

REPORT

Ministry of Transportation and Infrastructure

Highway 97 Skaha Hills Intersection Upgrade Environmental Assessment



SEPTEMBER 2022

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1 INTRODUCTION

Associated Environmental Consultants Inc. (Associated) is pleased to provide this environmental assessment report for the Skaha Hills Intersection upgrade project at the south end of Penticton, BC. The project is located in an area that has already been disturbed by residential, commercial, and existing highway infrastructure. This report summarizes aquatic and terrestrial resources, soils, terrain, and land use values associated with the project, and presents the methods, results, and discussion of an environmental assessment of the area.

1.1 Project Background

The BC Ministry of Transportation and Infrastructure (MOTI) is improving highway safety south of Penticton by upgrading the intersection where the Old Penticton-Oliver Highway meets Highway 97. Associated was retained by MOTI to conduct an environmental assessment to characterize the existing biophysical condition and determine the potential effects of the Project on environmental values. Associated originally completed an environmental assessment in 2016, and since then the design has been updated. The original environmental assessment from 2016 has been updated to reflect the new design and current biophysical conditions.

The objective of this environmental assessment is to assess the potential effects of the Project on the environment and develop strategies to avoid, reduce, or mitigate potential effects. Specific objectives of the environmental assessment are as follows:

- Describe the baseline environment and wildlife habitat quality in the Project Area.
- Identify potential environmental effects of construction and operation of the Project.
- Determine mitigation strategies and procedures to avoid or reduce any potential effects.
- Determine if there are any residual environmental effects that cannot be reasonably mitigated and develop a compensation strategy for those effects.

This environmental assessment included a comprehensive review of information relevant to the Project. Field surveys were conducted in 2016 and again in 2022 to confirm the findings of the review and describe the environment. Results of the background review and field surveys were used to evaluate the potential effects on the environment and develop mitigation strategies for the construction and operation phases of the Project.

This environmental assessment focussed on the natural environment and did not assess the effects of the Project on archaeological, cultural, or socio-economic values.

1.2 Project Description

The Project is located at the north western end of Skaha Lake, amongst existing residential and commercial developments (Figure 1-1). Most of the Project is located within the existing MOTI right-of-way, with the proposed stormwater outfall outside the right-of-way, and is surrounded by the Penticton Indian Band Reserve (Penticton IR #1). The Project is expected to include the following activities:

- decommissioning of the existing intersection and construction of a new intersection;
- terrain re-shaping through cut-and-fill activities;
- highway widening to accommodate new lane configurations;
- property access upgrades, where required;
- stormwater outfall into Skaha Lake; and

- culvert upgrades on Skaha Creek to improve flow capacity.

The effects of the Project were assessed at the following spatial scales:

- **Project Area** – A 200 m buffer on either side of the proposed alignment centreline. This area is 30.1 ha and includes the Project Footprint and Project Right-of-Way. The Project Area will be subjected to direct and indirect effects of the Project on the environment.
- **Project Footprint** – The area that will be subjected to direct Project-related effects, including vegetation clearing to accommodate roadway infrastructure, road surface placement, shoulders and fill slopes. Based on current designs, this area is 1.7 ha.
- **Project Right-of-Way** – The area cleared of vegetation outside toe of fill that may be intermittently modified by mowing or brushing during long-term maintenance of Highway 97 and the Old Penticton-Oliver Highway.

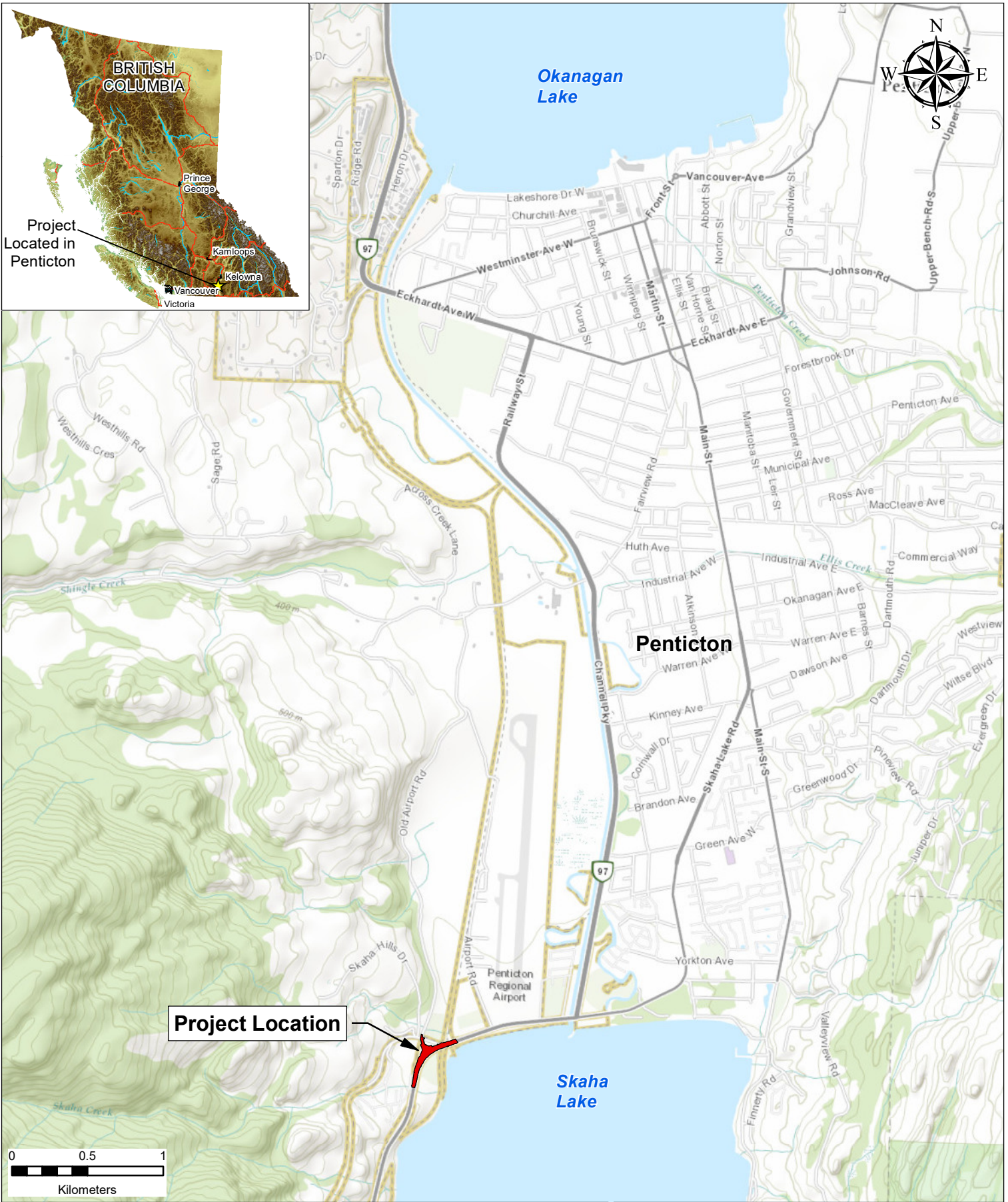


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PROJECT NO.: 2022-8273
 DATE: August 2022
 DRAWN BY: DA / BdJ

FIGURE 1-1: PROJECT LOCATION

Ministry of Transportation and Infrastructure
 Skaha Hills Intersection Upgrade

2 REGULATORY CONTEXT

Legislation and regulations relevant to the Project are provided in the following subsections.

Table 2-1. Regulatory Framework Relevant to the Project

Legislation	Relevant Section	Project Component
<p><i>Fisheries Act</i> (RSC 1985, c. F-14.)</p>	<p>This Act is to protect fish and fish habitat. Subsection 35 (1) states that “no person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction (HADD) of fish habitat.” Subsection 36 (3) stipulates that “no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish...”</p>	<p>If project works involve temporary disturbance and permanent alteration (i.e., loss and/or degradation), of Skaha Lake or Skaha Creek, works will affect fish habitat through habitat disturbances and losses and could, without appropriate mitigation, potentially introduce deleterious substances that could affect water quality. If so, the Project may require a <i>Fisheries Act</i> Request for Review from Fisheries and Oceans Canada (DFO).</p>
<p><i>Species at Risk Act</i> (SARA) (SC 2002, c.29).</p>	<p>SARA is to protect Federally listed species, their residences, and critical habitat. Under Sections 32 and 33 of SARA, it is an offence to kill, harm, harass, capture or take a Federally listed species that is endangered or threatened; and, damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction.</p>	<p>There are species at risk with the potential to occur in the Project Area. Mitigation measures described in Section 6.0 are intended to minimise potential impacts on species at risk.</p>
<p><i>Migratory Birds Convention Act</i>, 1994 (SC 1994, c. 22).</p>	<p>This Act is to protect migratory birds and their nests from indiscriminate harvesting and destruction.</p>	<p>If project works involve removal and disturbance of vegetation, habitat potentially used by migratory birds for stop-over, staging, breeding and summer foraging, the regional migratory timing window for a safe period to remove vegetation in the Project Area is August 15 to April 1 (Environment and Climate Change Canada 2018).</p>
<p><i>Water Sustainability Act</i> (WSA) (SBC 2014, c.15).</p>	<p>This Act is to protect the quality of water, fish and wildlife habitat, and the rights of licensed water users. Under Section 11 of the WSA, any activities that result in “changes in or</p>	<p>If project works include work below the high-water mark of Skaha Lake or Skaha Creek, the Project will require a Change Approval under Section 11.</p>

Legislation	Relevant Section	Project Component
<p><i>BC Wildlife Act</i> (RSBC 1996, c.488) and <i>Wildlife Amendment Act</i> (Bill 51-2004).</p>	<p>about a stream” require Notification or Approval.</p> <p>This Act is to protect wildlife species. The Act permits certain activities (e.g., wildlife salvage) and makes it an offence to kill, harm, harass or capture an animal identified as at risk.</p>	<p>If project works include work below the high-water mark of Skaha Lake, the project will require a fish salvage. A scientific collection permit with MOF will be obtained prior to the project.</p> <p>If any wildlife or their residences are found within the Project Area, a General Wildlife Act Permit will be required if capture, salvage, or relocation of individuals is required.</p>
<p><i>Weed Control Act</i> (RSBC 1996, c. 487).</p>	<p>This Act provides guidelines for noxious weed prevention and management, stating that it is the responsibility of the landowner to manage and prevent spread of noxious weeds.</p>	<p>Noxious weeds may be present in the Project Footprint. Mitigation measures described in Section 6.0 are intended to avoid the introduction, spread, or establishment of weeds in the Project Footprint.</p>

3 METHODS

Two methods were followed to collect information for the Project: 1) a background information review of relevant documents and online resources, and 2) a field assessment that verified the findings of the background review and filled any gaps in information from the background review. The following subsections outline the methods followed for each.

3.1 Background Information Review

Background information was gathered to describe the existing environmental conditions and generate a list of rare or endangered fish, ecosystems, vegetation, or wildlife that have potential to be affected by the Project.

Associated reviewed the following information sources during the background information review:

- relevant technical reports that discuss existing conditions near the Project;
- recent orthophotographic imagery and Google Earth© online imagery (Google Earth 2022);
- BC Conservation Data Centre (CDC) database for rare element occurrences (CDC 2022);
- DataBC search using iMapBC online resource identification tool (iMap BC 2022);
- BC Water Resources Atlas for ground and surface water information (WRBC 2022); and
- vascular and non-vascular plant identification handbooks and reference material.

The BC Conservation Data Centre (CDC) Species and Ecosystems Explorer was used to prepare lists of known and potential occurrences of species that are endangered, threatened, or of special concern within the Project Area (CDC

2022). Vegetation and wildlife species that are confirmed to occur within a 5-km radius of the Project Area were compiled using iMapBC, and potential occurrences of vegetation and wildlife were compiled in the Okanagan Shuswap Forest District, Okanagan-Similkameen Regional District (CDC 2022). Results of the database query were then refined by removing those species that did not use habitats that occur in the Project Area. Results of the refined search for vegetation and wildlife occurrences are available in Appendix B and Appendix C, respectively.

Additional site-specific information about land use, fish and fish habitat, vegetation and ecosystems, and wildlife and wildlife habitat was provided by Elliott Tonasket of the Penticton Indian Band (PIB) in 2016.

3.2 Field Assessment

Keenan Rudichuk, P.Biol. and Heather Taylor (née Hansen), P.Ag. of Associated conducted the original field assessment with Elliott Tonasket (PIB) on October 25, 2016. The field assessment verified information gathered during the background review, confirmed mapped stream presence, and assessed the fish-bearing status of Skaha Creek. The creek was assessed at two sites: Site 1, from Skaha Lake to Highway 97, measured 225 m in length; and Site 2, from Highway 97 west to the Riva Ridge Mobile Home Park, measured 100 m in length.

A detailed stream card was completed at several locations along the assessed areas. Electrofishing was used to determine the presence or non-detection of fish in Skaha Creek. Data were collected and 1: 20,000 Fish and Fish Habitat Inventory Site Cards were completed to document aquatic habitat (RISC 2006).

The terrestrial assessment focussed on the Project Footprint and lands adjacent that may be affected by construction or operation of the Project. Terrestrial ecosystems were assessed for their condition and value to wildlife, and data were collected. Information collected during the terrestrial assessment included the following:

- physical site description (e.g., slope, aspect, elevation);
- vegetation composition and condition;
- existing disturbance (e.g., type and relative amount);
- ecosystem connectivity;
- wildlife sign (e.g., type, age, distribution, and abundance);
- potential for rare plants and wildlife to occur; and
- wildlife habitat features (e.g., type and location).

A follow-up site visit was completed by Courtney Eyres, P.Ag., and Gisele Rehe, P.Ag., R.P.Bio., of Associated on August 4, 2022. The follow up site visit was to complete a mussel survey in Skaha Lake at the proposed outfall location and review existing conditions in the Project Area. The mussel survey was completed in Skaha Lake using the methods outlined in the Guidance for Freshwater Mussels in the Okanagan document (FLNRO 2018).

Data were compiled and used to determine direct and indirect Project-related effects on the environment. Mitigation measures were developed to avoid, reduce, or compensate for the potential effects of the Project.

3.3 Effects Assessment

Information gathered during the background information review was used to describe the climate, biogeoclimatic zone, soil condition, and groundwater information. Information collected during the field assessment was used to describe existing environmental values, such as:

- surface water condition and location;

- fish and fish habitat potential in Skaha Creek;
- vegetation and ecosystems condition; and
- wildlife potential and wildlife habitat suitability.

To quantify effects, the Project Area was stratified into ecosystem classes mapped during the field assessment. Project effects were quantified based on the amount of area of each ecosystem class affected by the Project Footprint and Right-of-Way. The magnitude of the effects was qualified based on the condition of the existing environment relative to the proposed Project plan (e.g., if existing manicured lawns would remain following construction, then effects were considered temporary).

Project design was assessed to determine if effects could be avoided or reduced by altering design. Project effects on environmental values were assessed for the construction and operations phases of the Project.

4 BASELINE ASSESSMENT

4.1 Climate and Biogeoclimatic Condition

The Project is located entirely within the Okanagan Very Dry, Hot Ponderosa Pine biogeoclimatic zone variant (PPxh1) (Ryan et al, 2021). This zone occurs at low elevations in south-central B.C. (typically between 335 and 900 metres above sea level [masl]) and is often associated with the Interior Douglas fir and Bunchgrass biogeoclimatic zones. The mean elevation at the Project site was measured at 360 masl.

The climate of the area is characterized by warm, dry summers and cool winters with light snow (Ryan et al. 2021). Annual average precipitation at the Penticton A climate station (Station ID: 1126150) is 53 mm, with approximately 17% (9 mm) falling as snow. The mean annual temperature for the area is 9.5°C (Government of Canada 2022). Thirty-year climate normals data recorded at the Penticton A station indicate a mean summer temperature of 18°C, and a mean winter temperature of 1°C (Government of Canada 2022).

The Project is not expected to have an effect on climate or biogeoclimatic condition because the Project is relatively small in scale, short in duration, and effects of the operation phase will be similar to those already incurred by the existing road alignment.

4.2 Local and Regional Land Use

Land outside of the Project Right-of-Way is entirely within the Penticton Indian Reserve #1, and has been developed into residential, business, and recreational properties (Figure 4-1). Skaha Hills community and Play Estate Winery has been developed since 2016, north of the Project Footprint. The Skaha Meadows golf course parking lot is located at the north-western extent of the Project Area. The Barefoot Beach Resort is located just east of the golf course parking lot, and is accessed directly off Highway 97.

Land between Highway 97 and Skaha Lake at the northern extent of the Project Area is managed by the Wright's Beach Camp RV Park and is adjacent to the proposed stormwater outfall location to Skaha Lake. Land west of the Project Footprint has been developed into the Riva Ridge mobile home park in the south, rural residential housing north of Riva Ridge, and commercial businesses at the north western extent of the Project Area (Figure 4-1). A small parcel of land that was formerly known as Okanagan Amusements was being decommissioned at the time of the field assessment in 2016, and has since been developed into Holiday Hills RV Resort. The Kettle Valley Railway right-of-

way is oriented north-south through the Project Area. The railway is no longer in use, the rails and ties have been removed, and the rail bed has been re-graded.

Penticton and the land surrounding Skaha Lake experience a high volume of seasonal tourism and recreational visitation over the summer months. Highway 97 south is a popular highway corridor for travellers seeking to visit the south Okanagan. Secondary highway routes such as the Old Penticton-Oliver highway function as regular travel corridors for residents commuting to-and-from Penticton, and are popular scenic recreation routes.

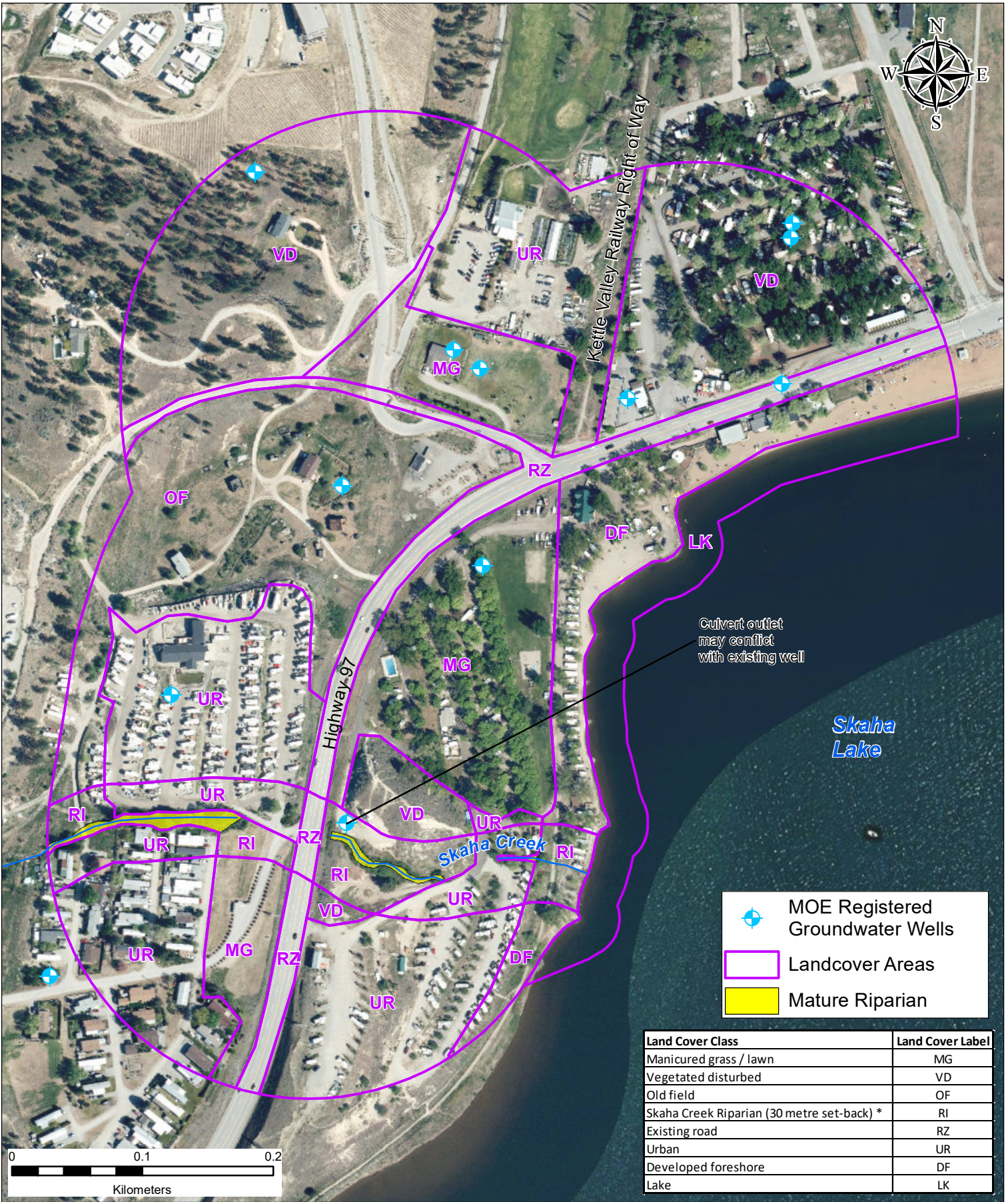


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PROJECT NO.: 2022-8273
 DATE: August 2022
 DRAWN BY: DA / BdJ

FIGURE 4-1: LAND COVER CLASSIFICATION IN THE PROJECT

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 Skaha Hills Intersection Upgrade

4.3 Soils and Terrain

Soils within the Project Footprint are already disturbed by existing road infrastructure (e.g., paved or gravel surface or road fill), or by commercial and residential developments. Terrain throughout the Project Area is low gradient, gradually sloping towards Skaha Lake. Terrain gradient steepens to the west, with a predominantly east-facing aspect in the hills above the Project Area. A natural mound located within the south extent of the Project Area was identified by Elliott Tonasket of the PIB as culturally significant; this mound has been disturbed by human influences (e.g., road construction, hiking trails). This mound is not expected to be disturbed by the Project.

The Kettle Valley Railway is oriented north-south through the Project Area. Soils within the right-of-way may be contaminated by hydrocarbons or leachates originating from the rail ties that once existed along the alignment. No soil contamination assessment was conducted for this EA, and the condition of these soils is unknown.

4.4 Water Resources

4.4.1 Groundwater

The Project Area is located within the Okanagan River watershed (Watershed ID 136645) (iMap BC 2022). The Project Area is located on a single mapped aquifer (Aquifer # 267) that is comprised of sand and gravel, has high productivity, moderate vulnerability, and moderate demand (Government of British Columbia 2022). Thirty (30) water wells are registered within the mapped aquifer associated with the Project Area (iMap BC 2022). Eleven of the water wells registered are within the Project Area. It should be noted that not all water wells are registered, and other water wells may occur in the Project Area.

A single registered water well (Well Tag Number 27421) is located in the south eastern extent of the Project Footprint, and may conflict with the location of a proposed culvert upgrade for Skaha Creek. No specific groundwater survey was conducted for the Project.

4.4.2 Surface Water

Skaha Creek occurs at the southern extent of the Project Footprint, which is located 225 m above its confluence with Skaha Lake (Figure 4-1). This second order stream flows west for approximately 5.6 km from its headwaters, which is located in the hills southwest of Penticton. Skaha Creek has a mapped, unnamed tributary approximately 2.5 km upstream of the Project Area. Source water for Skaha Creek comes from ponded meltwater that is non-fish bearing (Elliott Tonasket, personal communication). Skaha Creek flows through Penticton IR #1, passing under Highway 97 at the existing Riva Ridge intersection through a culvert under the highway. Drainage from the highway flows into Skaha Creek through two culverts upstream of the highway, before entering a 600 mm corrugated steel culvert beneath the highway. In the Project Area, the creek flows through five culverts in total: three between Highway 97 and Skaha Lake (Site 1), and two directly above (west) of the highway (Figure 4-1).

A mapped unnamed creek (Habitat Wizard 2022) on the north end of the Project Area was found to be dry and have no defined channel during the field assessment. This unnamed creek is not considered a surface water source for the Project.

4.5 Fish and Fish Habitat

Skaha Lake is known to support fish and mussel species which have been summarised in Table 4-1 below (FIDQ 2022).

Table 4-1. Fish and Mussel Species Known to Occur in Skaha Lake.

Common Name	Scientific Name
Prickly Sculpin	<i>Cottus asper</i>
Western Ridged Mussel	<i>Gonidea angulata</i>
Floater Mussel (General)	<i>Anodonta sp</i>
Slimy Sculpin	<i>Cottus cognatus</i>
Black Catfish (formerly Black Bullhead)	<i>Ameiurus melas</i>
Smallmouth Bass	<i>Micropterus dolomieu</i>
Sculpin (General)	<i>Cottus sp</i>
Longnose Sucker	<i>Catostomus catostomus</i>
Whitefish (General)	<i>Prosopium sp; Coregonus sp; Stenodus sp</i>
Rainbow Trout	<i>Oncorhynchus mykiss</i>
Carp	<i>Cyprinus carpio</i>
Kokanee	<i>Oncorhynchus nerka</i>
Western Floater Mussel	<i>Anodonta kennerlyi/oregonensis</i>
Sockeye Salmon	<i>Oncorhynchus nerka</i>
Northern Pikeminnow	<i>Ptychocheilus oregonensis</i>
Chiselmouth (formerly Chiselmouth Chub)	<i>Acrocheilus alutaceus</i>
Chub (General)	
Sucker (General)	<i>Catostomus sp</i>
Mountain Whitefish	<i>Prosopium williamsoni</i>
Burbot	<i>Lota lota</i>

Common Name	Scientific Name
Redside Shiner	<i>Richardsonius balteatus</i>
Lake Whitefish	<i>Coregonus clupeaformis</i>
Peamouth Chub	<i>Mylocheilus caurinus</i>
Largescale Sucker	<i>Catostomus macrocheilus</i>
Lake Trout	<i>Salvelinus namaycush</i>

In 2016, Skaha Creek was assessed for its habitat value for fish during the field assessment. Multiple fish barriers occur along the assessed section of Skaha Creek, below the highway (Figure 4-1); the stream gradient at Site 1 ranges from 6% to 12%, with two culverts having drops at their outlets of 10 cm and 28 cm (Appendix A, Photo 4-1). The channel has a man-made cascade with a rocky, stepped drop of approximately 1.5 m between the two culverts. While these barriers would be lessened during freshet, the high-water mark of the creek is below the bottom of each of these culverts, and they are therefore considered to be year-round fish barriers. These culverts will not be disturbed by construction; therefore, the existing barriers to fish passage will remain following construction. Site 2 has a gradient ranging from 9% to 12%, and also had a 30 cm drop in the channel bed. Construction adjacent (north) to the creek at Site 2 appears to have disturbed the natural channel, and slumping has occurred (Appendix A, Photo 4-2).

Overall, Skaha Creek has low habitat value for fish based on the stream’s value for spawning, rearing, or overwintering habitat for species known to occur in Skaha Lake. While there is a high percentage of crown closure at the top of Site 1 and the top of Site 2, overall quality of the stream is low. Large woody debris and instream cover is absent at both Sites. The streambed consisted primarily of fines, with little gravels or cobbles (Appendix A, Photo 4-3). At the time of the assessment (October 2016), the wetted area of the creek was narrow and shallow, with an average wetted width and depth of 0.7 m and 7.0 cm, respectively for Site 1, and 0.8 m and 8.0 cm, respectively, for Site 2. The channel widths were 1.0 m for Site 1, and 1.2 m for Site 2.

Electrofishing was conducted at Site 1 and Site 2 to determine fish presence in Skaha Creek, for a combined total of 304 seconds. Electrofishing produced no captures, and there were no visual signs of fish during electrofishing or the habitat assessment. Based on the results of the electrofishing, presence of significant fish barriers at the mouth of the creek, poor habitat value for fish, and lack of source population upstream, Skaha Creek is determined to be non-fish bearing.

In 2022, a mussel survey was completed in Skaha Lake in the area of the proposed stormwater outfall (Figure 5-1). The purpose of the survey was to determine to presence of non-detection of any mussel species, including provincially and federally listed Rocky Mountain ridged mussel (RMRM) (*Gonidea angulata*) and determine if specific mitigation is required to avoid impacts on mussels during the Project. The methods outlined in the Guidance for Freshwater Mussels in the Okanagan developed by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development were used (FLNRO 2018).

A prescribed survey area (PSA) was defined approximately 12 m east and 18 m west of the proposed stormwater outfall location. Within the PSA, a beach walking survey was conducted to determine the presence of any mussel shells and no mussel shells were observed. A walking survey was conducted within the PSA in shallow areas up to 0.3 m in depth and no live mussels or mussel shells were observed. The snorkel survey was conducted between 0.3 m – 1.5 m in depth. A total of 23 transects were surveyed, approximately 1 m apart. An existing dock and boat lift disrupted the transects, therefore two smaller quadrants were surveyed on either side on the boat lift in lieu of transects. The survey was conducted in water temperatures above 16 °C on a calm day where visibility was greatest, to increase the chance of detection. The survey commenced at 10.45 am and concluded at 12.15 pm (1.5 hrs). Substrates in the PSA consisted of cobble and pebble in shallow areas and beyond 5 m from the wetted perimeter substrates were dominated by silt and sand. There were patches of dense aquatic vegetation on the middle of the PSA. No mussel shells were observed and one live winged floater (*Anodonta nuttalliana*) was observed in the middle of the PSA in silt and sand substrate, approximately 30 m southwest of the proposed stormwater outfall at a depth of approximately 1.3 m.

4.6 Vegetation and Ecosystems

Vegetation and ecosystems in the Project Area are highly disturbed by existing residential, business, and roadway developments. Land that will be directly affected by the Project is within the MOTI right-of-way, and is comprised of grass seeded and regularly mowed areas, and areas dominated by non-native vegetation. Invasive species are common in the Project Area, and provincially noxious plants observed include diffuse knapweed (*Centaurea diffusa*) and dalmatian toadflax (*Linaria genistifolia*). Land cover classifications in the Project Area is presented in Table 4-2.

Table 4-2. Land Cover Classification in the Project Area.

Land Cover Class	Description	Area in m ² (ha)**
Manicured grass / lawn	<ul style="list-style-type: none"> Existing Right-of-Way or other manicured lawn Native plants absent Permeable surface 	45,955 (4.6)
Vegetated disturbed	<ul style="list-style-type: none"> Areas with some native vegetation Moderate amount of disturbance Permeable surface 	78,598 (7.9)
Old field	<ul style="list-style-type: none"> Old field, grazed land Native plants common Invasive plants prominent Permeable surface 	43,457 (4.3)
Riparian (30 metre set-back) *	<ul style="list-style-type: none"> Shrubby, sparse tree cover Manicured grass in places 	11,710 (1.2)

Land Cover Class	Description	Area in m ² (ha)**
	<ul style="list-style-type: none"> • Native plants prominent • Invasive plants common • Permeable surface 	
Existing road	<ul style="list-style-type: none"> • Existing paved surface, gravel road base, and shoulders visible from imagery • Impermeable surface 	16,315 (1.6)
Urban	<ul style="list-style-type: none"> • Commercial or residential development • Highly disturbed • Impermeable surface 	64,274 (6.4)
Developed foreshore	<ul style="list-style-type: none"> • Disturbed beachfront • Some permanent buildings, recreational vehicle pads, sparsely vegetated, sand and hard pack soils • Permeable surface 	22,865 (2.2)
Lake	<ul style="list-style-type: none"> • Skaha Lake surface area within 200 m of Project Footprint centreline 	18,081 (1.8)
Total Area		301,257 (30.1)

*30 metre set-back from Skaha Creek includes only permeable surfaces (e.g., manicured grass / lawn)

**m² = square metres; ha = hectares

Land east of the Project Footprint is classified as manicured grass and lawn, and is managed by the Wright’s Beach Camp RV Park. Vegetation on the property is comprised of cultivated, mature deciduous trees, manicured grasses, and gravel access roads (Figure 4-1). Beach front land cover in this area is classified as developed foreshore, and is sparsely vegetated with recreational vehicle pads located just above the shoreline of Skaha Lake. Beyond the shoreline of the lake, a 30 m buffer into Skaha Lake was included in the assessment to assess potential effects of the proposed stormwater outfall and surface runoff on the foreshore and littoral zones of the lake.

Riparian habitat adjacent to Skaha Creek is affected by urban encroachment and vegetation clearing, and only a small component (0.2 ha) remains mature riparian ecosystem (Figure 4-1). Much of the area along Skaha Creek that has been cleared of native vegetation has been replaced with manicured grass. Land cover within 30 m of Skaha Creek, whether it is native or manicured, has been classified as riparian, except where urban land cover encroaches on the 30

m setback. A total of 1.2 ha of riparian area exists in the Project Area, and is comprised of black cottonwood (*Populus trichocarpa*), trembling aspen (*Populus tremuloides*), tall Oregon grape (*Mahonia aquifolium*), willow (*Salix* sp.), and Douglas maple (Figure 4-1).

Land cover west of the Project Footprint is classified as an old field ecosystem, and is vegetated with a mix of native and invasive plant species (Figure 4-1). Two residential houses exist in this area, and the area appears to have been cleared for grazing or other agricultural activity at one time. This area is predominantly vegetated with non-native species such as tall tumble mustard (*Sisymbrium altissimum*), dalmatian toadflax (noxious), and Russian thistle (*Salsola tragus*). Native vegetation in this area is comprised of grasses (e.g., sand dropseed [*Sporobolus cryptandrus*] and rough fescue [*Festuca campestris*]), shrubs (e.g., tall Oregon grape and saskatoon [*Amelanchier alnifolia*]). The few trees that do occur on the property consist of cultivated fruit trees and three old, decaying black cottonwood trees that have been topped at approximately 2.5 m height. The black cottonwood trees closest to the Project Footprint have a number of cavities excavated in their boles.

Vegetated disturbed land cover in the Project Area is defined as areas that are vegetated with native species, or are dominated by a tree canopy, yet still have a relatively moderate amount of disturbance. These areas differ from old field ecosystems in that vegetated disturbed lands do not appear to have been cleared in the past, and the native plant community is largely intact.

Urban land cover is found throughout the Project Area, and is predominantly comprised of impermeable surfaces (e.g., housing, paved surface). The Riva Ridge mobile home park, Holiday Hills RV Resort, and the Skaha Meadows golf course parking lot are all classified as urban land cover (Figure 4-1).

Appendix B presents a list of rare plants with potential to occur in the Project Area based on habitat suitability for each plant. Table 4-3 presents a list of provincially or federally listed plant species at risk known to occur within 5 km of the Project Area (iMap BC 2022). Based on habitat requirements, the probability of these species occurring within the Project Area is low. No rare plant species were observed during the site assessment.

Table 4-3. Plant Species at Risk Reported within 5 km of the Project Area.

English Name	Scientific Name	BC List	SARA Schedule	Probability of Occurrence
Columbian carpet moss	<i>Bryoerythrophyllum columbianum</i>	Blue	1-SC (2005)	Low*
Tiny tassel	<i>Crossidium seriatum</i>	Blue	1-SC (2019)	Low*
Nugget moss	<i>Microbryum vlassovii</i>	Red	1-E (2009)	Low*
The Dalles milk-vetch	<i>Astragalus sclerocarpus</i>	Red		Low*
Short-rayed aster	<i>Symphotrichum frondosum</i>	Red	1-E (2007)	Low*

Source: CDC 2022

*Habitat does not exist in the Project Area

¹B.C. Status: Red-listed: indigenous species or subspecies (taxa) considered Extirpated, Endangered, or Threatened in B.C.; Blue-listed: indigenous taxa considered vulnerable in B.C.

²Species at Risk Act (SARA): E = Endangered: A species at risk of extirpation or extinction as a result of habitat loss or other factors. T = Threatened: A species that is likely to become endangered if limiting factors are not reversed. SC = Special Concern: A species of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.

Table 4-4 presents a list of provincially listed ecological communities that are known to occur within 5 km of the Project Area (iMap BC 2022). None of the ecological communities listed were observed in the Project Area and have low probability of occurring.

Table 4-4. Rare Ecological Communities Reported Within 5 km of the Project Area.

Common Name	Scientific Name	BC List
Big sagebrush / bluebunch wheatgrass	<i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i>	Red
Water birch / roses	<i>Betula occidentalis</i> / <i>Rosa</i> spp.	Red
Baltic rush - common silverweed	<i>Juncus balticus</i> - <i>Potentilla anserina</i>	Blue
Trembling aspen / common snowberry / Kentucky bluegrass	<i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Poa pratensis</i>	Red
Black cottonwood - Douglas fir / Douglas maple - common snowberry	<i>Populus trichocarpa</i> - <i>Pseudotsuga menziesii</i> / <i>Acer glabrum</i> - <i>Symphoricarpos albus</i>	Red

Source: CDC 2022

¹B.C. Status: Red-listed: indigenous species or subspecies (taxa) considered Extirpated, Endangered, or Threatened in B.C.; Blue-listed: indigenous taxa considered vulnerable in B.C.

4.7 Wildlife and Wildlife Habitat

The Project Area provides suitable habitat for a number of wildlife species. Because of the existing disturbance, small mammals such as mice, voles, or shrews are likely the most common habitat users in the Project Area, relying on the old field, riparian, and vegetated disturbed habitat for forage, cover, nesting or rearing. Birds such as raptors, woodpeckers, or small passerine birds are likely the next most common users of habitat in the Project Area, and may be found using trees or shrubs throughout the area. Raptors may use the large trees east of the highway for perching, and use the open areas for hunting, woodpeckers may use the cavities in the old cottonwood trees in the old field for nesting, and passerines will use trees and shrubs in all habitats for forage, cover, or nesting.

Reptiles such as Great Basin gopher snakes (*Pituophis catenifer deserticola*; listed under Schedule 1 of SARA as Threatened¹), common garter snakes (*Thamnophis elegans*), or lizards are likely to be found in the old field land cover the Project Area, using habitats north of the highway for forage, cover, or denning (Figure 4-1).

Larger wildlife like deer (*Odocoileus* sp.), California bighorn sheep (*Ovis canadensis*), and black bear (*Ursus americanus*) may be found using habitats in the old field, riparian, or vegetated disturbed areas for forage, cover, or general living; however, habitats found in the Project Area only provide marginal habitat value for these species because of the extent of existing disturbance and lack of forage and overhead canopy.

Mapped Critical Habitat that overlaps with the Project Area includes Lewis's woodpecker (*Melanerpes lewis*), western tiger salamander - southern mountain population (*Ambystoma mavortium*), great basin gophersnake (*Pituophis catenifer deserticola*), desert nightsnake (*Hypsiglena chlorophaea*), and western rattlesnake (*Crotalus oreganus*).

Appendix C presents a list of rare wildlife with potential to occur within the Project Area based on habitat suitability for the wildlife. Table 4-5 presents a list of provincially or federally listed wildlife species that are known to occur within 5 km of the Project Area. None of the species listed were observed, and no critical habitat features (e.g., nests, dens, or burrows) were identified during the field assessment.

Table 4-5. Rare Species Reported within 5 km of the Project Area.

Group	Common Name	Scientific Name	BC List	SARA Schedule	Probability of Occurrence
Birds	Canyon Wren	<i>Catherpes mexicanus</i>	Blue		Low*
Birds	Lewis's Woodpecker	<i>Melanerpes lewis</i>	Blue	1-T (2012)	Moderate**
Birds	Western Screech-owl, Macfarlanei Subspecies	<i>Megascops kennicottii macfarlanei</i>	Red	1-T (2005)	Low*
Birds	White-throated Swift	<i>Aeronautes saxatalis</i>	Blue		Low*
Mammals	Pallid Bat	<i>Antrozous pallidus</i>	Red	1-T (2003)	Low*
Mammals	Spotted Bat	<i>Euderma maculatum</i>	Blue	1-SC (2005)	Low*

¹ Species listed as Threatened under the *Species at Risk Act* (SARA) are likely to become endangered if limiting factors are not reversed.

Group	Common Name	Scientific Name	BC List	SARA Schedule	Probability of Occurrence
Mammals	Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	Blue	1-SC (2009)	High***
Mammals	American Badger	<i>Taxidea taxus</i>	Red	1-E (2018)	Moderate**
Reptiles	Western Skink	<i>Plestiodon skiltonianus</i>	Blue	1-SC (2005)	High***
Reptiles	Desert Nightsnake	<i>Hypsiglena chlorophaea</i>	Red	1-E (2003)	Low*
Reptiles	Great Basin gopher snake	<i>Pituophis catenifer deserticola</i>	Blue	1-T (2005)	High***
Reptiles	North American Racer	<i>Coluber constrictor</i>	Blue	1-SC (2006)	High***
Reptile	Northern Painted Turtle - Intermountain - Rocky Mountain Population	<i>Chrysemys picta pop. 2</i>	Blue	1-SC (2007)	Moderate**
Amphibian	Western Tiger Salamander	<i>Ambystoma mavortium</i>	Red	1-E (2018)	High***
Amphibian	Great Basin Spadefoot	<i>Spea intermontana</i>	Blue	1-T (2003)	Moderate**
Invertebrate	Western Bumble Bee	<i>Bombus occidentalis</i>	Blue		Moderate**
Invertebrate	Sagebrush Tiger Beetle	<i>Cicindela pugetana</i>	Blue		Low*
Invertebrate	Rocky Mountain Ridged Mussel	<i>Gonidea angulata</i>	Red	1-SC (2005)	High***
Invertebrate	Sandhill Skipper	<i>Polites sabuleti</i>	Red		Low*

Group	Common Name	Scientific Name	BC List	SARA Schedule	Probability of Occurrence
Invertebrate	Olive Clubtail	<i>Stylurus olivaceus</i>	Red	1-E (2017)	Low*

Source: CDC 2022

*Habitat does not exist in the Project Area

**Some marginal habitat exists in the Project Area.

***Suitable habitat exists, and there is a high likelihood that this species uses habitats in the Project Area.

¹B.C. Status: Red-listed: indigenous species or subspecies (taxa) considered Extirpated, Endangered, or Threatened in B.C.; Blue-listed: indigenous taxa considered vulnerable in B.C.

²*Species at Risk Act (SARA)*: E = Endangered: A species at risk of extirpation or extinction as a result of habitat loss or other factors. T = Threatened: A species that is likely to become endangered if limiting factors are not reversed. SC = Special Concern: A species of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.

5 EFFECTS ASSESSMENT

5.1 Design Phase

The design follows the existing alignment along Highway 97 and requires minimal encroachment into undisturbed lands. The new intersection approach from the Old Penticton-Oliver Highway (i.e., from the west) will be constructed on relatively level, vegetated terrain south of the existing approach to the highway. The proposed design affects already disturbed land and improves safety for motorists and pedestrians.

The design includes a stormwater outfall into Skaha Lake and has the potential to impact fish and fish habitat. Two design options are currently being considered:

1. Submerged outfall to Skaha Lake – this design consists of a combination of ditches and storm pipe networks to collect all of the stormwater runoff from the west of Highway 97. The 1,050 mm outfall will extent 74 m from Highway 97 with approximately 25 m of the pipe submerged below the Skaha Lake.
2. Open channel with a headwall at Skaha Lake – the 1,050 mm outfall will tie into an open channel with a headwall, which discharges the stormwater runoff into Skaha Lake at the shoreline. The outfall will extent approximately 40 m from Highway 97 to the open channel. The open channel passes through Wright’s Beach Camp and will require a wooden structural bridge to cover the open channel.

Option 1 will result in temporary disturbance below the high-water mark of Skaha Lake but will result in the least permanent disturbance above the high-water mark.

The design includes the upgrade of three culverts above Highway 97, on Skaha Creek. The upgrade will replace the existing 600 mm diameter culverts with new 1,400 mm diameter culverts to accommodate flows associated with changes to the regional climate, and will benefit Skaha Creek and Skaha Lake by increasing flood water capacity, thereby reducing the potential for backwatering, erosion, and sediment transport during high flow events.

The upgrade of the culvert beneath Highway 97 has potential to conflict with an existing well head (Figure 5-1). Future design and construction activities should avoid this well head by aligning the new culvert south of the well head, along the natural course of Skaha Creek.

5.2 Construction Phase

The following sections describe potential effects of the Project on the environment during the construction phase. Activities associated with the construction phase include vegetation stripping and temporary storage on-site (until it is trucked off-site), and soil grubbing and storage on-site. Potential effects of the Project can be avoided or reduced by implementing mitigation measures proposed in Section 6.

5.2.1 Local and Regional Land Use

Temporary disruption to local and regional land use is anticipated during the construction phase of the Project. Construction activities will result in slowed traffic, road closure, and temporary detour in the area. Road closures may result in decreased access to local businesses or travellers using the Old Penticton-Oliver Highway, but effects are considered temporary. Following construction, the Project will result in safer pedestrian routes across the highway, and improve safety access for motorists entering and exiting Highway 97 from the Old Penticton-Oliver Highway.

Potential effects of construction can be mitigated through the development and implementation of a Traffic Control and Safety Plan that considers pedestrian traffic and any concerns raised by the local community through consultation.

5.2.2 Water Resources and Fish Habitat

Construction of the stormwater outfall to Skaha Lake may require temporary disturbance below the high-water mark of Skaha Lake and either temporary or permanent disturbance above the high-water mark. Construction may cause reduced water quality and reduced habitat quality for fish.

The upgrade of culverts on Skaha Creek will require the removal of three existing culverts, and the installation of three new culverts beneath Highway 97. This and other construction activities (e.g., terrain filling) near Skaha Creek may cause reduced water quality if sediments are introduced into the creek. Reduced water quality may result in reduced habitat quality for fish where the creek discharges into Skaha Lake. Based on mapping provided in the Okanagan Large Lakes Foreshore Protocol, critical kokanee spawning habitat exists approximately 250 m south of the discharge point of the creek into Skaha Lake, and sediment suspended in Skaha Creek may affect this spawning area (MOE 2009).

The installation of a new culvert on Skaha Creek beneath Highway 97 has potential to conflict with a single water well (Well Tag Number 27421, located at UTM 310740E, 5480590N) (Figure 5-1). Depending on the final alignment of the new culvert, the well may need to be decommissioned, or the alignment of the culvert adjusted. Construction activities near the well head have potential to result in changes to water quality; however, these effects are considered temporary and can be avoided through mitigations presented in Section 6.

There are no anticipated direct effects on fish or fish habitat if mitigations presented in Section 6 are implemented.

5.3 Vegetation and Ecosystems

Most of the Project Footprint will alter previously disturbed ground cover, comprised of invasive plant species and grassy right-of-way, to allow for new paved surface, road shoulder, and road fill (Figure 5-1). The rest of the Project Footprint is existing paved surface that will be repaved. No large trees, native vegetation, or undisturbed ecosystems are expected to be affected by the Project. Table 5-1 summarizes the area of each land cover class that will be affected by the Project.

The Project Footprint will encroach on the 30 m riparian setback on Skaha Creek to accommodate the culvert replacements; however, the area that will be affected is highly disturbed and is comprised of paved surface, invasive plants, and access road infrastructure for the Riva Ridge mobile home park. Effects to the riparian area along Skaha Creek will benefit the flow capacity of the creek, and is not expected to reduce the amount or quality of riparian vegetation that currently exists. Mitigations to avoid or reduce effects on riparian values are presented in Section 6.

Invasive plants are common in the Project Area, and vegetation clearing, soil grubbing, and soil stockpiling increases the potential for spread of these plants or their seeds. Seeds from stripped vegetation, or those stored in the soil, may be distributed to areas where they did not previously exist. Equipment movement on-site (i.e., within the Project Footprint) has potential to spread invasive plants, and equipment movement off site (e.g., outside the Project Area) has potential for invasive plant spread off-site to new ecosystems. The spread of invasive plants will reduce the overall quality of any ecosystems they germinate in.

Table 5-1. Land Cover Class Affected by the Project

Land Cover Class Project	Area in m ²	Project Footprint in m ²
	(ha)*	(% of Project Area)
Manicured grass / lawn	45,955 (4.6)	1,249
Vegetated disturbed	78,598 (7.9)	573
Old field	43,457 (4.3)	6,568
Riparian (30 metre set-back) ***	11,710 (1.2)	33
Existing road	16,315 (1.6)	7,218
Urban	64,274 (6.4)	184
Developed foreshore	22,865 (2.2)	970
Lake	18,081 (1.8)	10
Total Area	301,257 (30.1)	16,805 (6%)

Note:

**Project Right-of-Way is in addition to Project Footprint.

***30 metre set-back from Skaha Creek includes only permeable surfaces (e.g., manicured grass / lawn)

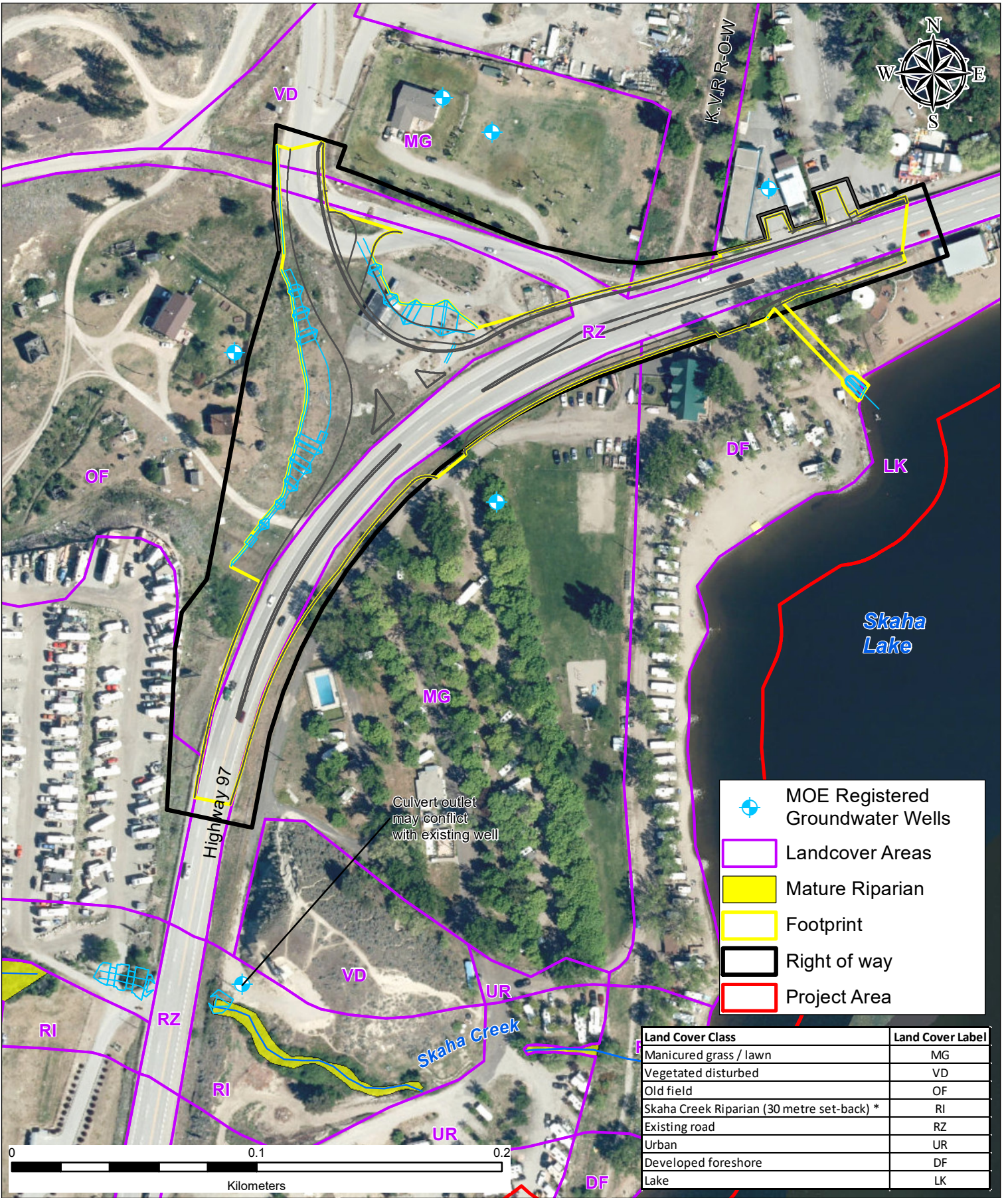


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PROJECT NO.: 2022-8273
 DATE: September 2022
 DRAWN BY: DA / BdJ

FIGURE 5-1 LAND COVER CLASSES AFFECTED BY THE PROJECT

Ministry of Transportation and Infrastructure
 Skaha Hills Intersection Upgrade

5.3.1 Wildlife and Wildlife Habitat

The construction of the new western approach from the Old Penticton-Oliver Highway will fragment existing habitat that small mammals and reptiles may use, creating a small, isolated island of habitat between the new alignment and the existing alignment (Figure 5-1). Decommissioning the existing alignment will remove barriers to movement and provide habitat for small wildlife, especially if the area is re-planted and invasive species management is implemented.

The western approach is aligned near an historic building that is situated next to three old, decaying black cottonwood trees that have multiple cavities in their bole, which are suitable cavity nests for woodpeckers or other small birds. The Project is not anticipated to affect the historic building, but may result in the disturbance or removal of the trees and nesting habitat. Occupied nests of any species are protected under the *Migratory Birds Convention Act, 1994*. If construction occurs during the breeding bird window (approximately March 31 and August 15), these features cannot be disturbed unless the nests are not occupied. Nests belonging to pileated woodpecker (*Dryocopus pileatus*) are protected year-round under the modernisation of the *Migratory Birds Convention Act, 1994* that came into effect July 30, 2022. Pileated woodpecker have the potential to nest in these cavities and prior to construction, a QEP should determine if pileated woodpecker utilise the cavities.

Large ranging wildlife, such as deer, may avoid habitats near the Project or alter their movement patterns as a result of construction activities; however, these effects are considered temporary, lasting for the duration of construction. Small ranging wildlife, such as mice and voles, using habitats within the Project Footprint may be affected during construction because their home ranges and daily dispersals may not be large enough to avoid construction. Vegetation clearing and soil grubbing may disturb or kill small ranging wildlife using habitats in these areas.

Potential effects of the Project on wildlife and wildlife habitat can be avoided or reduced by implementing mitigation measures presented in Section 6.

5.4 Operation Phase

The following sections describe potential effects of the Project on the environment during the operation phase. Activities associated with the operation phase include regular mowing or side-casting of materials (e.g., snow or gravel) within the Right-of-Way. Potential effects of the Project can be avoided or reduced by implementing mitigation measures proposed in Section 6.

5.4.1 Local and Regional Land Use

The Project will increase safety for pedestrians crossing the highway and vehicles entering or exiting Highway 97 at the Old Penticton-Oliver highway intersection. The operation phase will improve traffic flow through Penticton during all seasons, especially during the summer when traffic is at its peak from tourism and recreation.

5.4.2 Water Resources and Fish Habitat

Operational effects on water resources and fish habitat in the Project Area are largely restricted to seasonal maintenance. Winter snow plowing and the application of salt, sands, or gravels could increase sedimentation and temporarily reduce the quality of surface water flowing to Skaha Lake, which may affect fish habitat in the lake. Patching and sealing of pavement surfaces may result in runoff of chemical compounds into surface water or leaching into groundwater resources. Since all of these applications are followed under current practice, none of these activities are expected to result in changes to water resources or fish habitat in the Project Area. There may be maintenance required on the Skaha Creek culverts and Skaha Lake outfalls in the future, however these will be managed under the

appropriate approvals at the time of maintenance. Effects to water resources are anticipated to be minimal if standard environmental best practices and recommended mitigation measures are implemented (MOTI 2011)

5.4.3 Vegetation and Ecosystems

Regular maintenance (e.g., mowing, brushing) of the Right-of-Way will affect previously disturbed, grass-dominated ecosystems. Regular maintenance, such as mowing, will affect vegetation in the Project Right-of-Way by reducing vegetation height and percent cover, and may promote the growth of invasive plants. Winter road salting and snow plowing may affect vegetation growth and health, or result in the salinization of soils, which will affect the success of native vegetation growth. Operation phase effects on vegetation and ecosystems are anticipated to be minimal if standard environmental best practices (e.g., MOTI 2011), and recommended mitigation measures are implemented.

5.4.4 Wildlife and Wildlife Habitat

Effects of the highway on wildlife and wildlife habitat will not change from current conditions during the operational phase. Currently, the highway poses the risk of mortality to wildlife trying to cross the highway to access Skaha Lake, and the upgrades are not expected to increase or decrease that risk.

Small ranging wildlife movement may change as a result of the new west approach; however, a culvert proposed beneath the west approach may increase wildlife permeability across this section, reducing the potential for wildlife mortality from vehicles.

6 MITIGATIONS AND RECOMMENDATIONS

Construction activities should follow the recommendations set out in the 2020 Standard Specifications for Highway Construction, Section 165: Protection of the Environment (MOTI 2020) in addition to developing a Project-specific Construction Environmental Management Plan (CEMP) that incorporates the findings and mitigations presented in this report. The following preliminary mitigation measures will assist MOTI in planning and executing the proposed intersection upgrade.

Before work begins, a *Water Sustainability Act* Section 11 application for works planned on Skaha Creek and Skaha Lake should be submitted to FrontCounter BC. Applications should be submitted as soon as possible to prevent Project delays or additional costs. A *Fisheries Act* Request for Project Review for works planned on Skaha Creek and Skaha Lake should be submitted to Fisheries and Oceans Canada (DFO).

6.1 Design

Before ground work begins, identify locations for stockpile of soils and vegetation to prevent the spread of invasive plants or introduction of deleterious substances into the groundwater.

Design the culvert replacement on Skaha Creek to avoid Well Tag Number 27421 by aligning the new culvert south of the creek well head, along the natural course of Skaha Creek.

6.2 Construction

Construction contractors should retain a Qualified Environment Professional (QEP) to advise on construction practices to mitigate the overall environmental effects of the Project. An Environmental Monitor (EM), under guidance from the

QEP, should be on-site to monitor works around Skaha Creek and Skaha Lake to ensure mitigations are in place to prevent sedimentation of watercourses, and around the historic building to ensure the wildlife trees near the new west approach are protected from direct disturbance (e.g., cutting or felling).

Prior to construction, develop a comprehensive and site-specific Construction Environmental Management Plan (CEMP) that addresses erosion and sediment control and wildlife management, instream works, and complies with least-risk timing windows for breeding birds. Ensure that the CEMP incorporates the following recommendations to mitigate effects of the Project on the environment during road construction.

- **Prevent the spread of invasive plants.**
 - The Project Area is a source for invasive plant translocation outside of the Project Area, and spread of invasive plants off-site should be strictly controlled. Develop and implement a Weed Management Plan that considers construction personnel, soil stockpiling, equipment and machinery use entering or exiting the site.
 - Ensure that all equipment, including vehicles, clothing, and footwear, is free of invasive plant material before entering or exiting the work site.
 - Re-vegetate disturbed soils immediately following construction with a native grass seed mix to promote grass-dominated vegetation over invasive plants germination.
- **Protect vegetation and ecosystems and wildlife and wildlife habitat.**
 - Complete a site reconnaissance with the EM and contractor to determine the extent of site clearing activities and ensure that the Project Footprint and Right-of-Way are clearly defined, and the historic building and wildlife trees nearby are not disturbed.
 - Avoid clearing vegetation between **March 31 and August 15** during the breeding bird window. If construction is scheduled between March 31 and August 15, have an EM familiar with nesting bird surveys conduct a survey immediately prior to construction throughout the entire Project Footprint to ensure no birds are nesting during construction. If the nests are occupied, avoid disturbing the trees, birds, or nests until the chicks have fledged and the nests abandoned.
 - Construction work may need to be temporarily delayed if wildlife are observed using habitats scheduled for construction. A General *Wildlife Act* Permit will need to be obtained to disturb any wildlife using habitats in the Project Area.
 - To minimize human-wildlife conflicts, the construction site and site facilities must remain free of wildlife attractants.
- **Isolate Skaha Lake from construction activities.**
 - Conduct stormwater outfall work at a period of low water or in isolation of Skaha Lake.
 - If instream works are required, ensure a QEP conducts a fish salvage under a Scientific Fish Collection Permit prior to works commencing.
- **Isolate Skaha Creek from construction activities.**
 - Conduct work in the dry during removal and installation of culverts on Skaha Creek, to the extent possible. Install silt fence in any locations where sediment generated from culvert works may enter the creek and be transported downstream.
 - Prior to clearing or disturbance, have the EM survey the site with the contractor and install silt fence in areas where overland water flow may reach Skaha Creek or Skaha Lake. Isolate works from Skaha

Creek using silt fence buried at least 10 cm below the existing surface area, and of sufficient length that sediment will not breach the fence during intense rain events.

- Cover or regularly wet areas that have been cleared of vegetation to reduce erosion potential and fugitive dust disturbance.
- **Protect ground water resources.**
 - Prepare a staging area that is at least 30 m away from any water receiving areas or Skaha Lake before ground clearing work begins. Isolate the area with silt fencing to prevent overland flow of deleterious materials during large rain events.
 - Protect the well head of Well Tag Number 27421 (located near Skaha Creek). Communicate the potential for increased turbidity of well water during construction to the licenced users of the well.
 - Immediately address spills of hazardous materials (e.g., fuels or oils) in accordance with MOE operational guidelines for spill response (MOE 2014).
- **Maintain local and regional land use and traffic flow, to the extent possible.**
 - Where feasible, schedule construction activities at times when traffic volumes are lower, and implement strategies to maintain local and regional traffic flow by consulting with land users and developing and implementing a Traffic Control and Safety Plan that considers pedestrian flow, business traffic, and motorists traveling through the Project Area.

6.3 Operations

The following mitigation measures are intended to offset the effects of the operation and routine maintenance of the highway:

- **Protect ground water resources and fish habitat**
 - Conduct maintenance works during dry weather periods to minimize surface runoff of deleterious substances into adjacent habitat. When this is not possible, implement adequate site isolation (e.g., silt fencing) measures to keep contaminants contained.
 - For patching, sealing, seasonal surface cleaning, or salt application on Highway 97 or the Old Penticton-Oliver Highway, ensure that activities are completed with adequate environmental protection measures in place particularly when working in close proximity to water receiving areas. Silt fencing and spill response kits to prevent the release of toxic substances into the habitat may be required.
 - During outfall or culvert maintenance, ensure adequate site isolation and protection measures are implemented to prevent sediment from travelling downslope, as necessary.

7 CLOSURE

The report and its findings is based on the proposed design provided to Associated (dated 2022-07-07), and mitigation measures are presented in the report to avoid or reduce potential effects of the project on the environment.

Because of the extent of existing disturbance and relatively small new footprint of the project, there is not expected to be any residual or long-term effects to the environmental values identified for the project, if mitigations outlined in the report are implemented.

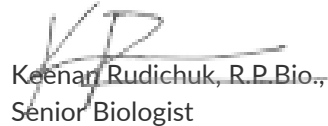
We trust that this report provides you with the information needed to move the project forward. If you have any questions or comments about this report please contact the undersigned.

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APPENDIX A - SITE PHOTOGRAPHS



Photo 4-1: Location of fish barriers along Skaha Creek. Blue arrow indicates outlet with 28 cm drop.



Photo 4-2: Construction alteration of Skaha Creek above Highway 97 at Site 2. Slumping, erosion, and sediment transport has occurred, indicated by the blue arrow.



Photo 4-3: Skaha Creek is comprised of cobbles, gravels, and fines.

APPENDIX B - RARE PLANTS WITH POTENTIAL TO OCCUR

Common Name	Scientific Name	BC List	SARA Schedule	Likelihood of Occurrence
Thurber's needlegrass	<i>Achnatherum thurberianum</i>	Red		Moderate
cut-leaved water-parsnip	<i>Berula erecta</i>	Blue		Low
narrow-leaved brickellia	<i>Brickellia oblongifolia</i> var. <i>oblongifolia</i>	Blue		Low
Columbian carpet moss	<i>Bryoerythrophyllum columbianum</i>	Blue	1-SC (2005)	Moderate
tiny tassel	<i>Crossidium seriatum</i>	Blue	1-SC (2014)	Low
<i>Didymodon</i> sp.	<i>Didymodon brachyphyllus</i>	Red		Low
Candle snuffer moss	<i>Encalypta intermedia</i>	Blue		Low
rusty cord-moss	<i>Entosthodon rubiginosus</i>	Blue	1-E (2006)	Low
<i>Grimmia</i> sp.	<i>Grimmia plagiopodia</i>	Red		Low
sulphur lupine	<i>Lupinus sulphureus</i>	Blue		Low
hairy water-clover	<i>Marsilea vestita</i>	Red		Low
nugget moss	<i>Microbryum vlassovii</i>	Red	1-E (2009)	Low
Snake River cryptantha	<i>Oreocarya sheldonii</i>	Red		Low
Grand Coulee owl-clover	<i>Orthocarpus barbatus</i>	Red	1-E (2006)	Low
<i>Orthotrichum</i> sp.	<i>Orthotrichum hallii</i>	Red		Low
branched phacelia	<i>Phacelia ramosissima</i> var. <i>ramosissima</i>	Red	1-E (2006)	Low
showy phlox	<i>Phlox speciosa</i> ssp. <i>occidentalis</i>	Red	1-T (2006)	Low
alkaline wing-nerved moss	<i>Pterygoneurum kozlovii</i>	Blue	1-T (2006)	Low

Common Name	Scientific Name	BC List	SARA Schedule	Likelihood of Occurrence
<i>Pterygoneurum</i> sp.	<i>Pterygoneurum lamellatum</i>	Red		Low
<i>Schistidium</i> cp.	<i>Schistidium heterophyllum</i>	Blue		Low
Ute lady's tresses	<i>Spiranthes diluvialis</i>	Red		Low

Source: CDC 2022; species list truncated based on the availability of suitable habitat in the Project Area.

¹B.C. Status: Red-listed: indigenous species or subspecies (taxa) considered Extirpated, Endangered, or Threatened in B.C.; Blue-listed: indigenous taxa considered vulnerable in B.C.

²Species at Risk Act (SARA): E = Endangered: A species at risk of extirpation or extinction as a result of habitat loss or other factors. T = Threatened: A species that is likely to become endangered if limiting factors are not reversed. SC = Special Concern: A species of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.

APPENDIX C - RARE WILDLIFE WITH POTENTIAL TO OCCUR

Class	Common Name	Scientific Name	BC List	SARA List	Likelihood of Occurrence
Amphibian	Blotched Tiger Salamander	<i>Ambystoma mavortium</i>	Red	1-E (2018)	Moderate
Amphibian	Great Basin Spadefoot	<i>Spea intermontana</i>	Blue	1-T (2003)	Moderate
Bird	Grasshopper Sparrow	<i>Ammodramus savannarum</i>	Red		Moderate
Bird	Swainson's Hawk	<i>Buteo swainsoni</i>	Red		Low
Bird	Lewis's Woodpecker	<i>Melanerpes lewis</i>	Blue	1-T (2012)	High
Bird	Williamson's sapsucker	<i>Sphyrapicus thyroideus</i>	Blue	1-E (2006)	
Invertebrate	Rocky Mountain Ridged Mussel	<i>Gonidea angulata</i>	Red	1-SC (2005)	Moderate
Mammal	Western Small-footed Myotis	<i>Myotis ciliolabrum</i>	Blue		Low
Mammal	Fringed Myotis	<i>Myotis thysanodes</i>	Blue	3 (2005)	Low
Mammal	Columbia Plateau Pocket Mouse	<i>Perognathus parvus</i>	Blue		High
Mammal	Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	Blue	1-SC (2009)	High
Mammal	Merriam's Shrew	<i>Sorex merriami</i>	Red		High
Mammal	Preble's Shrew	<i>Sorex preblei</i>	Red		High

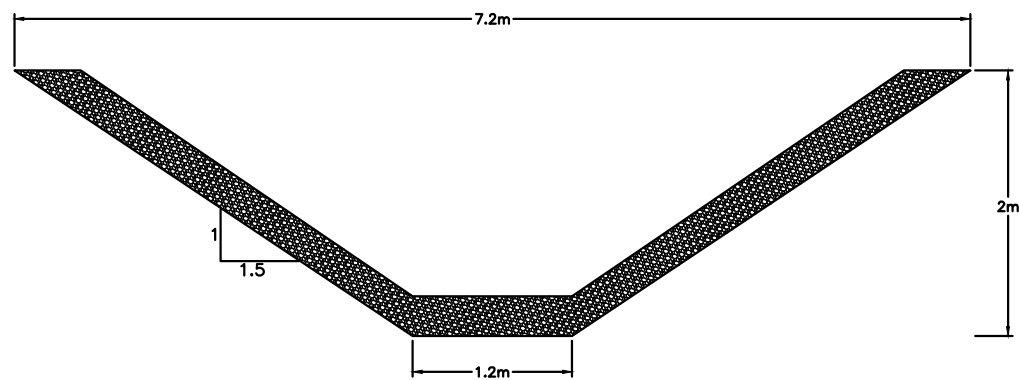
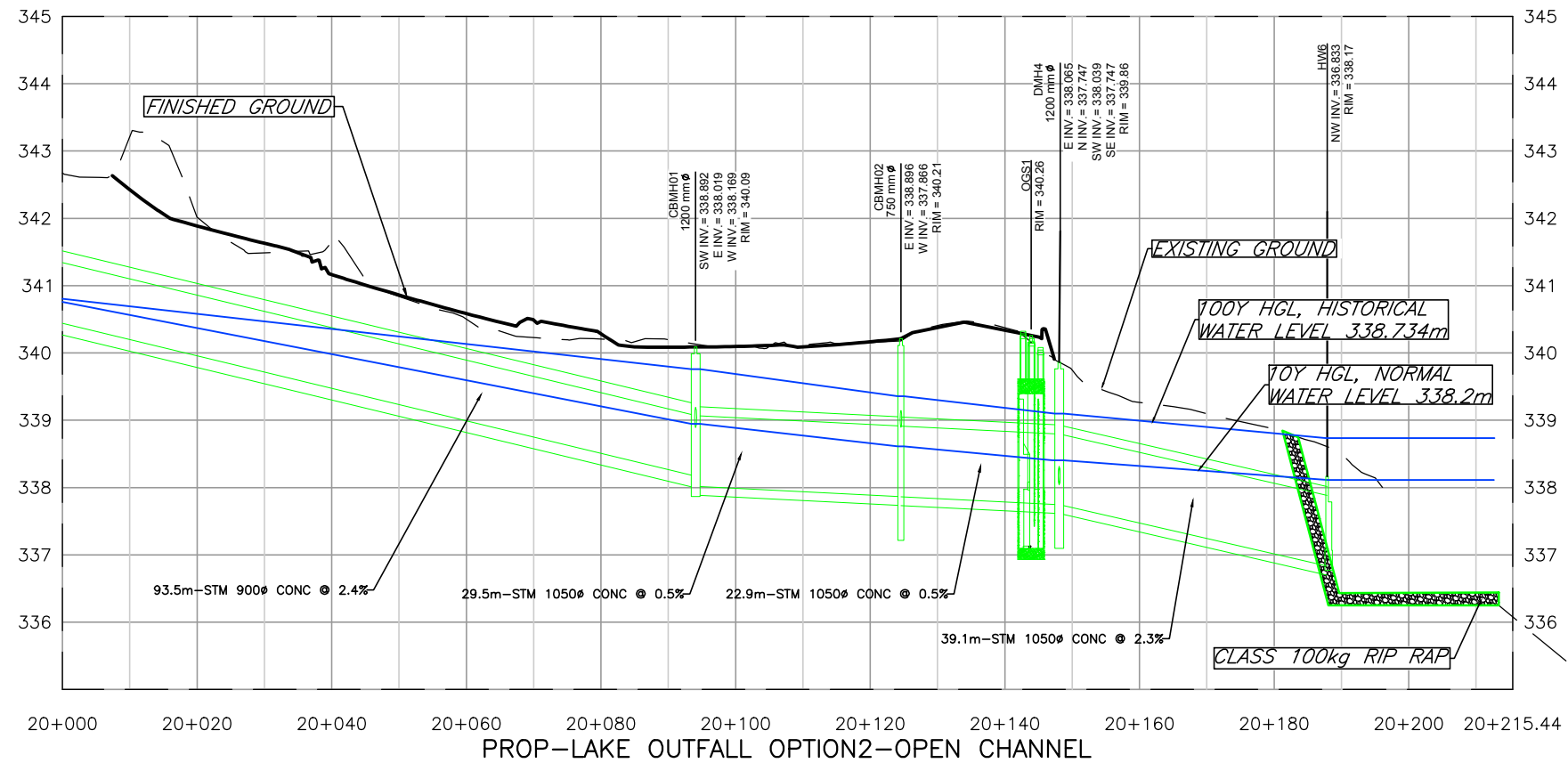
Class	Common Name	Scientific Name	BC List	SARA List	Likelihood of Occurrence
Reptile	North American Racer	<i>Coluber constrictor</i>	Blue	1-SC (2006)	High
Reptile	Western Rattlesnake	<i>Crotalus oreganus</i>	Blue	1-T (2005)	Moderate
Reptile	Gopher Snake, <i>deserticola</i> subspecies	<i>Pituophis catenifer deserticola</i>	Blue	1-T (2005)	High
Reptile	Western Skink	<i>Plestiodon skiltonianus</i>	Blue	1-SC (2005)	High

Source: CDC 2022

¹B.C. Status: Red-listed: indigenous species or subspecies (taxa) considered Extirpated, Endangered, or Threatened in B.C.; Blue-listed: indigenous taxa considered vulnerable in B.C.

²*Species at Risk Act (SARA)*: E = Endangered: A species at risk of extirpation or extinction as a result of habitat loss or other factors. T = Threatened: A species that is likely to become endangered if limiting factors are not reversed. SC = Special Concern: A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

APPENDIX D - DRAWINGS



CROSS-SECTION A-A

**PRELIMINARY
FOR INFORMATION ONLY**
 2022-07-28

PRINTED: Jul 28, 2022 1:52:45 PM
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Memorandum

To:	MOTI	Date:	August 4, 2022
From:	Richard Wong, P.Eng. Design Manager SNC Lavalin	Ref:	625158-1000-41EN-002
CC:		Rev:	00

Subject: Highway 97 Skaha Drainage Plan Lake Outfall Options

1 Proposed Design Options

1.1 Lake Outfall Option 1

SNC Lavalin has been working with MoTI to evaluate options to drain the stormwater runoff resulting from the intersection and from the PIB Skaha developments land upstream. Five options were presented by MOTI to PIB including onsite infiltration options early this year, and through several run of communication and discussion between MOTI and PIB, it has been decided to go for the new outfall to the Skaha Lake.

The Skaha highway drainage lake outfall option 1 is to drain the storm runoff by using a submerged outfall to the lake in the southeast of the highway 97 intersection. The drainage system consists of a combination of ditches and storm pipe network to collect all of the stormwater runoff from the west part of highway 97 at the low position of the highway at catch basin manhole 1 and discharge towards the Skaha lake through 1050 mm concrete sewer trunk which has the capacity to handle a 100-year storm event from the relative catchments. The 1050 mm outfall has the approximate length of 74m outgoing into the lake with approximately 25 m long pipe submerged blow the water. The drainage plan lake outfall option 1 is shown in Figure 1.

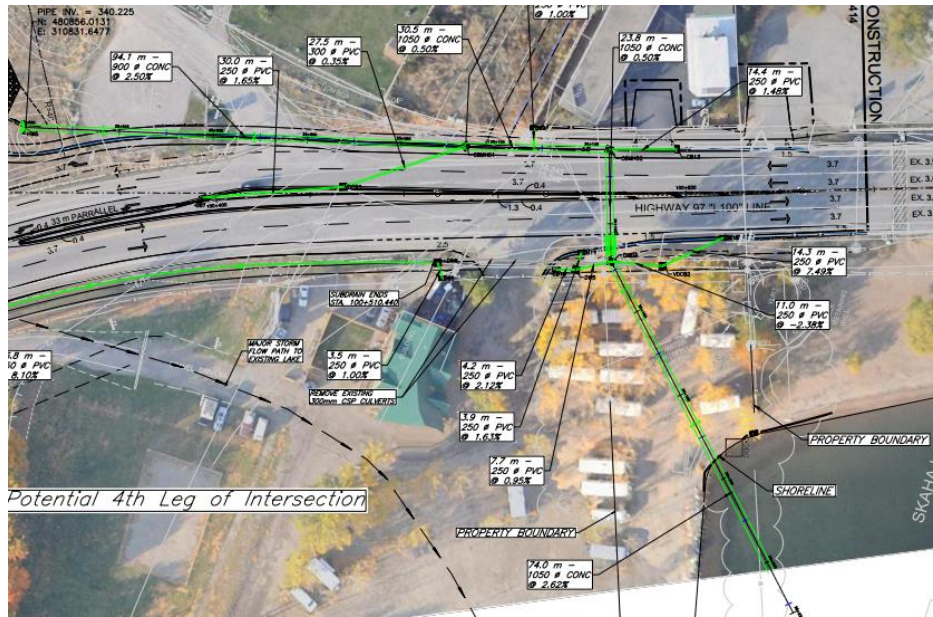


Figure 1. Drainage plan lake outfall option 1, Discharging into the Lake through a Submerged Sewer

More details are presented in the drawing package lake outfall plan and profile option 1.

1.2 Lake Outfall Option 2

The drainage plan lake outfall option 2 follows the same drainage plan as option 1, however the 1050mm diameter lake outfall pipe was designed to tie into an open channel with a headwall, which discharges the stormwater runoff into the Skaha lake at the shoreline. The open channel is a trapezoidal channel fully covered with class 100 kg riprap, with the bottom width of 1.2 m, side slopes of 1 to 1.5 m and the channel full depth of 2 m, which provides a top width of 7.2 m. In this option the length of the lake outfall pipe (1050 mm) is decreased from 74 m to 39.8 m due to the existence of the open channel. As this open channel option passes through the property on the beach, a wooden structural bridge is designed to cover the channel to accommodate the passage for residents and beach goers. The drainage plan option 2 is shown in Figure 2, and the concept of wooden bridge plan and profile are shown in Figures 3 and 4 respectively.

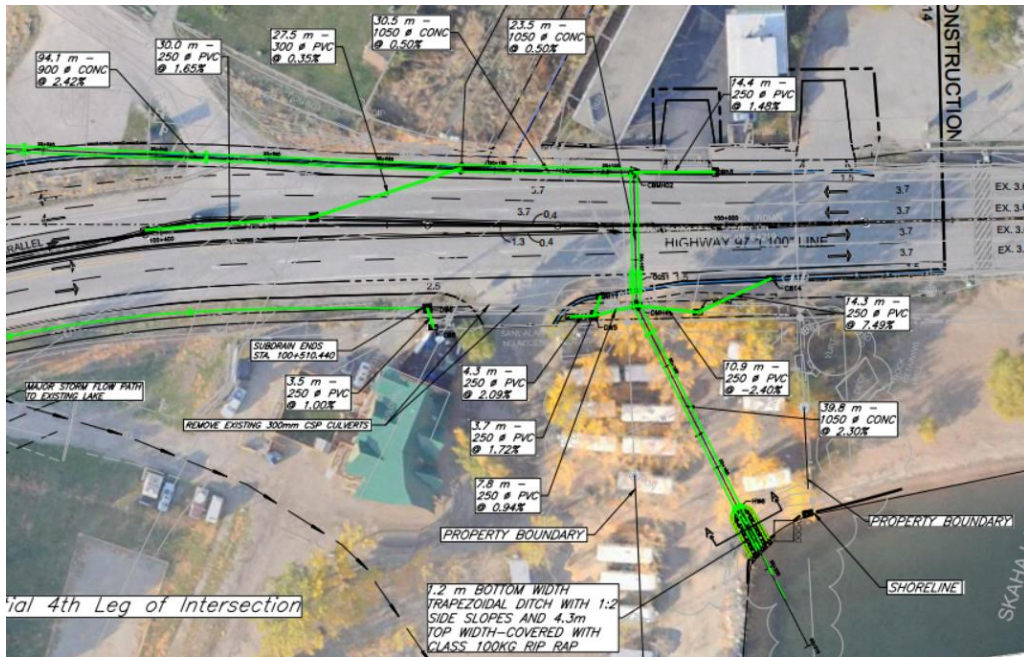


Figure 2. Drainage Plan Lake Outfall Option 2, Open Channel Discharging into the Lake

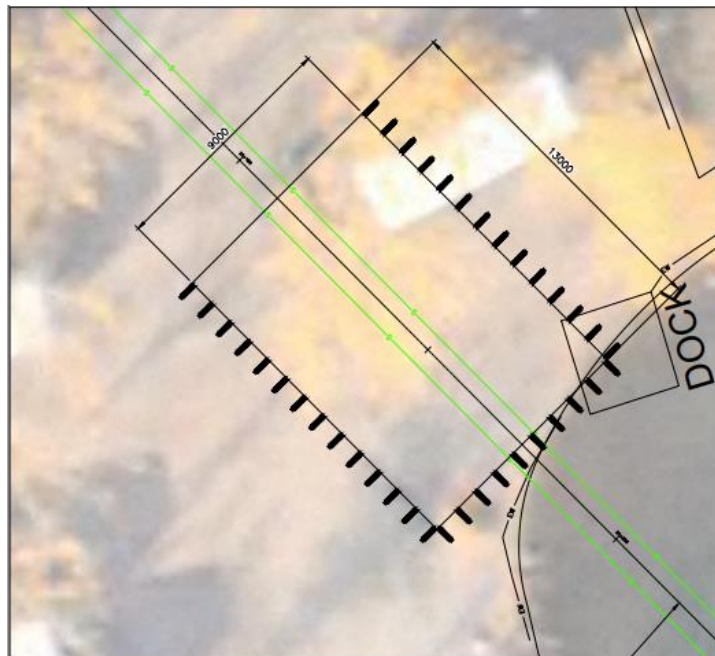


Figure 3. Drainage Plan Lake Outfall Option 2, Wooden Bridge Plan

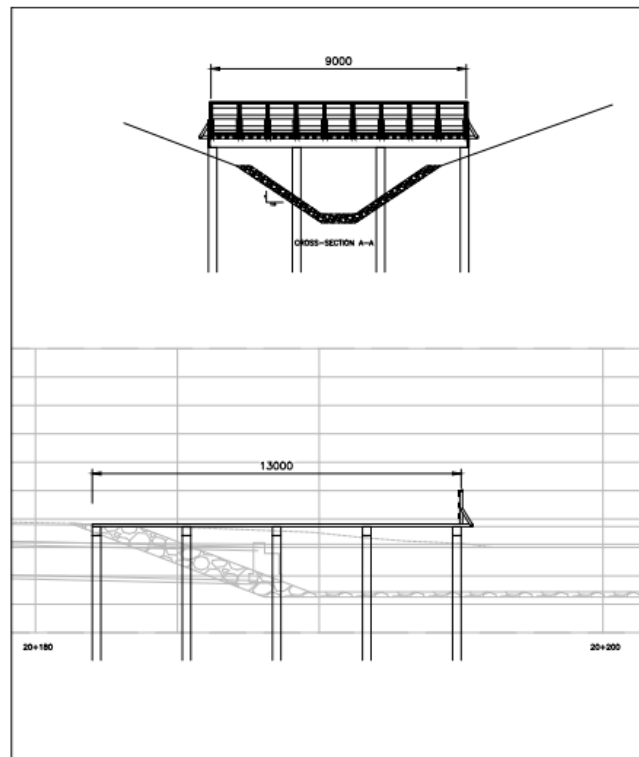


Figure 4. Drainage Plan Lake Outfall Option 2, Wooden Bridge Profile

Option 1 would have the storm sewer buried underneath the beach, with less impact on the users of beach, however, the construction of outfall under the water would result higher construction cost, and environmental impact to the lake. Option 2 would have open channel crossing the beach and daylighting to the shoreline to reduce the complexity of underwater construction of the outfall, but this would may cause some inconvenience for the beach user. However, with a wooden bridge structure to be built above the channel, it would maintain integrity of beach and create some features of recreation.

It should be noted that an oil-grit separator is proposed before manhole 4 for both options to settle down the coarse sediments and oil from stormwater before discharging into the lake.

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Checked by:

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