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Canada Nature Fund: Community-Nominated Priority Places for Species at Risk

Kootenay Connect: Columbia Wetlands
Literature Review of Species at Risk in the Columbia Valley

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The Columbia Wetlands Stewardship Partners

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KCP Kootenay Conservation Program

Executive Summary

This report for the Kootenay Connect-Columbia Wetland focal area provides the first comprehensive list of species at risk (SAR) in the 180-km long Columbia Valley, from Canal Flats to Donald. This report summarizes the research that has been conducted to date for bird, plant, mammal, reptile and amphibian SAR. The species that remain to be reviewed in detail are ungulates and carnivore species (e.g., bighorn sheep, grizzly bear, mountain goat); in year two of Kootenay Connect these species will be used to help determine the location of high priority landscape level corridors in the Columbia Valley. Two focal species (Columbia spotted frog, Rocky Mountain elk) were selected to aid in the process of locating west-east connectivity corridors.

The study determined that a total of 65 species at risk (SAR) species and 21 ecological communities at risk are found within the study area:

- 35 bird species
- 2 amphibian species
- 2 reptile species
- 9 mammal species
- 7 vascular plant species
- 2 fish species
- 6 invertebrate species
- 1 fungus and 1 lichen species
- 21 ecological communities

Included in this assessment is the collation of SAR spatial occurrences in the Columbia Valley study area, obtained through various data sources such as the British Columbia Conservation Data Centre (B.C. CDC), eBird database, final reports from projects supported by funding agencies (e.g., Columbia Basin Trust, Fish & Wildlife Compensation Program), the knowledge of the author and other local experts, and government data. All known spatial occurrences for SAR were entered into excel tables that were subsequently converted into maps (using ArcGIS), in order to provide a detailed overview of the spatial occurrence for each SAR in the Columbia Valley.

Based upon what is already known, this qualitative and spatial collation of data was used to help identify data gaps and provide recommendations for conservation actions that will help conserve and enhance SAR in the Columbia Valley. The spatial data is also being used to help identify biodiversity hotspots and potential areas for habitat connectivity on the larger landscape. This document provides the main source of information for SAR in the Columbia Valley. Sources such as the B.C. CDC are too underfunded to be able to have a comprehensive list of SAR and their occurrences for every region in the province.

The species assessment presented here has outlined several recommended conservation actions and data gaps, once filled, will aid with the identification of biological hotspots and linkage areas within the Columbia valley, and work towards species at risk recovery efforts. A major gap in our knowledge base includes location information for most of the at-risk ecological communities. Fish, bat, Rocky Mountain elk migration routes, and amphibian data are also pointedly lacking.

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1.0 Introduction

Kootenay Connect is a four-year project funded by Environment and Climate Change Canada in which over 25 Kootenay Conservation Program (KCP) partners, including the Columbia Wetlands Stewardship Partners (CWSP), are working together to enhance and restore habitat for species at risk in four biodiversity hotspots in the Kootenay region. The Kootenay Connect project is the result of a recent analysis that identified 12 key areas within the Kootenays that are critical for wildlife movement corridors and for conserving at-risk and other vulnerable species (Proctor & Mahr, 2019). Kootenay Connect aims to enhance, restore, and manage large riparian and wetland complexes to support the recovery of numerous species at risk (SAR) and of conservation concern. The overarching goal is to maintain and enhance biological hotspots by focusing on habitat connectivity within and between valley bottoms and mountain ranges. In the case of this analysis the main focus is valley bottom riparian wetland, the Columbia Wetlands. Grizzly bear and wolverine are focal species that will be used to represent the greatest extent of upland connectivity. It is important to include habitat that goes up to their high-quality upland habitats.

Kootenay Connect is currently focusing on four key areas identified where KCP's partners have been active in conservation and stewardship. The CWSP group was formed in 2006 and has been active on conservation and stewardship activities in the Columbia valley ever since. This group is made up of more than 30 diverse groups of community interests, First Nations and government agencies, created to develop effective stewardship and management practices for the Columbia Wetlands and the Upper Columbia River. The partnership works to engage the general public and works with all levels of governments to implement a shared stewardship model for the management of the Columbia river and wetlands. In year one (2019-2020) of the Kootenay Connect – Columbia Wetlands project, the CWSP needed to address what is currently known about SAR in the Columbia Valley to help identify biodiversity hotspots, linkage areas, and data gaps in our knowledge that would be necessary to fill in order to satisfy the overarching goal of the four-year project.

A literature review was conducted in order to determine what is known about federally and provincially listed SAR in the Columbia valley, including their locations and habitats in the Columbia Wetlands and riparian areas. This report provides the first comprehensive list of species at risk in the Columbia Valley (from Canal Flats north to Donald). It also includes two focal species (Columbia spotted frog, Rocky Mountain elk) that have been chosen to help identify wildlife corridors for habitat connectivity. This report summarizes all of the research that has been conducted to date on these at-risk and focal species, including the collection of all occurrence data through various data sources. This qualitative and spatial assessment is being used to help assess data gaps and provide recommendations for conservation actions that will help conserve and enhance SAR in the Columbia Valley. The spatial data is also being used to help identify biodiversity hotpots and potential areas for habitat connectivity on the landscape.

The report provides a coalition of research and data collected though the British Columbia Conservation Data Centre (B.C. CDC), eBird database, result of projects supported by funding agencies (e.g., Columbia Basin Trust, Fish & Wildlife Compensation Program), the knowledge of experts, and government data. It will provide the main source of information for species at risk in the Columbia Valley, as sources such as the B.C. CDC are too underfunded to have a comprehensive list of species at risk and their occurrences for every region in the province.

1.1 Designations

Various designations can be used to conserve species at risk and their habitats and some are referred to throughout this paper. Legislative frameworks outlining various forms of protection and ranking systems available as outlined under federal and provincial jurisdiction are provided in Table 1. Examples of these various forms of protection are as follows:

1) The Minister responsible for the Wildlife Act may identify any or all of the following as a Wildlife Habitat Feature (WHF) in the Kootenay Boundary Region: the nest of a bald eagle, osprey, flammulated owl, great blue heron, Lewis's woodpecker; an American badger burrow, a grizzly bear den, a significant mineral lick, a bat hibernaculum, a significant wallow, a hot spring or thermal spring (Province of B.C., 2018).
2) Under the Forest and Range Practices Act, the Minister responsible for the Wildlife Act can establish two categories of wildlife that require special management, species at risk and regionally important wildlife. "Identified wildlife are managed through the establishment of Wildlife Habitat Areas (WHAs) and the implementation of general wildlife measures (GWMs) and wildlife habitat area objectives, or through other management practices specified in strategic or landscape level plans'' (Ministry of Environment, n.d.). Creating a WHA is a lengthy approval process, whereas WHF identification provides immediate habitat protection.
3) Recovery strategies and action plans are developed by Environment and Climate Change Canada for Endangered, Threatened and Extirpated species. These plans identify the main threats to SAR survival, as well as identify, when possible, the habitat that is necessary for their survival and recovery in Canada. Species of Special Concern benefit from the development of a management plan, which includes conservation goals for the species (Government of Canada, 2019).
4) Critical habitat (CH) is defined by the Species at Risk Act (SARA) as "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified in a recovery document for the species". CH is designated in either a SAR recovery strategy or an action plan for SAR. An action plan or amendment (which are normally very slow to come) to the recovery strategy are ways to update and modify CH in an already developed recovery strategy. Reporting nesting records to Environment and Climate Change Canada (ECCC) and the B.C. CDC is the easiest way to ensure these data are incorporated. Regulations for critical habitat only apply where the CH occurs on protected federal land, unless an Order is applied (there have only been a few orders applied nationwide).

Table 1. Legislative frameworks outlining various forms of protection and ranking systems.

Jurisdiction	Responsible Agency	Legislative Framework	Form of Protection	Ranking System
Federal	Environment and Climate Change Canada	Migratory Bird Sanctuaries under the Migratory Bird Sanctuary Regulations' Schedule	Migratory Bird Sanctuary (MBS) - can be established on private, provincial, territorial or federal land. National Wildlife Area (NWA) - under the Canada Wildlife Act, National Wildlife Areas.	Various criteria considered for MBS and NWA, e.g., supports populations that are concentrated; area is vulnerable to area-specific threats; areas that support threatened, endangered or rare species; regularly supports at least 1% of a population of one species or subspecies.
	COSEWIC (Committee on the Status of Endangered Wildlife in Canada)	Species at Risk Act (SARA, 2002)	Recovery Strategies developed by Enironment and Climate Change Canada are required for endangered and threatened species, and Management Plans for species of concern. Recovery strategies and critical habitat identification does not apply for species of concern.	Endangered: facing imminent extirpation or extinction. Threatened: species likely to become endangered if nothing is done to reverse factors leading to its extirpation or extinction. Species of Concern: species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
Provincial (British Columbia)	NatureServe and CDC (Conservation Data Centre	None	Provide an objective ranking system based on all sources of credible information regarding distribution, abundance, trends and threats.	S = Provincial; N = National; G = Global; X = Extirpated or extinct; H = Historical 1=critically imperiled; 2=imperiled; 3=vulnerable; 4=apparently secure; 5=secure; ?=unranked; U=unrankable
	Province of BC, Ministry of Water, Land and Air Protection	Wildlife Act; BC Species at Risk Strategy (Endangered Species and Ecosystems in BC)	Red-listed (sometimes Blue-listed) species require special management attention by protecting critical habitat in the form of special management guidelines.Wildlife Habitat Areas (WHA), General Wildlife Measures (GWM), and Higher Level Plans.	Red-listed: Any species or ecosystem that is at risk of being lost (extirpated, endangered or threatened). Blue-listed: Any species or ecosystem that is of special concern. Yellow: Any species or ecosystem that is at risk of being lost.
	Ministry of Water, Land and Air Protection	Forest and Range Practices Act Identified Wildlife Management Strategy (IWMS)	Wildlife Habitat Areas (WHA), Wildlife Habitat Features (WHF), General Wildlife Measures, and Higher Level Plans.	Schedule 1 species list (section 11 (1)) (May 6th, 2004): Red and Blue listed species negatively affected by forest or range management on Crown Lands. WHF Order (July 1, 2018)

Note - Summary tables prepared by the South Coast Conservation Program (Bedore 2014; SCCP 2016) and the Whistler Biodiversity Project (Brett, 2016) were used to help prepare this table.

1.2 Research objectives

A number of objectives were completed during this research project working towards the overarching goal of maintaining and enhancing biological hotspots by focusing on species at risk, biodiversity hotspots and habitat connectivity within and between the valley bottom and mountain ranges. Research objectives were as follows:

- Determine a workable study area boundary for the Columbia Valley.
- Develop a comprehensive list for all SAR in the study area.
- Review and summarize information available in the British Columbia Conservation Data Centre (B.C. CDC) database on species at risk, habitats and locations for at-risk bird, amphibian, mammal and plant species in the upper Columbia Valley.
- Complete a literature review on nearly all 65 identified SAR and 21 at-risk ecological communities.
- Assemble available spatial and qualitative data on SAR populations into excel format, including occurrence locations and habitat types primarily used, when known.
- Provide a summary of recent (2015-2019) bird information obtained from the Columbia Wetlands Waterbird Survey (CWWS), including map production of bird SAR occurrences.
- Provide an overview of information from the (2016-2019) Columbia Wetlands Marsh Bird Monitoring Project (CWMBMP), including map production of bird SAR occurrences.
- Create maps for most SAR within the study area using available occurrence data obtained through all available sources.
- Produce a map indicating the areas of highest waterbird concentration during bird migration.
- Produce a map indicating the spatial distribution of swans (trumpeter/tundra) in the Columbia Wetlands during migration.
- Create a map that highlights ungulate habitat in the study area.
- Create a map that overlays all available data (other than ungulate) including federally legislated critical habitat (CH), provincially legislated Wildlife Habitat Areas (WHAs) and Wildlife Habitat Features (WHFs). This map is being used to start addressing locations of east-west wildlife corridors in the Columbia Valley.
- Make recommendations for conservation action, including what species require additional inventory in 2020 and beyond, due to current data gaps.

2.0 Study Area

The Columbia Valley is located at the northern end of the Rocky Mountain Trench, in southeastern British Columbia (Figure 1). The study area at 549058.24 hectares in size, is a diverse ecological mosaic comprising a wide variety of habitat types including montane, subalpine, grasslands, lakes, valley bottom and higher elevation wetland ecosystems. Biogeoclimatic zones within the Columbia Valley study area are Engelmann spruce -- subalpine fir, interior cedar – hemlock, interior douglas-fir, montane spruce and interior mountain-heather alpine (Figure 2). The area is part of the traditional territory of

the Ktunaxa Nation (Akisqnuk First Nation), Secwepemc First Nation (Shuswap Indian Band) and Metis Nation Columbia River.

The Columbia Wetlands located in the valley bottom, is one of the largest contiguous wetlands in North America, making them an important refuge for species which rely on wetlands for important stages of their life history. The Columbia Wetlands is identified as an essential habitat component of the Pacific Flyway, which in North America, is the westernmost primary migratory bird corridor of which there are four (Wilson, 2010). This ecosystem plays an important role as migration stopover habitat for birds (Kaiser, McKelvey & Smith, 1977), providing a refuge where birds can fuel up and rest during the necessary long migratory flights requiring substantial amounts of energy. The Columbia Wetlands and valley bottom also provides vital habitat for a number of ungulates, mammal, amphibian, reptile, invertebrate, fish and plant species.

The Columbia Wetlands are designated with Ramsar status, a designation that acknowledges this wetland system has international significance. Approximately 60.1% of the Columbia Wetlands has been designated as a Wildlife Management Area (WMA) (BC Hydro, 2014), with the provincial government [Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD)] as land managers. By definition, a WMA is an area of land designated under section 4(2) of the Wildlife Act for the benefit of regional to internationally significant fish and wildlife species or their habitats. There are additional conservation properties in the study area, including Burgess and James Gadsden Provincial Park, Columbia National Wildlife Area, and lands owned by The Nature Trust of British Columbia and the Nature Conservancy of Canada. Much of the study area is adjacent to additional world-class conservation lands such as Glacier, Yoho and Kootenay National Parks, Mount Assiniboine Provincial Park, Bugaboo Provincial Park, and the Purcell Wilderness Conservancy Park.

The ecologically-defined “fuzzy” study area boundary for the Columbia Valley was chosen based upon five criteria: 1) the northern and southern ends of the Columbia Wetlands from Donald in the north to Canal Flats in the south; 2) elevation of 1500 meters to capture upper-montane to valley bottom; 3) higher elevation boundary in some areas represents the lower edge of predicted wolverine and grizzly bear habitat – these are the focal species that represent our higher elevation connectivity goals across valley bottoms; 4) National Park boundaries – important to connect habitat in the valley to those lands that are already protected and relatively nearby, 5) the inclusion of major tributaries were incorporated to some degree. There is also some benefit to connecting habitats up to existing protected areas (e.g., National Parks) when they are nearby, and there is some relevance to extending the study area boundaries into some tributaries that appear to contain important habitat for species at risk.

Figure 1. Map depicting the study area boundary.

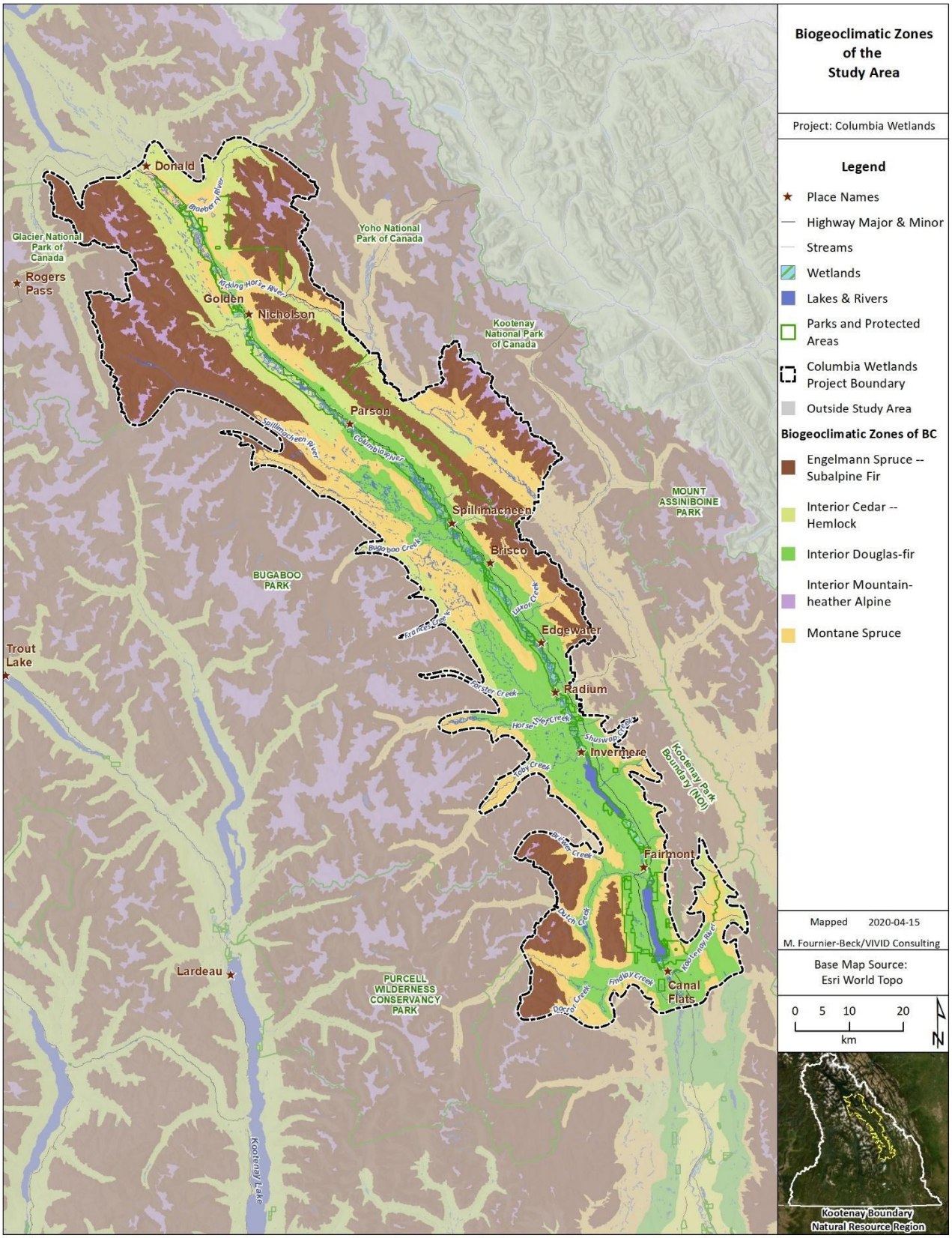


Figure 2. Biogeoclimatic zones of the study area.

3.0 Methods

Various data sources such as the British Columbia Conservation Data Centre (B.C. CDC), eBird database, iMap BC, final reports from projects supported by funding agencies (e.g., Columbia Basin Trust, Fish & Wildlife Compensation Program), the knowledge of the author and other local experts, and government data was used to identify and search for locations of species at risk and at risk ecological communities in the study area. Species and ecosystems at risk with either provincial (red or blue) and/or federal status (Endangered, Threatened, Special Concern), and within the areas of Columbia Shuswap Regional District (CSRD) and Regional District of East Kootenay (RDEK) located within the Columbia Valley study area were assessed. A number of spatial layers were used from various sources and were used to create the maps provided in this report, which were produced by Vivid Consulting.

4.0 Results

This study determined that a total of 65 species at risk species and 21 ecological communities at risk are found within the study area, as follows:

- 35 bird species
- 2 amphibian species
- 2 reptile species
- 9 mammal species
- 7 vascular plant species
- 2 fish species
- 6 invertebrate species
- 1 fungus and 1 lichen species
- 21 ecological communities

Information on each of these at-risk bird, amphibian, reptile, mammal, fish, vascular plant species and ecological communities will be presented in the following sections. Conducting a literature review for invertebrates, fungi and lichen SAR was beyond the scope of this project. The six invertebrate SAR found within the study area, but not reviewed in this report are: pale jumping-slug (*Hemphillia camelus*), glossy valvata (*Valvata humeralis*), pronghorn clubtail (*Phanogomphus graslinellus*), vivid dancer (*Argia vivida*), magnum mantleslug (*Magnipelta mycophaga*) and rocky mountain snail (*Oreohelix cooperi*). The fungi SAR not included in this review, but known within the study area is cryptic paw (*Nephroma occultum)* and the lichen SAR found in the study area is charred stippleback (*Dermatocarpon atrogranulosum*).

Additional SAR not included were those with historical occurrences that are assumed to be locally extirpated:

- dark Lamb's-quarters (*Chenopodium atrovirens*)] - Golden area, last observation date: 1958-08-19.

- long-leaved aster (Symphyotrichum ascendens) - Beside an irrigation ditch in Edgewater, last observation date: 1950-09-04.
- Montana larkspur (*Delphinium bicolor ssp. Bicolor*) - Fairmont Hot Springs, last observation date: 1960-05-13.
- stiff-leaved pondweed (*Potamogeton strictifolius*) – Lake Windermere, last observation date 1972-08-17.
- pale bulrush (*Scirpus pallidus*) - Columbia River at Mud Lake on silty bank of river, last observation date: 1978.
- saltwater cress (*Eutrema salsugineum*) - 3.2 km north of Windermere, last observation date: 1939-07-14.

4.1 Birds

American golden-plover

The American golden-plover (*Pluvialis dominica*) is blue-listed in the province of B.C. and has a provincial ranking of S3S4B (2015). It has not been assessed by COSEWIC or SARA (Table 2). There is no occurrence data in the B.C. Conservation Data Center for the American golden-plover in the Columbia Valley, but there are two accounts of this species in eBird records, both recorded by the same expert bird observer at two different locations: one individual at Burges and James Gadsden Provincial Park on September 21, 2017, and one individual at McMurdo Slough on September 22, 2014 (see Appendix 1 for location map). No other records for the study area were found for this species. This species is considered to be a rare migrant visitor to the Columbia Wetlands. Beyond furthering habitat conservation efforts of the Columbia Wetlands, there are no recommended conservation actions for this species at this time.

Table 2. Bird species at risk in the Columbia Valley study area.

Scientific Name	English Name	Provincial Ranking	BC List	COSEWIC	SARA	Provincial FERPA	IUCN red List	Habitat use	
								Breeding	Migratory
Pluvialis dominica	American golden-plover	S3S4B (2015)	Blue	not assessed	not assessed	N	Least Concern	N	Y
Recurvirostra americana	American avocet	S2S3B (2015)	Blue	not assessed	not assessed	N	Least Concern	N	Y
Botaurus lentiginosus	American bittern	S3B, SNRN (201	Blue	not assessed	not assessed	N	Least Concern	Y	Y
Pelecanus erythrorhynchos	American white pelican	S1B (2015)	Red	NAR (1987)	not assessed	Y	Least Concern	N	Y
Riparia riparia	bank swallow	S4B (2015)	Yellow	T (2013)	1-T (2017)	N	Least Concern	Y	Y
Hirundo rustica	barn swallow	S3S4B (2015)	Blue	T (2011)	1-T (2017)	N	Least Concern	Y	Y
Cypseloides niger	black swift	S2S3B (2015)	Blue	E (2015)	1-E (2019)	N	Vulnerable	probable	Y
Dolichonyx oryzivorus	bobolink	S3B (2015)	Blue	T (2010)	1-T (2017)	N	Least Concern	Y	Y
Buteo platypterus	broad-winged hawk	S3?B (2015)	Blue	not assessed	not assessed	N	Least Concern	unknown	Y
Larus californicus	California gull	S2S3B (2015)	Blue	not assessed	not assessed	N	Least Concern	N	Y
Hydroprogne caspia	caspian tern	S3B (2015)	Blue	NAR (1999)	not assessed	N	Least Concern	N	Y
Chordeiles minor	common nighthawk	S4B (2015)	Yellow	SC (2018)	1-T (2010)	N	Least Concern	Y	Y
Phalacrocorax auritus	double-crested cormorant	S3S4 (2015)	Blue	NAR (1978)	not assessed	N	Least Concern	N	Y
Podiceps nigricollis	eared grebe	S3B (2015)	Blue	not assessed	not assessed	N	Least Concern	Y	Y
Coccothraustes vespertinus	evening grosbeak	S5 (2015)	Yellow	SC (2016)	1-SC (2019)	N	Vulnerable	Y	Y
Psiloscops flammeolus	flammulated owl	S3B (2015)	Blue	SC (2010)	1-SC (2003)	Y	Least Concern	Y	Y
Sterna forsteri	Forster's tern	S1B (2015	Red	DD (1996)	not assessed	N	Least Concern	N	Y
Ardea herodias herodias	great blue heron, herodias subspecies	S3? (2017)	Blue	not assessed	not assessed	Y	Least Concern	Y	Y
Podiceps auritus	horned grebe	S4B, SNRN (201	Yellow	SC (2009)	1-SC (2017)	N	Vulnerable	Y	Y
Chondestes grammacus	lark sparrow	S3S4B (2015)	Blue	not assessed	not assessed	N	Least Concern	N	Y
Melanerpes lewis	Lewis's woodpecker	S2S3B (2015)	Blue	T (2010)	1-T (2012)	Y	Least Concern	Y	Y
Numenius americanus	long-billed curlew	S3B (2018)	Blue	SC (2011)	1-SC (2005)	Y	Least Concern	Y	Y
Contopus cooperi	olive-sided flycatcher	S3S4B (2015)	Blue	SC (2018)	1-SC (2018)	N	Near threatened	Y	Y
Falco peregrinus anatum	peregrine falcon, anatum subspecies	S2? (2011)	Red	NAR (2017)	1-SC (2012)	N	Least Concern	unknown	Y
Falco mexicanus	prairie falcon	S1 (2018)	Red	NAR (1996)	not assessed	Y	Least Concern	suspected	Y
Phalaropus lobatus	red-necked phalarope	S3S4B (2015)	Blue	SC (2014)	SC (2019)	N	Least Concern	N	Y
Buteo lagopus	rough-legged hawk	S3N (2015)	Blue	NAR (1995)	not assessed	N	Least Concern	N	Y
Euphagus carolinus	rusty blackbird	S3S4B (2015)	Blue	SC (2017)	1-SC (2009)	N	Vulnerable	N	Y
Asio flammeus	short-eared owl	S3B,S2N (2015)	Blue	SC (2008)	1-SC (2012)	Y	Least Concern	unknown	Y
Melanitta perspicillata	surf scoter	S3B,S4N (2015)	Blue	not assessed	not assessed	N	Least Concern	N	Y
Buteo swainsoni	Swainson's hawk	S2B (2015)	Red	not assessed	not assessed	N	Least Concern	unknown	Y
Cygnus columbianus	tundra swan	S3N (2015)	Blue	not assessed	not assessed	N	Least Concern	N	Y
Aechmophorus occidentalis	western grebe	S1B,S2N (2015)	Red	SC (2014)	1 - SC (2017)	N	Least Concern	N	Y
Aeronautes saxatalis	white-throated swift	S3S4B (2015)	Blue	not assessed	not assessed	N	Least Concern	Y	Y
Troglodytes hiemalis	winter wren	S3S4B (2015)	Blue	not assessed	not assessed	N	Least Concern	N	Y

American avocet

The American avocet (*Recurvirostra americana*) is blue listed in B.C. and has a provincial ranking of S2S3B (2015). It has not been assessed by COSEWIC and is not listed under SARA (Table 2). The American avocet, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There is no occurrence data in the B.C. CDC for the American avocet in the Columbia Valley. There are eight records for this species for the Columbia Valley in the eBird database from April to June during 2008-2018, and all records are from the Columbia Wetlands: Blaeberry River delta, McMurdo seasonal marsh, Richies Point- Columbia NWA, Windermere Creek delta (two records), Fairmont meadows, north and south ends of Columbia Lake (see Appendix 2 for location map). "[S]mall numbers of American avocets have been observed in late April and May in shallow-water habitats in the Columbia Wetlands Wildlife Management Area near Spillimacheen and Parson. Breeding there is unlikely due to the inundation of potential nesting areas in June by rising floodwaters of the Columbia River" (Ferguson, 2004). The presence of American avocet appears sporadic and seasonal in the Columbia Wetlands. There are no documented breeding records, and no critical habitats have been identified in the study area (Ferguson, 2004). Beyond furthering habitat conservation efforts of the Columbia Wetlands, there are no recommended conservation actions specific to the American avocet at this time.

American bittern

Status and occurrence

The American bittern (*Botaurus lentiginosus*) is blue-listed in the province of B.C. and has a provincial ranking of S3B, SNRN (2015). It has not been assessed by COSEWIC or under SARA (Table 2). It is listed on the International Union for Conservation of Nature's (IUCNs) Red List as 'least concern.' The American bittern, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. The B.C. CDC does not have any mapped data occurrences for the American bittern in the Columbia Valley, but there are a number of American bittern occurrences in the Columbia Wetlands coming from other data sources (see Appendix 3 for location map). There are 22 eBird records with a date range of 1967 to 2019. Eight of the species accounts were from the Moberly Marsh/Burgess James Gadsden Provincial Park (date range 1995-2015); four from Canal Flats from 1968, 1977, 1974, and 1999; with additional eBird observation records from Fairmont, Radium area, and Lillian Lake. There are two American bittern records from the 2015-2019 Columbia Wetlands Waterbird Survey (CWWS) from the Parson area and Edelweiss Slough (in Golden). There are 16 additional observations from the 2016-2019 Columbia Wetlands Marsh Bird Monitoring Project (CWMBMP), all of which were concentrated around the Brisco area (Darvill & Westphal, 2020a). The CWMBMP conducted repeated marsh bird surveys using broadcast equipment at 65 monitoring stations in the Columbia Valley (most stations in the Columbia Wetlands) over a four-year period. Each survey station was visited three times during the breeding season (Darvill & Westphal, 2020a).

Cooper and Beauchesne (2003) used call-playbacks at a number of survey stations in the Columbia Basin that were visited once during the breeding season. They reported one American bittern at Lillian Lake near Invermere, one at Twin Lakes near Brisco, one from Bittern Lake near Parson, and two detections from the Parson area that were within the Columbia Wetlands (Cooper & Beauchesne, 2003). In total, the American bittern has been recorded 46 times in the Columbia Valley since 1967, with most of those accounts occurring between 2003-2019 with 19 occurrences in the Brisco area, and a few accounts from higher elevation lakes (i.e., Lillian Lake, Bittern Lake, Twin Lakes) on the west benches of the Columbia Valley. Given that the timing of detections was during the breeding season, most or all bitterns detected in the Columbia Valley since 1967 could be assumed as breeders, but confirmation of this has not occurred at any sites, nests with eggs or young have not been recorded. There is one observation from 1943 where a pair of American bitterns reportedly nested in a bed of bull rush (*Scirpus sp*.) at the south end of Columbia Lake. This nest produced four fully fledged young (Johnstone, 1949). Johnstone (1949) reported that the American bittern was "fairly abundant in the Columbia river valley between Canal Flats and Golden", but recent research suggests that bittern numbers are low (Cooper & Beauchesne, 2003; Darvill & Westphal, 2020a; Darvill & Westphal, 2020b). They tend to occur more frequently in the wetlands near Brisco (Darvill & Westphal, 2020a; Darvill & Westphal, 2020b).

Habitat use

American bittern is highly dependent upon inland freshwater marshland habitat (Lowther, Poole, Gibbs, Melvin, & Reid, 2009). Little is known about their behaviour and routes during migration, but they rely on freshwater wetlands with tall emergent vegetation for breeding habitat (Darvill & Westphal, 2020b; Lowther, Poole, Gibbs, Melvin, & Reid, 2009). Threats to this species include habitat loss, habitat degradation (e.g. eutrophication, siltation, chemical contamination), human disturbance (e.g. recreation, hunting), pesticides and other contaminants (Lowther, Poole, Gibbs, Melvin, & Reid, 2009).

Recommended conservation objectives

Darvill and Westphal (2020b) recommended that the Columbia Wetlands Marsh Bird Monitoring Project be replicated every 3-5 years, in order to determine any population level changes to the marsh birds of the Columbia Wetlands, including American bittern. Repetition of the same survey protocol at the same survey stations is a useful way of measuring impacts of environmental factors such as climate change (Darvill & Westphal, 2020b). The CWMBMP did not survey the wetlands located between Radium and Brisco for bittern or other marsh birds. Also, only four higher elevation lakes were inventoried for marsh birds during the CWMBMP. A more thorough inventory of marsh birds at higher elevation lakes in the Columbia Valley is warranted given that American bitterns have been detected at four of these lake ecosystems.

It was also recommended to conserve "areas with abundant growth of emergent herbaceous vegetation, especially in areas where there are reduced amounts of woody vegetation, and equal amounts of water interspersed amongst emergent vegetation (Darvill & Westphal, 2020a)." Furthermore, "[i]ncreasing levels of non-motorized use by recreationists likely will be cumulatively problematic for sensitive waterbird species with abandonment of high-quality habitat areas and adoption of lower quality habitat when disturbed. Accordingly, it is recommended that with respect to

the emergent vegetation, efforts should be undertaken to create and publicly promote buffer distances secluding this breeding habitat — particularly adhered to during the peak breeding periods (mid-May until mid-July) with best efforts to limit all traffic including non-motorized recreationists during this critical season" (Darvill & Westphal, 2020b).

Darvill and Westphal (2020b) also recommended that a specific private land parcel in Brisco be acquired for conservation purposes specifically to conserve American bittern breeding habitat that is directly adjacent to the Columbia National Wildlife Area – Brisco Unit. This parcel had consistent observations of American bittern during the four-year CWMBMP surveys, indicating that bitterns are successfully breeding in this area. This site is also located next to a nearby commercial plant that uses a wood preservative called K-33 chromated copper arsenate (CCA) to treat wooden poles. "Experimental studies of the fate of CCA in soil and monitoring studies of wood-preserving sites where CCA was spilled on the soil indicate that the chromium (VI), arsenic and copper components of CCA can leach from soil into groundwater and surface water. In addition, at CCA wood-preserving sites, substantial concentrations of chromium (VI), arsenic and copper remained in the soil and were leachable into water four years after the use of CCA was discontinued, suggesting prolonged persistence in soil, with continued potential for leaching" (Chou, Colman, Tylenda, & De Rosa, 2007). Given that CCA has the potential to impact the American bittern breeding site in Brisco, as well additional negative ecosystem-level impacts caused by leaching, it is recommended that potential chemical leaching of CAA and its derivatives be investigated at the commercial plant (Darvill & Westphal, 2020b).

American white pelican

The American white pelican (*Pelecanus erythrorhynchos*) is red listed in the province of B.C., and has a provincial ranking of S1B (2015). In 1987, COSEWIC listed this species as 'not at risk'. It has not been assessed under SARA (Table 2). The IUCN considers the American white pelican as a species of 'least concern,' and it is one of only three species legally designated (by the provincial government) as 'endangered' under B.C.'s Wildlife Act. There are no occurrences for American white pelicans in the Columbia Valley according to the B.C. CDC, likely because they do not breed in the region. Breeding for this species is known for only two places in B.C. (Stum and Puntzi Lake), both located within the central interior region within the Vanderhoof Forest District (Fraser & Ramsay, 2015). There are 21 records for this species in eBird and four from the Columbia Wetlands Waterbird Survey, date range from 2005 to 2019 (see Appendix 4 for location map).

According to available data, the American white pelican has been observed passing through the valley during spring migration (usually early to mid May) in small flocks (1-16 individuals). A flock of 34 individuals was seen flying overhead through the Blaeberry River Valley on June 16, 2006. This is the largest recorded flock of American white pelicans in the Columbia Valley. The use of lake and shallow open water wetlands foraging habitat in the Columbia Wetlands is temporary, as pelicans have rarely been observed to stay in a single location for multiple consecutive days (Ferguson, 2004). There are two eBird records from August 2016 that indicate a group of 14 American white pelicans were observed

feeding in the Columbia Wetlands for a two-week period. The location was approximately 15 kilometers south of Golden. Given that the American white pelican is a rare, infrequent, and migrant visitor to the Columbia Wetlands, there are no recommended conservation strategies for this species.

Bank swallow

Status and occurrence

The bank swallow (*Riparia riparia*) is yellow listed in British Columbia (Table 2). In 2013, it was listed as a Threatened species by COSEWIC because the bank swallow population in Canada has declined by 98% over a recent 40 year period (COSEWIC, 2013a). Reasons for this significant decline are not well understood, but are thought to be cumulative, including loss of breeding and foraging habitat, collision with vehicles, widespread pesticide use, climate change and destruction of nest sites during excavation (COSEWIC, 2013a). The bank swallow was listed as Threatened on Schedule 1 of SARA in 2017, and it is a species of Least Concern on the IUCN's Red List. The bank swallow, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

There were 18 records for bank swallow during the 2016-2019 Columbia Wetlands Marsh Bird Monitoring Project (CWMBMP), four records from the 2015-2019 Columbia Wetlands Waterbird Survey, with 306 additional records for the Columbia Valley in the eBird database (see Appendix 5 for location map). The eBird data has a date range of 1972-2019 (April to August) and flock size varied from 1 to 150 individuals. The majority of observational records are clustered around Golden, Radium Hot Springs, Lake Windermere and Columbia Lake, with additional records scattered throughout the Columbia Valley.

Habitat use

Bank swallows are primarily insectivores that feed on a wide variety of insects such as ants, bees and wasps (Hymenoptera), flies (Diptera), beetles (Coleoptera), mayflies (Ephemeroptera), bugs (Hemiptera), and dragonflies (Odonata) (Garrison, 1999). Characterizations of bank swallow nesting-colony sites throughout North America include vertical banks, cliffs, and bluffs in alluvial, friable soils, as well as artificial sites such as sand and gravel quarries and road cuts (Garrison, 1999). Surrounding the colony, foraging habitats include open water, wetlands, grasslands, agricultural areas and riparian woodlands (Garrison, 1999).

Dawe et al. (2012) reported a colony of at least 50 bank swallows at the Columbia National Wildlife Area (Wilmer Unit), just past Walker's point. Several bank swallow breeding colonies have been reported through the 'Kootenay Bank Swallow Survey (KBSP),' a project that was launched in 2015 to help address data gaps for this species. Some volunteers of the KBSP have suggested that bank swallows may have been misidentified as northern rough-winged swallows, which have similar appearance and vocalization and both species use (sometimes share) the same breeding habitat. While there are several reported bank swallow colonies in the Columbia Valley, some colonies need to be re-visited to confirm species identification. Information on the status of swallows in the Columbia Valley is lacking, and an inventory for bank swallow important habitats (nesting and roosting locations) has not been conducted.

Recommended conservation objectives

The SARA listing requires the production of a federal recovery strategy, which is meant to be completed two years after the listing date. In this strategy, the threats to the bank swallow will be defined and its critical habitat identified. There is a need to undertake inventory work in the Columbia Valley to determine/confirm nesting locations and to help identify critical habitat. There is also a need for hands-on stewardship activities, such as enhancement (artificial or enhanced nesting habitat), to conserve swallows and their habitats in the Columbia Valley.

In 2020, the Columbia Valley Swallow Project (CVSP) will be initiated by a contractor (R. Darvill, Goldeneye Ecological Services) to Wildsight Golden. The CVSP intends to be a two-year project (2020-2021) that will conduct nest site inventories for bank (and barn) swallows, landowner outreach, and stewardship activities within swallow habitat. The main purpose of year one of the CVSP will be to locate bank (and barn) swallow nest sites. Volunteer citizen-scientists will be involved with monitoring known nest sites. Nest locations will be used to inform the management of nest sites and contribute to provincial and federal recovery planning and implementation processes, including the identification of critical habitat in the Columbia Valley. In year two, the emphasis of the CVSP will be on-the-ground stewardship and conservation activities such as creating artificial nesting banks and enhancing natural banks.

Barn swallow

Status and occurrence

The barn swallow (*Hirundo rustica)* is blue-listed in British Columbia, was listed as Threatened by the COSEWIC in 2011, and was listed as Threatened on Schedule 1 of SARA in 2017 (Table 2). The barn swallow, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. COSEWIC (2011a) states that the Canadian barn swallow population has declined by 76% over a recent 40-year period, and provides the following rationale for its Threatened designation:

> *This is one of the world's most widespread and common landbird species. However, like many other species of birds that specialize on a diet of flying insects, this species has experienced very large declines that began somewhat inexplicably in the mid- to late 1980s in Canada. Its Canadian distribution and abundance may still be greater than prior to European settlement, owing to the species' ability to adapt to nesting in a variety of artificial structures (barns, bridges, etc.) and to exploit foraging opportunities in open, human-modified, rural landscapes. While there have been losses in the amount of some important types of artificial nest sites (e.g., open barns) and in the amount of foraging habitat in open agricultural areas in some parts of Canada, the causes of the recent population decline are not well understood. The magnitude and geographic extent of the decline are cause for conservation concern.*

There are numerous records (1,372) for barn swallow in the eBird database, with observation dates ranging from 1967 until 2019, May through to September (see Appendix 6 for location map). Most of these records (1,052) were from a single observer who spent much time birding in the Columbia Valley and contributed greatly to the eBird database. There were 28 additional records for barn swallow from the 2016-2019 CWMBMP, and one record from the CWWS. The eBird records show that the barn swallow is relatively abundant and widely distributed throughout the Columbia Valley, with most records associated with the valley bottom wetlands.

Habitat use

Prior to European settlement, barn swallows nesting habitat was associated and characterised with natural features such as holes, caves, crevices and ledges on rocky cliff faces (Campbell et al., 1997; COSEWIC, 2011a; Peck & James 1987; Speich, Jones & Benedick, 1986). Since European settlement, barn swallows have largely shifted their habitat preference to human-made structures, such as bridges, buildings and ledges, although they do still nest in natural habitats located in relatively 'pristine' areas (COSEWIC, 2011a; Speich, Jones & Benedick, 1986). Barn swallows will often nest solitarily, but nesting more often occurs in colonies sometimes mixed with other species. They feed almost entirely on flying insects, mainly those in the order Diptera (true flies), but they will also consume other insects (COSEWIC, 2011a). Barn swallows forage within 500 meters from the nest site (COSEWIC, 2011a).

Recommended conservation objectives

While many visual detection observations have been recorded for barn swallows in the Columbia Valley, nest sites have not been well documented and virtually no stewardship activities have occurred in the Columbia Valley to maintain or enhance barn swallow habitat. In 2020, the Columbia Valley Swallow Project (CVSP) will be initiated by a contractor (R. Darvill, Goldeneye Ecological Services) to Wildsight Golden. The CVSP intends to be a two-year project (2020-2021) that will conduct nest site inventories for barn (and bank) swallows, landowner outreach, and stewardship activities within swallow habitat. The main purpose of year one of the CVSP will be to locate barn (and bank) swallow nest sites. Volunteer citizen-scientists will be involved with monitoring known nest sites. Nest locations will be used to inform the management of nest sites and contribute to provincial and federal recovery planning and implementation processes, including the identification of critical habitat to help conserve barn swallow species in the Columbia Valley. In year two, the emphasis of the CVSP will be on-the-ground stewardship and conservation activities such as creating artificial nesting structures.

Black swift

Status and occurrence

The black swift is blue-listed in the province of B.C., and has a provincial ranking of S2S3B (2015) (Table 2). It was listed as Endangered by COSEWIC in 2015, and was listed as Endangered on Schedule 1 of SARA in March 2017. SARA states that a recovery strategy must be posted on the SAR registry within one year of listing for an Endangered species (Government of Canada, 2017). The black swift, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

Currently, there is no recovery strategy for the black swift and critical habitat has not been identified. The reason for COSEWIC designation is as follows:

> *Canada is home to about 80% of the North American population of this bird species. It nests in cliff-side habitats (often associated with waterfalls) in B.C. and western Alberta. Like many other birds that specialize on a diet of flying insects, this species has experienced a large population decline over recent decades. The causes of the decline are not well understood, but are believed to be related to changes in food supply that may be occurring at one or more points in its life cycle. The magnitude and geographic extent of the decline are causes for conservation concern. (*COSEWIC, 2015).

There are no records for black swift in the B.C. CDC for the Columbia Valley, but there are 416 records for this species in the eBird database, with a date range from 1981 to 2019 (see Appendix 7 for location map). There are also four records for black swift from the Columbia Wetlands Marsh Bird Monitoring Project (Darvill& Westphal, 2020b), in addition to one record of Vaux's/black swift. Reported flock size ranges from 1 individual to 80, with one exceptionally high count of 300 individuals dated August 19, 1999 from the Blaeberry River Valley on Holmes Deakin Road.

Habitat use

The black swift is one of the least studied birds in B.C. (Boyd, 2015), but the vast majority of black swifts found in Canada occur in B.C. (COSEWIC, 2015). Much of their range is within the Northern Rockies Bird Conservation Region (BCR 10) (COSEWIC, 2015), which includes the Columbia Valley. Black swifts' nest near or behind montane waterfalls, with a few nesting records from caves that are located in canyons, as well as small cave-like habitats within streams (references cited in COSEWIC, 2015). Their nests can be very challenging to locate; nest sites are characterized by the presence of flowing water, inaccessibility, high relief, unobstructed flight path and darkness (COSEWIC, 2015). Black swifts tend to forage for insects at high altitudes, over open country and forests within mountainous areas and lowlands. The black swift diet is thought to be varied depending on various factors such as time of year, whether they are feeding young, and the weather's influence on prey availability (COSEWIC, 2015). It appears that black swifts feeding is specialized on swarming ant species that fly, these may be critical to swifts as they provide essential fat and nutrient resources for breeding and migration (references cited in COSEWIC, 2015).

COSEWIC (2015) states that the most important threats to the black swift are airborne pollutants that can reduce aerial insect food availability and that may cause reproductive failure; climate change impacts may reduce stream flow at nest sites or could lead to mismatched timing between the swifts breeding cycle and food source (e.g., aerial arthropods) phenology. Additional threats are considered to be negligible and include logging, livestock farming and ranching, water management, recreational activities and hydroelectric operations (COSEWIC, 2015).

Recommended conservation objectives

There are no recorded breeding accounts of black swift in the Columbia Valley, but given the high number of observations, there are likely to be undiscovered breeding locations. There are known breeding sites in nearby protected areas including Banff National Park, Jasper National Park and Kootenay National Park (COSEWIC, 2015). It is recommended to complete a mapping exercise to compile a list of potential nesting locations (i.e., waterfalls, shallow caves or caves in steep rock faces or canyons) in the Columbia Valley. Subsequently, complete an inventory at these sites for black swift breeding locations in the Columbia Valley and protect all discovered breeding sites; breeding sites should also be used to help identify critical habitat.

Bobolink

Status and occurrence

The bobolink (*Dolichonyx oryzivorus*) is blue-listed in the province of B.C. and has a provincial ranking of S3B (2015) (Table 2). It was assessed and ranked as a Threatened species by COSEWIC in April 2010, and it was added to Schedule 1 of SARA on March 11 2017, as a Threatened species. As a Threatened species under SARA, a recovery strategy was meant to be posted on the Species at Risk Registry within two years of listing; recovery strategies include the identification of critical habitat (Government of Canada, 2017). The bobolink, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

The B.C. CDC (2014a) has one species occurrence report for a bobolink in Edgewater, the observation was made on June 14, 1982 when one male was calling and defending its territory. There are 26 records in the eBird database for bobolink in the Columbia Valley, dating from 1969 to 2019; all were from the months of May, June and July. Twenty-one of those records are from the Moberly Marsh area, dating from 1995 to 2019 (see Appendix 8 for location map). According to eBird records, breeding evidence has been detected at Moberly Marsh for the bobolink. Four of the eBird records for bobolink are from the Brisco area (from 1990, 2003, 2005, and 2018), and one eBird record is from 1969 at the north end of Columbia Lake. Ferguson (2004) noted that "bobolinks' nests in the Rocky Mountain Trench as far north as Parson, and possibly as far north as Golden." Current information extends this breeding range in the trench to Moberly Marsh near the confluence of the Blaeberry and Columbia Rivers.

Habitat use

This species has faced severe population declines since the late 1960s, particularly over the core of its range in Eastern Canada (COSEWIC, 2010). The habitat of the bobolink is generally linked to large open forage crops, such as hayfields, pastures and moist meadows (Campbell et al., 2007; COSEWIC, 2010). Threats to this species include mortality from agricultural operations, pesticide exposure, habitat loss and fragmentation, and bird control at winter roosts (COSEWIC, 2010). The bobolink was reported to be a "scarce summer visitor in the 1940s" (Johnstone, 1949), and is still uncommon in the Columbia Valley with one to three breeding areas documented through eBird.

Recommended conservation objectives

During the breeding season, surveys for bobolink should occur at all locations where they have been detected previously as reported through eBird (Fairmont meadows, Brisco and Moberly Marsh). Inventory work to provide current information on bobolink breeding habitat would aid in the identification of critical habitat. Educational outreach should occur with any private landowners who have jurisdiction at any detected bobolink breeding sites. Since bobolink are vulnerable to agricultural practices such as hay cutting during the nesting period, landowners should be encouraged to wait until the end of the nesting season to begin agricultural practices in habitat known to be occupied by bobolinks.

Broad-winged Hawk

The broad-winged hawk (*Buteo platypterus*) is blue-listed in the province of B.C., with a provincial ranking of S3?B (2015) (Table 2). This species has not been assessed by COSEWIC or SARA, and is considered to be of Least Concern according to the IUCN's Red List. The broad-winged hawk is protected under the provincial Wildlife Act. There is one breeding location recorded for broad-winged hawks in the CDC database. On July 22, 2002 there were 2-3 nestlings seen in a nest located approximately 3.8 kilometers west of the confluence of Bobbie Burns Creek and the Spillimacheen River in conifer forest habitat (elevation 1065 meters); and on August 4, 2002, two fledglings with two adults present were seen at this location (B.C. CDC, 2014b).

There are 122 records for broad-winged hawks in the eBird database, records dating from 1996 until 2019 (see Appendix 9 for location map). The majority of records (n=107) came from a single experienced observer (D. Leighton). 94 of the observations were located at the private residence of D. Leighton in the Blaeberry River Valley, eBird location called "Blaeberry—Holmes-Deakin.' Other records from eBird were distributed throughout the Columbia Valley, mainly at lower elevations from Fairmont as far north as Donald. Given that this hawk is relatively inconspicuous, and hawk species are often found to be more difficult to identify by experienced and inexperienced birders, broad-winged hawks may be more widespread in the Columbia Valley during migration. The broad-winged hawk nests in relatively dense mixed or deciduous forests (particularly stands with trembling aspen (*Populus tremuloides*)] that are often on a slope and near forest openings with wet areas that are used for hunting (Ferguson, 2004; Phinney, 2015).

Recommended conservation objectives
Revisit the nesting site at the confluence of Bobbie Burns Creek and the Spillimacheen River to determine if this breeding site is still being used. All known nesting locations should be protected due to their rarity, and nest sites should be monitored for their continued use and tolerance of habitat alteration and human activity (Phinney, 2015).

California Gull

Status and occurrence

The California gull (*Larus californicus*) is blue-listed in the province of B.C. due to very small numbers of breeding pairs and breeding locations in B.C. (recent records confirmed at only two locations) (Siddle, 2015) (Table 2). This species has a provincial ranking of S2S3B (2015) and it has not been assessed by COSEWIC or SARA. It is listed by the IUCN as a species of Least Concern. The California gull, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

There are no B.C. CDC records for the California gull in the Columbia Valley. There are 42 records of California gulls from the 2015-2019 Columbia Wetlands Waterbird Survey, and 149 eBird records dating from 1995 to 2019 (see Appendix 10 for location map). Both CWWS and eBird records are from the spring and fall migration periods; peak abundance in the Columbia Valley is from April – May, and then again from August until late October.

Habitat use

Recorded observations of California gull are scattered throughout the valley from Canal Flats to Donald, but most of the recorded observations come from the following locations: Althalmer Slough, Blaeberry River delta, Golden- lower Kicking Horse River, Lake Windermere and Burgess and James Gadsden Provincial Park. The habitat used in the Columbia Valley during migration is often composed of gravel bars, or muddy substrates in the Columbia Wetlands located adjacent to open water. The species is known to breed in the Prairies, adjacent Boreal forest, and some of the western basins within North America (Siddle, 2015). California gulls are not known to breed in the Columbia Valley (Ferguson, 2004).

Recommended conservation objectives

Determine the land status at areas where California gulls are known to frequent and work towards conservation strategies at those sites, especially at those locations falling outside of the Columbia Wetlands Wildlife Management Area or Columbia National Wildlife Area.

Caspian Tern

The Caspian tern is blue-listed in the province of B.C. and has a provincial ranking of S3B (2015) (Table 2). It has not been assessed by COSEWIC or under SARA, and is listed by the IUCN as a species of Least Concern. The Caspian tern, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There are no records for the Caspian tern in the Columbia Valley in the B.C. CDC database. There are eight records for the Caspian tern in the eBird database, with data ranges from 2005-2017 and seen during the months of May, August and October (see Appendix 11 for location map). The Caspian tern is the largest tern species and is not known to breed in the Columbia Valley. Given that the Caspian tern is a rare, infrequent, and migrant visitor to the Columbia Wetlands, there are no recommended conservation actions at this time for this species.

Common Nighthawk

Status and occurrence

The common nighthawk (*Chordeiles minor*) is yellow-listed in B.C., it is not considered to be at-risk provincially (Table 2). It was listed as a species of Special Concern by COSEWIC in 2018, and was listed as a Threatened species on Schedule 1 under SARA in 2010. The common nighthawk, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. According to COSEWIC (2007), the common nighthawk population has declined by 49% in surveyed areas. COSEWIC (2007) states this decline is largely attributed to a reduction in food source (wide variety of insects), but that other factors such as reduced habitat availability and decline in gravel rooftops and intensive agricultural activities may also be factors. Declines of up to 80% have been reported for common nighthawk through B.C. Breeding Bird Survey records made between 1968 and 2005 (Brigham, Ng, Poulin & Grindal, 2011).

Two nighthawk observations were made during the 2016-2019 Columbia Wetlands Marsh Bird Monitoring Project (see Appendix 12 for location map). There are 203 records for common nighthawk in the eBird database for the Columbia Valley; observation dates range from 1969 to 2019 and all observations were made between late May through early September (most observations from June, July and August). Common nighthawk observations are scattered throughout the Columbia Valley, with most recorded in the valley bottom and associated with lakes and the Columbia Wetlands. Flock size ranged from 1 to 30 individuals.

Manley (2008) compiled a summary of common nighthawk sightings that were reported on by the public for the Fish & Wildlife Compensation Program's (FWCP) web-based program for reporting species-at-risk in the Columbia Basin. This program had several observations reported for the Columbia Valley between Golden and Canal Flats. Specific locations were not provided and therefore are not represented on the species location map in Appendix 12. Manley (2008) found that between Fairmont and Radium there were many nest sites as well as foraging observations reported.

Habitat use

Common nighthawk has a large breeding range throughout most of B.C. and much of North America. They winter in South America, but the distribution during winter is still poorly known (Brigham, Ng, Poulin & Grindal, 2011). They are an aerial insectivore that primarily feeds during dawn and dusk, and that visually detects its prey (COSEWIC, 2007a; Poulin et al., 1996). The B.C. Breeding Bird Atlas reports that the highest abundances of breeding common nighthawks "are in the valley systems of the Southern Interior, Central Interior and Southern Interior Mountains ecoprovinces" (Brigham, Ng, Poulin & Grindal, 2011), such as the Columbia Valley. For nesting habitat, common nighthawk requires open habitats such as grasslands, pastures, recently logged areas, gravel roads, beaches, gravel roofs, and rocky outcrops (Brigham, Ng, Poulin & Grindal, 2011; COSEWIC, 2007a). "The combination of dry open uplands close to wetland or riparian areas that are productive foraging habitat appears to provide good habitat for the species" (Manley, 2008).

Common nighthawk may be directly impacted by habitat degradation owing to uncontrolled and unrestricted ATV activity in nighthawk habitat (Environment and Climate Change Canada, 2016). Additional work is required to determine further potential reasons for the population decline, including

habitat destruction, forest fire suppression, increase in terrestrial predators (e.g., cats, skunks), avian predators (e.g., ravens, crows) and pesticide use on insect prey (Brigham, Ng, Poulin & Grindal, 2011; COSEWIC, 2007a). Mosquito control programs in North America are assumed to be responsible for the decline of several species of aerial insectivores, including the common nighthawk (COSEWIC, 2007a; Poulin et al., 1996).

Recommended conservation objectives

"As long as suitable nesting habitat exists (which is currently poorly understood for the B.C. Interior) as well as an available food supply, few management actions with respect to connectivity are known for this species at this time" (Adams, 2011). The identification of critical habitat is needed to arrest or reserve the decline of this species. Monitoring surveys for common nighthawk should occur in key areas (i.e., Fairmont to Radium), and the protocol being used across North American by the 'WildResearch Nightjar Survey' should be utilized (Manley, 2008).

"Urgently needed research for this species from a conservation perspective includes data on population status and the impacts of pesticide use on insect prey. Data [is] also needed to understand the factors accounting for declining incidence of nesting on gravel roofs and the potentially positive effects of deforestation" (Brigham, Ng, Poulin, & Grindal, 2011). The use of *Bacillus thuringiensis* (Bti) in the Columbia Wetlands as a larvicide and biological control agent should seriously be considered in terms of its potential impacts on insectivores such as at-risk common nighthawk, bank swallow and barn swallow. Bti works to kill insects of different orders such as Lepidoptera, Coleoptera, Diptera and Nematodes (Bravo, Gill, & Soberon, 2007).

Double-crested cormorant

Status and occurrence

The double-crested cormorant (*Phalacrocorax auratus*) is blue-listed in the province of B.C., and has a provincial ranking of S3S4 (2015) (Table 2). This species was assessed by COSEWIC in 1978 to be 'not-at-risk'. The double-crested cormorant, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

There are no data records for this species in the B.C. CDC. There are two records for double-crested cormorant through the Columbia Wetlands Waterbird Survey (Darvill, 2020), two records from the Columbia Wetlands Marsh Bird Monitoring Project (Darvill & Westphal, 2020a; Darvill & Westphal, 2020b), and 37 additional records in the eBird database (see Appendix 13 for location map). Flock size is 1-9 individuals observed from May through until October, with most records from between 2012 and 2019.

Habitat use

Observations of double-crested cormorant are spread throughout the Columbia Wetlands from Canal Flats north to Donald, usually detected on the main or side channels of the Columbia River. There are a

few other scattered occurrences at higher elevations. The double-crested cormorant is a large, conspicuous waterbird that breeds in colonies along the Atlantic and Pacific coasts, and in freshwater wetlands (Butler, 2015). It is not known to breed in the Columbia Wetlands, but some individuals pass through during migration and rely upon the Columbia River and its tributaries as stopover habitat. Its diet is composed almost entirely of fish, but it also feeds on other aquatic animals including amphibians, insects, and crustaceans (Dorr, Hatch & Weseloh, 2014). It feeds on shallow open water and typically close to shore (Dorr, Hatch & Weseloh, 2014).

Recommended conservation objectives

Since the double-crested cormorant observations are scattered, infrequent, and it does not appear to breed in the Columbia Valley, there are no conservation actions recommended at this time.

Eared Grebe

Status and occurrence

The eared grebe (*Podiceps nigricollis*) is a blue-listed species in the province of B.C. and has a provincial ranking of S3B (2015) (Table 2). It has not been assessed by the COSEWIC or under SARA. It is a species of Least Concern under IUCN assignment. The eared grebe, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

There are no records for this species in the B.C. CDC, but the Columbia Wetlands Marsh Bird Monitoring Project (2016-2019) recorded eared grebes at Reflection Lake near Golden on five separate occasions: six individuals on May 31, 2016; two on May 18, 2018; 1 on June 5, 2018; four on June 28, 2018; and two individuals on June 10, 2019 (Darvill & Westphal, 2020). There have been observations of breeding evidence (nest and chicks) made of eared grebe at Reflection Lake (pers. comm., D. Leighton, 2016). The 2015-2019 Columbia Wetlands Waterbird Survey detected eared grebes 15 times, with observations distributed between Lake Windermere north to Reflection Lake (Darvill, 2020). There are 134 records of eared grebe in the eBird database for the Columbia Valley, 66 of those were for Reflection Lake. See Appendix 14 for the species location map. Additionally, Appendix 15 indicates where horned/eared grebes were reported. Both the eared and horned grebe species are at-risk, and they can be very challenging to tell apart especially when in non-breeding plumage.

Habitat use

Other than Reflection Lake, no other breeding locations of eared grebe have been reported for the Columbia Valley. This species is usually found in areas where it breeds in colonies that number into the low thousands. Preferred breeding habitats are shallow, freshwater marshes, ponds and lakes with emergent vegetation and an abundance of macroinvertebrate communities (Cullen, Jehl & Nuechterlein, 1999). Kaiser, McKelvey & Smith (1977) noted that eared grebes were rarely seen but that nests were observed just south of Canal Flats, and “on the upland ponds behind Steamboat Mountain” (MacKinnon, 1977).

The eared grebe is small and considered to be the most abundant grebe in the world (Cullen, Jehl & Nuechterlein, 1999). This grebe is a highly social bird, has wispy yellow 'ear' feathers, and is smaller and more delicate looking than horned grebe. Peak migration for the eared grebe in the Columbia Valley (according to eBird records) is May and mid-September into late October. In the fall, almost the entire population of eared grebe stages and feeds at Mono Lake, California, or Great Salt Lake, Utah, to fatten up on brine shrimp and alkali flies before migrating farther south. Here it more than doubles its body weight. This bird has unique physiology in that it spends up to 9-10 months of the year flightless, which may be the longest flightless period of any bird in the world capable of flight (Cullen, Jehl & Nuechterlein, 1999). During this time, it is going through multiple changes in body mass and internal digestive organs.

Recommended conservation objectives

Surveys conducted by boat during fall migration period should be conducted in order to determine eared grebe level of use at Columbia Lake and Lake Windermere during bird migration. It is also recommended to protect eared grebe breeding habitat at Reflection Lake by incorporating this crown land parcel into the Columbia Wetlands Wildlife Management Area boundaries.

Evening Grosbeak

Status and occurrence

The evening grosbeak (*Coccothraustes vespertinus*) is yellow-listed in B.C., it is not considered to be at-risk in B.C. It was listed as a species of Special Concern by COSEWIC in 2016, and was listed as Special Concern on Schedule 1 of SARA in 2019 (Table 2). The IUCN has listed the evening grosbeak as a Vulnerable species. The evening grosbeak, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

There are no known mapped locations in the B.C. CDC for the evening grosbeak, but it is known to occur throughout B.C. There are 1,720 records for evening grosbeak in the eBird database for the Columbia Valley, dates range from 1970 until 2019 with most records occurring after 1993 (see Appendix 16 for location map). This species is recorded year-round in the eBird database. The majority of the eBird records came from one observer (D. Leighton) with 1,479 observations, 1,424 were from that observer's private residence in the Blaeberry River Valley on Holmes-Deakin Road. Flock size recorded in the eBird database varied from 1 to 105 individuals.

Habitat use

The evening grosbeak is a large, robust finch with a thick bill that is greenish to yellow in color, especially the male. The evening grosbeak breeds mainly throughout the central and southern interior of B.C., and mostly at mid-elevation (Martell, 2015). It feeds on a varied diet including invertebrates, seeds from a wide variety of trees, buds, flowers, berries, sap, and is strongly attracted to roadside salt (Gillihan & Byers, 2001). The evening grosbeak was once considered to be one of the most common birds at

feeders, but data from 'Project FeederWatch' (continent-wide bird monitoring program initiated in 1987) suggests that this species has experienced dramatic population declines in recent years, with the mechanisms driving the decline unclear (Bonter & Harvey, 2008). Threats to evening grosbeak in the Columbia Valley include: potential impacts of herbicides used in forestry practices, collisions with building windows and vehicles (especially when attracted to salt on roadsides), degradation of habitat and disturbance at roost sites (Gillihan & Byers, 2001).

Recommended conservation objectives

Year-round, the evening grosbeak is widespread in the Columbia Valley. Monitoring, research and evaluating population trends for the evening grosbeak is required in order to determine the most appropriate conservation actions for this species. Since this species still appears to be relatively widespread and common in the Columbia Valley, specific population thresholds should be developed to assist with deciding when appropriate conservation action(s) should be implemented (Dunn, 2002).

Flammulated owl

Status and occurrence

The flammulated owl (*Psiloscops flammeolus*) is blue-listed in the province of British Columbia (Table 2). It was listed as a species of Special Concern by COSEWIC in 2010 and was listed as Special Concern on Schedule 1 of SARA in 2003. The IUCN has listed it as a species of Least Concern. This species is protected under the provincial Wildlife Act; and with the provincial government recognition that the flammulated owl could be affected by forest or range management on crown land, this species has been recognized as a species at risk under the Forests and Range Practices Act (FRPA). There are a number of provisions under the FRPA that can be used to manage these species, such as Wildlife Habitat Areas (WHA) and Wildlife Habitat Features (WHF).

There are four eBird records for flammulated owls in the Columbia Valley, and three records in the B.C. CDC. All records were made during the breeding season (May through July) at the following locations: Wilmer National Wildlife Area (in 2015), Mount Swansea (in 1999, 2005, and 2008), Steamboat Mountain near Steamboat Lake (1983), and Mount Sabine at the southwest exposure of the Columbia Lake Ecological Reserve in 1993 (B.C. CDC, 2014c; B.C. CDC, 2014d). Appendix 17 shows the species location map. Ferguson (2004) reported a confirmed nesting observation of flammulated owls as far north as Brisco in 2002, but no specific information (other than general location and year) was found for this occurrence. Van Woudenberg, Cristie & Erikson (2000) reported hearing at least five different flammulated owls on Mount Swansea during a flammulated owl inventory conducted in 2000. The East Kootenay Flammulated Owl Surveys in 2003 also reported detections of flammulated owls and confirmed nesting cavities at Mount Swansea (Manley, Ohanjanian & Beaucher, 2004). No flammulated owls were detected during inventory efforts on the Shuswap Reserve (Gillies, 2009).

As a result of inventory work conducted by Manley, Ohanjanian & Beaucher (2004), two flammulated owl Wildlife Habitat Areas (WHAs) were established (WHA number 4-084 and 4-085) and are located

east of Windermere Loop Road on Mount Swansea. There are two additional WHAs established for flammulated owls southeast of Canal Flats (see Appendix 17). Additionally, there were five flammulated owl detections on the 2.5-kilometer Columbia Lake transect in 2003 (Manley, Ohanjanian & Beaucher, 2004). Columbia Lake Provincial Park has the habitat attributes to support flammulated owl (Tipper, 2015), but Wildlife Habitat Area (WHA) designation did not apply to the Columbia Lake site because it is within a provincial park (Manley, Ohanjanian & Beaucher, 2004). There has been little inventory work completed for flammulated owl north of the Mount Swansea WHAs, but several reports indicate that within the Rocky Mountain Trench, flammulated owls are primarily found on the east side where suitable habitat exists (Adams, 2011; Addison & Cristie, 2002; van Woudenberg, Cristie & Erikson, 2000).

Habitat use

The flammulated owl is a small insectivorous owl (Cannings, 2015a) and a secondary-cavity nester that usually uses the old cavities from larger woodpeckers, (i.e., northern flicker, pileated woodpecker) for nesting (Ferguson, 2004; Linkhart & McCallum, 2013). "Its breeding range in Canada is restricted to the dry and old Douglas-fir and ponderosa pine forest zones of south interior British Columbia; essentially the forested portion of the Ponderosa Pine and Bunchgrass and the lower, drier subzones of the IDF BEC zones'' (Cooper, Manning, Deans & Howie, 2005). The flammulated owl is mainly an insectivore, with its diet chiefly composed of crickets and grasshoppers, beetles, true bugs, moths, and rarely small vertebrate prey. This species is considered to be common in North America (Linkhart & McCallum, 2013), but appears to be rare and irregular in the Columbia Valley where it is near the northern extent of its range. Since this species is dependent upon woodpecker cavities as nesting sites, timber harvesting in mature and old forests comprising Ponderosa Pine and Douglas Fir has direct impacts in breeding habitat by affecting the availability of nesting trees (Ferguson, 2004). Additional threats to this species include their low reproductive potential, landscape changes, fire suppression management, harvesting and silviculture, pesticide use, predators, competitors and disturbance (Cooper, Manning, Deans & Howie, 2005).

Recommended conservation objectives

It is recommended that a flammulated owl inventory be conducted within suitable habitat located on the east side of the Columbia Valley, especially north of Mount Swansea where inventory data is limited, and in areas where flammulated owls have previously been recorded. Flammulated owls are uncommon and difficult to detect, nocturnal and usually solitary (Linkhart & McCallum, 2013). Therefore, bioacoustics monitoring should be strongly considered in order to increase effort and collect more data by recording the entire calling period over a large survey area. Wildlife Habitat Area establishment should occur at all previously known nesting sites that are outside of the two WHAs already established, and areas outside of Provincial Parks.

In order to identify critical breeding habitat features such as wildlife trees and snags (dead trees or branches with good potential for holes), a wildlife tree inventory should occur in areas where flammulated owls have previously been detected and within suitable habitat areas within the Columbia Valley. Previously, snags were reported not to be abundant on the eastern slopes of the Rocky Mountain Trench (van Woudenberg, Cristie & Erikson, 2000). Wildlife tree habitat supply should be

enhanced in areas where few wildlife trees are detected within flammulated owl habitat. Wildlife tree enhancement should follow methods used for fungal inoculation treatments (Manning, 2017). This will help to increase wildlife tree habitat in areas that currently lack wildlife trees, which will be beneficial for increasing flammulated owl habitat, as well as habitat for other at-risk species in the Columbia Valley that need wildlife trees, such as Lewis's Woodpecker and bat species. Further detailed recovery strategies are provided in the flammulated owl management plan (Cooper, Manning, Deans & Howie, 2005). Snag recruitment and health of woodpecker populations that create nesting cavities is also essential to the conservation of flammulated owls (Linkhart & McCallum, 2013).

Forster's tern

Forster's tern (*Sterna forsteri*) is red-listed in B.C. and has a provincial ranking of S1B (2015) (Table 2). It was last assessed by COSEWIC in 1996 as 'Data Deficient'. It has not been ranked by SARA and is listed as Least Concern on the IUCN's Red List. Forster's tern, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There are no data records for this species in the B.C. CDC with only two records in the eBird database: 1 individual reported from the 'Moberly Marsh Spring Survey Route' in Burgess James Gadsden Provincial Park on May 5, 1996 (see Appendix 1 for species location map). The other record is from September 7, 1970 at the "Radium Hot Springs-Saw Mill Pond' eBird hotspot. Given that this species is rare and accidental in the Columbia Valley, there are no recommended conservation objectives for the Forster's tern.

Great blue heron, *herodias* subspecies

Status and occurrence

The great blue heron, *herodias* subspecies (*Ardea herodias Herodias*) is blue-listed in B.C. and has not been assessed by the COSEWIC or under SARA (Table 2). It is listed to be of Least Concern on the IUCNs Red List. The great blue heron, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. This species is also listed as a species at risk under the B.C. Forest and Range Practices Act (FRPA). There are a number of provisions under FRPA that can be used to manage the great blue heron, such as Wildlife Habitat Area (WHA) and Wildlife Habitat Feature (WHF) establishment. Time constraints did not allow for eBird data mining for the great blue heron, but there are numerous records listed on eBird for the great blue heron in the Columbia Valley, indicating that this species is widely distributed in the Columbia Wetlands during spring, summer and fall. There were 64 records for great blue heron from the CWMBMP, and 306 detections from the CWWS. The great blue heron was the most frequently detected at-risk species during both the CWMBMP and CWWS projects.

Habitat use

The great blue heron forages mainly for fish, but also for a wide variety of additional animals such as mammals, amphibians, birds, insects and crustaceans, with individual diet composition reflecting the local abundance of prey in an area (Vennesland & Butler, 2011). During the breeding season, foraging

occurs in wetlands, water bodies and waterways of all sizes, but it can occasionally be found upland as well (Vennesland & Butler, 2011). In the Columbia Valley, the great blue heron usually nests colonially near water, in trees (deciduous or coniferous) or bushes.

In 2002, a great blue heron breeding inventory and habitat assessment project was initiated in the Columbia Basin with four active breeding sites located in the Columbia Valley, and three additional historic breeding sites (Machmer & Steeger, 2003). Since project initiation, 22 breeding sites in the Columbia Valley have been found with 1 to 55 nests recorded per site, yet only three sites were active during the last year of monitoring in 2017 (Machmer, 2017) (see Appendix 18 for heronry locations with four designated Wildlife Habitat Features). "Results in 2017 represent the lowest number of active nests (173) recorded to date, following a 2016 breeding season with the highest rate of nest failure (52.1%) documented, since monitoring was initiated in 2002" (Machmer, 2017). Machmer (2017) suggested that reasons for increasing nest failure can be attributed to bald eagle and other predators/scavengers (e.g., ravens, crows) harassment and predation, as well as habitat development, disturbance, and natural events such as windstorms. "There is a lot of turnover [in the Columbia Valley] for a variety of reasons but what is clear is that there are many more herons nesting in conifers away from the water, and there are more eagles breeding than when I started (pers. comm., M. Machmer, November 2019).

Recommended conservation objectives

Breeding activity in the Columbia Valley has declined since inventories began in 2002. Herons are sensitive to disturbance and with the provincial government recognition that great blue herons could be affected by forest or range management on crown land, this species has been recognized as a species at risk under the Forests and Range Practices Act (FRPA). As such, Machmer (2017) suggests the following:

> *"[K]ey consideration for land securement and conservation covenants to protect breeding habitats, as well as the establishment of Wildlife Habitat Area (WHAs). To justify the time and effort needed for their establishment, WHAs must include active and several suitable alternate candidate nest sites within an overall nesting area in proximity to known rich foraging areas. The latter can take 1-2 years to establish, because of consultation and administrative requirements (pers. obs.). In the interim, designating a Wildlife Habitat Feature (WHF) may offer some short-term restrictions on activities around occupied breeding sites, and this designation may also be applicable to certain key wintering sites on crown land."*

A number of additional recommendations are outlined by Machmer (2017) and include stewardship follow-up actions, continued monitoring, increased private land protection, public awareness campaign, "re-evaluate and refine existing land use, access restrictions, fencing and interpretive signage to improve protection and awareness of herons and their habitat."

Horned Grebe

Status and occurrence

The horned grebe (*Podiceps auratus*) is yellow-listed in British Columbia, was listed by COSEWIC as a species of Special Concern in 2009 due to ongoing, range-wide, long-term declines, and as a species of Special Concern under SARA in 2017 (Table 2). The IUCN has listed the horned grebe as Vulnerable, which is one listing below IUCN Endangered status. The horned grebe, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

In the eBird database, there were 232 records for horned grebe in the Columbia Valley, as well as one record from the CWMBMP, and 51 records from the CWWS (see Appendix 19 for species location map). Appendix 15 indicates where horned/eared grebes were reported; both the eared and horned grebe species are at-risk, and they can be very challenging to tell apart especially when in non-breeding plumage. Flock size ranged from 1 to 120 individuals. Sparse B.C. Breeding Bird Survey data suggest horned grebe population decline may be steeper in B.C. than elsewhere (Howie, 2015a). Threats include loss of wetlands during droughts, degradation of wetland breeding sites, and increasing nest predators (Howie, 2015a).

Habitat use

Observational records are from locations scattered along the valley bottom in the Columbia Wetlands, but observations are more concentrated at Lake Windermere and Columbia Lake; they appear to prefer the large shallow water wetlands and lakes. In migration, stopover sites are known to occur on medium to large (>1,000 ha) bodies of water such as Columbia Lake and Lake Windermere. Horned grebes are seen in the Columbia Valley bottom lakes and wetlands from mid-April until early November, with peak abundance occurring during periods of migration.

Fewer data records are from the breeding season, suggesting a limited number of horned grebes nest in the Columbia Wetlands. Kaiser, McKelvey & Smith (1977) reported that the horned grebe was a common breeder in the Columbia Valley wetlands. Johnstone (1949) also described the horned grebe as a "common summer visitor to the small ponds and grassy sloughs." Results from surveys conducted by the CWS in 2006 confirmed that nests of horned grebe were found in the off-channel wetlands of the Columbia Wetlands (Hammond, 2007). However, no data occurrences or information could be found regarding these specific breeding occurrences. The horned grebe was a primary species of the Columbia Wetlands Marsh Bird Monitoring Project, but was detected only once (12 individuals observed on June 1, 2019 at the Radium Mill Pond) during the four-year project (2016-2019) and breeding was not confirmed. Horned grebe breeding activity may often go undetected due to their highly secretive and elusive behaviour. The horned grebe is monogamous and territorial, and it usually nests solitarily or occasionally in small colonies (Stedman, 2018). They build cryptic, floating nests built in emergent vegetation including cattail, bulrush, sedge (Stedman, 2018).

Recommended conservation objectives

Inventory work for horned grebe conducted during the breeding season should occur in order to locate breeding sites and if found, they should be protected. It is also important to minimize levels of human disturbance at sites documented to be important stopover habitat, (e.g. Columbia Lake and Lake Windermere) for horned grebes.

Lark Sparrow

The lark sparrow (*Chondestes grammacus*) is blue-listed in B.C. and has not been assessed by COSEWIC or SARA (Table 2). It is listed as Least Concern by the IUCN. The lark sparrow, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There is only one known record for lark sparrow in the Columbia Valley, photo documentation was made by an experienced bird observer at Moberly Marsh on the edge of a hayfield and is in the eBird database. See Appendix 1 for species location. Given that this species is accidental and very rare in the Columbia Valley, there are no recommended conservation objectives for this species.

Lewis's woodpecker

Status and occurrence

The Lewis's woodpecker (LEWO) (*Melanerpes lewis*) is blue-listed in British Columbia, was listed as Threatened by COSEWIC in 2010, and was listed as Threatened on Schedule 1 of SARA in 2012 (Table 2). The LEWO is listed as a species of Least Concern on the IUCN's Red List and is listed as a species at risk under the B.C. Forest and Range Practices Act Identified Wildlife Management Strategy. "This strategy contains specific management practices [General Wildlife Measures (GWMs)] that outline allowable forest practices within Wildlife Habitat Areas (WHAs) designated as LEWO conservation areas" (Cooper et al., 2004). The LEWO, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. Environment and Climate Change Canada (2017) estimates that the LEWO's population is at least 371 pairs in total for Canada, other estimates vary from 250-2,500 individuals (B.C. CDC, 2015a). There were 123 records for this species in the eBird database within the study area that date from 1986 until 2019, as well as five records in the CDC, and one from the Columbia Wetlands Marsh Bird Monitoring Project (see Appendix 20 for location map).

Habitat use and occurrences

In Canada, breeding range for LEWO is found only within six geographic regions of southern British Columbia: East Kootenay, West Kootenay, Okanagan-Similkameen, Thompson-Nicola, Boundary, and Cariboo-Chilcotin (B.C. CDC, 2015a). The most northerly breeding location within the East Kootenay Trench appears to be located at the critical habitat parcel in the Wilmer area, west of the Columbia National Wildlife Area (Wilmer Unit). Formally, LEWO was known to breed as far north as Golden and Revelstoke, but there are no recent breeding records for these areas (Ferguson, 2004), although they are infrequently seen farther north near Golden during migration (Appendix 20). Several of the known breeding sites in B.C. have been designated as WHAs (B.C. CDC, 2015a). There are three LEWO Wildlife Habitat Areas (WHA) in the south end of the study area (Appendix 20), two overlap one another and the third WHA is less than one kilometre from the other two.

"In the East Kootenay Trench, LEWO are found nesting in four habitat types: burned coniferous forest which had suffered stand destroying fire, open ponderosa pine forest with an obvious history of frequent fire, grassland with isolated large veteran trees, and riparian cottonwood stands adjacent to openings" (Cooper et al., 2004). Wildlife trees and suitable nesting cavities are important habitat

attributes for this species (Cooper et al., 2004). In the Invermere area, wildfires as well as land clearing from timber harvesting and agricultural practices have negatively impacted nesting trees (Hoar, 2016). Intensive grazing by livestock may result in a reduction of brushy understory that can provide abundant insect (prey) populations (Ferguson, 2004). B.C.'s small LEWO population, restricted breeding range, and limited habitat is impacted by a number of threats including: residential and commercial development, agriculture and aquaculture, transportation and service corridors, biological resource use (e.g., firewood cutting), human intrusion and disturbance (e.g., recreational pursuits), natural system modifications (e.g., fire suppression and fire), invasive species, pollution, severe weather and climate change (Environment and Climate Change Canada, 2017a). Since LEWO diet varies and includes insects, vegetable foods, cultivated and wild fruit, and wild seeds (Vierling, Saab & Tobalske, 2013), the ideal LEWO habitat includes a heterogeneous herb and shrub layer that is able to supply a diverse population of insects in addition to a late summer fruit crop (Cooper et al., 2004).

A survey conducted in the East Kootenay region (south of Brisco) in 1997-1998 found that up to one-fifth of the Canadian population was found to breed in that region (Cooper & Beauchesne, 2000). In 1998, Cooper & Beauchesne (2000) identified 85 breeding pairs of LEWO during an inventory in the East Kootenay Trench. Inventory results included nine nests found in the Dutch Creek area (west of Windermere Lake and Fairmont Hot Springs) in 1997, and seven nests found in 1998 were in the same area (Cooper & Beauchesne, 2000). A subsequent LEWO inventory completed in 2007, found no nests at Dutch Creek. Nesting habitat in the Dutch Creek burn area had been reduced due to fallen wildlife trees from decay (Beauchesne & Cooper, 2007). In the Findlay Creek burn area (west of the south end of Columbia Lake and Canal Flats), three nests were found during an incomplete survey in 1997, 31 nests in 1998, and 26 in 2007 (Beauchesne & Cooper, 2007). In 2007, one nest was found at Fairmont, down from six in 1998 (Beauchesne & Cooper, 2007). Environment and Climate Change Canada's Canadian Wildlife Service (CWS) has had permanent road survey routes in the East Kootenays since 2015; every year the routes are surveyed from the end of June to beginning of July, but continued road-side monitoring by CWS in 2020 is uncertain (pers. comm., J. Maida, March 23, 2020).

Three critical habitat areas have been identified and designated for LEWO within the Columbia Valley study area (see Appendix 20): Dutch Creek burn, Findlay Creek burn, and Wilmer area. These were selected based on habitat suitability models and nesting occurrence data (Environment and Climate Change Canada, 2017a). There are some private land parcels within critical habitat areas and from available occurrence data it appears that additional LEWO nesting sites may occur outside of designated critical habitat. The nesting area at the Findlay Creek burn (located west of Canal Flats) was documented to support about 30 nesting pairs, and was "designated a Wildlife Habitat Area according to the Identified Wildlife Management Strategy" (Ferguson, 2004). There are three WHAs in the southern end of the study area, but two overlap each other and the third is less than one kilometer from the other.

Recommended conservation objectives

From 2013-2016, the Lake Windermere District Rod & Gun Club constructed and placed 70 LEWO nest boxes in the southern region of Columbia Valley from Canal Flats to Brisco (Hoar, 2016). None of the nesting boxes are known to have been used by LEWO to date, but LEWO have reportedly shown interest in boxes, while some boxes have been occupied by other cavity-nesting species (i.e., northern flicker, bluebird spp., tree swallow) (Hoar, 2016). European starlings (*Sturnus vulgaris*) have also been seen using LEWO nesting boxes on Nature Conservancy of Canada land in the Columbia Valley (pers. comm.,

R. Klafki, March 2020). European starlings are invasive species that compete for nesting cavities and are often listed as a threat to LEWO (Environment and Climate Change Canada, 2017a). Given the mostly unknown status regarding LEWO occupancy of nest boxes, and since boxes have been used by European starlings, installation of additional boxes is not recommended at this time. Lewis's woodpecker nest box monitoring and occupancy have been a short-coming for LEWO conservation; it isn't known with certainty if they are effective or not, and any sort of presence/absence of next box utilization would be very helpful [pers. comm., J. Maida (Canadian Wildlife Service), March 23, 2020].

Lewis's woodpeckers, in addition to a number of other wildlife species, are dependent upon wildlife trees for critical life stages. Some agencies or organizations (i.e., B.C. FLNRORD, Nature Conservancy of Canada (NCC), The Nature Trust of British Columbia, Rocky Mountain Trench Ecosystem Restoration Program) have put much effort into enhancing wildlife tree habitat supply in the southern portion of the Columbia Valley. Fungal inoculation treatment methods have been used to create wildlife tree habitat (Manley & Manning, 2017; Manning, 2008; Manning, 2010), with the intent to restore and maintain habitat for LEWO and other wildlife tree dependent species, such as flammulated owl and other woodpecker species. In 2007, 107 wildlife trees were inoculated at the Hoodoo-Hofert NCC property, 75 trees were inoculated in 2010 at Dutch Findlay, 19 trees were treated in 2010 at Thunder Ranch, and 25 trees were treated at Columbia Lake in 2013 (Manning & Manley, 2014). Effectiveness monitoring of the fungal inoculation has shown that treatments are useful as a wildlife habitat enhancement tool (Manning & Manley, 2014).

Given that there has been a documented habitat decline for LEWO in the study area, and that fungal inoculation can take several years before a tree will become suitable for cavity excavation, it is recommended that wildlife tree creation using this methodology continue. Wildlife tree creation can benefit and provide habitat for over 70 species of wildlife in B.C. (Fenger et al., 2006; Manning, 2017). It is advised to speak with contractors who have expertise in the area of wildlife tree creation for their opinion on best options for treatment areas. Conservation lands should be prioritized for treatment since investment of creating trees on undesignated crown land is risky as treated trees could be logged or taken for firewood (pers. comm., C. Bosman, March 2020). Manning (2017) recommended "increase[d] recruitment of nest trees for Lewis's woodpecker. This can include a combination of short-term, relatively rapid habitat supply enhancement (i.e., tall stub treatments in ponderosa pine), as well as longer-term nesting habitat enhancement [i.e., dead top treatments in Douglas-fir and cottonwood (*Populus balsamifera trichocarpa*)]."

The Columbia Wetlands Waterbird Survey, along with other individuals, conducted two years of road-side monitoring in the Canal Flats and Fairmont area, reporting data to the CWS. Through this project, it was discovered that there is a colony of 3-4 nesting pairs of LEWO nesting in a small stand of cottonwood trees on an empty lot of private land in Fairmont. This land should be considered for private land acquisition for conservation purposes to maintain and enhance wildlife trees and nesting cavities at the site. At the very least, further outreach should take place with the landowners. CWS has already sent the landowners information regarding the LEWO colony on their property, but no response from landowners (living in Alberta) was received.

Canadian Wildlife Service has been conducting LEWO roadside surveys since 2015, but they are uncertain if routes will be surveyed in 2020. Not all known nesting locations (e.g., Lake Enid) are

surveyed during CWS roadside monitoring. Additional monitoring at known and suspected nesting sites should be conducted so that specific management recommendations can be made for each unique location. If additional nesting sites are discovered outside of current critical habitat (CH) areas, this data should be sent to the CWS with a request to expand CH that would incorporate all nesting sites. Regulations for CH only apply where it occurs on protected federal land, unless an order is applied (there have only been a few orders applied nationwide).

As mentioned, there are three WHAs already established for LEWO in the study area, but there are no WHFs established. Depending on the land jurisdiction, the province could designate nesting sites as WHAs or WHFs, or if on private land a regional district could be requested to protect the area through Official Community Planning, and/or a conservation initiative could work on stewardship with private landowners. Appendix 21 illustrates that ten LEWO occurrences occur on crown land, outside of any protected area, and have not been designated as WHAs. Some of these sites are suspected nesting locations, i.e., west of Columbia Lake. An inventory of all probable nesting locations should occur and where nests are located on crown land (and fall outside of a WHA or protected area), they should be submitted to the MFLNRORD for WHA designation. Since WHAs can take 1-2 years to establish, in the interim, designating WHFs at nest sites may offer some short-term restrictions on activities around occupied breeding sites.

Long-billed curlew

Status and occurrence

The long-billed curlew (*Numenius americanus*) is blue-listed in the province of B.C. and has a provincial ranking of S3B (2018) (Table 2). This species was listed as a species of Special Concern by the COSEWIC in 2011, and was listed on Schedule 1 of SARA as a species of Special Concern in 2005. The long-billed curlew is listed as a species at risk under the B.C. Forest and Range Practices Act (FRPA) identified Wildlife Management Strategy. Provisions under FRPA can be used to manage these species, such as Wildlife Habitat Area (WHA) and Wildlife Habitat Feature (WHF) designation. The long-billed curlew, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There are no mapped occurrences in the B.C. CDC for long-billed curlew, but 51 records are in the eBird database with a date range of 1996 to 2019 (see Appendix 22). Over the past 150 years, population decline of the long-billed curlew in North America was originally driven by harvest for human consumption, and then drivers shifted to habitat destruction largely from agricultural intensification with urban expansion (Davidson & Mahony, 2015).

Habitat use

The long-billed curlew is the largest shorebird species in North America, its wingspan is as wide as one meter. In B.C., breeding habitat is restricted to valley bottoms and open grasslands. Their breeding habitat consists of open, dry grasslands or cropland, with vegetation that is less than 30 cm tall (Province of B.C., 1998). The last population estimate for long-billed curlews in B.C. was 400-500 individuals (COSEWIC, 2011b). They breed in the southern interior in fairly disjunct regions including the Rocky

Mountain Trench (COSEWIC, 2011b). They make a shallow nest in soil that may be lined with a small amount of dry vegetation, cow or rabbit dung (Province of B.C., 1998). In the Rocky Mountain Trench, they use their long, slender bills to probe into the burrows of insects and other small creatures; they also pick small invertebrates off the soil surface and from bushes and feed on toads, snails, slugs, berries and nestling birds (Province of B.C., 1998).

Ohanjanian (2002) reported that long-billed curlews have been known to occur in the Windermere area since 1986. On May 15 and July 10 of 2009, survey work at the Shuswap Reserve near Invermere was conducted in all potential grassland habitat on the reserve. A pair of long-billed curlews was observed near the north end of the Shuswap Reserve that were thought to be breeding (Gillies, 2009). Gillies (2009) also reported that curlews had been observed near the highway and at the south end of the reserve in that same year. It was postulated that they were using the adjacent highway habitat and the south end habitat as a foraging area, but breeding elsewhere (Gillies, 2009). Between 2002-2004, a long-billed curlew inventory was conducted in the East Kootenay that went as far north as Invermere. During this inventory, nesting was confirmed in two locations in the Invermere area in 2001: the Shuswap Reserve and Kimpton Ranch located on Highway 93/95 (Ohanjanian, 2004). In 2002, two broods were reported at the Zehnder ranch (Bunyan Lake), one brood was observed at the Invermere airport, and one chick was observed at Kimpton Ranch (Ohanjanian, 2004). According to eBird records from 1996-2019, long-billed curlews are found within the study area as far north as the agricultural field located directly adjacent (east) of Burgess and James Gadsden Provincial Park, where breeding is suspected. Recently, long-billed curlews have been reported in agricultural fields along Brisco Road and eBird records for this location from 2015-2019 indicate that a pair may be breeding there each year.

Recommended conservation objectives

Long-billed curlews are using cropland within the Columbia Valley. Davidson and Mahony (2015) suggest that the use of cropland by long-billed curlews should be a research priority in B.C. It is recommended that an inventory be completed to determine the current status of long-billed curlew in the study area. Subsequently, when breeding areas are identified, WHAs should be established over suitable nesting and brood rearing habitats (Ohanjanian, 2004).

Olive-sided flycatcher

Status and occurrence

The olive-sided flycatcher (*Contopus cooperi*) is blue-listed in the province of B.C., with a provincial ranking of S3S4B (2015) (Table 2). In 2007, COSEWIC listed this species as Threatened because of its widespread and consistent population decline. There was a 79% decline between 1968 to 2006 with a further 29% decline from 1996 to 2006 (COSEWIC, 2007b; Environment Canada, 2016a). In 2018, as a result of revised population estimates (450,000 in 2008 to 900,000 in 2013) owed to newer analytical techniques, COSEWIC re-designated the olive-sided flycatcher from Threatened to a species of Special Concern due to the following rationale:

The Canadian population of this widespread forest songbird has experienced a substantial long-term decline, although the rate of decrease has slowed over the past decade. Loss of wintering habitat in northern South America is likely the greatest threat facing this aerial insectivore, but the species may also be affected by changes on the breeding grounds such as the effects of altered fire regimes and changing climates on nesting habitat quality, and reductions in the abundance and availability of aerial insect prey. Concerns for the species remain, as most of these threats are continuing, and those related to climate change may increase (COSEWIC, 2018).

The olive-sided flycatcher was listed as a Threatened species under SARA in 2010, but this status is expected to be re-examined soon and status change is being considered based on COSEWIC's status reassessment [pers. comm., E. Gross (CWS), March 25, 2020]. The IUCN lists this species as Near Threatened on their Red List. The olive-sided flycatcher, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There are 186 records of olive-sided flycatcher occurring in the Columbia Valley within the eBird database, with a date range from 1981 to 2019. These are scattered occurrences with most records occurring at higher elevations on the west bench (see Appendix 23 for species location map).

Habitat use

The olive-sided flycatcher is found in open coniferous or mixed-coniferous forests, usually near wetlands or water, and with the presence of tall snags of wildlife trees that are used for perching in order to watch for prey (flies out to catch insects) and to advertise its territory (Altman & Sallabanks, 2012; Brandy, 2001; Environment Canada, 2016a). Mature conifer forest stands within patchy landscapes that have been influenced by natural disturbance (such as wildfire) support the highest densities of olive-sided flycatcher in Canada (Environment Canada, 2016a; Haché et al., 2014). This species prefers post-burn areas that create open areas or wetlands areas supporting a high abundance of aerial insects (prey) (Altman & Sallabanks, 2012; Brandy, 2001; Environment Canada, 2016a). Nesting territories for olive-sided flycatcher are relatively large for a passerine bird and are usually between 10-20 hectares (Atman & Sallabanks, 2012; Environment Canada, 2016a), but one pair may defend territories up to 40-45 hectares in size (Bock & Lynch, 1970; Environment Canada, 2016). There is limited information regarding habitat types used during migration (Environment Canada, 2016a). Olive-sided flycatcher is widely distributed throughout Canada, with the highest densities of breeding individuals thought to occur in the mountainous regions of western Canada and the United States (Environment Canada, 2016a). "Examination of [B.C. Breeding Bird Survey] data indicates that greatest declines have occurred primarily west of Rocky Mountains, in regions that also support highest relative abundance of the species thus; declines are greatest in the core of this species' population" (Wells, Stuart-Smith, Mahony, Norris & De Groot, 2009).

The olive-sided flycatcher (as well as many other bird species) nests and eggs are incidentally taken each breeding season as a result of industrial activities such as logging. This is in violation of the Migratory Birds Convention Act (Wells, Stuart-Smith, Mahony, Norris & De Groot, 2009). Currently, there is no way to permit this activity. This species was one of the focal species in an East Kootenay project that was

undertaken in partnership with the CWS to help address 'incidental take' of this and other focal songbird species (Wells, Stuart-Smith, Mahony, Norris & De Groot, 2009). Results indicated that there was a significant amount of suitable habitat for this species in the Columbia Valley study area, and that the majority of habitat was within 'high risk lands' (Wells, Stuart-Smith, Mahony, Norris & De Groot, 2009), subject to forestry practices. Hobson, Wilson, Wilgenburg & Bayne (2013) estimated that 616,000 to 2.09 million bird nests are lost annually in Canada due to forestry operations.

Recommended conservation objectives

A recovery strategy for olive-sided flycatcher has been developed, but critical habitat has not yet been identified for this species. If the species is delisted from Threatened Status when re-assessed, critical habitat would no longer apply to this species. Regardless, the "Boreal Avian Modelling Project (BAM) and Environment and Climate Change Canada (ECCC) have partnered on a project to support the definition and identification of critical habitat for this species (Schmiegelow pers. comm. 2017)" (COSEWIC, 2018). Undertaking olive-sided flycatcher monitoring activities in the Columbia Valley to identify priority habitat, including key areas for prey and habitat features, should be identified and subsequently conserved in the Columbia Valley. This information should be provided to forestry companies so that they can avoid harvest in identified areas. Information on abundance, productivity and other measures of habitat quality can also be used to assist with the establishment of critical habitat areas (Environment Canada, 2016a), if they are not delisted.

Due to long-term population declines and its COSEWIC status, Wells, Stuart-Smith, Mahony, Norris & De Groot (2009) indicated that the olive-sided flycatcher "should be a priority for monitoring and model evaluation." It is unclear whether regional habitat modelling has occurred for the Columbia Valley. If it has not, it should be considered a priority at this time to assist in halting or reversing the population decline that this species has faced. Conservation and stewardship initiatives (e.g., developing regulations, policies, and BMPs that provide protection for the species) should be pursued in the Columbia Valley, given that this species is likely to be further impacted by forestry activities in this region. "During the breeding period, potential destructive or disruptive activities should be avoided at locations where olive-sided flycatcher is likely to be encountered or known to occur" (Environment Canada, 2016a).

Peregrine falcon

Status and occurrence

The peregrine falcon, *anatum* subspecies (*Falco peregrinus anatum*) is red-listed in the province of B.C., it has a provincial ranking of S2? (2011), and was listed as 'not-at-risk' by COSEWIC in 2017. Previous COSEWIC assessments for the anatum subspecies were: Endangered in April 1978, Threatened in both April 1999 and in May 2000 (COSEWIC, 2017c). The national population is recovering from the effects of DDT. It was listed as a species of Special Concern under the SARA in 2012. It is regarded as a species of Least Concern by the IUCN on the Red List. There were 102 records for peregrine falcon in the eBird database with most records from a single observer and with this volunteer survey effort concentrated at

the north end of the Valley (i.e. Blaeberry, Burgess and James Gadsden Provincial Park, Donald). Appendix 24 shows a map of peregrine falcon spatial occurrences within the study area.

Habitat use

In terms of nesting habitat, the peregrine falcon requires a suitable cliff face (or human-made substitute) usually beside water that is in close proximity to an adequate food supply (Campbell et al., 1990). This habitat type is not limited in the Columbia Valley, where there are no known nest sites but given they have been seen during the breeding season, nest sites do probably exist. Due to widespread use of DDT and other pesticides from the 1950's to 1970's, B.C.'s interior species of peregrine falcon (*F.p. anatum* subspecies), was considered to be extirpated by the 1970s (Chutter, 2015). Ferguson (2004) stated that, "[t]here are indications that peregrine falcons formerly bred in the East Kootenay (up to the early 1980s), but recent evidence of breeding in this area is lacking." In 2010, the B.C. Wildlife Branch conducted standardized surveys every five years for peregrine falcon; 154 occupied sites were discovered including 17 of the *F.p. anatum* subspecies. An inventory on diurnal raptors in 1996 did not locate any nesting evidence in the East Kootenays, but only a small portion of potential habitat was inventoried (Cooper, 1998; Ferguson, 2004). Cooper (1998) indicated that small numbers of peregrine falcons possibly breed in the East Kootenay, with considerable nesting habitat located in the Rocky Mountain Trench and adjacent valleys.

Recommended conservation objectives

Given that this species occurs sporadically and irregularly in the Columbia Valley with no known nesting locations at this time, naturalists and biologists should be strongly encouraged to record any peregrine falcon sightings into the eBird database. If any breeding evidence is discovered, this should be reported to the B.C. CDC and Environment and Climate Change Canada's Canadian Wildlife Service (ECCC CWS).

Prairie falcon

Status and occurrence

The prairie falcon (*Falco mexicanus*) is red-listed in the province of B.C (Table 2). The endangered status provincially reflects on its very low population, restricted range and habitat, and its extirpation from certain portions of B.C. (Cooper & Beauchesne, 2004). Reasons for the population decline in B.C. are likely due to alienation, loss and fragmentation of foraging habitats through impacts such as forest encroachment, changing agricultural practices and urbanization (Chutter, 2015; Cooper & Beauchesne, 2004). Pesticide loading in the prey base, as well as nest disturbance and collecting for falconry are also suspected causes of population decline (Enns & Ryder, 1994). The prairie falcon was assessed as 'not-at-risk' by COSEWIC in 1996 and it has not been assessed under SARA. In 2004, Copper & Beauchesne stated that there was cause for long-term concern. They recommended continued monitoring and also that COSEWIC readdress the 1996 status listing as soon as possible. This has still not occurred. The IUCN considered this species to be a species of Least Concern.

The prairie falcon is protected under the provincial Wildlife Act and has been recognized as a species at risk under the Forests and Range Practices Act (FRPA). There are a number of provisions under FRPA that can be used to manage these species, such as Wildlife Habitat Area (WHA) and Wildlife Habitat Feature (WHF) designation. There are no occurrences in the B.C. CDC for prairie falcon. There are 145 data occurrences in the eBird database for prairie falcon, the date range for these occurrences is from 1996 until 2019. Appendix 25 shows a map of prairie falcon spatial occurrences within the study area. Most of the eBird records are for individual occurrences, although 11 eBird records from the Blaeberry area had two individuals, and three additional observations from the Blaeberry recorded seeing three individuals at one time. 138 of the eBird records were from a single experienced bird observer (D. Leighton). 119 of those records were from the observer's private residence located in the Blaeberry Valley.

Habitat use

Prairie falcon populations in the Kootenays have been reported to be extremely low (Cooper & Beauchesne, 2004), with a total of 10-20 breeding pairs estimated to be nesting in B.C. (Chutter, 2015). "The prairie falcon nests on cliffs, either within cavities or on ledges, in open, arid grassland habitats in the southern and central interior of British Columbia. Nests are located near water, usually adjacent to rivers" (Chutter, 2015). Chutter (2015) stated that prairie falcons were sometimes observed in the Kootenays, especially during fall, but breeding had not been confirmed. "Two aeries in the Kootenay Region [reported to Cooper (1998)] that were thought to be active historically were not confirmed to be active during field surveys' ' (Cooper & Beauchesne, 2004). Ferguson (2004) reported that breeding was suspected at localized sites based on sightings of adults during the breeding areas. They have been observed occasionally near Canal Flats, Columbia Lake, Invermere and Brisco. In 2018, it was reported to the author that there was a suspected aerie (falcon nest) near the north end of Kicking Horse Mountain Resort's tenure, but this has not been confirmed. Prairie falcons feed mainly on ground squirrels during the breeding season, but in B.C. they have also been known to prey on small to medium-sized birds such as vesper sparrows (*Pooecetes gramineus*), western meadowlarks (*Sturnella neglecta*) and horned larks (*Eremophila alpestris*), as well as small mammals like chipmunks and young marmots (Cooper & Beauchesne, 2004; Steenhof, 2013).

Recommended conservation objectives

There may be prairie falcon nesting sites in the Columbia Valley. An aerie site is suspected near Kicking Horse Mountain Resort and this site in particular should be investigated to determine status of habitat use in that area. Communication with the resort should occur, to let the tenure holders know about the rare falcon utilizing habitat within their tenure area. If any breeding evidence is found, the site should be protected from human activity. Human disturbances can startle birds, causing them to flush the nest and possibly knock eggs out of nests accidentally (Steenhof, 2013). A 1-kilometer buffer zone around any found nest is recommended (Suter & Joness, 1981). All breeding evidence should be submitted to the B.C. CDC. Cooper & Beauchesne (2004), made the following recommendation: "establishment of Wildlife Habitat Areas or other reserves at all aeries where land tenure allows, purchase of land that contains active aeries and critical foraging habitat and management for prairie falcon habitat, liaison with landowners who have active or potential aeries on their properties with the intention of fostering

better management of privately-owned lands for prairie falcons, continued surveys for new aeries, control of activities such as rock-climbing at nesting cliffs, excavation of cavities in silt cliffs to create additional nest sites in areas where suitable nest ledges or potholes are low in number, population augmentation through hacking of young falcons at selected sites, and continuation of the ban on taking young for falconry purposes'' (Cooper & Beauchesne, 2004). Additionally, the CWSP could contact the COSEWIC with a recommendation to re-assess the status of the prairie falcon.

Red-necked phalarope

Status and occurrence

The red-necked phalarope (*Phalaropus lobatus*) is blue-listed in the province of B.C., was listed as a species of Special Concern by COSEWIC in 2014, and Special Concern under SARA in 2019 (Table 2). The IUCN has the red-necked phalarope listed as species of Least Concern on the Red List. There are no occurrence records for this species in the B.C. CDC. There are 21 records of this species in the Columbia Valley recorded in the eBird database from 1994 until 2019 (May until September), with flock size ranging from 1-22 individuals. See Appendix 26 for species occurrence map within the study area. The red-necked phalarope, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act.

Habitat use

The eBird data locations are scattered in the Columbia Wetlands, but somewhat concentrated with six records from Reflection Lake, and six records from Fairmont meadows. The red-necked phalarope is a unique shorebird that spends up to nine months at sea as a pelagic seabird, and most North American birds breed in the arctic and taiga in the high north above most human habitation (Di Corrado, 2015a). The red-necked phalarope does not breed in the Columbia Valley. “Like many shorebirds that end their northbound migration in May or June and start their southbound migration in June or July, there is a chance of encountering this phalarope anywhere in the province during the spring and summer months” (Di Corrado, 2015a). From eBird records we know that the red-necked phalarope uses the Columbia Wetlands as stopover habitat during migration, but occurrences are rare and infrequent.

Recommended conservation objectives

Given that this species is rare and irregular in the Columbia Wetlands, there are no recommended conservation objectives for this species.

Rough-legged hawk

Status and occurrence

The rough-legged hawk (*Buteo lagopus*) is blue-listed in the province of B.C., it was considered not-at-risk in 1995 by COSEWIC and it has not been assessed under SARA (Table 2). It is listed as Least Concern on the IUCN’s Red List and it is protected under the provincial Wildlife Act. No inventory or research work has been done on this species in the Columbia Valley. There are 198 records (date range 1998-

2020) for the rough-legged hawk in the eBird database (for the Columbia Valley), with nearly all records are from the periods of hawk migration (March to April, September until November). A map indicated species occurrence locations can be found in Appendix 27.

Habitat use

Records of rough-legged hawks during periods of bird migration are widely distributed throughout the valley bottom, but there are more records in the Blaeberry and Moberly Marsh area, which is likely due to higher levels of volunteer eBird recording in those areas. The rough-legged hawk does not breed in the Columbia Valley. This species "migrates north from wintering grounds located in the United States (U.S.) (March-May) and arrives in northern breeding areas in the Beaufort Sea area by late April-early May. Southward migration occurs in fall, arriving in the U.S. mostly in September to October; it is present in the southern winter range mostly from November to February" (B.C. CDC, 1994a; Palmer, 1988).

Recommended conservation objectives

The rough-legged hawk uses lower elevations in the Columbia Valley as stopover habitat to rest and forage during migration. Given that this species is infrequent and is not known to concentrate at any particular area in the valley, there are no species conservation actions recommended for this area at this time.

Rusty blackbird

Status and occurrence

The rusty blackbird (*Euphagus carolinus*) is blue-listed in B.C, with a provincial conservation status of S3S4B (2015) (Table 2). It was designated Special Concern by COSEWIC in April 2006, that status was re-examined and confirmed in April 2017. Rusty blackbirds were listed as Special Concern under SARA in 2009 and it is protected under the provincial Wildlife Act. The rusty blackbird has suffered alarming population declines, with an 85-95% decline over the past 40 years (Avery, 2013). Potential reasons for this decline include wetland habitat loss, contaminants on the breeding grounds, poisoning, and increasing levels of disturbance on breeding grounds in the boreal wetlands (Avery, 2013). One of the most significant factors of population decline has been linked to the conversion of wetland forests in the U.S., which are important wintering grounds for the rusty blackbird (Government of Canada, 2014). Continued research is needed to track population levels and better address potential factors of population decline (Avery, 2013). There are no mapped occurrences for rusty blackbirds in the CDC, but there are 129 records for the Columbia Valley in eBird with a date range from 1972 to 2017; flock size 1-24 (see Appendix 28 for a map of occurrence locations in the study area).

Habitat use

The majority of eBird records (119) were made by a single experienced volunteer naturalist, with 92 of those records made from that observer's private residence in the Blaeberry. Other eBird records were from the Moberly Marsh (Burgess and James Gadsden Provincial Park), Athalmer Sloughs in Invermere,

Wilmer (Columbia National Wildlife Area), Radium, Fairmont meadows and Donald. The eBird records are from February to May, and September through December, with most observations made during periods of bird migration indicating the rusty blackbird does not breed in the Columbia Valley. The species is rare and infrequent in this region with scattered occurrences. Migration habitat for the rusty blackbird is associated with beaver ponds, flooded forests, wooded wetlands, brush along water edges, rivers and streams (Avery, 2013; COSEWIC, 2017b).

Recommended conservation objectives

The rusty blackbird uses valley bottom habitat in the Columbia Wetlands as stopover habitat to rest and forage during migration. Given that this species is infrequent and is not known to concentrate at any particular area in the valley, there are no species conservation actions recommended at this time for this area. Citizen scientists should be encouraged to contribute to knowledge of rusty blackbird migratory and habitat requirements (Di Corrado, 2015b) of the Columbia Valley wetlands by entering observations into eBird.

Short-eared Owl

Status and occurrence

The short-eared owl (*Asio flammeus*) is blue-listed in B.C. and has a provincial ranking of S3B, S2N (2015) (Table 2). This species was listed as Special Concern by COSEWIC in 1994 and re-assigned in 2008, and was designated as Special Concern by SARA in 2012. The IUCN considered the short-eared owl to be a species of Least Concern and it is protected under BC's provincial Wildlife Act. COSEWIC states that the reason for designation is as follows: "this owl has suffered a continuing population decline over the past 40 years, including a loss of 23% in the last decade alone. Habitat loss and degradation on its wintering grounds are most likely the major threat, while continuing habitat loss and degradation on its breeding grounds in southern Canada and pesticide use are secondary threats" (Environment Canada, 2016b). Threats to habitat loss and/or to breeding success include: residential and commercial development, agriculture, energy production and mining, transportation and service corridors and climate change (Environment Canada, 2016b). There are no short-eared owl occurrences in the B.C. CDC database for this area, with 31 records of single individuals recorded in the Columbia Valley in the eBird database (see Appendix 29 for a map of occurrence locations). The eBird data date range is 1996-2018, with the majority of sightings made during October and November (two in April; one in August); 30 eBird records were provided by a single experienced bird observer (D. Leighton). The eBird data reveals that the majority of reported observations came from the lower Blaeberry River area, the confluence of the Blaeberry and Columbia Rivers, and Burgess and James Gadsden Provincial Park. It could be because these were the areas in the valley with the most survey effort.

Habitat use

The short-eared owl breeds in all of Canada's provinces and territories, but is most common along the arctic coast and the Prairies (Alberta, Saskatchewan and Manitoba) (Environment Canada, 2016b). The short-eared owl has been suspected of breeding in the Columbia Valley (Ferguson & Halverson, 1997),

but an inventory conducted in May 2003 within the Columbia Basin did not detect any short-eared owls (Cooper, Beauchesne, Errington & Nelson, 2003). It was noted that that one owl was reported by a knowledgeable birder in Wasa during the breeding season, but none were reported for the Columbia Valley (Cooper, Beauchesne, Errington & Nelson, 2003). The low availability of a prey source (vole) was cited as potential rationale for the lack of owl observations during 2003 inventories (Cooper, Beauchesne, Errington & Nelson, 2003).

Short-eared owls like to forage and nest in open habitats such as bogs and marsh edges, old pastures, hayfields and grasslands (Cannings, 2015b). Several sites within the Columbia Valley were rated with a high or moderate wildlife habitat rating for short-eared owls (Cooper, Beauchesne, Errington & Nelson, 2003). In the Columbia Wetlands, suitable breeding habitat and potential nest sites are susceptible to predation by wild animals (e.g., coyotes), domestic pets, and human disturbance.

Recommended conservation objectives

For short-eared owls, conservation actions in the Columbia Valley could include "conservation of grassland areas, increasing the amount of fallow field habitat in wildlife management areas, retaining patches of shrubs and hedgerows between fields for roost cover, and minimizing disturbance by people, vehicular traffic and domestic animals in areas frequented by owls" (Cooper, Beauchesne, Errington & Nelson, 2003). It is important to encourage local naturalists and biologists to record any discovered nesting sites to the B.C. CDC and to record any short-eared owl observations in the eBird database so that we can learn more about this species utilization of the Columbia Valley. Several additional guidelines for raptor conservation are outlined in "Guidelines for Raptor Conservation" (B.C. Ministry of Environment, 2013).

Surf scoter

Status and occurrence

The surf scoter (*Melanitta perspicillata*) is blue-listed in the province of B.C., and had a provincial ranking of S3B, S4N (2015) (Table 2). This species has not been assessed by COSEWIC or SARA. The IUCN considered this species to be of Least Concern on the Red List. The surf scoter, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There are no species accounts for this species in the Columbia Valley in the B.C. CDC. In the eBird database there are 38 surf scoter occurrences between 1996 and 2019 for the Columbia Valley, and three records from the Columbia Wetlands Waterbird Survey. All surf scoter observations in eBird and the CWWS were made in May, August, September and October and all occurrence locations can be seen on a map in Appendix 30.

Habitat use

The surf scoter does not breed in the Columbia Valley. "This medium-sized sea duck breeds in boreal forest lakes of northern Canada and Alaska and during non breeding periods is widely distributed in nearshore marine habitats along both coasts of North America '' (Anderson et al., 2015). According to the available eBird/CWWS data, the surf scoter is rare and irregular in the Columbia Wetlands, with

scattered occurrences during periods of bird migration. The surf scoter uses Columbia Wetlands habitat as stopover grounds during migration. In the freshwater environment, the main foods taken during stopover are a diverse range of benthic invertebrates (Anderson et al., 2015).

Recommended conservation objectives

Given that this species is rare and irregular in the Columbia Wetlands there are no specific recommended conservation objectives for the surf scoter at this time, beyond large-scale habitat protection of the stopover habitat used by the surf scoter in the Columbia Wetlands.

Swainson's hawk

Status and occurrence

The Swainson's hawk (*Buteo swainsoni*) is red-listed in B.C. with a provincial ranking of S2B (2015) (Table 2). It has not been assessed by COSEWIC or SARA and it is listed as Least Concern on the IUCN's Red List. There are 11 scattered occurrences for Swainson's Hawk in the Columbia Valley in the eBird database; date range 1997 until 2019. A map of these eBird occurrences can be found in Appendix 31.

Habitat use

Most of B.C.'s population of Swainson's hawk is restricted to the Southern Interior Ecoprovince, with most breeding evidence restricted to lower elevation grasslands and agricultural habitats is in the grasslands of the Thompson-Nicola valleys (Fraser, 2015). The Swainson's hawk is currently not known to breed in the Columbia Valley. Ferguson (2004) states that "prior to the 1940s, the Swainson's hawk was reportedly "common" in the East Kootenay (and may have bred here historically), but there are no documented nesting records in the Kootenay Region within the last 50 years." An inventory in 1996 found no Swainson's hawks in the East Kootenay, and Cooper (1998) concluded that they are extremely rare in the Kootenay Region. The historical decline of the Swainson's hawk population is owed to shooting (they were considered pests on agricultural land), pesticides and other contaminants, and degradation of habitat. Ongoing declines are related to additional human disturbances such as habitat degradation, disturbance at nest sites (Bechard, Houston, Sarasola, & England, 2010) and decline in primary prey (Richardson's ground squirrel, *Spermophilus richardsonii*) abundance on breeding grounds (Fraser, 2015).

Recommended conservation objectives

There are only sparse and erratic records available for Swainson's hawk in the Columbia Valley. Birders, naturalists and biologists are encouraged to look for this species and document any discovered breeding evidence. If any critical habitat features for Swainson's hawk are discovered in the Columbia Valley, there are a number of additional guidelines for raptor conservation that are outlined by the provincial government and that should be adhered to (B.C. Ministry of Environment, 2013).

Tundra swan

Status and occurrence

The tundra swan (*Cygnus columbianus*) is blue-listed in the province of B.C. and has a provincial ranking of S3N (2015); it has not been assessed by COSEWIC or SARA and is listed as Least Concern on the IUCN's Red List (Table 2). This species, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There are no occurrences for tundra swans in the Columbia Valley in the B.C. CDC. There are 163 eBird, 69 Columbia Wetlands Waterbird Survey (CWWS), and one Columbia Wetlands Marsh Bird Monitoring Project records for tundra swans observed in the Columbia Wetlands. Flock size varied from one to 64 individuals. Observations were scattered throughout the Columbia Wetlands with a date range from 1985 to 2020 and mapped occurrences are found in Appendix 32.

Aerial surveys conducted by Canadian Wildlife Service in 1977 recorded 1,200 swans (tundra and trumpeter swan species) in the Columbia Valley during a single day count on March 28, 2020. In addition to regular survey dates during migration, the CWWS conducted aerial swan surveys each spring from 2016-2019. These surveys lasted approximately two hours on each survey date and swan counts were as follows: on March 23, 2016 = 756 swans, March 26, 2017 = 621 swans, April 9, 2018 = 915 swans, April 8, 2019 = 669 swans (Darvill, 2020). Given the similar appearance of trumpeter and tundra swans, these two species were unable to be differentiated from the air, so those are the total counts for both swan species combined (Darvill, 2020).

Habitat use

Tundra swans do not breed in the Columbia Valley, they nest along the Beaufort Sea coast, but the relatively high level of habitat use by swans indicates that the Columbia Wetlands provide important stopover habitat during migration. They use the shallow water wetlands that provide necessary food resources needed to build up energy reserves for migration and breeding. Food taken in the Columbia Wetlands are plants, primarily the seeds, stems, roots, and tubers of submerged and emergent aquatic vegetation. The eBird database indicates that tundra swan moves through the Columbia Valley during March-May and October-November. Aerial survey data from the 2016-2019 CWWS (Darvill, 2020) indicates that the highest concentrations of swans during migration can be found between: Fairmont and the south end of Fairmont, Althalmer to the Wilmer, an area just north of Radium, a long stretch between Brisco and Harrogate, and a few smaller areas north of Harrogate all the way to Nicholson. Appendix 33 shows the spatial distribution of tundra/trumpeter swans in the Columbia Valley according to four aerial survey dates during each year of 2016-2019 from the CWWS.

During the winter of 2020, multiple tundra and trumpeter swans (in addition to other waterfowl) were using ice-free habitat located at Athalmer Slough (near Invermere). During an aerial flight on February 2, 2020, Athalmer was the only area observed to be ice-free in the Columbia Valley north of Lake Windermere (ice-free areas were not surveyed south of Lake Windermere), indicating that Athalmer

provides important staging habitat as a feeding area during winter when other areas in the Columbia Wetlands are frozen (making food unavailable).

Recommended conservation objectives

Tundra swans and other bird species have been observed to use the ice-free areas of Tatley Slough, Mud Lake and Athalmer during winter. "The single most important aspect of [1976-1977 CWS] survey results are that the majority of birds were concentrated to a very limited amount of open water at the southern end of lake Windermere (Rushmere). This marsh and its neighbor, Tatley Slough, benefit from the warmth of the hot springs at Fairmont and are not only ice free very early but should have an increased productivity during the growing season" (Kaiser, Smith, & Cadenhead, 1978).

While Althamer Slough was observed to be ice-free in 2020, it is unknown if this area (in addition to the south end of Lake Windermere and Tatley Slough) are ice-free each winter. A part-time resident of Fairmont has stated that he has never seen the areas around Mud Lake frozen during winter and that there are springs in the wetlands at that location, which likely prevents the water from freezing (pers. comm., D. Gibson, March 2020). It was also noted that there is still some waterfowl use in this area during winter. Conducting winter bird surveys at the noted ice-free areas during winter is recommended. This will allow for a better understanding of current habitat conditions and bird use at these sites. This type of information in addition to determining land ownership at these ice-free sites is needed prior to developing conservation recommendations at ice-free areas. "Outflow areas of warm water should be acquired as irreplaceable migration habitat and fully protected" (Kaiser, McKelvey & Smith, 1977).

Western grebe

Status and occurrence

The western grebe is red-listed in the province of B.C., and has a provincial ranking of S1B, S2N (2015) (Table 2). It was listed as a species of Special Concern by COSEWIC in 2014, and was listed on Schedule 1 of SARA in 2017 as a species of Special Concern. The western grebe, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. The western grebe is a regular spring and fall migrant in the Columbia Valley, and across most of the southern interior of B.C. (Howie, 2015b). There were 302 accounts of western grebe in the Columbia Valley in the eBird database at the time of writing, 69 of those were accounts from the Columbia Wetlands Waterbird Survey (Darvill, 2020), and three eBird records come from inventory work that was conducted on Lake Windermere and Columbia Lake by the principal author (Darvill, 2019). These reported occurrences are provided in a map found in Appendix 34. There are two historical records with considerable numbers for the Columbia Wetlands; 250 in Spillimacheen on October 3, 1951, and 300 in Golden on October 4, 1951 (Davis, 1954).

Habitat use

The western grebe does not breed in the Columbia Valley, with only two confirmed colonies in B.C.: Salmon Arm Bay on Shuswap Lake (largest breeding colony) and at Leach and Duck Lakes in the Creston

Valley Wildlife Management Area (Howie, 2015b). Other colonies are possible at Okanagan Lake and in the Peace River lowlands, but have not been recently confirmed according to the latest surveys for the 'Atlas of the Breeding Birds of B.C.' in 2015. Western grebes often concentrate in larger numbers (e.g. 224 individuals seen on Lake Windermere during the Columbia Wetlands Waterbird Survey on October 5, 2019), but there are also several reported observations of single individuals. The majority of western grebe sightings in the Columbia Valley come from Columbia Lake and Lake Windermere (Appendix 34), with several additional scattered sightings throughout the Columbia Wetlands. An analysis by Darvill (2019) found that according to the eBird data records, the at-risk bird species most frequently reported for Lake Windermere was the western grebe. Habitat used during migration in the wetlands are the shallow open water bodies and lakes. This type of habitat is where western grebes congregate as it provides a safe staging area during migration and protection from land-based predators (e.g., coyotes, dogs). Also, shallow open water wetlands and lakes are also likely to contain fish, a critical food source for this fish specialist species.

Recommended conservation objectives

Darvill (2019) provides a number of recommendations to protect the waterbirds (including western grebe) on Lake Windermere, including:

- *Since virtually nothing is known regarding the incidence of people approaching at-risk grebe species or other birds on [Lake Windermere], research should be conducted to determine the extent of human intrusion on the birds of Lake Windermere. If it is determined that birds are being impacted, buffer distances for recreationists should be established.*
- *The south end of Lake Windermere is currently relatively free of human development, has a high amount of food availability for waterbirds, with limited human access or use. It is important to continue with the current habitat conditions found at the south end so that high habitat suitability for migrating birds can be maintained.*
- *The south end of Lake Windermere has been documented to be the most important staging grounds for birds in terms of largest mixed flock size detected in the Columbia Wetlands, and this area is likely a key breeding area in B.C. for marsh birds. The south end is already part of the WMA; therefore, it is suggested that this section be marked with educational buoys and signage suggesting that people keep out of this area during sensitive periods for birds (e.g. breeding and migration). Current boating regulations already prohibit motorized boats from entering the WMA" (Darvill, 2019).*
- *Since at-risk grebe species are at the top of the food chain, feed extensively on fish and are sensitive to aquatic pollutants, it is recommended that a toxic analysis on the fish of Lake Windermere be conducted.*

Darvill (2020) suggested designating the south end of Lake Windermere as a Migratory Bird Sanctuary, which should be pursued in addition to two additional areas as will be discussed in the forthcoming section related to the Columbia Wetlands Waterbird Survey.

White-throated swift

Status and occurrence

The white-throated swift was placed on B.C.'s blue-list in 2015 and it has a provincial ranking of S3S4B (2015) (Table 2). This species has not been assessed by COSEWIC or SARA and it is listed as a species of "Least Concern' by the IUCN. The white-throated swift, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. No inventory work has been conducted for this species in the Columbia Valley. There are 101 eBird records in the Columbia Valley for this species (83 of those from Dutch Creek Hoodoos area), with a date range of 1994 to 2019 and from April to August for all records indicating that this species breeds in the Columbia Valley. A species location map can be found in Appendix 35. In 1995 it was estimated that about 400 breeding pairs are concentrated at relatively few nesting sites in B.C. (Summers, 1995), making the Columbia Valley an important breeding area for this species.

Habitat use

White-throated swift nesting occurs in crevices within large rock bluffs, canyon walls, pinnacles, large rocks, and in a variety of human-made structures such as bridges, highway cuts, quarries, and crevices in buildings (Cannings, 2015c). This species can be found in the Interior Cedar-Hemlock, Ponderosa Pine, Bunchgrass and Interior Douglas-fir biogeoclimatic zones (Cannings, 2015c). They occur in mountainous and hilly terrain, adjacent to both open country and heavily forested areas and are often seen foraging on updrafts associated with canyons, hills, and mountains (Cannings, 2015c).

The B.C. Breeding Bird Atlas map for the white-throated swift indicates that there is 'possible' breeding habitat located at the Dutch Creek Hoodoo area. Those lands were donated to, and are managed by, the Nature Conservancy of Canada (NCC) who has stated that white-throated swifts do nest in the cliff face at the Dutch Creek Hoodoo property (pers. comm., R. Klafki, March 20, 2020). The eBird records indicate that white-throated swift may have been nesting here since at least 1994. In addition to this breeding location, white-throated swifts have reportedly been breeding in the Johnson Canyon area northwest of Invermere. The species was first recorded in this area in 2016, indicating that the white-throated swift may be expanding its range further northward, first being recorded in B.C. in 1907 at Vaseux Lake in the southern Okanagan (Cannings, 2015c). In addition to the two breeding sites in the Columbia Valley, white-throated swift has also been reported as far north as the Golden area (in 2018 and 2019), as well as in Spillimacheen, Lake Lillian, Columbia National Wildlife Area (Wilmer Unit), Invermere area, Lake Windermere area, Fairmont Hot Springs and the north end of Columbia Lake. Main foods taken by the white-throated swift are aerial insects as well as other arthropods carried by air currents (Ryan & Collins, 2000). Recent declines of aerial prey species are the rationale for placing this species on B.C.'s blue list (Cannings, 2015c).

Recommended conservation objectives

Given that confirmed and probable breeding locations are in relatively inaccessible locations on cliffs, and one known breeding location is on a conservation property owned by the NCC, this species is less

susceptible to development, natural resource extraction and other human-caused pressures that are posing threats to other at-risk species in the Columbia Valley. Conducting inventories at the two breeding locations (see Appendix 35) to collect baseline information at each site, and determining landowner status at the Johnson Canyon breeding site, is advised. Baseline data at each site should be officially documented and submitted to the B.C. CDC. In order to help assess population trends for this species in the Columbia Valley, the NCC should be asked if they are able to take on annual monitoring at the breeding site located at the NCC Dutch Creek Hoodoo property. The NCC may also want to consider installing educational signage at this site to raise public awareness about this at-risk species. "This species requires thorough inventory, confirmation of breeding status at many sites, and increased levels of public awareness" (Summers, 1995). Since white-throated swifts are usually not recorded far from nesting cliffs (Summers, 1995), any potential nesting habitat documented through eBird should be inventoried.

Winter wren

The winter wren (*Troglodytes hiemalis*) is blue-listed in B.C. and has a provincial ranking of S1B (2015) (Table 2). It has not been assessed by COSEWIC or SARA and is listed as Least Concern on the IUCN's Red List. Winter wren, its nests, and its eggs are protected under the federal Migratory Birds Convention Act and the provincial Wildlife Act. There are no data records for this species in the B.C. CDC with only two records in the eBird database (see Appendix 1) for the Columbia Valley. Both accounts were reported by the same knowledgeable naturalist (D. Leighton) at the same location; Moberly Marsh in Burgess and James Gadsden Provincial Park on September 7, 1970 and on May 5, 1996. Given that this species is rare and accidental in the Columbia Valley, there are no recommended conservation objectives for the winter wren.

4.2 Fish

Bull trout

Bull trout (*Salvelinus confluentus*) is a blue-listed species in the province of B.C., with a provincial ranking of S3S4 (2018) (Table 3). It was listed as a species of Special Concern by COSEWIC in 2012. It has not been assessed under SARA. The bull trout is an identified wildlife species at risk under the Forest Practices Code in B.C., indicating that Wildlife Habitat Areas could be designated for this species. Bull trout require diverse habitats during different life stages, but for spawning, bull trout show a preference for gravel and cobble sections in smaller, lower order rivers and streams (Hammond, 2004). They spawn in flowing water and have specific requirements, including sections with low gradients, specific water velocities (0.03-0.80m/s), debris jams, pools and overhanging vegetation cover, and undercut banks (references cited in Hammond, 2004). Bull trout are long-lived, slow-growing and late sexually maturing fish making them susceptible to overexploitation and sustained population effects (Haas & Porter, 2001). Major threats to bull trout include overfishing, invasive exotic species, and habitat alteration such as forestry activities that can increase fine sediment loads and significantly increase stream temperatures resulting in impacts to bull trout growth and survival (Goetz, 1989; Haas, 1997; Haas & Porter, 2001).

"Migratory bull trout populations have been identified in accessible reaches of the Dutch, Toby, and Horsethief Creek systems (Fielden, Wood & Slamey, 1993), and in the lower Blaeberry River (Triton Environmental Consultants Ltd., 1991)" (Hagen, 2008). Bull trout are known to utilize the mainstem of the Columbia River and Lake Windermere (Westslope Fisheries, 2001). Bull trout are also present in the Kicking Horse River system (Morley & Barlow, 2016). The only completed enhancement project the author could locate addressing bull trout habitat within the study area was a FWCP-supported kokanee spawning habitat improvement project at the outlet of Lake Windermere (Ahren & Kormen, 2004). Ahrens & Korman's (2004) project focused on kokanee, but "represented an enhancement of the reach for bull trout populations as well, given the seasonal availability of migrating adult and juvenile kokanee for fluvial bull trout, and enrichment resulting from decomposing kokanee bodies" (Hagen, 2008).

Columbia Lake and Lake Windermere are known to provide excellent habitat for a number of fish species including bull trout (McPherson, Hlushak, Adams & Polzin, 2010). A fish inventory on Columbia Lake was completed in 2009, where a variety of sampling methods such as snorkel, seine, Gee trap, and trap net were used to obtain information on species presence and relative abundance (McPherson, Hlushak, Adams & Polzin, 2010). The study found that redside shiner (*Richardsonius balteatus*) and cyprinids (minnows and carps) were most abundant in Columbia Lake; bull trout were not seen (McPherson, Hlushak, Adams, & Polzin, 2010). The last fish inventory on Lake Windermere was completed in 2007 and bull trout were detected (McPherson & Hlushak, 2008). Despite mounting public concerns about indigenous fish stocks in both lakes, identified through heightened written and oral communications from the public to the Lake Windermere Ambassadors (LWA) and Columbia Lake Stewardship Society (CLSS), no formal study has been done to quantify how fish population dynamics

may be changing with time and with warming water temperatures from climate change, invasive fish species, and other anthropogenic factors.

Recommended conservation objectives

Management strategies to conserve bull trout require first obtaining an adequate baseline knowledge, such as distribution and habitat use information of bull trout populations (Haas & Porter, 2001) in the Columbia Valley. Given that little fish inventory and monitoring work has been completed within the study area, it is recommended to implement an at-risk fish species (bull trout and westslope cutthroat) inventory and habitat monitoring program in the study area. This program is needed to gather fish habitat assessment and baseline data on at-risk fish populations to inform management recommendations. It is important that this program also works to detect the presence and extent of exotic or invasive species that may be having an impact on at-risk indigenous fish populations.

Invasive fish species known to be present in the Columbia Valley include: pumpkinseed sunfish (*Lepomis gibbosus*), largemouth bass (*Micropterus salmoides),* brook trout (*Salvelinus fontinalis*), yellow perch (*Perca flavescens*) and northern pike (*Esox lucius*) (Craig, 2015). Largemouth bass is on the IUCN's top 100 list of the world's worst invasive alien species (Lowe, Browne & Boudjelas, 2000). There are several negative implications that invasive fish can have on indigenous fish species populations such as hybridization, competition for prey, direct predation, spread of pathogens and parasites (Vitule, Freire & Simberloff, 2009). "There remains an inherent risk that potentially catastrophic, irreversible ecological consequences will develop from [a freshwater fish] introduction, as evidenced by global case-studies involving invasive tilapias, carps and catfishes (Vitule, Freire & Simberloff, 2009), with Gozlan (2009) suggesting that 10% of freshwater fish introductions are likely to result in adverse ecological effects" (Britton, Gozlan & Copp, 2010). Major concerns stem from not knowing the extent of invasive fish species populations in the upper Columbia river system. Determining the extent of invasive fish is needed to create a management strategy to limit their proliferation and impacts on indigenous fish populations.

A B.C. Hydro powered dam is located on the Spillimacheen River, which is located approximately 55 kilometers upstream of Golden. Owing to the low diversion rate, this dam has little influence on river habitats (or on fish) within the immediate area, except during periods of low flow (Hagen, 2008; Moody et al., 2007; Triton, 1991). However, the presence of brook trout in the upper Spillimacheen system can lead to competition and hybridization with at-risk bull trout that are also present (Hagen, 2008). "The presence of brook trout within the distribution of resident bull trout populations in the upper Spillimacheen River, therefore, should be viewed with concern even though it is unrelated to the construction of the Spillimacheen facility" (Hagen, 2008). In order to develop a management strategy, a fish survey on the upper Spillimacheen River is recommended to determine the current populations of brook and bull trout. This should include an assessment regarding the amount of hybridization that has taken place.

In 1993, it was suggested that fertilization in Dutch Creek could enhance the low nutrient levels, but that water quality and temperature data would be required to determine the effectiveness of this method.

Barrier removal was also suggested for habitat enhancement (Fielden, Wood, & Slamey, 1993). There were further recommendations provided by Fielden, Wood & Slamey (1993), including "to further protect spawners in Dutch Creek, it may be desirable to close the river to bull trout fishing on August 1." Additionally, "riparian restoration along streams is highly likely to benefit bull trout, given that water temperatures above 13 degrees Celsius reduce habitat suitability and favour other species (Hagen, 2008). Restoration activities in riparian areas that have been affected by forestry activities should also be strongly considered. Candidate streams for restoration activity need to be considered and identified.

Westslope cutthroat trout

The westslope cutthroat trout (WCT) (*Oncorhynchus clarkii lewisi*) is blue-listed in the province of B.C. and has a provincial ranking of S2S3 (2018) (Table 3). It was listed as a species of Special Concern by COSEWIC in May 2015, with this status was re-examined and confirmed in November 2016. This species was also designated on Schedule 1 as a Species of Special Concern under SARA in 2010. The WCT has been recognized as a species at risk under the Forests and Range Practices Act (FRPA).

The B.C. (and Alberta) populations of WCT have experienced significant manipulation by humans (COSEWIC, 2006). Threats to this species includes introduced species (i.e., fish stocking lakes for sport fishing), expanding urban development, resource-based activities (i.e., logging, mining), habitat loss and degradation, and other anthropogenic factors such as overharvesting and climate change (COSEWIC, 2006). Since the 1920s, fish stocking has focused on providing or enhancing recreational angling opportunities; "introductions often serve to obscure trends in [indigenous] production and may, in fact, further contribute to the decline of populations" (references cited in COSEWIC, 2006).
The stocking of rainbow trout and other trout species has caused affects to the genetic integrity of indigenous WCT populations in B.C. (COSEWIC, 2006). The WCT is arguably one of the most popular and thus important species in the recreational fisheries industry (B.C. Ministry of Environment, 2014) and is an important cultural resource for Indigenous peoples. "Westslope cutthroat trout is identified as a priority [indigenous] sport fish species by the BC Freshwater Fisheries Program (BCFFP). Healthy and persistent wild fish populations are necessary for achieving conservation goals and a sustainable fisheries program, which in turn provide social, economic, and recreational benefits to the province. Implicit in this management plan (BCFFP) is that the conservation goal must be met first to achieve the recreational goal" (B.C. Ministry of Environment, 2014).

Habitat requirements for WCT are strict and vary according to various life history stages. They require cold clean water, and cover (i.e., riparian vegetation, pool-riffle habitat, undercut banks) to maintain population levels (COSEWIC, 2006). WCT are found in large rivers and lakes, as well as small mountain streams within B.C. Within the study area, habitat range of WCT includes the upper Kootenay River drainage and may have included the Kicking Horse River above Wapta Falls, having gained access to the area through headwater transfer with the upper Kootenay River (references cited in Mayhood, 1995); "and in a few small headwater tributaries of the Columbia near Windermere and Columbia lakes" (references cited in Mayhood, 1995). No other indigenous strains of WCT populations are known within

the study area. Yet, WCT has been widely introduced to other parts of the province, both within and outside of their native range (COSEWIC, 2006). For instance, in Windermere Lake, the "Fish Inventory Summary System (FISS) identified that 5,000 hatchery fry were stocked in the lake in 1952 and that the wild adfluvial form was observed in 1983 (Ministry of Environment, 2008a)" (McPherson & Hlushak, 2008). WCT have been inventoried and captured in Horsethief Creek (at the Grottos), and at Jumbo Creek of the Toby creek system (Fielden, Wood & Slamey, 1993).

Recommended conservation objectives

The population and genetic status of WCT in B.C. (both indigenous and introduced populations) are unknown (Mayhood, 1999). Recommendations to protect WCT are in line with those recommendations listed above in the bull trout section. That is, adequate knowledge such as population, distribution and habitat use information for WCT populations is required within the study area. Given that little inventory and monitoring work has been completed, it is recommended to implement an at-risk fish inventory and habitat monitoring program in the Columbia Valley. This program is needed to gather fish habitat assessment data and gather baseline data on at-risk fish populations (WCT and bull trout). It should also work to detect the presence and extent of exotic or invasive species that may be having an impact on at-risk fish populations. This program is needed to inform management recommendations to conserve and enhance WCT. Determining the extent of invasive fish is also needed to create a management strategy to limit their proliferation and impacts on WCT populations.

4.3 Mammals

American badger

The American badger (*Taxidea taxus jeffersonii,* eastern population) is red-listed in the province of B.C., and has a provincial ranking of S2 (2015) (Table 4). It is listed as an Endangered species under COSEWIC (2012) and on Schedule 1 of SARA (2018). The reason for COSEWIC designation is because "as few as 100 mature badgers live in the East Kootenay region where they are vulnerable to increasing threats from roadkill. The loss of open areas to forest succession and urban development is resulting in ongoing habitat decline" (COSEWIC, 2012a). It is listed as Least Concern on the IUCNs Red List. The American badger has been recognized as a species at risk under the Forests and Range Practices Act (FRPA). There are a number of provisions under the FRPA that can be used to manage these species, such as Wildlife Habitat Areas (WHA) and Wildlife Habitat Features (WHF).

Southeastern B.C. is at a northern extent of the American badger range (COSEWIC, 2012a). Within B.C., most badger activity occurs at low elevations in dry areas with non-forested grasslands or shrubland biomes, but they can be found from alpine areas to wetlands (COSEWIC, 2012a). Badger densities are low where they are found, and they have large home ranges with hundreds of different burrows within their home range (Newhouse, 2001). They often change locations daily and they reuse burrows from year to year making it important to ensure that unoccupied burrows are not destroyed (Newhouse, 2001). It has been shown that soil and prey availability (not specific vegetative habitat associations) are

the key defining features or requirements for badger habitat (COSEWIC, 2012a). Their primary food source in the study area is the Columbian ground squirrel (*Urocitellus columbianus*) (Kinley & Newhouse, 2008), and badgers prefer coherent soils that do not collapse when tunnelled (COSEWIC, 2012a). Additional habitat associations are also important for badgers: low elevations, shallow slopes, low forest crown exposure, and high solar radiation (Kinley, Whittington, Dibb & Newhouse, 2014).

The American badger is one of the most well-studied at-risk species within the Columbia Valley study area. A number of studies have been conducted on badgers within the study area, including habitat modelling (Apps & Newhouse, 2000), assessing habitat associations of American badgers in southeastern B.C. (Apps, Newhouse & Kinley, 2002), translocation of badgers to the Upper Columbia Valley (Newhouse & Kinley, 2003), assessing roadkill risk in relation to the presence of culverts and barriers (Kinley & Newhouse, 2009), and effectiveness monitoring of badger Wildlife Habitat Areas (Kinley, 2009). With the badger habitat model developed by Apps & Newhouse (2000) for the northern portion of the East Kootenay, in addition to the collection of much radio-telemetry data (Kinley & Newhouse, 2008), a resource selection function (RSF) model was developed in 2014 for all badger range within the B.C. portion of the Rocky Mountain Trench (Kinley, Whittington, Dibb & Newhouse, 2014) (see Appendix 36). "Connectivity habitat in [the] Upper Columbia is primarily a north-south concern as badgers are mostly limited to lower elevations in the Trench" (Adams, 2011).

Recommended conservation objectives

The RSF model is the result of extensive research and best management practices and it should be adhered to within this area. "Ongoing thinning and burning to restore the open conditions that historically occurred within this fire-maintained ecosystem (Anderson et al., 2006) should improve badger habitat quality within the Rocky Mountain Trench. Such restoration actions would probably provide the most benefit to badgers if they occurred in areas with Brunisolic or Chernozemic soils on glacio-lacustrine parent material" (Kinley, Whittington, Dibb & Newhouse, 2014).

There are badger sites and dens on crown land within the study area (pers. comm., R. Klafki, March 24, 2020). These areas should be identified and designated as WHAs. Additionally, WHFs could be identified and established within the study area. An American badger WHF would be a burrow, which "means an excavated hole that descends below ground that either (1) is currently occupied for denning, shelter, or foraging or (2) is habitually occupied and still capable of providing for denning, shelter, or foraging" (Ministry of Environment, 2018b). Identifying potential WHFs for badgers would require further research to identify current burrow sites.

Table 3. Fish species at risk in the study area.

Scientific Name	English Name	Provincial Ranking	BC List	COSEWIC	SARA	Provincial FERPA	IUCN red List
Salvelinus confluentus	bull trout	S3S4 (2018)	Blue	SC (2012)	not assessed	Y	Vulnerable
Oncorhynchus clarkii lewisi	westslope cutthroat trout	S2S3 (2018)	Blue	SC (2016)	1-SC (2010)	Y	n/a

Table 4. Mammal species at risk in the study area.

Scientific Name	English Name	Provincial Ranking	BC List	COSEWIC	SARA	Provincial FERPA	IUCN Red List
Taxidea taxus jeffersonii	American badger - *jeffersonii* subspecies	S2 (2015)	Red	E (2012)	1-E (2018)	Y	Least Concern
Rangifer tarandus pop. 1	caribou (Southern Mountain Population)	S1 (2017)	Red	E (2014)	1-T (2003)	Y	Vulnerable
Ursus arctos	grizzly bear	S3? (2015)	Blue	SC (2002)	1-SC (2018)	Y	Least Concern
Neotamias minimus	least chipmunk, *oreocetes* subspecies	S3 (2006)	Blue	not assessed	not assessed	N	Least Concern
	least chipmunk, *selkirki* subspecies	S1 (2006)	Red	not assessed	not assessed	N	Least Concern
Myotis lucifugus	little brown myotis	S4 (2015)	Yellow	E (2013)	1-E (2014)	N	Endangered
Oreamnos americanus	mountain goat	S3 (2015)	Blue	not assessed	not assessed	N	Least Concern
Myotis septentrionalis	northern myotis	S3S4 (2015)	Blue	E (2013)	1-E (2014)	N	Near threatened
Ovis canadensis canadensis	Rocky Mountain bighorn sheep	S3? (2015)	Blue	not assessed	not assessed	Y	Least Concern
Gulo gulo luscus	wolverine	S3 (2015)	No status	SC (2014)	1-SC (2018)	N	Least Concern

Bighorn sheep

Bighorn sheep (*Ovis canadensis*) is a blue-listed species in the province of BC with provincial conservation status of S3? (2015, its status has not been determined by COSEWIC or SARA (Table 4). The IUCN has listed bighorn sheep as a species of Least Concern on their Red List. The bighorn sheep has also been recognized as a species at risk under the Forests and Range Practices Act (FRPA). This species is not immediately threatened, but they are of concern because they are particularly sensitive to human activities or natural events (Teske, 2015). There are two separate ecotypes (Rocky Mountain and California) of bighorn sheep in BC. The Rocky Mountain ecotype is the one present in the study area. Bighorn Sheep use a variety of habitat types within their home range, all on moderately steep to very steep slopes. These habitats include open grasslands, alpine, subalpine, shrub-steppe, rock outcrops, cliffs, meadows, moist draws, stream sides, talus slopes, plateaus, deciduous forest, clear cut or burned forest and conifer forest (Demarchi, 2004). Their diet in winter consists mainly of bunchgrasses, such as wheatgrasses (Agropyron spp.), fescues (Festuca spp.), bluegrasses (Poa spp.), needle grasses (Stipa spp.), and various forbs and shrubs (Davidson, 1994). There are 26 different bighorn sheep herds in the Kootenay region. Total population estimates have ranged from 1,700 to 2,500 individuals since the mid-1980's (Teske, 2015).

The range of bighorn sheep in the Columbia Valley is shown in Appendix 37. Three herds (Golden, Radium and Columbia Lake) delineated into two Population Management Units (PMUs) (i.e., Golden and Columbia-Radium) are located within the study area. The herd in the Radium area has been well-studied (Dibb, 2007; Stelfox, 1990; Stelfox, et al., 1985; Tremblay, 2001), with movement patterns well documented (Dibb, 2007; Tremblay, 2001) since bighorn sheep consistently follows the same routes (Adams, 2011). Since the late 1980's, the MFLNRORD has conducted aerial inventories, population estimates, developed harvest strategies, and conducted research on the Columbia Lake and Radium herds, which were assessed to have a stable population with 120 and 160 individuals respectively in 2014 (Teske, 2015). Through aerial and ground counts conducted in January to February 2019, the Columbia-Radium PMU is estimated at 253 individuals, and the Golden PMU had 16 individuals in 2019 (Poole & Ayotte, 2019).

Recently, two bighorn sheep conservation projects have been initiated in Golden by local community groups. Since 2016, Wildsight Golden has been monitoring sheep numbers in the canyons, and they have found herd size has decreased over the last several years to 14 individuals in 2020 (pers. comm., M. Langley, January 2020). Through non-invasive methods, Wildsight Golden had been collecting fecal matter to learn more about the health of bighorn sheep in the Kicking Horse Canyon. Investigations have included inbreeding, parasites, pregnancy, stress hormone and nutritional requirement levels. The public was also requested to share ungulate sightings and locations. The Golden District Rod and Gun Club, along with Conservation Officer Services, the MFLNRORD, and the Wild Sheep Society of BC came together to conduct a study on the health, habits and habitats of the Golden herd, involving the collaring of sheep. Both Wildsight Golden and the Rod and Gun Club are working on independent projects with the common aim of conserving the small herd in the Golden area.

Substantial population declines have been reported for bighorn sheep and "sheep continue to lose good quality habitat (especially native winter range) to various types of direct habitat loss and land conversion, invasive plants and to forest encroachment (BC Conservation Data Centre, 2019)" (Poole &

Ayotte, 2019). Sheep are vulnerable to parasites and diseases (i.e., respiratory disease introduced from contact with domestic sheep and goats) (references cited in Poole & Ayotte, 2019), an increase in predators (poor quality escape terrain), harsh winters and avalanches, competition from other ungulates, human disturbance and development (Teske, 2015). Road mortality is also a significant factor, especially for the Radium and Golden herds that use foraging and lambing habitat adjacent to busy highway corridors.

Recommended conservation objectives

In 2018, consultation meetings were held with stakeholder groups in December 2018 with the result being the 'Kootenay Region Bighorn Sheep Management Plan – Draft for Discussion' (Poole & Ayotte, 2019). Included in this draft discussion are a number of broad-level management goals and objectives such as: "maintain viable and ecologically sustainable populations of bighorn sheep throughout suitable native range for ecological, cultural, economic and social benefits using science-based management; manage populations to provide quality hunting opportunities; protect and enhance the quality and quantity of bighorn sheep habitat throughout native range, considering human access, forest encroachment, logging, spread of invasive plants, and livestock forage competition; manage impacts of predation on bighorn sheep populations while preserving ecosystem integrity" (Poole & Ayotte, 2019). It is recommended that the CWSP and Kootenay Connect project stay apprised with the management plan. It would also be useful to work on conservation objectives that would assist with road mortality as that appears to be a significant factor for two of the three herds in the study area.

Grizzly bear

The grizzly bear is blue-listed in the province of B.C., and has a provincial ranking of S3? (2015) (Table 4). This species was listed with Special Concern by COSEWIC in 2002, and was listed on Schedule 1 of SARA in 2018 as a species of Special Concern. The grizzly bear has been recognized as a species at risk under the Forests and Range Practices Act (FRPA) and is listed as Least Concern on the IUCNs Red List.

Recent grizzly bear habitat modelling has occurred based upon research conducted and provided by Dr. Michael Proctor. A resulting map of grizzly bear core habitat in the study area is shown in Appendix 38. Grizzly bear core habitat was delineated based on variables such as landscape features and food availability. This map indicates that within the Columbia Valley study area, most of the grizzly bear core habitat is found at higher elevations from Brisco northward to the Donald area.

The grizzly bear male's average home range is 318 square kilometres and a female's average home range is 89 square kilometres (Wood, McLellan, Paetkau, Proctor & Stobeck, 1997). Grizzly bear and wolverine are both focal species that represent higher elevation connectivity goals across the valley bottoms. Habitat connectivity across valley bottoms needs to accommodate for these low-density, large roaming species. Developing recommendations for conservation actions to develop linkage corridors that will connect core wildlife habitat patches for large-roaming species like grizzly bear and wolverine, will occur in year 2 (2020-2021) and will be led by Dr. Michael Proctor. Section 4.9.2 will outline

mapping work (including grizzly bear corridors in the Columbia Valley) that will be used to help determine wildlife corridors in 2020/2021 of the Kootenay Connect – Columbia Wetlands project.

Least chipmunk

According to the B.C. CDC, two subspecies of least chipmunk (*Neotamias minimus*) occur in the study area. The least chipmunk is listed as Least Concern on the IUCNs Red List. Least chipmunk, *oreocetes* subspecies (*Neotamias minimus oreocetes*) is blue-listed with a provincial conservation ranking of S3 (2006), it has not been assessed by COSEWIC or SARA (Table 4). This subspecies has limited range with few occurrences which is reflected in its provincial at-risk status. Nagorsen, Panter & Fraker (2002) reported that, "although there are no reliable data on population numbers or trends, this species clearly is not at risk provincially or nationally." The least chipmunk, *selkirki* subspecies (*Neotamias minimus selkirki*) is red-listed in the province of B.C., and has a provincial conservation ranking of S1 (2006). It has not been assessed by COSEWIC or SARA.

According to the B.C. CDC, the least chipmunk, *selkirki* subspecies is only known from one location; Paradise Mine, 31 km west of Invermere at the head of Springs Creek with access off Toby Creek road (B.C. CDC, 2014e). This one record comes from the B.C. CDC and the observation date is from August 1944 when three specimens were collected. It is unknown if this species is present elsewhere in the Purcell Mountains (B.C. CDC, 2014e). Nagorsen, Panter & Fraker (2002) states that, "[i]t is known from only two general locations in the Purcell Mountains, has an area of occupancy less than 100 km2, consists of fewer than 1,000 animals, and is isolated with no potential for rescue. These same criteria would qualify *T. m. selkirki* as a candidate for Threatened under the COSEWIC criteria." More identification and inventory work would be required to determine the current population and extent of both least chipmunk subspecies in the study area.

Little brown myotis

The little brown myotis (*Myotis lucifugus*) is yellow-listed in B.C., and was given a provincial ranking of S4 in 2015 (Table 4). It was listed as an Endangered species by COSEWIC in 2013, and was assigned to Schedule 1 of SARA as an Endangered species in 2014. Little brown myotis is on the IUCN's Red List as an Endangered species. COSEWIC (2013b) states that the reason for their designation is as follows:

> *"Approximately 50% of the global range of this small bat is found in Canada. Subpopulations in the eastern part of the range have been devastated by White-nose Syndrome, a fungal disease caused by an introduced pathogen. This disease was first detected in Canada in 2010, and to date has caused a 94% overall decline in known numbers of hibernating Myotis bats in Nova Scotia, New Brunswick, Ontario, and Quebec. The current range of White-nose Syndrome has been expanding at an average rate of 200-250 kilometres per year. At that rate, the entire Canadian population is likely to be affected within 12 to 18 years. There is no apparent*

containment of the northward or westward spread of the pathogen, and proper growing conditions for it exist throughout the remaining range."

White-nose Syndrome has not yet been detected in British Columbia. Additional threats to little brown myotis include habitat loss and degradation to hibernacula, maternity roosts, and foraging areas, human disturbance, pollution and climate change (ECCC, 2018).

These relatively small bats (length of head and body 41-54 millimetres) have summer colonies that range from 50 to 2,500 individuals and average 400, with winter roost concentrations that may include many thousands of individuals (B.C. CDC, 2015b). Little brown myotis use a wide variety of habitats including: human-made structures, caves and hollow trees for resting and maternity sites (B.C. CDC, 2015b). Foraging sites are over water, along lake, stream or wetland margins, or near water in forested areas, and maternity colonies tend to be located in warm areas of buildings such as house attics (B.C. CDC, 2015b). Their diet consists largely of flying insects (e.g., mosquitoes, moths, caddisflies, midges) and sometimes spiders (references cited in B.C. CDC, 2015b).

Very little research or inventory work has been done to date for bats within the study area. The Kootenay Community Bat Project has been collecting some data in the past few years, regarding mainly roosting bats; they have also been interacting with people in the Columbia Valley regarding bat conservation initiatives (e.g., bats reported in attics, installing maternity bat boxes). The Wildlife Conservation Society Canada has conducted some research on bats in the Columbia Valley, including acoustics monitoring in 2012-2013 along the lakeshore of the NCC Lot 48 property on Columbia Lake (Lausen, 2013), but at the time of this report little monitoring had occurred north of that area.

Recommended conservation objectives

Identifying and conserving critical habitat for Threatened or Endangered species (such as little brown myotis) is necessary for the survival or recovery of the species. Currently, there are significant data gaps to determine all habitats required for the survival or recovery of bat species (ECCC, 2018). Environment and Climate Change Canada produced a recovery strategy in 2018 that details identification of the endangered bat species' critical habitat as any site where hibernation has been observed at least once between 1995 and 2018. Maternity roosts are also acknowledged to contribute to the survival and recovery of bat species in the recovery plan, but the locations of most maternity roosts are currently either unknown or undocumented, or are unavailable to Environment and Climate Change Canada. Given this lack of data, it is not possible to determine which maternity roosts are necessary for the survival or recovery of these species. Maternity roosts are not currently identified as critical habitat in this recovery strategy (ECCC, 2018). If other habitats (e.g., migration routes, swarming sites) are deemed critical for species recovery, they will be classified as critical habitat in future recovery strategies.

Inventory information for bat species is lacking for large areas of potential habitat in the Columbia Valley. Inventories are needed to determine locality of critical habitat for little brown myotis, as well as to develop management strategies (e.g., make hibernacula inaccessible to humans) for land jurisdictions

where SARA legislation is not mandated. In 2020, Dr. Cori Lausen is planning to implement a structured North America Bat survey for seven nights per year in the Columbia Valley, where researchers will drive a certain distance at a specific interval and record bat echolocations. There will also be some passive, non moving stations for the North American monitoring survey. Additionally, a number of bat boxes have been installed on private lands in the Columbia Valley to help enhance bat habitat, but there are concerns regarding the possible effects of heat on bat boxes and it is uncertain how bats are faring in these artificial conditions. This needs to be addressed.

Caribou

Caribou (Southern Mountain Population) (*Rangifer tarandus* pop. 1) is red-listed in the province of B.C, and has a provincial conservation ranking of S1 (2017) (Table 4). This species was assessed as an Endangered species by COSEWIC in 2014, and was assigned Threatened status on Schedule 1 of SARA in 2003. The mountain caribou has been recognized as a species at risk under the Forests and Range Practices Act (FRPA) and is listed as Vulnerable on the IUCNs Red List. Mountain caribou critical habitat occurs in the higher elevations of the southern western study area boundary. This species has received a significant amount of conservation attention in the province of B.C., and working on recovery efforts for this species in the Columbia Valley study area will not be a focus of the Kootenay Connect – Columbia Wetlands project.

Mountain Goat

The mountain goat (*Oreamnos americanus*) is blue-listed in the province of B.C, with a provincial conservation ranking of S3 (2015) (Table 4). This species has not been listed by COSEWIC or SARA and is listed as Special Concern on the IUCNs Red List. Mountain goat habitat is found within high elevations of the study area (Appendix 39), while the ungulate winter range covers much of the valley bottom from Canal Flats north to Horse Creek. In some areas, mountain goats may migrate up and down mountains between summer and winter habitat ranges (B.C. CDC, 1994b; Rideout & Hoffman, 1975). A study in Montana showed that summer and winter habitat range were 2.2 kilometers apart (B.C. CDC, 1994b; Singer & Doherty, 1985).

Some mountain goats may also travel to salt licks during spring and summer (B.C. CDC, 1994b). At least three potential goat licks are known within the study area: one is a goat lick in Kindersley, one in Canyon Creek and the other at Toby Creek. Under the Wildlife Act, any significant mineral lick on crown land can be designated as a Wildlife Habitat Feature and this should be pursued. Mountain goats will be considered in more detail in year two of this project when recommendations for conservation actions will occur for this species. We aim to develop linkage corridors connecting core wildlife habitat patches for ungulate and large-roaming species like grizzly bear and wolverine.

Northern myotis

The northern myotis (*Myotis septentrionalis*) is blue-listed in the province of B.C. with a provincial conservation status of S3S4 assigned in 2015 (Table 4). The species was listed as Endangered by COSEWIC in 2013, and assigned to Schedule 1 of SARA as an Endangered species in 2014. It is listed as Near Threatened on the IUCN's Red List. COSEWIC (2013b) states that the reason for designation is as follows:

> *"Approximately 40% of the global range of this northern bat is in Canada. Subpopulations in the eastern part of the range have been devastated by White-nose Syndrome, a fungal disease caused by an introduced pathogen. This disease was first detected in Canada in 2010 and to date has caused a 94% overall decline in numbers of known hibernating Myotis bats in Nova Scotia, New Brunswick, Ontario, and Quebec hibernacula compared with earlier counts before the disease struck. Models in the northeastern United States for Little Brown Myotis predict a 99% probability of functional extirpation by 2026. Given similar life history characteristics, these results are likely applicable to this species. In addition to its tendency to occur in relatively low abundance levels in hibernacula, there is some indication this species is experiencing greater declines than other species since the onset of White-nose Syndrome. The current range of White-nose Syndrome overlaps with approximately one third of this species' range and is expanding at an average rate of 200 to 250 kilometres per year. At that rate, the entire Canadian population will likely be affected within 12 to 18 years. There is no apparent containment of the northward or westward spread of the pathogen, and proper growing conditions for it exist throughout the remaining range."*

Within B.C., there are currently seven 50 x 50-meter UTM grid squares that are designated as critical habitat for little brown myotis and/or northern myotis, and one of those grid squares is located at the northeastern end of the Columbia Valley study area. This area is designated as northern myotis critical habitat due to observation data from thesis research conducted in 1996 when at least one northern myotis was identified within Glacier National Park, along the Beaver River east of the Trans-Canada highway near the Mountain Shaughnessy Tunnel and Tupper Creek (Caceres, 1998). There is no other observation data recorded for northern myotis in the study area.

The northern myotis bat is usually associated with old-growth forests with trees 100 years or older. This species relies upon intact interior forest habitat with low edge-to-interior ratios (B.C. CDC, 2014f). Structural diversity found in old growth forests is useful for several reasons. For instance, decaying trees may be used for breeding, summer day roosting and foraging (B.C. CDC, 2014f). Some summer roosts are found under bridges, in barns, other buildings or bat boxes (references cited in B.C. CDC, 2014f). Nursing colonies are found in cavities or beneath loose bark on trees. Reproductive females use a wide variety of tree species (references cited in B.C. CDC, 2014f). Hibernation occurs in caves, mines and tunnels, typically those with large passages and entrances, relatively constant and cool temperatures, high humidity with no air currents (references cited in B.C. CDC, 2014f). The diet of northern myotis includes flying insects (i.e., Lepidoptera, Coleoptera, Neuroptera, Diptera, Hymenoptera, Homoptera,

and Hemiptera), as well as insects living on plants or on the forest floor (references cited in B.C. CDC, 2014f).

Recommended conservation

Recommended actions for northern myotis are the same as those outlined above for little brown myotis. In addition to implementing the structured North American Bat survey and the North American monitoring survey, Dr. Cori Lausen is planning a bat survey in 2020 for northern myotis using mist netting and other methodologies.

Wolverine

The wolverine (*Gulo gulo luscus*) is currently not assigned with a status on B.C.'s species at risk list, but it does have a provincial conservation ranking of S3 (2015) (Table 4). Special Concern status was re-assigned by COSEWIC in 2014 (originally designated Special Concern in 1982), and assigned to Schedule 1 of SARA as a species of Special Concern in 2018. The IUCN considers this species to be of Least Concern on its Red List.

Recent research suggests that wolverines are highly dependent upon hoary marmot (*Marmota caligata*) as a food source and thus wolverine occurrence is closely tied to hoary marmot habitat (Kortello, Hausleitner & Mowat, 2019). There is a negative association of wolverine with forestry road density and a positive correlation with protected areas, whereas climatic factors were of lower importance (Kortello, Hausleitner & Mowat, 2019). COSEWIC (2014a) states that threats to this species include habitat fragmentation by industrial activity and increased motorized use, putting more pressure on harvest numbers. Climate change is also likely having an impact on the southern part of the wolverine range. This species is far roaming with a low reproductive rate, requiring large secured areas for viable populations to persist (COSEWIC, 2014a).

A major goal of the Kootenay Connect - Columbia Wetlands project is to connect habitat across valley bottoms to accommodate for large roaming species such as wolverine. Wolverine and grizzly bear are focal species that represent the Kootenay Connect - Columbia Wetlands higher elevation connectivity goals across valley bottom. "Wolverines may indicate ecosystem health, given their dependence on extensive connected ecosystems that support ungulates and large carnivores which create opportunities for scavenging" (COSEWIC, 2014a). Developing recommendations for conservation actions to develop linkage corridors that will connect core wildlife habitat patches for large-roaming species like grizzly bear and wolverine, will occur in year 2 (2020-2021) and will be led by Dr. Michael Proctor. The map as shown in Appendix 40 shows that valley bottom and lower elevations are low value wolverine habitat with most high value wolverine habitat found at higher elevations at the north end of the valley around Golden and Donald.

4.4 Reptiles and Amphibians

Northern leopard frog

Status and occurrence

The northern leopard frog (*Lithobates pipiens*) is red-listed in the province of B.C. and has a provincial conservation ranking of S1 (2016) (Table 5). This species was listed as Endangered by COSEWIC in 2009, and was listed as Endangered on Schedule 1 of SARA in 2003. The northern leopard frog is recognized as a species at risk under the Forests and Range Practices Act (FRPA) and is considered to be of Least Concern according to the IUCN's Red List. COSEWIC designated the leopard frog as Endangered because it had been extirpated from many localities in southeastern British Columbia and the Okanagan, and it remained only in small numbers at a single native population in the Creston Valley (Northern Leopard Frog Recovery Team (NLFRT, 2012). The population has been in steep decline in B.C. due to direct predation from introduced species (e.g., bass, yellow perch, pumpkinseed fish), mortality suffered from chytridiomycosis disease (B.C. CDC, 2010a), as well as anthropogenic factors such as residential and commercial development, agriculture and natural system modifications (NLFRT, 2012).

Habitat use

Northern leopard frogs require wet habitats such as marshes, bogs, ponds, flood plains, springs, slow streams, reservoirs and lakes. Habitats usually have permanent water with rooted aquatic vegetation (B.C. CDC, 2010a). Seasonal migration occurs from over-wintering sites to breeding sites that are one to two kilometers apart, likely representing the frog's longest distance travelled annually (B.C. CDC, 2010a). After the breeding season there is movement to upland foraging habitats and water edges that are likely to be within a few hundred meters of breeding sites. In fall, frogs move upland to the vicinity of the overwintering sites (B.C. CDC, 2010a). After metamorphosis, juvenile frogs may disperse widely - a frog was reported eight kilometers from its breeding site the following spring in Alberta (as referenced in B.C. CDC, 2010a). If necessary, during these migrations frogs may traverse across suitable and unsuitable habitat (e.g., roads, meadows, agricultural lands, sparse forests), which may cause these animals to suffer higher mortality rates from impacts during migration, e.g., being killed on roads, desiccation or elevated predation risk (references cited in NLFRT, 2012). Adult frogs predate small invertebrates such as insects, worms and spiders. Metamorphosed frogs eat mainly a variety of insects in their habitat, as well as algae and plant tissue, while tadpoles feed on submergent vegetation and algae (B.C. CDC, 2010a).

Northern leopard frogs had been presumed to be extirpated from the Columbia Wetlands for at least 35 years (Ohanjanian & Carli, 2010), but were historically widespread in this habitat (Green & Campbell 1984). In 2010, Ohanjanian & Carli identified seven potential reintroduction sites in the Columbia Wetlands between Canal Flats and Spillimacheen. Captive bred frogs had been released into the wetlands at a site in Brisco every year between 2013 and 2019 (Environment and Climate Change Canada 2016; Ohanjanian, 2018). In 2018, tadpoles reportedly survived in good numbers (more than 10% of tadpoles reached metamorphosis), despite the potential predatory effects of fish that had been

brought into the reintroduction site during high water (Ohanjanian, 2018). Effects of a pathogenic fungus disease known as Batrachochytrium dendrobatidis (Bd) was first detected in 2016 at Brisco, and has been having some impacts on the Brisco northern leopard frog population. In 2019, the project was able to reintroduce a combination of captive breed tadpoles, metamorphs and juveniles obtained from the Vancouver Aquarium and the Calgary Zoo. Live translocations of egg masses from the Creston Valley Wildlife Management Area also occurred (Randall & Stanton, 2019). No calling was detected on song meters in 2019, but three observations were made of either juvenile or adult leopard frog confirming overwinter survival at the reintroduction site (Randall & Stanton, 2019). Through the leopard frog recovery strategy, critical habitat has been designated at the Brisco reintroduction site.

Recommended conservation objectives

"Consideration going forward is the fact that much remains unknown about the effects of Bd, which was confirmed in leopard frogs in the [Brisco Release Pond] in 2016 and 2018. There is evidence that some leopard frogs at Creston developed resistance to Bd. The small number of frogs available for transplant further complicates [reintroduction efforts], as it reduces the probability that individuals with resistance are included. Further translocations to the Columbia marshes and elsewhere should be considered in this light" (Ohanjanian, 2018). If the reintroductions in Brisco are viewed to be successful by the Northern Leopard Frog Recovery Team, and if additional captive bred frogs become available, it may be worth considering additional reintroduction projects into additional suitable habitat in the Columbia Wetlands previously identified by Ohanjanian and Carli in 2010.

Table 5. Amphibian and reptile species at risk in the study area.

Scientific Name	English Name	Provincial Ranking	BC List	COSEWIC	SARA	Provincial FERPA	IUCN Red List
Lithobates pipiens	northern leopard frog	S1 (2016)	Red	E (2009)	1-E (2003)	Y	Least Concern
Anaxyrus boreas	western toad	S4 (2016)	Yellow	SC (2012)	1-SC (2018)	N	Least Concern
Charina bottae	northern rubber boa	S4 (2018)	Yellow	SC (2016)	1-SC (2005)	N	Least Concern
Chrysemys picta pop. 2	western painted turtle - Intermountain - Rocky Mountain Population	S3? (2018)	Blue	SC (2016)	1-SC (2007)	N	Least Concern

Northern rubber boa

Status and occurrence

The northern rubber boa (*Charina bottae*) is yellow-listed in the province of B.C. and was listed as a species of Special Concern by COSEWIC in 2016, and assigned to Schedule 1 of SARA as a species of Special Concern in 2015 (Table 5). It is considered to be of Least Concern by the IUCN. Northern rubber boa is known to occur at the Radium Hot Springs (Clair, 2003; pers. comm., L. Halverson, March 2020). Ohanjanian & Teske (1996) stated that the northern rubber boa is known from the east side of Columbia Lake. Ferguson (2004) suggested that rubber boa is found at Fairmont Hot Springs in addition to Radium Hot Springs and Columbia Lake. Given the relatively few observations known for this species, it is likely uncommon and locally distributed in the study area to those few localities.

Habitat use

The northern rubber boa has varied habitat requirements: moist coniferous forest and riparian areas, forest openings with rotting logs, to drier habitats ranging from sea level to 3000 meters. The major habitat requirements of the rubber boa are rocky outcrops and an abundance of coarse woody debris which the snakes use for protective cover and to aid in thermoregulation. Rubber boas spend a considerable amount of time underground in abandoned rodent burrows and rock crevices (Ferguson, 2004).

Recommended conservation objectives

A number of future research and monitoring efforts are suggested by Clair (2003), including inventory efforts, restoration projects to increase suitable habitat including prescribed burns and logging to create openings in forested areas (Clair, 2003). It was also noted that care needs to be taken in demolishing old buildings in areas where they are known to occur, and that hibernacula should be located and protected (Clair, 2003). No hibernacula are currently known. To locate rubber boa hibernacula, it has been suggested to capture a sufficient number of snakes and fit them with transmitters that will allow the snakes to be traced back to the hibernacula.

Western painted turtle - Intermountain - Rocky Mountain Population

Status and occurrence

The western painted turtle - intermountain - Rocky Mountain population (*Chrysemys picta* pop. 2) is blue-listed in the province of B.C (Table 5). It was listed as species of Special Concern by COSEWIC in 2006, then re-examined and confirmed in 2016 as being of Special Concern. It was listed as a species of Special Concern on Schedule 1 of SARA in 2016. The western painted turtle (WPT) is also listed as Least Concern on the IUCN's Red List. COSEWIC (2016) states their rationale for designation is as follows: "This population occurs mainly in larger valleys, which have been subjected to extensive wetland loss and habitat alteration from human activities. The [WPT] population is suspected to be declining because of continuing habitat loss, fragmentation of habitats and road mortality. The number of turtles is likely

small, and the population may become threatened if threats are neither reversed nor managed with demonstrable effectiveness."

The painted turtle is the only freshwater turtle in B.C. It's estimated that at least 41 water bodies have turtles in the East Kootenays (COSEWIC, 2016). The Intermountain – Rocky Mountain population is estimated to have somewhere between 5,000 to 10,000 adults, but no accurate population estimate exists (COSEWIC, 2016). COSEWIC (2016) states: "In the East Kootenays, the lack of western painted turtle sightings from the Columbia River wetlands between Invermere and Golden is surprising. They were possibly more widespread throughout this area historically (Larsen pers. comm. 2015), but currently are known from only three localities in a wetland complex stretching over 140 km in length." However, WPTs have informally been reported from the following locations: 1) Columbia Wetlands at a small section of Columbia Lake in the southwest corner isolated from the main lake by a CPR railway berm (I. Adams pers. obs.); 2) Dorothy Lake in Invermere where turtles are often seen basking; 3) Columbia NWA (Wilmer Unit); 4) Columbia Wetlands near the west end of Luxor Station Road (R. Darvill, pers. obs.); 5) turtle seen digging a nest at Westside Road in Spillimacheen near first bridge (V. Shaw, pers. obs.); 6) nests observed near the west end Westside Road in Spillimacheen that bisects the Columbia Wetlands (G. Lepp, pers. obs.); 7) Parson River Crossing (R. Smith, pers. obs.); 8) Reflection Lake (CDC record from 2009); 9) Columbia River between Columbia Lake and Lake Windermere (L. Halverson pers. comm.) (as referenced in McPherson, Hlushak, Adams & Polzin, 2010). At the Columbia NWA (Wilmer Unit), turtle nests were observed on a few occasions between 2016-2019 while conducting marsh bird surveys; at least two nests appeared to have been dug up and predated by a predator (R. Darvill, pers. obs.). Western painted turtles were not observed at any of the 20 sites where herpetological surveys were conducted by Ohanjanian & Teske (1996), even though they were one of the focal species of that project.

Habitat use

Western painted turtles and human settlements tend to prefer the same habitat type, the valleys and lowlands in the southern part of B.C. Being so close to humans poses a number of threats to turtles, including disturbance of basking or resting sites, road mortality, illegal capture and trampling at nest sites (Ministry of Environment, Lands and Parks, 1998). Movements occur north-south in valley bottoms; long distance east-west movements are unlikely given the rugged mountain landscapes between valley bottoms (COSEWIC, 2016). Painted turtles are highly aquatic species that are found in slow-moving stream reaches, lakes, oxbows, in quiet backwater marshes of rivers and in shallow water wetlands (COSEWIC, 2016). Optimal habitats contain emergent aquatic vegetation [including exposed cattail (*Typha* spp.) mats], muddy substrates, floating logs or branches used for basking, vegetation root mats, and open banks that can be used for digging nests (COSEWIC, 2016). The eggs are laid in sites with little to no vegetation and in exposed patches of soil, sand or gravel substrates (COSEWIC, 2016). Western painted turtles are omnivorous, they feed on aquatic vegetation as well as on invertebrates and tadpoles.

Recommended conservation objectives

No monitoring or inventory work has been completed for western painted turtles in the Columbia Wetlands. Habitat protection is a priority in order to conserve this species, but this requires more knowledge of WPT in terms of their habitat use, distribution and abundance. Once the location of key habitat areas is known, efforts to reduce human disturbance at these sites will be important. Vegetation management needs to be considered, as well as enhancement activities at resting and nest sites.

Ahead of inventory work (given the vast size of the Columbia Wetlands), the potential WPT habitat within the study area should be mapped. This will help ensure the most suitable habitat is targeted with inventory work. The Rocky Mountain Naturalists (with support from the Fish & Wildlife Compensation Program) completed a WPT monitoring and nest site enhancement project during the 2000's at Elizabeth Lake in Cranbrook (Clarke & Gruenig, 2001; Clarke & Gruenig, 2003; Clarke & Gruenig, 2006). This project is a useful model to follow for project development in the Columbia Wetlands. Implementing an inventory and monitoring project for WPT in the Columbia Wetlands would be in line with management objectives as described in the management plan for the western painted turtle - intermountain - Rocky Mountain population in B.C.:

1. *Protect habitat across the range of the population through legal and stewardship actions.*
2. *Mitigate road mortality and habitat destruction threats across the range of the population.*
3. *Complete an inventory across the range of the population, and monitor significant populations (> 50 individuals) and their responses to threats, protection, and mitigation actions.*
4. *Address key knowledge gaps in threat impacts and effectiveness of recovery actions through research* (B.C. Ministry of Environment, 2017).

Western toad

Status and occurrence

The western toad (*Anaxyrus boreas*) was recently downgraded from blue to yellow status in B.C., and it has a provincial conservation rating of S4 (2016) (Table 5). COSEWIC listed this species as one of Special Concern in 2002. It was split into two populations and reassessed as Special Concern in 2012 by COSEWIC. It was listed as Special Concern on Schedule 1 of SARA in 2018 and is considered to be of Least Concern according to the IUCN's Red List. The reasons for COSEWIC's 2012 designation are owed to population declines and extirpations, as well as to western toads' sensitivities to threats such as an emerging skin disease (chytrid fungus), and its intolerance to human disturbances, habitat fragmentation (e.g., from transportation corridors) and habitat alteration and destruction (e.g., forestry, road building). Additional issues are also considered to be threats to this species including: increased UV-B, increased vulnerability to infectious diseases, climate change and the introduced American bullfrog (COSEWIC, 2012b), which is not currently not known in the study area.

A herpetology survey of 87 wetlands in the Columbia Basin was conducted from June to August in 1995, and included seven survey stations in the Columbia Valley study area. Western toad was reported for one of those seven survey stations on the West Benches off Donald Forest Road (Ohanjanian & Teske,

1996). Ohanjanian, Adama & Davidson (2005) conducted an amphibian inventory of the East Kootenays; 20 of their survey sites were within the Columbia Valley and five of those sites had western toad detections. In 2004, species at risk inventory work in the Columbia National Wildlife Area (NWA) reported western toad only from the Spillimacheen unit, but the species was thought to likely be present at all NWA units (Dawe et al., 2012). The western toad also was detected at all but one of the sites surveyed in the northern end of the Columbia Valley study area, during amphibian inventories in 2008, 2009, 2010 and 2015 (Dulisse & Boulanger, 2016).

Inventory work done to date indicates that important habitat exists for this species in (at least) the northern end of the Columbia Valley. Dulisse & Boulander (2016) did not have coverage for random amphibian sampling in the Columbia River Valley from Canal Flats to Golden. The Columbia Valley area was not sampled because it had not been sampled during previous years of survey effort, they were more inaccessible sites, and it is not within the Upper Kootenay Ecosystem Enhancement Plan (UKEEP) project area (Dulisse & Boulanger, 2016). Lastly, while it was not the intent to survey for amphibians, in 2016 a wetlands inventory project on the West Bench noted the presence of western toad in large numbers at Loon Lake, located west of Parson (Darvill, 2016). Loon Lake was found to have increased levels of recreational disturbance within this sensitive western toad habitat, with a dirt road accessing the lake edge, boat launch, and elevated camping pads that were created with gravel were located as close as 11 meters from the water's edge (Darvill, 2016). A map depicting 19 locations of all known western toad habitats in the Columbia Valley can be found in Appendix 41.

Habitat use

Western toad uses several different types of aquatic environments for breeding including shallow sites of ponds, streams, river deltas, sandy margins of lakes, river backwaters, river estuaries, and geothermal hot springs (references cited in COSEWIC, 2012b). They also use human-made habitats such as road ruts, ditches and tailings ponds (references cited in COSEWIC, 2012b). "Following breeding, adults may remain and forage in adjacent marshes or riparian edges of breeding sites, or they may travel up to several kilometres to other wetlands, riparian areas along streams, or upland sites, such as forests, meadows, shrub lands, or subalpine or alpine meadows" (COSEWIC, 2012b). They hibernate underground in winter, and it has been suggested that winter snowpack is a requirement for the survival of western toads in B.C. (Cook, 1977; COSEWIC, 2012b).

Recommended conservation objectives

In 1996, Ohanjanian & Teske recommended the following:

> *"A major study on B. boreas in our region must be undertaken. The serious declines noted above for toads in Montana, Idaho and Colorado make it important to revisit known breeding sites in the study area. The population may be declining here as well. At the minimum, known breeding ponds should be revisited several times per year and permanent transects should be established along roads near breeding ponds to be driven each spring on rainy nights. This will provide a relative index of toad numbers over time. Ideally, catch and release monitoring, as part of a major research effort, would provide data not only on numbers but would allow other population*

parameters such as recruitment, survivorship, longevity, fecundity and hatching success to be measured as well."

There has been a very limited amount of amphibian monitoring work in the study area, with no information on population trends for western toad in the study area. The lack of amphibian monitoring in the Columbia Valley study area represents a data gap when trying to determine the status of western toads as well as other amphibian species, and it is a data need when looking to identify biodiversity hotspots.

The Provincial Western Toad Working Group (2014) developed a management plan for the western toad in 2014 that states, "[p]opulation trends in different parts of B.C. are unavailable and required to assess population stability and importance." It is recommended that multi-year amphibian surveys be implemented using the same methods followed by Dulisse & Boulander (2016), with randomly selected wetlands and standard occupancy surveys. Conducting amphibian inventories will fill knowledge gaps that are required before further work can be completed on habitat protection, habitat restoration and private land stewardship (Provincial Western Toad Working Group, 2014; Ohanjanian, Adama & Davidson, 2005; Ohanjanian & Teske, 1996). Relying on historical observation could also lead to error; it is important that a multi-year approach be taken when attempting to determine the status of western toads in the Columbia Valley (Ohanjanian, Adama & Davidson, 2005). It is also important to identify the travel corridors used by western toads, so that they can be protected.

4.5 Additional Focal Species

Rocky Mountain elk

Status and occurrence

Rocky Mountain elk (*Cervus elaphus nelson;* hereafter elk) are yellow-listed in the province of B.C. and have not been assessed by COSEWIC or SARA. The Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) [formally the Ministry of Environment (MOE)] conduct randomized aerial winter surveys every 5-10 years in the Rocky Mountain trench from the Canadian – USA border north to Radium. The 2008 inventory determined that the 2008 elk population estimate was substantially higher than the estimate in 2001 and the estimate was also the highest since surveys began in 1992 (Phillips, Szkorupa, Mowat & Stent, 2008). In the 4-25 Management Unit (MU) (located on the west side of the study area from south of Canal Flats north to Radium), the following information was provided by Phillips, Szkorupa, Mowat & Stent (2008):

"Although the extent of population change within 4-25 should be interpreted cautiously, it is likely that the population has increased in recent years. The study area was similar in 2001 and 2008 and the inventories indicate a 261% increase during this period. Currently, there is no antlerless elk season in 4-25, which is likely contributing to the increase. Much of the MU is private land and there is little opportunity for safe hunting. There are concerns with overgrazing, which is of particular concern to wildlife managers as the area provides important habitat for

bighorn sheep. The area has {had] very little graz[ing] by domestic livestock so any overgrazing is primarily due to wild ungulate populations. Crop depredation is also an issue for a few landowners, although levels are substantially lower than in southern areas."

The MU on the west side of the southern part of the Columbia Valley is MU 4-26; Phillips, Szkorupa, Mowat & Stent (2008) report the following finding from that management unit:

"MU 4-26 was the only MU with a population decline (by 21%) between 2001 and 2008; the 2008 population estimate was similar to the 1997 estimate. A number of factors could explain the decline. In 2008, we surveyed this MU last and snow conditions had [begun] to deteriorate, which may have decreased elk sightability. In addition, there are reports of substantial First Nations harvest in this area in recent years. Although the reported antlerless elk harvest rates for resident hunters were relatively low (2% in 2007), the cumulative effect of all hunting may be contributing to a population decline. The habitat has also changed substantially in 4-26 recently, reducing the number of elk that can be supported. Many areas of elk winter range have been developed for subdivisions and forest in-growth is increasing. In 1985, a large burn on Fir Mountain opened up habitat and increased forage for elk (L. Ingham, Fish and Wildlife Compensation Program: Columbia Basin, pers. comm. 2008), however the forest is now closing in and forage levels are declining. Although there are pockets of overgrazed land, range health is generally better than in southern areas. Private land crop depredation is also less prevalent in this MU."

The most recent elk surveys conducted between the USA border north to Radium were completed in 2018 and indicate that population estimates for the entire study area had declined by 53% since the last surveys in 2008 (Stent, Gooliaff & Lamy, 2018). Causes for the decline are not well understood, but rationales for this decline were attributed to decreased habitat quality, the predation of carnivores on newborn elk (neonates), and winter severity (references cited in Stent, Gooliaff & Lamy, 2018).

The last elk inventory conducted between Radium and Birchland's Creek (north of Parson near McMurdo) was completed in 2011 to assess the elk population in agricultural areas. "The survey objective was to determine the size of the elk population in those North Trench areas with agricultural conflicts. This information would then be used to help determine whether an antlerless elk hunt is sustainable and/or required in the area, and if so what the level of hunting should be (dependent on the number of elk)" (Szkorupa & Thornton, 2011). The 2011 aerial surveys detected 250 elk in 44 groups; elk were most abundant in the wetlands located at the southern end of the 1000 square kilometre study area, especially between Luxor and Brisco and the wetlands around Radium (Szkorupa & Thornton, 2011). Based upon correction factors for incomplete sightability and extrapolating to blocks not surveyed, the population estimate for elk in the study area was 377 (90% CI: 241-513) (Szkorupa & Thornton, 2011).

The most recent aerial ungulate surveys that took place in the North Columbia Basin and Kinbasket area were in 2005 and 2006. The survey area included the region between Golden and the north end of the Kootenay Connect – Columbia Wetlands study area. Klafki (2007) found that in 2005, "the highest

densities of elk were in the Frenchman's and Willowbank Enhancement Area, including the Columbia River wetlands and agricultural land in the Blaeberry River area with 0.78 elk/km2."

> *"In 1991, survey blocks on the East Benches of the Trench, south of Golden, had an observation rate of 17 elk per hour with the Columbia Marshes North having 22 elk per hour (Bindernagel et al., 1991). In 1996 the Frenchman's-Willowbank Enhancement Area was surveyed, with 31 elk per hour (Tinker et al., 1997). The survey blocks south of the Blaeberry River that coincide with portions of MU 4-36 East Benches and Columbia Marshes North (Bindernagel et al., 1991) had an observation rate of a comparable 24 elk per hour in 2005. Elk observation rates appear to be steady between Blaeberry River and Golden"* (Klafki, 2007).

The 2005 counts in combination with previous aerial surveys in 1996 and 1997 indicate that Willowbank and Frenchman's Ridge contribute important winter range for elk located north of Golden (Klafki, 2007), yet this area is not recognized in the current elk winter habitat range, as shown in Appendix 42. Similarly, the Columbia Wetlands north of Birchlands are also important habitat for elk, but are not recognized as current elk ungulate winter range (Appendix 42).

Habitat use

Elk occupy a wide variety of habitats ranging from coniferous forests, as well as mixed wood and deciduous forests, wetlands, vegetated slides, avalanche chutes in sub-alpine environments and rocky outcrops. Their elevational range and movement patterns are strongly associated with snow accumulation and forage availability; many populations migrate to different elevations to use different habitats depending on the season. During winter, elk tend to occupy the wetlands in the valley bottom to forage on forbs (herbaceous flowering plants) under a relatively thin snowpack, whereas during spring they migrate to higher elevations to forage on forbs as the snowpack recedes. Snow depth is a significant factor for elk in terms of locating winter foraging sites. "Elk in this area have historically used alluvial fans or forested bulges on the west side of the wetlands during the winter, where they browse on cedar seedlings' (P. Holmes, personal communication, MFLNRORD, Invermere, BC)" (Szkorupa & Thornton, 2011).

Recommended conservation actions

Elk have migration routes requiring elevational movements, and the Rocky Mountain elk have been selected as one of the key focal species to help determine the location of wildlife corridors in the Columbia Valley. Appendix 42 provides a map that depicts how current elk ungulate winter range is limited to just north of Parson (Birchlands), but this appears to leave out important elk habitat to the north as described above. Appendix 42 shows the extent of currently known elk calving grounds and migration routes, but these are known only south of the study area. In order to locate important habitats (i.e., migration routes, calving grounds) for Rocky Mountain elk within the Columbia Valley study area, inventory work needs to be conducted with migration routes and calving grounds identified. It appears very little data has been produced regarding habitat use of Rocky Mountain elk in the Columbia Valley including the wetlands. More frequent aerial winter surveys could be useful in monitoring population trends.

Columbia spotted frog

Status and occurrence

The Columbia spotted frog (*Rana luteiventris*) is yellow-listed in the province of B.C., and has a provincial conservation ranking of S5? (2016). It was assessed in 2000 by COSEWIC to be not-at-risk. Ohanjanian & Teske (1996) completed amphibian and reptile inventories in 1995, which included seven survey stations on the west benches off Donald Forest Road. It was stated that one of the two main areas of concentration for Columbia spotted frogs in the Columbia Basin was the Donald Forest Road area near Golden (Ohanjanian & Teske, 1996). Amphibian decline is probably happening in the region but we have no baseline data to make any firm conclusions or recommendations regarding population trends and distribution (Ohanjanian & Teske, 1996). An amphibian inventory of the East Kootenays was conducted in 2005; this inventory found that eight of 20 sites within the Columbia Valley found Columbia spotted frogs (Ohanjanian, Adama & Davidson, 2005).

The Columbia spotted frog was also detected at all sites surveyed within the Columbia Valley study area during amphibian inventories that took place in 2008, 2009, 2010 and 2015 (Dulisse & Boulanger, 2016), indicating that important habitat exists for this species in the Columbia Valley. Dulisse & Boulanger (2016) were only able to complete random amphibian sampling in the north end of the Columbia Valley (2016), sampling did not take place from Canal Flats to Golden. “The Columbia Valley area was not sampled because it had not been sampled during previous years (we were working through the forest districts of the FWCP area) and is not within the [Upper Kootenay Ecosystem Enhancement Plan] UKEEP project area” (Dulisse & Boulanger, 2016). In 2004, species at risk inventory work in the Columbia National Wildlife Area (NWA) reported Columbia spotted frogs at the Spillimacheen and Wilmer Units of the NWA (Dawe et al., 2012). A map depicting 53 occurrences for Columbia spotted frog in the Columbia Valley study area is found in Appendix 41.

Habitat use

Columbia spotted frogs are a highly aquatic species; they usually occur among the emergent vegetation found at the margins of lakes, streams, ponds, marshes and springs. Females have been documented to move an average of 500 meters from breeding to overwintering sites, whereas some frogs have moved up to 1.8 kilometers away from breeding grounds (Pilliod, Peterson & Ritson, 2002). In a study that looked at season migration of Columbia spotted frogs in high mountainous areas, it was found that many Columbia spotted frog are spatially separated and they may migrate hundreds to thousands of metres annually among complementary resources, i.e., specific habitat patches used for breeding, foraging, and hibernating (Pilliod, Peterson & Ritson, 2002). Movements of up to 6.5 kilometers have been reported for Columbia spotted frogs (Engle, 2001).

Recommended conservation objectives

Recommendations for the Columbia spotted frog are in line with the recommendations for western toad: a multi-year amphibian inventory project should be implemented using the same methods followed by Dulisse & Boulanger (2016), with randomly selected wetlands and standard occupancy

surveys. Conducting amphibian inventories will help fill knowledge gaps that area required before further work can be completed on habitat protection, habitat restoration and private land stewardship (Ohanjanian, Adama & Davidson, 2005; Ohanjanian & Teske, 1996). It is also important to identify the corridors connecting anuran habitats (Pilliod, Peterson & Ritson, 2002), and to develop a conservation plan with that goal in mind.

4.6. Ecological Communities

According to the B.C. CDC, there are 10 ecological communities (formally known as plant communities) on BC's provincial red-list and 11 on the provincial blue-list that are located within the study area (Table 6). This list of 21 at risk ecological communities was based on a B.C. CDC search criteria for red and blue listed ecological communities in the following locations: CSRD, RDEK, Canal Flats, Invermere, Radium Hot Springs and Golden. Nine of the 21 ecological communities have CDC occurrence maps available for the province of B.C., but only one species has listed occurrences in the Columbia Valley. This is alkali saltgrass - foxtail barley (*Distichlis spicata - Hordeum jubatum*), which is described further in the next section of this paper. The remaining 20 ecological communities have no location or occurrence data for the study area, but are assumed to occur in the area because they are closely tied to the Biogeoclimatic Units in the area (Katrina Stipec, pers. comm., January 28, 2020). Further research, inventory and mapping work is needed to determine specific locations for these ecological communities.

Table 6. Ecological communities listed as at-risk within the Columbia Valley.

Scientific Name	English Name	Prov Status	BC List	Provincial FRPA	Municipality	Ecosystem Group	Endemic
Betula nana / Carex aquatilis	scrub birch / water sedge	S3	Blue		Invermere;Radium Hot Springs;Canal Flats;Golden	Wetland Realm - Peatland Group: Fen Wetland Class (Wf)	Y
Carex lasiocarpa / Drepanocladus aduncus	slender sedge / common hook-moss	S3	Blue		Invermere;Radium Hot Springs;Canal Flats;Golden	Wetland Realm - Peatland Group: Fen Wetland Class (Wf)	Y
Deschampsia cespitosa Community	tufted hairgrass Community	S2	Red		Invermere;Radium Hot Springs;Canal Flats;Golden	Terrestrial Realm - Grassland Group (G): Alkaline/Saline Meadow Class	
**Distichlis spicata - Hordeum jubatum*	*alkali saltgrass - foxtail barley	S2S3	Blue	Y	Invermere;Radium Hot Springs;Canal Flats	Terrestrial Realm - Grassland Group (G): Alkaline/Saline Meadow Class (Ga)	
Equisetum fluviatile - Carex utriculata	swamp horsetail - beaked sedge	S3	Blue		Invermere;Radium Hot Springs;Canal Flats	Wetland Realm - Mineral Wetland Group: Marsh Wetland Class (Wm)	
Festuca campestris - (Pseudoroegneria spicata) - Achillea borealis - Cladonia spp.	rough fescue - (bluebunch wheatgrass) - yarrow - clad lichens	S1S2	Red		Invermere;Radium Hot Springs;Canal Flats;Golden	Terrestrial Realm - Grassland Group (G): Grassland Class (Gg)	
Festuca idahoensis - Eriogonum umbellatum - Eremogone capillaris	Idaho fescue - sulphur buckwheat - thread-leaved sandwort	S2	Red		Canal Flats	Terrestrial Realm - Grassland Group (G): Grassland Class (Gg)	
Festuca idahoensis - Pseudoroegneria spicata - Eriogonum umbellatum - Eremogone capillaris	Idaho fescue - bluebunch wheatgrass - sulphur buckwheat - thread-leaved	S2S3	Blue		Canal Flats	Terrestrial Realm - Grassland Group (G): Grassland Class (Gg)	
Juncus balticus - Carex praegracilis	Baltic rush - field sedge	S1S2	Red		Invermere;Radium Hot Springs; Canal Flats	Terrestrial Realm - Grassland Group (G): Alkaline/Saline Meadow Class (Ga)	
**Picea engelmannii x glauca - Populus tremuloides / Aralia nudicaulis*	*hybrid white spruce - trembling aspen / wild sarsaparilla	S2	Red		Invermere;Radium Hot Springs;Canal Flats	Terrestrial Realm - Forest: Mixed - moist/wet	
Pseudoroegneria spicata - Koeleria macrantha	bluebunch wheatgrass - junegrass	S3	Blue		Invermere;Radium Hot Springs;Canal Flats	Terrestrial Realm - Grassland Group (G): Grassland Class (Gg)	
Pseudotsuga menziesii / Calamagrostis rubescens - Linnaea borealis	Douglas-fir / pinegrass - twinflower	S3	Blue		Invermere;Radium Hot Springs;Canal Flats	Terrestrial Realm - Forest: Coniferous - dry;Terrestrial Realm - Forest:	
**Pseudotsuga menziesii - Larix occidentalis / Calamagrostis rubescens*	*Douglas-fir - western larch / pinegrass	S2	Red		Invermere;Radium Hot Springs;Canal Flats	Terrestrial Realm - Forest: Coniferous - mesic	
**Pseudotsuga menziesii / Symphoricarpos albus / Balsamorhiza sagittata*	*Douglas-fir / common snowberry / arrowleaf balsamroot	S2	Red	Y (Jun 2006)	Invermere;Radium Hot Springs;Canal Flats	Terrestrial Realm - Forest: Coniferous - dry	
Puccinellia nuttalliana - Hordeum jubatum	Nuttall's alkaligrass - foxtail barley	S2	Red		Invermere;Radium Hot Springs;Canal Flats;Golden	Terrestrial Realm - Grassland Group (G): Alkaline/Saline Meadow Class (Ga)	
**Purshia tridentata / Pseudoroegneria spicata*	*antelope-brush / bluebunch wheatgrass	S2	Red	Y (Jun 2006)	Invermere;Radium Hot Springs;Canal Flats	Terrestrial Realm - Grassland Group (G): Shrub Steppe Class (Gs)	
Purshia tridentata - Symphoricarpos albus / Pseudoroegneria spicata	antelope-brush - common snowberry / bluebunch wheatgrass	S1S2	Red		Canal Flats	Terrestrial Realm - Grassland Group (G): Shrub Steppe Class (Gs)	
Salix drummondiana / Calamagrostis canadensis	Drummond's willow / bluejoint reedgrass	S2S3	Blue		Canal Flats;Golden	Terrestrial Realm - Flood Group (F): Low Bench Flood Class (Fl)	
Schoenoplectus acutus Deep Marsh	hard-stemmed bulrush Deep Marsh	S3	Blue		Invermere;Radium Hot Springs;Canal Flats	Wetland Realm - Mineral Wetland Group: Marsh Wetland Class (Wm)	P
Symphoricarpos albus - Rosa woodsii	common snowberry - prairie rose	S3	Blue		Canal Flats	Terrestrial Realm - Flood Group (F): Fringe Flood Class (Ff)	
Typha latifolia Marsh	common cattail Marsh	S3	Blue		Invermere;Radium Hot Springs;Canal Flats;Golden	Wetland Realm - Mineral Wetland Group: Marsh Wetland Class (Wm)	

Alkali Saltgrass - Foxtail Barley

Alkali saltgrass - foxtail barley (*Distichlis spicata - Hordeum jubatum*) is a blue-listed ecological community (EC) [provincial ranking of S2S3 (2018)], it has not been ranked by COSEWIC (Table 6). It is also an ecological community at risk under the provincial Forests and Range Practices Act (FERPA), thus WHA designation could apply to areas where it is found. There are four known locations in the Columbia Valley: 1) 1.3 kilometers east of Lake Windermere near Ellenvale Creek, 2) 2.5 kilometers west of Canal Flats, 3) 1.5 kilometers southwest of Doctor Creek/Lavington Creek confluence, and 4) 1.1 kilometers west of Doctor Creek/Lavington Creek confluence (B.C. CDC, 2012) (see Appendix 43 for mapped locations).

The habitat of this ecological community is found on plateaus and valleys of the dry central and southern interior of B.C. below 1000-meter elevation. It is found on moist sites, including depressions, potholes, and areas surrounding alkaline ponds. The habitat is usually closed (linked basins), briefly flooded in spring, and is subject to drying and salt accumulation later in the growing season (B.C. CDC, 2012). Beyond the B.C. CDC, no information on the alkali saltgrass - foxtail barley occurrences located in the Columbia Valley could be found. The Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) is working on regulations that would protect alkali saltgrass - foxtail barley plant associations, in addition to 13 ecological communities that are slated for protections under the Forest and Range Practices Act (FRPA):

> *"Once in place the regulations would provide better protection and management of ecological communities on provincial crown lands that are licensed for grazing and forestry activities. This would include assigning practice requirements for grazing, e.g., the timing and amount of grazing permitted, limiting stubble heights, pesticide use and limiting or denying road and trail development in order to protect and possibly improve the integrity of the site. The protections are implemented by mapping the area (ecological community) and assigning the practice requirements within that area. In some instances, fencing can be required to help manage grazing intensity. Typically, proposals of this nature are developed by ministry staff including ecosystems biologists, but can also be proposed by range staff, tenure holders or the general public. The work on the regulations to provide this type of protection will not be in place until sometime later this year or possibly as late as 2021."* (pers. comm., Jeff Shatford (MFLNRORD), January 27, 2020).

Recommended conservation objectives

A map has been created to indicate locations of the alkali saltgrass - foxtail barley ecological communities in the Columbia Valley, along with the associated land jurisdictions (Appendix 43). These four sites should be re-inventoried and assessed for current plant association distribution, to ensure the at-risk ecological communities still exist at these sites. Assuming occurrences still exist on crown land, a proposal to designate these sites as a Wildlife Habitat Area (WHA) should be created and sent to

ministry staff. This proposal should include a map indicating areas of overlapping crown land with alkali saltgrass - foxtail barley ECs as presented in Appendix 43.

4.7 Vascular Plants

Alkaline wing-nerved moss

The alkaline wing-nerved moss (*Pterygoneurum kozlovii*) is a rare, blue-listed plant species that has a provincial ranking of S3 (2015) (Table 7). In 2018, it was ranked globally with G3 status, meaning that the species is vulnerable to extirpation or extinction. According to the IUCN (2019), it is critically endangered. Alkaline wing-nerved moss was listed as a Threatened species by COSEWIC in 2004, and subsequently listed as Threatened under SARA in 2006. A recovery strategy was prepared by the B.C. Bryophyte Recovery Team in 2009.

There have been 28 sites reported with alkaline wing-nerved moss in British Columbia, six of these have likely been extirpated (B.C. Bryophyte Recovery Team, 2009). One of the 22 sites still thought to exist is found within the Columbia Valley study area. The site is located three kilometers southwest of Canal Flats. It was first observed on May 15, 1980, with the last recorded observations from November 9, 2002. During the 2002 visit, it was noted that the population was '[r]elatively undisturbed and possibly stable, with minor grazing impacts" (B.C. CDC, 2014g). The site is located on provincial government Crown land and was one of the most abundant and widespread patches observed. It was located amongst sedges and grasses, on partially shaded soil, in a 10-meter area around approximately 66% of a saline lake (B.C. CDC, 2014g). This species typically grows on soil among sedges and grasses, along the margins of open alkaline wetlands. Threats to this species in B.C. include livestock, urban and/or highway development, ATV and other vehicle use, invasive alien plants, and climate change (B.C. Bryophyte Recovery Team, 2009).

Recommended conservation objectives

At the time of writing, the current status of the site within the study area is unknown as it has not been revisited since 2002. However, an anonymous source stated that the extirpation of this moss was recorded the year or two following it originally being found. It is recommended to revisit this site, confirm whether or not it is present and conduct an inventory to identify, map and describe the current population if it is still there. If still present, this known population of alkaline wing-nerved moss should be maintained. Since grazing by cattle has been known to occur at this site, it is prudent to protect this known occurrence by erecting and maintaining a cattle enclosure to exclude grazing opportunities, as well as other potential site disturbances. Public outreach is recommended with any persons who may have a cattle grazing tenure in this area.

Table 7. Vascular plants and their associated at-risk rankings in the Columbia Valley.

Scientific Name	English Name	Provincial Ranking	BC List	COSEWIC	SARA	Provincial FRPA	IUCN Red List	Habitat
Pterygoneurum kozlovii	alkaline wing-nerved moss	S3 (2015)	Blue	T (2004)	1-T (2006)	N	Critically endangered	Grassy margins of alkaline depressions that are frequent in the British Columbia steppe.
Pinus flexilis	limber pine	S2S3 (2019)	Blue	E (2014)	Under review (2019)	N	Least Concern	Mesic to dry slopes in the subalpine zone.
Adiantum capillus-veneris	southern maiden-hair	S1 (2019)	Red	E (2011)	1-E (2003)	N	Least Concern	Springs / Hot Spring / Obligate
Eleocharis elliptica	slender spike rush	S3 (2019)	Blue	not assessed	not assessed	N	Least Concern	Wetland / Fen
Nymphaea tetragona	pygmy waterlily	S3 (2019)	Blue	not assessed	not assessed	N	Least Concern	Lake, ponds, slow moving streams.
Pinus albicaulis Engelm.	whitebark pine	S2S3 (2019)	Blue	E (2010)	1-E (2012)	N	Endangered	Moderately moist sites in subalpine areas.
Liparis loeselii	yellow widelip orchid	S3 (2019)	Blue	not assessed	not assessed	N	Near threatened	Riparian, wetland, riverine floodplain.

Limber Pine

Limber pine (*Pinus flexilis*) is blue-listed in the province of B.C. with a provincial ranking of S2S3 (2019) (Table 5). It was listed as an Endangered species in 2014 by COSEWIC (Table 7). Limber pine has no status under SARA, but at the time of writing it was listed as "under consideration for addition" to Schedule 1 of SARA (Government of Canada, 2019). COSEWIC's (2014b) reason for designating the limber pine as Endangered is as follows:

> *"This tree species is imminently and severely threatened throughout its Canadian range by White Pine Blister Rust (an introduced pathogen), Mountain Pine Beetle, and climate change. Surveys at a number of sites in 2009 document an average of 43% and 35% of infected or dead trees, respectively. Repeated survey information leads to an estimated decline in the Canadian population of about 1% per year. At that rate, close to 2/3 of mature individuals are expected to be lost over the next 100 years, and local subpopulations could become extirpated" (Government of Canada, 2015).*

Additional threats include direct tree removal and habitat reduction due to human development (Pigott & Moody, 2013).

Limber pine is a five-needled pine that stands 3-15 meters tall and normally occurs as scattered individuals. It has a rounded crown with egg-shaped seed cones that are greenish-brown to light brown in color. It is similar in appearance to the whitebark pine, another at-risk tree species (described later in this report), and these two species may form mixed stands (COSEWIC, 2014b). Limber pine is considered to be a keystone species (COSEWIC, 2014b). The seeds are an important high-fat food source for a number of animals including birds (especially the Clark's nutcracker), small mammals and grizzly bears; shelter for some animals is also provided by the trees (COSEWIC, 2014b). Limber pine has a long-life span; trees over 1,000 years of age are known (COSEWIC, 2014b).

This tree is found in B.C. and Alberta where it is at the northern limit of its range. It can be found at many elevations (850-2000 meters) within its range, and its habitat is found on dry rocky sites on slopes that vary from gentle to steep (COSEWIC, 2014b). It can occur scattered throughout forested regions on mesic sites and dry slopes in the subalpine zone, especially in low density, open areas. It is a very uncommon tree species and is known at a limited number of locations in B.C., most of which are scattered in the Columbia Valley from Canal Flats to Kindersley Creek (north of Edgewater) (Appendix 44). Additional sites are located further north in the Kicking Horse Canyon (northeast of Golden) and near Field. Limber pine has been recorded at 12 locations in the study area. Due to difficult access to potential survey sites, ground surveys have been limited and this species may be more widespread than is currently known; more extensive surveys have been recommended (Pigott & Moody, 2013).

Recommended conservation objectives

Given that the Columbia Valley contains most of the known limber pine locations in B.C., more extensive surveys should occur in the study area. Potential restoration sites should also be identified, and seed collection should occur to prepare for future restoration projects in the study area.

Southern maiden-hair

Southern maiden-hair (*Adiantum capillus-veneris*) is red-listed in B.C., with a provincial ranking of S1 (2019), it is listed as an Endangered species under COSEWIC and Endangered on Schedule 1 of SARA (Table 7). There is only one known location of this species in B.C., which is restricted to a small area at the Fairmont Hot Springs Resort (B.C. CDC, 2010b). This species requires very specific habitat conditions (i.e., tufa substrates, close proximity to hot springs water flow) in order to survive; very little is known about the basic ecology of this species (B.C. CDC, 2010b). It is unknown when this species was first discovered at Fairmont Hot Springs, but three new subpopulations were discovered between the years 2000 and 2003. The B.C. CDC (2010b) recommends that "the entire hot springs system at Fairmont Hot Springs should be surveyed periodically to ensure that all extant populations/subpopulations have been located." This area could be considered for Wildlife Habitat Feature designation if the occurrence is on crown land, as 'hot springs or thermal springs' can be designated under the FRPA Order put into place on July 1, 2018.

Slender spike rush

Slender spike rush (*Eleocharis elliptica*) is a blue-listed species in B.C. with a provincial ranking of S3 (2019) and no ranking assigned under COSEWIC or SARA (Table 7). There are no occurrence accounts for this species in the B.C. CDC, but there are known locations of this species at the confluence of the Columbia and Kicking Horse Rivers and at Edelweiss Slough in Golden (pers. comm., anonymous, January 21, 2020). Due to limited survey effort in the study area, slender-spike rush could be more widespread in the Columbia Valley. The habitat type for this species is fen wetland. It is recommended to protect all known occurrences at the confluence of the Columbia and Kicking Horse Rivers and Edelweiss sites by expanding the Columbia Wetlands Wildlife Management Area Boundaries into these areas.

Pygmy waterlily

Pygmy waterlily (*Nymphaea tetragona*) is blue-listed in the province of B.C. with a provincial ranking of S3 (2019) (Table 7). It has not been ranked by COSEWIC or SARA. While the B.C. CDC does not have any records for this species in the study area; it has been observed or reported to the author to occur in at least four locations in the Columbia Valley: the Brisco area, Burgess James Gadsden Provincial Park, and at a higher elevation lakes northwest of Golden. The first record for this species in the Columbia Valley was the discovery in the Columbia Wetlands near Brisco on July 14, 2004 (Halverson, 2004). Subsequent discoveries were within the past five years, one was made by the principal author of this report in 2016 (Darvill, 2016). The Columbia Valley represents the most southerly known location for this species (Halverson, 2004). The habitat for pygmy waterlily is lake, pond and slow-moving streams within montane and lowland zones. It is recommended to inventory for other pygmy waterlily occurrences in the Columbia Valley and determine the best management strategy to protect all known locations.

Whitebark pine

Whitebark pine (*Pinus albicaulis Engelm*) is blue-listed in the province of B.C. with a provincial ranking of S2S3 (2019) (Table 7). The COSEWIC listed whitebark pine as an Endangered species in 2010, and it was listed as a species of Special Concern on Schedule 1 of SARA in 2012. It is also listed as Endangered on the IUCN's Red List (IUCN, 2019). A recovery plan was developed by Environment and Climate Change Canada in 2017, which included proposed landscape scale areas for critical habitat designation. The reason for COSEWIC's Endangered designation is as follows:

> *This long–lived, five–needled pine is restricted in Canada to high elevations in the mountains of B.C. and Alberta. White Pine Blister Rust alone is projected to cause a decline of more than 50% over a 100-year time period. The effects of Mountain Pine Beetle, climate change, and fire exclusion will increase the decline rate further. Likely, none of the causes of decline can be reversed. The lack of potential for rescue effect, life history traits such as delayed age at maturity, low dispersal rate, and reliance on dispersal agents all contribute to placing this species at high risk of extirpation in Canada* (Environment and Climate Change Canada, 2017b).

Additional human-caused impacts (i.e., logging, recreation, road building or erecting permanent structures) are threats to the destruction of proposed critical habitat for whitebark pine (Environment and Climate Change Canada, 2017b). The whitebark pine is almost entirely reliant upon the Clark's nutcracker for seed dispersal and regeneration; therefore, recovery is also limited by its reliance on this bird species as well as its long time to regenerate (Environment and Climate Change Canada, 2017b). Impacts of white pine blister rust in combination with other threats such as pine beetle and climate change cannot be eliminated or avoided entirely through habitat preservation (Environment and Climate Change Canada, 2017b). Inventories and assessment of whitebark pine stand density within the potential area of critical habitat is required before the final critical habitat can be finalized (Environment and Climate Change Canada, 2017b). There is a significant amount of proposed critical habitat area in the study area for whitebark pine (Appendix 44).

Recommended conservation objectives

In 2019, the Crown of the Continent Ecosystem (CCE) Hi-5 Working Group (whose mission to protect and restore functional whitebark and limber pine ecosystems) piloted a process to develop a strategic approach for conserving and restoring whitebark pine on a five-million acre subset of the CCE that included the Confederated Salish and Kootenai tribal lands, Glacier National Park, and the Flathead National Forest. This work is meant to inform the selection of restoration core areas as part of the National Whitebark Pine Restoration Plan and also will be used as a template for other management units outside the CCE. Given that such a large part of the Columbia Valley study area includes proposed whitebark pine critical habitat (according to the federal government designations), the CWSP and Kootenay Connect should strongly consider becoming engaged with the Hi-5 Working Group.

Yellow widelip orchid

Yellow widelip orchid (*Liparis loeselii*), also well-known as fen orchid, is a blue-listed glabrous, herbaceous perennial species with a provincial ranking of G5 (2016) (Table 7). It has not been assessed by COSEWIC and is not listed under SARA. It is listed on the IUCN's Red List as Near Threatened. Yellow widelip orchid habitat type is riparian and wetland. The B.C. CDC has two detailed species occurrence reports for the study area. One is from Edelweiss, which is a marsh wetland in the Town of Golden. The first observation date for this site is 2009-07-12; last recorded observation was on 2010-07. There were four subpopulations with a total of 41 plants recorded at this site (B.C. CDC, 2014h). Comments in the B.C. CDC (2014h) species occurrence report include: "population in an area of intensive activity by recreational vehicles," "[o]ne plant that was undetected in 2009, was subsequently trampled by a dog," and "[t]he trail system is heavily degraded by increasing off-road vehicle activity." In the last 10 years the Town of Golden had installed barriers to help keep motorized traffic off Edelweiss Trail, but extensive human and dog use continues posing continued risk of trampling to the remaining at-risk plants.

The second site recorded in the B.C. CDC database is from Golden at the confluence of the Columbia and Kicking Horse Rivers. The first observation of yellow widelip orchid at this site was on 2004-06-11. In July 2010, a total of 889 plants in six subpopulations were located at this site (B.C. CDC, 2014h). The B.C. CDC (2014h) reports in comments: "[a] large population that is being degraded by the activities of recreational vehicles and dogs. Other potential threats include herbivory and the creation of a water theme park." There is a series of ORV trails at this site, but the provincial government is planning to pursue the expansion of the Columbia Wetlands Wildlife Management Area (CWWMA) at this site. The CWSP should follow up on potential CMWMA expansions to ensure that this, along with additional sites identified with at-risk species, are included in a WMA boundary expansion.

4.8. Overview of waterbird research findings

4.8.1 Columbia Wetlands Waterbird Survey (2015-2019)

The Columbia Wetlands Waterbird Survey (CWWS) was a five-year (2015-2019) coordinated bird count that involved more than 230 volunteer citizen-scientists in data collection (Darvill, 2020). The project was led by a biologist who (along with multiple volunteers) collected baseline data on bird populations and bird diversity in the Columbia Wetlands during spring and fall migratory periods. There were three survey dates during fall and three survey dates during spring (April 3, 10, 16; Sept 29, Oct 5 and 15). The CWWS documented 163 bird species in the Columbia Wetlands, 14 of those were at-risk species: horned grebe, eared grebe, western grebe, tundra swan, American bittern, rough-legged hawk, bank swallow, barn swallow, long-billed curlew, surf scoter, American white pelican, California gull, peregrine falcon, double-crested cormorant and great blue heron (Darvill, 2020).

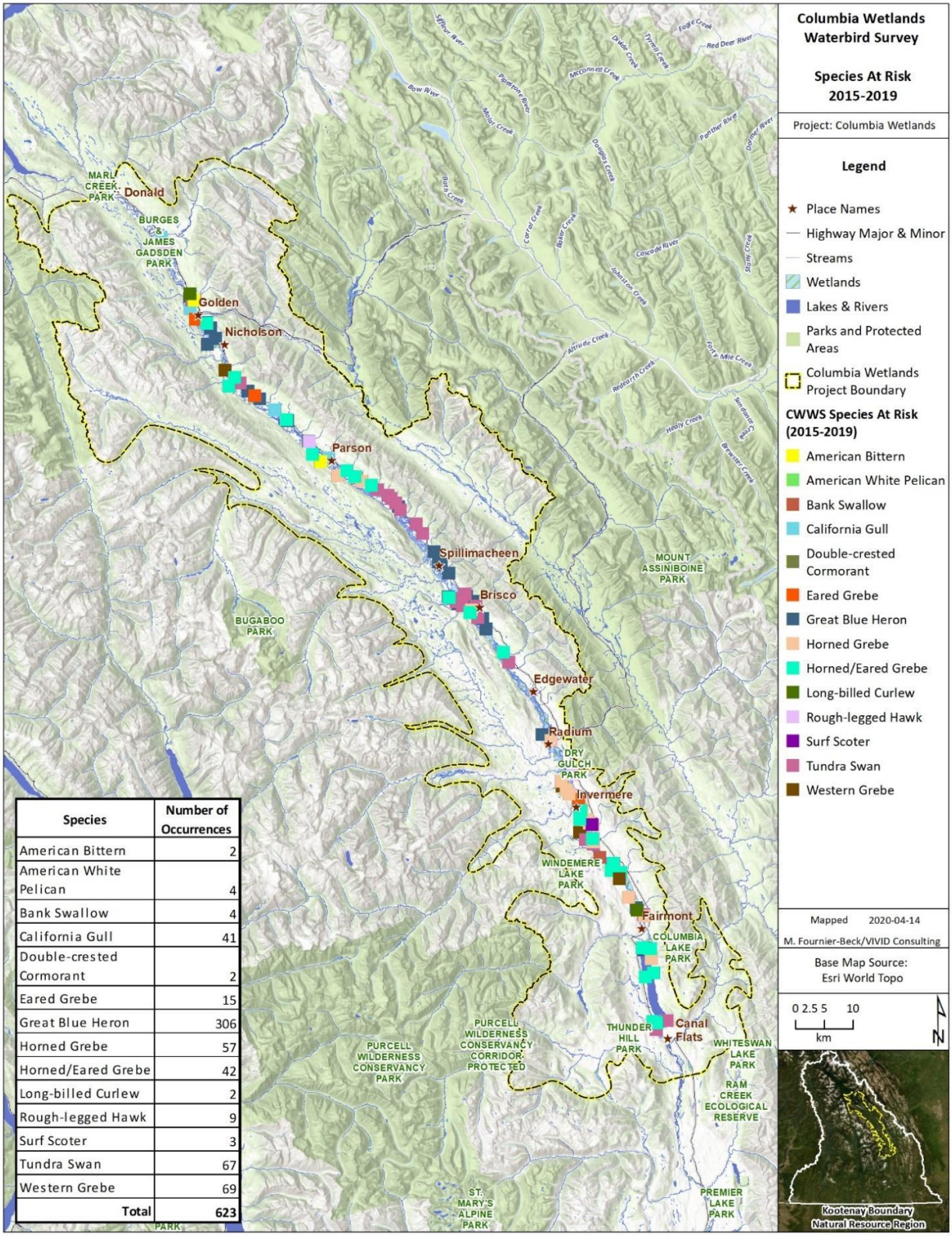
The distribution of these at-risk bird species observed during the CWWS project is shown in Figure 3. Essentially, most CWWS survey stations in the Columbia Wetlands had observations of at-risk bird species. The only areas devoid of at-risk birds were those that had poor survey coverage usually owing to lack of accessibility, e.g., north of Golden, Radium to north of Edgewater, central portions of Columbia Lake. Recent boat surveys indicate that the middle region of Columbia Lake does appear to be important for at-risk grebe species (i.e., horned, eared, western) that use these waters as stopover habitat for feeding during migration (pers. obs., R. Darvill), but peak grebe use of the lake is after the CWWS survey dates.

Single day bird counts from the CWWS determined that American coot, American wigeon, and mallard are the most common bird species in the wetlands during spring and fall bird migration (Darvill, 2020). Other waterbird species found in high abundance included Canada goose (*Branta canadensis*), green-winged teal (*Anas carolinensis*), ring-necked duck (*Aythya collaris*) and northern pintail (*Anas acuta*) (Darvill, 2020). Cavity-nesting waterfowl [mergansers (*Mergus spp*.), goldeneye (*Bucephala spp*.), wood duck (*Aix sponsa*), bufflehead (*Bucephala albeola*)] were found to be less abundant than the dabbling duck species aforementioned, but the cavity-nesters were found in higher abundance during the CWWS survey dates when compared to previous aerial waterbird surveys conducted in 1976-1977 (e.g., Kaiser, McKelvey & Smith, 1977). There is a large amount of available nesting habitat in the valley bottom for cavity nesters - dense riparian and lowland forest with abundant dead trees and woodpeckers to make cavities (Kaiser, McKelvey & Smith, 1977). Given high habitat availability and since cavity-nesting species like hiding in dense cover, the Columbia valley bottom may be underrated in terms of the important habitat value provided to this guild of species.

Aerial surveys of the CWWS documented that the Columbia Wetlands provides significant habitat to trumpeter swan (*Cygnus buccinator*) and tundra swan (*Cygnus columbianus*), with specific areas more important than others in terms of the value of stopover habitat provided during migration (Darvill, 2020). The distribution of swans in the Columbia Wetlands as indicated through four years of aerial data is illustrated in Figure 4. This figure/map shows that the following regions are used with a greater intensity by swans: area between Fairmont and the south end of Lake Windermere, Althalmer to Columbia National Wildlife Area (Wilmer Unit), north of Edgewater, between Brisco and Castledale, and some smaller sections scattered between Parson and Golden. Swans prefer open shallow water wetland habitats during migration, likely for their ample food resources and protection from predators (e.g., coyotes do not like the water). The trumpeter swan is the main target species that could end up providing the Columbia Wetlands with 'Important Bird and Biodiversity' (IBA) of 'Key Biodiversity Area' (KBA) status, since 1% of the regional population is found in the Columbia Wetlands. "In order to conserve nature effectively, it is necessary to identify those places most important for biodiversity and therefore conservation action. Important Bird and Biodiversity Areas—IBAs—constitute the largest and most comprehensive global network of sites that are significant for the global persistence of biodiversity" (Birdlife International, 2018). A major outcome of the CWWS project was to use the data to nominate the Columbia Wetlands into the 'Important Bird and Biodiversity Area' (IBA) program. A decision on the IBA outcome is pending, although the KBA program is now taking precedence over IBA establishment.

The CWWS project completed an osprey inventory in 2019 and located 60 osprey nests in the Columbia Valley. Forty-three nests (71.7% of the total count) had some level of osprey activity in 2019 (Darvill, 2020). It is likely that more osprey nests are present in the valley bottom (especially between Invermere and Brisco), but those nests went undetected (Darvill, 2020) . High osprey habitat suitability in this area is located away from roads and the 2019 inventory, only roadside inventories were conducted. All osprey nest locations located on crown land should be submitted to MFLNRORD to become Wildlife Habitat Features under the Forest and Range Practices Act. Figure 5 provides a map for the locations of known osprey nesting sites in the Columbia Valley.

During the five-year CWWS, four areas in the Columbia Wetlands consistently had the highest bird concentrations (Figure 6). These areas were located at the south end of Lake Windermere, a wetland complex between Brisco and Spillimacheen, at the Columbia National Wildlife Area (Wilmer Unit), and Mulligan's Slough near Nicholson (Darvill, 2020). With the reported trend of decreasing global bird populations, Darvill (2020) recommends protecting these high valued habitat areas by designating them as Migratory Bird Sanctuaries, managed by the federal government. Alternatively, designating them as part of the Columbia National Wildlife Area should also be considered.



Species	Number of Occurrences
American Bittern	2
American White Pelican	4
Bank Swallow	4
California Gull	41
Double-crested Cormorant	2
Eared Grebe	15
Great Blue Heron	306
Horned Grebe	57
Horned/Eared Grebe	42
Long-billed Curlew	2
Rough-legged Hawk	9
Surf Scoter	3
Tundra Swan	67
Western Grebe	69
Total	**623**

Figure 3. Spatial distribution of at-risk bird species using data collected through the 2015-2019 Columbia Wetlands Waterbird Survey.

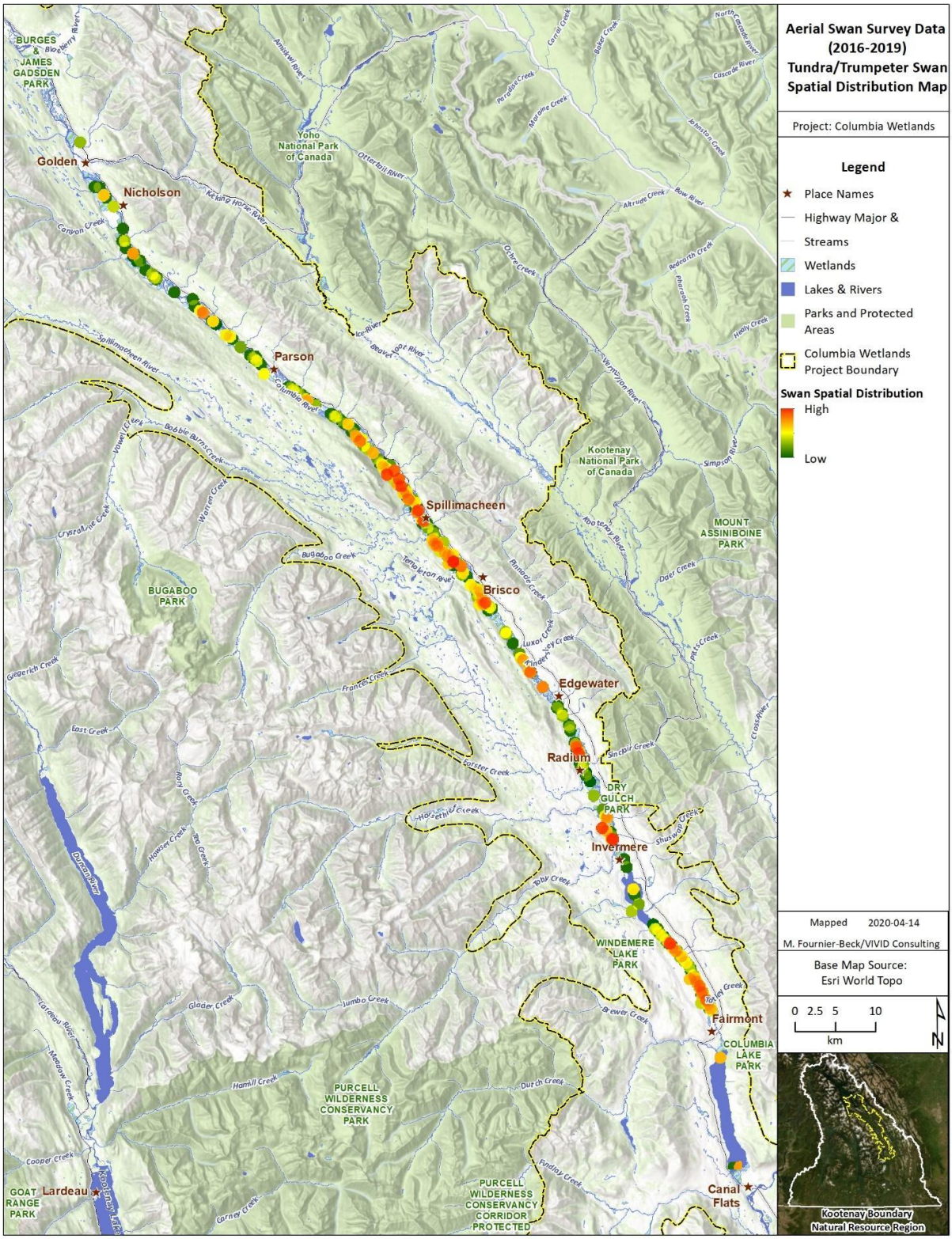


Figure 4. Tundra/trumpeter swan spatial distribution in the Columbia Wetlands, as determined through Columbia Wetlands Waterbird Survey (2015-2019) data.

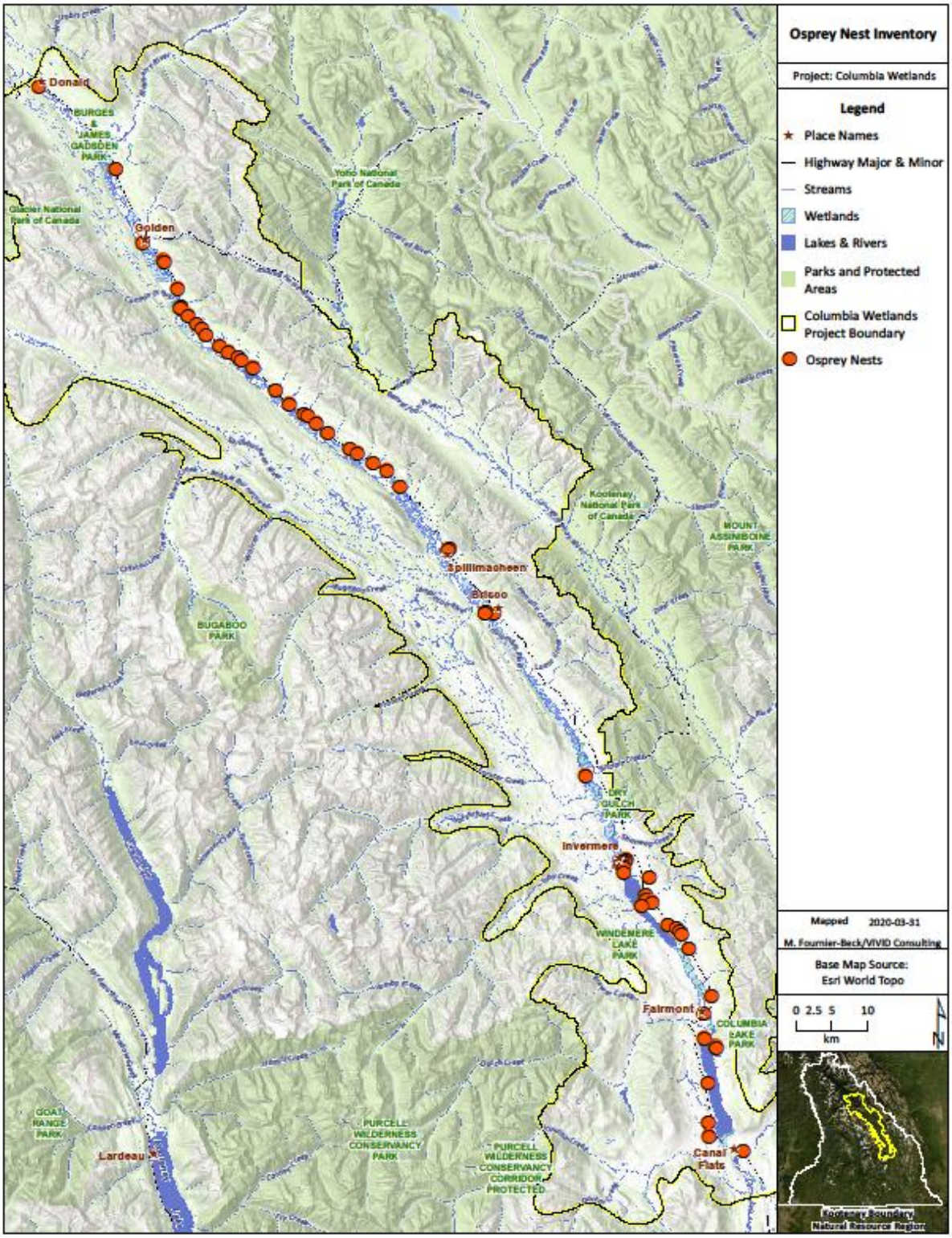


Figure 5. The osprey nests that were located in the Columbia Valley in 2019.
Note – Data source is Columbia Wetlands Waterbird Survey (Darvill, 2020).

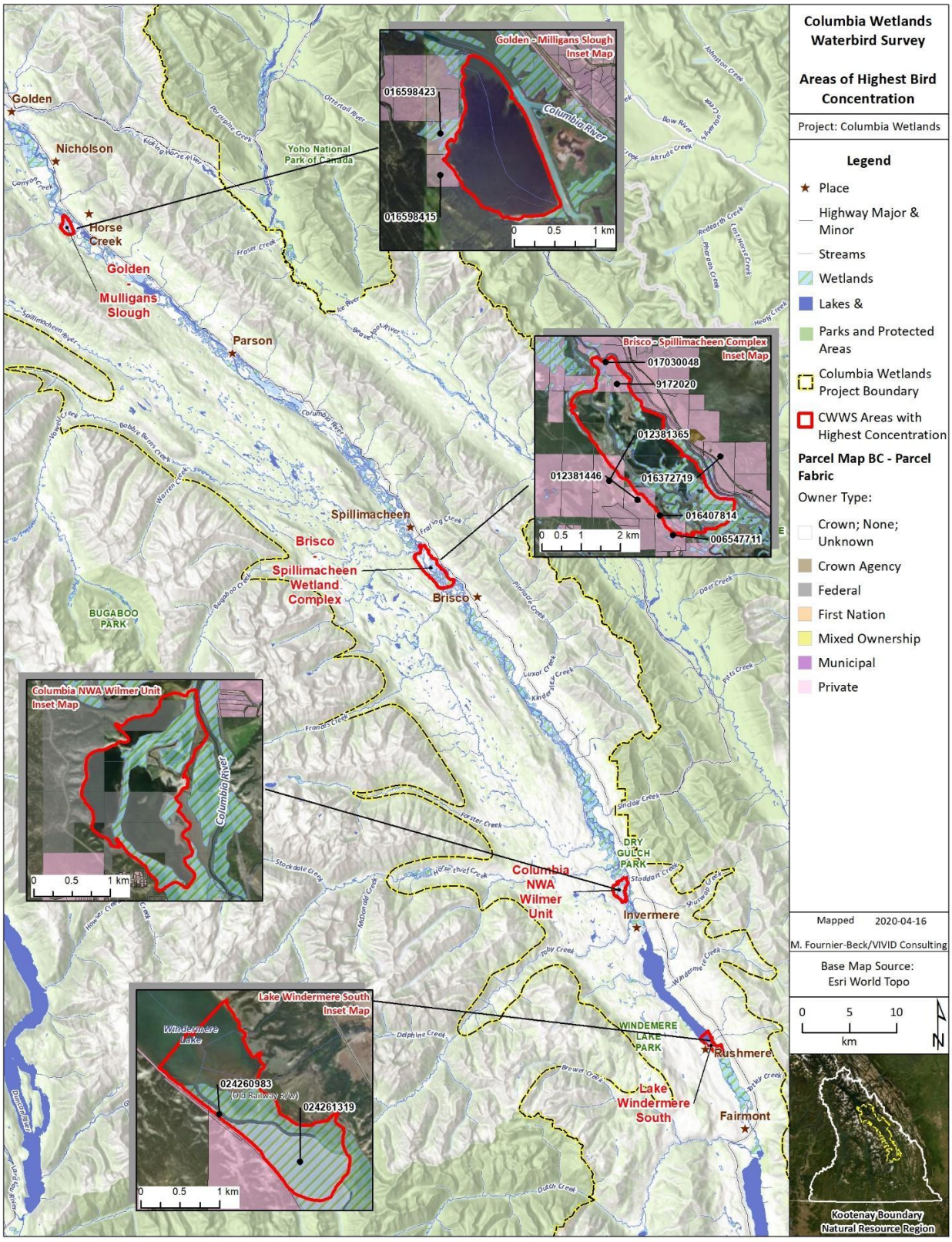


Figure 6. Areas in the Columbia Wetlands with the highest bird concentration during bird migration.

4.8.2 Columbia Wetlands Marsh Bird Monitoring Project (2016-2019)

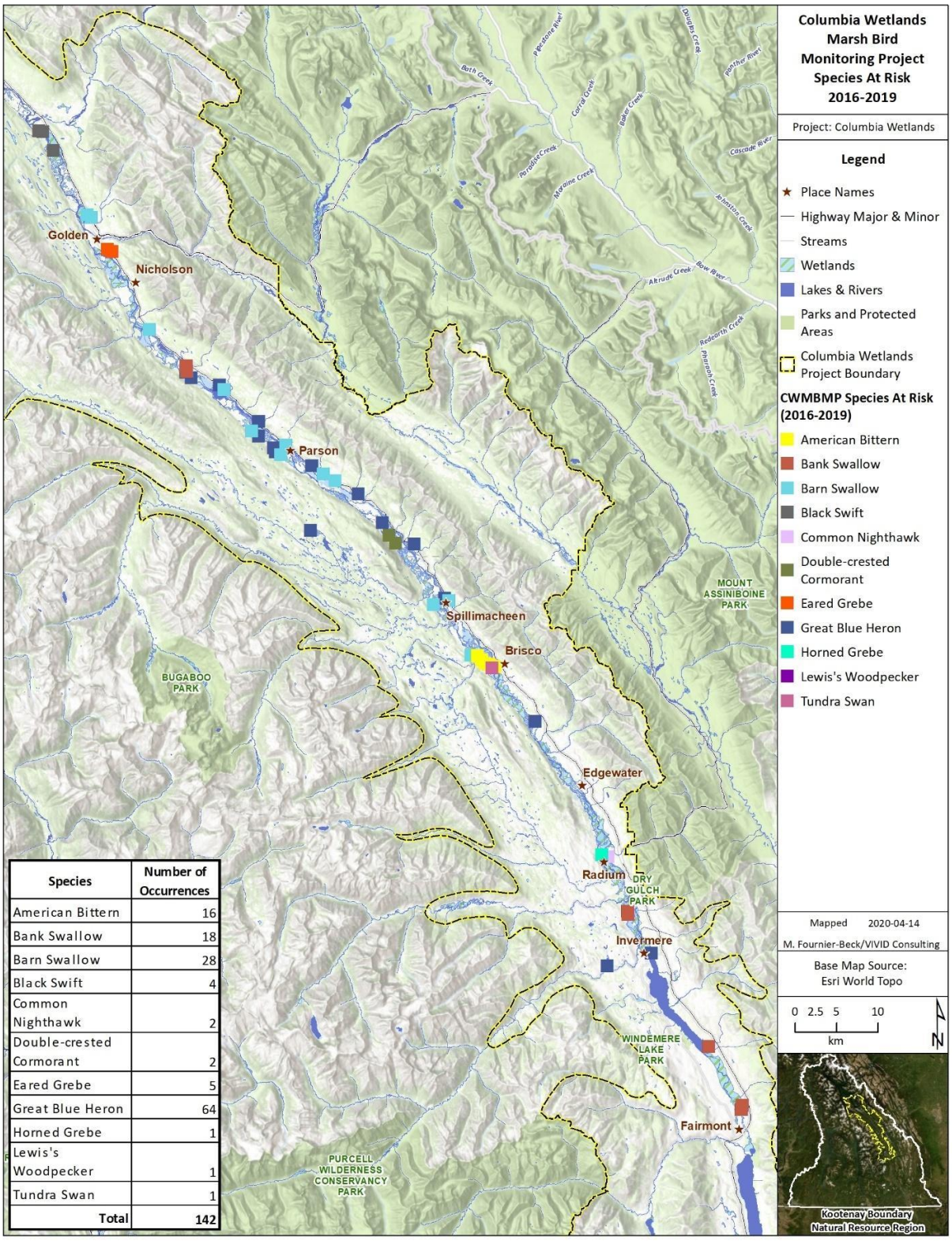
Marsh bird species are dependent on wetland habitats with reports increasingly indicating that many marsh bird species populations are in decline. Many marsh bird species are inconspicuous, elusive, and secretive, making them difficult to detect through visual observations alone. This has led to significant gaps in our understanding of their population status and how best to maintain and enhance marsh bird species populations. The Columbia Wetlands Marsh Bird Monitoring Project (CWMBMP) was a multi-year study (2016-2019) designed to estimate marsh bird species populations, assess the distribution of target species, and identify significant breeding areas or habitat types within the Columbia Wetlands (Darvill & Westphal, 2020a; Darvill & Westphal, 2020b; Darvill, Westphal, Flemming & Drever, in press). A standardized call broadcast protocol was used to conduct point count surveys at stations throughout the Columbia Wetlands. These stations were surveyed multiple times during the breeding season and most stations were visited annually across the course of the study. Call-broadcast recordings were focused on five focal species of secretive marsh birds: American bittern, Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), pied-billed grebe (*Podilymbus podiceps*), and American coot (*Fulica americana*). Visual and aural observations of all bird species present during a 15-minute survey were recorded. Additional habitat surveys, focusing on major habitat types and the vegetation community, were conducted annually at each survey station.

All five focal and most primary bird species were present in the Columbia Wetlands during the study, including nine species considered to be at-risk either provincially and/or federally: great blue heron, barn swallow, bank swallow, black swift, common nighthawk, American bittern, horned grebe, eared grebe, double-crested cormorant, tundra swan and Lewis's woodpecker (Darvill & Westphal, 2020b). The distribution of these at-risk bird species observed during the CWMBMP project is shown in Figure 7. The bird species most frequently detected were the yellow warbler (*Setophaga petechia*), Canada goose, red-winged blackbird (*Agelaius phoeniceus*), willow flycatcher (Empidonax traillii) and tree swallow (*Tachycineta bicolor*) (Darvill & Westphal, 2020b).

Four of the focal species and five primary species were observed with enough frequency to estimate their abundance within the Columbia Wetlands (Darvill, Westphal, Flemming & Drever, in press). The abundance estimates for pied-billed grebe in particular are significant in that they have been used to nominate the Columbia Wetlands as an IBA. In 2016 pied-billed grebe estimations were 1,187 (95% CI = 838-1,682), 792 (95% CI = 577-1,086) in 2017, 1,006 (95% CI = 689-1,468) in 2018, and 887 (95% CI = 633-1,243) in 2019 (Darvill & Westphal, 2020b).

Research results supported the existing literature proposing that a 'hemi-marsh' state (a well interspersed 50:50 ratio of emergent vegetation and open water) is an important habitat condition for most marsh bird species. Based on point count surveys, key areas with particularly abundant species richness and/or hosting at-risk species were identified, including Reflection Lake, Radium Mill Pond, and the wetlands surrounding Brisco (Darvill & Westphal, 2020b). Darvill and Westphal (2020b) provided a number of recommendations resulting from this research, including: repetition of the project over 3-5 years increments to assess population trends, use mapping to identify areas of emergent herbaceous vegetation (high valued breeding habitat), create and promote buffer distances to emergent vegetation to be observed during breeding season, expand CWWMA boundaries to include Reflection Lake and

other important bird breeding habitats, and explore water flow connectivity options at Radium Mill Pond.



Species	Number of Occurrences
American Bittern	16
Bank Swallow	18
Barn Swallow	28
Black Swift	4
Common Nighthawk	2
Double-crested Cormorant	2
Eared Grebe	5
Great Blue Heron	64
Horned Grebe	1
Lewis's Woodpecker	1
Tundra Swan	1
Total	**142**

Figure 7. Spatial distribution of at-risk bird species using data collected through the Columbia Wetlands Marsh Bird Monitoring Project.

4.8.3 Important historic waterbird information

The Columbia Wetlands are considered an important migration stopover habitat for birds, used for resting, feeding and drinking (Kaiser, McKelvey & Smith, 1977); a vital component of the Pacific Flyway. Until recently, very little data had been reported in terms of waterbird use in the Columbia Wetlands. There were some historical surveys conducted by the Canadian Wildlife Service, but few of those were published. Aerial surveys conducted in 1976 and 1977 and reported on by Kaiser, McKelvey & Smith (1977) arguably provides the most important historical records and habitat use for waterbirds of the Columbia Wetlands. Ground-based surveys were not conducted, many birds went undetected and several individuals went unidentified (Kaiser, McKelvey & Smith, 1977). Regardless, some important highlights regarding habitat use were reported on by Kaiser, McKelvey & Smith (1977) and are as follows:

- Large movement of 1,200 swans (trumpeter/tundra) was seen on March 28, 1977.
- Approximately 100 mergansers of various species were detected in the Columbia Wetlands through aerial surveys in 1977.
- The dense riparian and lowland forests (with abundant dead trees and woodpeckers) provided excellent nesting opportunities for cavity nesting waterfowl, e.g. mergansers, bufflehead, goldeneye, wood duck. Inventories probably underestimated their numbers breeding in the valley given they like to hide in dense vegetation.
- Scaup, ring-necked ducks and goldeneye preferred still water for breeding, and ring-necked ducks preferred dense cover for nesting.
- Canvasback and redhead moved through the valley in small flocks in April and May.
- South end of Lake Windermere was an important staging habitat with very large mixed flocks present in fall; this may have been the result of less human disturbance and possibly due to enhanced food production at warm outflow areas of Fairmont Hot Springs. Hot springs may allow for open water areas later in fall, and earlier in spring.
- Outflow areas of warm water should be protected since these are areas of irreplaceable migration habitat.
- Trumpeter swans may depend on the small patches of open water that are associated with hot spring outflows.
- Large flocks congregated on ‘large sloughs’ between Brisco and Golden. This area “may offer the best habitat because the marshes are a complex of large islands and levees totally separated from the west bank by Bott’s Channel…” While significant, numbers of birds found there were far smaller than the large rafts of American coot seen at the southern end of Lake Windermere.
- Dabbling ducks occurred in much larger numbers both as breeders and migrants when compared to diving ducks.
- Mallards were the most common duck in the valley and during the winter they became concentrated to open water remaining at hot springs and the Columbia Lake outflow. Aerial surveys indicated that the Columbia Wetlands provided one of the densest populations of mallard in B.C.

- American wigeons were seen in very large numbers during fall, but only a few are known to breed in the valley.
- Green-winged teal had large concentrations gathering in the wetlands until just before freeze-up; only one brood was observed in 1977, suggesting minimal breeding.
- Small numbers of other dabblers observed: northern pintail, northern shoveler, gadwall.
- Unknown if freshet was a factor in flooding nests of dabbling ducks in the Columbia Wetlands. Most geese and many ducks had fledged chicks ahead of flooding events.
- Western grebe occurred as large migrant flocks.
- Great blue herons occurred in large numbers throughout the valley bottom.
- The report pointed out that Munro (1949) reported small populations of bald eagles in the valley; at least 6 active nests were noted during 1976-1977 aerial surveys.
- Ospreys were extremely abundant along the Columbia River.
- Dense growth of emergent herbaceous vegetation may be of high value as production areas for waterfowl.
- Wind played an important role in terms of bird distribution around Columbia Lake and Lake Windermere.
- Many large trees north of Brisco were missing. These were important for a variety of woodpeckers including: Lewis's, Williamson's, piliated, downy, and northern flicker.
- The Columbia Valley "is probably the second most important migration corridor in British Columbia and competes with the coast in its ability to hold and feed large numbers of birds at critical moments during their annual migrations."

4.9 Overview of spatial data compilation

4.9.1 Birds

Hammond (2007) stated that the Columbia Wetlands ecosystem is arguably of most importance for bird species when considering only the vertebrate perspective. There have been 264 species of birds reported for the Columbia Wetlands (Ferguson & Halverson, 1997) with 150 of those species that have been known to breed in the region. The Columbia Wetlands are the largest wetlands complex in the southern interior of B.C., providing significant habitat and refuge for large concentrations of staging waterfowl and 35 at-risk bird species.

All spatial data compiled for bird species at risk (SAR), as well as for osprey nest locations, and was integrated to produce a map in order to help indicate potential biodiversity hotspot locations for bird SAR in the Columbia Valley. The map shown in Figure 8 indicates that those areas where people are concentrated (i.e., Canal Flats, Columere, Fairmont, Lake Windermere, Invermere, Parson, Golden, Blaeberry, Donald) also indicate a higher abundance of at-risk birds. Since survey effort is likely more concentrated in communities, this map is likely more representative of survey effort rather than spatial distribution and bird abundance. However, some areas outside of communities have medium to high levels of bird SAR abundance such as the south end of Lake Windermere, between Brisco and Spillimacheen, north of Spillimacheen and between Parson and Nicholson. These areas appear to be more important than others in terms of the habitat value provided to bird SAR.

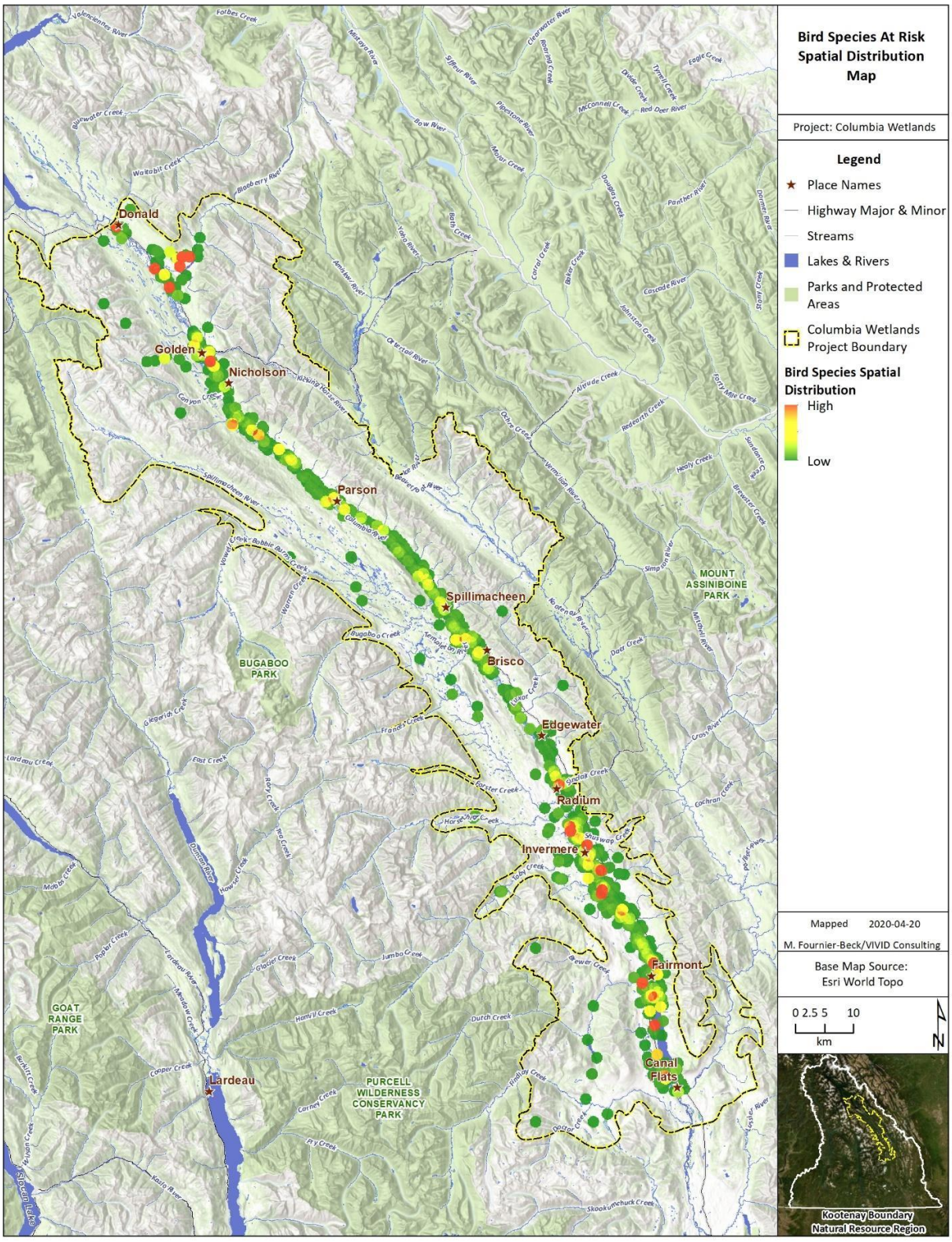


Figure 8. Bird species at risk spatial distribution using all available data records for the Columbia Wetlands.

4.9.2 Preliminary look at the spatial occurrence of wildlife corridors in the Columbia Valley

In an attempt to move towards identifying wildlife corridors, all spatial data available for select ungulate species (bighorn sheep, caribou, Rocky Mountain elk, mountain goat) was combined into a single map as shown in Figure 9. This map indicates that most of the higher elevations in the Columbia Valley provide important habitat for ungulates. The winter ungulate range appears to be concentrated to the lower elevations, especially south of Birchlands Creek. A major data gap in identifying wildlife corridors is a lack of elk migration route data for the study area.

The map provided in Figure 10 provides an overview of all spatial data collected for non-ungulate species of this project. This map also includes all WHFs, WHAs, and critical habitat (CH) located within the study area. Approximately half of the study area has been proposed as CH for one federally listed species at risk (whitebark pine) (Appendix 44), but inventory work is required to designate final CH parcels for whitebark pine. There are federally designated areas of CH for the following federally listed SAR within the study area: caribou - southern mountain population, Lewis's woodpecker, little brown myotis, northern leopard frog, and northern myotis. Wildlife habitat areas for three SAR (American badger, flammulated owl, Lewis's woodpecker) are located within the study area, along with WHFs for flammulated owl and great blue heron.

Regarding grizzly bear connectivity, the predicted corridors shown in Figure 10 are an interaction between backcountry core areas, front country habitat quality, and human disturbance. The current predictions for wildlife connectivity indicate that corridors are located at the north and south ends of Columbia Lake, the Edgewater - Brisco area, and a smaller corridor located near the McMurdo area close to Parson. There are good grizzly bear core areas on opposite sides of Golden as well, but the grizzly bear model avoided identifying corridors through heavily populated areas. Areas located north of Golden may also be suitable for grizzly bear corridors and this should be further investigated. The area north of Brisco and north of Golden will be further investigated in year two of Kootenay Connect – Columbia Wetlands, to identify key wildlife corridors in those areas.

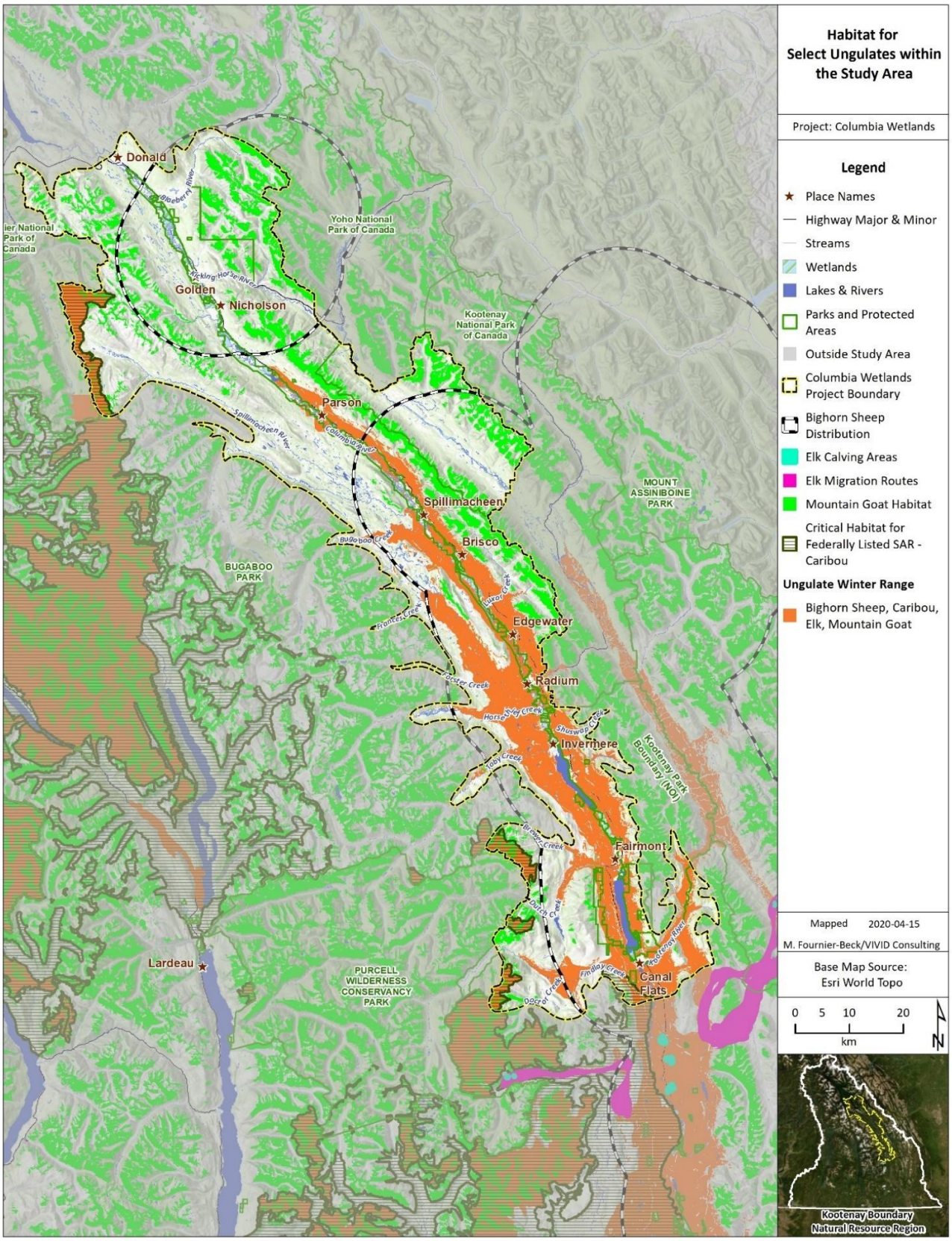


Figure 9. Habitat for select ungulate species within the study area.

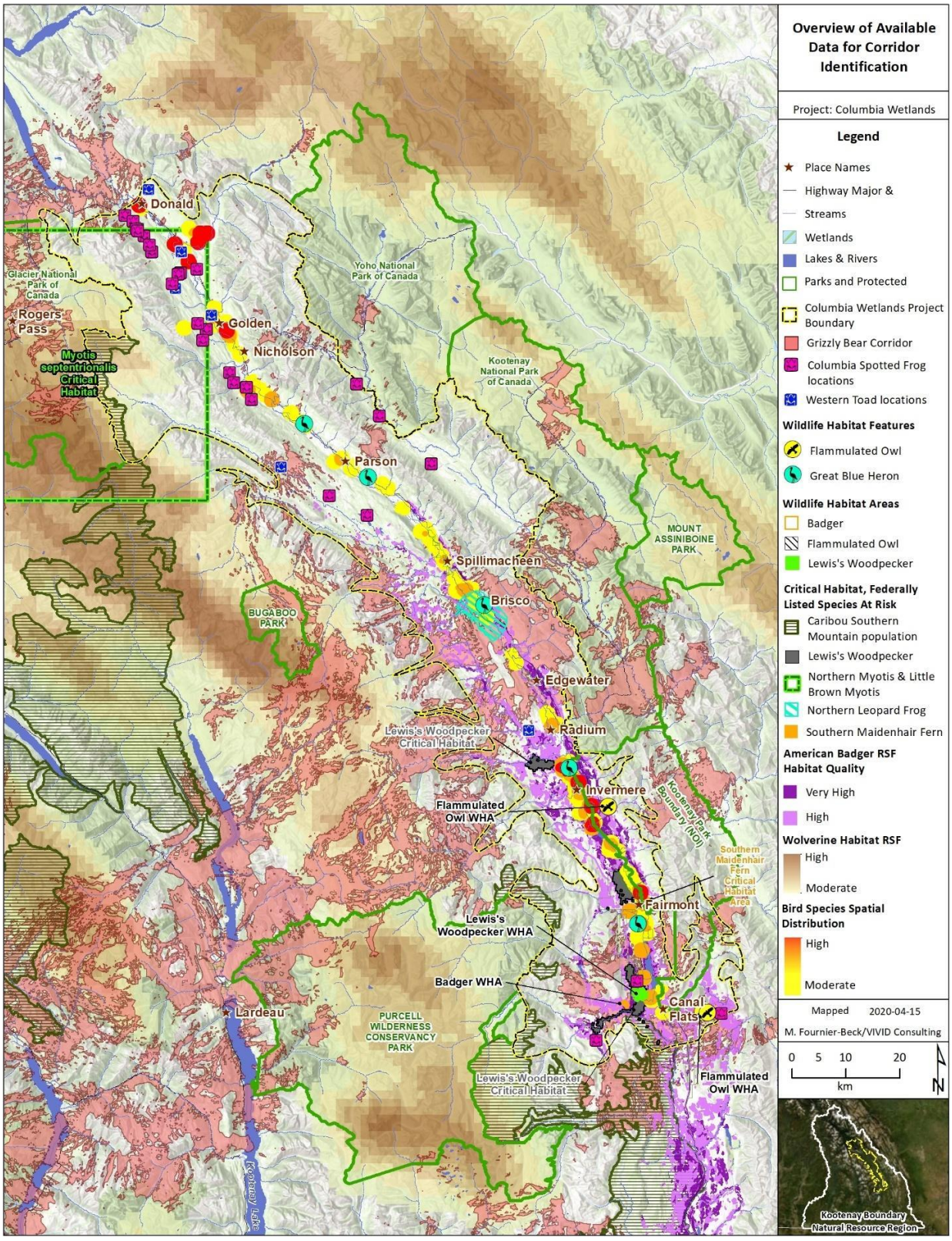


Figure 10. Overview of available spatial data used for corridor identification in the study area.

5.0 Discussion and Conclusion

This report provides the first comprehensive list of species at risk (SAR) in the approximately 180-kilometer-long Columbia Valley, from Canal Flats to Donald. This report summarizes research conducted to date for bird, plant, mammal, reptile and amphibian SAR and a number of recommendations are presented to help guide conservation objectives in the Columbia Valley. Preliminary results indicate that from a SAR perspective, the valley bottom (Columbia Wetlands) is a biological hotspot. Wetlands are well known to provide a number of ecosystem services and values including functional (e.g., flood management, water purification) and anthropogenic values (e.g. timber collection, fisheries, tourism), and they support areas of intense biodiversity and genetic resources (Denny, 1994). The world's largest wetlands have now become some of the largest conservation priorities in the world (Keddy et al., 2009).

The Columbia Wetlands have been designated as a Ramsar site, a wetland with international significance, and are currently being considered as an 'Important Bird and Biodiversity Area' and 'Key Biodiversity Area.' Much of the wetlands are protected as a Wildlife Management Area (or through other conservation designations as described previously), yet approximately 21.2% of the Columbia Wetlands is private land including the First Nation Reserve Lands (BC Hydro, 2014). Using spatial data presented in this report, private lands located in the valley bottom will be prioritized in year two of Kootenay Connect – Columbia Wetlands, in terms of determining what specific parcels have higher conservation value. This will lead towards a determination for what lands should be acquired through conservation covenants and land acquisitions.

Specific parcels shown to have the highest concentration of birds during migration (Figure 6) need to be considered as human-free zones of bird refugia, which could help mitigate the behavioural disturbances caused to birds through hunting activities (Casas, Mougeor, Vinuela & Bretagnolle, 2009; Fox & Madsen, 1997; Madsen, 1998; Sokos, Birtsas, Connelly & Papaspyropoulos, 2013), and through recreational pursuits that can cause a wide range of potentially detrimental behavioural patterns for waterbirds (Korschgen & Dahlgren, 1992; Hockin et al., 1992; Korschgen, George & Green, 1985; Liddle & Scorgie, 1980; York, 1994). Putting stronger protections in place for specific habitat parcels shown to be critically important for migratory birds will provide opportunities for hunters and recreationalists outside core refugia, while at the same time benefit numerous bird species including SAR and additional species experiencing population declines.

There are several smaller, more isolated wetlands and lakes on the west bench of the Columbia Valley. From the little inventory data that has been collected at some of these smaller wetlands (e.g., Darvill, 2006; Dulisse & Boulander, 2016; Ohanjanian, Adama & Davidson, 2005; Ohanjanian & Teske, 1996), research has indicated that they provide important habitat especially for amphibian species. For instance, during amphibian inventories in the Columbia Basin, one of two main areas of concentration for Columbia spotted frog was in wetlands found along the Donald Forest Road area near Golden (Ohanjanian & Teske, 1996), with additional amphibian species also present in that area. These smaller wetlands may be extremely valuable for maintaining biodiversity and for connectivity of various species

populations (Semlitsch & Bodie, 1998). Cohen et al. (2015) suggests that sustaining landscape functions such as hydrological, biogeochemical and biological connectivity "requires conserving the entire continuum of wetland connectivity, including geographically isolated wetlands." Some smaller wetlands in the Columbia Valley are subject to increasing levels of recreational use and forestry activities, but these wetlands must not be considered expendable. Wetlands as small as 0.2 hectares in size should be conserved until a complete wetland assessment is completed (Semlitsch & Bodie, 1998). There may be important transition areas between the biologically rich valley bottom and higher elevation wetlands that provide important connectivity corridors for more wide-ranging wildlife species. Where exactly these are located needs to be identified and those areas conserved.

This report determined that there are parcels of critical habitat, wildlife habitat area, and wildlife habitat features designated for some SAR in the Columbia Valley. Further inventory work is required for specific SAR (e.g., Lewis's Woodpecker, bank swallow, American badger) and at-risk ecological communities, to help conserve additional lands based upon the significant habitat values they provide. Certain habitat types deserve further conservation attention, including the ice-free areas in the Columbia Wetlands during winter (e.g., Tatley Slough, Mud Lake, Athalmer Slough), and areas of herbaceous emergent vegetation interspersed with open water (hemi-marsh). Collecting information on data deficient species (e.g., fish, amphibians, SARA listed birds, western painted turtle, Rocky Mountain elk) and creating habitat models for large-roaming species (e.g., grizzly bear, wolverine), especially in the north end of the valley where data is lacking, will help to improve our knowledge of biodiversity hotspots and wildlife corridors in the Columbia Valley.

A number of data gaps have been identified through this research and a summary table of recommendations is provided in Appendix 45. These date gaps include: the identification of migration routes for Rocky Mountain elk, determining additional nesting locations for Lewis's woodpecker, identifying sites for at-risk ecological communities, and for high quality habitat on crown land (e.g., burrows and/or prey concentrations for American badger, bat hibernaculum and maternity roosts, grizzly bear denning sites, mountain goat mineral licks, significant wallows for elk). Once known, this type of information can be used to inform the purchase of conservation lands, as well as designations such as critical habitat, WHAs, WHFs and the location of wildlife corridors. Old growth management areas (OGMAs) have yet to be considered in corridor identification, nor have gravel-bed river floodplains been considered in terms of their importance to wildlife connectivity (Hauer, et al., 2016). These will be important habitat types to consider in year two of Kootenay Connect – Columbia Wetlands.

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The cover photos for this report feature tundra swans, mountain goat, horned grebe and the Columbia Wetlands ecosystem near Parson, with all photos taken by Rachel Darvill.

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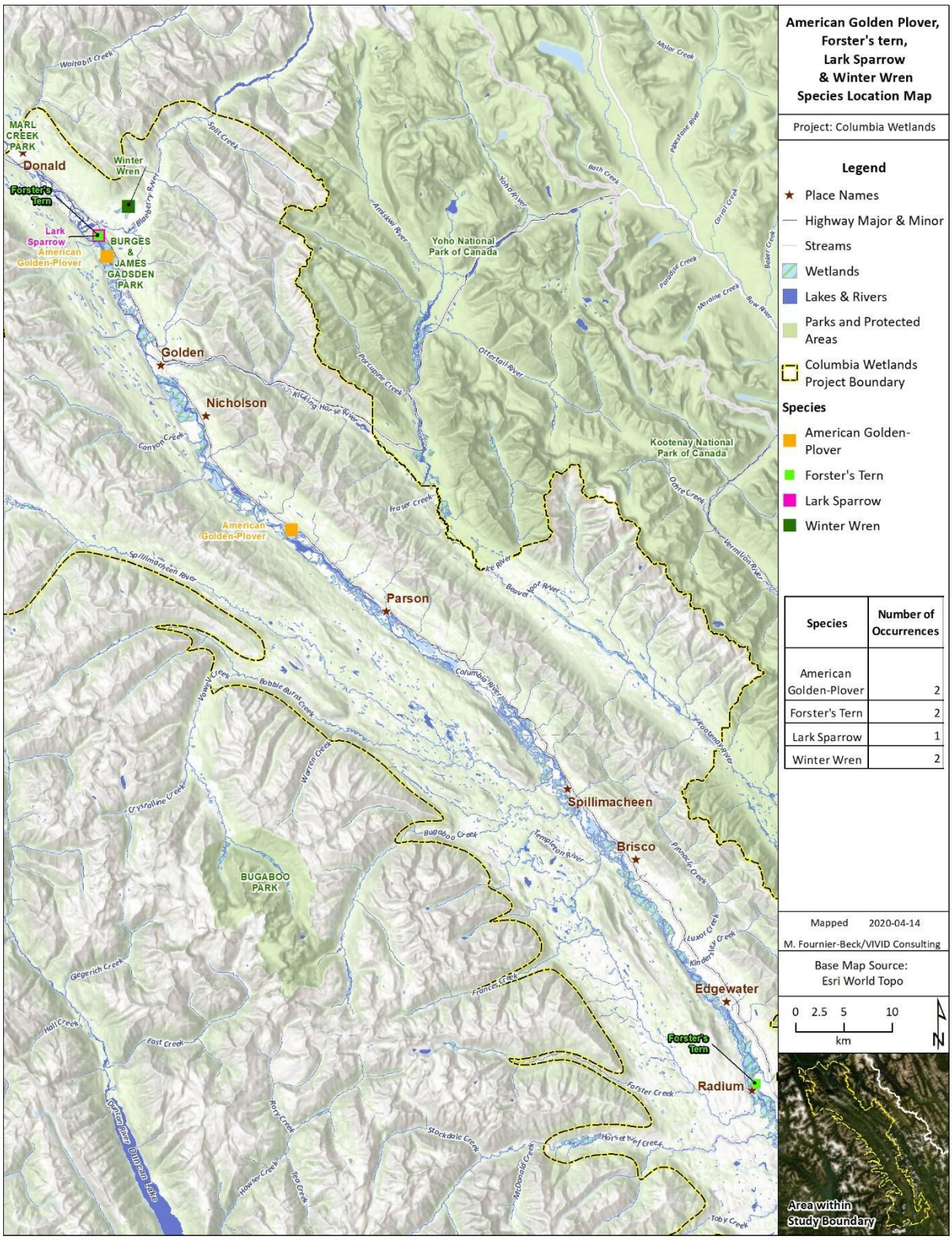
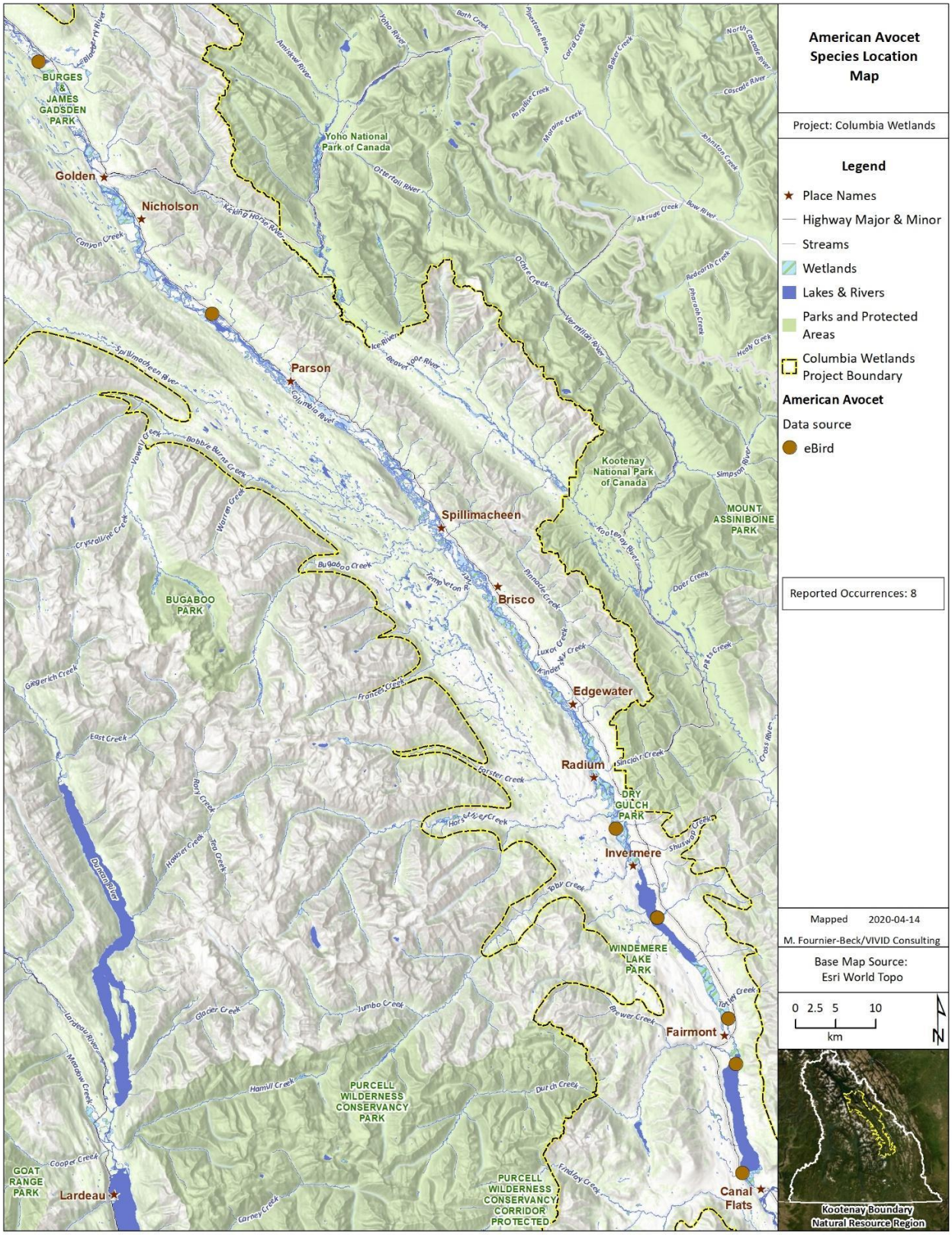
8.0 List of Appendices

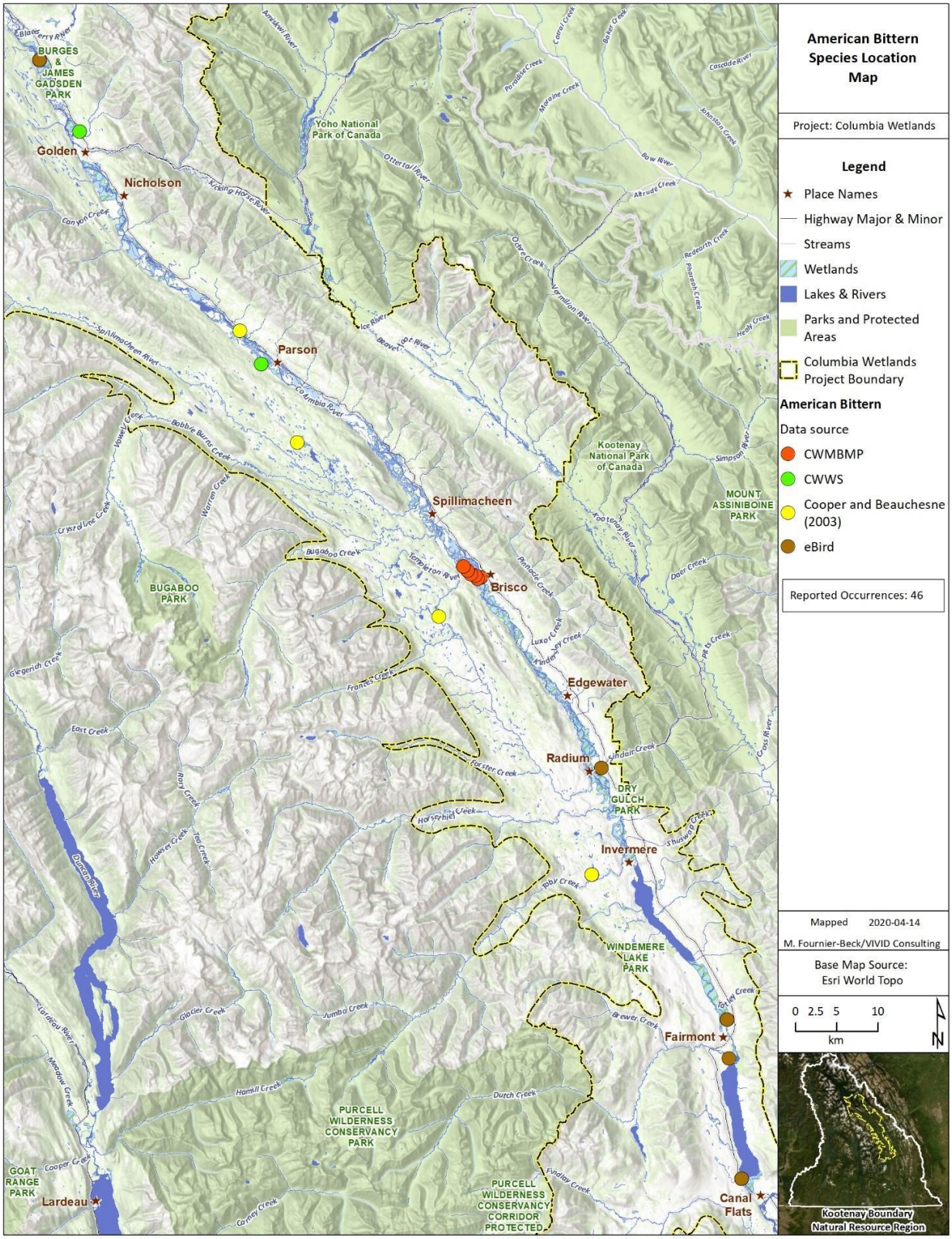
Appendix 1. American golden-plover, Forster's tern, lark sparrow and winter wren occurrence data.



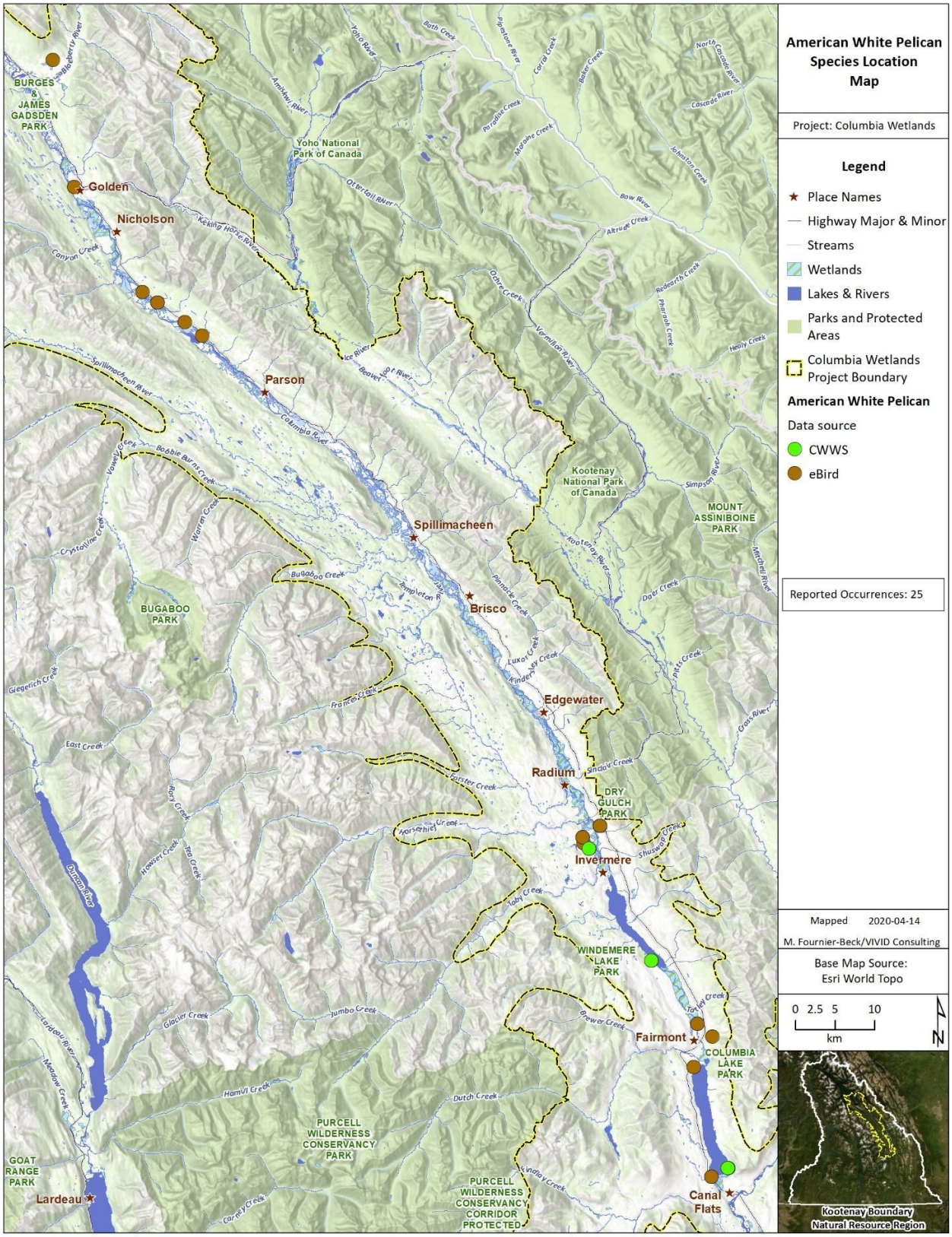
Appendix 2. American avocet spatial occurrences.



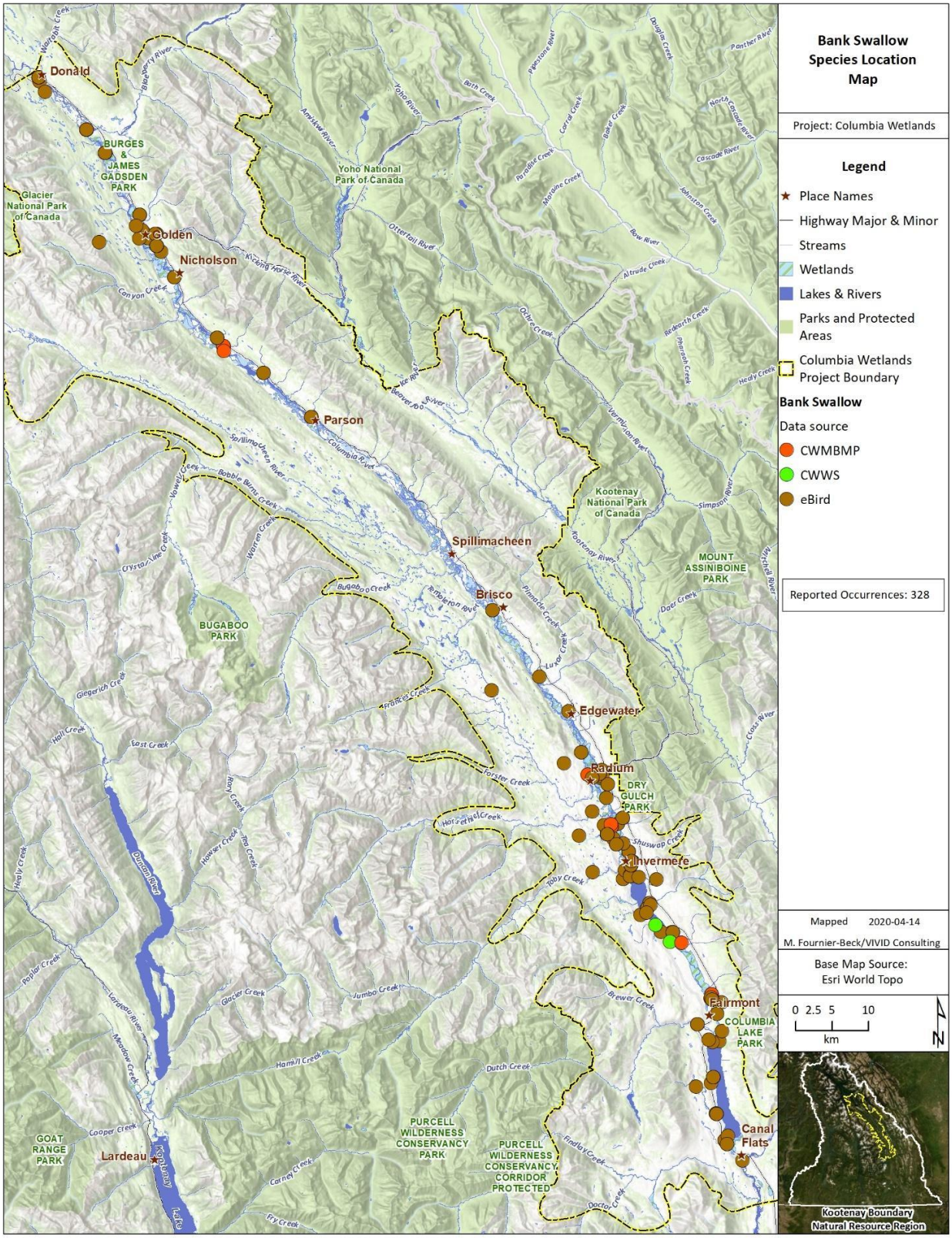
Appendix 3. American bittern spatial occurrences.



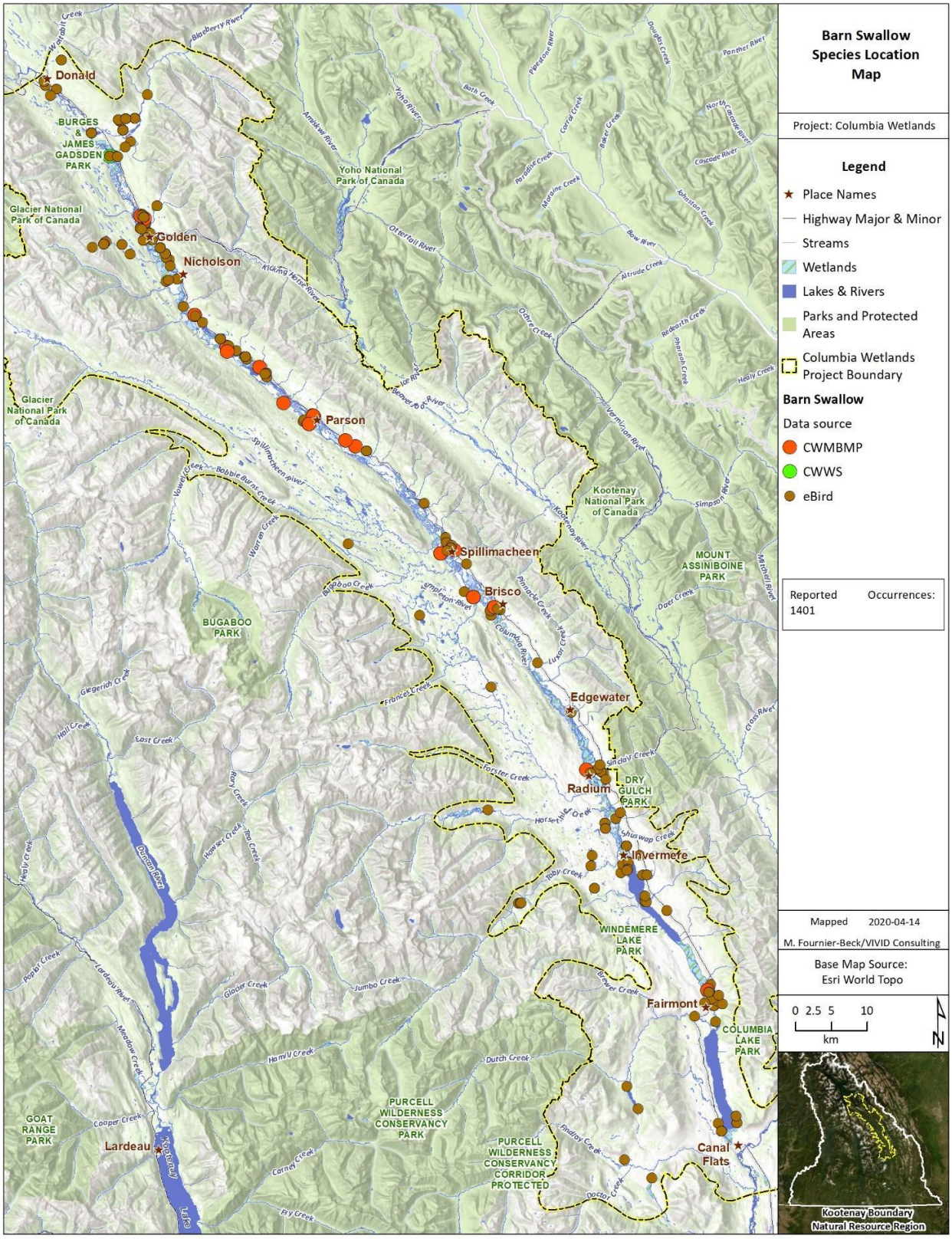
Appendix 4. American white pelican spatial occurrences.



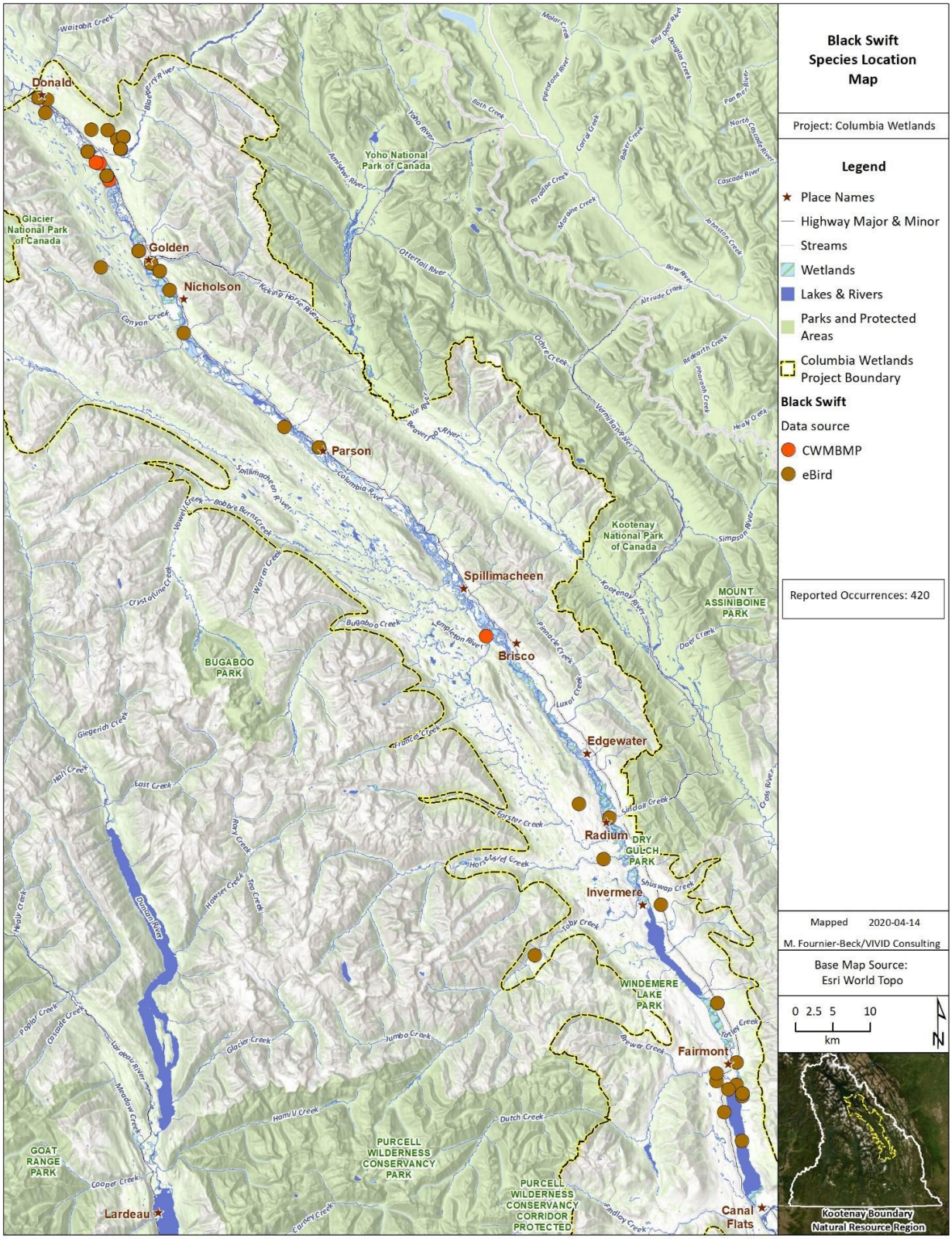
Appendix 5. Bank swallow spatial occurrences.



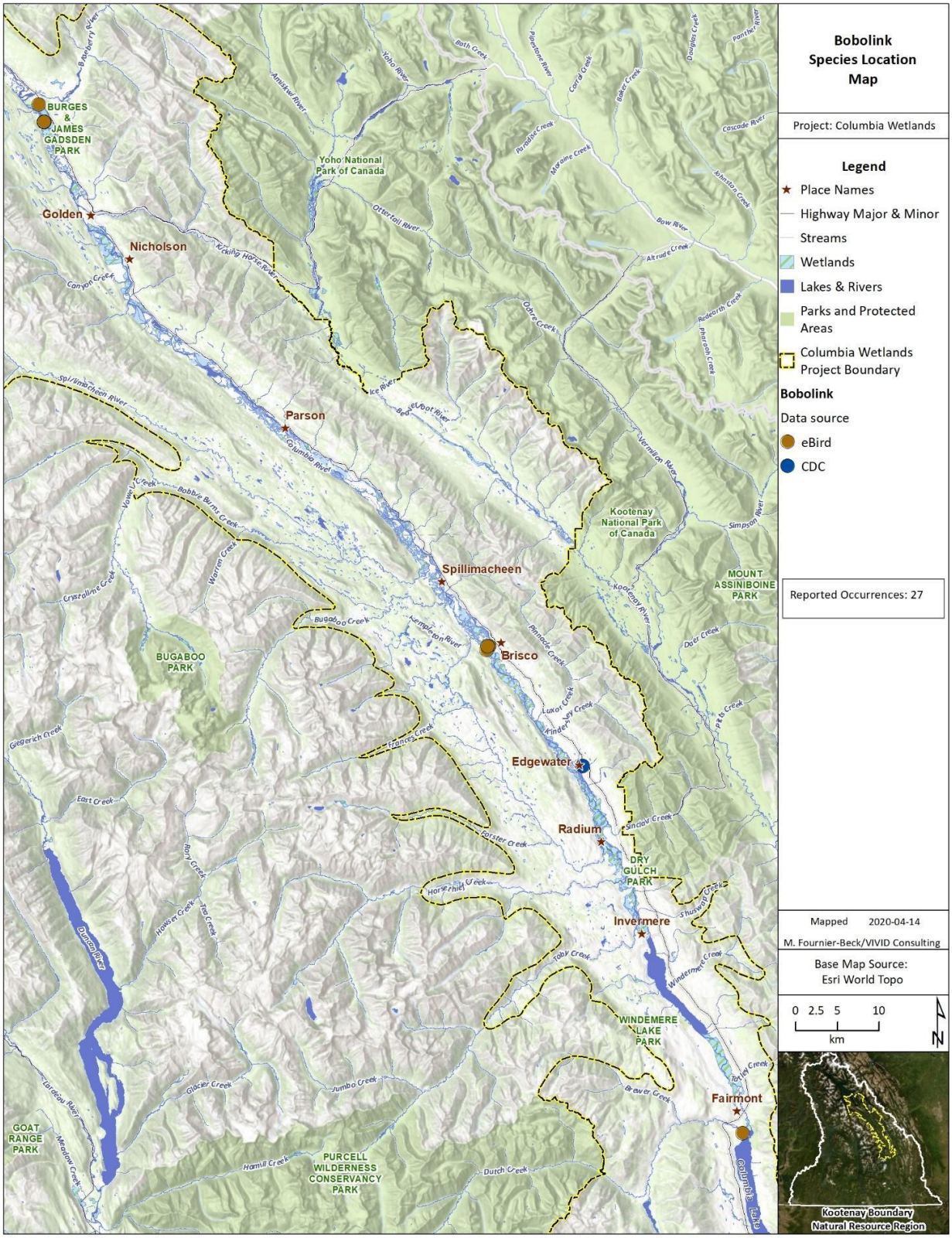
Appendix 6. Barn swallow spatial occurrences.



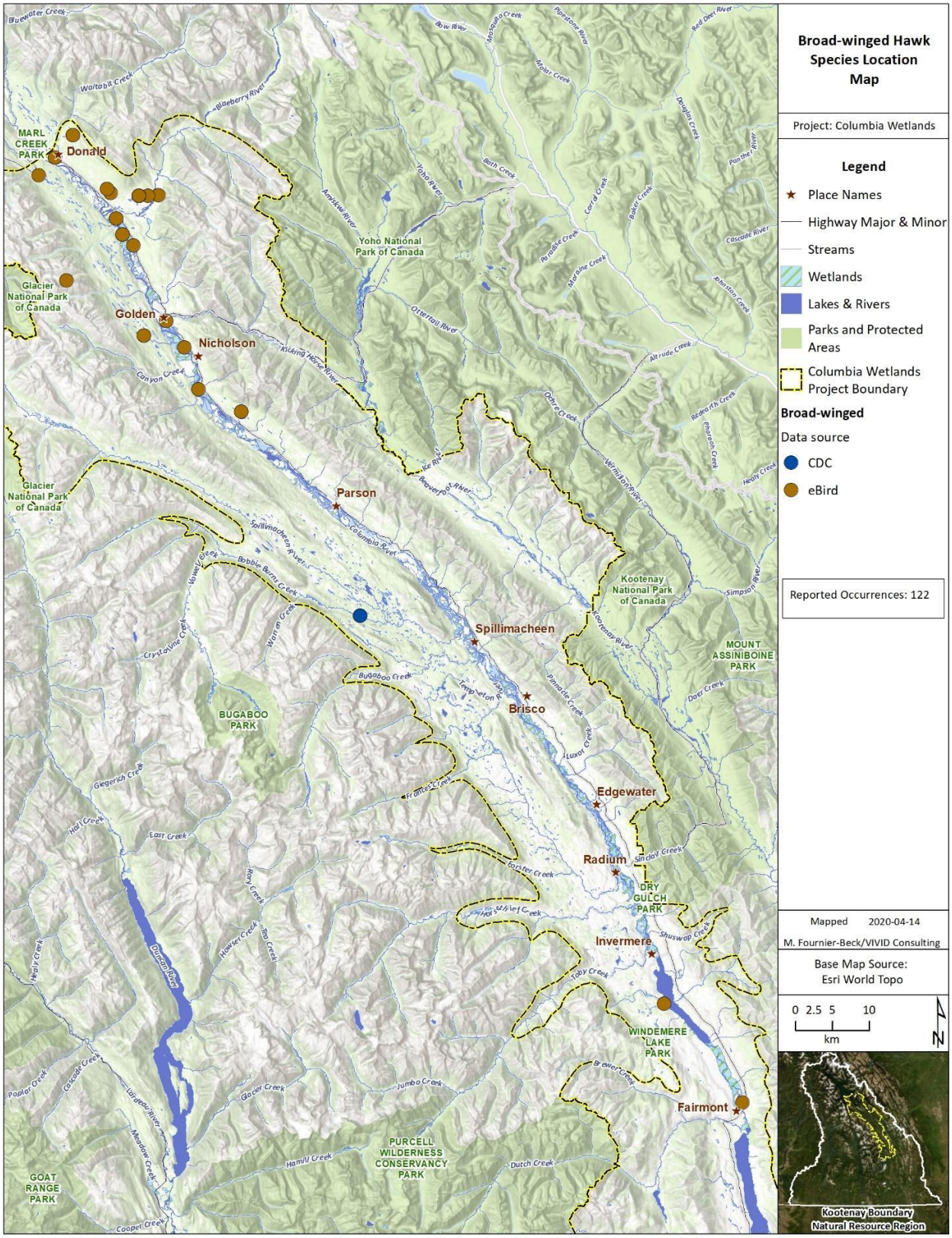
Appendix 7. Black swift spatial occurrences.



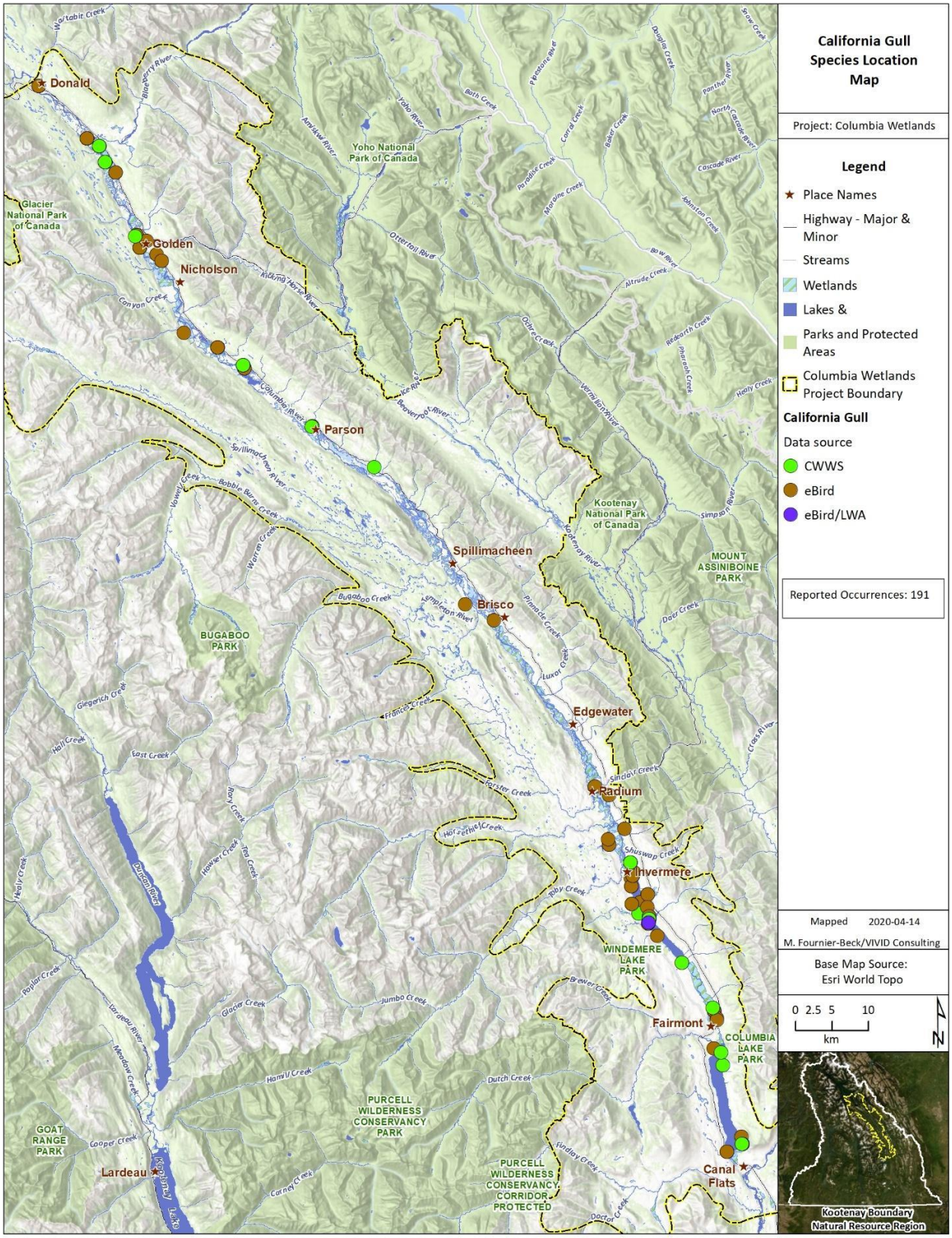
Appendix 8. Bobolink spatial occurrences.



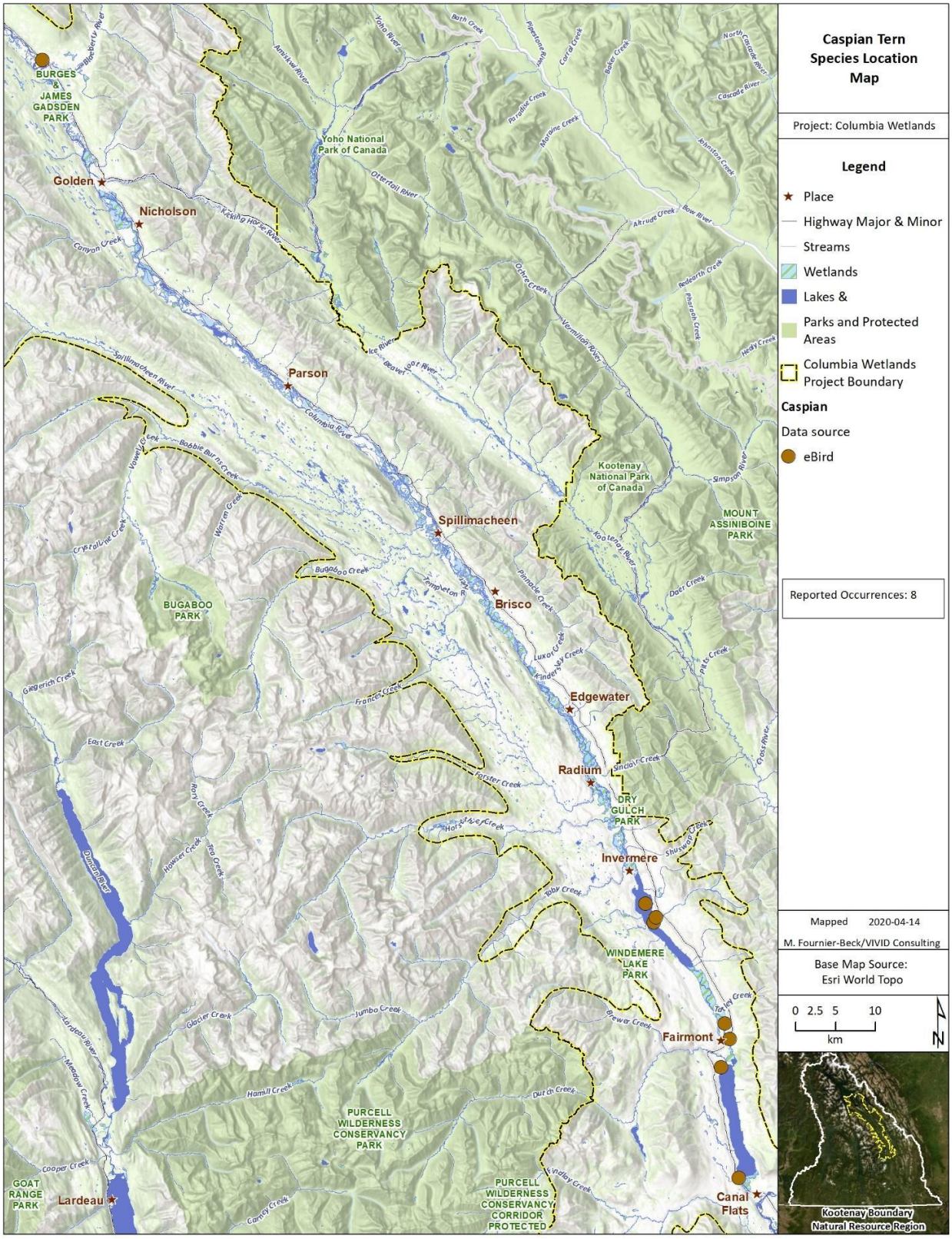
Appendix 9. Broad-winged hawk spatial occurrences.



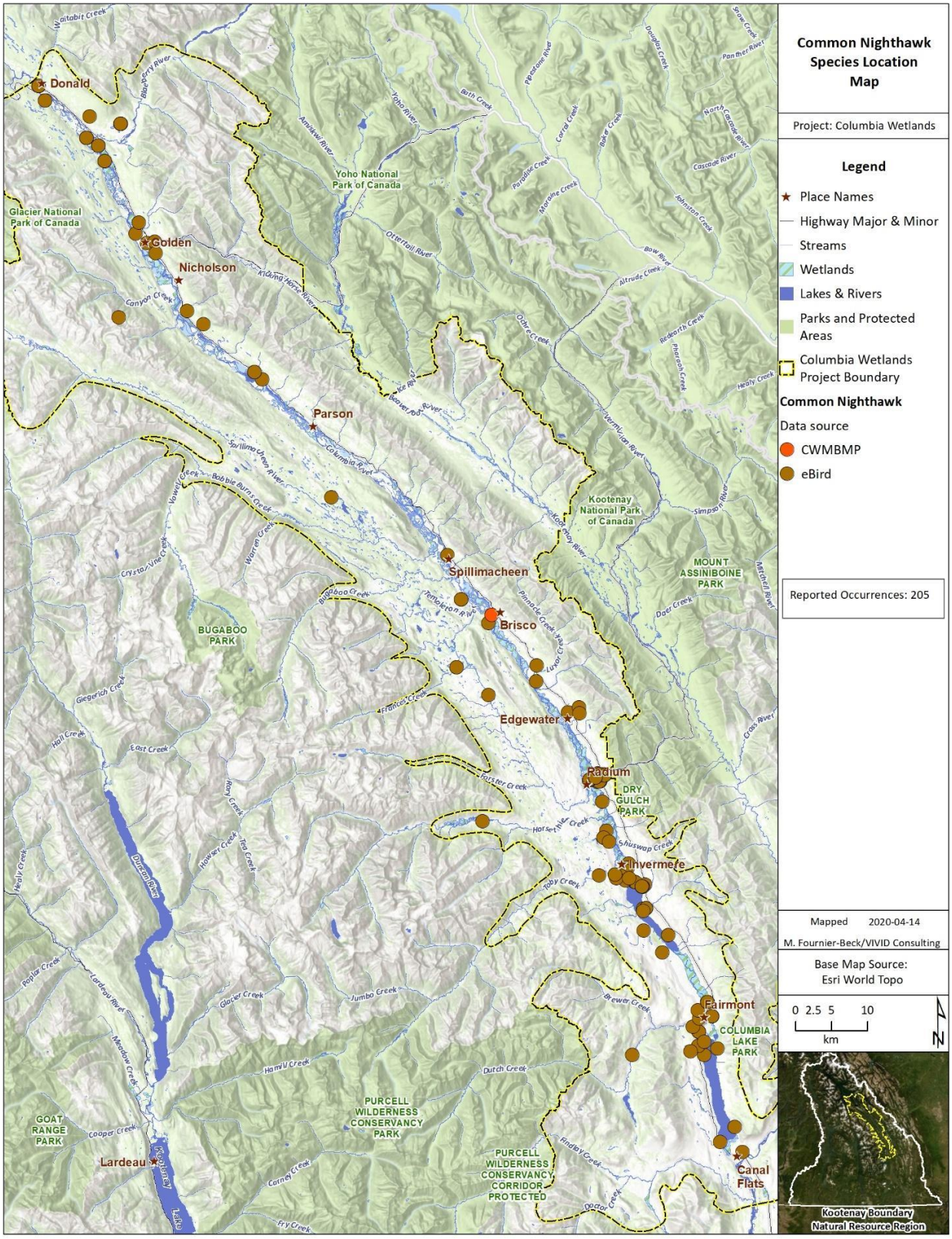
Appendix 10. California gull spatial occurrences.



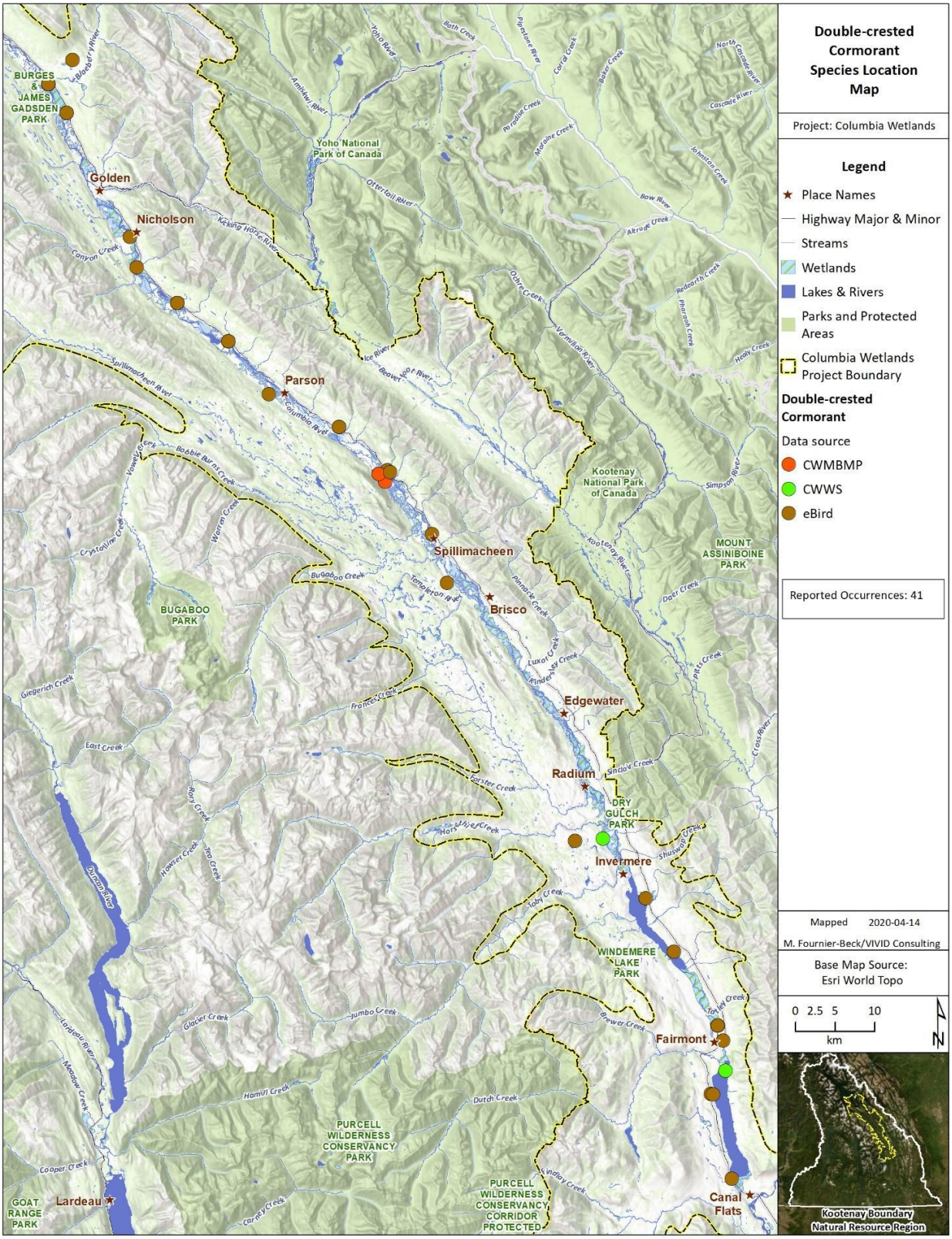
Appendix 11. Caspian Tern spatial occurrences.



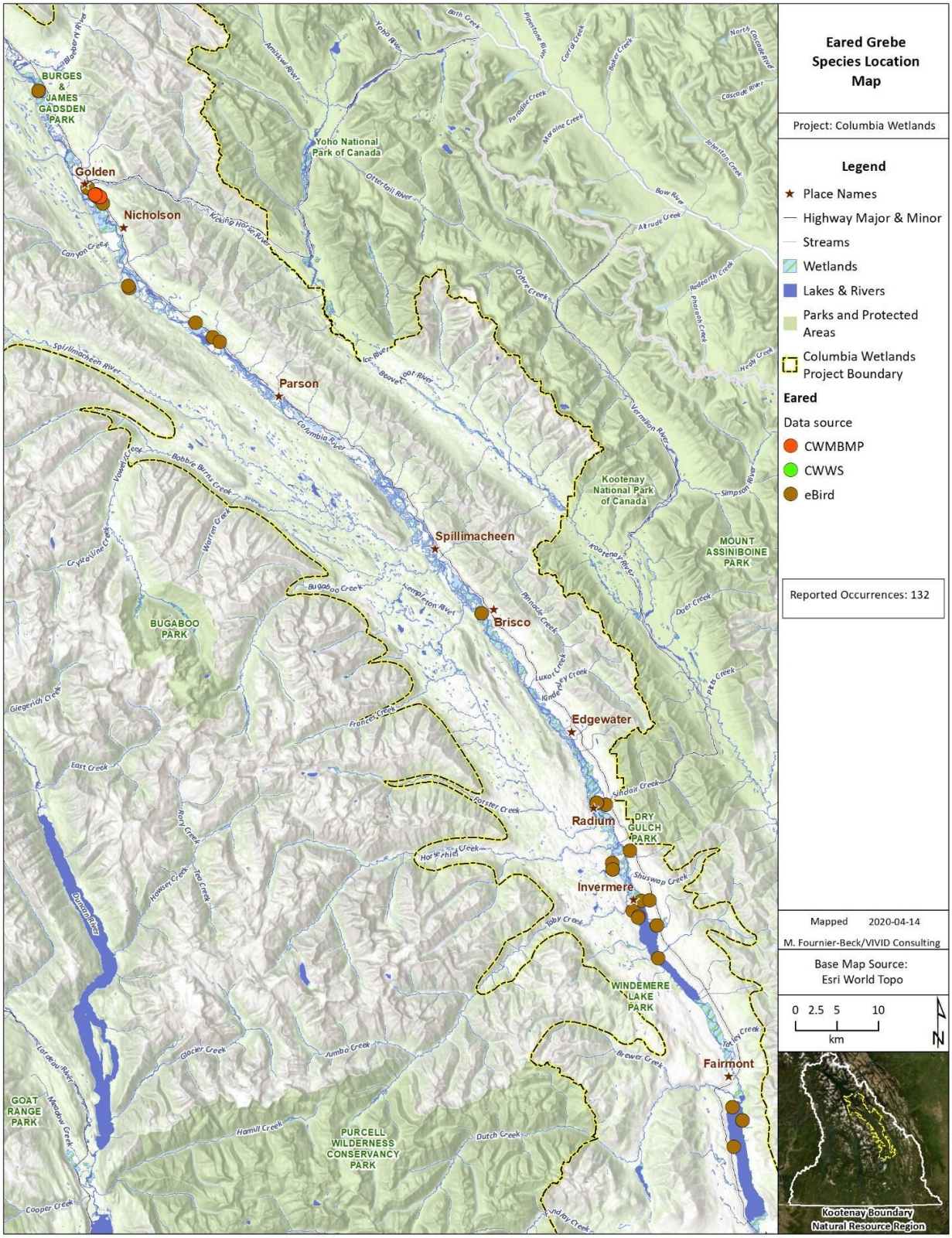
Appendix 12. Common nighthawk spatial occurrences.



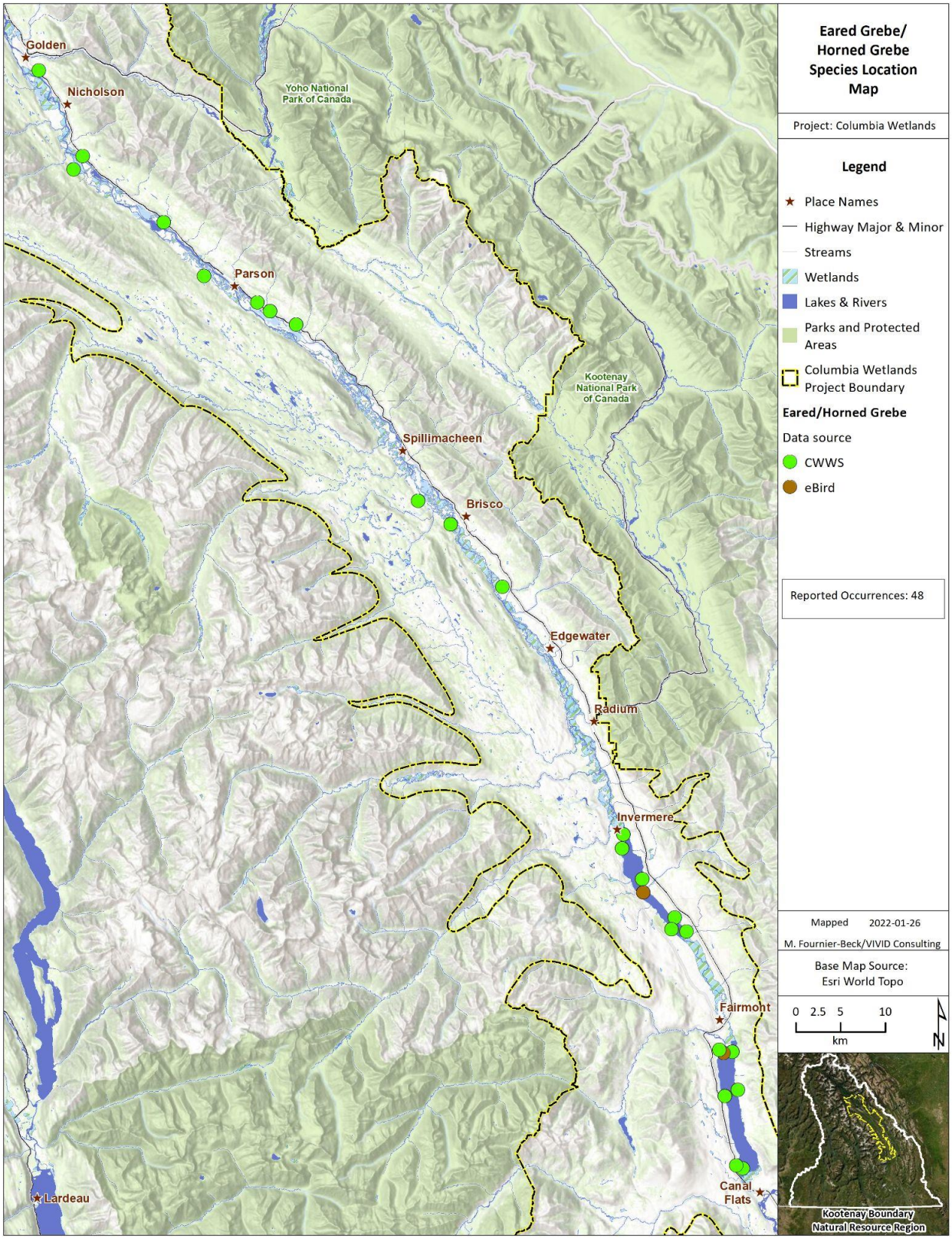
Appendix 13. Double-crested cormorant spatial occurrences.



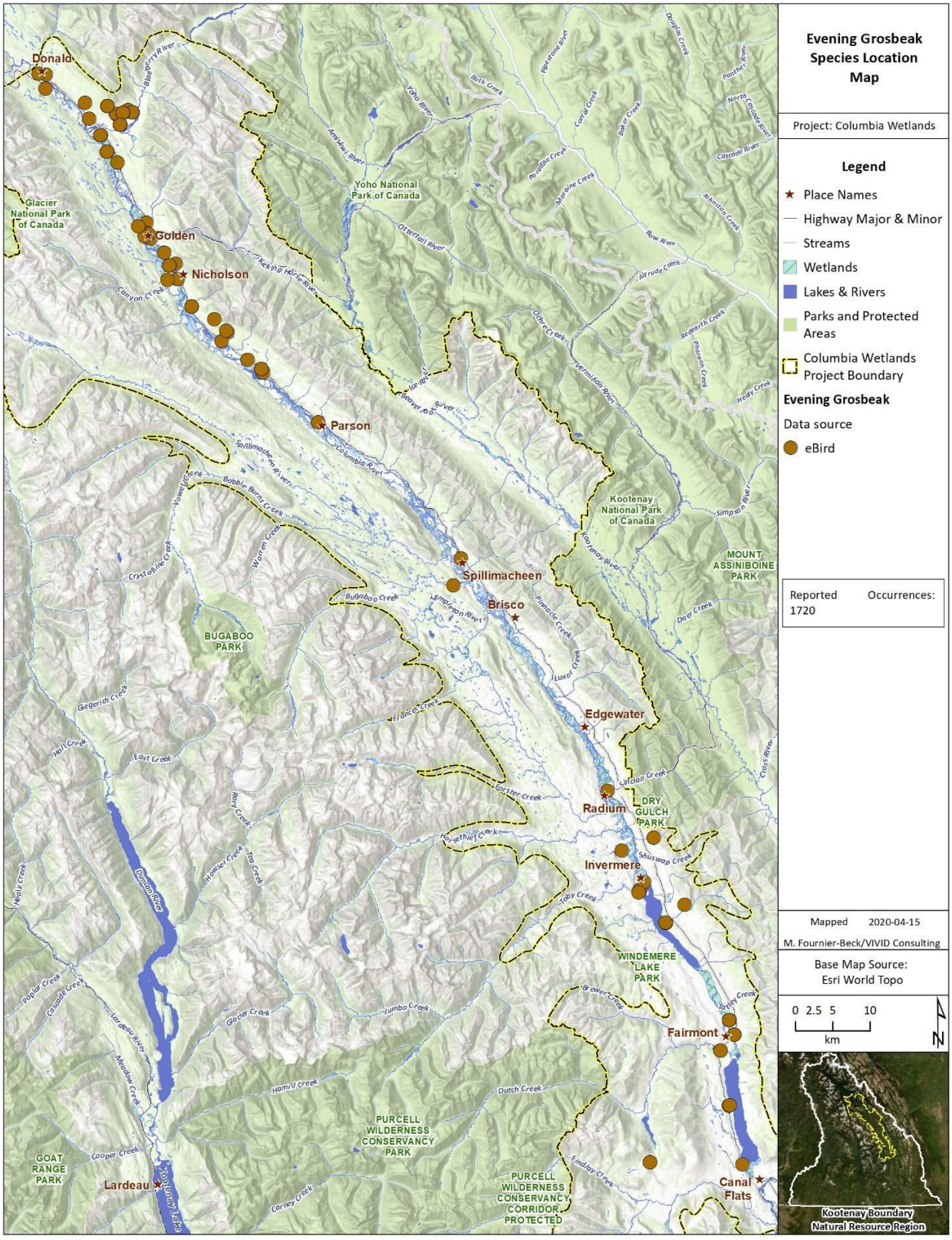
Appendix 14. Eared grebe spatial occurrences.



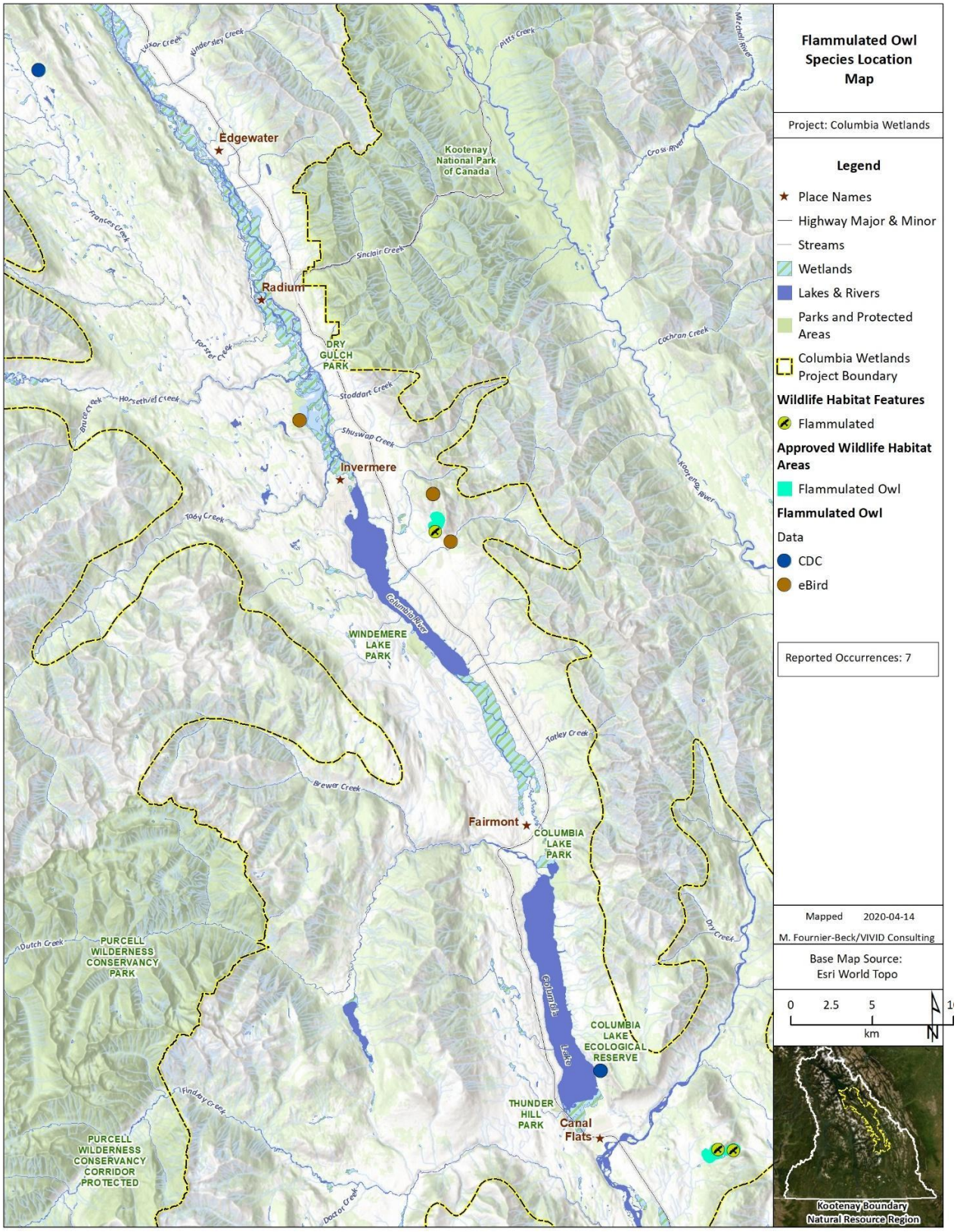
Appendix 15. Eared/Horned grebe spatial occurrences.



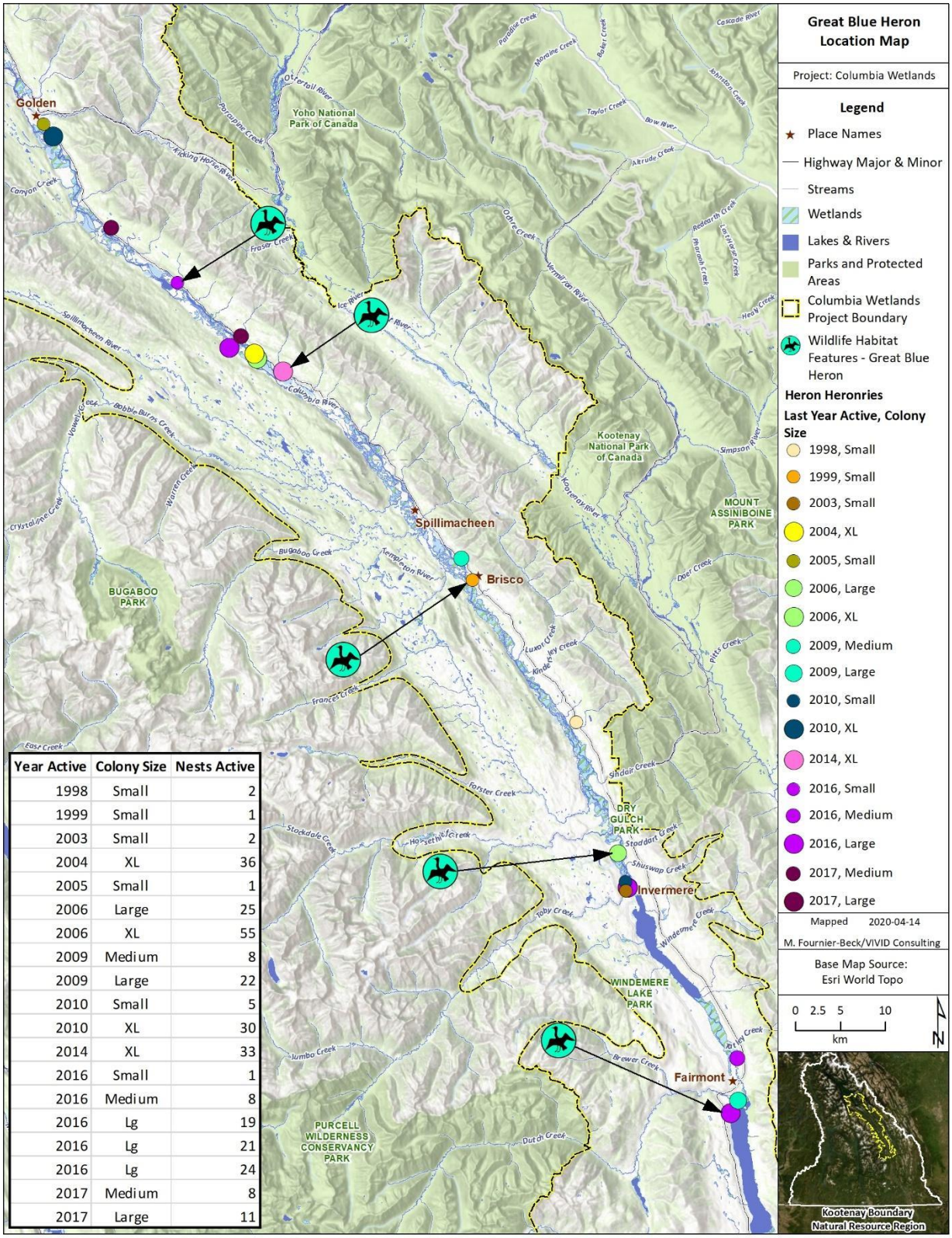
Appendix 16. Evening grosbeak spatial occurrences.



Appendix 17. Flammulated owl spatial occurrences and WHA locations.

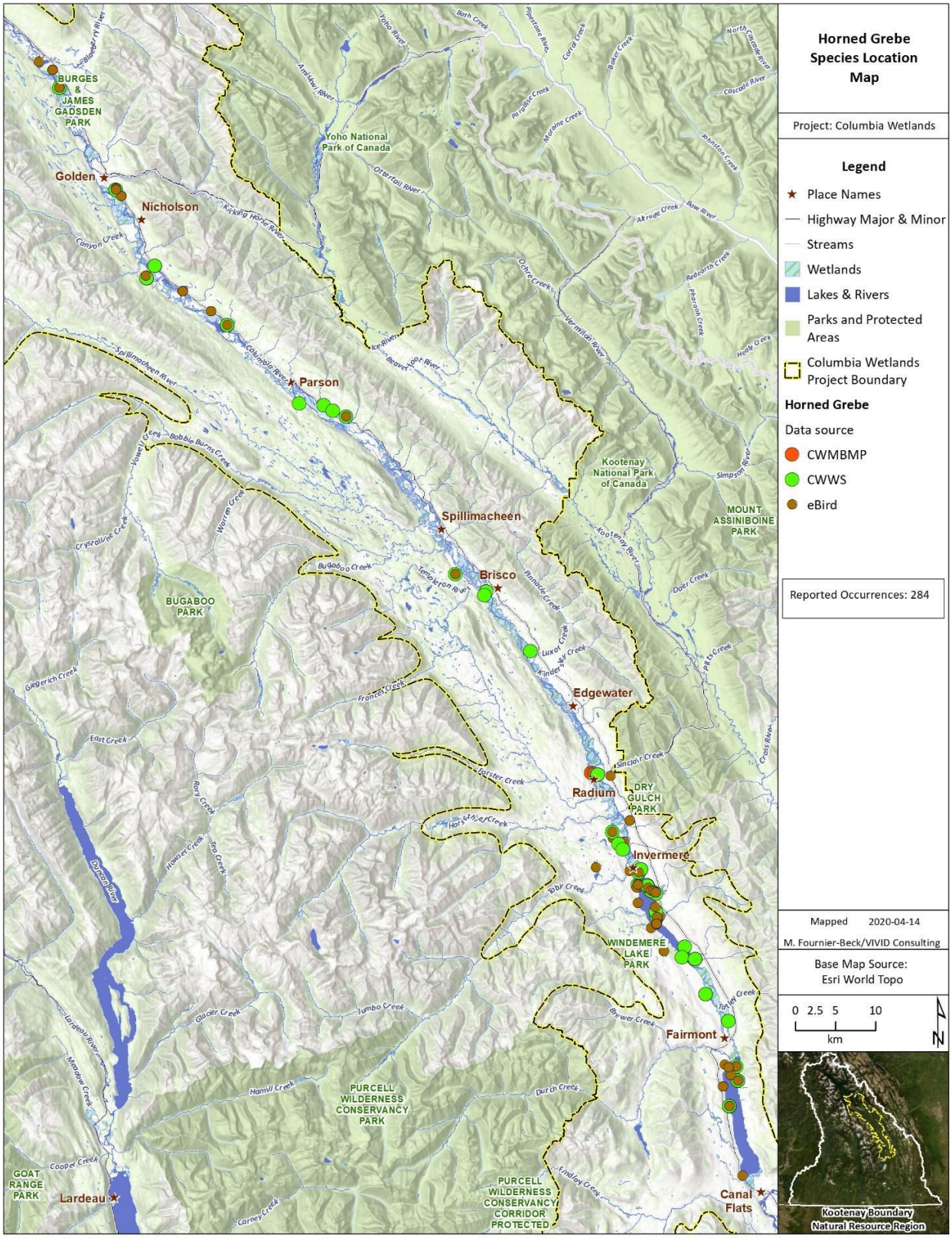


Appendix 18. Great blue heron (herodias subspecies) heronries and WHF locations.

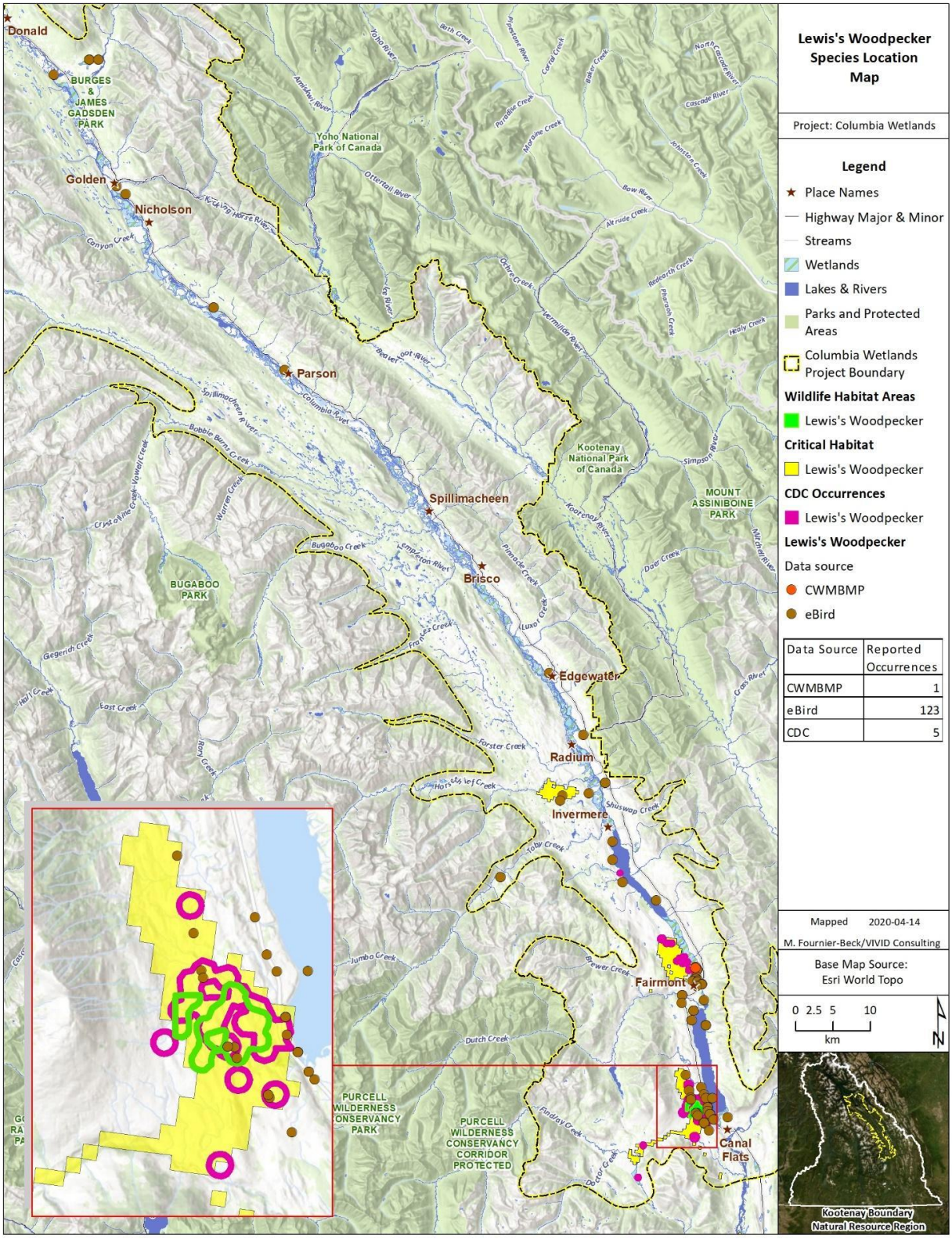


Year Active	Colony Size	Nests Active
1998	Small	2
1999	Small	1
2003	Small	2
2004	XL	36
2005	Small	1
2006	Large	25
2006	XL	55
2009	Medium	8
2009	Large	22
2010	Small	5
2010	XL	30
2014	XL	33
2016	Small	1
2016	Medium	8
2016	Lg	19
2016	Lg	21
2016	Lg	24
2017	Medium	8
2017	Large	11

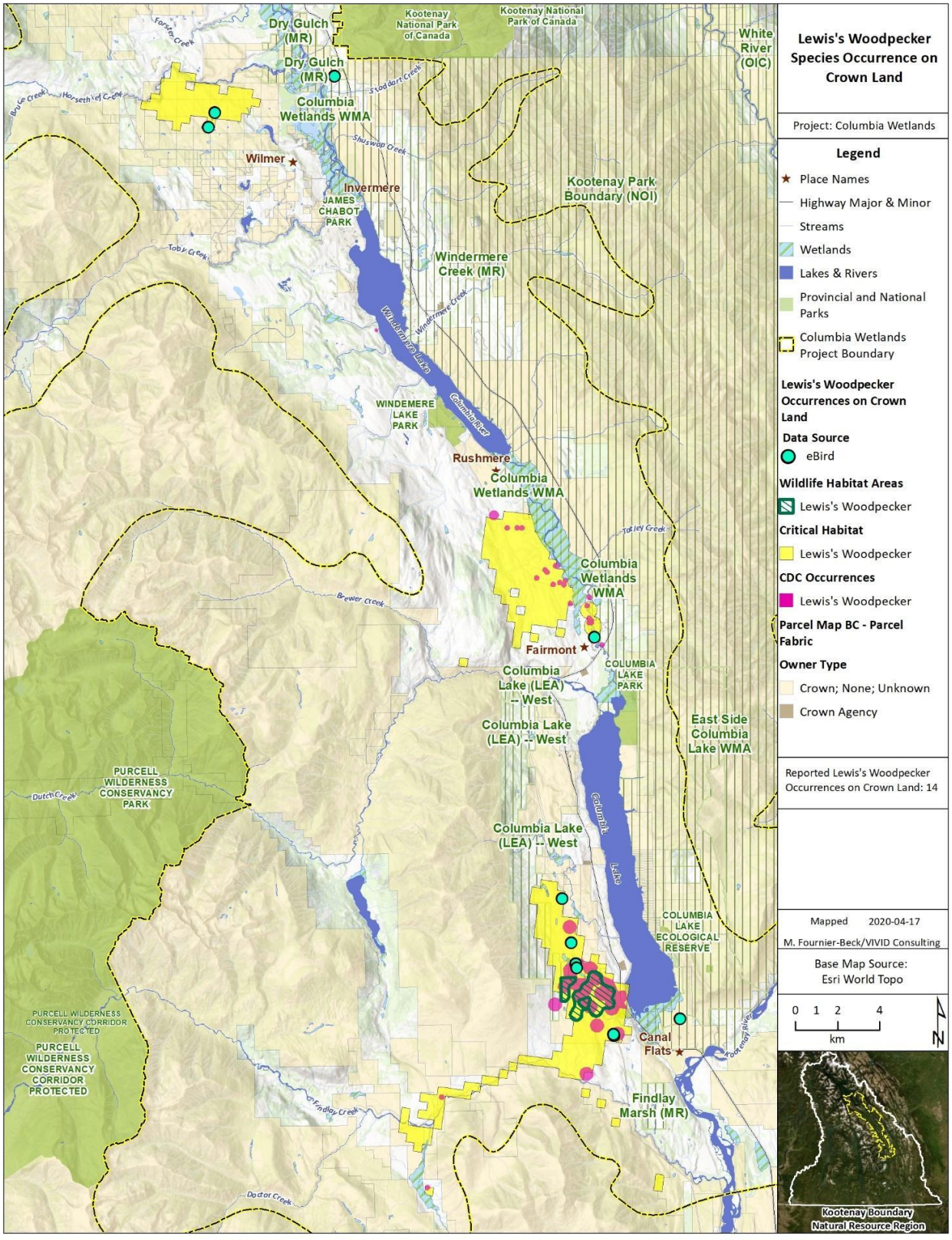
Appendix 19. Horned grebe spatial occurrences.



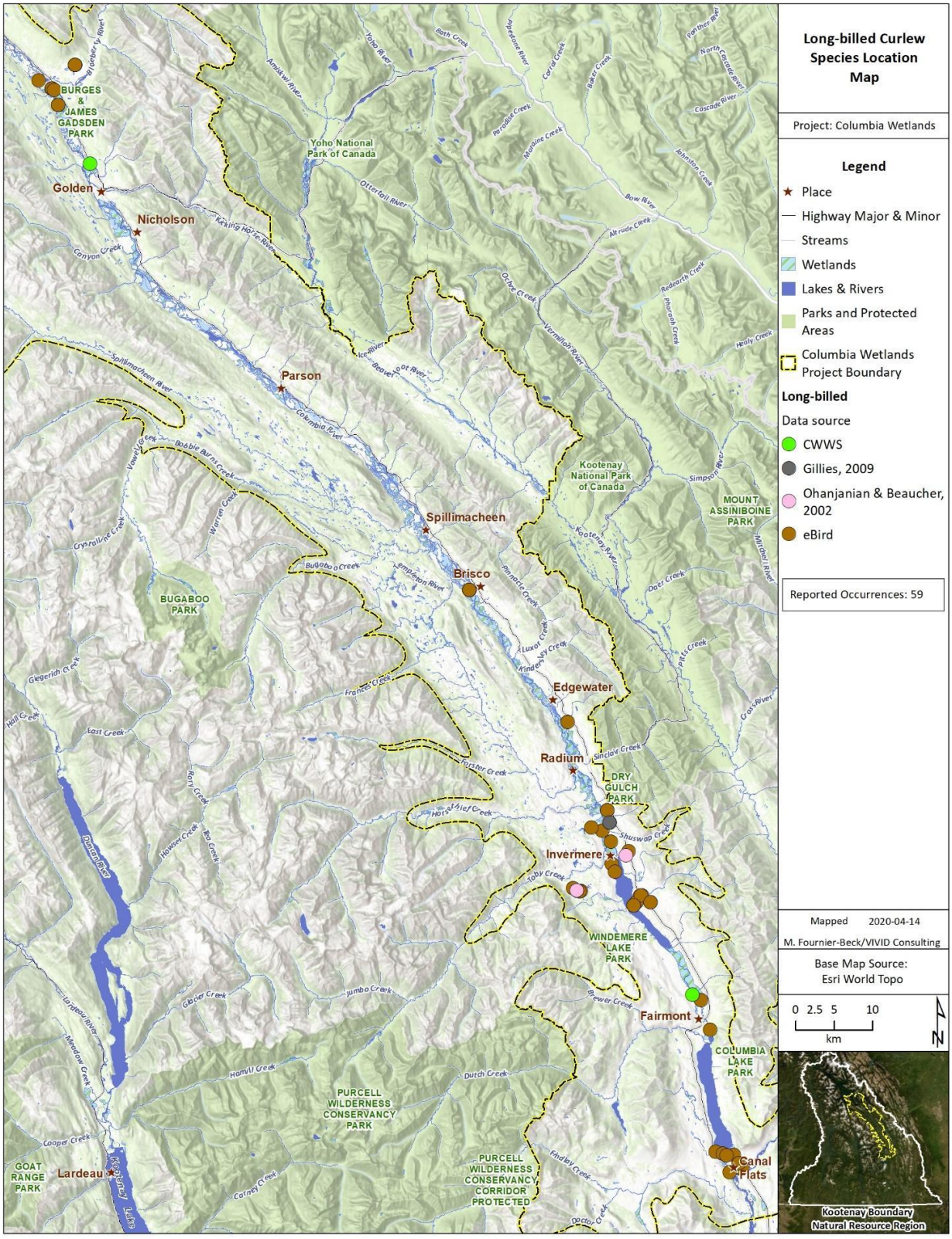
Appendix 20. Lewis's woodpecker spatial occurrences, critical habitat and WHA locations.



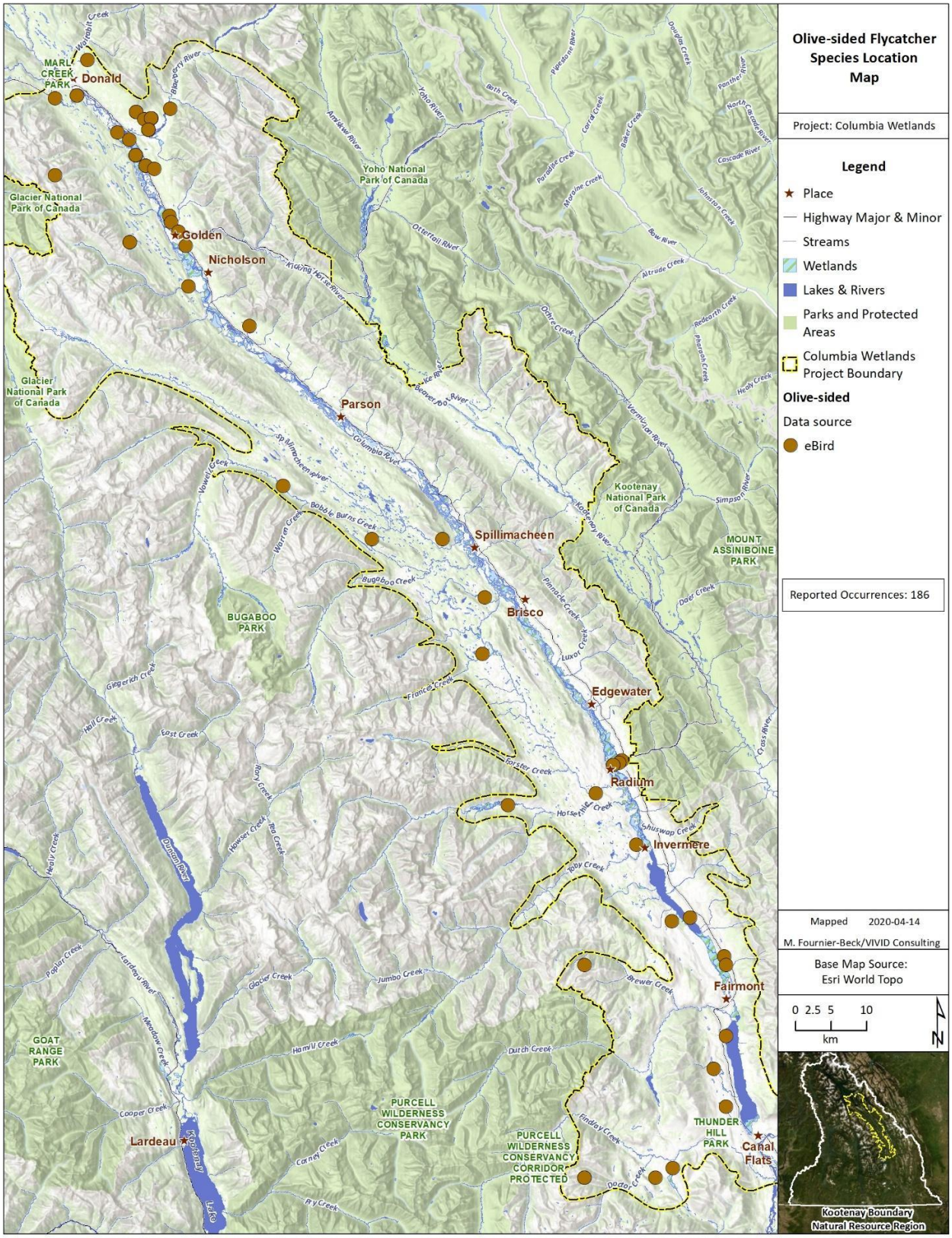
Appendix 21. Lewis's woodpecker species occurrences on crown land, outside of WHAs.



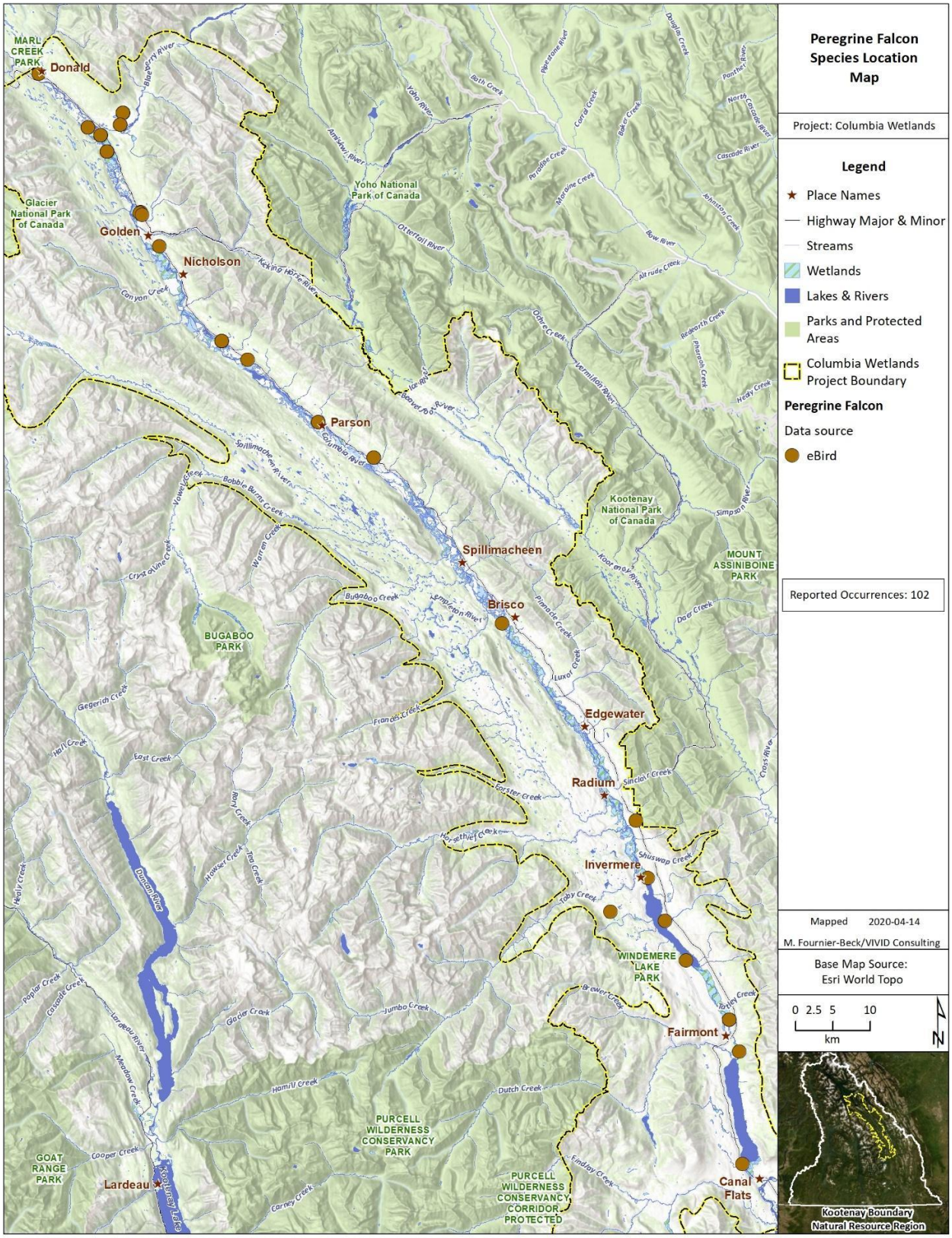
Appendix 22. Long-billed curlew spatial occurrences.



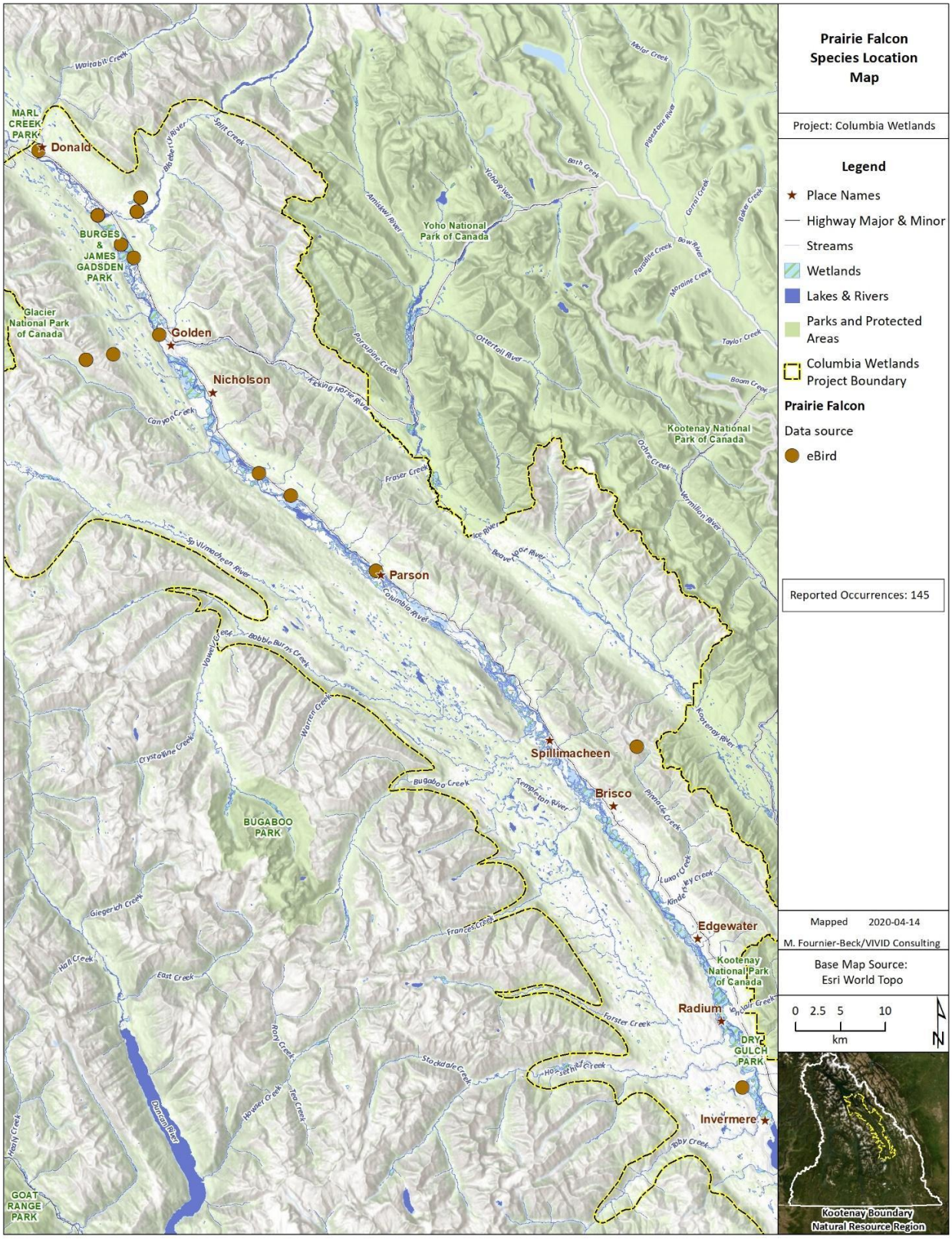
Appendix 23. Olive-sided flycatcher spatial occurrences.



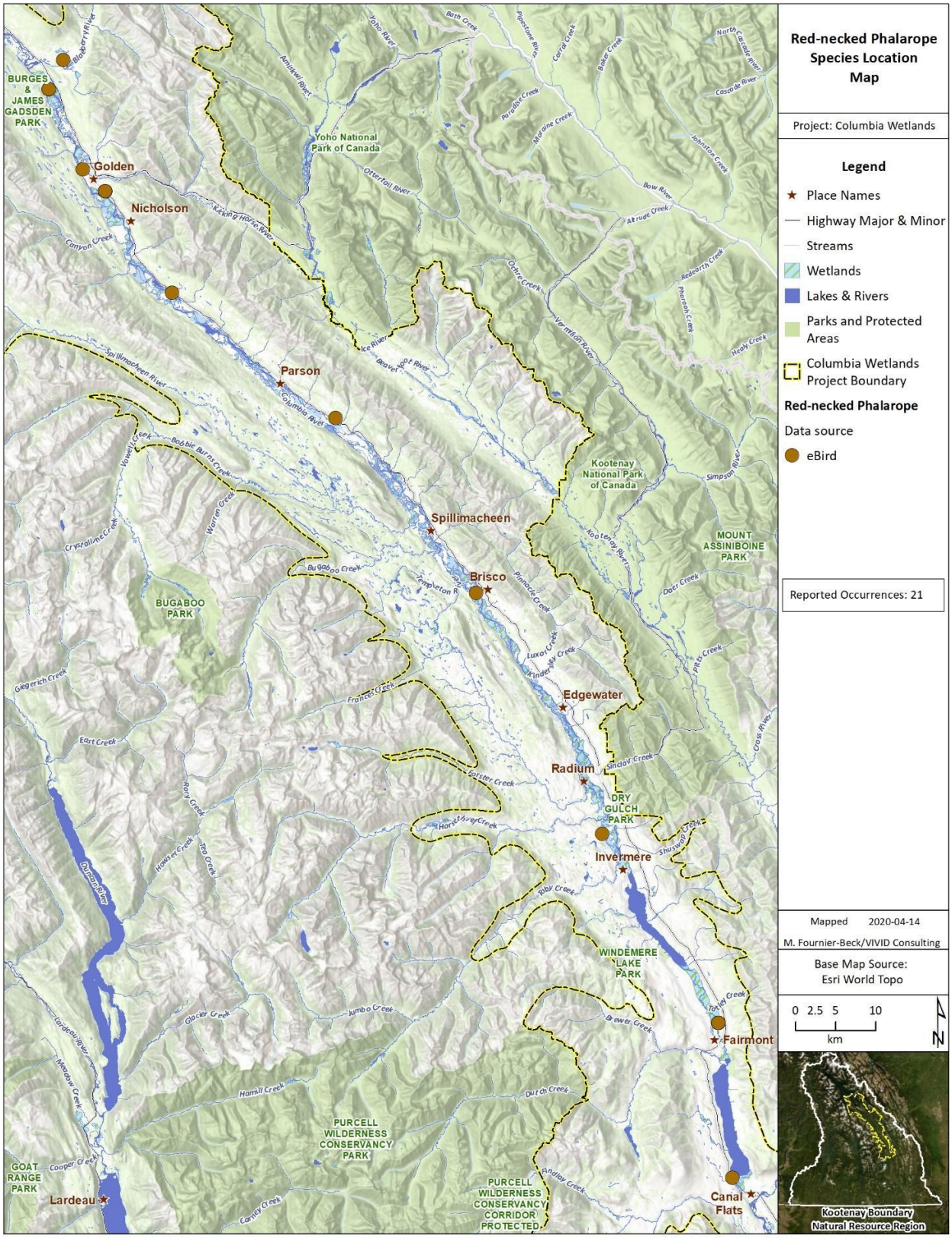
Appendix 24. Peregrine falcon spatial occurrences.



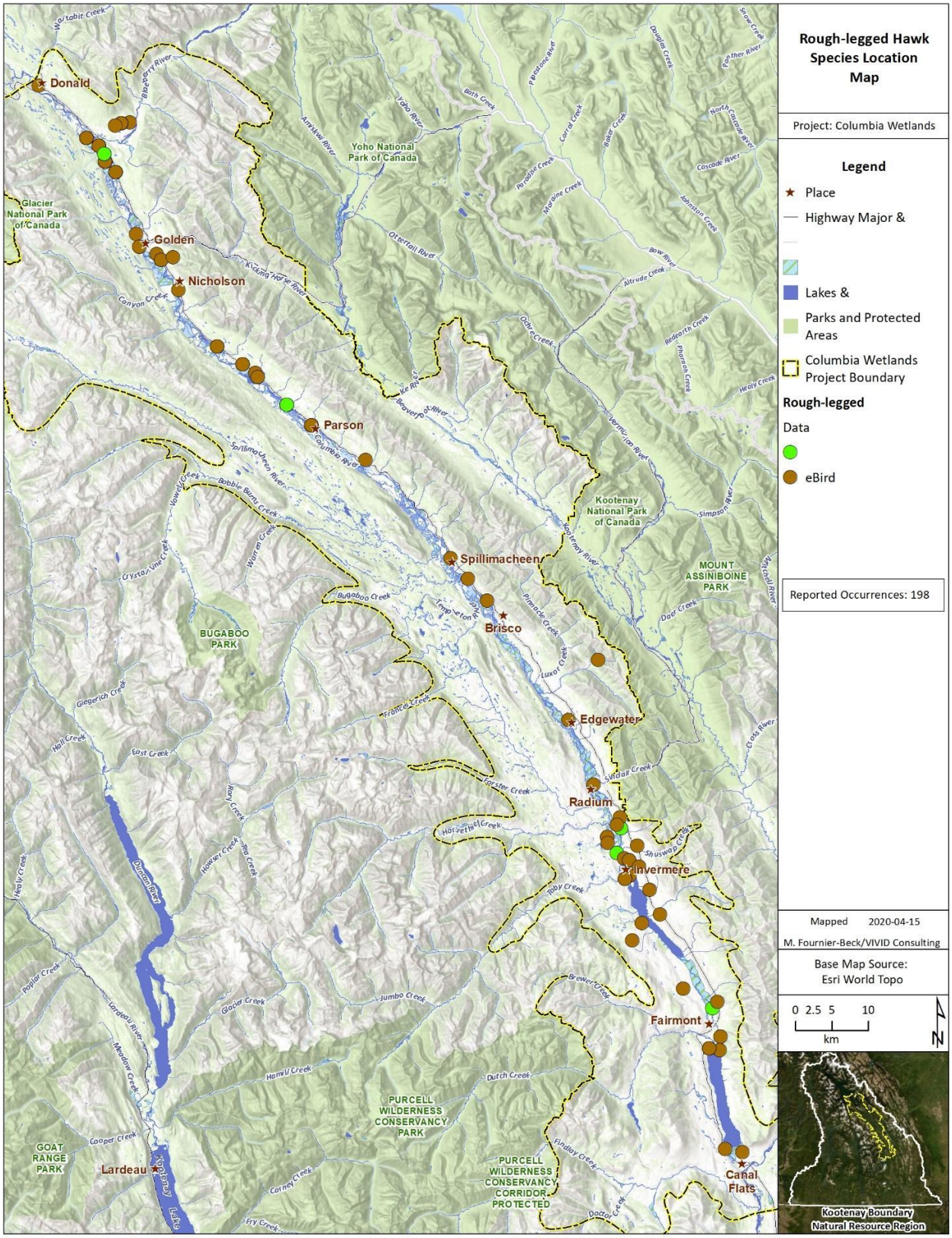
Appendix 25. Prairie falcon spatial occurrences.



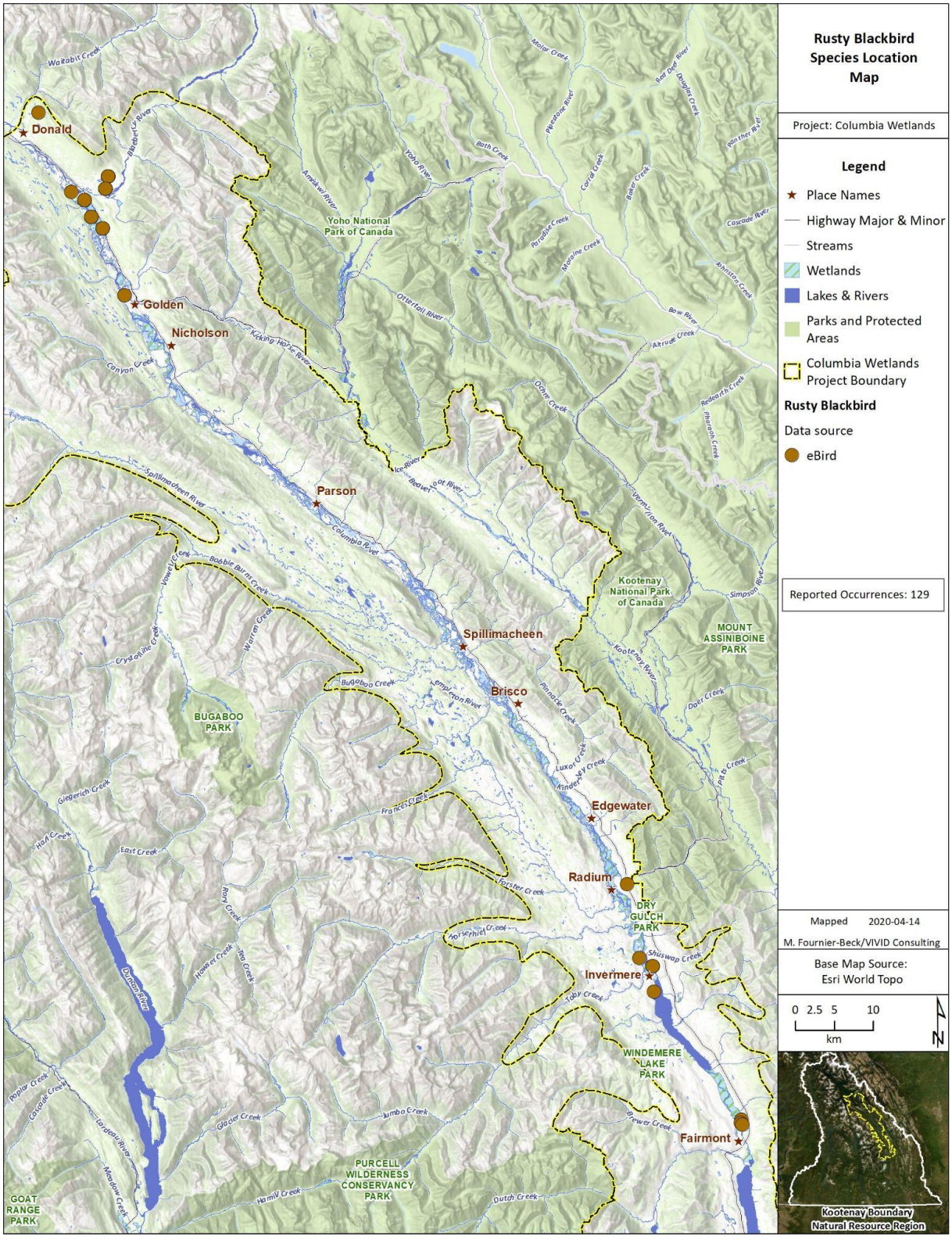
Appendix 26. Red-necked phalarope spatial occurrences.



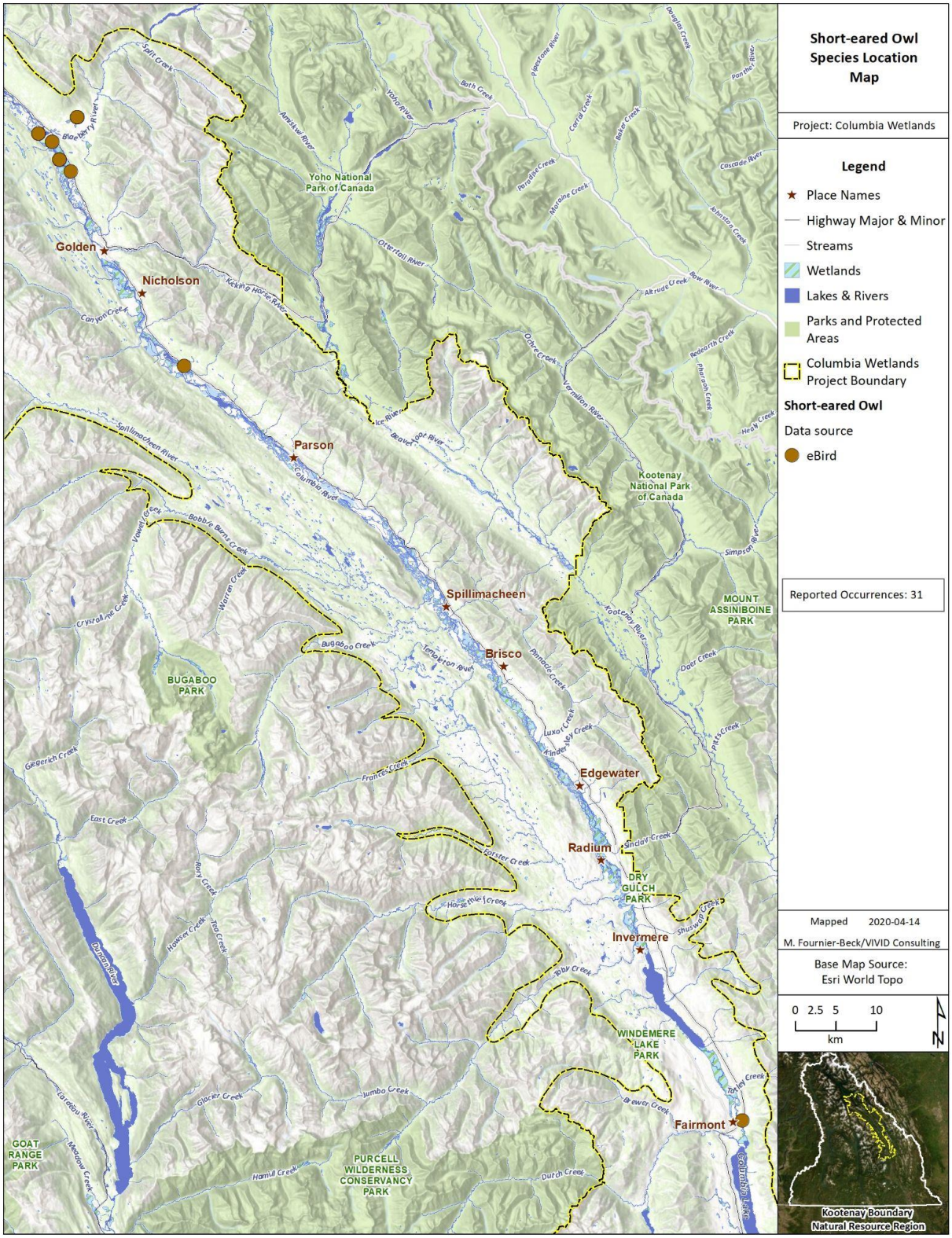
Appendix 27. Rough-legged hawk spatial occurrences.



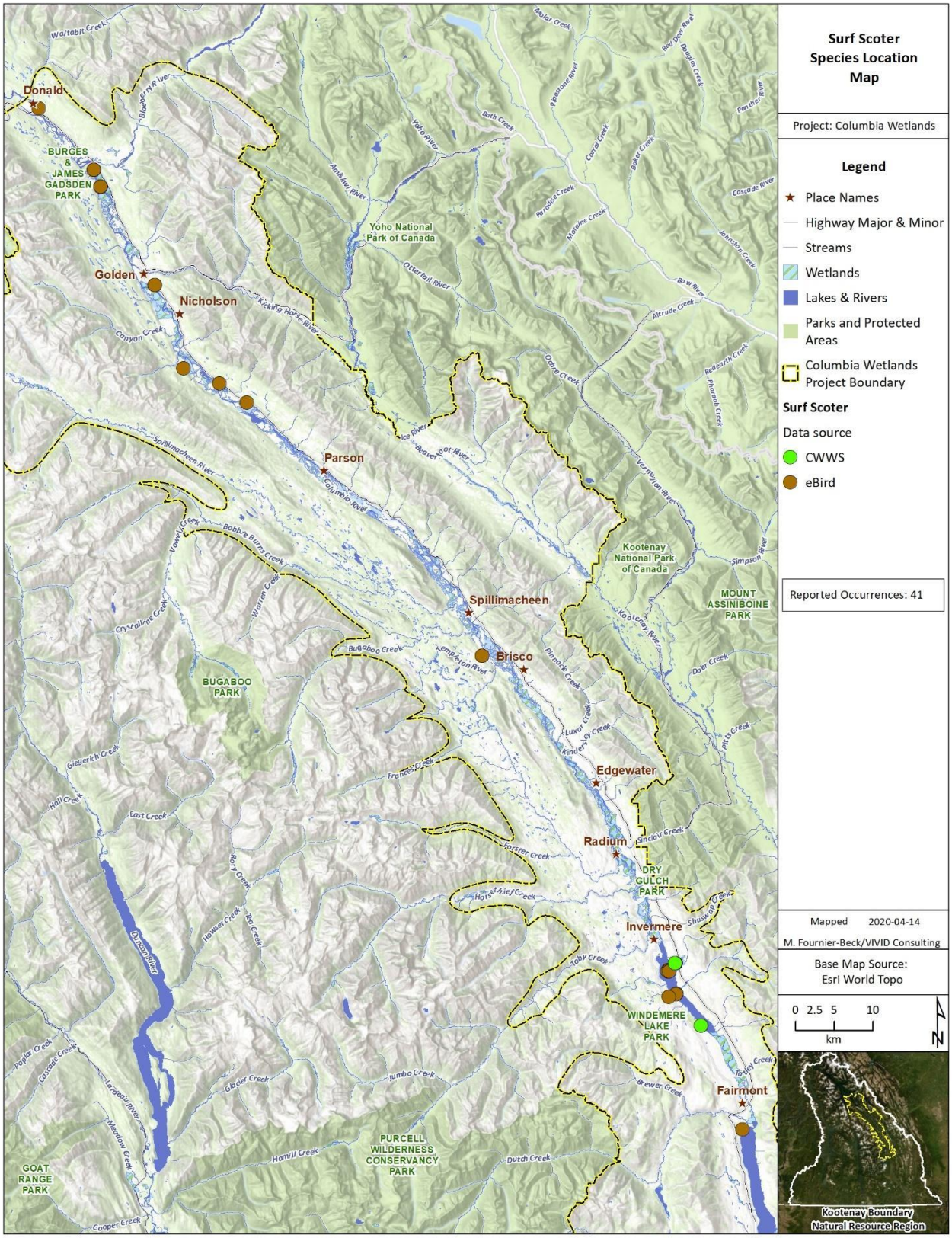
Appendix 28. Rusty blackbird spatial occurrences.



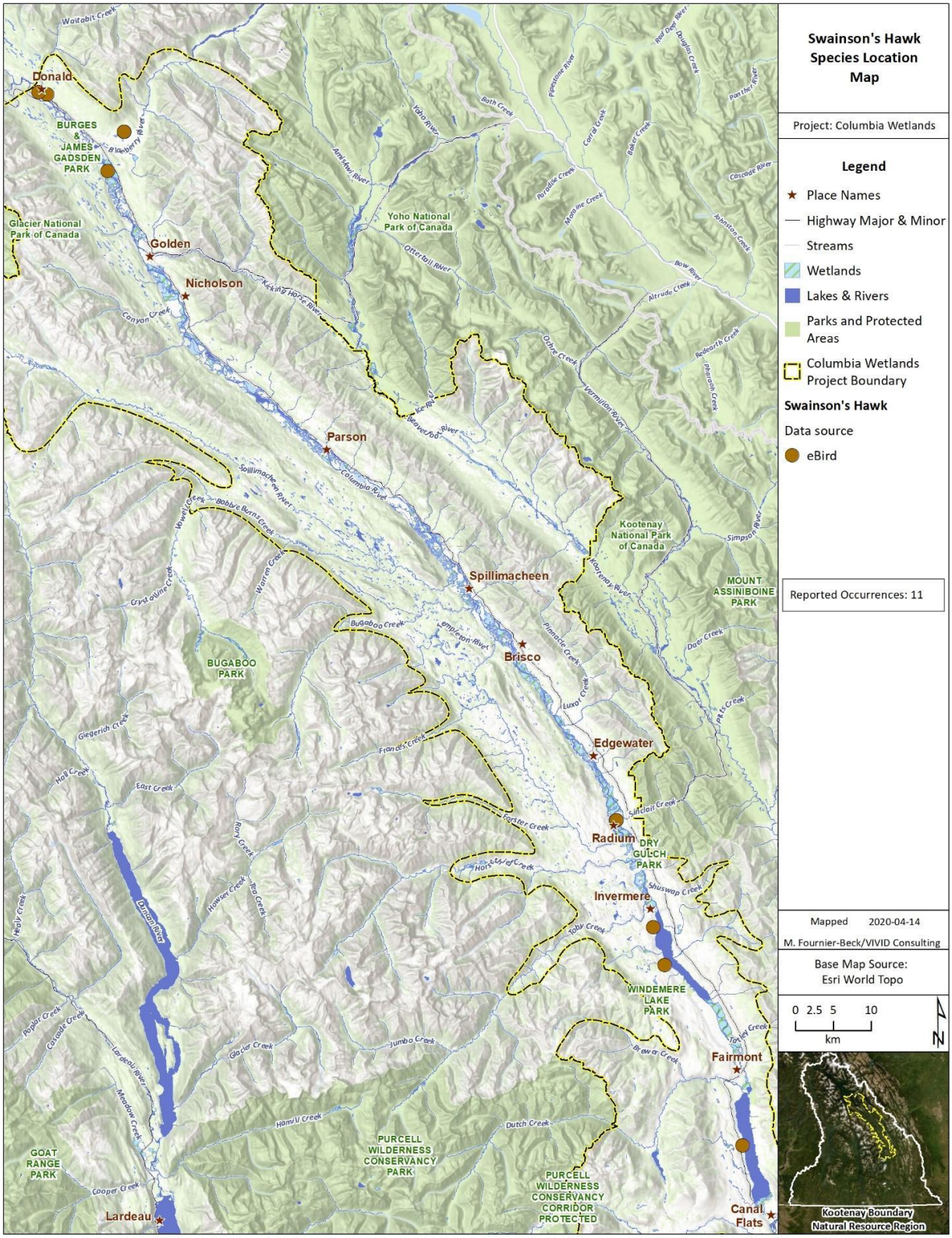
Appendix 29. Short-eared owl spatial occurrences.



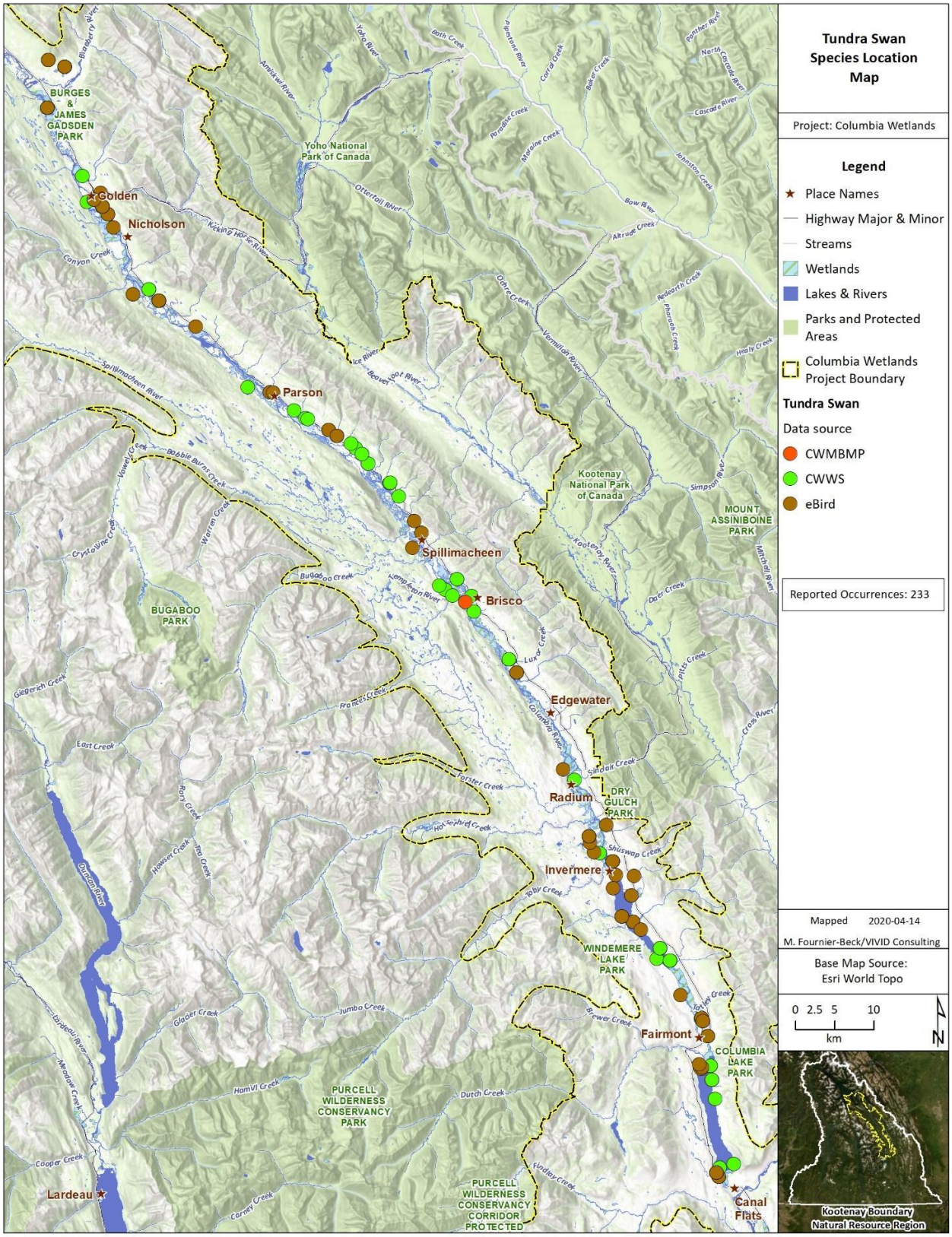
Appendix 30. Surf scoter spatial occurrences.



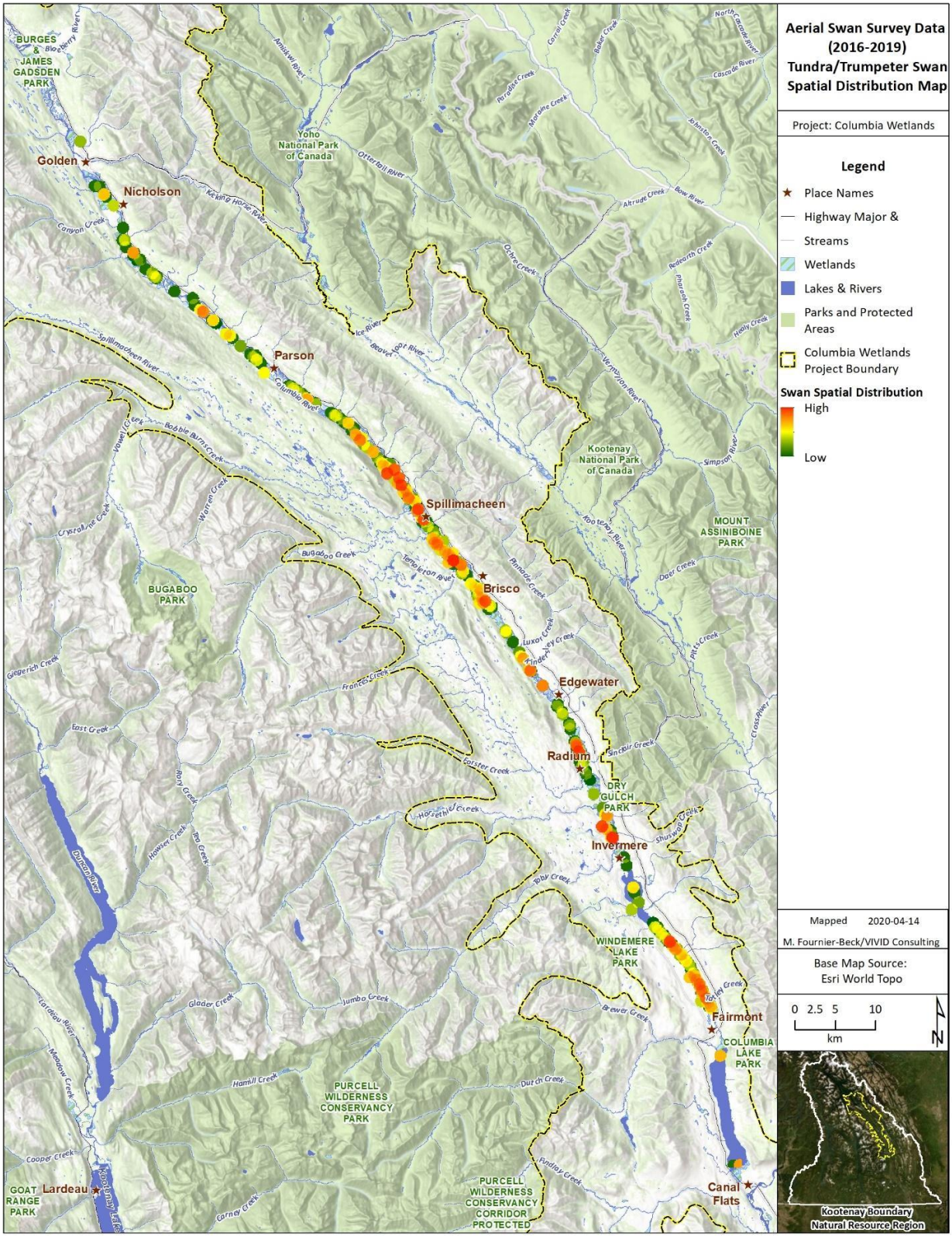
Appendix 31. Swainson's hawk spatial occurrences.



Appendix 32. Tundra Swan spatial occurrences.

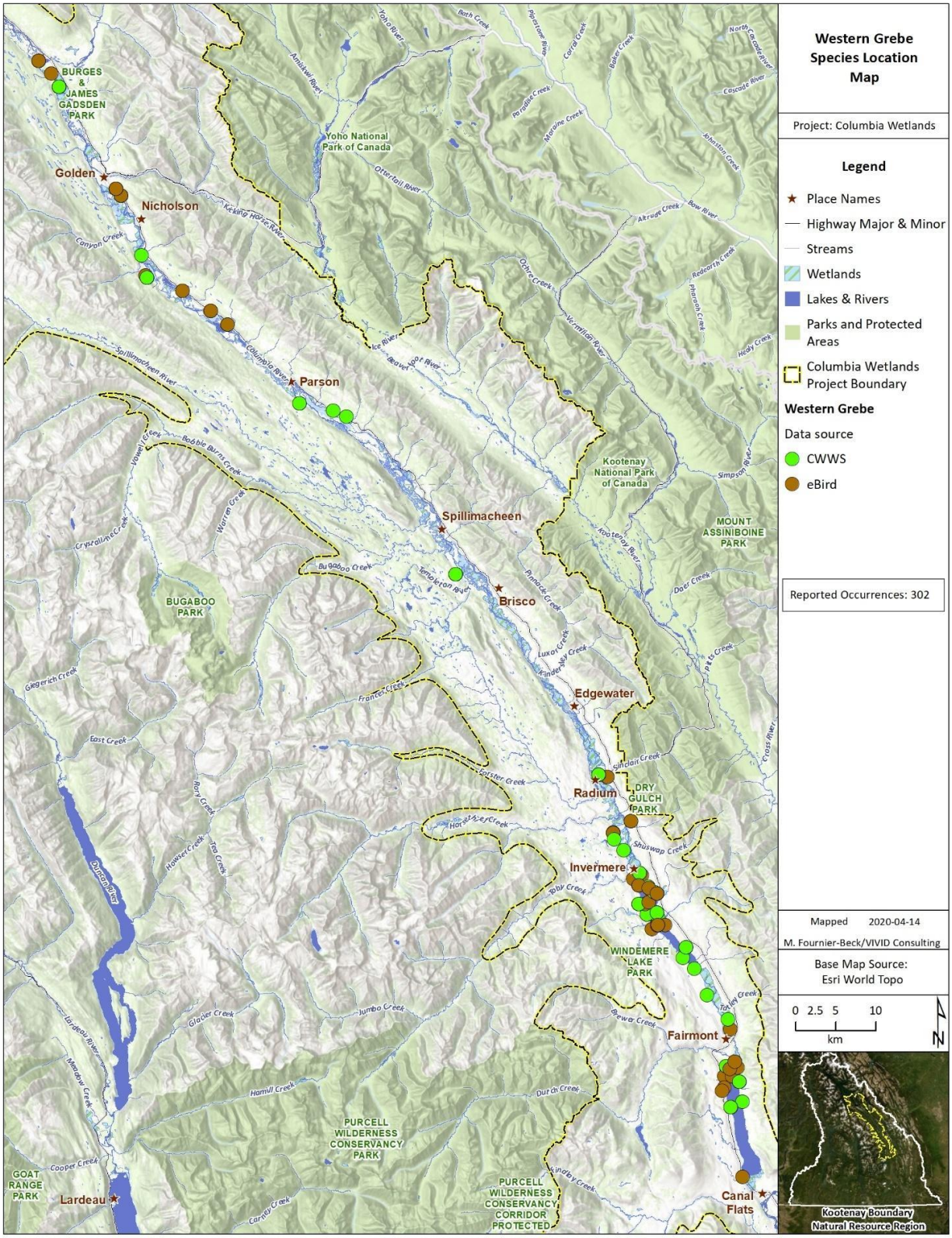


Appendix 33. Aerial swan survey data (2016-2019) indicating spatial distribution.



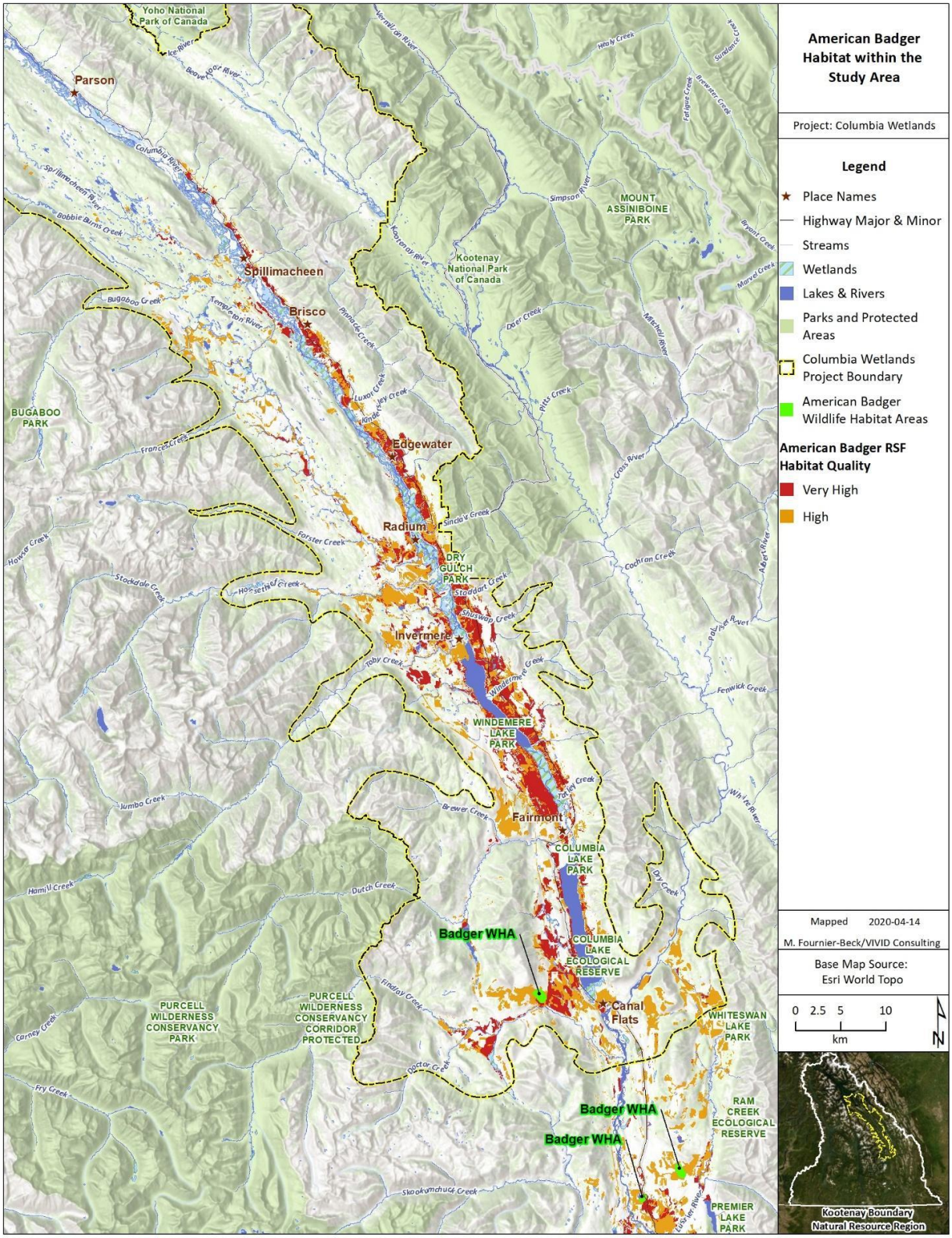
Note: This aerial swan data was collected during the Columbia Wetlands Waterbird Survey (Darvill, 2020).

Appendix 34. Western grebe spatial occurrences.

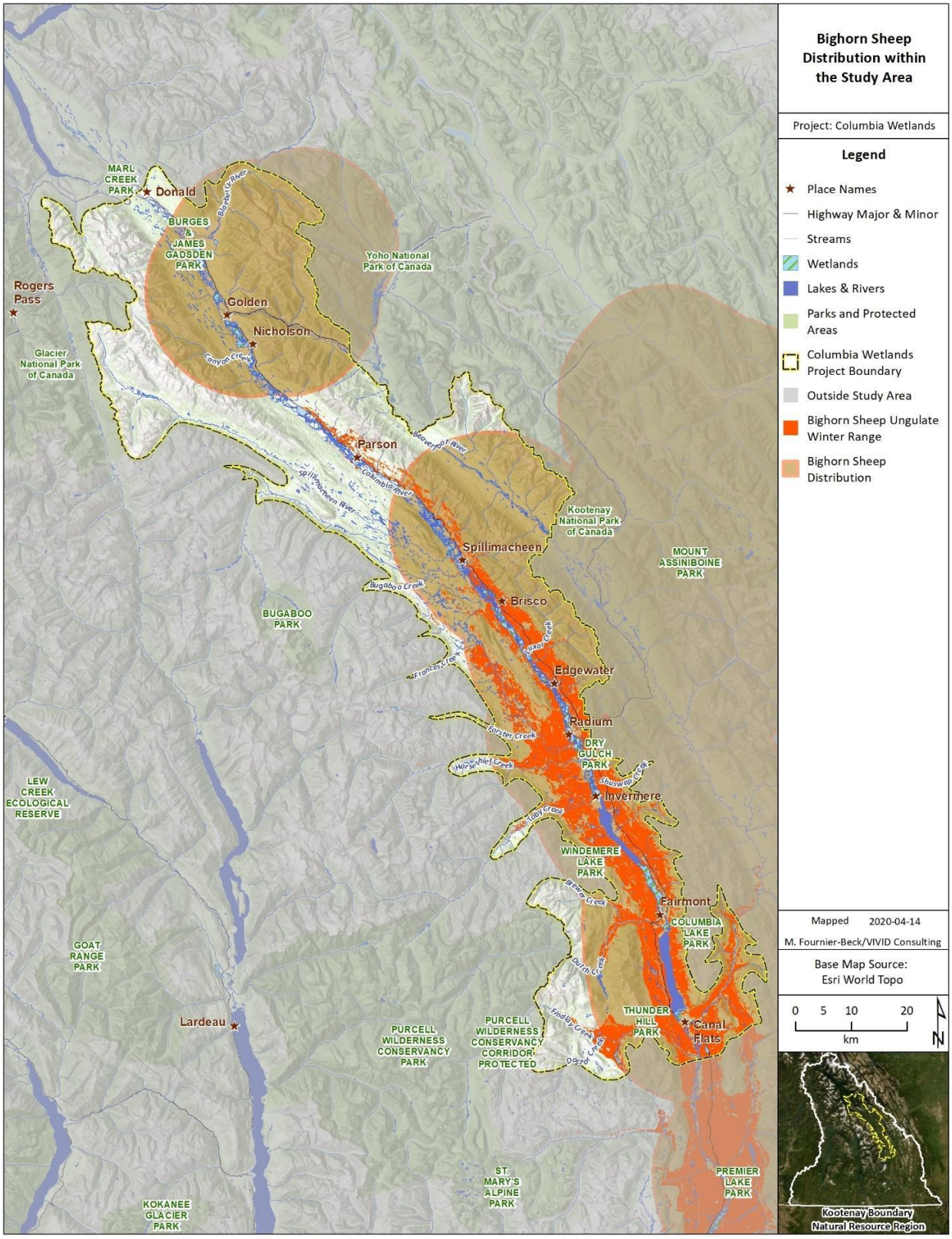


Appendix 35. White-throated swift spatial occurrences and breeding site locations.

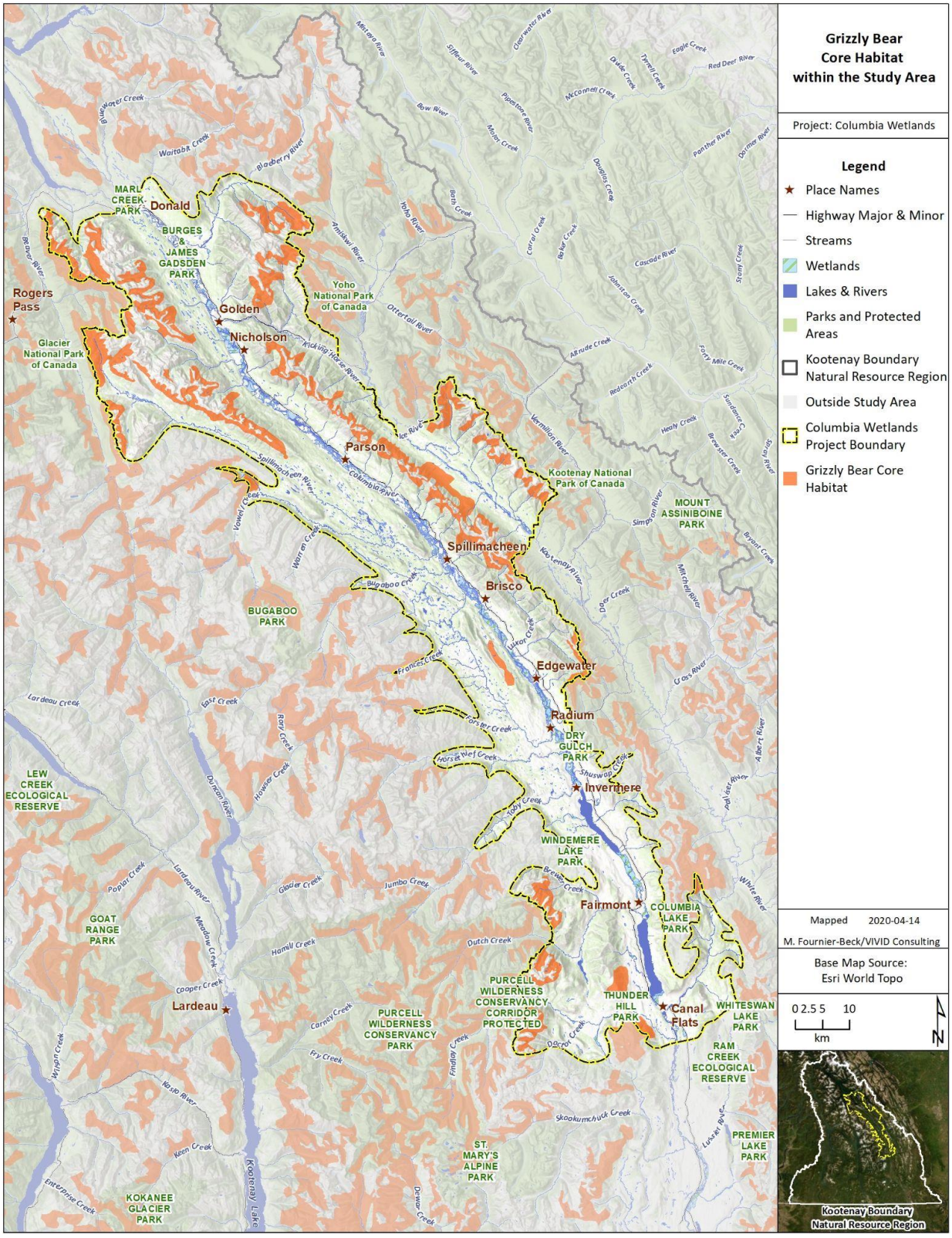
Appendix 36. American badger habitat within the Columbia Valley study area.



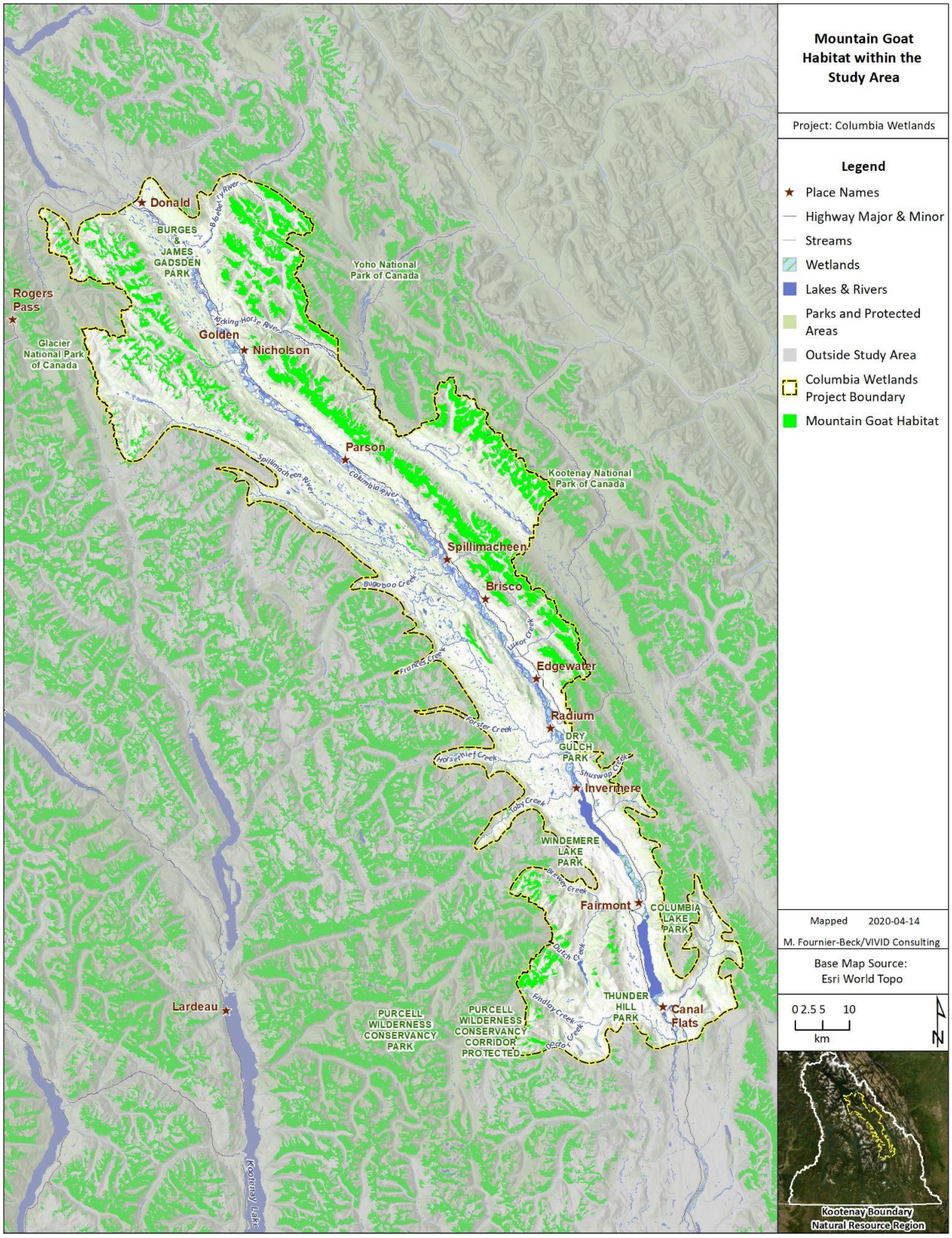
Appendix 37. Bighorn sheep habitat and range within the study area.



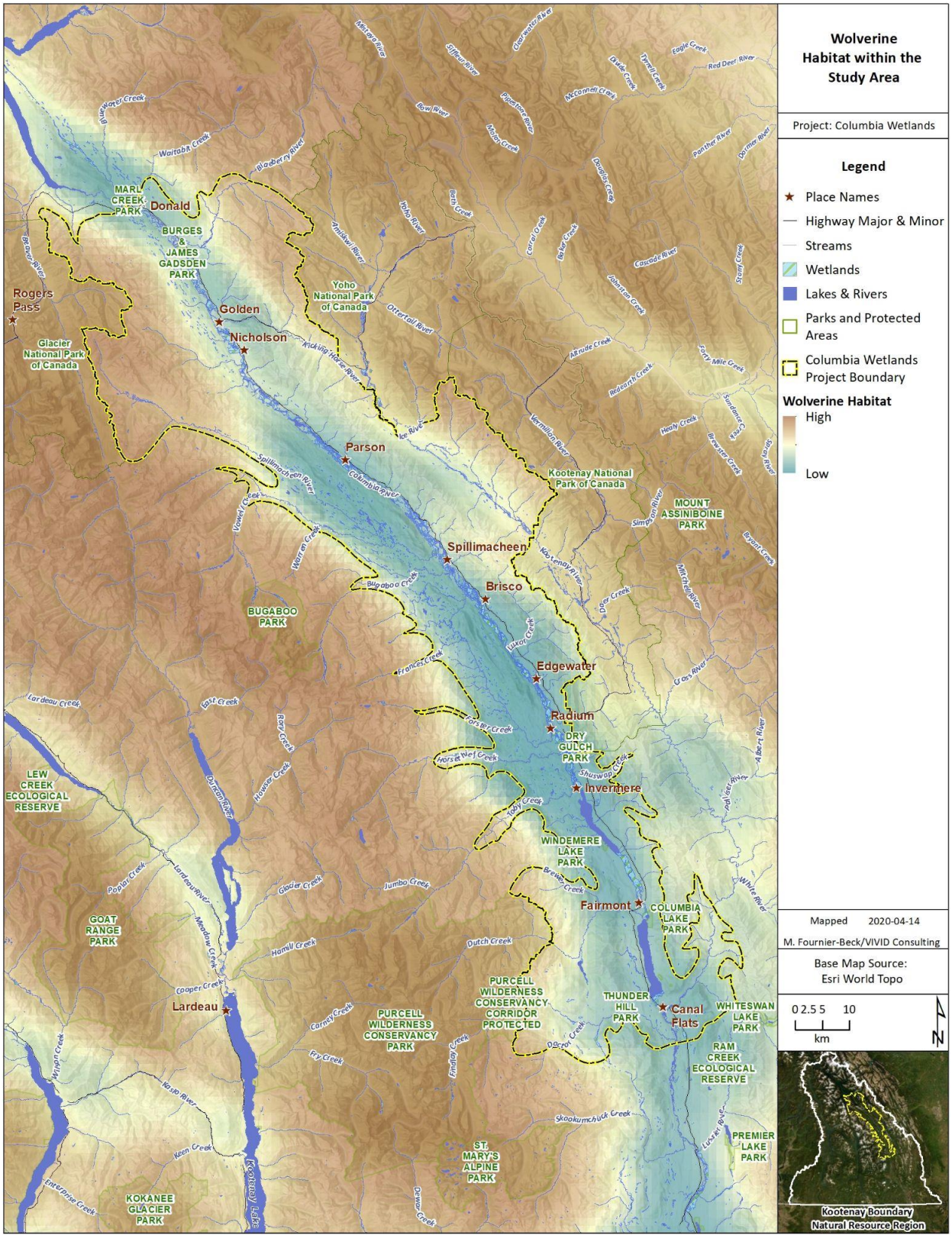
Appendix 38. Grizzly bear core habitat within the study area.



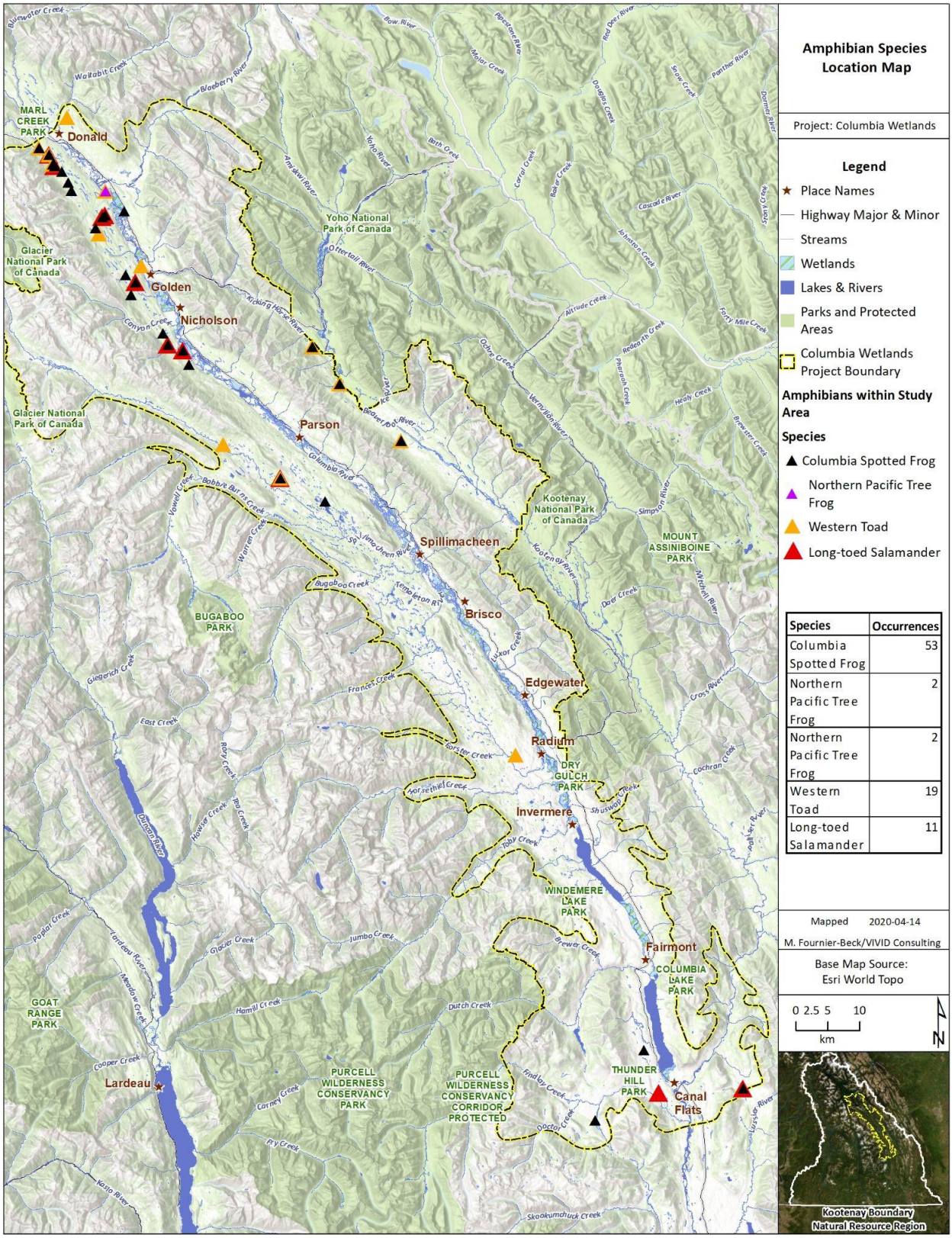
Appendix 39. Mountain goat habitat within the study area.



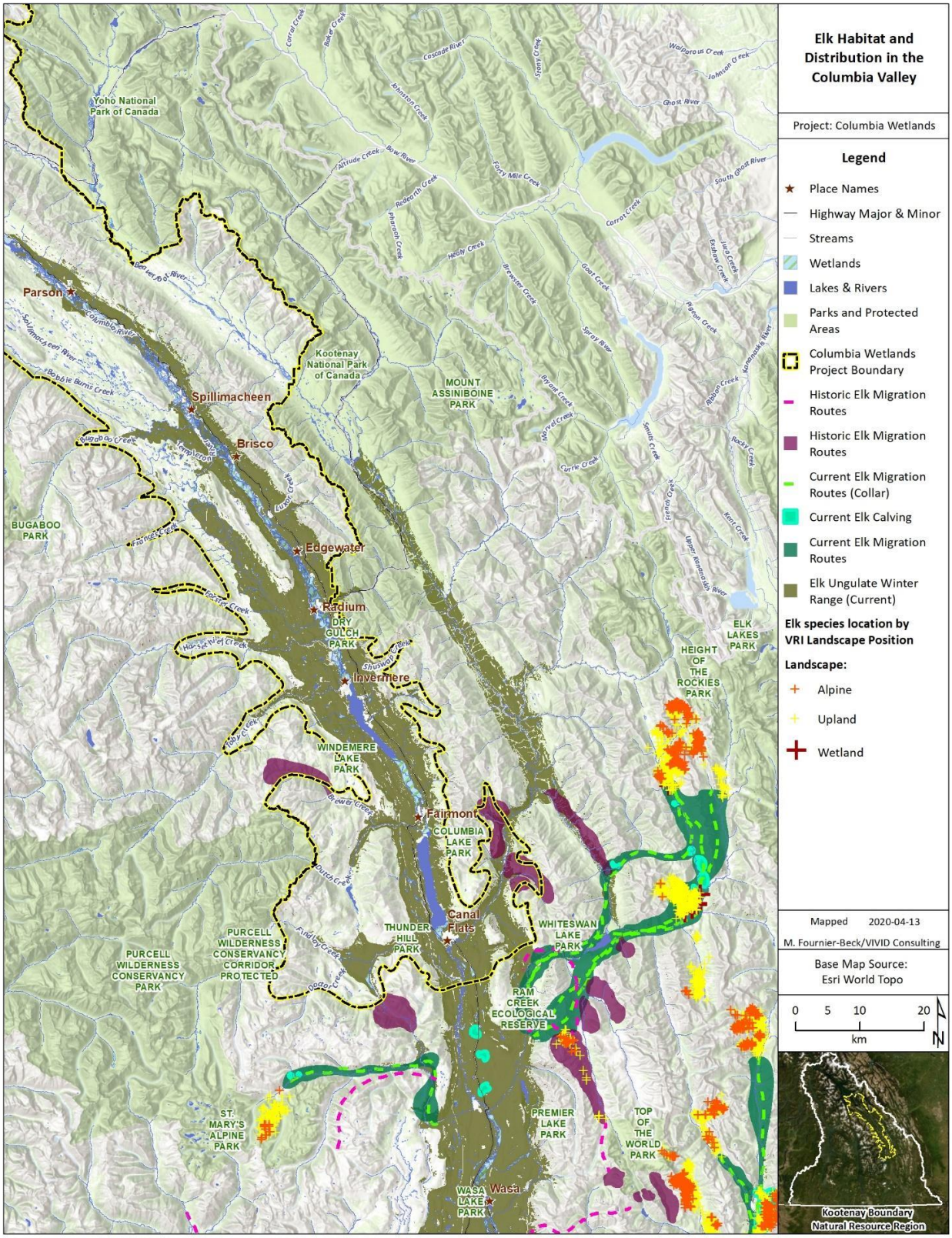
Appendix 40. Wolverine habitat within the study area.



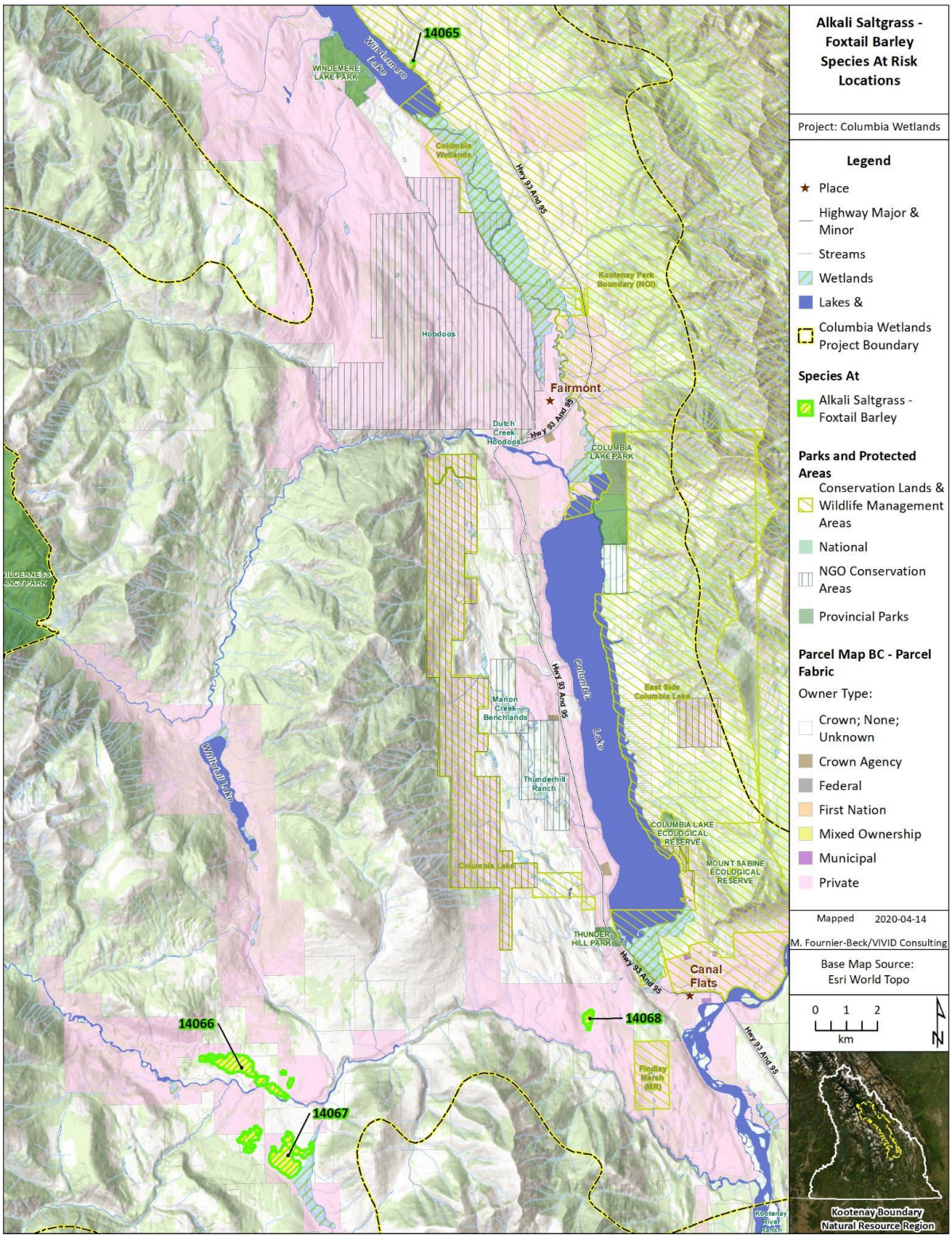
Appendix 41. Amphibian species location map in the Columbia Valley.



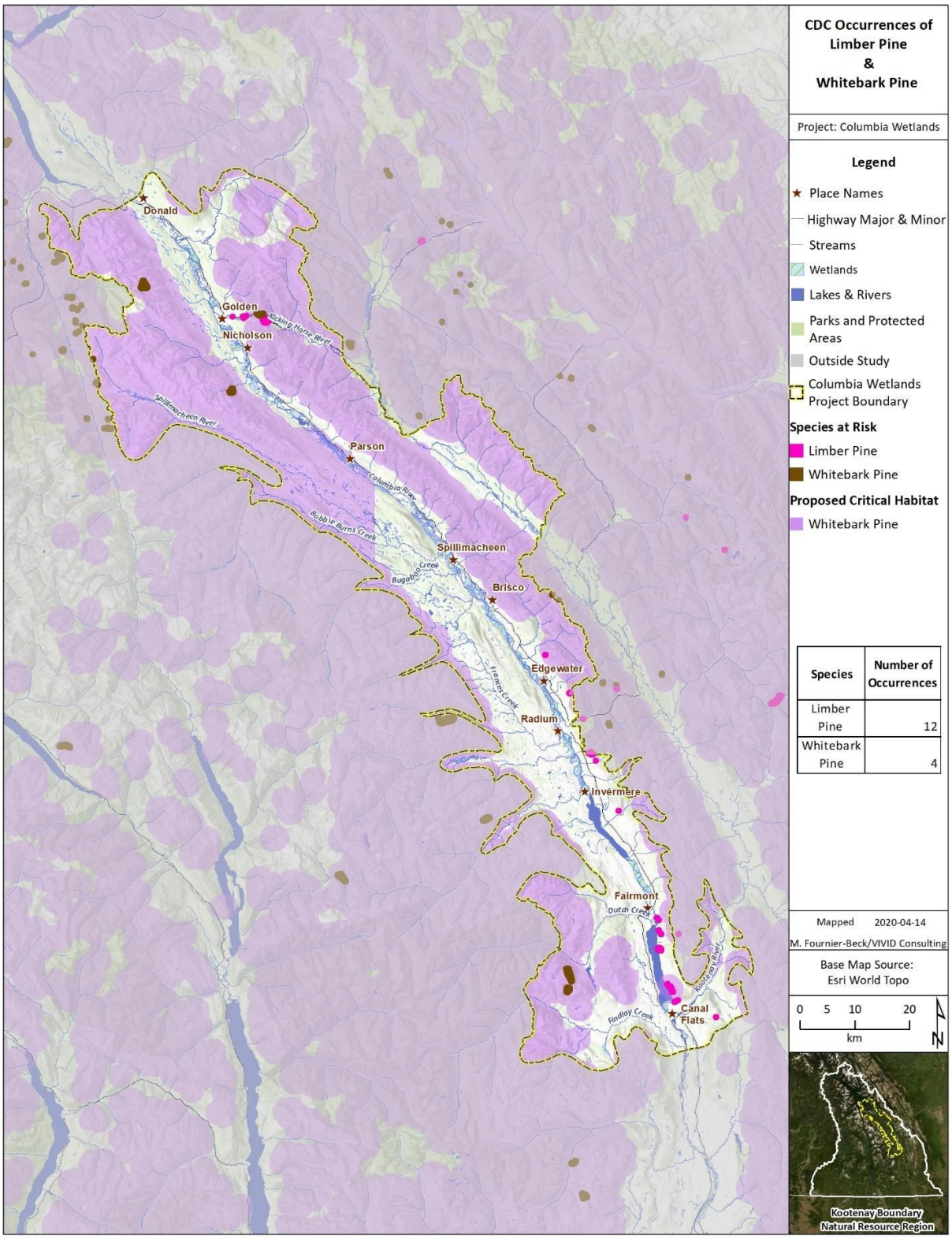
Appendix 42. Elk habitat in the study area and surrounding region.



Appendix 43. Locations of alkali saltgrass – foxtail barley and associated land jurisdictions within the Columbia Valley.



Appendix 44. Occurrences of limber pine and whitebark pine within the study area, including proposed whitebark pine critical habitat (under the Recovery Strategy).



Appendix 45. Summary table of recommended conservation actions for SAR in the Columbia Valley.

Species Name	Recommended Conservation Actions	Critical Habitat	Wildlife Habitat Area	Wildlife Habitat Feature
American golden-plover	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
American avocet	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
American bittern	Map and conserve areas with abundant growth of emergent herbaceous vegetation, especially in areas where there are reduced amounts of woody vegetation, and equal amounts of water interspersed amongst emergent vegetation. Inventory wetlands between Radium and Brisco for marsh birds, as well as higher elevation lakes. Recommended that with respect to the emergent vegetation, efforts should be	N	N	N

	undertaken to create, and publicly promote, buffer distances secluding this breeding habitat — particularly adhered to during the peak breeding periods (mid-May until mid-July) with best efforts to limit all traffic including non-motorized recreationists during this critical season. Investigate potential chemical leaching of K-33 chromated copper arsenate (CCA) and its derivatives at the Brisco Wood Preservatives commercial plant.			
American white pelican	Occurrence is sporadic and seasonal, no recommended conservation action.	N	Y	N
bank swallow	Columbia Valley Swallow Project will be implemented in 2020. This project will determine the location of bank swallow colonies to identify critical habitat; protect nesting habitat; on-the-ground stewardship and conservation	Y	N	N

	activities such as creating artificial nesting banks and enhancing natural banks (in 2021).			
barn swallow	Columbia Valley Swallow Project will be implemented in 2020. This project will determine the location of barn swallow nests to identify critical habitat; protect nesting habitat; on-the-ground stewardship and conservation activities such as creating swallow nest boxes in 2021. Landowner outreach.	Y	N	N
black swift	Compile a list of potential nesting locations (i.e. shallow caves or caves in steep rock faces or canyons, usually behind or near waterfalls) based on habitat suitability. Complete an inventory at these sites for black swift breeding locations in the Columbia Valley, protect breeding sites. Use inventory data to help identify Critical Habitat.	Y	N	N

bobolink	During the breeding season, surveys for bobolink should occur at all locations where they have been detected previously. Inventory work to provide current information on bobolink breeding habitat would aid in the identification of Critical Habitat. Educational outreach should occur with any private landowners who have jurisdiction on any detected bobolink nesting habitat	Y	N	N
broad-winged hawk	Revisit nesting site at the confluence of Bobbie Burns Creek and the Spillimacheen River to determine if this breeding site is still being used. All known nesting locations should be protected due to their rarity, and they should be monitored for their continued use and tolerance of habitat alteration and human activity.	N	N	N

California gull	Determine the land status at areas that California gulls are known to frequent and work towards conservation strategies at those sites, especially at those locations that fall outside of the Columbia Wetlands Wildlife Management Area and Columbia National Wildlife Area.	N	N	N
Caspian tern	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
common nighthawk	Identify critical habitat for common nighthawk by initiating monitoring surveys in key areas (i.e., Fairmont to Radium). The protocol being used across North American by the 'WildResearch Nightjar Survey' (a citizen-science program) should be utilized.	Y	N	N
double-crested cormorant	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N

eared grebe	Surveys conducted by boat during fall migration should occur in order to determine eared grebe level of use at Columbia Lake and Lake Windermere during bird migration. Protect known eared grebe breeding habitat in study area (i.e. Reflection Lake) by working with MFLNRORD to incorporate this land parcel into the CWWMA boundary.	N	N	N
evening grosbeak	Monitoring, research and evaluating population trends for the evening grosbeak is required in order to determine the most appropriate conservation actions for this species.	N	N	N
flammulated owl	Flammulated owl inventories should be conducted within suitable habitat located on the east side of the Columbia Valley, especially north of Mount Swansea where inventory data is limited, and in areas where	N	Some WHAs already identified, could work to ID more.	Some WHFs already identified, could work to ID more.

	flammulated owls have previously been recorded. WHAs should be established at any additional nest sites currently located outside of WHAs.			
Forster's tern	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
great blue heron, *herodias* subspecies	Support work done by the Great Blue Heron Inventory and Stewardship Project, WHAs and WHFs to be established.	N	Y	?
horned grebe	Inventory work for horned grebe conducted during the breeding season should occur to locate breeding sites, breeding sites should be protected. Work with stakeholder groups to minimize levels of human disturbance at sites documented to be important stopover habitat (Columbia Lake and Lake Windermere).	N	N	N

lark sparrow	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
Lewis's woodpecker	Implement LEWO nest box monitoring and occupancy, determine effectiveness. Habitat enhancement - fungal inoculation treatments on protected lands. Monitor at known and suspected nesting sites should be conducted so that specific management recommendations can be made for each unique location. If additional nesting sites are discovered, this data should be sent to the Canadian Wildlife Service to identify further critical habitat areas. All known nesting locations should be submitted to the provincial government to be designated as WHFs. Nesting sites located on crown land outside of the WMA or current	Some CH already identified, could work to ID more.	Some WHAs already identified, could work to ID more.	Y

	WHAs should be designated as WHAs.			
long-billed curlew	Inventory to determine the current status of long-billed curlew in the study area. Subsequently, when breeding areas are identified, WHAs should be established in suitable nesting and brood rearing habitats.	N	Y	N
olive-sided flycatcher	Undertake monitoring activities in the Columbia Valley to identify priority habitat, including key areas for prey and critical habitat features. These should be identified and preserved in the Columbia Valley.	N	N	N
peregrine falcon, *anatum* subspecies	Naturalists and biologists should be strongly encouraged to record any peregrine falcon sightings into the eBird database. If any breeding evidence is discovered, this should be reported to the B.C. CDC.	N	N	N

prairie falcon	Nest suspected near Kicking Horse Mountain Resort. This site should be investigated to determine the status of habitat use. Communication with the resort should occur to let the tenure holders know about the rare falcon utilizing habitat within their tenure area. WHAs and WHFs should be established in all areas where the Prairie Falcon is known to breed. Restrictions on human use of the WHAs or WHFs should be established as appropriate within limitations of the Forest and Range Practices Act. Some of these restrictions could include seasonal closures on rock climbing (see below), camping, off-road vehicle use, livestock herding, road building, and blasting.	N	Y	Y
red-necked phalarope	Occurrence is sporadic and seasonal, no recommended	N	N	N

	conservation action.			
rough-legged hawk	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
rusty blackbird	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
short-eared owl	Encourage local naturalists and biologists to record any discovered nesting sites to the B.C. CDC and to record any short-eared owl observations in the eBird database so that we can learn more about this species utilization of the Columbia Valley.	N	Y	N
surf scoter	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
Swainson's hawk	Birders, naturalists and biologists are encouraged to look for Swainson's hawk and document occurrence and breeding evidence. If any	N	N	N

	critical habitat features for Swainson's hawk are discovered in the Columbia Valley, there are a number of additional guidelines for raptor conservation that are outlined by the provincial government.			
tundra swan	Conducting winter bird surveys at ice-free areas (Tatley Slough, Mud Lake and Athalmer Slough) during winter is recommended. This will allow for a better understanding of current habitat conditions and bird use at these sites. This type of information in addition to determining land ownership at these ice-free sites is needed prior to developing conservation recommendations at ice-free areas. "Outflow areas of warm water should be acquired as irreplaceable migration habitat and fully protected."	N	N	N

western grebe	Research should be conducted to determine the extent of human intrusion on the birds (including western grebe) of Lake Windermere. Since at-risk grebe species are at the top of the food chain, feed extensively on fish and are sensitive to aquatic pollutants, it is recommended that a toxic analysis on the fish of Lake Windermere be conducted. Designate areas with high waterbird concentrations as Migratory Bird Sanctuaries or National Wildlife Areas.	N	N	N
white-throated swift	All potential nesting habitats documented through eBird should be inventoried for nesting sites.	N	N	N
winter wren	Occurrence is sporadic and seasonal, no recommended conservation action.	N	N	N
bull trout	1) Implement an at-risk fish species inventory and habitat monitoring	N	Y	N

	program, to include inventories for invasive fish species. 2) Fish inventory in Upper Spillimacheen, 3) Dutch Creek habitat enhancement, 4) Riparian restoration.			
westslope cutthroat trout	Implement an at-risk fish species inventory and habitat monitoring program, to include inventories for invasive fish species.	N	Y	N
alkali saltgrass - foxtail barley	Locations of alkali saltgrass - foxtail barley ecological communities are known in the Columbia Valley. Occurrences have been mapped and some locations are on provincial crown land. An inventory at these known sites is required. If this ecological community is still present at these sites, a management proposal to designate these sites as WHAs should be sent to ministry staff.	N	Y	

alkaline wing-nerved moss	The current status of sites with known occurrences are unknown. The site found in the Columbia Valley study area has not been revisited since 2002, according to online CDC data. It is ecommended to revisit this site, confirm viability and conduct an inventory to identify, map and describe the current population. Submit data to CDC. If present, maintain this known population of alkaline wing-nerved moss. Since grazing by cattle has been known to occur at this site, it is prudent to protect this known occurrence by erecting and maintaining a cattle enclosure to exclude grazing opportunities, as well as other potential site disturbances. Public outreach is recommended to occur with any persons who may have a cattle	Y	N	

	grazing tenure in this area.			
limber pine	Given that the Columbia Valley contains most of the known limber pine locations in B.C., more extensive surveys should occur in the study area for the limber pine. Potential restoration sites should also be identified, and seed collection should occur to prepare for future restoration projects in the study area. Work with the Crown of the Continent Ecosystem (CCE) Hi-5 Working Group.	Y	N	
southern maiden-hair	One location only at Fairmont Hot Springs. The B.C. CDC recommends that “the entire hot springs system at Fairmont Hot Springs should be surveyed periodically to ensure that all extant populations/subpopulations have been located.”	Already identified	N	

slender spike rush	Protect all known occurrences at the confluence of the Columbia and Kicking Horse River and Edelweiss sites, working with the government to incorporate these areas into the CWWMA.	N	N	
pygmy waterlily	Determine the location for any other pygmy waterlily occurrences in the Columbia Valley and determine the best management strategy to protect all known locations.	Y	N	
whitebark pine	Inventory needs to occur in order to identify final critical habitat areas for this species. Identifying specific locations of critical habitat would be useful for forestry activities and they should be asked to avoid critical habitat areas once established.	Y	N	
yellow widelip orchid	Protect all known occurrences at the confluence of the Columbia and Kicking Horse River and Edelweiss sites, working with the	N	N	

	government to incorporate these areas into the CWWMA.			
American badger - *jeffersonii* subspecies	Continued restoration activities. Identify and establish WHAs and WHFs. WHF establishment will require inventory work for den sites.	Y	A WHA already identified near Canal Flats, could work to ID more to the north.	Y
grizzly bear	Developing recommendations for conservation actions for this species will occur in year 2 (2020-2021), which will be led by Dr. Michael Proctor. Important to get Highway 95 wildlife mortality data from MoT.	N	Y	Y
little brown myotis	Inventory work to begin in 2020 (Dr. Cori Lausen). Identify critical habitat.	Y	N	Y
northern leopard frog	If the Brisco reintroduction is viewed to be successful by the Northern Leopard Frog Recovery Team and if additional captive bred frogs become available, it may be worth considering additional reintroduction	Already identified	Y	?

	projects into additional suitable habitat previously identified by Ohanjanian and Carli in 2010.			
northern myotis	Inventory work to begin in 2020 (Dr. Cori Lausen). Identify critical habitat.	Some CH already identified, could work to ID more.	N	Y
northern rubber boa	No hibernacula are currently known. To locate rubber boa hibernacula, a project would need to work on capturing a sufficient number of snakes and fit them with transmitters that would allow the snakes to be traced back to the hibernacula.	N	N	Y
painted turtle - Intermountain - Rocky Mountain Population	Habitat protection is a priority in order to conserve the painted turtle - intermountain - Rocky Mountain population, but this requires more knowledge of turtles in terms of their habitat use, distribution and abundance. Inventory is required.	N	N	N
western toad	Implementing multi-year amphibian surveys with randomly selected wetlands and	N	N	N

	standard occupancy surveys. This will help determine the status and location of western toads and fill knowledge gaps which are required before further work can be completed on habitat protection, habitat restoration and private land stewardship. This will also identify corridors connecting anuran habitats.			
wolverine	Developing recommendations for conservation actions for this species will occur in year 2 (2020-2021).	N	N	N
Rocky Mountain bighorn sheep	Stay apprised with ongoing Kootenay Region Bighorn Sheep Management Plan (2019).	Y?	Y	Y
caribou (Southern Mountain Population)	Stay apprised with Mountain Caribou recovery objectives, directed by the provincial government.	Already identified	N	N
mountain goat	Identify mineral licks and designate as WHFs.	N	?	Y

Columbia spotted frog	Implementing multi-year amphibian surveys with randomly selected wetlands and standard occupancy surveys. This will help determine the status and location of Columbia spotted frogs and fill knowledge gaps which are required before further work can be completed on habitat protection, habitat restoration and private land stewardship. This will also identify corridors connecting anuran habitats	N	N	N
Elk	Inventory work needs to be conducted along the entire study area, and elk migration routes need to be identified.	N	N	N
Ecological Communities at risk	Identify locations and determine management strategy to conserve sites.	N	This is coming.	N