McElhanney in 2010 (McElhanney 2010). There are no fish bearing reaches of Roy Creek in the Cayet lots in this study.

Piercy / Millard

Millard-Piercy Watershed Stewards (MPWS) conducted an assessment of fisheries resources in this watershed (MPWS 2000). Piercy Creek (Watershed code 920-551800-52000) and Millard Creek (Watershed Code 920-551800) merge to become one creek in their lower reaches. Fish species reported in these creeks are listed in [Table 17](#). Artesian wells, seeps and wetlands in evidence on Lot 3 may provide water downstream to this system through natural and manmade drainage channels though connectivity has not been verified.

*Table 17. Fish species known to occur in the Millard-and Piercy Creeks.
(FISS 2017, CDC 2017a)*

Common Name	Scientific Name	Condition
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	Observed
Coho Salmon	<i>Oncorhynchus kisutch</i>	Observed spawning location in lower reach of Millard Creek and Piercy Creek
Chum Salmon	<i>Oncorhynchus keta</i>	Observed spawning location in lower reach of Millard Creek
Cutthroat Trout	<i>Oncorhynchus clarkii clarkii</i>	Observed spawning location in lower reach of Millard Creek and Piercy Creek
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	Observed
Rainbow trout (freshwater)	<i>Oncorhynchus mykiss</i>	Observed
Steelhead trout	<i>Oncorhynchus mykiss (anadromous)</i>	Observed

5.4.3. Invertebrate Species

During watercourse sampling for amphibians and fish, some invertebrate species were encountered. [Table 18](#) lists species encountered in minnow trap catches and observation locations during the 2017 field season.

Table 18. Aquatic and Terrestrial Invertebrates

English Name	Scientific Name Species, Family or Order	Type of Invertebrate	Location of Observation (UTMs)	
			Easting	Northing
Scud	<i>Amphipoda</i>	Aquatic Insect	354926.49	5501866.59
			354930.42	5501867.39
			354246.69	5498108.98
Giant Water Bug	<i>Belostomatidae</i>	Aquatic Insect	355854.65	5497936.86
Water Boatman	<i>Corixiae</i>	Aquatic Insect	355084.16	5498169.48

English Name	Scientific Name Species, Family or Order	Type of Invertebrate	Location of Observation (UTMs)	
			Easting	Northing
			354930.42	5501867.39
			354245.83	5498106.35
Predacious Diving Beetle	<i>Dytiscidae</i>	Aquatic Insect	355854.65	5497936.86
			355927.60	5498859.34
			355084.16	5498169.48
			355394.05	5499165.45
Minnow Mayfly	<i>Siphonuridae</i>	Aquatic Insect	354209.52	5498094.39
Caddisfly	<i>Trichoptera</i>	Aquatic Insect	355842.10	5497902.35
			355861.91	5497944.27
			354926.47	5501864.29
			354930.42	5501867.39
			354247.7	5498124.86
			354239.79	5498123.21
			355931.02	5498222.82
			354246.69	5498108.98
Freshwater leech	<i>Hirudinea</i>	Aquatic Worm	354252.61	5498113.10
			355849.76	5497932.96
			355084.16	5498169.48
Chocolate arion	<i>Arion rufus</i>	Terrestrial Mollusc	355833.09	5497881.07
			355231.25	5498660.73
			355403.51	5499258.57
			355767.62	5498326.36
			354416.01	5497853.19
Grovesnail	<i>Cepaea nemoralis</i>	Terrestrial Mollusc	354334.44	5498125.59
			355939.32	5498232.75

5.4.4. Wildlife Corridors and Habitat Connectivity

Natural ecosystems around developing urban areas are often retained to provide habitat and pathways or movement corridors for wildlife. Wildlife corridors connect or support ecological processes that occur across the landscape and promote plant and animal species dispersal for genetic mixing and population security (Cumberland 2014).

Promotion of ecological connectivity is central to the environmental protection contemplated in OCP. Important habitats that provide for biodiversity include wetlands, creeks and their riparian areas as well as unusual landscape features such as bluffs and cliffs. Corridors connect such habitat areas within the subject properties as well as connecting with habitat areas in the surrounding landscape. Corridor planning for the subject properties has been presented by Civitas (2006) and Ecofish (2017) and has been a key consideration within the current study. The following conceptual mapping (*Figure 22*) is a compilation of information from the above cited sources and McElhanney (unpublished data). Technical data defining the proposed wildlife corridors is presented in *Table 19*. Corridor IDs presented in *Table 19* may be used to cross reference with corridors mapped in *Figure 22*.

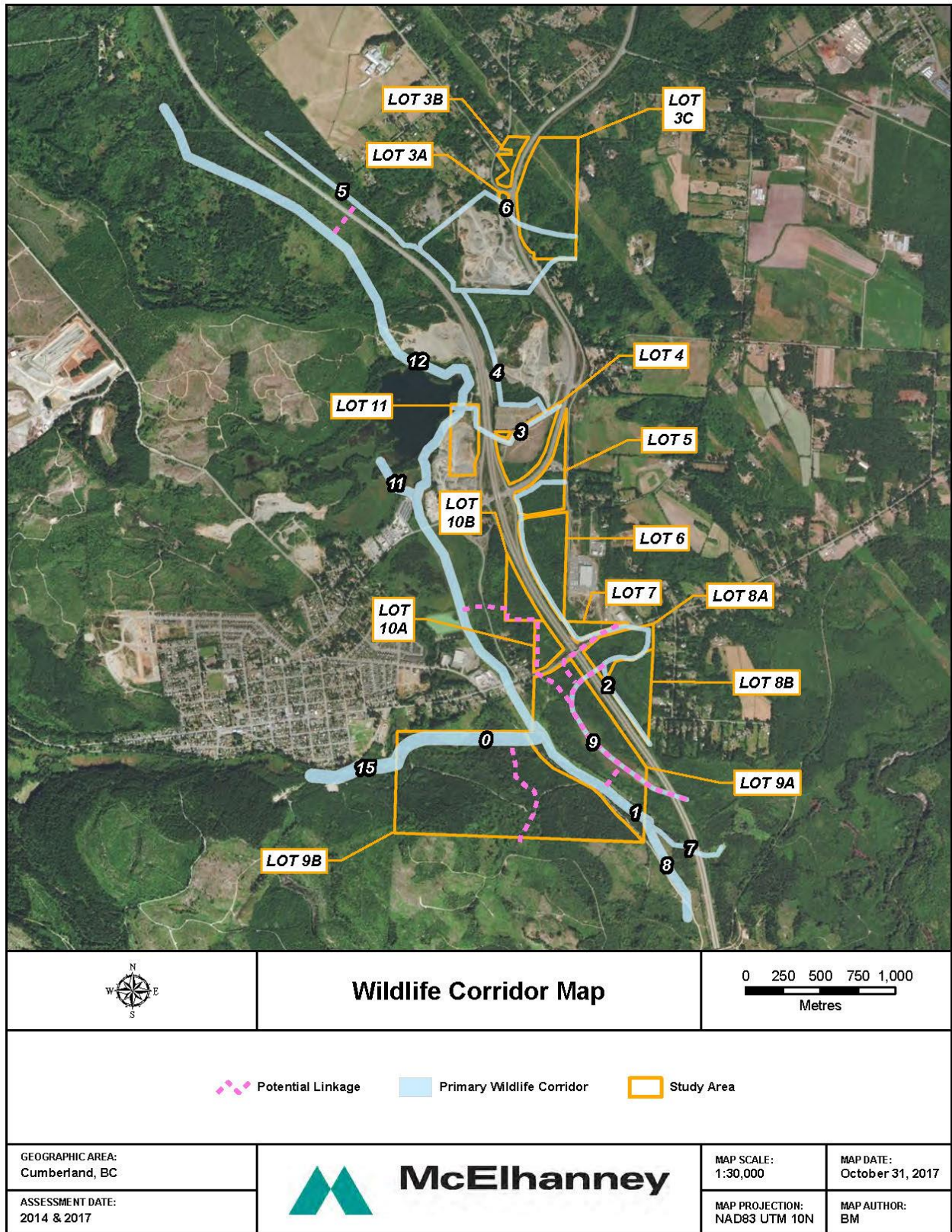


Figure 22. Wildlife corridor map for the Study Area and surrounding habitats. Corridor information is provided on Table 19.

Table 19. Description of wildlife corridors proposed for the Cayet Development (compiled by Ecofish 2017).

Corridor ID	Recommended Corridor Width (m)	Corridor Linkage ¹	Species Usage	Author	Buffer (m)
0	90	Primary	Use by large predators: cougar, bear, deer, elk, small mammal, amphibians	Trilogy / ERL	45
1	60	Primary	Bear, deer, elk, small mammals, amphibians	Trilogy / ERL	30
2	30	Primary	Deer, bear	ERL	15
3	30	Primary	An unfenced highway crossing for deer	Trilogy	15
4	30	Primary	Deer	Trilogy	15
5	30	Primary	Connects to Morrison Headwaters; potential amphibian, bear, deer, small mammal	Trilogy	15
6	30	Primary	Deer	Trilogy	15
7	30	Primary	Connects Maple Creek (fish bearing) through culvert across highway towards Trent	Trilogy	15
8	60	Primary	Connects south; elk	ERL	30
9	30	Potential Link	Connects wetland east of highway to those on west side through culvert; potential amphibian corridor; bear and deer use overpass on Royston Road.	ERL	15
10	0	Potential Link	Maintain a point of connection between 2 wetlands	ERL	0
11	60	Primary	Corridor around Maple Lake; bear, elk, potential amphibian	ERL	30
12	60	Primary	Corridor through industrial area and around Maple Lake; bear, elk, potential amphibian	ERL	30
13	0	Potential Link	Maintain a connection corridor; abundant deer use	ERL	0
14	0	Potential Link	Maintain connection points between both sides of highway	ERL	0
15	90	Primary	Used by predators and prey: Cougar, bear, deer, elk, small mammals, amphibians	ERL	45
16	0	Potential Link	Abundant deer use	ERL	0
17	0	Potential Link	Connects west and east sides of highway; bear and cubs observed frequently, deer	ERL	0

¹ Primary: known frequent use. Potential Link: Expected link but location not confirmed.

5.5. Summary of Protected Areas

Figure 23 maps the areas identified as restricted development zones. It compiles information previously presented in *Figures 6, 9 and 22*. *Figure 6* maps ESAs and setbacks per OCP specifications (Cumberland 2014). *Figure 9* shows the location of an eagle nest near the southeast corner of Lot 9a. The eagle nest comprises an ESA in addition to those mapped in *Figure 6*, and is assigned a 200-m buffer per the terms of Develop With Care (MOE 2014b). *Figure 22* maps wildlife connectivity corridors. Together these comprise the restricted development areas identified during the current study. Large ESA areas in Lots 3c, 6, 8a, 9a and 9b comprise core habitats. The connectivity design provides for wildlife movement within the Study Area and between habitat areas preserved within the Study Area and neighbouring habitat outside the Study Area.

Future development applications will need to protect these areas pursuant to the regulatory standards in place at the time of application.

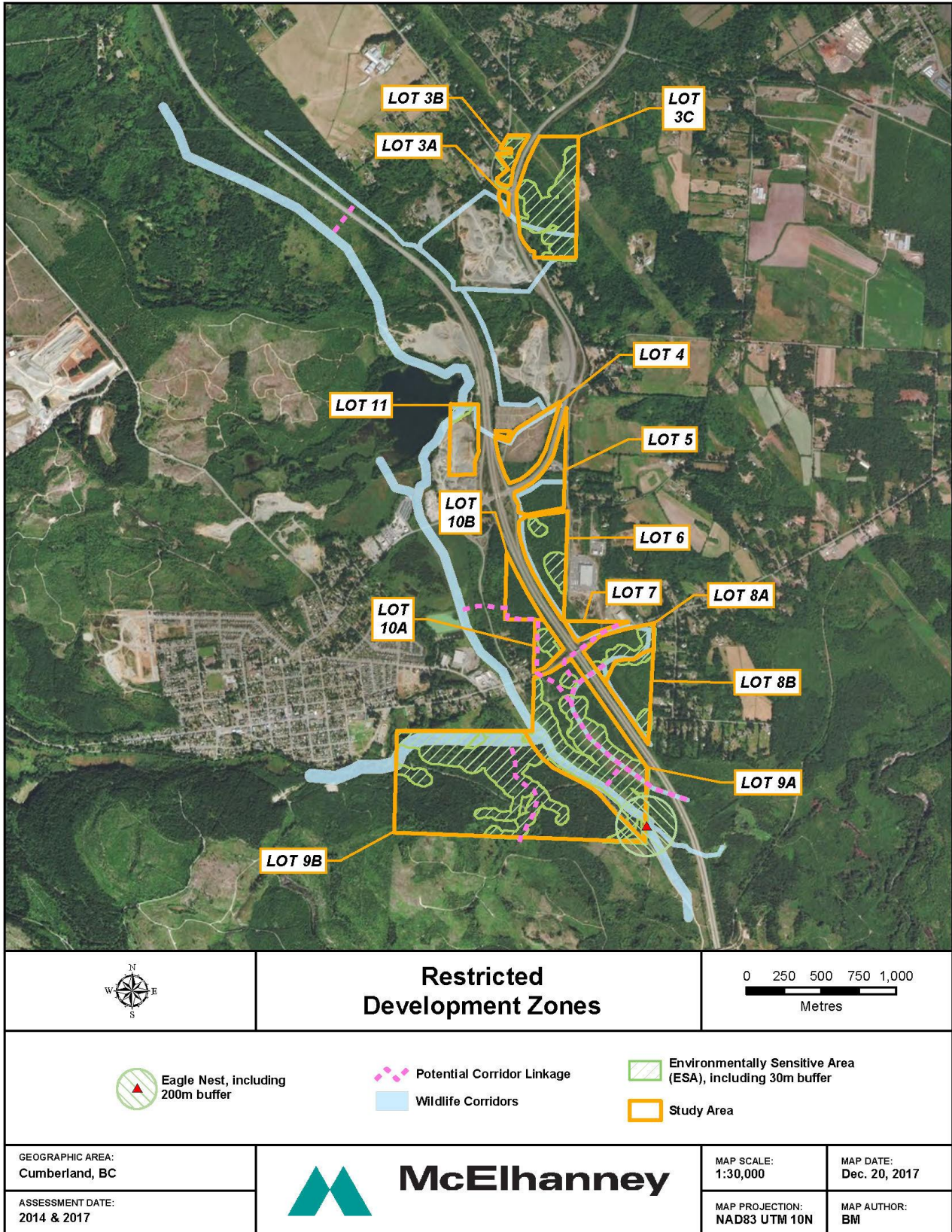


Figure 23. Presentation of ESAs and associated buffers as well as connectivity corridors.

6. Potential Project Impacts

The current development permit application is for subdivision and no physical development activities are included in the application. Consequently, the current application will result in no environmental impacts within the lands under application.

Future detailed development plans are anticipated for the lots resulting from this subdivision. However, no plans currently exist and it is only possible to fulfill a portion of the requirements of OCP Section 10 based on currently available information. Pursuant to the OCP terms described in Section 2.3, Table 2 in Section 3 delineates the areas that are fulfilled herein and those that will need to be fulfilled at a subsequent stage.

Detailed bioinventories associated with future development plans will be required for the anticipated individual lot development plans. Those bioinventories will need to include detailed environmental impact assessments and associated mitigation strategies and implementation plans.

The current study, along with the TEM and hydrology studies included in the appendices, provides the foundation for future studies which will complete the fulfillment of the OCP requirements. The current study is compliant with the regulatory environment and environmental features in place at the time of writing. As regulatory environments and biotic and physical features can change with time, future applications will need to interpret both the data and the advice provided here-in in the context of regulatory, biotic and physical features in place at the time of those future development applications.

7. Mitigation Strategies

This section presents avoidance or mitigation strategies to reduce potential impacts associated with the alteration of the natural environment during land development activities. These mitigation options, among others, are a template for standard best practices and measures to be employed for the protection of the environment for activities that may be employed in this project. All advice contained in this section should be interpreted based on the regulatory environment in place at the time of individual lot applications.

7.1. Hydrology and Wetlands

7.1.1. Water Quality

Mitigation measures and best management practices (BMPs) to protect surface water quality during construction include:

- Develop and employ an Erosion and Sediment Control (ESC) plan to manage the installation and maintenance of erosion control measures (e.g., exposed surface protection, silt fences, matting, gravel, and check dams),

- Employment of proper measures containing / isolating works and prevention of materials (such as debris, soil or other deleterious materials) being placed within, or spilling into watercourses, wetlands and their riparian areas,
- Effective management of site water and ESC measures to protect water quality. Prevention of erosion is the first line of defense in ESC. Rigorous attention to the protection of erodible surfaces can greatly reduce or eliminate the generation of sediment laden waters. If erosion occurs, contain sediment laden waters and treat appropriately to meet legislated standards. Delivery of sediment laden waters to robust vegetative buffers often results in waters emerging from the buffers meeting legislated standards. Where vegetated buffers fail to prevent the release of sediment laden waters, additional sediment control measures up to and including on-site treatment may be required to effectively treat sediment laden waters and achieved legislated standards prior to waters entering ESAs.
- Employ established BMPs to prevent waste and potential contaminants from construction equipment entering the environment.

7.1.2. Water Quantity

Future development plans should employ Low Impact Development (LID) concepts such as infiltration galleries, rain gardens and/or ponds to mitigate potential impacts. Each site will need to be assessed and designed as lot-by-lot development plans emerge. Groundwater tables and subsurface soil types will dictate the best options, but to investigate these now is pre-mature and these measures will need to be deferred to the preparation of future development plan applications.

7.1.3. Wetlands and Watercourses

Mitigation measures around wetlands and watercourses include the determination of protective setbacks or 'buffers' from the top of bank to where development may occur. These protective buffers are legislated under the provincial *Riparian Areas Protection Act*, and administered under RAR by municipalities through development permit areas. These protective buffers are usually intact areas of riparian vegetation which provide for wildlife habitat and fish life processes. Development within these buffers is prohibited. Appropriate buffers were determined and provided in the mapping of the wetlands and watercourses in the current report. It is anticipated that these will be refined based on detailed studies to be completed under RAR at the future development permit application stage.

7.1.4. Watersheds

Watershed extents outside the subject properties are described above in Section 5.1.3 Hydrology. As stated above, future development plans should be based on LID concepts to mitigate potential impacts. While neighbouring land use issues are best addressed during the detailed design phase, the following summarizes current land uses to act as a guide in developing future plans.

The Study Area lies along the headwater boundaries of the Millard / Piercy Creek and Roy Creek watersheds, and upstream land uses are limited primarily to road rights-of-way, and for Lot 3c, a gravel pit on the west side

of the Comox Valley Parkway. Extensive land uses downstream of the Study Area in the Millard / Piercy Creek and Roy Creek watersheds will need to be examined at the next stage of development. Important hydrological consideration will include wells and water licenses for the Roy Creek watershed (McElhanney 2010). Similar concerns may exist for the Millard / Piercy Creek watershed.

As *Figure 5* demonstrates, the Maple Creek watershed upstream of the Study Area includes most of the old village of Cumberland and recently logged areas to the north of the village centre. Downstream of the Study Area, Maple Creek flows roughly 1.8 km to join the Trent River 5 km southwest of its estuary. Upstream and downstream uses will need to be examined in detail in the future development permit applications.

7.2. Timing Windows for Fish and Amphibians

7.2.1. Fish

Least risk windows assist developers in applying BMPs to protect fish and fish habitat when contemplating works around water, and must be applied to all instream activities that have a risk of causing deleterious materials to enter fish streams. They generally apply to fish streams and non-fish bearing streams whose waters flows into fish streams. The sensitive life stages that they're intended to avoid include adult migration, spawning, incubation, emergence and juvenile rearing. Least risk or work windows are timed to fall outside these sensitive periods and generally occur during summer months.

The Ministry of Forest, Lands, and Natural Resource Operations and Rural Development (FLNRO) has developed reduced risk work windows for fish species common to Vancouver Island streams. *Table 9* represent the least risk time periods or dates by species (FLNRO 2011).

Table 20. Least risk instream work windows for fish and wildlife for Vancouver Island.

Species	Least Risk Work Window	
	Start Date	Finish Date
All Species	June 15	September 15
Steelhead	June 15	September 15
Rainbow Trout	August 15	September 15
Cutthroat Trout	August 15	September 15
Dolly Varden	June 15	September 1
Chinook	July 15	September 15
Chum	May 15	September 15
Coho	June 15	September 15
Pink	May 1	August 15
Sockeye	June 1	September 15

Species	Least Risk Work Window	
	Start Date	Finish Date
Kokanee	June 1	September 15

The general least risk fisheries timing window for instream work on Vancouver Island is June 15th to September 15th; however, where the fish species present at the work site are known, then the timing window should be based on the species present. The most restrictive dates should be selected, and the start and finish dates shown in [Table 19](#) may be for different species to adequately protect all fish resources. Least risk windows should be based on fish presence by watershed as presented in [Tables 14, 15 and 16](#) and the species-specific start and finish dates presented in [Table 19](#).

7.2.2. Amphibians

Amphibians also have sensitive breeding periods. While there are no specific least risk timing windows for amphibians, FLNRO recommends use of the general least risk fisheries timing window for instream work of June 15 to Sept 15 ([Table 19](#)). The MOE web page on “General BMPs and Standard Project Considerations” also provides guidance for projects involving any work in and about a stream (MOE 2017b). Amongst other recommendations, this site specifies that a qualified environmental professional should monitor construction near aquatic habitat to check for movements of juveniles away from the breeding waters in the summer and fall. General best management practice is to avoid construction activities during periods when amphibians and reptiles are congregated for breeding, nesting, or seasonal migrations; migrations could involve migrations of juvenile frogs, toads, and salamanders to foraging habitats in late summer, or movements of turtles to terrestrial nesting sites (WSP 2009, MOE 2003). Sensitive habitats for amphibians and reptiles include wetlands, riparian areas, talus slopes, nest sites, and denning areas (MWLAP 2004a).

Amphibian breeding studies should be conducted during the bioinventories required for the preparation of development permit applications at the next stage of development. Results of those studies will inform the determination of least risk work windows for amphibians on a waterbody by waterbody basis.

7.3. Wildlife, Birds, and Bird Habitat

Project construction will require implementation of provincial guidelines and BMPs to comply with federal and provincial environmental protection legislation. Following finalization of development plans for individual lots, regulatory requirements and mitigation strategies recommended here may need to be updated or reassessed.

The development contractor will need to retain a qualified biologist to conduct wildlife surveys of the immediate development areas (site plus 100m) prior to construction. All-important wildlife features including, protected raptor nests, active nests and den sites will need to be marked and appropriate minimum buffer distances established (MOE 2014b). In addition to the use of buffer zones or setbacks, least risk timing windows in which the disturbance of wildlife is minimized must be considered.

7.3.1. Least Risk Timing Windows for Birds

Nests and breeding activities of local bird species and certain specified species are protected under the provincial *Wildlife Act*. Migratory breeding birds and their active nests are protected under the federal *MBCA*. As vegetation provides nesting and foraging habitat for birds and other animals, there is the potential to contravene Section 36 of the *Wildlife Act* and the *MBCA* with the cutting of trees and shrubs for project construction. During their breeding season, birds are especially sensitive to noise disturbances and may desert their nests and young. Construction timing windows for birds (*Table 21*) are the most suitable periods for performing works that would otherwise impact sensitive life stages, and the recommended BMP for tree and vegetation clearing is to complete works outside of the general nesting period.

In addition, particularly noisy activities such as those that may be created during construction (i.e. chain saws, certain heavy equipment) should be scheduled outside of the breeding season when possible. While the nesting period for bird species varies by species, the general bird breeding period is March through August (MOE 2014b). Nesting periods for migratory birds in the area can be determined through use of the nesting calendar query tool (Canada 2016).

If vegetation clearing or other disruptive construction activities must be conducted during the breeding period, a qualified biologist should be engaged by the construction contractor to survey the Site for active nests and flag no-go buffer zones around active nests. Monitoring of active nests for disturbance within 200m of construction noise is recommended (MOE 2014b). Nests should be monitored for signs of disturbance behavior until each nest has fledged. Clearing vegetation outside the general nesting period does not require a pre-clearing survey. If project activity occurs near a protected nest, a protective buffer is required so that damage or disturbance to the nest and nest tree does not occur.

Table 21. Bird Breeding Season and Least Risk Timing Windows for Compliance with Wildlife Act 34.¹

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bald Eagle												
Other birds												
Great Blue Heron												
Migratory Birds												

¹(MOE 2014 a, b, c)

 Breeding Window  Least Risk Window

7.4. Invasive Species

Control of designated noxious and invasive species is required by the Province under the *Weed Control Act* (BC 1997). Due care should be taken to protect the development site and surrounding area from the introduction of invasive plants during construction. Mitigation measures include:

- Keeping equipment and vehicles clean to prevent tracking of soil on or off site,

- Inspect work clothes at the beginning and end of every day,
- Chemical application for vegetation control should not occur within 30 m of any wetland, unless otherwise authorized,
- Providing fill and topsoil clean of seeds of invasive species, and
- Treatment of nearby infestations.

7.5. Summary of Environmental Components, Potential Impacts and Recommended Mitigation Strategies

Table 22 provides a template for avoiding impacts that may develop as detailed design is completed for individual lots in future. The general approach employed in developing *Table 22* was based on implementation of standards and BMPs to assist in compliance with federal, provincial and municipal environmental protection legislation and regulations.

BMPs and standards at the time of writing included “Standards and Best Practices for Instream Works (MWLAP 2004b, Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck *et al.* 1993), Stormwater Planning: A Guidebook for British Columbia (Stephens *et al.* 2002), Develop with Care Environmental Guidelines for Urban and Rural Land Development in British Columbia (Section 3 - Guidelines for Ecosystems and Species Protection (MOE 2014a) and Section 4), Access Near Aquatic Areas: A Guide to Sensitive Planning, Design and Management (MOE 2014b) and other best management practices guides produced by the provincial government. Designs developed for future applications should reflect these documents as well as others included in the regulatory regime at the time of writing.

Table 22. Potential impacts of land development activities and best management practices / mitigation measures that may be applied to avoid or mitigate those impacts.

Biophysical Component to be Mitigated	Potential Impact	Activities that may impact environmental components	Mitigation Measure	Goals in Managing Residual Impact
Soils	Alteration or disturbance of soils.	- Land based clearing and construction - Site regrading / infilling - Excavations - New road surfaces, - Accidental spills of deleterious substances	- Use of natural landscaping techniques. - Soils stripped during site preparation should be stockpiled (with cover to prevent soil erosion or incursion by invasive species) and re-use on site during landscaping. - Ensure that at least 20 cm of topsoil is replaced on all future lawn areas after development has been completed. This will promote deeper-rooted lawns and plants that will require less water in summer and will be able to absorb more rainwater in winter. - Use established best management practices to isolate deleterious substances from ESAs and their buffers, and to contain and control any substances which spill.	- Employ mitigation measures and proper pre-construction stripping of soils for re-use to retain the health of the soils to be reused. - Target avoidance of impacts in sensitive habitat areas and associated buffers.
	Altered drainage patterns	- Land based clearing and construction - Site regrading - Installation of hard surfaces	- Use of appropriately qualified professionals to create site drainage plan that will maintain current water quantities within the Study Area - Use appropriate setbacks - As specified in the Hydrology Report (Appendix A), employ LID measures to sustain hydrological function in future development plans.	Avoid impacting onsite and offsite drainage patterns through use of LID technologies.
	Erosion and sedimentation	- Land based clearing and construction - Stripping and stockpiling of soils	- Develop an ESC that controls erosion and sediment generation at source rather than requiring treatment sediment-laden water. - Minimize the extent of the area cleared at any one time. Cover exposed surfaces to prevent erosion and promptly revegetate disturbed areas as work in each area is completed. - Revegetate using appropriate native plant species that will quickly re-establish vegetation cover - Apply erosion protection measures to stockpiled materials to minimize the risk of sediment release	Utilize established ESC BMPs and standards to avoid introduction of deleterious materials to ESAs.

Biophysical Component to be Mitigated	Potential Impact	Activities that may impact environmental components	Mitigation Measure	Goals in Managing Residual Impact
Wetlands, Watercourses and Aquatic Habitat			if sediment bearing waters are generated, employ additional sediment control measures up to and including on-site treatment to achieve legislated standards prior to release of affected waters.	
	Compaction	Heavy equipment uses on site	- Soil compaction can be reduced by avoiding the use of machinery near retained vegetation wherever possible - Strip topsoil and retain it for reuse prior to the extensive use of heavy equipment during construction	- Avoid impacts on stored soils - Mitigation measures and proper pre-construction stripping of soils for re-use should retain the health of the soils to be reused.
	Loss of native soils	- Land based clearing and construction - Removal of stockpiled materials offsite	Retain soils and reuse within the project footprint	- Avoid loss of native soils - Avoid impacts on ESAs and buffers.
	Loss, alteration or disturbance of wetlands or watercourses.	- Construction or infrastructure and permanent buildings - Failure of ESC or deleterious material control protocols	- Establish wetlands, watercourses and aquatic habitat as ESAs with appropriate buffers - Employ established BMPs to avoid failure of ESC or deleterious material control protocols - Employ professionally qualified environmental monitors with the authority to stop work in the event of said protocol failures.	- Avoid impacts on aquatic resources - Should environmental damage occur, provide mitigation and rehabilitation of the impacted ESA per the terms of OCP S. 10.1.5 paragraph 6)
	Alteration or loss of fish habitat	General construction works, grading and infill.	- Construction to be completed in the least risk timing windows for fish; periods during the year where construction impacts are minimized. - Delineate riparian setbacks as no-go zones for equipment by protecting with fencing (e.g. snow-fencing).	- Avoid impacts on fish habitat - Should environmental damage occur, provide mitigation and rehabilitation of the impacted ESA per the terms of OCP S. 10.1.5 paragraph 6)
	Accidental spill of deleterious substances that degrade the water quality, such as fuel, oil or spills from equipment	- Spills from heavy equipment such as fuel or hydraulic fluid - Concrete pouring - Generation of sediment laden water during construction works	- Protection of water quality through use of ESC measures as appropriate - Develop and employ a spill prevention and response plan - Recommend containment of works involving the use of concrete, cement, mortars, and other Portland cement or lime-containing construction materials. - Include measures that will not deposit, directly or indirectly, sediment, debris, concrete and	- Avoid spills resulting in deleterious materials entering ESAs - Mitigate spills where necessary through application of the recovery procedures defined in the spill prevention and response plan

Biophysical Component to be Mitigated	Potential Impact	Activities that may impact environmental components	Mitigation Measure	Goals in Managing Residual Impact
			concrete fines, wash or contact water, into any watercourse or wetland	
	Potential for construction materials (including fill) to be inadvertently placed into a watercourse, wetland or it's vegetated buffer zone	• Placement of laydown areas for equipment storage • Soil stockpiling	• Storage and stockpiling of material on an approved upland area • Employ fencing and signage around ESAs and associated buffers to delineate as no-go zones for equipment	• Manage construction materials to avoid impacts on ESAs and associated buffers.
	Alterations to hydrology by installing hard surfaces in surrounding land use and re-grading the adjacent land	• Construction of buildings, parking lots, roads, sidewalks, playground and paved areas	• Develop and implement a stormwater management plan • Employ LID concepts to result in post-development hydrological regimes sustaining predevelopment hydrological features.	• Avoid negative impacts on local and regional hydrology
	Altered water quantity flowing into or out of a watercourse or wetland	• Site regrading causing change in drainage patterns. • Stormwater collection away from natural pathways of flow.	• Use a qualified professional to develop a drainage plan and stormwater management plan • Employ LID concepts such as infiltration galleries to promote natural subsurface flows and groundwater recharge.	• Avoid negative impacts on local and regional hydrology
	Sediment loading or erosion during construction, or alterations to soil chemistry or quality	• Land based clearing and construction • Stockpiling of soils	• Land based construction managed through standard erosion and sediment control plans which are to be maintained until all disturbed ground has been permanently stabilized. • As much as possible, schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation	• Contain all impacts within the footprint of the developable area under each issued development permit.
	Changes in the natural hydroperiod	• Re-grading of surface resulting in changes in catchment areas for watercourses or wetlands	• The use of a qualified professional to develop a drainage plan and stormwater management plan • Retain natural drainage catchments and patterns • Employ LID concepts such as bioswales to facilitate natural infiltration	• Avoid negative impacts on local and regional hydrology
Plant Species & Communities	Introduction of invasive species	• Disturbance to soil and vegetation clearing during site preparation	• ESC design should result in staged removal of vegetation to minimize the amount of exposed soils at any point. • Replace removed vegetation with new native plantings as quickly as possible to further	• Minimize temporal extent of localized disturbances to the environment

Biophysical Component to be Mitigated	Potential Impact	Activities that may impact environmental components	Mitigation Measure	Goals in Managing Residual Impact
			minimize the amount of exposed soils at any point. Use local native plants adapted to local climates in landscaping; which once established, will need less maintenance and watering than non-native plants.	
	Damage or loss of native plant communities and species	Vegetation clearing during site preparation	- Project design should retain vegetation where appropriate. - Offset impacts by retaining a landscaping architect to create a revegetation plan to replace removed vegetation with new native plantings, as feasible within the project footprint - Use local native plants in landscaping that are adapted to local climates - Manage weeds according to the provincial guidelines	- Minimize impacts on local plant communities - Where impacts to local vegetation are unavoidable, mitigate by replanting with native plants as soon as possible
	Potential root zone disturbance of trees to be retained	Damage to root zones by construction activities	- Erect a fence at the outer limit of the critical root zone of trees to be retained, which is (defined as the distance around the tree at a radius equal to 10 times the diameter of the tree (at breast height) or outside the dripline of the tree, where feasible. - Avoid damage to the root system, trunk or branches of any retained tree. - Do not place any material or equipment within the critical root zone of the tree. - Do not attach any signs, notices or posters to retained trees.	Employ mitigation measures to avoid impacts on retained trees.
	Decrease in biodiversity	Increase in invasive species to newly disturbed areas	- Re-establishing native vegetation along new or disturbed edges of natural features by seeding or transplanting locally appropriate native species. - Design re-planting plan to sustain or enhance local biodiversity - Control of designated noxious species when encountered.	- Employ mitigation measures to avoid impacts - Design recovery plan to sustain or enhance local biodiversity
Wildlife and Habitat	Loss or disturbance of wildlife and active	Land based clearing for development	Construction to be completed during the least risk timing windows for birds, which are periods	Manage construction to avoid impacts.

Biophysical Component to be Mitigated	Potential Impact	Activities that may impact environmental components	Mitigation Measure	Goals in Managing Residual Impact
	breeding sites (burrow, nests, dens, etc.)	Noise generated during construction	during the year where construction impacts are minimized. - If work occurs during the bird breeding season ensure that a Qualified Environmental Professional (QEP) is to complete nesting surveys prior to construction. - Preparation of bird management plans should be prepared by a QEP to protect nests and nesting birds as encountered. - Conduct similar studies for terrestrial wildlife breeding sites.	
	Barrier to wildlife movement & loss and/or fragmentation of wildlife habitat	Connectivity is broken by roadways and installation of fencings and permanent structures	- Employ the connectivity strategy presented herein, - Adapt as needed to meet the specifics of future development plan applications	Design future development application plans to avoid fragmentation of wildlife habitat and facilitate wildlife movement within the Study Area and between the Study Area and adjacent habitats.
	Reduced habitat suitability	Development of lawn or grass surfaces requiring maintenance such as mowing and pesticides	- Provide protective buffers on ESAs and wildlife connectivity as provided for herein - Use responsible pest management practices to avoid harming non-pest wildlife	Sustain habitat suitability within ESAs and protective buffers

8. Conclusion

A detailed bioinventory of the Cayet lands was conducted in the spring and summer of 2017 and the results are presented herein. Environmental legislation was reviewed to determine the environmental protection measures to be applied and best practices to be considered for the mitigation of potential impacts to identified ESAs. Environmentally sensitive features within and surrounding the Study Area were identified and mapped. Requirements for habitat connectivity within and through the subject properties were also delineated and mapped.

This bioinventory provided baseline data to inform the potentially developable areas within the subdivided lots and assist future planning for the development of these lots while protecting environmentally sensitive features and ESAs. Future site-specific data and reporting needs to support impact assessments, mitigation measures, and restoration plans to accompany anticipated lot-by-lot development permit applications are recommended in this report.

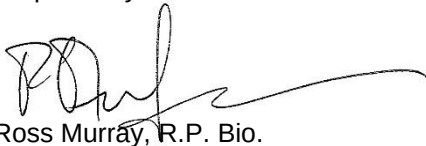
9. Closing

The information presented in this report is for use by the Village of Cumberland and Trilogy Properties VI Corporation. This study was prepared based on available provincial and regional data and field research. We trust the information provided is sufficient to meet your needs at this time.

Respectfully submitted,

McELHANNEY CONSULTING SERVICES LTD.

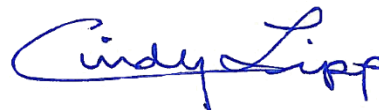
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