2021 BIOPHYSICAL INVENTORY/ ENVIRONMENTAL OVERVIEW

KNOX MOUNTAIN PARK, KELOWNA, BC

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1.0 INTRODUCTION

Ecoscape Environmental Consultants Ltd. (Ecoscape) has been retained by the City of Kelowna (the City) to provide environmental consulting services pertaining to the Knox Mountain Park Management Plan update. Specifically, we provide this document as an environmental overview and biophysical inventory of ecological features, including ecosystems and species that exist within the park. Here, we also present very specific recommendations that are designed to be included within the Management Plan update and are geared toward achieving a balance between recreational park use by the general public and environmental protection over the long term.

Knox Mountain Park is located within the city limits of Kelowna and covers an area of approximately 386.3 hectares (Figure 1). The park currently consists of two independent parcels. The original parcel (~77 ha) was sold to the City for a dollar in 1939 and is located immediately adjacent to Okanagan Lake and downtown Kelowna. Since the 2011 management plan, the Park has expanded by 27.3 ha through land acquisitions. The 2011 management plan referred to the original parcel and the Grainger parcel. This report will refer to the original parcel as Knox Mountain West and the Grainger parcel as Knox Mountain East (Figure 1). A total of 18.3 ha of park land has been added to the Knox Mountain East and 9 ha has been added to Knox Mountain West (Figure 1). The addition to Knox Mountain East includes two relatively undisturbed woodland parcels off of Crosby Road. The addition to Knox Mountain West includes several parcels south of Royal View Drive and north of Trench Place comprised of disturbed grasslands. All new parcels will collectively be referred to as Knox Mountain Park for the purposes of this report, but in some cases Knox Mountain East and Knox Mountain West may be discussed individually.

1.1 Project Objectives

The purpose of this assessment is to provide environmentally specific contributions that will be considered in the preparation of the park management plan update. The last management plan was prepared in 2011, and improvements are warranted with regard to establishing management that achieves improved environmental health and overall condition of the park. In recent years, several broad-scaled environmental inventories (e.g., Sensitive Ecosystem Inventory, Foreshore Inventory and Mapping) have been undertaken, and the City of Kelowna wishes to incorporate and refine these data for Knox Mountain Park.

To meet this objective, Ecoscape has focused on the following elements to more accurately describe the natural components of the park and to highlight avenues for improved environmental conditions:



- Spatially accurate mapping of the existing trail network, in order to understand the
 extent of disturbance and to make informed recommendations for future trail
 management;
- The incorporation of data from the 2009 Sensitive Ecosystem Inventory (SEI), the most up-to-date Okanagan Lake Foreshore Inventory and Mapping (FIM), and the Wetlands Inventory Mapping (WIM), in order to more precisely describe and document the existing natural communities, their relative sensitivities and levels of anthropogenic disturbance;
- Assess and update the environmental sensitivity of the park with the inclusion of the aforementioned data; and
- Propose a park use/zoning concept that will achieve a balance between continued recreational use and minimal environmental impacts.

2.0 BIOPHYSICAL ASSESSMENT

Knox Mountain Park is located in the Okanagan Very Dry Hot Ponderosa pine variant (PPxh1), which is generally described as the driest forested region in British Columbia. Hot dry conditions are commonplace in the summer months and cool conditions with light snow levels are typical in the winter (Lloyd *et al.* 1990).

Ecoscape spent several days in August 2021 in Knox Mountain Park documenting extents of disturbance, verifying the accuracy of ecosystem mapping within existing and new park parcels, and updating the existing sanctioned and non-sanctioned trail networks.

2.1 Topography, Geology and Soils

The topography, geology and soils of Knox Mountain Park have been described in detail in the previous park management plan from 1999 (Urban Systems Ltd., 1999). Since these characteristics remain unchanged, only a brief summary will be provided here.

The topography of Knox Mountain Park is undulating with moderate to very steep slopes across all aspects (see Figure 1 for 10 m contour lines). Slopes ascend abruptly from Okanagan Lake, and less so from other park boundaries into a series of ridges and peaks. Topographic draws and depressions are also commonplace. In addition, near vertical topography occurs as a result of the south and east facing bedrock outcrops that overlook downtown Kelowna and Clifton Road.

The geology of Knox Mountain Park is primarily characterized by volcanic bedrock as the park occurs on the eastern edge of the physiographic division known as the Thompson Plateau. The mountain itself was formed from localized volcanic activity some fifty million years ago (Kelowna Geology Committee, 2004). The soils within the park boundaries are grouped



taxonomically as Orthic Eutric Brunisols. They have developed over the bedrock and have a sandy loam texture, good drainage, approximately 20 to 50 percent volume of course fragments and a xeric moisture regime.

Knox Mountain West and Knox Mountain East are separated by a narrow, low-lying, highly urbanized valley that runs north/south. Despite their separation, the two parcels are very similar in topography, geology and soils.

2.2 Ecosystem Classification

2.2.1 Mapping Methodology

The ecosystem mapping component incorporated Terrestrial Ecosystem Mapping (TEM) polygons previously described in the Conservation Analysis and Updated Ecosystem Mapping for Central Okanagan Valley. Haney and Iverson (2009), detail the methodology for stratifying TEM polygons and for identifying generalized groupings of sensitive ecosystems (Sensitive Ecosystem Inventory (SEI) polygons). In short, TEM is a stratification of landscape into polygons of similar biophysical characteristics including climate, terrain, soils and vegetation. Within each of these identified polygons, up to three different ecosystems may be included. The percentage of ecosystems within each polygon is determined, then ecosystem codes and descriptive qualifiers such as structural stage, stand composition and any relevant site modifiers are assigned. Sensitive Ecosystem Inventory then identifies groupings of ecosystems based on at-risk status, ecological sensitivities, ecological processes, and wildlife habitat values (Haney and Iverson, 2009).

Ecoscape overlaid the previously described TEM polygons across park boundaries in order to verify their accuracy. Many of these polygons incorporated areas beyond the extents of the park; therefore, they were cut at the park boundary and reclassified based on the existing ecosystems within. Additional polygon boundary adjustments and classification changes were made as necessary based on desktop mapping at a finer spatial scale (1:5,000) and as a result of field verification. The updated polygons were compiled using a geographic information system (GIS), and a final database including ecosystem descriptions consistent with the Standard for Terrestrial Ecosystem Mapping in British Columbia was prepared (RIC, 1998). To help decipher the database, a mapping key specific to those ecosystems occurring in Knox Mountain Park is included in Appendix A.

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2.2.2 Mapping Results

Within Knox Mountain Park, a total of twenty-seven (27) different ecosystems were identified within the two hundred and sixty-two (262) TEM polygons (see Figure 2 for polygon extents and Appendix A for ecosystem classification and descriptions). Table 1 shows the ecosystem codes, their associated site series name, the areas of each, their percent coverage of the total park, and their provincial conservation status (CDC, 2022). Of the twenty-even (27) ecosystem types, six (6) are provincially Red-listed, seven (7) are Blue-listed, five (5) are anthropogenic classifications and nine (9) are not provincially classified.

Ecosystem Code	Site Series	Ecosystem / Community Type	Area (ha) / Percent of Total	Provincia Status ^{1.}
BE	00	Beach	0.28 / 0.1	i s
ВМ	00	Bullrush Marsh	0.68 /0.2	Blue*
СВ	-	Cutbank	0.04 / 0.0	122
CW	00	Choke cherry - Bluebunch wheatgrass rocky bluff	0.12 / 0.0	14
DM	08	Douglas-fir - Water birch - Douglas maple	0.19 / 0.1	Red
DS	07	Douglas-fir/Ponderosa pine - Snowberry - Spirea	4.55 / 1.2	Red
ES	5.	Exposed Soil	4.78 / 1.2	類
FB	00	Rough fescue - Bluebunch wheatgrass	14.20 / 3.68	Red
FO	00	Douglas-fir/Ponderosa pine -Saskatoon - Mock orange	7.74 / 2.0	:=
Gs03	00	Field Sedge Meadow	0.32 / 0.1	Blue*
GW	00	Giant Wild Rye Grassland	0.64 / 0.2	æ
OW	00	Shallow Open Water	1.85 / 0.5	Blue*
PC	04	Ponderosa pine - Bluebunch wheatgrass - Cheatgrass	111.45 / 28.9	Blue
PF	05	Ponderosa pine - Bluebunch wheatgrass - Rough fescue	45.55 / 11.8	Blue
PT	02	Ponderosa pine - Red three-awn	25.10 / 6.5	Blue
PW	01	Ponderosa pine - Bluebunch wheatgrass - Idaho fescue	44.39 / 11.50	Blue
RO	00	Rock Outcrop	0.58 / 0.2	E
RW	ä	Rural	7.68 /2.0	14
RZ	:-	Road Surface	10.11 / 2.6	i s
SA	00	Antelope Brush - Selaginella	3.45 / 0.9	is.
SB	00	Selaginella - Bluebunch wheatgrass rock outcrop	16.95 / 4.4	2
SO	00	Saskatoon - Mock orange Talus	11.99 / 3.1	24
SP	06	Douglas-fir/Ponderosa pine - Snowberry - Pinegrass	11.16 / 2.9	Red
SW	01	Big sage - Bluebunch wheatgrass	3.37 / 0.9	Red
TA	00	Talus	3.35 / 0.9	栏
UR	=	Urban/Suburban	1.59 / 0.4	-
WB	00	Bluebunch wheatgrass - Balsamroot	54.18 / 14.0	Red

¹-Blue-list: List of ecological communities of special concern (formerly vulnerable) in British Columbia.

^{*}At this time only some wetland units have a provincial listing. Ecoscape uses professional discretion when assigning wetlands that have not yet been provincially designated.



Red-list: List of ecological communities that are extirpated, endangered or threatened in British Columbia.

For ease of discussion and due to the large number of TEM polygons that occur across the park, Ecoscape utilized the coarser SEI mapping to generate broad ecological communities (as shown in Table 2). Each TEM polygon was grouped into one broad ecological community based on the dominant ecosystem type in each polygon. Professional judgment was utilized in a few cases where there were equal components of multiple ecosystem types. Figure 3 illustrates the occurrences of broad ecological communities across Knox Mountain Park, and Table 2 provides a summary of their relative areas and percent coverage.

Broad Ecological Communities	# of TEM Polygons	Area (hectares)	Percent of Tota Area
Wetlands	2	2.84	0.74
Old Forest	9	23.17	6.00
Grassland	46	70.02	18.13
Coniferous Woodland	159	257.02	66.5
Mixed Riparian/Moisture Receiving Sites	3	1.72	0.44
Sparsely Vegetated	18	18.37	4.76
Anthropogenic Sites	24	13.15	3.41
Total	- It	386.28	100.00

Coniferous woodlands make up the greatest area within the park; at 70 percent, while grassland, old forest, and sparsely vegetated sites are the next most abundant ecological communities encountered. Together, these four ecological classifications comprise more than 95 percent of the total area in Knox Mountain Park. Mixed riparian / moisture receiving sites and wetland communities occupy a small area, however, they are extremely important to the overall biodiversity of the park and are considered integral to the habitat values present. Most of the remaining area is made up of various anthropogenic classifications including rural, urban/suburban, exposed soils, cutbanks and roads. Because the broad ecological communities were determined based on the first decile of the TEM polygons, there are several cases where anthropogenic sites are not displayed. One example occurs in the NW corner of Knox Mountain East, where a water reservoir and main access road are classified as Coniferous Woodland (Figure 3). Based on this methodology, broad ecological community areas should be considered approximate, as it is possible that the areas of less frequently occurring communities could be underestimated.

The following section provides greater detail regarding the broad ecological communities that occur within the park.

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2.3 Broad Ecological Community Descriptions and Relevant Discussion

2.3.1 Wetlands

A wetland is defined as land that is saturated long enough to promote wetland or aquatic processes indicated by poorly drained soils, hydrophilic (water-loving plants) vegetation (>50 composition) and various kinds of biological activity, which are adapted to a wet environment. Wetlands are ecologically significant communities that have a higher moisture regime than coniferous and grassland areas. Because of the increased water that is available, they tend to provide vital habitat for a variety of species. Studies have shown that the majority of wildlife is either directly or indirectly dependent on wetland and riparian ecosystems and that they are frequented more often than any other habitat types.

It is estimated that more than 85 percent of valley bottom wetland and riparian habitats have been lost within the Okanagan Valley (Hawes and Schleppe, 2009). Given their imperiled state, wetlands are of high conservation priority. Comprehensive wetland inventory and mapping was completed within the City of Kelowna municipal limits (Hawes and Schleppe, 2009). Table 3 is derived from the wetland database and provides a brief summary of the two wetlands that occur in the Park. The ecosystem key (Appendix B) is also inclusive of wetland classification descriptions that are useful in understanding the information presented below (Table 3). The spatially accurate extents and wetland numbers are also depicted on Figure 3.

Common Name (Wetland No.) ¹	Area (m²)	No. Types ²	No. Communities ³	No. Veg. Forms ⁴	Open Water Type	Classes	Types	BC Wetland Associations
Discharge					1 (<5%	Marsh	Tall Rush	Wm06
Basin (C3-1)	6,229	1	2	3	Open Water)	Flood Low Bench	Tall Shrub	F107
Kathleen Lake	20,292	2	2	2	8 (>95%	Shallow water	Submerged aquatic	Wa
(C4-7)					Open Water)	Marsh	Tall Rush	Wm06

- 1. Wetland numbers in accordance with Hawes and Schleppe (2009).
- 2. Number of Wetland Types: Total wetland classes per wetland unit (e.g., Marsh/Swamp/Low flood bench = 3).
- 3. Number of Communities: Total number of Vegetation communities within the wetland unit (e.g., cattail marsh (Wm05) / shallow water(Wa) / Great bulrush marsh (Wm06) / Water birch-rose (Fl07) = 4).
- 4. Number of Vegetation Forms: Form is the physical structure or shape of a plant determined by features such as height, branching, pattern, and leaf shape.

2.3.1.1 Discharge Basin



Discharge Basin in 2021.

The discharge basin occurs near the Second Lookout (formerly known as the Apex) in Knox Mountain West. It occurs within a depression (a topographic low point), where the water table is near or at the surface depending on seasonal fluctuations. Haney and Iverson (2009) classify the basin as 60 percent bulrush marsh (BM) and 40 percent Field Sedge Meadow (Gs03). As illustrated in Table 3, the City of Kelowna wetland inventory described the discharge basin as an approximately 6,229 m² marsh/flood low bench system, with less than 5% open water (Hawes and Schleppe, 2009).

Upon field verification, it was evident that the basin maintains plant species which are indicative of a wetland community; however, several of the species were stressed and, in some cases, appeared to be dying (e.g., water birch) from what appears to be a lack of water. The level of standing water in the discharge basin has varied since 2011; there was minimal

standing water at the time of the 2017 spring site visit when water levels should be at their highest, however in 2021 open water was present.

Ecoscape understands that historically (>25 years ago), water was pumped into this discharge basin from a water reservoir within the park. This influx of water was used as a preventative fire fighting measure (pers. com., Adrian Weaden, City of Kelowna). The previous Management Plan from 1999 described the wetland as an unnamed pond with permanent standing water (Urban Systems Ltd. 1999), thus it was wetted as recently as the late 1990s. In discussions with Mr. Weaden at the City of Kelowna, Ecoscape understands that infrastructure used to supplement water to the basin, is unlikely to still be intact and functional. Nevertheless, the addition of water to this wetland feature during dry years would likely enhance species such as field sedge, Baltic rush and bulrush, and will also make the feature more attractive to a variety of wildlife including birds, invertebrates, mammals and herptiles.

2.3.1.2 Kathleen Lake

Kathleen Lake is a permanent alkaline water body that is approximately two hectares in size and is located near the eastern park boundary within Knox Mountain West. It is also located in a topographic depression of an isolated basin and fills from subsurface drainage and surface runoff. The lake is highly dynamic and routinely experiences significant vertical fluctuations that contribute to its alkaline water chemistry. Because it is the only significant water



Kathleen Lake (September 2, 2009) during a period of lower water levels



Kathleen Lake

source within Knox Mountain Park; it acts as a critical ecological feature for a variety of wildlife. The shoreline of Kathleen Lake provides important thermoregulatory conditions in what is an otherwise hot and dry landscape. The area also provides critical nesting and foraging habitat for species ranging from invertebrates to mammals. Finally, the lake's alkaline conditions contribute to productive invertebrate populations, and an overall



high species richness. Together these conditions create a level of endemism and biodiversity that is unrealized in other areas of the park.

The SEI classifies Kathleen Lake as 90% open water (OW) and 10% bulrush marsh (BM). The north end of Kathleen Lake maintains a flat area which supports emergent vegetation, as well as various grasses and sedges. This densely vegetated section provides ample habitat for nesting waterfowl and other avian species.

The remaining OW component of Kathleen Lake maintains permanently flooded water and supports a diversity of rooted, submerged and floating aquatic vegetation. Although no fish are known to inhabit Kathleen Lake, it does support a hearty population of brine shrimp and other invertebrates (e.g., dragonflies, damselflies, beetles, mayflies, midges, etc).

The eastern border of Kathleen Lake is a steep, west facing talus slope that provides optimal basking habitat for reptiles. Some of the species that could occur on this slope include Northwestern alligator lizard (*Elgaria coerulea principis*), Western skink (*Plestiodon skiltonianus*), common garter snake (*Thamnophis sirtalis*), Western terrestrial garter snake (*Thamnophis elegans vagrans*), and the great basin gopher snake (*Pituophis catenifer deserticola*). At the time of the site visit, there was no evidence of the blue-listed Western painted turtle (*Chrysemys picta bellii*), however, this species has been previously documented at Kathleen Lake.

Unfortunately, despite its ecological value, Kathleen Lake has been and continues to be impacted by anthropogenic disturbance. Ecoscape noted evidence of 4x4 activities below the high-water level in 2011; while the park caretaker has removed a variety of items from the lake including a bicycle, lawn chairs and garbage (pers. com., Mark Goddard). Reducing anthropogenic effects on Kathleen Lake via education and enforcement is an important step to protect this feature, especially as park users become more familiar with the Kathleen Lake, and the number of people visiting the site increases.

2.3.2 Okanagan Lake Foreshore and Riparian Fringe

Most of the TEM polygons that overlap the Okanagan Lake Foreshore / Riparian Fringe were broadly grouped into the Coniferous Woodland category. Nevertheless, it is important to discuss the Okanagan Lake foreshore independently due to the significance of this feature. Since the issuance of the last Management Plan update in 2011, the Okanagan Lake Foreshore Inventory and Mapping was updated in 2016 (Schleppe and Plewes, 2017). The most recent Foreshore Inventory and Mapping (FIM) project's primary objective was to update the FIM dataset to be more current. Because of the level of overlap, Ecoscape only summarizes data from the most recent report below (see Table 4).

Generally, FIM is used to collect baseline information regarding the current condition of shorelines and associated riparian habitats. Data such as shoreline character, shore/bank



types and condition, substrates, land use and habitat modifications are combined with existing fisheries inventories and orthophotos to determine the relative habitat value of the shoreline.



Riparian Fringe

Knox Mountain Park abuts two shoreline segments, 77, and 79, extending from south to north (Table 4; Schleppe and Plewes, 2017). Segment 79 has the greatest overlap with 100% of the segment occurring adjacent to the Knox Mountain boundary (see Figure 4). Due to the steep grades along much of the park, a distinctive riparian band is not overly developed along the foreshore. However, fringe species such as black cottonwood and red-osier dogwood intermittently where flatter grades and

gravel beaches exist. A second zone generally encompassing coniferous woodland extends upslope above the narrow riparian fringe communities.

The foreshore along Knox Mountain Park is largely comprised of cliff/bluff features with elements of a rocky shoreline. Substrates consist of bedrock and boulders with patches of gravel and cobble. The rocky substrates provide optimal habitat for the shore spawning kokanee. In Okanagan Lake, kokanee are the fish species of most concern with respect to shoreline development and aquatic habitat alteration. Recent declines of kokanee have been primarily attributed to factors including interspecific competition with the opossum shrimp (Mysis relicta), a general reduction in lake carrying capacity due to nutrient imbalance, and egg and alevin mortality associated with stranding (a result of lake level regulation) (Wilson and Andrusak, 2003), as well as habitat loss.

The peak of spawning for shore spawning kokanee in Okanagan Lake occurs generally over a 2-week period in mid-late October, beginning when lake temperatures drop to approximately 13°C. The vast majority of kokanee shore spawners (in Okanagan Lake) utilize a very restricted water depth of 0.25 - 0.75 m, with the majority of fish spawning at a depth of 0.5 m (Wilson and Andrusak, 2003).

Since the issuance of the last management plan in 2011, the Ministry of Environment released the finalized the Okanagan Large Lakes Foreshore Protocol that is used to guide review of current applications for foreshore developments such as moorages (BC MFLNRORD, 2018). This protocol incorporates the most recent kokanee shore spawning data, and that of select species at risk. The majority of the shoreline along Knox Mountain Park (~ 1.2 km) occurs in a Black Zone, which is defined as critical habitat, where greater than

1000 spawning kokanee have been documented (see Figure 4). In addition, approximately 160 metres of the shoreline falls within a Red Zone (>50 spawning kokanee, or 1000 or more historical occurrences).

The current and potential Aquatic Habitat Index (AHI) for FIM Segments 77 and 79 were ranked as moderate and very high, respectively in the 2016 FIM study (Figure 4; Schleppe and Plewes, 2017). The ranking parameters include the foreshore protocol (e.g., presence of the critical shore spawning kokanee habitat) and upland conservation zones as determined from the Sensitive Ecosystem Inventory.

The high FIM rankings along Knox Mountain Park are also due to the relatively little disturbance to foreshore and riparian areas. Because the shoreline is adjacent to the park, it prevents future upland development and thus it is that much more critical to maintain the natural state of the foreshore. Given the rate of growth within the Okanagan Valley, and the overall development pressure on Okanagan Lake, efforts should be made to minimize shoreline disturbance and to maintain its natural state well into the future.

Table 4. Abbreviated Summary of FIM Shoreline Segments that Abut Knox Mountain Park (Schleppe and Plewes, 2017). Current Segment **Dominant** Littoral Large **AHI Rating** Length (m) Condition Level of % Black % Red Juvenile Substrate Zone Segment Shore Woody Docks Veteran / Percent Slope (%) Impact Snags Zone Zone Rearing Disturbed Type Width Current / Debris Per km No. Type Trees Overlap (%) (Kokanee) (Kokanee) Potential / Natural Potential (%) (%) (m) with KMP (%) Very 719.37 / High Bedrock Moderate Moderate / Cliff/Bluff 77 45 / 55 25-50 16.68 25-50 0 0 Moderate Steep <5 8.0 (>40) (10-50)Moderate (50)(60+) Very 1407.29 / Bedrock Narrow Very High / Cliff/Bluff 79 5/95 0 0 25-50 25-50 0 100 Moderate Steep 100 (<10) (35) (<10) Very High

(60+)

2.3.3 Grasslands



Typical grassland community

Knox Mountain Park contains four grassland communities distinctive including the Bluebunch wheatgrass -Balsamroot (WB), the Rough Fescue -Bluebunch Wheatgrass (FB), Giant Wildrye (GW), and the Big Sage -Bluebunch Wheatgrass (SW) ecosystem. These communities typically occur on drier, south facing slopes that have good soil drainage. Grasslands are extremely fragile and are very prone to anthropogenic disturbance of the cryptogamic soil crust, facilitating

infestation by non-native Eurasian species (e.g., knapweed). Cryptogamic soil crusts are an assemblage of bacteria, cyanobacteria, green algae, mosses, liverworts, microfungi and lichen living symbiotically. The cryptogamic crust promotes soil structure and formation, protection of the soil surface from erosion, increases water infiltration and provides a stable rooting soil structure for other flora species (Marsh et al., 2006). Cryptogamic crusts are incredibly sensitive to disturbance and take a long time to recover, if at all. Once the cryptogamic crust has been disturbed, the soil structure and functionality become less suitable to native species but some invasives can thrive under these conditions. Many of the grassland areas in the Okanagan have been so heavily impacted that they no longer resemble the native community, but are better described as "weed fields". For this reason, the preservation of high-quality grassland and associated cryptogamic crust within park environments is that much more important. Given their inherent sensitivity, it is critical to pinpoint the extents of grassland ecosystems within Knox Mountain Park, in order to direct anthropogenic activities elsewhere.

Terrestrial ecosystem mapping of grasslands incorporates levels of weed infestation. The classifications are generally 2-fold, a mid to late seral association where there is still a reasonable component of bunchgrasses with introduced Eurasian species such as cheatgrass, knapweed and sulfur cinquefoil, or an early to very early seral association where there are few to no native bunchgrasses remaining on site. In Knox Mountain Park, the early to very early seral association is limited to smaller areas that are in close proximity to development. For example, there are some polygons near the entrance to the park that are highly infiltrated by weedy species. But, for the most part grassland communities within Knox Mountain Park are fairly intact; making it one of the few remaining destinations within urbanized areas of the Central Okanagan, to view a variety of native grassland ecosystems.

The Bluebunch wheatgrass – Balsamroot (WB) grassland ecosystem typically occurs on moderately steep to steep warm slopes (Iverson & Cadrin, 2003), and is the most commonly occurring grassland within the park. In general, the WB community is predominantly found in the southwestern corner of Knox Mountain West and there are also patches of the ecosystem in Knox Mountain East. For the most part, this grassland is in good to excellent condition; however unsanctioned trail development appears to be its greatest threat. Trail networks and general site disturbance in some areas have resulted in noxious weed cover, soft soils and erosion potential.

The Rough Fescue – Bluebunch Wheatgrass (FB) ecosystem occurs on more gentle, warm aspects sites, level sites, and on non-forested cool aspects. It consists of a mixture of rough fescue and bluebunch wheatgrass with balsamroot and other herbs. Other less common grassland ecosystems in Knox Mountain Park include Giant Wildrye grassland (GW) and Big Sage – Bluebunch Wheatgrass (SW). Both of these ecosystems are generally limited to the south facing front face of Knox Mountain East.

The Big Sage community (SW) is of particular interest, because in Knox Mountain Park it occurs at, or near, the most northern edge of its distribution. The vegetation within this ecosystem is a mixture of bunchgrasses with forbs that are interspersed amongst big sagebrush (*Artemisia tridentata*). Sagebrush communities are much more typical in the south Okanagan within the bunchgrass biogeoclimatic zone. Within Knox Mountain Park, the SW community used to be restricted to polygon 107 (see Figure 2), with sagebrush occurring on both sides of Knox Mountain Drive just up from the first switch back. However, with the additional parcels to Knox Mountain West, there are multiple polygons south of Royal View Drive comprised of SW and GW communities. Because these communities are so rare, both within the Central Okanagan and within Knox Mountain Park, efforts should be made to limit disturbance (e.g., trails) and to protect these unique ecosystems.

Other areas of interest within Knox Mountain Park are the many transitional areas between grasslands and coniferous woodlands. These ecosystems often consist of elements of WB grasslands and PC woodlands (see Coniferous Woodlands below). The coniferous species, often Ponderosa pine, are widely spaced apart; however, they provide habitat structure and complexity for numerous species that utilize grasslands for foraging, but also need the woodlands for cover, protection against predators and breeding/nesting sites. Given the importance of these transitional areas for wildlife; it critical to maintain their natural state by directing trail development and recreational activities elsewhere.

2.3.4 Coniferous Woodland and Old Forest

Forest ecosystems vary based on numerous characteristics including slope, aspect, slope position (i.e., at the top or bottom of hills/mountains), and soil moisture regime. Coniferous woodlands in the Ponderosa Pine Very Hot dry subzone generally have open

canopies that typically occur in drier climates, on rocky knolls, and on steep, dry south-facing slopes where there is sufficient moisture to allow tree growth to occur. Within Knox Mountain Park, there are six unique ecosystem types of coniferous woodland (DS, FO, PC, PF, PT and PW; see Table 1 above).

The majority of the coniferous woodland in Knox Mountain has relatively open canopies with a bunch grass dominated understory. Ponderosa pine is the predominant species present, although Interior Douglas fir occurs in areas that have a higher moisture regime (e.g., more north facing slopes, depressions, gullies, etc.) Commonly encountered shrubs include Saskatoon, common snowberry, tall Oregon-grape, and Rose spp.; while grasses include bluebunch wheatgrass, pinegrass and fescues.



Ponderosa pine forest that has been thinned due to the pine beetle infestation. New saplings (with a white protective casing) have been planted by each remnant stump.

Coniferous woodlands provide important habitats for a suite of wildlife. The Ponderosa pine is of particular importance to two rare woodpeckers (whiteheaded (Picoides albolarvatus) and Lewis' (Melanerpes lewis) for feeding and nesting. Woodpecker cavities are also utilized by secondary cavity nesters including the Blue-listed

Flammulated Owl (*Otus flammeolus*), whose habitat is restricted to Ponderosa pine and interior Douglas-fir. Ponderosa pine is of further importance to other species, especially when the trees are located in close proximity to water and riparian habitats, such as in Knox Mountain Park.

Of particular interest are the seven TEM polygons that are grouped into the broad ecological classification of Old Forest. These Old Forest polygons occur within both parcels on very steep slopes where forest harvesting was likely difficult. Haney and Iverson (2009) assigned Old Forest the highest SEI value (10) based on sensitivity, rarity, condition and benefit to wildlife. They report that Old Forest within the Central Okanagan is very rare (~0.5%) (Haney and Iverson, 2009), yet in Knox Mountain Park, Old Forest makes up 23 hectares or approximately 6.5% of the park. These larger groupings of Old Forest, especially since they occur adjacent to water bodies (Okanagan Lake and Blair Pond), provide such invaluable habitat for a variety of species.

Generally, across its range Ponderosa pine stands are declining. Their value as wildlife trees increases with age, and unfortunately younger trees are not being allowed to live long enough to replace veterans¹. The issue is further complicated by the recent mountain pine beetle infestation and especially so in urban parks, as foresters are faced with balancing wildfire potential and public safety issues with long term retention of wildlife habitat. In Knox Mountain Park, there are numerous examples of recent tree removal. The concern with the sheer number of removals is not only the loss of potential wildlife trees, but also the potential impacts due to ground disturbance from logging machinery (i.e., establishment of invasive plants) and erosion potential within steep slope areas.

2.3.5 Mixed Riparian/Moisture Receiving Sites

There are four TEM polygons (#80, 97, 126 and 252) with this general ecological classification, which includes Douglas fir/Ponderosa pine – Snowberry – Spirea (DS) and Douglas-fir - Water birch - Douglas maple (DM) ecosystems. These polygons are distributed as follows in the park:

- #80: DS and DM gully ecosystems that extend in the north/south direction and abuts the edge of the Magic Estates development;
- #97: DS ecosystem that extends in the north/south direction just north of Kathleen Lake;
- #126: DS ecosystem that extends in the north/south direction west of Kathleen Lake; and,
- #252: A DS ecosystem at the furthest northeast boundary of the park, within Knox Mountain East.

These ecosystems maintain a high diversity of mixed coniferous (fir and pine) and deciduous overstories, as well as a diverse shrub and forb understory. These ecosystems often have riparian vegetation and the pockets are typically high diversity areas for avian and mammalian species because of the increased vegetated diversity of the sites. The moist soils of these sites are particularly sensitive to disturbances of subsurface flows and any alterations present a considerable risk.

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¹ Wildlife & Trees in British Columbia. BC Ministry of Forests and Range and Lone Pine Publishing. 2006.

2.3.6 Sparsely Vegetated

Sparsely vegetated sites in Knox Mountain Park are common and include habitats such as talus slopes and bedrock outcrops. There are six individual ecosystems grouped within the broad classification of sparsely vegetated including talus (TA), rock outcrop (RO), choke cherry - Bluebunch wheatgrass rocky bluff (CW), antelope Brush -Selaginella (SA),selaginella Bluebunch wheatgrass rock outcrop (SB), Saskatoon - Mock orange Talus



Sparsely vegetated talus slope and rock outcrop in new parcels in Knox Mountain East

(SO). These sites are also extremely fragile, as it can take many years for plant development due to the dry nature of these sites.

Rocky outcrops are often encrusted with a diversity of lichen species, which are adapted to the dry and nutrient poor nature of the sites. Coupled with this, these sites are also extremely important to reptile species as they typically provide critical security and denning habitat. Furthermore, sparsely vegetated sites with warm aspects provide important basking habitat for reptiles. Whereas ungulates such as deer rely on them in the winter, as they maintain minimal snow pack.

Sparsely vegetated sites are sensitive to anthropogenic disturbance as lichen species can be easily trampled. Sites that are vulnerable to anthropogenic disturbance include the rock outcrops immediately below the First Lookout (formerly known as the crown lookout) and those in close proximity to the Second Lookout. Both of these areas have been heavily trampled by foot traffic.

2.3.7 Anthropogenic Sites

There are five ecosystems grouped within the broad classification of anthropogenic sites and includes urban/suburban (UR), roads (RO), rural (RW), cutbank (CB) and exposed soils (ES). The primary anthropogenic sites in Knox Mountain West include the day use recreational area at the main entrance to the Park, the aparking lot southeast of the Second Lookout, the First Lookout, Paul's Tomb, and the pavilion and related structures at the Second Lookout. Although the levels and extents of disturbance at these sites are highly variable, they are generally considered primary destinations within the park, and they experience the most intensive recreational use.





An example of anthropogenic disturbance within the Kathleen Lake property.

View of cutbank ecosystem in new parcels in Knox Mountain West

The Kathleen Lake area has become a primary destination for park users since the last management plan update in 2011 and exhibits a high level of anthropogenic disturbance compared to the rest of the park. Ecoscape understands that a portion of this parcel was cleared for future development prior to being purchased by the City. Although it will likely be decades before the disturbance is no longer apparent, there have been significant gains in terms of re-establishment of vegetation and naturalization of the area.

Polygon 244 is within one of the new parcels added to Knox Mountain West and is comprised of a 100% cutbank ecosystem. The parcel additions to Knox Mountain West also include areas of exposed soils and weed infestations, considering their close proximity to an industrial area of the City.

Knox Mountain East is almost entirely natural in character, with the exception of a single location of anthropogenic development in the northwestern corner. Structures at this site include multiple water reservoirs and a cell phone monopole². Although the larger parcel has little anthropogenic development, there is evidence of unsanctioned activities including fire pits and unauthorized dumping.

In addition to individual development sites, anthropogenic effects are also felt throughout the park mainly through the proliferation of unsanctioned trails. In realizing efforts to protect and restore natural areas, Ecoscape has begun the fundamental exercise of identifying unsanctioned trails and has made recommendations for implementing an action plan that will successfully reduce the trail network (see Section 3.2).

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² Figure 3 does not show this area as an anthropogenic site, since it is a smaller percentage of the TEM polygon, however its general location can be seen on the airphoto.

2.4 Flora

2.4.1 Potential for Rare Plant Species



Slender Hawksbeard (*Crepis atribarba* ssp. *atribarba*)

Photo Credit: © National Defence, Angela Knopp

A search of the BC Species and Ecosystems Explorer for Red/Bluelisted plants and/or Federally listed plants in cliff, conifer forest - dry, conifer forest- mesic, conifer forest wet, grasslands, lake, marsh, old forest, pond/open water, riparian forest, rock/sparsely vegetation rock, urban/suburban habitats within the PPxh zone in the City of Kelowna results in eight (8) records (Appendix B) (BC CDC, 2022). Ecoscape understands that at least one of these rare plants has been previously documented within Knox Mountain

Park. Slender hawksbeard (*Crepis atribarba* ssp. *atribarba*), is a red-listed perennial herb in the Aster family that has a taproot, woody base and strap-shaped yellow flowers (E-Flora BC, 2010). Ecoscape is not aware of its current distribution within Knox Mountain Park; however, if this plant or other rare and endangered species are identified, then detailed mapping should be undertaken and appropriate mitigation measures employed to prevent encroachment and the loss of these species.

2.4.2 Presence of Non-native and Invasive Plants

A comprehensive invasive plant inventory has yet to be completed in Knox Mountain Park. In 2006 the City of Kelowna carried out an invasive plant inventory plan of areas impacted by the 2003 wildfires; however, Knox Mountain was not inventoried as apart of that assessment (Scott and Robbins, 2003). Detailed invasive plant inventories were beyond the scope of this environmental overview but are an important part of holistic parks management. Future inventories and mapping of invasive species should be undertaken as budgets allow.

In order to assess its ongoing effectiveness based on factual data rather than anecdotal evidence, the 2011 management plan outlined the need to establish an on-going monitoring program in the park in the form of an annual scorecard. The scorecard assessment has been conducted annually in June since 2012. Assessment parameters for measurement include: environmental condition criteria; vehicular traffic; frequency and

type of outdoor events; service requests and bylaw infractions. One component of the scorecard is a plant survey. The focus of the plant survey is to determine the relative abundance of native versus non-native species. Plant counts have been conducted annually in June since 2012 by a team of volunteers from the Central Okanagan Naturalists Club. There are five linear transects throughout the park where multiple plant plots are randomly placed along each transect to document native / non-native abundance.

Efforts to control pedestrian access have resulted in reestablishment of native vegetation at both the Apex and Front Face transects. Analysis done on the 2012-2017 plant data confirmed that some of the transects at the Apex have increased coverage of native species.

During field investigations for this assessment, Ecoscape documented the presence of several invasive plants and trees. Table 5 lists some of the common species that were encountered within the park boundaries. Invasive plants were most commonly noted at the interface of trails/roads, and within or adjacent to areas of disturbance.

Common Name	Scientific Name		
Mustard	Sisymbrium sp.		
Perennial Sow Thistle	Sonchus arvensis		
Wild Buckwheat	Polygonum convolvulus		
Common Dandelion	Taraxacum officinale		
Sulphur Cinquefoil	Potentilla recta		
Diffuse Knapweed	Centaurea diffusa		
Spotted Knapweed	Centaurea maculosa		
Dalmatian Toadflax	Linaria genistifolia ssp. dalmatica		
Canada Thistle	Cirsium arvense		
Bull Thistle	Cirsium vulgare		
Great Mullein	Verbascum thapsus		
Cheatgrass	Bromus tectorum		
Whitetop	Lepidium draba		
Tree of Heaven	Ailanthus altissima		
Siberian Elm	Ulmus pumila		



Disturbed hillside that was hydroseeded with crested wheatgrass



A non-hydroseeded portion of the slope that is overrun with invasive weeds

Within the Knox Mountain East there is a sizable slope that was likely cleared to facilitate development of the water reservoirs and associated roads. Most of the slope was hydroseeded with crested wheatgrass (first photo), and as a result there is very little weed establishment. However, in some of the smaller adjacent areas, no mitigative measures were undertaken and the resulting weed establishment is shown in the second photo. At least five (5) different weed species occur within this photo, and the area of weed establishment appears to be encroaching into the surrounding coniferous woodland. The use of a crested wheatgrass hydroseed could also be questioned given that it is not a native species. Furthermore, similar non-native associations were observed in the new parcels within Knox Mountain West with disturbed slopes adjacent to industrial development resulting in a dense establishment of whitetop, Siberian elm and tree of heaven, as well as evidence of seedings crested wheatgrass. Within the frisbee golf area, there is a stand of planted Siberian Elm that is likely contributing to the spread of invasives within the Park and adjacent riparian habitats of Okanagan Lake.



View of Tree of Heaven encroaching upon grassland ecosystems in Knox Mountain West



View of Siberian Elm stand in Frisbee Golf area in Knox Mountain West

Areas of disturbance within parkland may be best mitigated with the use of a native grass seed mix, so that eventually the area may return to more natural conditions. Nevertheless, these photos clearly illustrate the benefit of hydroseed, whether native or not, to prevent the establishment of weeds.

2.5 Fauna

2.5.1 Wildlife Presence

The natural, relatively intact lands of Knox Mountain Park provide valuable habitat for a variety of native wildlife ranging from invertebrates to mammals. The interface of grassland, coniferous woodland and lacustrine ecosystems collectively provide a unique habitat mix that supports a diverse species group. Commonly encountered species include mule deer (Odocoileus hemionus), coyote (Canis latrans), yellowbellied marmot (Marmota flaviventris), yellow-pine chipmunk (Tamias amoenus), Cooper's hawk (Accipiter cooperii), great blue heron (Ardea Herodias), great-horned owl (Bubo virginianus), and a variety of waterfowl and passerines. Less conspicuous



Great-horned Owl (*Bubo virginianus*) encountered in Knox Mountain East during 2021 field work.

species include reptiles such as Northern alligator lizard (*Elgaria coerulea principis*), Western skink (*Plestiodon skiltonianus*) common and terrestrial garter snakes (*Thamnophis sirtalis and Thamnophis elegans vagrans*, respectively), great basin gopher snake (*Pituophis catenifer deserticola*), Western Yellow-bellied racer (*Coluber constrictor*) and Western painted turtle (*Chrysemys picta*). Amphibians typically associated with lake and wetland features may include western toad (*Bufo boreas*), Pacific chorus frog (*Hyla regilla*), long-toed salamander (*Ambystoma macrodactylum*) and potentially the great basin spadefoot (*Spea intermontana*).

Appendix C provides a fairly comprehensive listing of species including birds, mammals, amphibians and reptiles that are known to occur in cliff, conifer forest – dry, conifer forest-mesic, conifer forest – wet, grasslands, lake, marsh, old forest, pond/open water, riparian forest, rock/sparsely vegetation rock, urban/suburban habitats within the PPxh zone in the City of Kelowna³. The list also includes provincially listed invertebrates, but it is far short of a complete invertebrate listing. Given that the various habitats in Knox Mountain Park are

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³ Although we have attempted to generate a comprehensive species list, it is likely that at least some species have been unintentionally excluded.

in good condition, it is likely that many of the species included in Appendix D may utilize the park for general living, feeding, reproduction, or as a migratory stopover.

2.5.2 Rare Wildlife Potential



Gopher Snake (Pituophis catenifer deserticola) in Knox Mountain Park

Habitats within Knox Mountain Park have the potential to support a variety of rare and/or endangered wildlife, ranging from invertebrates to mammals. begin to ascertain the potential species, a search of the BC Species and Ecosystems Explorer was conducted for Red and Blue listed fauna associated with cliff, conifer forest - dry, conifer forest- mesic, conifer forest - wet, grasslands, lake, marsh, old forest, pond/open water, riparian forest, rock/sparsely vegetation rock, urban/suburban habitats within the

PPxh zone in the City of Kelowna (BC CDC, 2022). The search resulted in eighty-two (82) records that are displayed in Appendix D. Ecoscape then critically evaluated this list to further highlight a subset of the species that are most probable based on the specific ecosystems and habitats within the Park (Table 6).

Group	Common Name	Scientific Name	Global Rank	Provincial rank	BC List	COSEWIC
Amabibian	Western Toad	Anaxyrus boreas	G4	S4	Yellow	Special Concern
Amphibian	Great Basin Spadefoot	Spea intermontana	G5	S 3	Blue	Threatened
	Great Blue Heron, Herodias subspecies	Ardea Herodias herodias	G5T5	S3	Blue	
	American Bittern	Botaurus lentiginosus	G5	S3B, SNRN	Blue	
	Swainson's Hawk	Buteo swainsoni	G5	S2B	Red	
Birds	Evening Grosbeak	Coccothraustes vespertinus	G5	S5	Yellow	Special Concern
	Olive-sided Flycatcher	Contopus cooperi	G4	S3S4B	Blue	Special Concern
	Horned Lark, merrilli subspecies	Eremophila alpestris merrillie	G5T4	S3	Blue	
	Barn Swallow	Hirundo rustica	G5	S3S4B	Blue	Special Concern

	California Gull	Larus californicus	G5	S2S3B	Blue	
	Lewis's Woodpecker	Melanerpes lewis	G4	S2S3B	Blue	Threatened
	Flammulated Owl	Otus flammeolus	G4	S3B	Blue	Special Concern
	Lance-tipped Darner	Aeshna constricta	G5	S2S3	Blue	
	Emma's Dancer	Argia emma	G5	S3S4	Blue	
Invertebrates	Vivid Dancer	Argia vivida	G5	S2S3	Blue	Special Concern
	Common Sootywing	Pholisora catullus	G5	S 3	Blue	
	American Badger	Taxidea taxus	G5	S2	Red	Endangered
	Townsend's Big- eared Bat	Corynorhinus townsendii	G4	S3S4	Blue	
	Western Small- footed Myotis	Myotis ciliolabrum	G5	S2S3	Blue	
Mammals	Little Brown Myotis	Myotis lucifugus	G3	S4	Yellow	Endangered
	Fringed Myotis	Myotis thysanodes	G4	S3	Blue	Data Deficient
	Western Harvest Mouse	Reithrodontomys megalotis	G5	S3	Blue	Endangered
	Northern Rubber Boa	Charina bottae	G5	S4	Blue	Special Concern
	Western Painted Turtle – Intermountain - Rocky Mountain Population	Chrysemys picta pop. 2	G5T2T3Q	\$3	Blue	Special Concern
Reptiles	Western Yellow- bellied Racer, <i>Mormon</i> subspecies	Coluber constrictor mormon	G5	S2S3	Blue	Threatened
	Western Rattlesnake	Crotalus oreganus	G5	S2S#	Blue	Threatened
	Gopher Snake, deserticola subspecies	Pituophis catenifer deserticola	G5T5	S3	Blue	Threatened
	Western Skink	Plestiodon skiltonianus	G5	5354	Blue	Special Concern

1 Source: http://www.env.gov.bc.ca/cdc/

Yellow: Not at risk.

Blue: Of special concern (formerly vulnerable). **Red:** Extirpated, endangered, or threatened.

2 Source: https://www.cosewic.ca/index.php/en-ca/assessment-process/wildlife-species-assessment-process-categories-guidelines/status-categories.html

Special Concern: A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

Endangered: A wildlife species facing imminent extirpation or extinction.

Threatened: A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

Data Deficient: A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.

In addition to the information available on the CDC website, Ecoscape also attempted to gather recent rare species occurrences within the Park. Information was obtained through discussions with local experts, previous assessments and field inventories (Table 7).

Common Name	Scientific Name	Observation/Comment
American Badger	Taxidea taxus	Based on Badger Recovery Team mapping, at least 3 individuals have been documented within close proximity to the Park (pers. com. Richard Weir)
Flammulated Owl	Otus flammeolus	An injured adult was rescued near the Pavilion Trail in the fall of 2006.
Great Basin Gopher Snake	Pituophis catenifer deserticola	Multiple young snakes were documented near the Apex in May of 2008.
Northern Rubber Boa	Charina bottae	Observed at the Park (pers. com., Mark Goddard).
Western Yellow-bellied Racer	Coluber constrictor mormon	Observed at the Park (pers. com., Mark Goddard).
Swainson's Hawk	Buteo swainsoni	Adults were observed soaring in the spring of 2009 and 2010 (Ecoscape).
Great Blue Heron	Ardea Herodias herodias	An individual observed at Kathleen Lake, summer of 2010 (Ecoscape)
Barn Swallow	Hirundo rustica	Multiple flying over head in proximity of the Okanagan Lake foreshore (Ecoscape).

2.6 Environmental Sensitivity

Numerous factors were considered when determining the environmental sensitivity of the various polygons within the Park. Using a suitability index, ecosystem community polygons were stratified and evaluated in terms of habitat/ecosystem rarity, wildlife habitat suitability, rare and endangered species occurrence potential, functional condition (e.g., ecological connectivity, level of disturbance, seral stage, structural stage etc.) and fragility. Four species at risk, including Flammulated Owl, Great Basin Gopher Snake, Lewis' Woodpecker and Swainson's Hawk were selected for use in the sensitivity index. Each species is provincially listed, is generally recognized as an umbrella species, and collectively, they utilize all broad ecological communities that occur within Knox Mountain Park (see Appendix E for species accounts). Discrete ecosystems were given a rating score based on the above criteria, and then each TEM polygon was weighted based on the percent composition of respective ecosystems within each polygon, thus deriving environmental sensitivity class (Very High, High, Moderate or Low) for each polygon (see Appendix F for the suitability matrix).

Vegetation community polygons within Knox Mountain Park were grouped into one of four Environmental Sensitivity classes: Very High, High, Moderate and Low. The connotation of each class is detailed below:

- Very High These areas contain significant, intact vegetation and wildlife characteristics representing a diverse range of sensitive habitat. They substantially contribute to the overall function and connectivity of the Park and conservation is the primary objective for these areas.
- High Ecosystems of High environmental sensitivity also contribute to the overall diversity and contiguous nature of the surrounding landscape. In many cases, the ecosystems and environmental features lumped into this category are as sensitive as those in the Very High classification, however they are downgraded because they do not provide the necessary habitats for the selected Species At Risk. Park development should generally avoid High sensitivity areas, however if encroachment does occur, significant portions of these habitats must be retained and in no cases should High sensitivity features (e.g., Kathleen Lake) be eliminated or heavily encroached upon. Furthermore, encroachments into these areas should be compensated for by restoration in other areas to work towards achieving a no net loss of Very High and High value habitats.
- Moderate Ecosystems of moderate significance represent disturbed habitats or fragmented features. Moderate areas contribute to the diversity of the landscape, however their condition and adjacency may limit significant function.
- Low These areas contribute little to no value with regard to habitat diversity and have limited potential for supporting significant wildlife. Park development should be focused to these areas before consideration is given to higher sensitivity ecosystems.

Generally, the polygons in the Knox Mountain Park were classified as having Excellent or Good landscape context. Because the area is designated as park, there is a level of certainty that limits fragmentation and anthropogenic influence. The Park, as it is located within the City core is limited with regards to landscape condition at a broad scale. Nevertheless, in comparison with other local ecosystems, those within the Park fair well, given the relative size of the protected area.

The condition of ecosystems within the Park included Fair, Good and Excellent, with most of the area classified as Good and Excellent condition. Significant anthropogenic disturbances are generally minimal when compared to conditions outside the Park boundary. Coverage of invasive plant species is low to moderate depending on the polygon being assessed. Invasive plants are, for the most part, limited to areas adjacent to park boundaries / development and existing trails. Although, recent forest harvesting due to

mountain beetle has also realized increases in weed invasions due to more wide-scale ground disturbance.

Given the favourable ratings for both landscape context and condition, in combination with the other assessed factors, it is not surprising that the majority of Knox Mountain Park is considered to have Very High and High environmental sensitivity (see Figure 4). Table 8 details the environmental sensitivity by area, percent of total and by the number of polygons included in each sensitivity class.

nvironmental Sensitivity	Area (hectares)	Percentage (%)	Total Polygons
Very High	171.34	44.4	108
High	181.92	47.1	106
Moderate	30.15	7.8	37
Low	2.88	0.7	10

Almost ninety-two percent of the Park is classified as having either High or Very High environmental sensitivity. Steep sloped mature coniferous woodland and open grassland ecosystems account for much of the Very High classification. Other areas of sensitivity include the sparsely vegetated rock outcrops, Kathleen Lake, and moisture receiving sites.

Moderate and Low sensitivity areas account for only about 9% of the Park. These areas typically consist of anthropogenically influenced sites (e.g., the entrance to the park) and areas with previous disturbance.

3.0 CONSIDERATIONS FOR THE UPDATED PARK MANAGEMENT PLAN

3.1 Educational Opportunity

Knox Mountain Park occurs within the City of Kelowna and is immediately adjacent to the downtown core. Because of its central location, it is a highly accessible urban park that is visited by a variety of people with varying interests and knowledge of the surrounding natural lands. Because of its adjacency, it is probable that the park attracts more people with a limited knowledge of the local natural world, compared with other parks that are located further from the city. For this reason, Knox Mountain Park has the potential to act



Signage at the interface of Knox Mountain Park and Magic Estates

as an educational opportunity for many, but it is not fully taken advantage of due to a lack of educational infrastructure, personnel, and signage.

Currently, educational opportunities within the park are limited to signage posted near the Second Lookout in the vicinity of the pavilion that highlights some of the local plant and animal species, as well as signage that pinpoints the park boundary and suggests appropriate activities within.

Ecoscape strongly encourages an expansion of this type of educational material to more effectively promote and communicate the uniqueness of Knox Mountain Park including the many rare ecosystems and wildlife, indigenous culture, history, language and values, the reasons to protect the park, and specifically the tools in which the public can participate in its protection. In addition to the expansion of the general public's knowledge of our local environment, an effective educational program will work to minimize existing challenges currently faced within the park. Challenges such as unsanctioned trail development, unwarranted motorized access, and human/wildlife conflict will undoubtedly be more easily overcome by expanding the educational system within the park.

Signage is one of the most economical ways to educate the park user. Ecoscape identifies the following areas where additional signage would be beneficial:

- There is a need for signage at all park boundaries where sanctioned trails intersect the boundary. Especially where there is the potential for driving access from private lands. Signage at these locations should identify the park boundary, permitted activities and resultant fines for not adhering to permitted activities (e.g., no motorized vehicles). This is especially applicable with newly acquired lands associated with Knox Mountain East, where it is challenging for park users to determine when they are within the Park.
- Sensitive Park zones and permitted uses (see Section 3.3) should be identified with signage at highly accessible locations where there is potential for unwarranted access/activities.
- A large sign should be erected at the park entrance that welcomes park users and clearly defines the rules of the park. The existing information kiosk at the entrance to the park is out of date and should be updated.

- Signage could also be effective to inform the park user of trails that are being decommissioned or to direct the user to more appropriate locations.
- Finally, signage that educates the park user of the unique and rare wildlife, indigenous culture, history, language and values, vegetation and significant landforms that occur within the park.

In addition to signage, Knox Mountain Park would greatly benefit from a more formal educational facility such as an interpretive centre or minimally an educational kiosk. This facility should be located at the entrance to the Park. Placement of an educational facility at this location will target the majority of users prior to them entering the natural areas of the park, and it is an excellent venue to inform users of current park conditions (e.g., areas closed for restoration works, season for snake movement).

The inclusion of an actual interpretative allow for additional educational opportunities such as school facilitating community programs, participation in park restoration and other enhancement events, establishing community events. development of interactive educational programs. These types of programs are very effective at targeting existing park are also but important educational tools to connect with people who do not normally frequent natural parks.



Extensive dumping within the Knox Mountain East

Environmental educational initiatives could be centered on the following ideas:

- Kokanee Shore Spawning The Paul's Tomb trail in Knox Mountain West is an excellent location to safety observe shore spawning kokanee without disrupting their natural behavior.
- Blooming of the arrow-leaved balsamroot (Balsamorhiza sagittata) (city official flower) – Knox Mountain Park is likely the best location within the city to appreciate this spring flower. Activities could include professional photos with the blooming hillsides as the background, kids activities and challenges, etc.
- A Grassland Conservation Day An emphasis on the rare and unique grasslands in Knox Mountain Park with special attention brought to the extremely rare Big Sage

 Bluebunch Wheatgrass (SW) ecosystem.

 Seasonal Interpretive Nature Walks – Local naturalist groups, summer students or similar, could develop and run seasonal nature walks at scheduled times throughout the year for the general public to learn more about the diverse flora and fauna in the Park.

In Knox Mountain East, the educational requirements are different given that the parcel is less known as a park resource and has a low number of visitors compared to Knox Mountain West. During field inventories, Ecoscape encountered at least three fire pits, one area of extensive garbage dumping, a higher incidence of off leash dogs, and several biking obstacle courses. Furthermore, the additions to Knox Mountain East and West also show signs of human disturbance, including bike obstacle courses, fire pits, forts, garbage and unsanctioned trails. Enhanced oversight and a management presence would likely reduce these types of activities. In addition, boundary signage and fencing at strategic locations are critical to prevent unwarranted access and sordid activities.

3.2 Access Management

One of the predominant recreational concerns in the Park is the increasing number and



An example of redundant trails within Knox Mountain Park

ever widening trails. Often new trails result from park users taking shortcuts, rather than staying on designated routes. The shortcuts then get established, and it becomes difficult to discern between sanctioned and unsanctioned trails. The proliferation of trails between the park entrance and the First Lookout is the

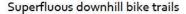
most concerning, because of the steep terrain, the sensitivity of the ecosystem and the extensive trail expansion that has occurred in this area.

In addition to shortcut trails for hikers, this south facing slope has also become a favorite route for downhill bikers. Downhill biking is a much more intensive form of recreation that can generate soft soils, loss of vegetation, creation of narrow channels and erosion potential. Furthermore, Knox Mountain Drive facilitates the use of vehicles to shuttle mountain bikers to the Second Lookout; enabling a higher frequency of riding.

There are several concerns with regards to ever-expanding trail networks within Knox Mountain Park.

- Trail development often leads to the establishment of introduced and invasive plants. As the density of trails expand over relatively small areas, the individual plant invasions can meld together; completely displacing the native plant community.
- Trails, especially on steep sloped areas, act to facilitate the movement of water and can become hotspots for downcutting and erosion.
- Any trail crossing or road upgrades that would require a culvert (i.e., gully, stream), should be designed in accordance with the Guidelines for amphibian and reptile conservation during road building and management activities in British Columbia guidance document (BC MOE, 2020).
- The addition of new trails increases the probability of animal-human interactions, and possible collisions between passing wildlife and trail users.
- Trails can also negatively impact local species, often times resulting in a reduction
 of species richness and abundance. As an example, the Blue-listed Great Blue Heron
 is considered vulnerable because of their sensitivity to disturbance when nesting
 (Wildlife and Trees in BC, 2006). This species may avoid an otherwise optimal
 nesting site, due to the routine disturbance that originates from an adjacent trail.
 This example underlies the importance of ensuring that trails do not encroach upon
 critical wildlife features such as wetlands, significant wildlife trees, etc.







Superfluous trails in newly acquired parcel in Knox Mountain East

In the 2011 management plan, the cumulative length of trails within just Knox Mountain West, approached 58,022 m, or approximately 205 m of trail for every hectare of park. Of this total trail length, 42,317 m (or 73%) was unsanctioned. A recent shapefile of the sanctioned trails within Knox Mountain Park was obtained from the City of Kelowna. Ecoscape then greatly expanded the database of trails by mapping unsanctioned routes using a hand-held GPS and recent ortho-imagery.

The cumulative length of trails within the entire Park is just over 75,000 m (including Knox Mountain Road), or approximately 196 m of trail for every hectare of park. A breakdown of sanctioned trails, unsanctioned trails, rehabilitated trails and roads within Knox Mountain East and Knox Mountain West is provided in Table 9. The various types of sanctioned trails are displayed in Figure 5.

Type of Trail	Knox Mountain West – Length (m)	Knox Mountain East – Length (m)	Total Knox Mountain Park — Length (m)
Sanctioned	24,428	4,342	28,770
Unsanctioned	31,489	3,373	34,862
Rehabilitated	7,698	0	7,698
Road	4,077	477	4,554
Total	67,692	8,192	75,884

Since 2011, the trail network within Knox Mountain West has increased by approximately 17% overall; yet, the total unsanctioned trail network in Knox Mountain West has decreased by approximately 26%. However, of the existing total trail network across the entire Park, approximately 46% is unsanctioned. Although there has been success in decommissioning previously unsanctioned trails in Knox Mountain West, nearly 50% of all trails throughout the Park are unsanctioned, which indicates that unwarranted trail development is most likely the single greatest environmental issue within Knox Mountain Park and requires ongoing evaluation and management.

To begin to address the ever-expanding trail network, Ecoscape recommends that currently unsanctioned trails either be decommissioned and rehabilitated or sanctioned. Criteria that can be utilized to identify trails suitable for decommissioning and rehabilitation include:

- Shortcut legs that occur across steep slopes;
- Smaller, unsanctioned trails that have the same end destination as an existing sanctioned trail;
- Trails that encroach on critical wildlife features (e.g., Kathleen Lake); and
- Any trails that are generally redundant.

The successful decommissioning of unsanctioned trails throughout the Park will be a very slow and difficult process that will require ample resources and personnel. Minimum elements of decommissioning will include educational signage, temporary split rail fencing or access barriers, a regular enforcement component and a frequent review of works to evaluate progress and to make changes as necessary.

The above criteria used to determine the trails for decommissioning are valid considerations; however, the criteria are not likely comprehensive. For example, there may very well be additional factors such as existing right-of-ways, maintenance route requirements, etc. Therefore, a comprehensive access management plan should be developed for Knox Mountain Park to identify all relevant access issues, target a preferred trail network, and to implement an all-inclusive action plan to more effectively manage access throughout the Park. As part of the comprehensive access management plan, we strongly recommend that the trail network be revaluated every three to five years to ensure any additional unsanctioned trails are caught early, before they become more established by park users.

Ecoscape makes the following recommendations that could be incorporated into an access management plan or within the upcoming master plan.

- Additional City bylaws should be developed that will prevent the use of unsanctioned trails and facilitate enforcement.
- The steep sloped areas between the park entrance and the second lookout is the
 priority location for decommissioning trails. As previously discussed, this south
 facing slope maintains a rare grassland that is particularly sensitive to disturbance.
 In addition, trail development across the extreme grades enhances erosion
 potential.
- In order to prevent downhill biking/hiking conflicts and the widening of multiple trails, a single challenging downhill biking route that extends from the Second Lookout to the entrance of the park has been sanctioned and designated for downhill biking only. Down slope of the second lookout, this downhill bike trail has experienced significant widening. The extension of a split rail fence in this location should help to minimize the footprint. In other locations downslope of Knox Mountain Drive, the south facing slope now has multiple braided trails and shortcuts, that have developed over time. Furthermore, numerous other trails within the Park are regularly used by mountain bikers. Regular maintenance of these trails is imperative to ensure a minimal footprint, reduce impacts to wildlife and to prevent erosion potential in more ecologically sensitive areas within the Park. Ecoscape recommends that City staff and representatives of Mountain Bikers of the Central Okanagan (MTBCO) walk the regularly used mountain bike trails annually to ensure maintenance standards are met.
- Within Knox Mountain East, Ecoscape documented at least three steep downhill
 mountain bike trails that originate from the peaks and extend downward to the
 valley bottom. These trails should be a priority for decommissioning, or a
 designated mountain bike loop trail should be established, with all other ad hoc

trails decommissioned. Knox Mountain East is regularly used for mountain biking and designated trails with signage is imperative.

• In addition to decommissioning trails, it is also critical to prevent the establishment of newly developed unsanctioned trails. To successfully implement such works, it is essential to be highly familiar with the existing trail network and to regularly survey and monitor recreational activities/points of new trail development prior to their establishment. Due to personnel and resource limitations, it will likely be difficult to implement such a program across the entire park. The highest priority locations to prevent newly developed trails are steep sloped areas that have inherent erosion concerns and also within and adjacent to important ecological features that are sensitive and prone to disturbance (e.g., wetlands).

3.3 Proposed Park Use / Zoning Concept

As previously discussed, within Knox Mountain Park there are several broad ecosystem classifications with varying degrees of sensitivity, ecological importance and existing disturbance. Given this variability, the park should be managed in such a way that provides a greater protection for rare and sensitive ecosystems and also focuses recreational activities to less sensitive locations or areas that already have an existing level of disturbance. To achieve these goals, Ecoscape recommends the implementation of park zones based on the presence of the different ecosystems and their sensitivity to disturbance. The recommended park zones are as follows: 1) Conservation; 2) Nature; 3) Access; and 4) Recreation (Figure 6).

1) Conservation (CON) – Ecoscape recommends that "Conservation" zones be designated across representative areas of sensitive ecosystems of Knox Mountain Park. This zone is intended to protect provincially significant natural ecosystems for their intrinsic value, their contribution to the Park's biodiversity and for long-term public appreciation. It specifically targets the Bluebunch Wheatgrass – Arrow-leaved Balsamroot grassland, Ponderosa Pine Parkland, Interior Douglas-fir – Pinegrass Woodland, Kathleen Lake, and the critically valued kokanee spawning shoreline of Okanagan Lake. In general, Conservation areas are considered highly fragile and sensitive to human disturbance and hence, the priority is protection/conservation. By minimizing recreational activities from the Conservation zone, ecosystems will remain in tact and species susceptible to disturbance (i.e., owls) will have better opportunities for general living and breeding. The Park Zoning Panel depicts five concept Conservation zones:

Knox Mountain West

CON-1: South and Southwest Slopes Grasslands

CON-2: Northwest Slopes Coniferous Woodlands

CON-3: Kathleen Lake

CON-4: Kokanee Spawning Area along Okanagan Lake

Knox Mountain East

CON-5: Grassland plateaus and Open Ponderosa Pine Woodland.

The following general recommendations pertain to the Conservation Zone.

- Any unsanctioned trails within this zone should be immediately decommissioned. Where unsanctioned access has degraded the natural condition, restoration efforts in conjunction with future access management should be implemented.
- Native vegetation planting may be useful to speed up the process of trail decommissioning and to naturalize areas of enhanced disturbance.
- The Conservation zone should be evaluated for non-native and invasive plant species, and a weed management strategy should be implemented.
- In order to prevent future site degradation, no additional park development should be permitted. However, sanctioning of existing trails is permitted but should be minimized to the greatest extent possible.
- Mature trees, including those that are dead and/or decaying (snags) should be left standing, unless they pose an immediate public safety hazard.
- There are only fragments of sanctioned trails that intersect the Conservation Zones (in CON-5 in Knox Mountain East, and a couple intersections with CON-1 in Knox Mountain West at the northwest corner of the park, near Paul's Tomb), and thus there should be little to no human activities within this zone.
- Where the Conservation area abuts other high use zones, spilt rail fencing with appropriate signage should be erected to delineate the Conservation zone and to discourage unwarranted access.
- Habitat enhancement opportunities (i.e., construction of nesting platforms, nest boxes, etc.) for rare and endangered species should be undertaken. Kathleen Lake is the priority location for habitat enhancements.
- The Conservation area should be monitored annually to evaluate any enhancement progress and to identify areas at risk or that are in need of improvement.
- 2) Nature (NA) This zone is inclusive of the remaining open coniferous woodland and other natural landscapes that exist within the Park. Minimal development is permitted, but

should be limited to the existing gazebos located at the First and Second Lookouts, signage necessary for route identification, and minimal interpretative facilities to support lower intensity recreational. Depending on the condition of individual sites, portions of the Nature zone should be temporarily closed off from park users to facilitate restoration activities and to decommission trails. The Park Zoning panel illustrates three concept Nature zones:

- NA-1: Due to the relatively steep nature of NA-1 zones, the permitted use
 is hiking on narrow sanctioned trails only. There are numerous, unsanctioned
 redundant trails within NA-1 zones that are currently utilized, but should be
 decommissioned.
- NA-2: Mixed low-intensity use: Hiking and cross-country biking on sanctioned trails should be permitted with this zone. Generally, NA-2 zones are less steep with wider trails to facilitate both forms of recreation. Nevertheless, the NA-2 zone occurs directly adjacent to a Conservation zone (Kathleen Lake) and appropriate signage and split rail fencing should be erected to prevent recreationalists from encroaching into this sensitive ecological feature.
- NA-3a-c: This zone is inclusive of sites that are either in need of immediate restoration or should be closely monitored to ensure restoration efforts previously completed are not lost. It includes the steep south facing slope near the park entrance, including the newly added south facing parcels in Knox Mountain West disturbed by invasives, exposed soils and cutbanks (NA-3a). NA-3b includes the area downslope of the second lookout, where restoration works are needed to narrow the downhill mountain bike trail (Apex Trail), and the isolated discharge basin (wetland) south of the Second Lookout (NA-3c) where an asphalt parking lot could be eliminated. Since 2011, split rail fencing was installed along trails south of both the First and Second Lookouts and was generally successful in rehabilitating trails and limiting new off trail disturbances consequently, reducing the spread of invasives allowing natives species to reestablish and flourish. The south facing slopes are deemed the highest priority sites for decommissioning unsanctioned trails and preventing any reversal of previous restoration efforts. It is recommended that additional split rail fencing be installed at the First Lookout, especially considering foot traffic in this area is anticipated to increase during the two-year vehicle access trial period. With concern to the newly added south facing parcels to Knox Mountain West, given the level of restoration necessary, it is recommended that the entire hillside east of Jones Street within the NA-3a zone be excluded from recreational use until measures are put in place to discourage unsanctioned trail use and to allow the recovery of native vegetation. A comprehensive

invasive species management plan / restoration plan should be developed for this area (see Section 3.6).

Ecoscape makes the following recommendations pertaining to the Nature zone:

- The existing trail network within the Nature zones should be critically evaluated and reduced where possible.
- Given the current density of trails, additional trail development is not encouraged.
- Critical wildlife habitat, specifically wildlife trees, should be retained whenever possible. The presence of these features ought to be considered when evaluating trails for decommissioning and if any new trails are to be designed. Ideally trails should avoid higher risk areas adjacent to mature trees with high wildlife value (e.g., potential nest cavities, and perches) to mitigate the need for hazard tree management.
- Where existing sanctioned trails bisect areas deemed high risk with respect to hazard trees (notably mature pine and fir), options should be considered to realign portions of trails to avoid the need for tree removal or management practices that may otherwise have high impacts – especially if trees are providing important nest cavities and roosts for species at risk.
- All low impact, human activities (walking/hiking/cross country biking) should be restricted to sanctioned trails only.
- Signage should be posted to encourage proper use.
- 3) Access (AC) This zone will act as a staging area to service the remaining portions of the park. Existing development is limited to roads (dirt and paved), small parking lots and may also be inclusive of infrastructure (e.g., water reservoirs). The Park Zoning panel shows the following concept Access zones:
 - AC-1: Knox Mountain Drive extending from the park entrance to the Second Lookout.

Roads – Because there is currently no formal access for vehicles within Knox Mountain East, Ecoscape has delineated access routes based on already established dirt roads that traverse the park in both the north/south and east/west directions. These existing routes provide sufficient access for park maintenance without creating additional disturbance. Within this AC-2 zone are also two water reservoirs and a monopole for cellular coverage.



North/south access route on the western edge of Knox Mountain East

- AC-3: Maintenance Access Roads/Infrastructure Includes dirt and paved access roads to water reservoirs in Knox Mountain West. The areas of infrastructure and associated disturbance (e.g., water reservoirs) are also included.
- 4) Recreation (REC) and Points of Interest The sites pinpointed within this zone are currently experiencing the most intensive recreational use. Future recreational development and expansion such as frisbee golf, off leash dog parks, playgrounds, etc. should target the Recreation zone, prior to the consideration of other park zones. In addition to the recreation zone, there are several other points of interest that also attract numerous park users. Below we make recommendations to reduce the environmental impact of park users at these sites.

Recreation Zones

REC-1: Dayuse Parkland at Park's Entrance (Knox Mountain West) – Much
of this area is turfed and therefore it is optimal for more intensive types of
recreation. Existing activities include tennis and disk golf.

Points of Interest

- First Lookout: The First Lookout is a popular destination for park users that
 access the park via vehicle on Knox Mountain Drive. There are parking stalls
 at this location, and it also acts as a starting point for several popular trails
 (e.g., trail to Paul's Tomb). The following are recommendations to lessen the
 impact of park users at this location:
 - The numerous unsanctioned trails extending down slope from the first lookout should be decommissioned.

- Signage should be erected that directs the park user to the appropriate sanctioned route.
- Similar to the Second Lookout, much of this area consists of sparsely vegetated rocky outcrops. Currently, park users are sprawling across the entire area, rather than using a single route. Split rail fencing should be erected to prevent access to these sensitive features and culturally significant species.
- Down slope of the rocky outcrops, Ecoscape encountered a substantial amount of garbage (e.g., broken beer bottles).
 Signage should be posted to educate the park user of appropriate activities and a sufficient number of garbage cans should be located at this location.
- Second Lookout: The Second Lookout is located at the apex. The Second Lookout has been accessible by road previously, but a Council resolution in the Fall of 2021 determined that vehicle access would be restricted to the First Lookout for a two-year trial period. Destinations in the general area include the pavilion and gazebo where there are excellent views of the surrounding landscape. The following are recommendations to lessen the impact of park users at this location:
 - Due to the sparsely vegetated nature of the apex, park users tend to sprawl across the entire area rather than using a designated trail. A single trail alignment has been selected and delineated with fencing to prevent unwarranted access to the remaining parts of the Second Lookout. This minimal fencing effort has resulted in vegetation re-establishment and a healthier ecosystem. Similar fencing should be undertaken at other sparsely vegetated sites where there are existing trails.
 - The downhill mountain bike trail, which starts near the Second Lookout, has widened over time and is now the width of a road. This trail should be narrowed by extending the split rail fencing further down slope.
 - Several rare juvenile gopher snakes have been documented in the vicinity of the apex. Given the number of park users that frequent this location, it is important to provide the users with educational materials that direct appropriate behavior if a snake is encountered.

- Paul's Tomb: Paul's Tomb is located in the remote north western corner of the park and is also a favourite destination of park users. This site is particularly unique because it is surrounded by two Conservation zones. The sensitive Kokanee Red and Black Zones of Okanagan Lake are immediately west of Paul's Tomb; and it is the only accessible portion of the Okanagan Lake foreshore from Knox Mountain Park. The lake accessibility is likely the main attractant for park users (especially for those people and dogs who like to swim). This same stretch of foreshore provides critical habitat for kokanee shore spawning and thus there must be a balance between recreational activities and the natural state of the foreshore. The following are recommendations to lessen the impact of park users at this location:
 - The natural state of the larger area surrounding Paul's Tomb has diminished over time with unsanctioned trail development, commonly encountered off leash dogs, and the proliferation of invasive plants. Similar to the other points of interest, signage, decommissioning of unsanctioned trails, and split rail fencing will be instrumental to lessen the environmental impact.
 - Signage should be erected to remind park users that their dogs must be leashed and that this is not an off-leash dog beach. Furthermore, the signage should indicate that this is a vital Kokanee spawning area and that there is to be no in water use by Park users between October 1st and May 31st to ensure the protection of Kokanee eggs. Kokanee are a Federally protected fish and any harmful alteration, disruption or destruction of fish or fish habitat would be in contravention of the Federal Fisheries Act.
 - Conservation zone signage should be posted at the interface of both CON-2 and CON-4 zones that discourages entry.
 - Invasive plant monitoring and removal should be undertaken in the Paul's Tomb area.
 - Sanctioned access routes (trails) within the Paul's tomb day use area should be better defined using woodchips or gravel to delineate preferred walking paths.

3.4 Edge Effects

Forest edge is the area where one ecosystem type meets another (e.g., where a forest meets a meadow, boundary between a harvested area and old-growth forest, or a gap in the forest canopy). Edge effects include increased rates of predation and competition on the existing flora and fauna from exotic animals (cats, starlings) and plants (weeds in general) that are associated with the modified habitat (Andren & Anglestam, 1988; Wilcove, 1985; Barratt, 1995; Pauchard and Alaback 2004). Reflected heat from asphalt can lead to drying of microclimate conditions. Often, there is a difference in microclimate conditions (such as temperature, humidity, light, snow/moisture accumulation, and wind) that can penetrate 100-200 metres from an edge into the intact forest. Changes to moisture regimes, such as increased runoff from paved areas, and localized climate resulting from differences in land use (development) can also affect the vegetation composition of forest edges (Brosofske et al., 1997).

Edge effects are currently being felt at both the micro- and macro-scale. Within the Park, numerous redundant trails bisect natural ecosystems and create edge effects within internal core areas of natural habitats. A reduction of the trail network would lessen these edge effects and may improve species utilization and overall biodiversity.

At the macro-scale, Knox Mountain Park has limited connections to other natural lands. The urban footprint continues to expand around Knox Mountain Park; with ongoing development including: the build out of the Wilden subdivision near the northern edge of the Knox Mountain East; the build out of the High Point subdivision on the south side of the Knox Mountain West; build out of the Shearwater development on the northern edge of Knox Mountain West, and; several planned multifamily developments along Clifton Road.

With the completion of these planned subdivisions, the parcels of Knox Mountain Park will effectively become islands of natural land surrounded by urbanization. One way to lessen the effect is to at least establish a natural connection for movement between the parcels. The recently added parcels to Knox Mountain East extends the Park north and west in a relatively undisturbed coniferous woodland habitat. Any east-west connection of the Park parcels would be somewhat limited given that Clifton Road runs in the north/south direction along the entirety of the park boundaries and effectively separates the parcels. Nevertheless, it would still be beneficial to connect the Park parcels through further acquisition of land that would be designated as park. A forested connection to Clifton Road would likely encourage the safe movement of larger wildlife during periods of reduced road use (e.g., night time). If the City of Kelowna is successful in connecting Knox Mountain West and Knox Mountain East, then other considerations should include the establishment of safe movement corridors for slower moving wildlife (i.e., box culverts with directional fencing). Land acquisition in the general vicinity of Blair Pond may be the most optimal for several reasons. First, there is already existing park land adjacent to the pond that could

be incorporated into the overall connection. Second, Blair Pond is an additional hotspot for species richness; maintaining species such as the Blue-listed Western Painted Turtle (*Chrysemys picta bellii*) (Hawes and Bekhuys, 2002). The painted turtle is known to migrate between ponds with successful overland homing distances of up to 3 km (COSEWIC, 2006). Therefore, an adequate reptile crossing similar to that which has been recommended within the Wilden Development (Olson and Hawes, 2008), may be effective at this location to facilitate migration of Western Painted Turtle between Blair Pond and Kathleen Lake.

3.5 Human-Wildlife Conflict

Human-wildlife conflict is defined as any interaction between wildlife and humans which causes harm, whether it's to the human, the wild animal, or property (i.e., vehicles). In the case of Knox Mountain Park, harm is most commonly felt by wildlife, with recurrent interactions felt from humans, domestic pets and vehicles.

Although the City of Kelowna has a leash law in Knox Mountain Park, Ecoscape commonly encountered unleashed dogs in the more remote forested areas of the park and especially within Knox Mountain East. Many of the pet owners live in adjacent neighborhoods and let their dogs run off leash once entering the less traveled parts of the park. Unleashed dogs are also regularly encountered near Paul's Tomb where dog owners often allow dogs to fetch sticks from Okanagan Lake. From an ecological standpoint, dog-wildlife interactions are the biggest concern regarding off leash dogs. Documented interactions include off-leash domestic dogs chasing deer causing injury and death, off-leash domestic dogs attacking deer resulting in injury or death, and off-leash dogs entering wetlands and chasing waterfowl and disrupting avian nest sites specifically ground nesting sites.



The remains of a Great Basin gopher snake.



An injured fawn that was apparently struck by a vehicle on Knox Mountain Drive in June 2009

Off-leash domestic dogs are not the only domestic pet that negatively impacts wildlife in the park; outdoor cats also roam and hunt within the Park boundaries. Cats that are either permitted to roam outside or feral cats are estimated to kill between 105-348 million birds and destroy 2 million bird nests in Canada every year. Cat predation is the largest single source of human-caused mortality of mammals and birds in North America, with free roaming cats having predation rates from 14-100 prey items each year and feral cats have a significantly greater predation rate. Not only do cats prey on birds, but also small mammals and herptiles. The most effective stewardship practices to mitigate cat predation is to promote keeping cats indoors and spaying and neutering (Pearson et al., 2016).

Human-wildlife conflicts have also been documented on Knox Mountain Drive as a result of vehicles. Wildlife most at risk from vehicles include deer and several species of reptiles, most of which are rare or endangered. Vehicle usage data for Knox Mountain Drive including volume and average speed of traffic has been collected and is available for analysis. In November 2021, City Council voted to restrict vehicle access to the First Lookout only for a two-year trial period following feedback from the community from a public survey. Wildlife are most active during the cooler parts of the day, so wildlife would best benefit from road closures during the am (e.g. until 10 am) and in the late afternoons (e.g. after 4 pm). As such, vehicles are only permitted to use the road between noon and 8 pm daily. It was found that during the pandemic, daily use of the road by walkers, hikers and cyclists increased by more than 55% during the week and 63% on the weekends, and as such, maintaining vehicular access to the Second Lookout was also a public safety risk.

Finally, Ecoscape is aware of some unsubstantiated evidence of direct human-wildlife conflict as a result of interactions between people and snakes. Many people fear snakes and therefore snakes are often persecuted by humans. Given the imperiled state of many of BC's reptiles, it is critical that parks such as Knox Mountain are safe places for reptiles.

In order to minimize human-wildlife conflict, Ecoscape makes the following recommendations:

- Ecoscape recommends the development of a comprehensive program to address off-leash dogs. The program would include the following main components:
 - Signage that cites the leash law should be posted at all entry points into the park from adjacent residential subdivisions, including Magic Estates, Glenmore, Wilden, High Point and Shearwater developments.
 - Ecoscape understands that owners of pets that come into conflict with a wild animal are liable for a \$345 fine. However, off leash activities may be more effectively curbed if pet owners are more regularly fined when encountered with off leash pets, rather than waiting for a conflict to occur. Therefore, bylaw enforcement will be essential to the success of the program.

- Education is a key element in reducing human-wildlife conflict. Educational materials should be distributed at the kiosk at the park entrance to inform park users of appropriate behavior when encountering wildlife and public awareness should be promoted throughout the City. Furthermore, educational/interpretive signage should be erected at high-risk areas (i.e., Paul's Tomb, Kathleen Lake, First and Second Lookouts) of the impacts off-leash dogs can have on nesting birds and small mammals as to inform and discourage Park users from letting their dogs off leash. The signage should also indicate disturbing wildlife is illegal in BC, particularly actively nesting birds (i.e., Wildlife Act). Human-wildlife conflict is most likely to occur in late spring/early summer during dispersal and nesting seasons. Educational measures and bylaw enforcement should be ramped up during this period.
- The two-year trail period on restricting vehicular access to the Second Lookout should be closely monitored to determine how a reduction in vehicle traffic impacts human-wildlife interactions. Following the trial period, vehicle usage data for Knox Mountain Drive should be critically analyzed to determine the most appropriate times of the day when vehicles could be excluded. A reduction in traffic on Knox Mountain Drive will likely result in less human-wildlife conflict.

3.6 Invasive Species Management

The greatest impact of invasive species is the displacement or competitive exclusion of native species (Gayton, 2007). Gayton (2007) cites several examples in British Columbia, where invasive species have not only displaced natives, but have dramatically altered the nature and function of the ecosystem. At least one of those examples, cheatgrass invasions was documented as being a problem within Knox Mountain Park. If this invasion is allowed to continue unchecked, it has the potential to dramatically alter ecosystem function and may result in displacement of native species and an overall loss of biodiversity.

Ecoscape recommends that a Knox Mountain Invasives Control Plan be developed and implemented to manage invasive species throughout the Park. The plan would include, but not be limited to, the following components:

- First, an invasive plant mapping exercise should be undertaken to thoroughly characterize the number of species present and their extent of invasion to understand baseline conditions.
- Following the mapping exercise to understand the extent and species assemblage
 of the invasive species, a detailed weed management plan can be developed, which
 will include species-specific management protocols. For example, diffuse knapweed
 is a provincially noxious tap-rooted biennial or short-lived perennial which has heavy

seeds that are readily dispersed by wind, seed drop, humans, animals and vehicles. Diffuse knapweed can produce as many as 18,000 seeds per year and flowering of diffuse knapweed occurs in July, with seed set in August. It is important invasive species are managed in a species-specific manner (i.e., specific timing and management strategies), otherwise it would be very easy to further spread an invasive plant while trying to manage it. Species-specific management protocols can be found from the Invasives Species Council of BC. Removal of plants by hand pulling is recommended earlier in the season, not only for the ease of pulling, but also to prevent seed dispersal.

 Known invasive plant populations within that Park that should be prioritized in the Invasives Control Plan are described in Table 10.

Table 10. Known invasive plant populations that should be prioritized in the Knox Mountain Invasives Control Plan		
Location of Invasive Plant Population	Recommendations	
Lands surrounding Kathleen Lake	Historic logging and development activities took place surrounding the lake prior to the City purchasing the parcel. As such, the existing ecological communities should be evaluated and a subsequent restoration plan developed. Much of the restoration should focus on narrowing roads, decommissioning trails and restoring native grasses, shrubs and trees.	
NA-3 South Facing Slopes	The steep south facing slope between the park entrance and the First Lookout and the newly added south facing parcels should have a site specific management plan developed to prevent further disturbances to the cryptogamic soil crust and further spread of invasive plants.	
The newly acquired parcels a part of Knox Mountain West	These areas include rare grasslands ecosystems that are being infiltrated by invasives species via edge effects. The Siberian Elm, Tree of Heaven, and Whitetop populations should be addressed immediately, following best management practices for these noxious species.	
Knox Mountain West at the end of Royal View Court cul de sac	Tree of Heaven was observed infiltrating this area and should be removed immediately before it outcompetes some sensitive vegetation in the area (i.e., sagebrush).	
Frisbee golf area near Park entrance	The planted Siberian Elm stand should be removed and replaced with a suitable native alternative. The number of mature Siberian Elms in this location is likely significantly contributing to the seed bank in the surrounding area of this highly invasive species.	
Northwest corner of Knox Mountain East	Extensive weeds were documented adjacent to the access road that originates from Rio Drive. Weeds are already well established, and hence a comprehensive inventory should be undertaken, with subsequent removal, monitoring and restoration with suitable native species.	

- The City Parks Department has a Dryland Restoration Mix that is Certified Agricultural Grade 1 and is a mix of native species and quick establishing, competitive species and does not include white sweet clover and alfalfa. These species tend to be invasive and can displace native grass communities.
- Education is a key element in controlling the impact of invasive species on biodiversity (Gayton 2007). Gaining public awareness and support is critical for any concerted action against invasive species, and is especially the case in a park situation where the public has direct access. Signage, split rail fencing, brochures



and verbal communication are all effective strategies for the protection of restoration areas and prevention of invasive species establishment and must be a key component of the Knox Mountain Invasives Control Plan to promote successful implementation.

3.7 Balancing Wildfire Protection with Critical Wildlife Habitat

The ongoing mountain pine beetle infestation has resulted in numerous Ponderosa pines within the Park becoming infested. Tree removal has been actively undertaken over the last decade.

Ecoscape understands that a Sustainable Urban Forest Strategy was developed for 2011-2021 to guide management of Kelowna's urban and parkland trees (Brown and Needoba, 2011). It is a delicate balance to control wildfire potential and public safety, while also maintaining critical wildlife habitat and the integrity of existing ecosystems.

The wide-spread removal of trees presents a 2-fold problem.

- 1) Ground disturbance from tree removal can result in erosion and weed infestations; and
- 2) Removal of dead or dying trees reduces critical habitat for many species groups including birds and bats.

Approximately 85 North American avian species excavate nesting holes, use natural decaying cavities or utilize holes created by other species in dead or deteriorating trees. Dead trees, often referred to as snags, are typically considered undesirable from a forest and park management perspective, as they may harbor insect pests (e.g., mountain pine beetle), and create the potential for fire and safety hazards. Nevertheless, the removal of such trees results in long-term adverse effects for important species such as woodpeckers, swallows, wrens, nuthatches, owls and others (Scott et al., 1977).

Previous studies have attempted to qualify the most important types of dead trees for avian use. Those which are most frequently used are trees that are dead for six or more years, are more than 18 inches diameter at breast height, and have more than 40 percent bark cover. This is a general qualifier that could most likely be narrowed further by targeting the specific species of trees that occur in Knox Mountain Park, namely Ponderosa pine and Interior Douglas-fir. By knowing the snag characteristics most important for critical habitat, park managers can selectively maintain critical wildlife trees, while also reducing risks to wildfire and public safety. Furthermore, the contributions of avian species in controlling insect pests should not be underestimated. The majority of cavity nesting birds are insectivores, and they do play an important role in the control of insect pests. Woodpeckers are especially important predators of the bark beetle.

Ecoscape makes the following recommendations to ensure that critical wildlife trees are maintained and that logging efforts do not result in weed establishment and erosion concerns.

- The City of Kelowna should develop a danger tree/wildlife database to ensure the long-term maintenance of critical wildlife trees. This database should be created using a data dictionary that can be utilized with GPS technology, in order to allow individual trees to be accurately mapped. The database should include information such as tree species, year of death, diameter at breast height, proximity to water/infrastructure (e.g., trails), level of risk to public safety, slope and gradient, accessibility, etc. This level of detailed data will allow Park Managers to make informed decisions regarding tree removal/maintenance. Similar works are currently underway by Regional District of Central Okanagan, and having comparable databases will facilitate data sharing and comparison.
- Ecoscape discourages the wide-spread removal of mature infested trees within
 the Conservation areas. There are only fragments of sanctioned trail within this
 zone and therefore, public safety is less of an issue. Ideally, mature trees will be
 left and will continue to provide critical habitat far into the future.
- Ecoscape encourages that mature trees be modified vs. fully removed whenever possible, when assessed as dangerous by a certified Wildlife Danger Tree Assessor. It is recommended that the BC Ministry of Environment Best Management Practices for Tree Topping, Limbing and Removal in Riparian Areas and their recommendations for tree modifications be adhered to. When trees must be removed, it is strongly encouraged this is completed during the winter when there is snow to protect the ground from disturbance and outside of the nesting bird window (February 18th to September 12th; Birds Canada, 2021).
- Locations with substantial ground disturbance following tree removal should be planted with appropriate bunch grass plugs to prevent weed establishment and erosion. Dying trees on extremely steep slopes that are difficult to access should not be removed.

3.8 Annual Scorecard

The 2011 management plan update outlined the need to establish an on-going monitoring program in the Park in the form of an annual scorecard in order to assess Park conditions and trends and whether they are consistent with the management plan objectives. Annual monitoring has been conducted since June 2012 as a means of evaluating the implementation of the management plan objectives, and to determine the effectiveness of management actions. Monitoring provides a means to establish the initial or baseline condition of specific values within the Park and change in the condition of those values over time. The score card audits performance of following through on management direction and provides a score for both condition and trend of specific values that are reflective of the ecological health and function of the Park. Individual scorecard criteria has been developed specifically for Knox Mountain Park and includes, but is not be limited to the following:

- Annual assessment of five specific location plots to include a photographic record, invasive weed count of targeted species, state of trail conditions, and an assessment of biodiversity (e.g., plant succession, snag count, frog calls or bird counts). Plot locations are as follows:
 - The Front Face of Knox Mountain West
 - The Second Lookout
 - Kathleen Lake
 - Discharge basin
 - Knox Mountain East
- Annual interview with the Outdoor Events Coordinator at Recreation & Cultural Services to determined number of sanctioned / permitted events per year and other related matters.
- Annual interview with the Knox Mountain Park Caretaker to obtain on-road wildlife
 mortality records, dog / wildlife conflicts; instances of unauthorized motorized
 vehicle use, and a general impression of size of deer population, off-leash
 infractions, vandalism, etc.
- Annual interview with the Bylaw Division to obtain annual bylaw infraction data (i.e., type, location, date etc.)
- 5. Traffic counts over the course of a week during higher traffic periods (e.g., late spring)

- Annual interview with Urban Forestry Supervisor to determine quantities of hazardous and pine beetle tree removals, extent of insect infestations, fire damage, general complaints, etc.
- 7. Assessment to determine if works are on track with the priorities identified in the management plan.
- 8. Annual memo to Council touching on highlights and dashboard measurements.

The annual scorecard assessment has been conducted annually between June 2012 and June 2019. The scorecard was designed to be assessed by city personnel who are intimately familiar with Knox Mountain Park (e.g., a Parks Planner and / or Natural Area Park Coordinator). Assessment criteria includes environmental condition criteria via avian points counts, vegetation counts hazardous tree removals and trees planted; vehicular traffic; frequency and type of outdoor events; service requests and bylaw infractions. The assessment parameters were ranked for their overall condition and general trend as described in Table 11.

Condition	Trend
Good: the condition of the indicator / measure is satisfactory.	Improving: the condition of the indicator / measure is improving
Fair: there is concern regarding the state of the indicator / measure.	Stable: the condition of the indicator / measure is not changing.
Poor: the condition of the indicator / measure is	Declining: the condition of the indicator / measure is declining.

General results and trends of the environmental condition assessment criteria documented annually between 2012 and 2019 are as follows:

- Avian point counts at all five stations have shown a steady Condition rating of Fair and Trends have been Stable across all seven years;
- Vegetation counts took place at all five sites between 2012 and 2017 and was reduced just the Second Lookout and Front Face of Knox Mountain West in 2018 and 2019. In 2017, the last year all sites were counted, the Condition had declined to poor after staying Fair between 2012 and 2016 and Trends in 2016 and 2017 were declining;
- Significant tree removals occurred in 2012 and 2013 (1,105 in total) due to pine beetle infestation. The Condition has improved since 2013, with a total of 260 tree removals occurring over the next six years;

 Tree planting varied between Excellent, Fair and Good Condition ratings between 2012 and 2016 where many Ponderosa pine seedlings were planted but has shown a declining Trend in 2018 and 2019 when no trees were planted. Hardly any trees were removed in 2018 and 2019, so the limited planting could be thought of as positive. Survivability of plantings should be considered in the future as a better indicator of success.

Ways to improve and enhance the annual scorecard and associated assessment parameters are currently being explored. Current considerations include incorporating indigenous traditional ecological knowledge and practices in the following way:

- Tracking bitterroot (Lewisia rediviva) populations throughout the Park. Bitterroot or spix am (Spitlem) has been a reverend plant to many Indigenous people, including the Okanagan/ syilx people. It has been used as a medicine, nutritious food source, important in trade, and is culturally and spiritually significant to many First Nations as one of the four food Chiefs and the Chief of all Roots (ISCBC, 2021; SFU, 2022). Unlike picking flowers, picking the roots without proper traditional harvesting techniques, which was the practice of the syilx, kills the plant. Historical harvest sites remained abundant due to the ways in which the syilx harvested and managed the land (ISCBC, 2021). As such, it is recommended that in partnership with our local indigenous partners, that bitterroot populations in the Park are monitored annually and managed, and that cultural harvesting practices be reintroduced to Knox Mountain.
- It is recommended to document the survival rates of planted pine seedlings on a 1-, 5- and 10-year time frame to ensure that new plantings are adequately offsetting tree removals.
- It is recommended to initiate a database of significant wildlife trees that provide critical habitat for species at risk, including Lewis's Woodpecker and Flammulated Owl, and to conduct annual surveys of the significant trees for wildlife nesting and use during the spring nesting season.

3.9 Summary of Considerations

In summary, Table 12 provides a comprehensive list of the key management recommendations provided in this report to be included in the Knox Mountain 2021 Management Plan.

Recommendations	Details
Interpretive Signage	Ecoscape strongly encourages an expansion of interpretive/educational signage throughout the park to more effectively promote and communicate the uniqueness of Knox Mountain Park including the many rare ecosystems and wildlife, indigenous culture, history, language and values, the reasons to protect the park, and specifically the tools in which the public can participate in its protection.
Permitted Activities / Bylaws Signage	Sensitive Park zones and permitted uses should be identified with signage at highly accessible locations where there is potential for unwarranted access/activities.
	A large sign should be erected at the park entrance that welcomes park users and clearly defines the rules of the park.
	Signage to inform the park user of trails that are being decommissioned/remediated and are not to be disturbed or to direct the user to more appropriate locations.
	Paul's Tomb – focus on impacts to spawning Kokanee and the federal Fisheries Act. Nathleen Lake – focus on of cryptogamic crust and associated rare and fragile grassland ecosystems and cultural significant flora. Second Lookout – focus on protection of cryptogamic crust and associated rare and fragile grassland ecosystems and cultural significant flora.
	Signage should indicate the leash bylaw but also describe the impacts off-leash dogs can have on nesting birds, small mammals, spawning Kokanee, and herptiles as to inform and discourage Park users from letting their dogs off leash. The signage should also indicate disturbing wildlife is illegal in BC (Wildlife Act), and any harmful alteration, disruption or destruction of fish or fish habitat is illegal in Canada (Fisheries Act). Human-wildlife conflict is most likely to occur in late spring/early summer during dispersal and nesting seasons. Educational measures and bylaw enforcement should be ramped up during this period.
Information Kiosk/Structure	Knox Mountain Park would greatly benefit from a more formal educational facility such as an interpretive center or minimally an educational kiosk. This facility should be located at the entrance to the Park. Placement of an educational facility at this location will target the majority of users prior to them entering the natural areas of the park, and it is an excellent venue to inform users of current park conditions (e.g., areas closed for restoration works, season for snake movement, Kokanee spawning).

Educational Initiatives	Kokanee Shore Spawning – The Paul's Tomb trail in Knox Mountain West is an excellent location to safety observe shore spawning kokanee without disrupting their natural behavior.
	Blooming of the arrow-leaved balsamroot (Balsamorhiza sagittata) (city official flower) – Knox Mountain Park is likely the best location within the city to appreciate this spring flower. Activities could include professional photos with the blooming hillsides as the background, kids activities and challenges, etc.
	A Grassland Conservation Day - An emphasis on the rare and unique grasslands in Knox Mountain Park with special attention brought to the extremely rare Big Sage – Bluebunch Wheatgrass (SW) ecosystem.
	Seasonal Interpretive Nature Walks – Local naturalist groups, summer students or similar, could develop and run seasonal nature walks at scheduled times throughout the year for the general public to learn more about the diverse flora and fauna in the Park.
Park Boundary Delineation	There is a need for signage at all park boundaries where sanctioned trails intersect the boundary. Signage at these locations should identify the park boundary, permitted activities and resultant fines for not adhering to permitted activities (e.g., no motorized vehicles).
Development and Implementation of a Comprehensive Access Management Plan	A comprehensive access management plan should be developed for Knox Mountain Park to identify all relevant access issues, target a preferred trail network and to implement an all-inclusive action plan to more effectively manage access throughout the Park. As part of the plan, we strongly recommend that the trail network be revaluated every three to five years to ensure any additional unsanctioned trails are caught early, before they become more established by park users.
	Unsanctioned trails should either be decommissioned and remediated or sanctioned as a primary action item of the plan. Minimum elements of decommissioning will include educational signage, temporary split rail fencing or access barriers, a regular enforcement component and a frequent review of works to evaluate progress and to make changes as necessary.
Split Rail Fencing Installations	Where the Conservation areas abuts other high use zones, spilt rail fencing with appropriate signage should be erected to delineate the Conservation zone and to discourage unwarranted access. This is particularly relevant between CON-3 (Kathleen Lake) and NA-2 to prevent recreationalists from encroaching into this sensitive ecological feature.
	Surrounding the First Lookout to prevent trampling the cryptogamic crust and facilitating the spread of invasives and to prevent the destruction of rare/ fragile grassland habitats.
	Surrounding the Second Lookout to prevent trampling the cryptogamic crust and facilitating the spread of invasives and to prevent the destruction rare/ fragile grassland habitats.
	Surrounding Paul's Tomb to prevent trampling the cryptogamic crust and facilitating the spread of invasives and destruction of rare and fragile grassland habitats.
	Any restoration / trail remediation sites.

Development and Implementation of a Knox Mountain Park Invasives Control Plan An invasive plant mapping exercise should be undertaken as the first step to thoroughly characterize the number of species present and their extent of invasion to understand baseline conditions.

A detailed weed management plan should be developed once the extent and invasive species assemblage within the park has been mapped, which would include species-specific management protocols. It is important invasive species are managed in a species-specific manner (i.e., specific timing and management strategies), otherwise it would be very easy to further spread an invasive plant while trying to manage it. Species-specific management protocols can be found from the Invasives Species Council of BC.

Known invasive plant populations within the Park that should be prioritized in the Invasives Control Plan are described in Table 10.

4.0 CLOSURE

This overview report has been prepared for the exclusive use of the City of Kelowna. Ecoscape has prepared this report with the understanding that all available information on the past, present, and proposed conditions of the Park have been disclosed.

If you have any questions or comments, please contact the undersigned at your convenience.

Respectfully Submitted,

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FIGURES





