

Environmentally Sensitive Area Mapping Study

City of Vernon, 2025



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Prepared For:
City of Vernon

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ENVIRONMENTALLY SENSITIVE AREA MAPPING STUDY: CITY OF VERNON, 2025

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EXECUTIVE SUMMARY

The objectives of this study are to provide updated maps, spatial data, and recommendations regarding Environmentally Sensitive Areas (ESAs) within the City of Vernon (City) to be included in the upcoming update to the Official Community Plan (OCP) and support the implementation of Vernon's Climate Action Plan (2021).

The analysis to update the Environmentally Sensitive Areas (ESA) was largely completed through mapping exercises. The ESA mapping methods combined change detection assessments, application of recent provincial and regional supporting data, and implementation of the standard Sensitive Ecosystem Inventory (SEI) conservation valuation methods with minor modifications. This resulted in a new Sensitive Ecosystem Ranking (SER) data layer that shows updated natural conditions within the City and includes greater consideration with respect to climate change. This SER layer divides the City into 4 classes of ecological sensitivity, which may also be thought of as conservation priority, ranging from SER 1 areas that have significant ecological value and indicate a high priority for conservation to SER 4 areas that have minimal ecological value and are not a priority for conservation. Areas classified as SER 1, 2, and 3 were used to create a new Environmental Development Permit Area (EDPA) for the City. The EDPA map includes both terrestrial and aquatic sensitive areas. Separate terrestrial and aquatic map layers are provided and a combined map layer that overlays the terrestrial and aquatic areas has also been created to ease comparison of the two sensitive area types. EDPAs indicate where development would require a permit with a Qualified Environmental Professional's (QEP) report and recommendations regarding the identification and management of environmental features on the property.

In addition to creating the EDPA maps, the previously mapped ecological connectivity corridors in the region were expanded to develop an updated ecological connectivity network. This network connects critical habitats and pathways within and across the City. Data considerations included the new SER data layer, the Biodiversity Conservation Strategy habitat connectivity data, the previously mapped regional SEI corridors, and a landscape-level wildlife movement probability model utilized by Parks Canada. It is recommended that the City and QEPs use the ecological connectivity corridor mapping to better evaluate how proposed developments impact existing ecological corridors at both the local and regional scales and where green infrastructure, conservation, and restoration efforts can be prioritized.

Recognizing and protecting ESAs early in community planning provides the best chance of safeguarding environmental values. The City has two areas – Commonage and Bella Vista – largely comprised of intact, high-value, natural ecosystems. The most effective way to protect these areas is to work with First Nations, regional, provincial, and federal partners to strategically secure land for long-term conservation. Additionally, the newly created DPAs and guiding policies should be implemented to help protect ESAs. The City should examine how current zoning and future land

use designations overlap with the EDPAs and the ecological connectivity corridor network to identify and alleviate areas of potential conflict. Development should avoid areas with a SER of 1 (Very High) and SER of 2 (High) and instead be focused in less environmentally sensitive locations. Strict development controls should be established for SER 1 and SER 2, as well as habitat compensation at minimum 3:1 and 2:1 replacement levels, respectively, and the establishment of a cash-in-lieu mechanism for when there is not an opportunity for on-site compensation.

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ACRONYMS

City	City of Vernon
CONDV	Condition Value of the ecosystem
CONS	Conservation Value of the ecosystem component
CONS_VAL	Conservation Value of the SEI polygon
DD1	City Centre District
DD2	Neighbourhood District
DD3	Hillside Residential and Agricultural District
DIPP	Drainage Infrastructure Prioritization Plan
DP	Development Permit
EDPA	Environmental Development Permit Areas
EMA-S	Environmental Management Areas Strategy
ESA	Environmentally Sensitive Area
GIS	Geographic Information Systems
LiDAR	Light Detection and Ranging
NGO	Non-governmental Organization
NPAECs	national priority areas for ecological corridors
OCCP	Okanagan Collaborative Conservation Program
OCP	Official Community Plan
QEP	Qualified Environmental Professional
REV	Relative Ecosystem Value
RAPR	Riparian Areas Protection Regulation
SAR	species at risk
SARA	Species At Risk Act
SEI	Sensitive Ecosystem Inventory
SER	Sensitive Ecosystem Ranking
SHIM	Sensitive Habitat Inventory & Mapping
SOSCP	South Okanagan Similkameen Conservation Program
TNCC	Thompson-Nicola Conservation Collaborative
VRI	Vegetation Resources Inventory
WLHV	Wildlife Habitat Suitability Value
WSA	Water Sustainability Act

1.0 INTRODUCTION

The City of Vernon (City) is currently the largest population centre in the North Okanagan and the second largest in the Okanagan. It encompasses a land area of 11,451 hectares (Figure B-1 in Appendix B). The urban centre is nestled between three lakes: Okanagan, Kalamalka, and Swan, historically significant agricultural lands, and sensitive natural environments. The region's early inhabitants were First Nations, who have long subsisted in the area through hunting, foraging, fishing, and trade. European colonization occurred in the mid-1800s by cattle ranchers and miners, later becoming a prominent ranching and orchard centre in the province's interior. Since European settlement, population growth and development have considerably altered the natural landscape. While significant natural areas remain in the Commonage and Bella Vista areas, the Vernon centre is highly urbanized.

At present, development pressures continue alongside new threats to sensitive ecosystems, such as climate change and global biodiversity loss. The City recognizes that natural areas greatly contribute to the health and resiliency of the urban centre and is developing new and revised policies and strategies to safeguard, preserve, and improve them. This Environmentally Sensitive Area Mapping Study and the State of Natural Assets Report will provide a critical foundation for future management of natural areas and connections between them in the City.

1.1. Purpose

The objectives of this study are to provide updated maps, spatial data, and recommendations regarding Environmentally Sensitive Areas (ESAs) and Natural Assets within the City, which will be included in the upcoming update to the Official Community Plan (OCP) and to support the implementation of Vernon's Climate Action Plan (2021). The three objectives are outlined as follows:

1. Provide an update to the City's Environmental Development Permit Areas (EDPAs), inclusive of a Natural Environment Development Permit Area and an Aquatic Development Permit Area, by updating and expanding on the existing Geographic Information System (GIS) datasets that inform the existing environmental management maps and produce updated EDPA maps for inclusion in the upcoming OCP update, as required by the Local Government Act. The maps will indicate where environmental sensitivity may limit or prevent land development and where provincial legislation and protections regarding aquatic features, such as the Riparian Areas Protection Regulation (RAPR) and the Water Sustainability Act (WSA), may apply.

2. Develop a State of Natural Assets report to define the quantity and condition of Natural Assets within the City, which will later be expanded upon to value natural assets (delivered under a separate cover); and,
3. Provide recommendations for implementing and updating Vernon's OCP, Environmental Management Areas Strategy (EMA-S), Climate Action Plan, and other policies aimed at preserving and protecting natural resources.

1.2. Background

The City is conducting this work, in part, to adhere to provincial law, specifically the Local Government Act, which requires the City to have maps showing where Development Permit (DP) requirements apply within their OCP. They are also conducting it per the recommendations from the 2021 Climate Action Plan to better protect natural resources within the municipal boundary. Having up-to-date ESA data with conservation priority values is an essential step in that direction. Additionally, emerging regulations, standards, and frameworks will require municipalities to have tools to report on natural asset data through audited financial reporting.

The City's current EMA-S, dated 2008, guides how environmental protection and development interact within the City by outlining DP requirements within three Development Districts (DD1 - City Centre, DD2 - Neighbourhood District, and DD3 - Hillside Residential and Agricultural). The management differences result from the previous conservation mapping completed in the City. That mapping consists of the Sensitive Ecosystem Inventory (SEI) projects (2002, 2005, 2007, 2008) and the Biodiversity Conservation Strategy project (2014) coordinated by the Okanagan Collaborative Conservation Program (OCCP) and South Okanagan Similkameen Conservation Program (SOSCP), which determined Conservation Values, also referred to as Sensitive Ecosystem Rankings, for ecosystems across the study area. As currently implemented, the Conservation Values translate to the three SER classes used by the City as High – SER 1, Moderate – SER 2, and Low – SER 3. This report expands that valuation schema into four SER classes, which is further explained in Section 2.1, to better align with environmentally sensitive area mapping processes in neighbouring municipalities and provide greater flexibility in managing sensitive natural areas.

Generally, DD1 contains few areas with High Conservation Value, and environmental priorities are ecosystem enhancement, riparian area protection, and increasing greenspace, whereas DD3 contains significant areas of Moderate and High Conservation Value, and the goal is to protect and conserve sensitive areas and environmentally significant features and to encourage the rehabilitation of previously impacted natural areas.

The EMA-S was not only guided by public input that emphasized the importance of environmental protection and management but also by the two ‘Guiding Principles’ of protecting and preserving greenspace and sensitive areas and creating a culture of sustainability. The objectives of the EMA-S center around identifying and protecting sensitive ecosystems and open spaces while balancing the demands and pressures of development.

2.0 ENVIRONMENTAL DEVELOPMENT PERMIT AREA UPDATE PROCESS

Environmental DPAs are essential for municipalities to manage their natural assets, ensure provincial and municipal legislation and policy are adhered to, and plan future development. EDPAs generally function as a flag for potentially sensitive natural environments and watercourses. They are areas where a site visit from a QEP should be conducted to identify and delineate the environmental features before finalizing any land use decisions.

The following subsections describe the methods used to update the existing databases to develop the updated EDPA data layers and maps. The ESA mapping methods combine visual and tabular change detection assessments, application of recent supporting data, and implementation of the standard SEI conservation valuation methods with minor modifications (Haney & Iverson, 2008; EMA-S, 2008). The aquatic and riparian area mapping methods generally included cleaning and combining the available water resource spatial datasets in the GIS and creating a 30 metre assessment area buffer around them.

2.1. Environmentally Sensitive Area Mapping Methods

The City’s ESA mapping, previously used in determining the current DP areas, identifies and ranks ecosystems for conservation priority. The dataset and mapping include terrestrial and aquatic ecosystems occurring in the study area – ranging from wetlands to forests to orchards to cliffs to suburban neighbourhoods – but generally excludes mapping of underwater habitat features. This information guides where further assessments of environmental values, impacts, and legislation may be needed before development.

The ESA inventory of the Study was primarily based on three separate SEI projects, including a partial update to them in 2013. These were the Bella Vista–Goose Lake Range (2002), Vernon Commonage (2005), and Coldstream–Vernon (2007) SEI projects. This data was the basis of the update to the landscape-level inventory for the study area. Ecosystem polygon boundaries were adjusted, amended, and updated based on a desktop review of the area. Through this update, ESAs were identified and evaluated. These key areas are vital to producing the EDPA maps and management strategies.

Ecoscape systematically and consistently updated the three SEI databases. Visual differences between the current (North Okanagan Regional District – 2022, ESRI World

Imagery – 2024) and historical imagery (DataBC Web Map Service Server – 1997, 2007) were checked against the existing SEI polygon boundaries, ecosystem attributes, and supporting base data and substantive differences (approximately >10% change) were accounted for (Appendix C – Table C-1). This visual inspection was mostly completed at a 1:2,000 – 1:5,000 scale because the proportions ecosystem polygon is split into deciles (i.e., ten equal-size proportions), so they need to be assessed at approximately one-tenth of the base mapping scale, which is 1:15,000. Polygons with substantive change were remapped, retaining existing polygon boundaries where possible to minimize the number of adjacent spatially affected polygons requiring updates.

The major elements of the update involved integrating observed differences into the pre-existing ecosystem polygons, updating the structural stage of undisturbed forested ecosystems using the age classes within the provincial Vegetation Resources Inventories dataset (VRI), reconciling the surrounding spatially affected polygons, and recalculating the SEI attributes and resultant conservation values for all changed polygons. Wetland features not previously captured by the SEI, likely due to scale and intermittent visibility in historical air photos, were added to the dataset. To achieve greater accuracy of the riparian-urban interface along the City’s prominent riparian corridors, the top-of-bank from the Sensitive Habitat Inventory Mapping (SHIM; dated 2007-2008) data was used where the imagery was not explicit due to the dense tree canopy.

Ecological sensitivity within the SEI framework, also called Conservation Value (CONS), functions as a high-level process for identifying areas that should be conserved, protected, and connected. This established methodology (Figure 1) utilizes three evenly weighted primary variables for each *ecosystem component*: the Relative Ecosystem Value (REV; Appendix C, Table C-2), the general Condition Value of the ecosystem (CONDV; Appendix C, Table C-3), and the Wildlife Habitat Suitability Value (WLHV; Appendix C, Table C-4) (Haney & Iverson, 2008; RISC, 2006; Pedersen et al., 2024). The factors considered in the initial determination and valuation of those variables were relative biodiversity, species richness, wildlife habitat suitability, species and ecosystems at risk, vulnerability to land use conversion, ecosystem fragility and sensitivity, rarity, connectivity, and ecosystem service provision.

The CONS is calculated using the following equation for each ecosystem component/unit within a polygon:

$$\text{CONS} = (2 [\text{REV} * \text{CONDV}] + \text{WLHV}) / 3$$

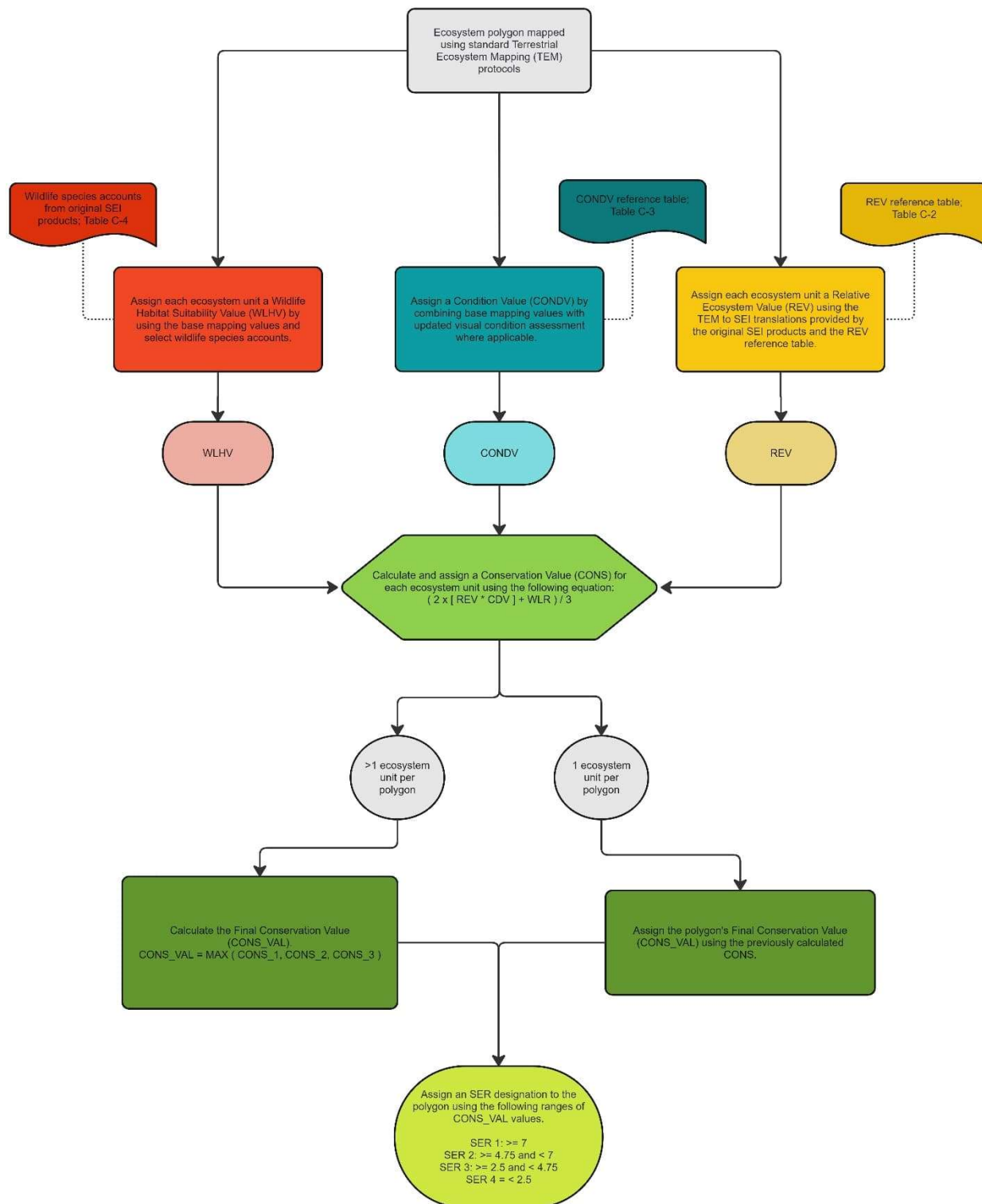


Figure 1. Conservation Value Determination Flowchart

The following change was made to the previous SEI methodology to better encapsulate the increasingly significant role natural ecosystems, regardless of their sensitivity metrics, play in mitigating the impacts of climate change and maintaining ecosystem functionality and connectivity. The change was to increase the REV of natural ecosystems not defined as Sensitive or Important by the previously established SEI framework (i.e., Not Sensitive). Where previously valued at 0 out of 10, they are now valued as 2 or 3 out of 10, depending on the ecosystem. Additionally, with the context of climate change and meeting the goals of the City's Climate Action Plan (2021), the REVs of Mature Forest categories were increased from 2 to 4 and from 3 to 5, respectively, due to its important role in capturing and storing carbon.

As previously completed for the Okanagan SEI projects, the Final Conservation Value (CONS_VAL) for each ecosystem polygon was calculated using a conservative method to support greater consideration and protection for higher-value ecosystems. This calculation method involves assigning the CONS_VAL to the polygon using the highest CONS of the three possible ecosystem components:

$$\text{CONS_VAL} = \text{MAX}(\text{CONS_1}, \text{CONS_2}, \text{CONS_3})$$

The next change applied to the previous methodology was to expand the Sensitive Ecosystem Rankings to a four-class system instead of a three-class so that it better aligns with the ESA mapping used by Qualified Environmental Professionals (QEPs) in other Okanagan municipalities, thereby fostering greater consistency and efficiency across jurisdictional boundaries. A greater number of SER classes also allows for more flexibility when managing and developing policies for these areas. The SER is a product of classifying the CONS_VAL for each ecosystem polygon and is broken into four classes:

- SER 1 = Very High Conservation Value (7.00 to 10.00)
- SER 2 = High Conservation Value (4.75 to 6.99)
- SER 3 = Moderate Conservation Value (2.50 to 4.74)
- SER 4 = Low Conservation Value (0.00 to 2.49)

The resultant SER map (Figure B-2 in Appendix B) is the primary basis for the new Natural Environment DPA map.

Qualitative and quantitative quality assurance and quality control measures were regularly employed to ensure the integrity of the dataset throughout the different phases of spatial and tabular changes.

The ESA data and map have scale and temporal limitations that should be considered when interpreting the results.

2.2. Aquatic and Riparian Area Mapping Methods

Watercourses, wetlands, and riparian areas are important natural features with numerous ecological and social benefits. These features require management and protection within the City's boundaries and often have provincial legislation guiding the activities that may occur around them. An inventory of confirmed and potential aquatic resources was mapped using the data sources outlined below and in Table C-1 (Appendix C). Resources include streams, Drainage Infrastructure Prioritization Plan (DIPP) overland flow lines, ponded and open water, lakes, wetlands and wet areas, and riparian ecosystems defined by the SEI. After identifying these features within the City, 30 metre buffers were established around them to ensure that they are identified for assessment and subsequent management to be consistent with the objectives and policies of the City and any applicable BC provincial legislation, such as the Riparian Areas Protection Regulation (RAPR) and Water Sustainability Act (WSA).

Within the SEI data, the Wetland and Riparian classes indicate a high likelihood for aquatic features – though the Riparian class (e.g., black cottonwood association) may be adjacent to an aquatic feature rather than being an aquatic feature (e.g., stream channel). Riparian areas are defined as “ecosystems [that are] identified by the proximity of streams, gullies with ephemeral or permanent creek flow, fringes of lakes and ponds, as well as sites with significant seepage. These systems provide habitat for a wide range of species and hydrologic ecosystem services, including water quality improvements, such as temperature control, pollutant filtration, rainfall water retention and delayed release, and the prevention of stream bank erosion.” (EMA-S, 2008, p. 19). Both Wetland and Riparian classes, regardless of a confirmed presence of water, require a form of environmental assessment and further management considerations.

Several data layers were used for mapping linear aquatic features: the City's stream and DIPP overland flow lines, the provincial Freshwater Atlas, and the Sensitive Habitat Inventory and Mapping (SHIM) top-of-bank lines. In locations where multiple layers were coincident, the linework that best represented the feature seen in the imagery was used. Linear aquatic features were included if they have the potential to carry water or if they are hydraulically connected, even intermittently, to an existing watercourse or water body.

Another resource used to identify potential aquatic areas was the DIPP depression mapping provided by the City, which analyzed LiDAR data to identify low points on the landscape. Several small, isolated pockets were identified and subsequently filtered only to include features larger than 10 m², as smaller features identified below that threshold were more likely to be noise in the data than actual features on the landscape that warranted investigation. Each feature was visually inspected against aerial imagery to ascertain if it holds water or has the potential to seasonally or during heavy precipitation or flood events. The Predictive Wetland Model in development by the OCCP and

Thompson-Nicola Conservation Collaborative (TNCC) was also used as a supplementary piece for assessing the likelihood of a wetland occurring in a previously unmapped location (2024). Many unmapped wetlands and wet areas were identified and confirmed through this process.

Lake foreshore assessment areas were included using a 30 m setback from the high water line (343 m asl) for Okanagan Lake.

Where aquatic assessment area buffers overlapped, the most conservative boundary (i.e., furthest from an aquatic feature) was kept. These combined buffered riparian and aquatic features form the basis of the new Aquatic DPA map.

2.3. Environmental Development Permit Area Updates

The two EDPAs recommended for adoption by the City are the Natural Environment Development Permit Area and the Aquatic Development Permit Area. Individual maps for both of these development permit areas (DPAs) will be incorporated into the OCP, as per the Local Government Act requirements, but they are consolidated into a single map for efficient civic communication with property owners and developers to inform when a QEP will have to be engaged in the development process (Appendix B, Figure B-3). The purpose of adopting these updated DPAs is to protect natural ecological systems and processes, improve climate resiliency, protect wildlife species and their habitats, and protect development from hazardous natural conditions. Unless exempted, a development permit acknowledging and adhering to the requirements of the applicable EDPAs must be approved prior to:

- Subdividing land;
- Constructing, altering, or adding to a building or structure; and/or,
- Modifying the form of the land, including but not limited to grading, clearing, services construction, road building, trail building, and blasting.

As a result of the environmental sensitivity mapping and aquatic and riparian area mapping, the current DPAs should be moulded to meet the recommendations presented by this study within the scope of the OCP update. The Natural Environment DPA should provide a set of development regulations for works being proposed on or near ESAs. Likewise, the Aquatic DPA should provide a greater catchment area and regulatory foothold for protecting aquatic resources and riparian habitats as well as development from hazardous environmental conditions. Both EDPAs, supported by the updated SEI and ecological connectivity corridor data layers, can be used as high-level tools for planners and developers to broadly decide on the least impactful areas to develop and the most valuable areas to protect.

Successful implementation of the updated Natural Environment DPA and Aquatic DPA requires professional reports submitted with DP applications that adhere to clearly defined

guidelines set out in a Terms of Reference for Professional Reports that align with and improve upon those found in neighbouring municipalities.

2.3.1 Natural Environment Development Permit Area

The recommended Natural Environment DPA (included within Figure B-3, Appendix B) was defined using a subset of the updated ESA mapping data as detailed in Section 2.1. The subset includes ecosystem polygons that have an SER of Very High (1), High (2), or Moderate (3). This subset was chosen because it captures a variety of important ecosystem communities ranging from bulrush marshes in a forest matrix in the Very High class, to ponderosa pine forests with light recreational trails on south-facing slopes and rocky ridgelines critical for wildlife movement in the High class, to disturbed grasslands with historic livestock grazing and undisturbed mature forests that sequester large amounts of carbon in the Moderate class. Ecosystem polygons with SER of Low (4) are deemed as having low potential environmental value and are generally considered suitable for alteration without the involvement of a QEP. However, proposed developments along the updated ecological connectivity corridors, detailed in Section 3.0, regardless of whether the ecosystems are SER 4, should be provided additional environmental management considerations. Also included in the Natural Environment DPA by City request are all parks within the City limits.

Objectives of the Natural Environment DPA:

- To ensure identification and protection of sensitive environments;
- To promote and support land use that prioritizes the conservation of rare and at-risk ecosystems;
- To protect the ecological characteristics and socioeconomic benefits prevalent in all environmentally sensitive areas;
- To preserve environmentally sensitive areas in a mostly natural condition while accommodating land use that meets larger community needs;
- To carefully plan land development and new subdivisions in ways that protect and connect environmentally sensitive areas;
- To protect environmentally sensitive areas by establishing buffer zones; and,
- To identify viable habitat corridors that connect core conservation areas and critical habitats.

For any proposed land use change within the Natural Environment DPA, a site visit by a QEP is strongly recommended before finalizing any land use decisions.

2.3.2 Aquatic Development Permit Area

The recommended Aquatic DPA (included within Figure B-3, Appendix B) was composed of areas that have or potentially have aquatic habitat within which an assessment by a QEP

needs to be undertaken to confirm the presence or absence of any aquatic habitat and to make recommendations in support of the management of those areas laid out in the OCP. These potential areas were established through the process detailed in Section 2.2. To define the updated Aquatic DPA map, all identified potential aquatic habitats were given a 30 metre buffer, such that any proposed works within those areas will require investigation by a QEP.

Objectives of the Aquatic DPA:

- To include areas potentially under provincial legislation surrounding aquatic environments, specifically the RAPR and the WSA;
- To ensure identification and protection of aquatic environments;
- To protect, restore, and enhance riparian and wetland ecosystems to maintain their ecosystem functions and capacity for housing wildlife;
- To protect, restore, and enhance habitat corridors to maintain ecological integrity, biodiversity, and sustainable ecosystem functioning across the landscape;
- To protect fish populations and fish habitat;
- To protect and improve water quality and quantity;
- To safeguard the ecological characteristics and socioeconomic benefits prevalent in all environmentally sensitive areas;
- To protect natural hydrological processes; and,
- To protect development from water-related natural hazards, such as flooding.

The Aquatic DPA includes watercourses that may be defined as a 'stream' under the provincial Water Sustainability Act (WSA). The WSA was brought into force in 2016 and was last updated in 2020. It includes a definition of a stream and how to go about changes in and about a stream:

"stream" means

(a) a natural watercourse, including a natural glacier course, or a natural body of water, whether or not the stream channel of the stream has been modified, or

(b) a natural source of water supply,

including, without limitation, a lake, pond, river, creek, spring, ravine, gulch, wetland or glacier, whether or not usually containing water, including ice, but does not include an aquifer;

Changes in and about a stream

11 (1) On application in accordance with section 12, the comptroller, a water manager or an engineer may issue an approval authorizing any of the following persons to make changes in and about a stream:

(a) the government of British Columbia or Canada;

(b) another person.

(2) Changes in and about a stream may only be made in accordance with

(a) the terms and conditions of a change approval,

(b) the regulations,

(c) the terms and conditions of an authorization, or

(d) an order.

There are several ravines and/or gullies within DD3 that do not usually contain water but are likely to be defined as a stream under the WSA due to the feature's connection to a higher-elevation water source. Any work within these streams (e.g., road crossing, filling in for agriculture, etc.) will likely require a Change/Notification approval from the province. Retention of these drainage features is increasingly important given the increased potential for extreme precipitation events, flash floods, and rapid snowmelt under the likely projected climatic scenarios (City of Vernon Climate Action Plan 2021).

The Aquatic DPA also includes wetlands. Protection of all remaining wetlands, both intermittent and permanent, in the Okanagan is vital and increasingly a greater priority, with hotter, drier, and longer summers projected for the future. Although EDPAs do not typically apply to agricultural activities, the City has a vital role to play in educating farmers about environmental best management practices and the importance of farming with an ecological lens.

3.0 ECOLOGICAL CONNECTIVITY CORRIDOR MAPPING UPDATE

BC's Okanagan basin is of great ecological significance due to its high biodiversity and that it is home to many rare and endangered ecosystems, flora, and fauna. The City provides potential habitat for up to 170 provincially red- or blue-listed species, according to a BC Conservation Data Centre search, and has been identified as a national priority area for ecological corridors (NPAECs) by Parks Canada. Due to the presence of large natural and artificial barriers, the City is viewed as an important bottleneck for both north-south and east-west connectivity, especially regarding the nationally rare, low-elevation, semi-arid ecosystems and their endemic species. Many of the remaining ecological connections and sensitive ecosystems are rare and at risk of further fragmentation due to development. With this increasingly disparate ecological network, particularly through the valley bottom,

it is paramount to identify and protect key connections between and across the remaining environmentally sensitive areas, critical habitats, and migratory pathways.

Ecological corridors are the primary conservation method in landscapes where natural environmental processes and anthropogenic land uses compete. If designed with respect to the biological requirements and sufficiently supported by society and policymakers, these corridors can become extremely valuable pieces in the landscape's ecological network and substantially benefit society.

Corridors are implemented to protect biodiversity, retain connectivity between highly valuable natural areas, provide avenues for genetic flow and diversity within species, protect wildlife movement pathways, improve climate resiliency, and protect ecosystem services, all of which have positive trickle-down effects on societal health and wellbeing (Cushman et al., 2013; Huang et al., 2020; IUCN, 2020; Parrott et al., 2019; Rudnick et al., 2012). Effective corridors should prioritize conservation, restoration, and stewardship efforts that increase the amount of park and conservation area within the corridor, reduce edge effects, enhance native vegetation, construct wildlife crossings, and remove barriers to aquatic and terrestrial wildlife movement (Beier, 2012; Environmental Law Institute, 2003; Latimer & Peatt, 2014). Successful implementation involves collaboration among various stakeholders, including governments, First Nations, NGOs, local communities, and scientists (Greenaway et al., 2019; Huang et al., 2020; IUCN, 2020; Latimer & Peatt, 2014; Parrott et al., 2019; Rudnick et al., 2012).

Ecoscape expanded upon the previously mapped corridors in the region and developed an updated ecological connectivity network that connects core habitat areas within and across the City (Figure B-4 in Appendix B). This updated corridor network considers the updated SEI data – prioritizing SER 1 and 2 areas, the Biodiversity Conservation Strategy habitat connectivity data – prioritizing High and Moderate connectivity areas, the previously mapped regional SEI corridor lines and polygons, and a landscape level wildlife movement probability model utilized by Parks Canada (Parks Canada, 2024; Pither et al., 2023). Corridor lines cross both natural and developed land areas, and successful connections will require conservation and enhancement efforts in both areas, which may include creating covenants on privately owned natural areas, restoration of agricultural land, land acquisitions, and strategically located green infrastructure through developed areas.

The ecological connectivity corridor mapping deliverable (Figure B-4, Appendix B) seeks to guide management solutions and conservation priorities, such as covenants on private land, restoration and reforestation of agricultural land, land acquisitions, green infrastructure prioritization, and more. However, it does not form a distinct DPA map.

4.0 RECOMMENDATIONS

Recognizing and protecting environmentally sensitive areas early in community planning provides the best chance of safeguarding environmental values (Iverson, 2002). The updated mapping provides a current snapshot of natural terrestrial and aquatic ecosystems. The City can use this information to guide and set sustainability objectives, beyond updating EDPAs. For example:

- Adapting to climate change (e.g., carbon sequestration, combating urban heat island effect);
- Create lasting partnerships with First Nations while working towards a common goal;
- Developing a green infrastructure network;
- Formally recognizing and prioritizing important wildlife movement corridors;
- Reducing flood risk and improving groundwater and stormwater management (e.g., permeable surfaces, rainwater collection/infiltration, protect intermittent aquatic features);
- Enhancing biodiversity (e.g., significant habitat, landscape connectivity, etc.);
- Providing new and/or improved outdoor recreation and wildlife viewing opportunities (e.g., greenways, parks, trails, wildlife sanctuaries);
- Supporting community mental and physical health (e.g., access to/views of nature);
- Preserving the socioeconomic benefits derived from the aesthetic value of the natural landscape;
- Increasing local food production (e.g., natural pollinators, fruit trees, etc.); and,
- Developing a culture of sustainability and stewardship within the community through education and exposure to nature.

The environmental development permit process has been implemented across the Okanagan Valley since the early 2000s with varied levels of success. It has effectively protected aquatic features such as streams and wetlands. It has been less effective at protecting terrestrial ecosystems (Pedersen et al., 2024). Even when developments are carefully planned to avoid high-value environmental features, there are still negative indirect impacts from road mortality, habitat fragmentation, edge effects, spread of invasive species, and loss of ecosystem function. These indirect effects become increasingly influential when they occur cumulatively across the landscape and are not effectively accounted for and considered.

The City has two areas (Commonage and Bella Vista) within DD3, largely comprised of intact, natural ecosystems. They provide essential habitat for species at risk and represent a unique mosaic of grasslands, sparsely vegetated areas, broadleaf woodlands often

associated with gully features, and woodlands. These largely contiguous natural areas provide the City with an opportunity to lead in safeguarding unique wildlife habitats and preserving natural lands for its residents to enjoy. The most effective way to protect these environmentally sensitive areas is to work with First Nations, regional, provincial, and federal partners to strategically secure contiguous swaths of land for long-term conservation and the enjoyment of residents and visitors.

There are a number of recommendations below that identify potential partners to secure land for conservation. It is our professional opinion that the Commonage and Bella Vista areas warrant a higher level of protection than what would be achieved solely through the environmental DP process.

5.1 Environmentally Sensitive Area Planning and Management

Objective: Recognize and safeguard sensitive natural areas early in the community and neighbourhood planning process to most effectively protect environmental values. Where development has already occurred, conserve, restore, and expand important connectivity corridors to improve habitat function.

Table 1. Natural Environment DPA Recommendations

#	Management Recommendation	Priority H: < 2 yrs; M: 2-5 yrs; L: > 5 yrs
1.1	Update the OCP and other planning documents to include the recommended Natural Environment Development Permit Area.	H
1.2	Consider updating the Natural Environment DPA to reflect traditional ecological knowledge.	H
1.3	<p>Ensure Natural Environment DPA guidelines support ESA management and ensure future development recognizes and is compatible with the City's environmental objectives:</p> <ul style="list-style-type: none"> ▪ Create a Natural Environmental Development Permit Area designation to manage and protect environmentally sensitive areas. Properties either wholly or partly within the Natural Environment DPA should be required to follow DPA provisions and/or guidelines where relevant; ▪ Development proposed within a Natural Development DPA will require an assessment by a QEP to evaluate the environmental sensitivity of the property and to make recommendations to minimize the environmental impacts of the development. ▪ The EMA-S should be updated to include the newly mapped Natural Environment DPA and to update the requirements for professional reports (see Table 3). ▪ Development within areas with a SER of 1 (Very High) should be prohibited and it should be highly discouraged in areas with a SER of 2 (High). ▪ Strict development controls should be established for SER 1 and 2, with a focus on maintaining and/or improving ecological connectivity and function; ▪ Locate and design development in DPAs to protect, complement, and enhance ESA values, including natural areas, landforms, and hydrological function; ▪ Locate development away from sensitive habitat and features; ▪ Require habitat compensation at minimum 3:1 and 2:1 replacement levels for SER 1 and 2, respectively, and develop a cash-in-lieu mechanism for any development impacting these areas. 	H
1.4	The updated corridor network (Figure B-4) should be incorporated into the EMA-S and GIS data made available for QEPs to evaluate how proposed developments impact the broader ecological corridors within and beyond the City boundaries.	H
1.5	Prioritize restoration and enhancement of the highest value SERs (1 & 2).	ongoing
1.6	Encourage natural buffers to be established around SER 1 and 2 to minimize edge effects of development.	ongoing
1.7	Continue to work in partnership with private developers to protect SERs 1 & 2, through the application of land use controls such as restrictive covenants and easements.	ongoing

Table 2. Aquatic DPA Recommendations

#	Management Recommendation	Priority H: < 2 yrs; M: 2-5 yrs; L: > 5 yrs
2.1	Update the OCP and other planning documents to include the recommended Aquatic Development Permit Area.	H
2.2	To ensure a standard that meets or beats RAPR, work with the province (RAPR office) and/or others to determine minimum riparian setbacks for BX and Vernon creeks. The minimum setbacks are likely to vary across the development districts based on existing urban density. Include riparian setbacks and development guidelines in the OCP to streamline the permitting process.	H
2.3	Consider updating the Aquatic DPA to reflect traditional ecological knowledge.	H
2.4	A net-gain approach for riparian areas should be mandated to improve the restoration of riparian areas and minimize the potential for flooding. Incentives (e.g., increased housing density) and flexibility (e.g., development variances) could be allowed to encourage buy-in from the development community.	M
2.5	Prioritize restoration, widening, and riparian enhancement plans for BX Creek and Lower Vernon Creek. During redevelopment, work with landowners to restore riparian management areas (RMAs) that have been encroached on and/or lost. Incentives could include tax breaks and/or increased density allotments.	M
2.6	At the time of redevelopment, grandfathering provisions for structures within the RMAs should be excluded, to align with the goal of re-establishing functional riparian corridors and fish habitat through DD1 and DD2.	M
2.7	Investigate an open drainage and daylighting policy for sections of BX Creek that are piped beneath the City.	M
2.8	In cases where the prescribed setbacks are disputed, riparian setbacks should be determined by a QEP in accordance with the RAPR methodology. Wider setbacks may be required if the QEP determines geotechnical, windthrow, flooding, or other environmental concerns warrant expansion.	—

Table 3. General Policy and Management Recommendations for Environmentally Sensitive Areas

#	Management Recommendation	Priority H: < 2 yrs; M: 2-5 yrs; L: > 5 yrs
3.1	Incorporate recommendations from this Study into relevant City policies, bylaws, and community plans.	H
3.2	Examine how current zoning, future land use designations, and proposed land use density may impact the function and protection of ESAs and ecological corridors. Identify areas of potential conflict and consider adjusting accordingly.	H
3.3	Investigate partnerships and funding opportunities for the protection and enhancement of ESAs, particularly large contiguous areas.	H
3.4	Refine and standardize methods for QEPs to better stratify environmentally sensitive areas (ESA 1-4) to ensure reproducible, quantitative results (already underway by OCCP) and update the EMA-S accordingly.	H
3.5	Refine environmental assessment report requirements so they are both rigorous and user-friendly for municipal planners.	H
3.6	Update the environmental DP process to include regional habitat connectivity objectives and to achieve consistent environmental protection requirements across jurisdictions.	H
3.7	Establish retention targets for sensitive ecosystems based on remaining ecosystems and City development objectives. Monitor progress at regular intervals and implement and enforce regional conservation goals based on the retention of connected terrestrial ecosystems across jurisdictions.	M
3.8	Develop a cost-efficient methodology to assess the cumulative impacts of individual developments at the local and regional scales (already underway by OCCP).	M
3.9	Advocate for and establish mechanisms that could provide Technical and Peer Reviews of Professional Reports.	M
3.10	Provide sufficient resources, including trained staff, to support the protection of ESAs and the appropriate oversight of EDPAs (Natural Environment and Aquatic).	M
3.11	Develop a Sustainable Urban Forest Management Plan to buffer ESAs, combat climate change, support corridors, and improve environmental service provision in urbanized areas.	M
3.12	Develop an Invasive Species Management Plan to manage invasive plants, animals, and insects that are degrading ESAs and urban greenspaces.	L
3.13	Allocate funds and resources to ensure effective environmental monitoring and enforcement.	L
3.14	Investigate implementing stormwater usage fees to encourage reductions in impermeable surfaces.	L
3.15	Review and update SEI and DPA mapping every 5 years to monitor any changes to the landscape and ensure the most up-to-date information is considered in City planning.	L
3.16	Ensure interdepartmental and interagency cooperation to manage ESAs.	ongoing

5.2 Species At Risk

Objective: Prioritize the protection of species at risk to ensure their existence over the long term.

Table 4. Species At Risk Recommendations		
#	Management Recommendation	Priority H: < 2 yrs; M: 2-5 yrs; L: > 5 yrs
4.1	Work with initiatives and organizations such as the BC Parks Foundation, the BC Watershed Security Fund, the 30x30 Tripartite Framework Agreement on Nature Conservation, and local land trusts to acquire land for long-term habitat protection and conservation management.	H
4.2	Highlight the importance and need for a BC Species At Risk Act to better protect species at risk and critical habitat on private land.	H
4.3	Refer to the BC Conservation Framework and other provincial resources for increasing awareness of species at risk and understanding how they utilize different landscape features during their life cycles.	H
4.4	Encourage development to retain habitat connectivity and facilitate seasonal and daily movements of wildlife in and out of areas while reducing the risk of wildlife mortality.	H
4.5	Incentivize the conservation of species and critical habitats/features on private land. This could be accomplished with property tax reductions and/or conservation covenants.	M
4.6	Work with other jurisdictions and regional partners to develop indicators to monitor ecological health and changes to ecosystems that support species at risk over time.	M
4.7	Educate the public by adding information on local species at risk on the City website and highlight successful conservation partnerships.	M
4.8	Prioritize the conservation of large contiguous areas with interconnected, varied habitat types, to best protect species at risk.	M
4.9	Require that species at risk information, which is gathered as part of development permit requirements, be uploaded to the B.C. Conservation Data Centre.	M
4.10	Support the naturalization of manicured City parks in certain low-use areas to improve ecological function/connectivity and additional wildlife refuge areas.	L

5.3 Climate Change and Connectivity Corridors

Objective: Incorporate adaptive management, restoration initiatives, and targeted land acquisitions to improve ecosystem resilience to projected changes in the climate and retain ecological functions at the landscape level.

Table 5. Climate Resilience and Ecological Connectivity Recommendations

#	Management Recommendation	Priority H: < 2 yrs; M: 2-5 yrs; L: > 5 yrs
5.1	Investigate funding opportunities for ecological corridor and climate change planning.	H
5.2	To mitigate against rising water temperatures in local watercourses, prioritize the planting of native, streamside vegetation that enhances shading, and will provide microhabitat refuge and cover for wildlife well into the future.	H
5.3	Utilize the natural asset inventory to conduct a climate risk assessment and financial valuation.	H
5.4	Collaborate with First Nations, conservation groups, and neighbouring municipalities to develop a Regional Ecological Connectivity Plan for biodiversity conservation and ecological connectivity.	M
5.5	Incorporate the Regional Ecological Connectivity Plan into regional growth strategies, OCPs, master park plans, agricultural plans, and climate action plans to effectively guide land use decisions.	M
5.6	Establish a green infrastructure network (GIN), particularly in DD1 and DD2, that contains natural and manicured greenspaces, as a key part of the larger ecological connectivity network for the City.	M
5.7	Encourage the development of green infrastructure (e.g., bioswales, artificial stormwater wetlands, green roofs) to improve climate resilience and connectivity between ESAs.	M
5.8	Develop landscaping and planting guidelines to ensure trees and vegetation can adapt to projected climate change.	M
5.9	Work with industry partners in carbon offsetting programs as a means to fund ecological restoration and connectivity projects for the City.	L
5.10	Develop and maintain a carbon emission and sequestration monitoring database. Develop guidelines for assessing carbon flux as part of the development permit process.	L
5.11	Recognize Okanagan, Swan and Kalamalka lakes as locally important biodiversity hotspots and maintain ecological connectivity to these areas.	M
5.12	Undertake strategic land acquisitions to facilitate long-term protection of wildlife movement corridors and intermediate habitat.	ongoing
5.13	Continue to work towards the country-wide goal of net-zero emissions by 2050.	ongoing
5.14	Improve and expand the City's recreational trail system with the ecological corridor network.	ongoing

5.4 Community Stewardship, Education and Awareness

Objective: Increase public awareness of the City's sensitive ecosystems and species at risk and support community stewardship initiatives to improve ecological conditions.

Table 6. Community Environmental Stewardship Recommendations		
#	Management Recommendation	Priority H: < 2 yrs; M: 2-5 yrs; L: >5 yrs
6.1	Continue to pursue and support aquatic and riparian areas restoration and enhancement projects on lower Vernon Creek and BX Creek in partnership with First Nations and local stewardship groups. The North Okanagan Conservation Fund and the Natural Infrastructure Fund could be funding sources, and a partner organization might be the Okanagan Similkameen Stewardship Society.	H
6.2	Engage the public through Citizen Science programs, whereby members of the public can report rare or interesting species in their backyards or in public spaces. Potential partners include the Allan Brooks Nature Centre and the Grasslands Conservation Council of BC. Encourage parks staff to also record wildlife observations and make observation data publicly available.	M
6.3	Enhance nature and wildlife viewing opportunities as part of park planning.	M
6.4	Work with local schools to encourage nature awareness and education in the City's unique ecosystems and rare wildlife. Project partners could include the Fresh Outlook Foundation.	M
6.5	Celebrate and promote the protection of wildlife and biodiversity in partnership with local stewardship groups, First Nations, and the public through local, national, and internationally recognized events (e.g., annual Christmas Bird Count, salmon spawning).	M
6.6	Engage with the environmental consulting and conservation community, "Friends" societies, stewardship groups, and higher education facilities to recruit volunteers for labour-intensive restoration efforts and monitoring programs.	L
6.7	Increase education, signage, and enforcement in parks and protected areas to protect sensitive ecosystems and wildlife from disturbance, including off-leash dogs and cats.	L
6.8	Increase public education on City and provincial regulations associated with dumping or polluting the City's watercourses and riparian areas, including potential fines.	L

5.5 Ecological Health on Agricultural Lands

Objective: Work with regional farmers and ranchers to improve and prioritize environmental protection on agricultural lands.

Table 7. Improving Ecological Functions on Agricultural Land Recommendations		
#	Management Recommendation	Priority H: < 2 yrs; M: 2-5 yrs; L: > 5 yrs
7.1	Collaborate with stewardship organizations (e.g., Okanagan Similkameen Stewardship Society) to develop outreach and environmental best management practices for agricultural lands.	H
7.2	Determine the opportunity for and encourage Group Environmental Farm Plans to make the most of shared environmental objectives and funding to enhance environmental values on agricultural lands within the City.	M
7.3	Develop incentives for farmers to receive financial support when implementing environmental best practices.	M
7.4	Help educate farmers on applicable carbon offsetting projects that meet the City's climate objectives, such as reforestation, regenerative agriculture, grassland restoration, agroforestry, etc.	M
7.5	Prioritize invasive species management to protect biodiversity and fragile grassland ecosystems.	L

5.0 CLOSURE

The purpose of this study was to provide updated maps, spatial data, and recommendations pertaining to environmentally sensitive areas within the City. Specific objectives included an update of the Natural Environment DPA and Aquatic DPA with recommendations that could be incorporated into future updates of the OCP, the EMA-S, supplementing the Climate Action Plan, and other policies aimed at the protection of natural resources.

The newly created DPAs and recommendations should be implemented wherever possible to help protect ESAs. The City should examine how current zoning and future land use designations overlap with the EDPAs and the ecological corridor network to identify and alleviate areas of potential conflict. Development should avoid SER 1 (Very High value) and SER 2 (High value), and instead be focused in less environmentally sensitive locations. Strict development controls should be established for SER 1 and SER 2, as well as habitat compensation at minimum 3:1 and 2:1 replacement levels, respectively, and the establishment of a cash-in-lieu mechanism, for when there is not an opportunity for on-site compensation.

It is recommended that ecological connectivity corridor mapping be used by the City and QEPs to better evaluate how proposed developments impact existing ecological corridors at both the local and regional scales.

Recognizing and protecting environmentally sensitive areas early in the community planning process provides the best chance of safeguarding environmental values. These works are an important initial step. We trust that this report satisfies the present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Respectfully Submitted

Ecoscope Environmental Consultants Ltd.,



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Environmental Scientist / GIS Technologist

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APPENDIX A: General Terms and Conditions



Terms and Conditions

General

This agreement shall be binding on the Client and Ecoscape Environmental Consultants Ltd. (Ecoscape) unless the Client provides written notice to Ecoscape within five (5) business days from the date of issuance it rejects any part of this agreement. Ecoscape, may at its sole discretion and at any stage engage sub consultants to perform all or any part of the Services.

Scope of Work

The scope of work for services has been agreed upon in the proposal and within the Letter of Agency.

Compensation and Payment Terms

Charges for the Services rendered will be made in accordance with Ecoscape's Schedule of Fees and Disbursements in effect from time to time as the Services are rendered. All Charges will be payable in Canadian Dollars. Invoices will be due and payable by the Client within thirty (30) days of the date of the invoice without hold back. Interest on overdue accounts is 12% per annum.

Termination

Either party may terminate this engagement without cause upon thirty (30) days' notice in writing. On termination by either party under this paragraph, the Client shall forthwith pay Ecoscape its Charges for the Services performed, including all expenses and other charges incurred by Ecoscape for this Project. If either party breaches this engagement, the non-defaulting party may terminate this engagement after giving seven (7) days' notice to remedy the breach. On termination by Ecoscape under this paragraph, the Client shall forthwith pay to Ecoscape its Charges for the Services performed to the date of termination, including all fees and charges for this Project. On termination by either party, Ecoscape will cancel any application processes that have been initiated with relevant agencies regardless of the status of the application. Reliance on any reports, files, or other information provided by Ecoscape to the client or relevant agencies (Municipal, First Nations, Provincial, or Federal), either under separate Contract or under the terms of our Agency representing the client, cannot be transferred to any other party, including relevant Provincial Agencies, without our express written agreement.

Professional Standards

In the performance of professional services, Ecoscape will use the degree of care and skill ordinarily exercised, conforming to recognized standards, and upholding professional ethics founded upon integrity, competence, and a responsibility to provide sound management and conservation of biological resources and legislated requirements at all levels of government. Ecoscape reserves the right to report occurrences of rare and endangered species resulting from inventories and incidental observations to the Conservation Data Centre or relevant Municipal, Provincial, or Federal authority. The client shall be responsible for presenting any and all information necessary for Ecoscape to undertake and adhere to professional standards. Ecoscape is not responsible and will bear no liability, whatsoever, for failure to provide or disclose any information, relevant to an application process, the subject property, Client, or otherwise. Further, Ecoscape reserves the right to determine whether information is relevant, and through signature on this agreement, the Client agrees that all relevant information pertaining to the Client, Property, Application Process, or otherwise has been disclosed and provided to Ecoscape in writing. The Client acknowledges that Ecoscape may be required by law to disclose information to regulatory agencies and hereby consents to such disclosure of information provided to relevant regulatory agencies, unless agreed to in writing.

Environmental, Site Information and Disclosure

The client agrees to fully cooperate with Ecoscape with respect to the provision of all available information on the past, present, and proposed conditions of the site. The Client acknowledges that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information. The Client acknowledges that Ecoscape will be required to provide any information requested to relevant agencies as required, and the Client must notify Ecoscape in writing of any information that is considered confidential. Ecoscape will not be responsible or liable for providing requested information to a relevant Municipal, Provincial, or Federal authority that the Client fails to notify Ecoscape in writing is confidential or for the viewing of Ecoscape only. Ecoscape's field investigations and recommendations will not address or evaluate pollution of aquatic resources, water, soil or groundwater unless we are specifically retained to provide such services. Ecoscape will co-operate with the Client's consultant(s) and any relevant regulatory Agencies, whether Municipal, Provincial, during the investigations as required, but reserves the right to amend scope to include such services if required.



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Limitation of Liability

Ecoscape shall not be responsible or liable for:

1. the failure of a contractor, retained by the Client, to perform the work required in the Project in accordance with the applicable contract documents or recommendations made in reports or in the field by Ecoscape;
2. the design of or defects in equipment supplied or provided by the Client for incorporation into the Project including any relevant construction drawings or designs, or information provided by any other third party such as a designer or consultant;
3. any Project decisions made by the Client without the advice of Ecoscape or contrary to or inconsistent with Ecoscape's advice;
4. any consequential loss, injury or damages suffered by the Client, including but not limited to loss of use, earnings and business interruption;
5. the unauthorized distribution of any confidential document or report prepared by or on behalf of Ecoscape for the exclusive use of the Client.

The total amount of all claims the Client may have against Ecoscape under this engagement, including but not limited to claims for negligence, negligent misrepresentation and breach of contract, shall be strictly limited to \$5,000.00. Only if specifically agreed to in writing by Ecoscape would this be revised to a specific amount of professional liability insurance Ecoscape may have available at the time such claims are made. In the event that Ecoscape is not carrying professional liability insurance at the time of a claim, the total amount payable would be \$0 under either circumstance.

No claim may be brought against Ecoscape in contract or tort more than two (2) years after the Services were completed or terminated under this engagement.

Personal Liability

For the purposes of the limitation of liability provisions contained in the Agreement of the parties herein, the Client expressly agrees that it has entered into this Agreement with Ecoscape, both on its own behalf and or acting as an agent on behalf of another party, its employees and/or principals. The Client expressly agrees that Ecoscape's employees and principals shall have no personal liability to the Client in respect of a claim, whether in contract, tort and/or any other cause of action in law. Accordingly, the Client expressly agrees that it will bring no proceedings and take no action in any court of law against any of Ecoscape's employees or principals in their personal capacity.

Third Party Liability

Any reports or information provided by Ecoscape as an agent was prepared by Ecoscape for the account of the Client. The material in it reflects the judgment and opinion of Ecoscape in light of the information available or provided to Ecoscape at the time of preparation. Any use of reports or information provided by Ecoscape to the Client cannot be provided to another party without our expressed, written permission. Any use or reliance upon reports or information provided Ecoscape, for which reliance has not been provided by Ecoscape, is the responsibility of the third party using or relying upon that information and Ecoscape cannot be held responsible or liable for any decisions to be made based on it. Ecoscape accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report or information provided to regulatory authorities in carrying out these services. This report may not be used or relied upon by any other person unless that person is specifically named by us as a beneficiary of the Report. The Client agrees to maintain the confidentiality of the Report and reasonably protect the report from distribution to any other person.

Documents

All of the documents or information prepared by Ecoscape or on behalf of Ecoscape in connection with the Project are instruments of service for the execution of the Project. Ecoscape retains the property and copyright in these documents, whether the Project is executed or not. These documents may not be used on any other project without the expressed prior written agreement of Ecoscape.

Field Services





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Where applicable, field services recommended for the Project are the minimum necessary, in the sole discretion of Ecoscape, to carry out in general conformity with the intent of the Services. Field investigations may identify additional field requirements that are required to be undertaken prior to completion of this agreement. Ecoscape will not proceed with additional field works without the express written consent of the Client. If Ecoscape recommends additional field visits and the Client advises these works are not to be undertaken, Ecoscape will be required to prepare written documentation addressing field data collection limitations.

Dispute Resolution

If requested in writing by either the Client or Ecoscape, the Client and Ecoscape shall attempt to resolve any dispute between them arising out of or in connection with this Agreement by entering into structured non-binding negotiations with the assistance of a mediator on a without prejudice basis. The mediator shall be appointed through agreement by all parties. If a dispute cannot be settled within a period of thirty (30) calendar days with the mediator, the dispute shall be referred to and finally resolved by an arbitrator appointed by agreement of all of the parties.

Agreement

This agreement is binding and will ensure to the benefit of the Client and Ecoscape. These conditions form a part of the proposal, with the same effect as if set forth therein. Verbal and email approvals to proceed with work outlined above are subject to the same conditions as this contract.



APPENDIX B: Figures

FIGURE B-2

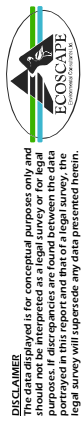
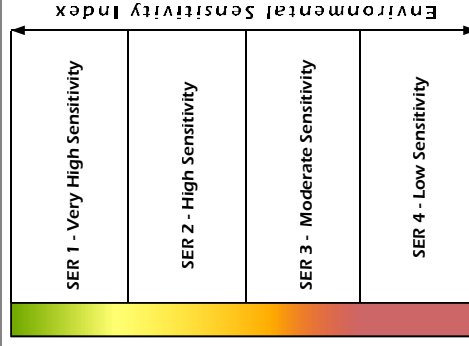
Sensitive Ecosystem Ranking

Project: Environmentally Sensitive Area Mapping
Location: City of Vernon
Project No.: 24-5044
Prepared for: City of Vernon
Prepared by: Dan Austin, GIS Specialist
Ecoscape Environmental Consultants Ltd.
Coordinate System: NAD83-UTM Zone 11N
Imagery: ESRI World Terrain
Map Date: December 20, 2024

LEGEND

- Stream / Watercourse
Highway
Major Roads
City of Vernon Boundary
Sensitive Ecosystem Inventory - SER
Very High (SER 1)
High (SER 2)
Moderate (SER 3)
Low (SER 4)

Environmental Sensitivity Gradient



DISCLAIMER
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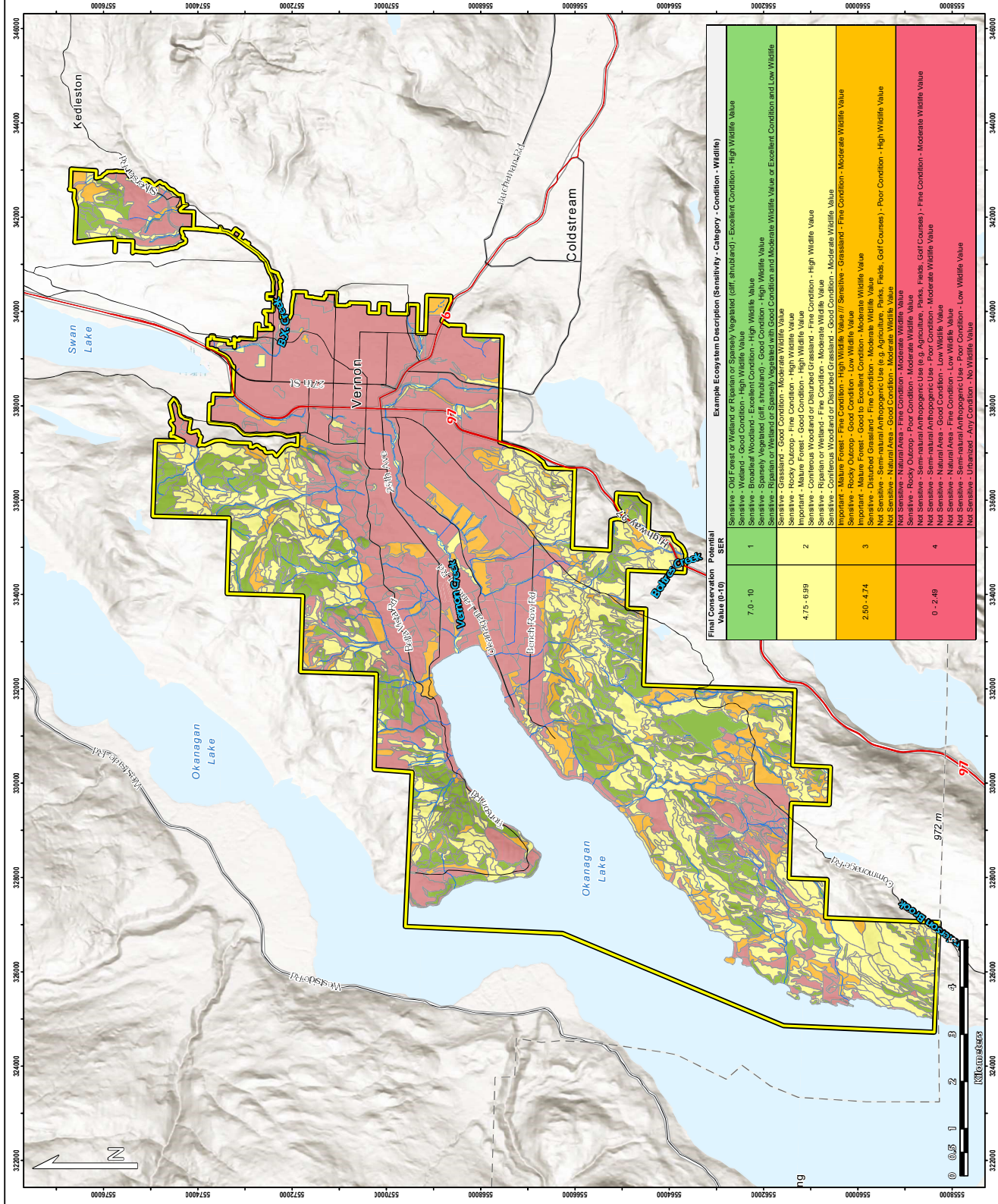


FIGURE B-3

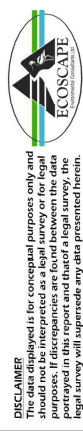
Environmentally Sensitive Area Mapping

Project: Environmentally Sensitive Area Mapping
Location: City of Vernon
Project No.: 245044
Prepared for: City of Vernon
Prepared by: Dan Austin, GIS Specialist
Ecoscape Environmental Consultants Ltd.
Coordinate System: NAD83-UTM Zone 11N
Imagery: ESRI World Terrain
Map Date: January 13, 2025

LEGEND

- Stream / Watercourse
- Highway
- Major Roads
- Proposed Environmental Development Permit Area
- City of Vernon Boundary

Environment Development Permit Area is comprised of all polygons with SER rating 1, 2, and 3 from the weighted SER calculation, all identified potential aquatic and riparian areas, and parks within the City limits.



DISCLAIMER
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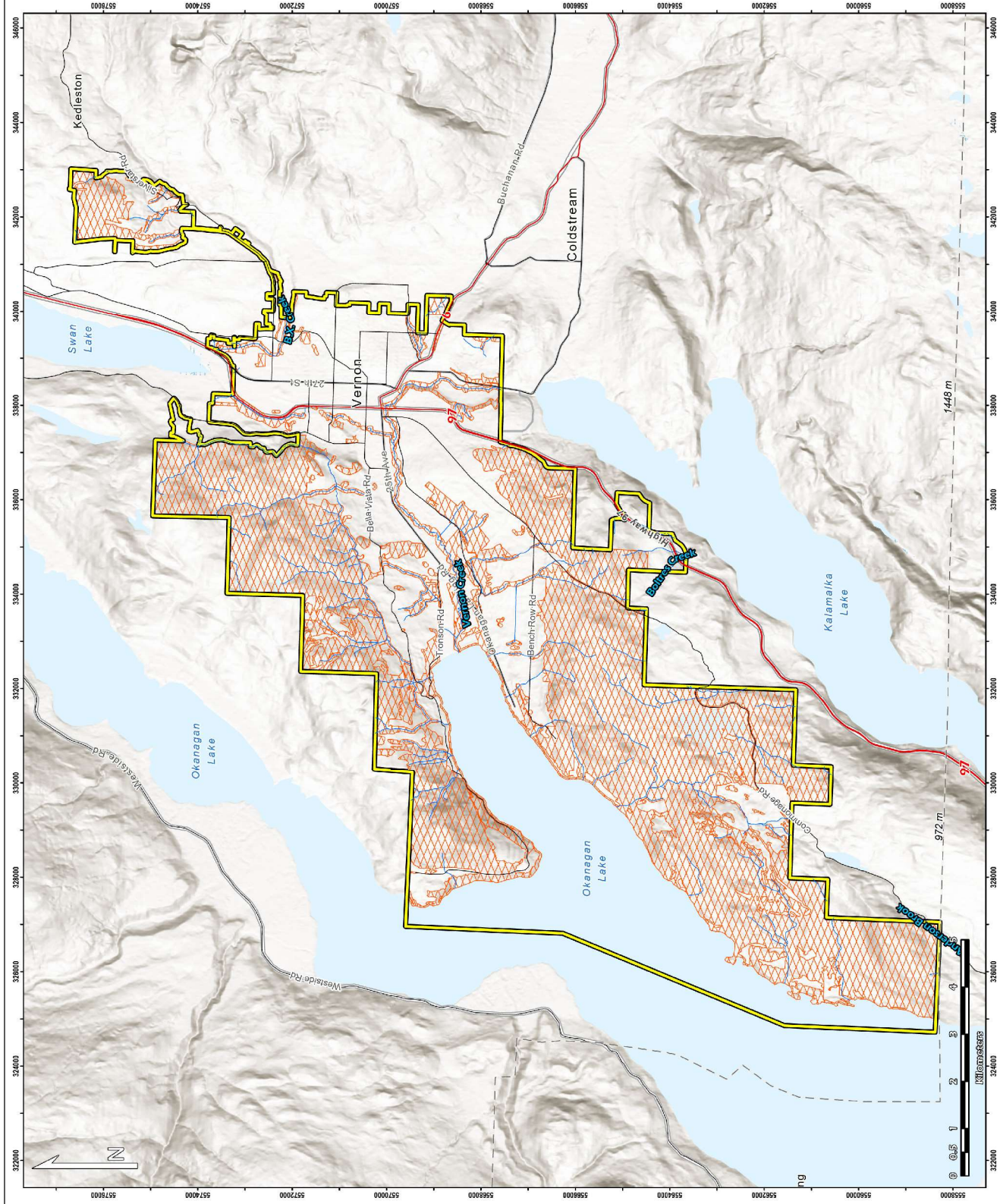








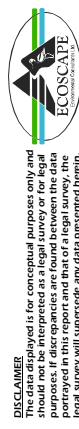
FIGURE B-4

Ecological Connectivity Corridor Network

Project: Environmentally Sensitive Area Mapping
Location: City of Vernon
Project No.: 24-5044
Prepared for: City of Vernon
Prepared by: Shane Pedersen, GIS Technologist
Ecoscape Environmental Consultants Ltd.
Coordinate System: NAD83-UTM Zone 11N
Imagery: ESRI World Terrain
Map Date: December 20, 2024

LEGEND

-  Stream / Watercourse
-  Highway
-  Major Roads
-  Ecological Connectivity Corridor
-  SEI Polygons within 30 m of Ecological Connectivity Corridor Lines
-  City of Vernon Boundary



DISCLAIMER
The data displayed is for conceptual purposes only and should not be interpreted as a legal survey or for legal purposes. If discrepancies are found between the data presented herein and the data presented in a legal survey, the legal survey will supersede any data presented herein.

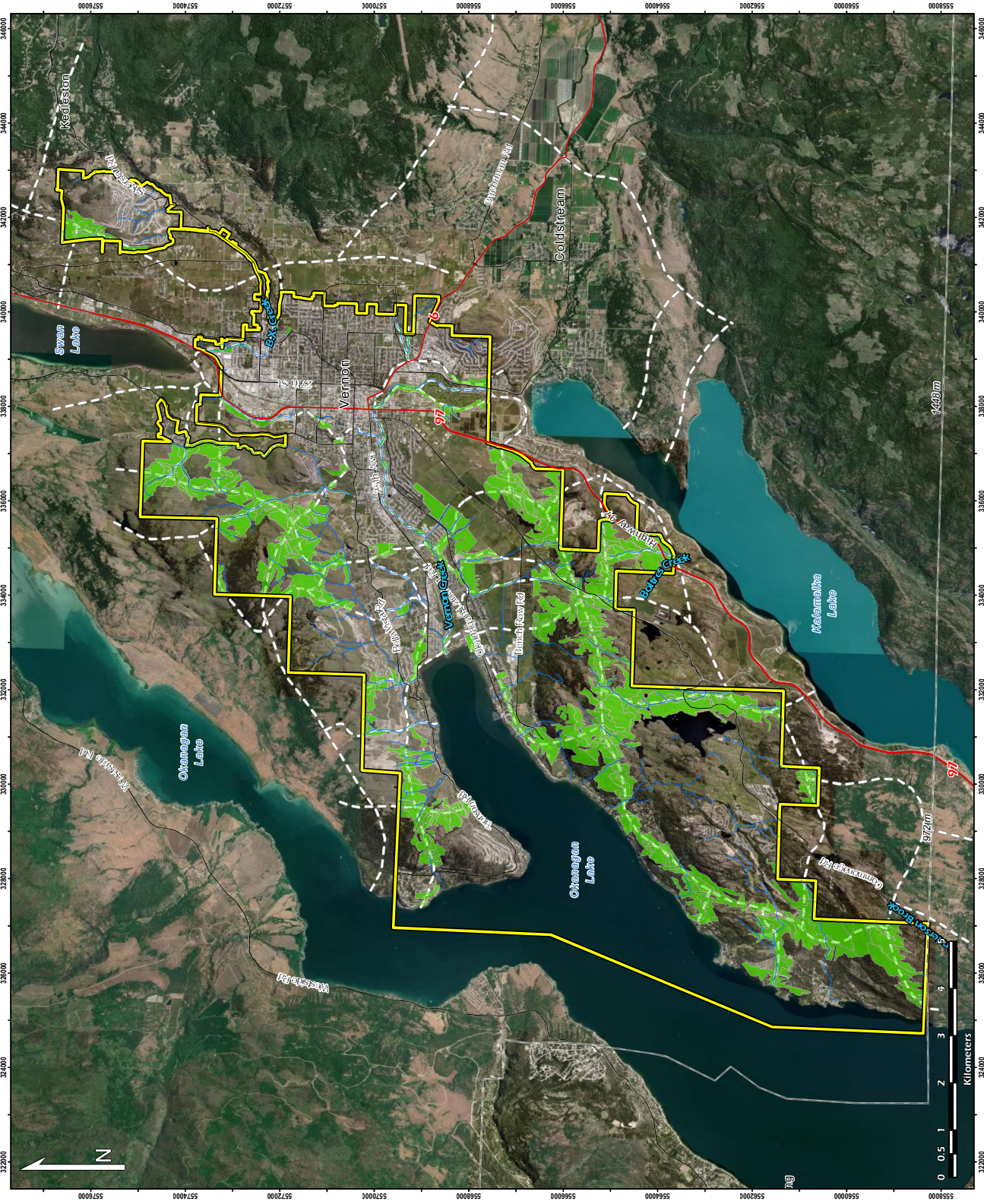


FIGURE B-1

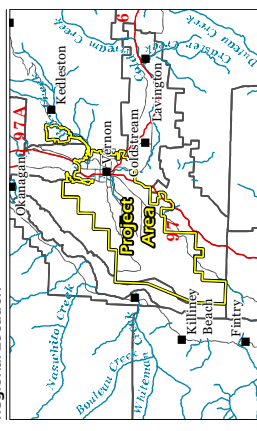
Study Area Overview

Project: Environmentally Sensitive Area Mapping
Location: City of Vernon
Project No.: 24-5044
Prepared for: City of Vernon
Prepared by: Dan Austin, GIS Specialist
Ecoscape Environmental Consultants Ltd.
Coordinate System: NAD83-UTM Zone 11N
Imagery: ESRI World Terrain
Map Date: December 20, 2024

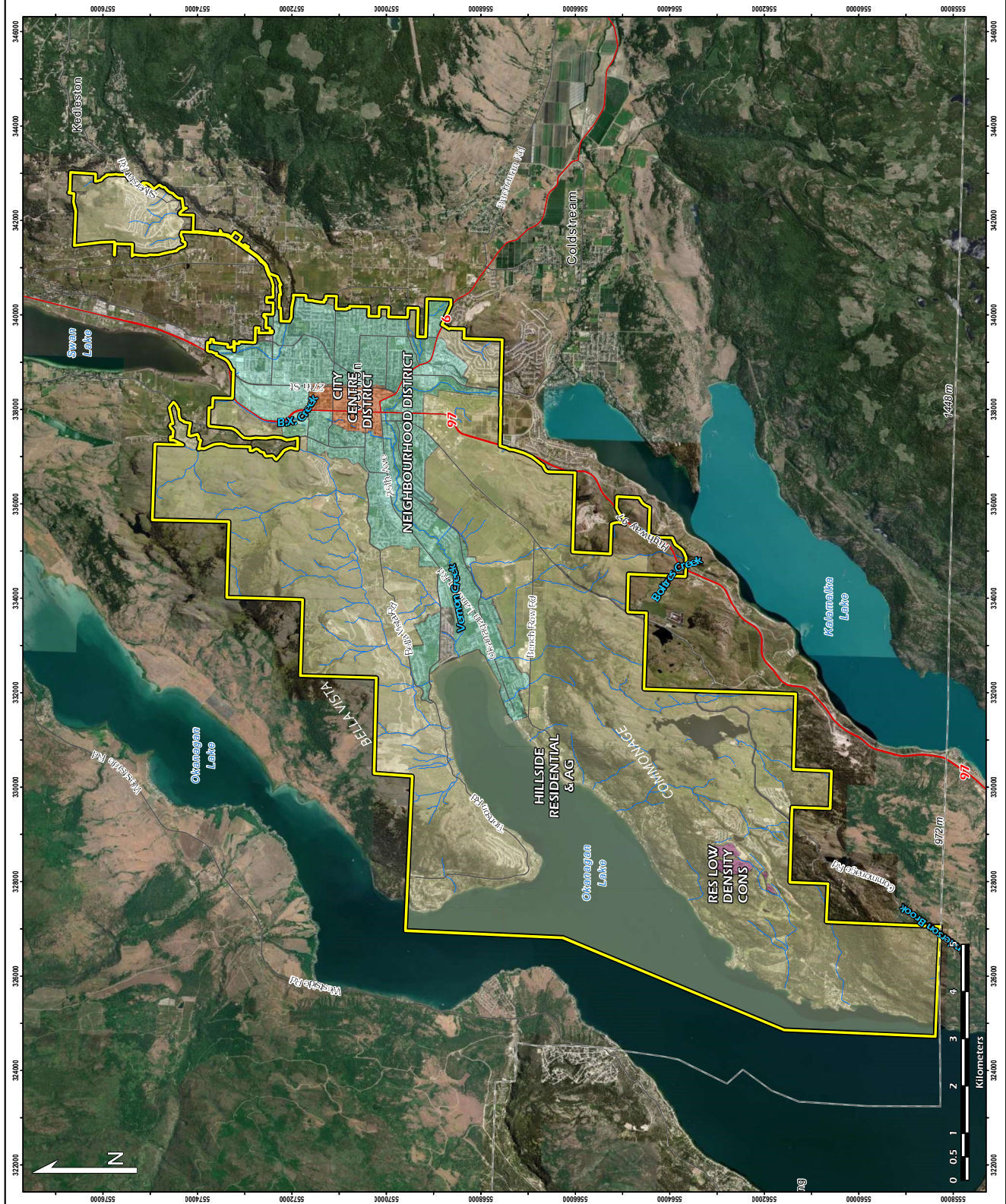
LEGEND

- Stream / Watercourse
- Highway
- Major Roads
- City of Vernon Boundary
- Vernon Development Districts
 - DD1 - CITY CENTRE DISTRICT
 - DD2 - NEIGHBOURHOOD DISTRICT
 - DD3 - HILLSIDE RESIDENTIAL & AG
 - RES LOW DENSITY CONS

Regional Location



DISCLAIMER
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APPENDIX C: Reference Tables

Table C-1. Data sources

Data Layer	Source	Date	Usage
Administrative Boundaries	City of Vernon	2024	Supporting information for landscape context and data display
City of Vernon Parks	City of Vernon	2024	Used to define Park Area DPA
Critical Habitat and CDC Mapped areas	DataBC	2024	Help to identify environmentally sensitive areas
Current Imagery	North Okanagan Regional District, ESRI	2022, 2024	Supporting the mapping and identification of features; change detection
Development Districts	City of Vernon	2024	Supporting information in understanding landscape context
Environmental Management Area Strategy Polygons	City of Vernon	2008, 2012	Base for updating environmentally sensitive areas and DPAs
Historical Imagery	DataBC WMS Server	1997, 2007	Supporting the mapping and identification of features; change detection
Mapped Wetlands	DataBC	2024	Help to identify environmentally sensitive areas and aquatic features
Modelled Flow Lines	Drainage Infrastructure Prioritization Plan, City of Vernon	2019	Help to identify environmentally sensitive areas and aquatic features
Okanagan Wetlands	OBWB, Ecoscape	2017	Help to identify environmentally sensitive areas and aquatic features
Predictive Wetland Mapping (V4 - 18m)	Thompson-Nicola Conservation Collaborative, & Okanagan Collaborative Conservation Program. (2024). Wetland Predictive Modeling data: Wetland maps and data layers.	2024	Help to identify environmentally sensitive areas and aquatic features
Sensitive Ecosystem Inventory	EcoCat: Bella Vista - Goose Lake (2002), Commonage (2005), Vernon - Coldstream (2007), 2012 SER update	2002, 2005, 2007	Base for updating environmentally sensitive areas and DPAs
Stream Habitat Inventory Mapping (SHIM)	OBWB: Vernon Creek (2007), BX Creek (2007), Hog Gulch (2008)	2007, 2007, 2008	Help to identify environmentally sensitive areas and aquatic features
Stream Networks and Aquatic Features	DataBC, municipal sources	Various	Help to identify environmentally sensitive areas and aquatic features
Terrestrial Ecosystem Mapping	Provincial: Bella Vista - Goose Lake (2002), Commonage (2005), Vernon - Coldstream (2007)	2002, 2005, 2007	Base for updating environmentally sensitive areas and DPAs
Topographic and LiDAR	City of Vernon	2018, 2019	Supporting information for ecosystem polygon confirmation and wet areas
Vegetation Resources Inventory (VRI)	DataBC	2024	Aide in species composition and structural stage updating
Wildlife Habitat Suitability Ratings	EcoCat, DataBC	2002, 2005, 2007	Supporting information for the conservation value calculations

Table C-2. SEI Classes and Subclasses with relative valuations and rationales

SEI Class	Class Description	SEFIN Unit (Class:subclass)	SEI Subclass	Relative Ecosystem Value ¹ (REV)	Rationale
Broadleaf Woodland	Ecosystems dominated by trembling aspen include aspen copse ecosystems (BW:ac) occurring in depressions and moist areas in grasslands, and aspen seepage ecosystems (BW:as) occurring on slopes with subsurface moisture in a matrix of coniferous forest; old Broadleaf Woodlands are part of the Old Forest category.	BW:ac	Aspen Copse	7	Sensitive; very rare in study area
		BW:as	Aspen Seepage	7	Sensitive; extremely rare in study area
Grassland	Non-forested ecosystems dominated by bunchgrasses (grassland, GR:gr), grasslands occurring on steep slopes (GR:st), grasslands occurring on steep shallow-soiled slopes (GR:ss), and shrubland (GR:sh) ecosystems that occur in a grassland matrix, or non-native invasive plants with some bunchgrasses (disturbed grassland, GR:dg).	GR:dg	Disturbed Grassland	6	Disturbed but provide values for many grassland species, including rare wildlife; rare in study area
		GR:gr	Grassland	9	Very sensitive and provincially rare; common in study area
		GR:sh	Shrubland	9	Very sensitive and provincially rare; very rare in study area
		GR:ss	Steep Shallow-soiled	9	Very sensitive and provincially rare; extremely rare
		GR:st	Steep	9	Very sensitive and provincially rare; extremely rare
Old Forest	Forest ecosystems dominated by large, old trees that are subdivided by dominant tree type: coniferous (OF:co) forest, mixed (OF:mx) forest, and broadleaf (OF:bd) forest; includes old Coniferous Woodlands, old Broadleaf Woodlands, and old Riparian forests.	OF:co	Coniferous	10	Very sensitive; very important wildlife habitat; very rare
		OF:mx	Mixed	10	Very sensitive; very important wildlife habitat; extremely rare
Riparian	Streamside ecosystems occurring on bench/floodplains (RI:fp) or in gullies with intermittent or permanent creeks (gully, RI:gu) and fringe ecosystems associated with pond and lake shorelines (fringe, RI:ff); also includes river (RI:ri) and beach (RI:be) ecosystems. Old Riparian forest ecosystems are part of the Old Forest category.	RI:be	Beach	10	Very sensitive; very important wildlife habitat; extremely rare in study area
		RI:ff	Fluvial Fringe	10	Very sensitive; very important wildlife habitat; very rare
		RI:fp	Bench / Floodplain	10	Very sensitive; very important wildlife habitat; rare
		RI:gu	Gulley	10	Very sensitive; very important wildlife habitat; rare
		RI:ri	River	10	Very sensitive; important wildlife habitat; very rare
Sparsely Vegetated	Ecosystems with little vegetation occurring on bedrock or colluvial features (shrub, SV:sh), grassy or unvegetated rock outcrops (SV:ro), talus (SV:ta) slopes, and cliffs (SV:cl).	SV:cl	Cliff	10	Sensitive; very important wildlife habitat; very rare
		SV:ro	Rock Outcrop	8	Sensitive; important wildlife habitat; rare
		SV:sh	Shrub	10	Sensitive; very important wildlife habitat; very rare
		SV:ta	Talus	8	Sensitive; important wildlife habitat; rare
Coniferous Woodland	Open stands of Douglas-fir or ponderosa pine, often on shallow soils, with typically grassy understories; coniferous woodlands are split into young (WD:co) and mature (WD:mc) categories. Old Coniferous Woodlands are part of the Old Forest category.	WD:co	Coniferous	6	Sensitive; very important wildlife habitat; common
		WD:mc	Mature Coniferous	8	Sensitive; very important wildlife habitat; rare
Wetland	Non-forested ecosystems where the water table is at or near the surface; includes wet meadows (WN:md), marshes (WN:ms), swamps (WN:sp), and shallow open water (WN:sw) including ponds.	WN:md	Meadow	10	Sensitive; important wildlife habitat; extremely rare
		WN:ms	Marsh	10	Very sensitive; very important wildlife habitat; very rare
		WN:sp	Swamp	10	Sensitive; important wildlife habitat; extremely rare
		WN:sw	Shallow Open Water	10	Very sensitive; very important wildlife habitat; very rare
Seasonally Flooded Fields	Cultivated fields that flood annually and provide important migratory habitats for birds and habitats for other wildlife. These sites were formerly riparian or wetland ecosystems and may have some potential for restoration of these ecosystems.	FS:fs		4	Less sensitive; important wildlife habitat
Mature Forest	Forests dominated by mature trees include broadleaf (MF:bd) forests, coniferous (MF:co) forests, and mixed (MF:mx) deciduous and coniferous forests, excluding mature Riparian forests and mature Coniferous and Broadleaf Woodlands.	MF:co	Coniferous	4	Less sensitive; uncommon in study area
		MF:bd	Broadleaf	5	Less sensitive; extremely rare
		MF:mx	Mixed	5	Less sensitive; very rare
Not Sensitive	Natural ecosystems, often forested ecosystems with ages < 80 years that are provincially common.	NS:na	Natural	2-3	Not sensitive per the SEI; some important wildlife habitat and ecological functions; growing importance in the context of climate change (i.e., carbon sinks, carbon sequestration, and refuge areas)
Not Sensitive	Anthropogenic ecosystem units, ranging from dense urban environments to cultivated orchards to exposed cutbanks.	NS:at	Anthropogenic	0-1	Not sensitive; anthropogenic ecosystem units; some important wildlife habitat and ecological functions in semi-vegetated categories

¹ These values are used as the REV variable in the Conservation Value calculations.**Note:** Table is modified from Pedersen et al., 2024. and Haney & Iverson, 2008.

Table C-3. SEI Condition Values classes

Condition Value ¹ (CONDV)	Label	Description ²
1	Excellent	Minimal to no anthropogenic disturbance currently or historically.
0.8	Good	Minor current and/or historic anthropogenic disturbances.
0.5	Fair	Some current and/or historic anthropogenic disturbances.
0.1	Poor	Significant current and/or historic anthropogenic disturbances.

¹ These values are used as the CONDV variable in the Conservation Value calculations.

² Condition is an estimation of how similar the ecosystem is to what it would be without any human influences. It considers the presence and influence of invasive plants, fragmentation, grazing, logging and other disturbances.

Note: Table is adapted from Haney & Iverson, 2008 and RISC, 2006.

Table C-4. SEI Wildlife Habitat Suitability Value classes

Wildlife Habitat Suitability Value ¹ (WLHV)	Label	Description
10	High	Highly suitable habitat for at least one of the previously selected life requisites of the ten selected rare wildlife species.
5	Moderate	Moderately suitable habitat for at least one of the previously selected life requisites of the ten selected rare wildlife species.
1	Low	Mildly suitable habitat for at least one of the previously selected life requisites of the ten selected rare wildlife species.
0	Nil	Unsuitable habitat for all of the previously selected life requisites of the ten selected rare wildlife species.

¹ These values are used as the WLHV variable in the Conservation Value calculations.

Note: Table is adapted from Haney & Iverson, 2008. Included life requisites and selected species can be found in Haney & Iverson, 2008.