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Abbreviations

ABMI	Alberta Biodiversity Monitoring Institute
AEP	Alberta Environment and Parks
AESCC	Alberta's Endangered Species Conservation Committee
ASRD	Alberta Sustainable Resource Development
ATV	all-terrain vehicle
AVC	animal-vehicle collisions
AWA	*Alberta Wildlife Act*
BCR	bird conservation region
BMA	bear management area
BMF	Biodiversity Management Framework
CEA	Canadian Environmental Assessment
CFB	Canadian forces base
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ECCC	Environment and Climate Change Canada
EIA	environmental impact assessment
ESA	environmentally significant area
ESRD	Environment and Sustainable Resource Development
FWMIS	fisheries and wildlife management information system
GVI	grassland vegetation inventory
IBA	important bird area

KWBZ	key wildlife and biodiversity zone
LAA	local assessment area
LCC	land cover classification
MBCA	*Migratory Birds Convention Act*
NRCB	Natural Resources Conservation Board
PDA	project development area
RAA	regional assessment area
RAP	restricted activity period
SARA	*Species at Risk Act*
SOMC	species of management concern
TLRU	traditional land and resource use
TOR	terms of reference
TRM	turf reinforcement mats
TUS	traditional use study
VC	valued component
ZOI	zone of influence

11.0 ASSESSMENT OF POTENTIAL EFFECTS ON WILDLIFE AND BIODIVERSITY

11.1 SCOPE OF THE ASSESSMENT

The conservation of biodiversity and wildlife is essential to the maintenance of healthy ecosystems. Changes to the abundance and distribution of wildlife and wildlife habitat can affect biodiversity at local or regional scales, which can alter ecosystem functions (e.g., connectivity) and cultural benefits (i.e. spiritual, recreational and esthetic values).

The scope of the wildlife and biodiversity assessment is directed by the terms of reference (TOR) issued for the Springbank Off-stream Reservoir Project by Alberta Environment and Parks (AEP), and the Canadian Environmental Assessment (CEA) Agency. In addition, the scope of the assessment considered project-specific regulatory and public stakeholder inputs and concerns from potentially affected Aboriginal communities.

11.1.1 Regulatory and Policy Setting

The scope of the wildlife and biodiversity assessment takes into consideration guidance provided by AEP (Government of Alberta 2013), specifically section 3.3.7 and 3.3.8 in the Guide to Preparing Environmental Impact Assessment Reports in Alberta. Some wildlife species in Canada are afforded both federal protection through the *Migratory Birds Convention Act* (MBCA) and the *Species at Risk Act* (SARA) as well as provincial protection as described below.

11.1.1.1 Provincial Requirements

Alberta Wildlife Act

In Alberta, wildlife is regulated under the Alberta *Wildlife Act* (AWA) and the Alberta Wildlife Regulation. The *Wildlife Act* (s. 36[1]) states that "a person shall not willfully molest, disturb or destroy a house, nest or den of a prescribed wildlife or beaver dam in prescribed area at prescribed times". In addition, the Alberta *Wildlife Act* protects species listed as endangered and threatened and the Alberta Wildlife Regulation lists species considered endangered or threatened. Before species are officially listed by the Government of Alberta, Alberta's Endangered Species Conservation Committee (AESCC) recommends officially designating Alberta species as endangered, threatened, special concern, data deficient, or in process (i.e., recommended for a change in status; Government of Alberta 2015a).

AEP evaluates Alberta wildlife species every five years and designates them as extirpated, at risk, may be at risk, sensitive, secure, undetermined, or exotic in the *General Status of Alberta Wild Species* (Government of Alberta 2017c).

11.1.1.2 Federal Requirements

Migratory Birds Convention Act

The purpose of the MBCA is to protect and conserve migratory bird populations and individuals and their nests within Canada. Section 6 of the Migratory Birds Regulations states that without a permit, the disturbance, destruction, or removal of a nest, egg, nest shelter, eider duck shelter, or duck box of a migratory bird, or possession of a migratory bird, carcass, skin, nest, or egg of a migratory bird are prohibited.

Species at Risk Act

The Government of Canada has implemented the SARA to protect wildlife species at risk in Canada; this applies to wildlife species listed on Schedule 1 of the SARA and their critical habitat. SARA serves several purposes: to prevent the extirpation or extinction of wildlife species; to provide recovery strategies for species that are extirpated, endangered, and threatened because of human activity; and to manage species of special concern so they do not become threatened or endangered.

Under SARA, it is prohibited to kill, harm, harass, capture or take individual species at risk (section 32), or damage or destroy their residences (section 33). Critical habitat may be identified and designated as such for species at risk. Section 58 of SARA prohibits the destruction of critical habitat for all species at risk on federally regulated lands and on all lands if the species is aquatic or a migratory bird protected under the MBCA.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses and designates the status of species and recommends designation for legal protection under SARA. Species listed under COSEWIC only are not afforded legal protection under SARA.

11.1.1.3 Additional Guidance

The following documents, which include management frameworks, provincial and federal recovery strategies as well as guidelines related to disturbance setback distances and restricted activity periods were reviewed and considered for this assessment:

- South Saskatchewan Regional Plan 2014-2024 (Government of Alberta 2017a)
- South Saskatchewan Biodiversity Management Framework (Draft) (Government of Alberta 2015b)
- Bird Conservation Region Strategies for Bird Conservation Region (BCR) 11 (Environment Canada 2013a)
- Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region (Environment Canada 2009)

- Master Schedule of Standards and Conditions (Government of Alberta 2017b)
- Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta (SRD 2011)
- Recommended Land Use Guidelines: Key Wildlife and Biodiversity Zones (KWBZ) (ESRD 2015a)
- Sensitive Species Inventory Guidelines (ESRD 2013)
- Amended Recovery Strategy for the Sprague's Pipit in Canada (Environment Canada 2012)
- Sprague's Pipit Conservation Management Plan 2010–2015 (ASRD 2010a)
- Recovery Strategy for the Olive-sided Flycatcher in Canada (Environment Canada 2016a)
- Management Plan for the Northern Leopard Frog (*Lithobates pipiens*), Western Boreal/Prairie Populations, in Canada (Environment Canada 2013b)
- Alberta Northern Leopard Frog Recovery Plan 2010–2015 (ESRD 2012a)
- Management Plan for the Long-billed Curlew (*Numenius americanus*) in Canada (Environment Canada 2013c)
- Long-billed Curlew Conservation Management Plan 2010–2015 (ASRD 2010b)
- Management Plan for the Peregrine Falcon anatum/tundius (*Falco peregrinus anatum/tundrius*) in Canada (Environment Canada 2015a)
- Alberta Peregrine Falcon Recovery Plan 2004-2010 (Alberta Peregrine Falcon Recovery Team 2005)
- Prairie Falcon Conservation Management Plan 2012–2017 (ESRD 2012b)
- Management Plan for the Yellow Rail (*Coturnicops noveboracensis*) in Canada (Environment Canada 2013d)
- Alberta Grizzly Bear Recovery Plan (Draft) (AEP 2016a)
- Proposed Recovery Strategy for the Little Brown Myotis, Northern Myotis and Tri-colored Bat (Environment Canada 2015b)

11.1.2 Key Indicators

11.1.2.1 Species at Risk and Species of Management Concern

Several wildlife species of management concern (SOMC), including species at risk that have potential to occur in the regional assessment area (RAA) were used to focus the assessment. SOMC represent birds, mammals and amphibians that depend on a variety of habitat types (e.g., grassland, forests, wetlands) potentially affected by the Project. For the purposes of this assessment, SOMC include species:

- listed federally as *endangered*, *threatened*, or *special concern* under Schedule 1 of the SARA (Government of Canada 2017)
- listed federally as *endangered*, *threatened*, or *special concern* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2017)
- listed provincially as *endangered or threatened* under the *Alberta Wildlife Act* or *special concern* by the Alberta Endangered Species Conservation Committee (Government of Alberta 2015a)
- provincially as *at risk*, *may be at risk*, or *sensitive* according to the General Status of Alberta Wild Species (Government of Alberta 2017c)
- listed in the Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta (SRD 2011) or
- recognized in provincial guidelines (SRD 2011, Government of Alberta 2017b)
- recognized as having socio-economic value or traditional importance to Aboriginal communities (see Section 11.1.3)

For a list of SOMC including species at risk that has the potential to occur in the RAA, see the Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report, Table 9-24.

11.1.2.2 Wildlife

To further focus the assessment, five wildlife species were chosen as key indicators to assess potential Project effects on wildlife. Wildlife key indicators included SOMC that are either legislatively protected (i.e., species at risk) or important for traditional and economic use.

A list of wildlife key indicators and the rationale for their selection is provided in Table 11-1. For each key indicator, quantitative (e.g., amount of habitat affected) and qualitative measurable parameters are used to assess potential Project effects (see Section 11.1.4).

Table 11-1 Key Wildlife Indicators and Rationale for Selection

Wildlife Indicator Species	Rationale for Selection
Olive-sided flycatcher (*Contopus cooperi*)	• Migratory bird species listed as threatened under Schedule 1 of SARA and protected under the MBCA • Representative bird species dependent on open and semi-open coniferous forests, as well as forest edges near natural openings (e.g., Elbow River)
Sprague's pipit (*Anthus spragueii*)	• Migratory bird species listed as threatened under Schedule 1 of SARA and protected under the MBCA • Listed as special concern under the AESCC • Representative bird species dependent on native grassland
Northern leopard frog (*Lithobates pipiens*)	• Listed as special concern under Schedule 1 of SARA • Listed as threatened under the Alberta *Wildlife Act* • Wetland dependent species sensitive to changes in proximity of habitat types required for breeding, foraging and overwintering
Elk (*Cervus canadensis*)	• Representative ungulate species that utilizes habitat along the Elbow River, which has been identified as a KWBZ • Prefers native fescue grassland to meet seasonal foraging requirements • Important to Aboriginal communities (i.e., traditional use) and a species of ecological and economic importance
Grizzly bear (*Ursus arctos*)	• Listed as threatened under the Alberta *Wildlife Act* • Large carnivore that is sensitive to habitat loss, fragmentation, and human-caused mortality risk • Focus of provincial recovery efforts and stakeholder concern • Cultural importance to Aboriginal communities
Sora ((*Porzana carolina*)	• Migratory bird species designated as sensitive under the General Status of Alberta Wild Species (Government of Alberta 2017c) and protected under the MBCA. • Sora was chosen as an additional key wildlife indicator to represent bird species dependent on wetlands because the pathways for potential Project effects on migratory birds would be similar for other wetland dependent birds represented under the MBCA.

Overall, olive-sided flycatcher, sora, and Sprague's pipit were chosen as key wildlife indicators because the pathways for potential Project effects on migratory birds would be similar for a broader group of species represented under the *Migratory Birds Convention Act* (MBCA) that are dependent on forest or grassland habitat types.

Similarly, elk and grizzly bear were considered representative of wildlife species used for traditional purposes because these species depend on a variety of seasonal habitat types that would include other wildlife species of traditional importance such as mule deer, white-tailed deer, coyote and weasel, which also depend on similar habitat types (e.g., grassland, shrubland, forest).

11.1.2.3 Biodiversity

Biodiversity refers to the variety of species and ecosystems that occur in an area (Government of Alberta 2014). To address the TOR requirement for biodiversity (Sections 3.8.1 and 3.8.2 in the TOR), indicators for biodiversity are based on guidance developed for the South Saskatchewan Regional Plan Biodiversity Management Framework (BMF) (Government of Alberta 2015b) (Table 11-2). The indicators for biodiversity are examined for the local assessment area (LAA) and RAA. For each indicator, at least one parameter is selected to provide a means of measuring and assessing the effects of the Project (Table 11-2).

Table 11-2 Biodiversity Indicators and Selection Rationale

Biodiversity Indicator	Rationale for Inclusion
Native cover – upland	• Tier 1 Indicator for the South Saskatchewan Regional Plan BMF • Habitat loss is a large contributor of biodiversity loss and monitoring the terrestrial native cover provides a measure of the native upland landscape composition (habitat diversity) available in the region and a measure of the amount of upland habitat (e.g., forest, shrubland, grassland) that has been lost due to cumulative effects of human disturbance.
Native cover –lowland	• Tier 1 Indicator for the South Saskatchewan Regional Plan BMF • Habitat loss is recognized as a key contributor to biodiversity loss and monitoring aquatic native cover (habitat diversity) in the region provides a measure of the amount of wetland and riparian habitat loss due to cumulative effects of human disturbance.
Native land cover patch size (upland and wetland/riparian)	• Tier 2 Indicator for the South Saskatchewan Regional Plan BMF • The increase in the amount of fragmentation of native land cover in the landscape poses a major threat to biodiversity as the reductions in the size and connectivity of native cover may lead to loss of species diversity, restriction in movement, and greater vulnerability of species extinction

Table 11-2 Biodiversity Indicators and Selection Rationale

Biodiversity Indicator	Rationale for Inclusion
Species of management concern (vegetation and wildlife)	• Tier 2 indicator for the South Saskatchewan Regional Plan BMF • Certain species of management concern have habitat requirements and known populations can be monitored to assess the effects of human disturbance
Species richness and abundance (bird and amphibian)	• Declines in habitat diversity can negatively affect species diversity in the landscape. Birds are used as un upland species indicator and amphibians are used as a water/wetland species indicator.

11.1.3 Engagement and Key Concerns

Alberta Transportation has engaged with industry, adjacent lease owners, landowners, public stakeholders, and Indigenous groups about the Project. Key concerns raised during open houses included potential project effects on wildlife habitat, movement, mortality risk, and biodiversity.

Alberta Transportation's engagement with Indigenous groups began in 2014 with five Indigenous communities. In June 2016, an additional eight Indigenous communities were engaged as outlined in the CEA Agency guidelines. Indigenous engagement has been ongoing prior to and through the Environmental Impact Assessment (EIA) process and will continue until a decision is made by Natural Resources Conservation Board (NRCB). Detailed information regarding the Indigenous Engagement program is presented in Volume 1 Section 7.

Traditional Land and Resource Use (TLRU) information was gathered through Project-specific traditional use studies (TUS) conducted by potentially affected Indigenous groups and through the results of Alberta Transportation's Indigenous Engagement program. At the time of writing of this assessment, Alberta Transportation had received a Project-specific TUS report from Piikani Nation, as well as a joint interim TUS report from Blood Tribe and Siksika Nation. In addition to Project-specific sources, publicly-available literature was reviewed for TLRU information relevant to the Project. Secondary source materials reviewed include:

- Regulatory traditional use studies conducted by Indigenous groups
- TLRU assessments, supplemental filings, and hearing evidence for other developments
- government reports and databases
- legal proceedings
- historical and ethnographic literature
- relevant internet sources (such as Indigenous community websites and the Indigenous and Northern Affairs Canada website)

TLRU information was considered during the preparation of all aspects of the EIA, including both methodology and analysis, as stipulated by the CEA Agency project guidelines. TLRU information contributed to the understanding of the existing ecological conditions, was used to identify wildlife resources that are used traditionally, and informed the assessment of potential Project effects. While this information did not directly affect the significance definition it has been incorporated into the analysis of effects on which the significance determination was based. This applies equally to effects assessed for construction, dry operations, flood operations and post-flood operations. Generally, issues and concerns related to effects of industrial development on wildlife, as reported by Indigenous groups through the review of Project-specific and publicly-available TLRU information, include:

- Loss or disturbance of wildlife habitat, including potential disturbance to important wildlife habitat features such as nests, dens, mineral licks, calving areas, springs and ungulate winter ranges
- Effects of sensory disturbance on wildlife
- Increased habitat fragmentation and alterations of wildlife migration and movement patterns
- Potential for animal-vehicle collisions (AVC) due to increased access and a lack of wildlife crossings, including associated intangible effects on the transmission of traditional knowledge (see Section 14.7 and 14.8.8)
- Increased wildlife mortality
- Effects to biodiversity

These issues and concerns have been considered in the assessment of potential project effects. More detailed information regarding TLRU in relation to wildlife is discussed in the TLRU assessment (see Section 14). These key concerns were used to identify wildlife species potentially affected by the Project, including those commonly hunted in the RAA. Some of these wildlife species were included as SOMC (e.g., elk, grizzly bear, migratory birds), which are used to focus the wildlife assessment (see Section 11.1.2 and Volume 4, Wildlife and Biodiversity Technical Data Report).The Tsuut'ina expressed the following concerns relating to wildlife and wildlife habitat:

- The Project area is an environmentally sensitive area, and includes a Key Wildlife and Biodiversity Zone and Environmentally Significant Areas.
- Construction of the Project may cause the loss of winter ungulate habitat and increase habitat fragmentation in the Project area.
- Habitat damage, including damage to sensitive fescue grassland and wetland ecosystems, could result from contaminated sediment left behind from flood waters or debris.

- The construction of the diversion channel and the off-stream dam would occur in areas of wetland. Construction activities related to these components have the potential to cause the loss or alteration of wetland habitat.
- Use of the reservoirwould likely result in the loss of migratory bird nests and would also temporarily reduce the availability of wetland habitat in the project area that is suitable for breeding, nesting and brood rearing for waterfowl and other migratory birds for the period the flood water is retained in the reservouir;
- Debris left after floods may result in loss of bird habitat or contamination of habitat, impacts to wetlands impacts will cause further impacts to wildlife, fish and birds, as well as the exercise of Aboriginal, Treaty, and Inherent rights.
- Adverse impacts could occur to the habitat of species of cultural significance, including bald eagles and grizzly bears.
- The Project could impact migratory herds of elk that pass through Tsuut'ina territory

The Siksika Nation expressed concerns about construction to impact animal homes, such as the beavers. The Siksika Nation requested that Species at Risk wildlife impact information gathered during the project site investigations be shared with the Nation.

The Piikani Nation expressed concerns about impacts to wildlife and stranding of fish in the reservoir during flood events. The Piikani Nation expressed concerns about construction impact to animal homes, such as the beavers. The Piikani Nation requested that Species at Risk wildlife impact information gathered during the project site investigations be shared with the Nation.

The Stoney Nakoda Nations inquired whether the Project would include any wildlife crossings and inquired about fencing. Stoney Nakoda Nations expressed concerns that the fences that would be built around the project site might impact wildlife passage through the area. Stoney Nakoda Nations emphasized the importance of wildlife crossings and was concerned that, if not properly managed, could be a problem for the pPoject. Stoney Nakoda Nations "requested that the project designers will also include wildlife crossing options into their assessment". Stoney Nakoda Nations inquired if there would be wildlife crossings built over HWY 22 or Highway 8 Stoney Nakoda Nations expressed concerns about effects on water and wetlands for wildlife, fish, birds, and vegetation. Concerns were expressed that the Project will drive away or minimize the availability of bird, fish, and wildlife. The Stoney Nakoda Nations also expressed concerns that the Project will act as a barrier to the migration of wildlife and fish.

The Piikani Nation expressed concerns about construction impact to animal homes, such as the beavers. The Piikani Nation requested that Species at Risk wildlife impact information gathered during the project site investigations be shared with the Nation.

Métis Nation Alberta (MNA) Region 3 expressed concern about potential effects to wildlife cause by the diversion of water from Elbow River and the construction of the Project.

The Louis Bull Tribe expressed concerns about maintaining the migratory patterns and game trails for wildlife. The Tribe also expressed concerns about eagle nesting in the area, and other wildlife (ungulates) such as elk, moose, deer and bears.

Ermineskin Cree Nation expressed concerns about maintaining the migratory patterns and game trails for wildlife. Ermineskin Cree Nation also expressed concerns about eagle nesting in the area, and other wildlife (ungulates) such as elk, moose, deer and bears and would like to do a walk through to determine any potential impacts to elk, game trails, birds, nesting and migratory patterns.

11.1.4 Potential Effects, Pathways and Measurable Parameters

11.1.4.1 Wildlife

Construction and dry operation has the potential to affect wildlife, wildlife habitat, and biodiversity including species at risk through direct habitat loss as well as reduced habitat effectiveness (i.e., sensory disturbance). The Project also has potential to affect wildlife movement and increase mortality risk.

Characterizing the potential effects requires the selection of measurable parameters that can be used to evaluate each predicted effect. Ideally, these parameters are measurable and quantifiable (e.g., direct habitat loss). However, some effects on wildlife lack defined, quantifiable parameters to measure effects. Such effects are predicted qualitatively using scientific literature, professional judgement, and past project experience. For example, increased mortality risk due to increased traffic volumes and potential vehicle collisions with wildlife is assessed qualitatively. Potential effects, effect pathways, and the measurable parameters used to characterize and assess effects on wildlife are provided in Table 11-3.

Table 11-3 Potential Effects, Effects Pathways and Measurable Parameters for Wildlife

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in habitat	• Direct habitat loss or alteration including residences of species at risk (SAR) from vegetation clearing. • Indirect loss or reduced habitat effectiveness from sensory disturbance.	• Amount (ha) of wildlife habitat (e.g., land cover classes) directly affected. • The amount (ha) of high and moderate habitat suitability directly and indirectly affected or altered for key indicator species [a]. • Number of formally-defined SAR residences (e.g., northern leopard frog breeding wetlands) directly or indirectly affected. • Habitat loss resulting from reduced habitat effectiveness (e.g., sensory disturbance) is assessed qualitatively for SOMC. Setback distances provide a guide to help estimate indirect habitat loss.
Change in movement	• Construction and operation could result in alteration of wildlife movement patterns (daily or seasonal) because of habitat change and sensory disturbance.	• Effect on change in movement is assessed qualitatively (e.g., effects of habitat change and sensory disturbance on wildlife movement).
Change in mortality risk	• Ground disturbance and vegetation clearing can result in physical destruction of key habitat features (e.g., nests, dens, roosts, hibernacula) • Vehicle and equipment movement and ground disturbance can result in accidental mortality of small, less mobile species or individuals (e.g., amphibians) • Vehicle collisions • Wildlife-human conflict (i.e., removal of nuisance animals)	• Evaluation of direct mortality risk is assessed qualitatively. • Risk of mortality because of vegetation clearing, site preparation and maintenance (e.g., potential risk of active nest destruction or abandonment) • Risk of mortality because of collisions with project vehicles (e.g., increase in traffic volumes) • Risk of wildlife-human conflict (e.g., removal of nuisance animals)

NOTE:

[a] Habitat suitability models assessed potential indirect effects (i.e. sensory disturbance) on key wildlife indicators using zones of influence (ZOI) criteria. See Volume 4, Appendix H, Attachment 11A for a discussion of habitat suitability model development and methods.

11.1.4.2 Biodiversity

Construction and dry operation of the Project might affect biodiversity at both the regional and local scales through habitat loss (i.e., changes to plant communities) and fragmentation (creation of edge effects), which can result in reduced plant and wildlife species diversity. Potential effects, effect pathways, and the measurable parameters used to characterize and assess effects on biodiversity are provided in Table 11-4.

11.1.5 Boundaries

The following spatial boundaries are defined for the wildlife and biodiversity assessment and include areas where the Project might interact directly or indirectly with wildlife.

- The project development area (PDA) is 1,440 ha and includes the anticipated area of physical disturbance and workspace associated with project construction activities and operation. The PDA includes all phases (e.g., construction, dry operations, and flood events) of the Project.
- The LAA includes the PDA and a 1 km buffer centered on the PDA (Figure 11-1), and includes the area in which the construction or operation of the Project could have direct or indirect effects on wildlife. The LAA is 4,860 ha, and considers potential zones of influence (i.e., area of reduced use or avoidance) and prescribed or recommended maximum setback distances for SOMC (e.g., 1 km for bald eagle).
- The RAA extends 15 km beyond the PDA (Figure 11-2), and is used for determining residual effects on wildlife and biodiversity and to assess where residual effects act cumulatively with residual effects of past, present, and reasonably foreseeable future activities (i.e., cumulative effects). The RAA is 102,817 ha. The spatial boundary is sufficiently large to encompass an average home range of a female grizzly bear (500 km^2), which would also include home ranges of other wildlife SOMC that have relatively smaller home ranges. The RAA boundary to the east borders the City of Calgary.

The following temporal boundaries are defined for the Project.

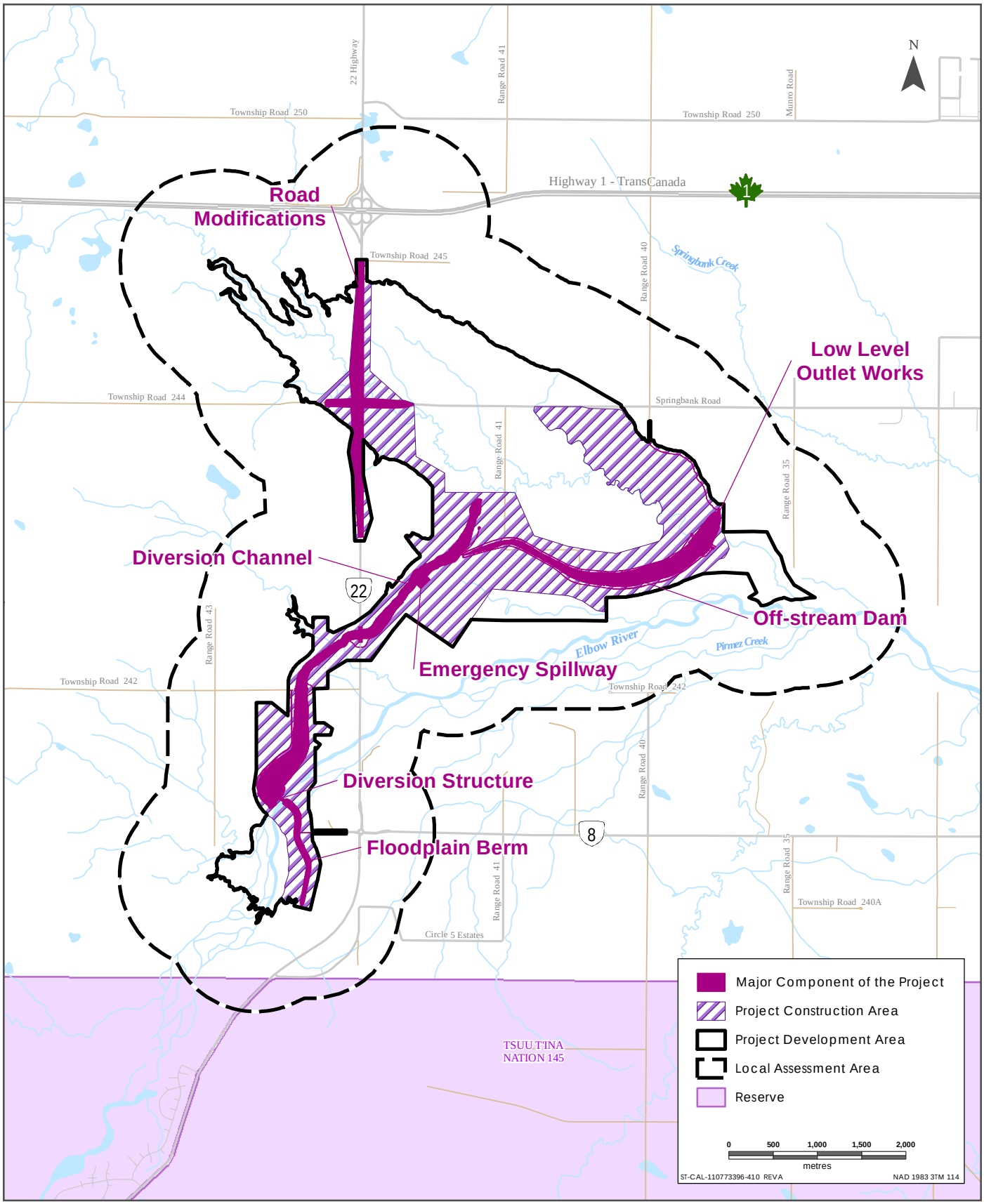
Project construction would take place over a 36-month period. Assuming regulatory approval by Q4 2018, construction would commence in Q1 2019. By Q4 2020, the Project would be able to accommodate a 1:100 year flood. Construction would be complete by Q1 2022 at which time the Project would be able to accommodate water volumes equal to the 2013 flood. Dry operations of the Project will occur indefinitely (i.e., permanent installation) after construction, with periods of dry operations alternating with flood and post-flood phases.

Table 11-4 Potential Effects, Pathways and Measurable Parameters for Biodiversity

Potential Effect(s)	Indicator	Effect Pathway and Justification	Spatial Scale	Measurable Parameter(s) and Units of Measurement	Assessment Location
Change in community diversity (vegetation)	Native upland cover	Direct loss or alteration of native upland habitat during construction and dry operations	LAA	• Area (ha) of upland native habitat (plant communities) lost or altered	Section 10.4.3 and Section 10.5 (vegetation and wetlands assessment)
	Wetland cover	Direct loss or alteration of wetland cover (e.g., seasonal or temporary wetlands) from vegetation clearing or ground disturbance. These habitats provide habitat for several wildlife (e.g., amphibians) and plant SOMC	LAA	• Area (ha) of wetland lost or altered by wetland type	Section 10.4.3 and Section 10.5 (vegetation and wetlands assessment)
Change in landscape diversity (habitat fragmentation)	Native cover	Construction and operation could result in fragmentation of habitat resulting in reduced connectivity of remaining native cover patches	RAA	• Change in mean patch size (ha), number of patches, and mean patch edge (km) of upland and wetland land cover types	Section 10.4.2 (vegetation and wetlands assessment)

Table 11-4 Potential Effects, Pathways and Measurable Parameters for Biodiversity

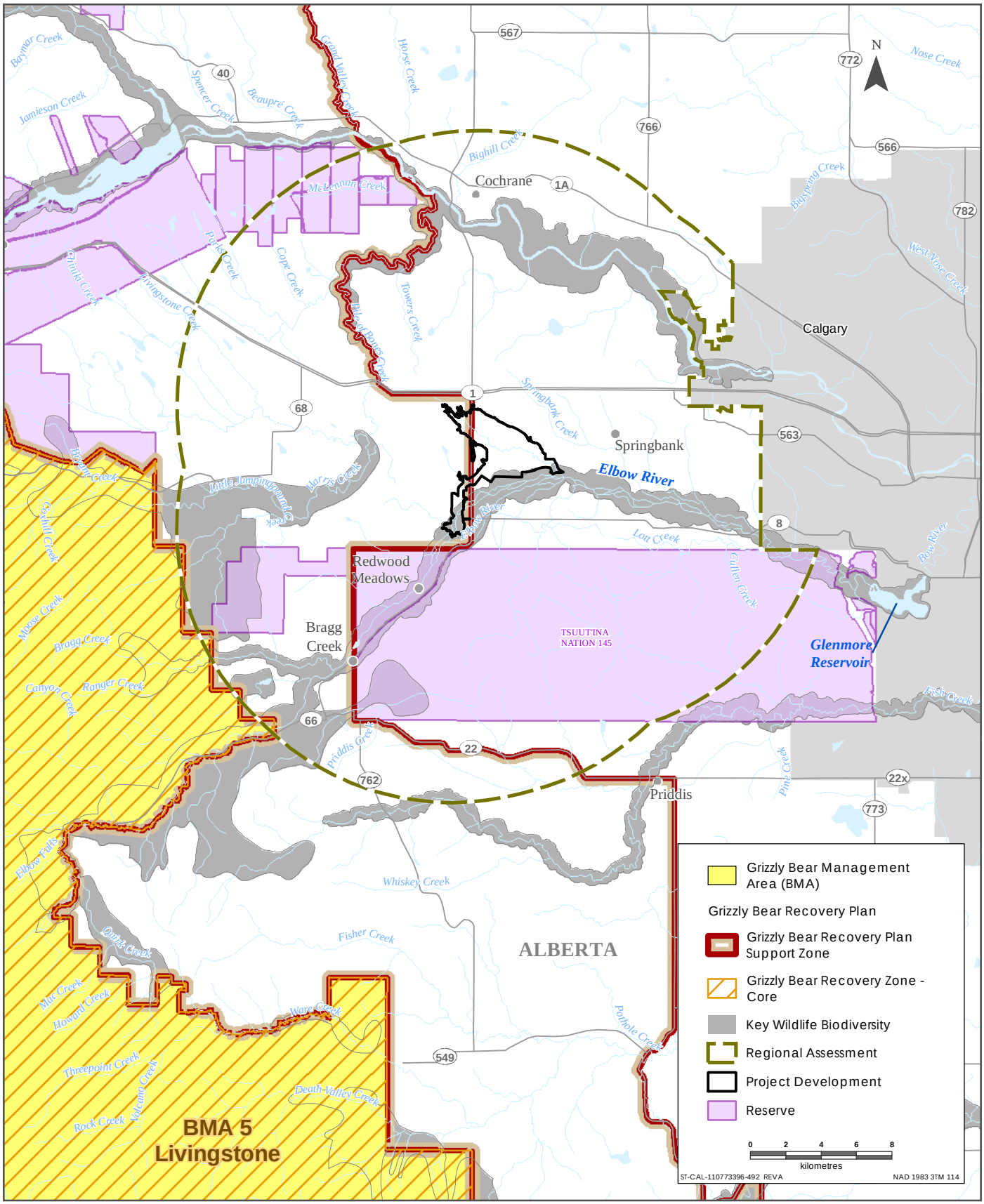
Potential Effect(s)	Indicator	Effect Pathway and Justification	Spatial Scale	Measurable Parameter(s) and Units of Measurement	Assessment Location
Change in landscape diversity (habitat fragmentation) (cont'd)	Rare and traditional plant species diversity	Loss of rare plants during Project construction.	LAA	• Number of plant SOMC occurrences affected by the Project • Occurrences of rare and traditional use plants affected by the Project	Section 10.2.2.3 and Section 10.4.4 (vegetation and wetlands assessment)
	Wildlife Habitat Diversity - Breeding Bird and Amphibian Diversity	Combined effect of Project construction and dry operations on breeding bird and amphibian species richness and abundance from existing conditions	LAA	• Combined metric based on area (ha) of vegetation community type that accounts for breeding bird and amphibian species richness, species overlap, and occurrence of SOMC	Volume 4, Wildlife and Biodiversity Technical Data Report, Section 3



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Wildlife Project Development Area and Local Assessment Area

Stantec



Sources: Base Data - ESRI, Natural Earth. Thematic Data - ERBC, Government of Alberta
(Alberta Species at Risk Recovery Plan No. 38)

Wildlife Regional Assessment Area

Stantec

11.1.6 Residual Effects Characterization

Specific criteria are used to characterize potential effects on wildlife and biodiversity remaining after mitigation activities have been completed (i.e., the residual effects). This is done for the potential effects during construction and dry operations in the LAA. The residual effects characterization for both the project phases is compared with existing conditions. Criteria used to characterize residual effects on wildlife and biodiversity are provided in Table 11-5.

Table 11-5 Characterization of Residual Effects on Wildlife and Biodiversity

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	Positive – a residual effect that moves measurable parameters in a direction beneficial to wildlife and biodiversity relative to existing conditions Adverse – a residual effect that moves measurable parameters in a direction detrimental to wildlife and biodiversity relative to existing conditions Neutral – no net change in measurable parameters to wildlife and biodiversity relative to existing conditions
Magnitude [a] (change in habitat for key indicator species)	The amount of change in measurable parameters or the VC relative to existing conditions	Low: <1% change in habitat abundance in the LAA Moderate: 1-10% change in habitat abundance in the LAA High: >10% change in habitat abundance in the LAA
Magnitude (change in habitat for non-indicator SOMC, including migratory birds and species at risk, change in movement and mortality risk)	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible – no measurable change in wildlife abundance and distribution Low – a measurable change in the abundance of wildlife in the LAA is unlikely, although temporary local shifts in distributions might occur Moderate – a measurable change in the abundance and distribution of wildlife in the LAA is possible, but a measurable change in the abundance of wildlife in the RAA is unlikely High – a measurable change in the abundance of wildlife in the RAA is possible
Geographic Extent	The geographic area in which a residual effect occurs	PDA – residual effects are restricted to the PDA LAA – residual effects extend into the LAA RAA – residual effects interact with those of other projects in the RAA
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a phase	Single event Multiple irregular event – occurs at no set schedule Multiple regular event – occurs at regular intervals Continuous – occurs continuously

Table 11-5 Characterization of Residual Effects on Wildlife and Biodiversity

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	Short-term – residual effect is limited to the construction phase Long-term – residual effect extends for the life of the Project
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	Reversible – the residual effect is likely to be reversed after activity completion and reclamation Irreversible – the residual effect is unlikely to be reversed
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	Undisturbed – area is relatively undisturbed or not adversely affected by human activity Disturbed – area has been substantially previously disturbed by human development or human development is still present
Timing	Periods of time where residual effects from Project activities could affect the VC	Seasonality – residual effect is greater in one season than another (e.g., spring/summer vs. fall/winter) Time of day – residual effect is greater during daytime or nighttime Regulatory – provincial or federal restricted activity periods or timing windows (e.g., migration, breeding, spawning) related to the VC Not applicable - the residual effect of Project activities will have the same effect on the VC, regardless of timing

NOTE:

[a] Habitat suitability models have been developed for key indicator species. The percent change in habitat abundance refers to the total amount of high and moderate habitat suitability combined. The magnitude categories and the 10% threshold represents a "cautionary limit" based on a tiered risk sensitive approach, which also considered the uncertainty associated with varying species responses to habitat loss including species at risk (see Johnson 2013; Salmo Consulting 2006).

11.1.7 Significance Definition

A significant adverse residual environmental effect on wildlife is defined as one that, following the application of avoidance and mitigation measures:

- threatens the long-term persistence or viability of a wildlife species in the RAA or,
- is contrary to or inconsistent with the goals, objectives or activities of recovery strategies, action plans and management plans.

11.2 EXISTING CONDITIONS FOR WILDLIFE AND BIODIVERSITY

11.2.1 Methods

11.2.1.1 Existing Data

A review of existing data was completed to gather information on SOMC and their habitat within the RAA. Specifically, existing information was reviewed from the following selected sources:

- Alberta Fisheries and Wildlife Management Information System (FWMIS)
- Alberta Wildlife Sensitivity Data (i.e., Key Wildlife Ranges and Key Wildlife Layers) (AEP 2016b)
- Environmentally Significant Areas (ESAs) in Alberta (Alberta Parks 2014; Fiera 2014)
- Important Bird Areas (IBAs) (Bird Studies Canada 2016)
- eBird (2017)
- The Atlas of Breeding Birds of Alberta: A Second Look (FAN 2007)
- General Nesting Periods of Migratory Birds in Canada (ECCC 2016)
- The Natural History of Canadian Mammals (Naughton 2012)
- The Amphibians and Reptiles of Alberta (Russell and Bauer 2000)
- Sprague's Pipit Conservation Management Plan 2010–2015 (ASRD 2010a)
- Alberta Grizzly Bear Recovery Plan (Draft) (AEP 2016a)
- Biology, demography, ecology and management of grizzly bears in and around Banff National Park and Kananaskis Country. The final report of the Eastern Slopes Grizzly Bear Project (Herrero 2005)
- Wildlife Habitat Assessment Jumpingpound Pipeline Region (Collister and Kansas 1997)
- Alberta Northern Leopard Frog Recovery Plan 2010–2015 (ESRD 2012a)

- SARA recovery strategies or management plans for species with potential to occur in the RAA (e.g., olive-sided flycatcher, Sprague's pipit, yellow rail.)
- Highway 22:14 and 22:16 highway twinning and interchange reconfiguration environmental overview assessment (EBA 2010)

11.2.1.2 Field Surveys

Wildlife field surveys were conducted in the LAA to estimate wildlife abundance and distribution, assess wildlife habitat suitability, and identify wildlife features that might require mitigation. Field surveys targeted SOMC, including species at risk that could potentially occur in the LAA. The following wildlife surveys were conducted in the LAA:

- nocturnal amphibian, May 2016
- diurnal tadpole, July 2016
- rail, June 2016
- breeding bird, June 2016
- raptor nest and waterfowl area search, June 2016
- remote camera, April 2016 – March 2017
- winter tracking, February 2015 and January 2017

Detailed descriptions of wildlife survey methods and results are provided in Volume 4, Wildlife and Biodiversity Technical Data Report.

11.2.1.3 Wildlife Habitat

Wildlife habitat abundance[1] in the LAA and RAA is estimated by calculating the area (ha) and percent cover of each ecosite or land cover type using the Grassland Vegetation Inventory (GVI) database and the Alberta Wetland Classification System (ESRD 2015b) and species-specific habitat associations. Ecosite phases are based on the Foothills Parkland Range Plant Community Guide (ESRD 2012c). Ecosite data is not available for the RAA; therefore, broad vegetation cover classes (e.g., mixedwood forest) were used to estimate habitat abundance in the RAA using Alberta Biodiversity Monitoring Institute's (ABMI) Land Cover Classification (LCC) spatial data (ABMI 2010). For a more detailed description of vegetation and wetland mapping methods, see Section 10.2.1.

Habitat suitability models assess potential direct (i.e., habitat loss) and indirect (i.e., sensory disturbance) effects on changes in habitat abundance in the LAA for five key indicator species: olive-sided flycatcher (*Contopus cooperi*), Sprague's pipit (*Anthus spragueii*), northern leopard frog (*Lithobates pipiens*), elk (*Cervus canadensis*), and grizzly bear (*Ursus arctos*). A four-class

[1] The term habitat abundance refers to the amount of habitat available, regardless of its availability to animals, which implies knowledge of accessibility and procurability of physical and biological components of a habitat by an animal (Krausman and Morrison 2016).

rating scheme (high, moderate, low, very low to nil) rates the suitability of each ecosite or land cover class to provide key life requisites (e.g., feeding, breeding) for each key indicator species. Indirect loss caused by sensory disturbance is estimated using species- and disturbance-specific zones of influence (ZOI). The life requisite rated for olive-sided flycatcher, Sprague's pipit and northern leopard frog is breeding habitat. Winter and summer feeding habitat is rated for elk and two seasons are rated for grizzly bear feeding habitat, including a pre-berry season (spring and early summer) and a berry season (late summer and fall). A description of model development, assumptions, and ZOI for each key indicator are provided in Volume 4, Appendix H, Attachment 11A.

11.2.1.4 Biodiversity

Biodiversity is assessed using land cover data to assess changes in landscape diversity, community diversity and species diversity. Vegetation communities were mapped in the LAA using ecosite phases and wetland classes. Regional vegetation cover types are mapped in the RAA (see Section 10.2.1). Existing conditions of biodiversity are discussed in Section 10.2.2, including landscape, community, and species diversity. Habitat fragmentation is assessed in the RAA using three landscape metrics: mean patch size (ha), number of patches, and mean patch edge (km). The abundance of wildlife habitat in the LAA is discussed in Section 11.2.2.3. Habitat abundance is assessed using changes in area (ha) and percent cover of habitats for the wildlife key indicator species (defined in Section 11.1.2.1 and Volume 4, Appendix H, Attachment 11A).

11.2.2 Overview

11.2.2.1 Key Wildlife Ranges and Zones

The LAA occurs in the Foothills Parkland natural subregion in Alberta as does most of the RAA. The southwestern portion of the RAA extends into the Montane natural subregion. The Foothills Parkland natural subregion is a transition zone between prairie grasslands and montane and alpine forests. It is characterized by rolling topography with hills (Natural Regions Committee 2006). The vegetation of the Foothills Parkland natural subregion comprises rough fescue grasslands, willow shrublands, and aspen woodlands (Natural Regions Committee 2006). The Montane natural subregion is characterized by Douglas fir (*Pseudotsuga menziesii*), limber pine (*Pinus flexilis*), and lodgepole pine (*Pinus contorta*) (SRD 2008).

Through the Project-specific Indigenous Engagement program, Tsuut'ina Nation noted that the Project area is an environmentally sensitive area that comprises an important ungulate winter range. The LAA and RAA overlap areas identified as KWBZs (AEP 2016b), including the Elbow River to the south and the Bow River to the north. KWBZs represent areas along river valleys that are a combination of important winter ungulate (e.g., deer, elk) habitat and areas of high potential for biodiversity (ESRD 2015a; AEP 2016b). KWBZs are areas that protect productive, key ungulate winter ranges and river corridors, protect locally and regionally significant wildlife

movement corridors and habitat types, and protect key hiding and thermal cover for wildlife (ESRD 2015a).

The LAA and RAA overlap the grizzly bear Support Zone identified in the draft *Alberta Grizzly Bear Recovery Plan* (AEP 2016a). The LAA and western boundary of the RAA overlap the Support Zone of the Livingstone Bear Management Area (BMA 5), south of the Trans-Canada Highway (Figure 11-2). Support Zones primarily occur on private agricultural or rural residential land and are designed to maintain grizzly bears with home ranges that only partially occur in the Core and Secondary Recovery Zones. The priority management actions in the Support Zones are to reduce attractants and bear-human conflict. Further to the west, the RAA borders the Core Recovery Zone of the Livingstone BMA 5 (AEP 2016a) where maintaining high quality grizzly bear habitat and low risk of human-caused mortality is the priority.

The PDA, LAA and RAA occur within sharp-tailed grouse (*Tympanuchus phasianellus*) and sensitive raptor ranges (AEP 2016b). Sensitive raptors are bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*) and prairie falcon (*Falco mexicanus*) (AEP 2016b). The assessment areas do not intersect any other key wildlife ranges (e.g., sensitive snake or sensitive amphibian range), wildlife sanctuaries, (AEP 2016b), or internationally significant areas for bird conservation (Bird Studies Canada 2016). The RAA overlaps Bragg Creek Provincial Park, Glenbow Ranch Provincial Park, and Gooseberry Provincial Recreation Area. A private Natural Reserve Area occurs within the off-stream reservoir of the PDA, and contains wetlands, native grass, trees and shrubs; however, it is not a designated federal, provincial or regional protected area established under legislation.

11.2.2.2 Species of Management Concern

Based on a review of known species distribution ranges, species life histories, and land cover types in the RAA, there is potential suitable habitat for 86 wildlife SOMC, including 54 birds, 26 mammals, three amphibians and three reptiles (Volume 4, Wildlife and Biodiversity Technical Data Report). Nineteen species at risk listed on Schedule 1 of SARA have the potential to occur in the RAA: horned grebe, western grebe, yellow rail, long-billed curlew, red knot, short-eared owl, common nighthawk, peregrine falcon, olive-sided flycatcher, loggerhead shrike, bank swallow, barn swallow, Sprague's pipit, Baird's sparrow, bobolink, rusty blackbird, little brown myotis, western toad, and northern leopard frog. Although federal recovery strategies have been developed for common nighthawk (Environment Canada 2016b) and olive-sided flycatcher (Environment Canada 2016a), critical habitat has yet to be identified. Recovery strategies for little brown myotis (Environment Canada 2015b) and Sprague's pipit (Environment Canada 2012) have partially identified critical habitat but they do not overlap the LAA.

In addition to the 19 wildlife species listed on Schedule 1 of SARA, there are three wildlife species designated as special concern by COSEWIC that have potential to occur in the RAA: grizzly bear, American badger and western tiger salamander (see Attachment A, Table A-1). Twelve species at risk listed under the AWA have the potential to occur in the RAA: trumpeter swan, Harlequin duck, western grebe, long-billed curlew, barred owl, peregrine falcon, prairie falcon, loggerhead shrike, Sprague's pipit, Cape May warbler, grizzly bear, and northern leopard frog. Although the western portion of the PDA, and RAA (west of Highway 22), intersects the grizzly bear Support Zone, the RAA does not overlap the grizzly bear Core or Secondary Recovery Zones.

Tsuut'ina Nation, through the Project-specific Indigenous Engagement program, and the Stoney Nakoda Nations (Stoney Consultation Team 2016) noted that bald eagles and grizzly bears are culturally important species. Other SOMC that are of cultural importance include elk and Sprague's pipit, which are key indictors for this assessment, along with grizzly bear. Of the 86 wildlife SOMC that have the potential to occur in the RAA, 31 are wildlife species of traditional importance to Indigenous communities.

11.2.2.3 Wildlife Habitat

The LAA is dominated by an agricultural landscape, which includes tame pasture (27.3%), annual cropland (11.3%) and hayland (9.7%) (Table 11-6). Although these land cover types provide relatively low habitat suitability for most SOMC, there are native vegetation communities in the LAA that provide relatively higher habitat suitability for wildlife including grassland (8.8%), shrubland (8.4%), and mixed forest (6.1%). Specifically, these habitat types provide suitable habitat for SOMC dependent on grassland (e.g., Baird's sparrow, elk), shrubland (e.g., loggerhead shrike, alder flycatcher) and mixed forest (e.g., western tanager). There is relatively less habitat available in the LAA for species dependent on broadleaf (deciduous) forest (5.2%), such as Baltimore oriole; coniferous forest (5.0%), such as great gray owl; and species dependent on wetlands (6.4%), such as yellow rail, waterfowl, and amphibians.

Through the Project-specific Indigenous Engagement program, Siksika Nation noted the existence of important wildlife habitat along the Elbow River, and that wildlife use the floodplain and wetlands adjacent to the river. A majority of the forest habitats (i.e., coniferous, broadleaf, and mixed) in the LAA occur along the Elbow River. In addition, wildlife features such as a bank swallow breeding colony, and stick nests used by raptors, including bald eagle, exist along the Elbow River.

The composition and abundance of habitats in the RAA differs from the LAA except for the proportion of mixed forest (Table 11-7). Overall, broadleaf (deciduous) forest, conifer forest and grasslands are relatively more abundant in the RAA, whereas shrubland and wetlands occur less frequently in the RAA compared to the LAA. The amount and distribution of existing habitat for key indicators is described in Section 11.4.2.3, Table 11-8.

Table 11-6 Vegetation and Wetland Cover Types in the PDA and LAA

Cover Type	Land Unit [a,b]	PDA [c]		LAA	
		Hectares (ha)	Percent (%)	Hectares (ha)	Percent (%)
Broadleaf Forest	b2 Hairy wild rye Aw	0.0	0.0	0.2	<0.1
	d1 Pine grass Aw	0.1	0.0	21.3	0.4
	e1 Snowberry-silverberry Aw-Pb	1.5	0.1	89.8	1.8
	f2 Red osier dogwood Pb-Aw	19.7	1.4	67.1	1.4
	g2 Horsetail Aw-Pb	0.0	0.0	73.4	1.5
	Broadleaf Forest Subtotal	***21.3***	***1.5***	***251.8***	***5.2***
Coniferous Forest	b4 Hairy wild rye Sw	0.0	0.0	59.1	1.2
	d3 Pine grass-Sw	0.0	0.0	6.8	0.1
	g1 Horsetail Sw	17.3	1.2	179.3	3.7
	Coniferous Forest Subtotal	***17.3***	***1.2***	***245.2***	***5.0***
Mixed Forest	b3 Hairy wild rye Aw-Sw-Pl	14.1	1.0	109.9	2.3
	d2 Pine grass-Sw-Pl-Aw	0.0	0.0	2.5	0.1
	e2 Snowberry-silverberry Sw	24.4	1.7	81.9	1.7
	e4 Snowberry-silverberry Sw-Aw	9.0	0.6	16.1	0.3
	f1 Red osier dogwood Sw	19.5	1.4	85.7	1.8
	Mixed Forest Subtotal	***67.0***	***4.7***	***296.1***	***6.1***
Shrubland	e3 Shrubland - mesic/rich	33.7	2.3	99.0	2.0
	f3 Shrubland - subhygric/rich	163.2	11.3	309.5	6.4
	Shrubland Subtotal	***196.9***	***13.7***	***408.5***	***8.4***
Grassland	b5 Grassland – submesic/medium	21.3	1.5	37.9	0.8
	c1 Rough fescue	187.6	13.0	381.8	7.9
	f4 Grassland - subhygric/rich	4.1	0.3	5.4	0.1
	Grassland Subtotal	***213.0***	***14.8***	***425.1***	***8.8***
	Upland Subtotal	***515.5***	***35.8***	***1,626.7***	***33.5***
Open Water	Open Water	102.4	7.1	283.5	5.8
	Open Water Subtotal	***102.4***	***7.1***	***283.5***	***5.8***
Ephemeral Waterbody	Ephemeral waterbody	0.7	0.0	5.0	0.1
Graminoid Marsh	Temporary graminoid marsh	32.4	2.3	92.9	1.9
	Seasonal graminoid marsh	47.1	3.3	102.7	2.1
	Semi-permanent graminoid marsh	18.1	1.3	34.7	0.7

Table 11-6 Vegetation and Wetland Cover Types in the PDA and LAA

Cover Type	Land Unit [a,b]	PDA [c]		LAA	
		Hectares (ha)	Percent (%)	Hectares (ha)	Percent (%)
Shallow Open Water	Shallow open water with submersed and/or floating aquatic vegetation	0.2	<0.1	7.2	0.1
	Saline shallow open water with submersed and/or floating aquatic vegetation	0.0	0.0	0.9	<0.1
Shrubby Swamp	Seasonal shrubby swamp	1.4	0.1	5.3	0.1
Wooded Mixedwood Swamp	Seasonal wooded mixedwood swamp	0.0	0.0	20.3	0.4
Shrubby Fen	Moderate-rich shrubby fen	23.1	1.6	42.6	0.9
	Wetland Subtotal	***123.0***	***8.6***	***311.6***	***6.4***
Agricultural	Annual crop	136.6	9.5	547.2	11.3
	Dugout	0.5	0.0	2.0	0.0
	Hayland	82.8	5.8	469.5	9.7
	Tame pasture	411.5	28.6	1,325.2	27.3
Disturbed Land	Disturbed land [e]	65.4	4.5	294.6	6.1
	Anthropogenic Subtotal	***696.8***	***48.4***	***2,638.5***	***54.3***
	Grand Total	***1,437.6***	***100.0***	***4,860.0***	***100.0***

NOTES:

Aw – aspen (*Populus tremuloides*)

Pb – balsam poplar (*Populus balsamifera*)

Pl – lodgepole pine (*Pinus contorta*)

Sw – white spruce (*Picea glauca*)

[a] Upland land units (ecosites) were classified using Range Plant Communities and Range Health Assessment Guidelines for the Foothills Parkland Subregion of Alberta (ESRD 2012c).

[b] Wetland land units classified using the Alberta Wetland Classification System (ESRD 2015b).

[c] The PDA includes all Project phases (e.g., construction, dry operations, and flood events).

[d] N/A indicates that ecosite phase data was not available for the RAA, and is summarized by broad cover types.

[e] Disturbed land includes industrial facilities, disturbed land, transportation and rural residential land unit types.

Table 11-7 Upland and Lowland Cover Types in the RAA

Vegetation Class [a]	Hectares (ha)	Percent (%)
Broadleaf Forest	10,181.7	9.9
Coniferous Forest	7,678.7	7.5
Mixed Forest	6,347.7	6.2
Shrubland	2,682.0	2.6
Grassland	27,950.6	27.2
Water	1,674.2	1.6
Wetland	973.5	0.9
Riparian	1,045.5	1.0
Agriculture	21,499.8	20.9
Tame Pasture or Hay	9,457.6	9.2
Exposed Land	69.7	0.1
Disturbed	13,255.7	12.9
Grand Total	**102,816.7**	***100***

NOTE:
[a] Vegetation classes were classified using ABMI's LCC spatial data (ABMI 2010)

11.2.2.4 Key Indicators

The results of the habitat suitability mapping for key indicators for existing conditions is provided in Table 11-8 and Figure 11-3 to Figure 11-9.

Olive-sided Flycatcher

The majority (96.5%) of the LAA consists of low and very low to nil suitability breeding habitat for olive-sided flycatcher with the remainder represented by 5.7 ha (0.1%) of high and 164.8 ha (3.4%) of moderate suitability habitat (Table 11-8). Overall, the existing agricultural and settlement lands combined with the relatively small amount of mature coniferous (5.1%) and mixed forest (6.1%) in the LAA have reduced breeding habitat suitability for the olive-sided flycatcher (see Table 11-6). Moderate and high suitability habitat occurs along the Elbow River where patches of mature conifer forests and edge habitat provide potential nest trees (Figure 11-3).

Sprague's Pipit

Although there are remnant patches of native prairie in the LAA, they are relatively small compared to the minimum patch size requirement of Sprague's pipit. As such, there is no high or moderate suitability breeding habitat in the LAA for existing conditions, which reflects the relatively disturbed and fragmented landscape (Table 11-8; Figure 11-4).

Northern Leopard Frog

The majority (96.9%) of the LAA consists of low and very low to nil suitability breeding habitat for northern leopard frog, with the remainder represented by 54.9 ha (1.1%) of high and 94 ha (1.9%) of moderate suitability habitat (Table 11-8). Moderate and high suitability habitat occurs throughout the LAA where a variety of wetlands, including marshes and shallow open water, as well as slow-moving sections of streams and rivers, provide potential breeding habitat (Figure 11-5).

Elk

Approximately 74.5% of the LAA consists of low and very low to nil suitability winter feeding habitat for elk, with the remainder represented by 223.0 ha (4.6%) of high and 1,016.7 ha (20.9%) of moderate suitability habitat (Table 11-8). High suitability winter feeding habitat occurs in discrete areas east and west of Highway 22 and along the Elbow River, where remnant patches of native grassland provide preferred forage species such as rough fescue (Figure 11-6). Although fescue grasslands provide valuable winter forage for elk, the accessibility of these potential foraging areas vary with the frequency of chinook winds and snow conditions. Moderate suitability feeding habitat occurs in upland areas and along the Elbow River where floodplain habitats support deciduous and mixed forests as well as open grasslands and adjacent forest cover (Figure 11-6).

Overall, elk summer feeding habitat occurs in similar amounts and distribution as winter habitat. Approximately 77.6% of the LAA consists of low and very low to nil suitability summer feeding habitat for elk with the remainder represented by 275.0 ha (5.7%) of high and 813.6 ha (16.7%) of moderate suitability habitat (Table 11-8). High suitability feeding habitat occurs in discrete areas east and west of Highway 22 where remnant patches of native grassland and shrublands provide preferred grasses, sedges, and forbs (Figure 11-7). Moderate suitability feeding habitat is well distributed throughout the LAA where deciduous and mixed forests occur along the Elbow River as well as tame pastures in upland areas (Figure 11-7). However, both winter and summer habitat suitability has been reduced in the LAA because of sensory disturbance associated with existing roads and less forest cover available near to potential feeding areas.

Areas of high suitability winter and summer feeding habitat in the LAA coincide with areas suggested by EBA (2010) to be of high quality habitat (e.g., natural shrub and grassland) for ungulates. Within the RAA, high suitability habitat for elk occurs in the eastern slopes of the Foothills Parkland natural subregion due to an abundance of graminoids and deciduous shrubs as forage (Collister and Kansas 1997).

Grizzly Bear

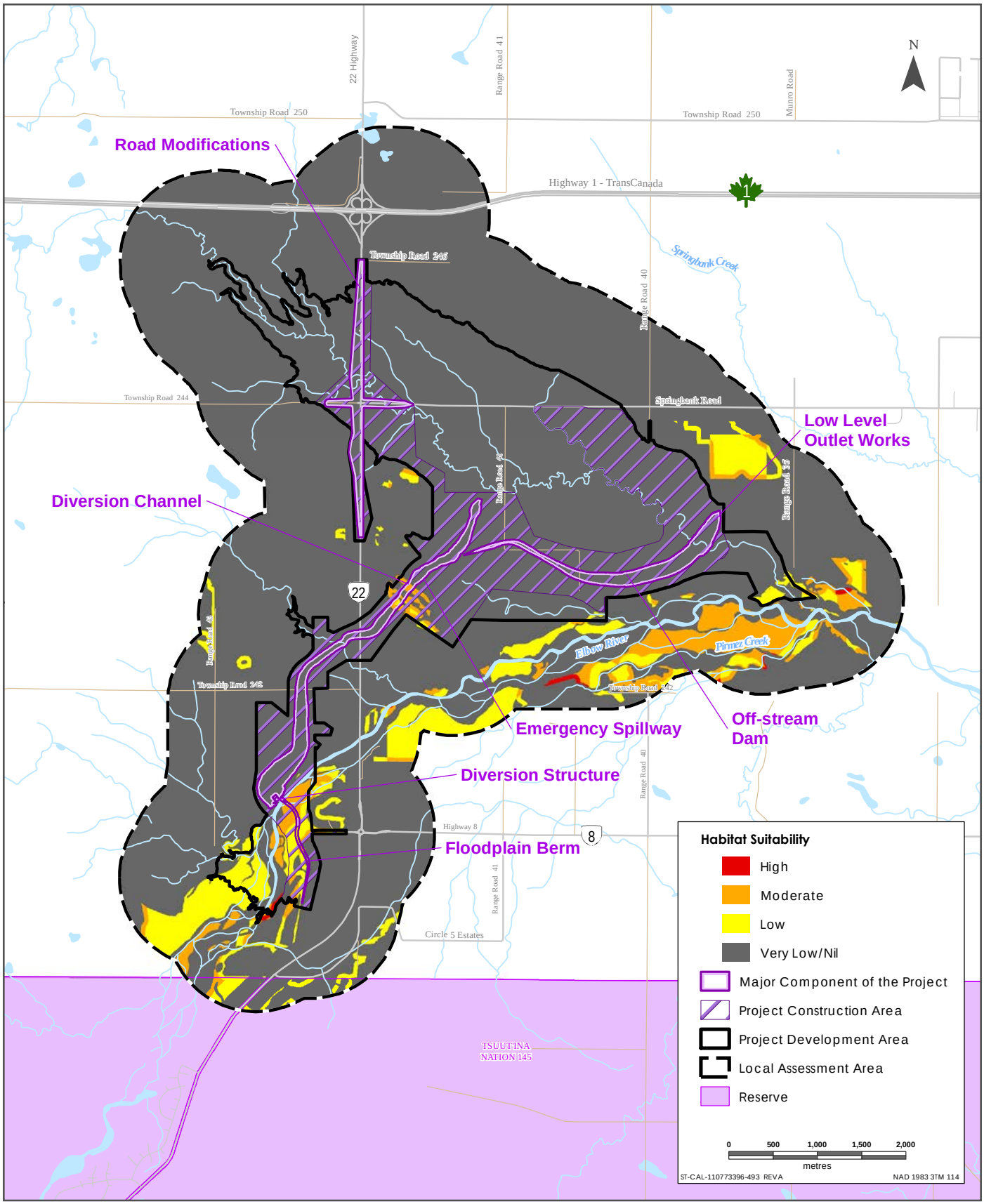
The majority (90.4%) of the LAA consists of low and very low to nil suitability spring feeding habitat for grizzly bear with the remainder represented by 228.9 ha (4.7%) of high and 240.4 ha (4.9%) of moderate suitability habitat (Table 11-8). Although grizzly bears can use agricultural lands (Northup et al. 2012), the existing agricultural landscape and settlement lands have reduced spring feeding habitat suitability for grizzly bears in the LAA.

High and moderate suitability spring feeding habitat occurs in wetlands and shrubland habitats that support preferred forage plants including sedges, grasses, and horsetails (Figure 11-8). High and moderate suitability spring feeding habitat also occurs in forested riparian areas along the Elbow River, which also provides preferred spring or early summer foraging plants such as horsetail and cow parsnip (Figure 11-8). Habitats that occur along and adjacent to the Elbow River might also provide opportunistic feeding opportunities for elk calves or winter-killed ungulates. Areas of high and moderate suitability spring feeding habitat in the LAA coincide with areas suggested by EBA (2010) likely to be east-west movement corridors for grizzly bears, which includes the areas south of the Trans-Canada Highway and along the Elbow River (EBA 2010).

During the late summer (berry season), there is very little grizzly bear feeding habitat available in the LAA. Almost all (98.9%) of the LAA consists of low and very low to nil suitability summer feeding habitat for grizzly bear with the remainder represented by 54.0 ha (1.1%) of moderate suitability habitat (Table 11-8). Similar to spring, the existing agricultural and settlement lands have reduced summer feeding habitat suitability for grizzly bears in the LAA. Moderate suitability summer feeding habitat is limited to patches of conifer and mixedwood open forests along the Elbow River, which provide berry-producing shrubs, including buffaloberry, saskatoon and bearberry (Figure 11-9). Higher suitability grizzly bear habitat occurs in the RAA further to the west (Collister and Kansas 1997; Jorgenson 2016; Stoney Consultation Team 2016), including upstream of the Elbow River where a grizzly bear Core Recovery Zone has been identified (AEP 2016a).

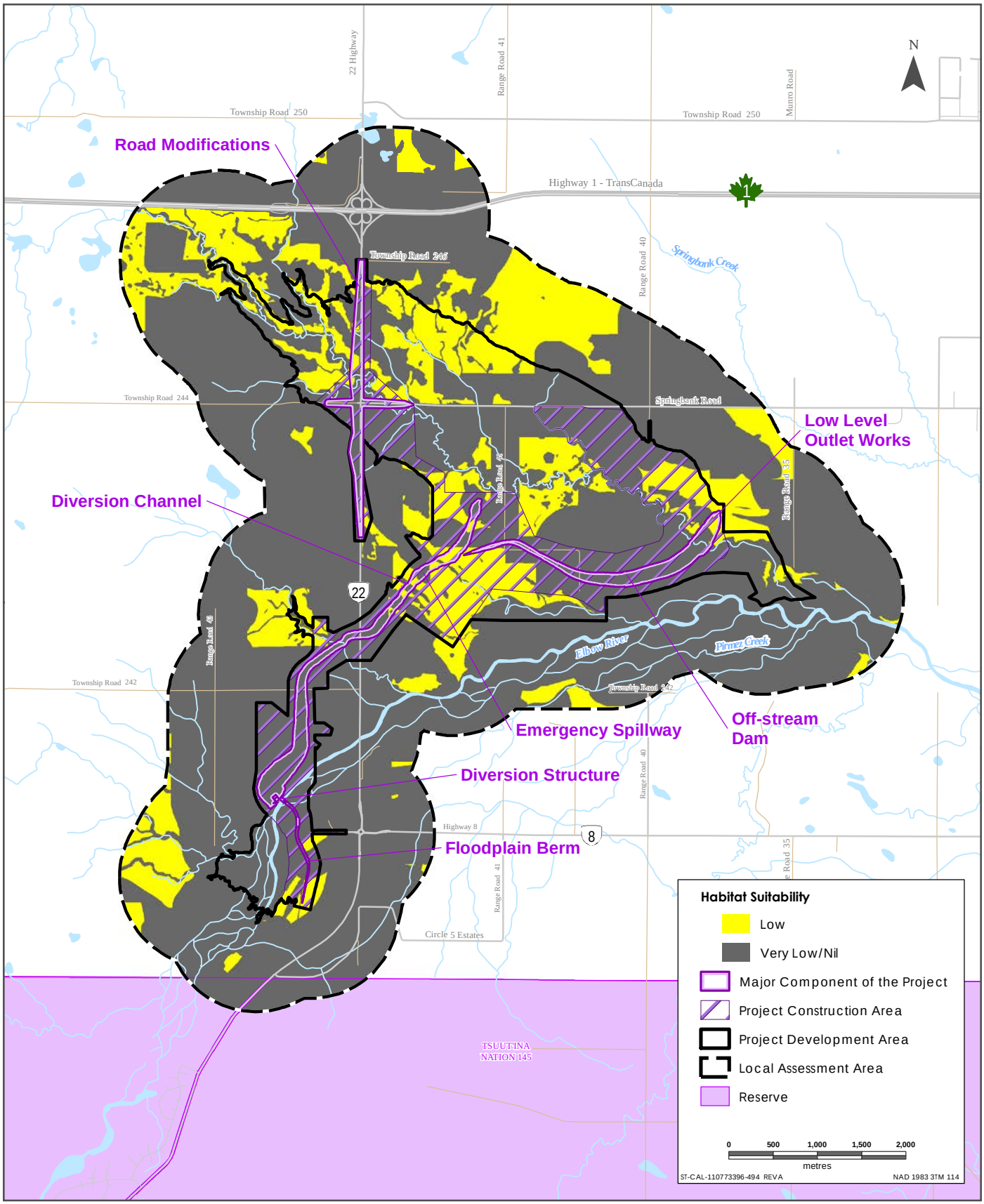
Table 11-8 Wildlife Habitat Abundance for Key Indicators in the LAA

Key Indicators	Habitat Suitability Rating	Area (ha)	Percent of Total LAA
Olive-sided flycatcher	High	5.7	0.1
	Moderate	164.8	3.4
	Low	272.1	5.6
	Very low to nil	4,417.3	90.9
Sprague's pipit	High	0.0	0.0
	Moderate	0.0	0.0
	Low	880.4	18.1
	Very low to nil	3979.5	81.9
Northern leopard frog	High	54.9	1.1
	Moderate	94.0	1.9
	Low	241.1	5.0
	Very low to nil	4,469.8	92.0
Elk - winter	High	223.0	4.6
	Moderate	1,016.7	20.9
	Low	451.7	9.3
	Very low to nil	3,168.6	65.2
Elk - summer	High	275.0	5.7
	Moderate	813.6	16.7
	Low	663.8	13.7
	Very low to nil	3,107.6	63.9
Grizzly bear – spring/early summer (pre-berry season)	High	228.9	4.7
	Moderate	240.4	4.9
	Low	854.9	17.6
	Very low to nil	3535.7	72.8
Grizzly bear – late summer/fall (berry season)	High	0.0	0.0
	Moderate	54.0	1.1
	Low	243.4	5.0
	Very low to nil	4,562.6	93.9



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

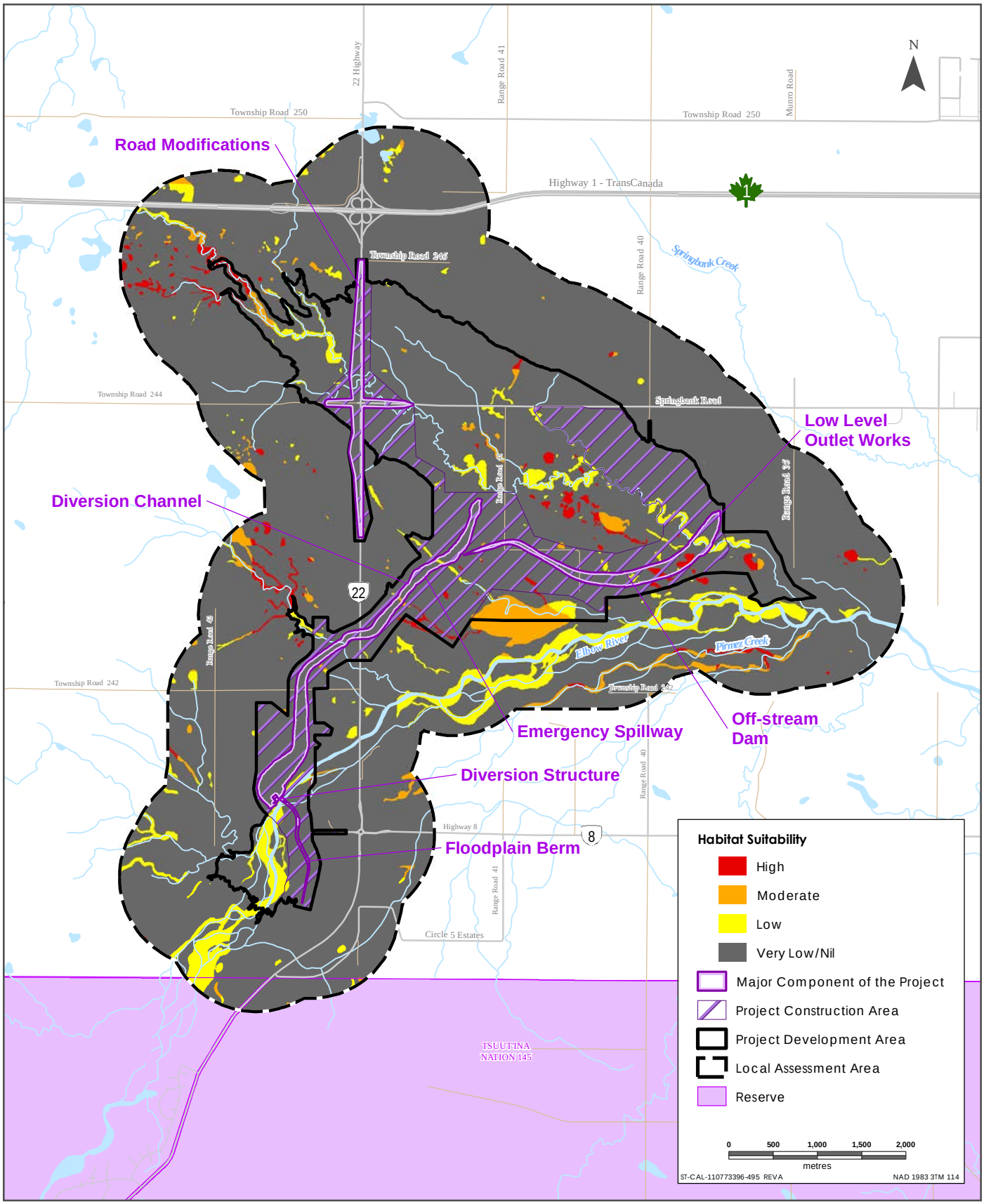
Olive-sided Flycatcher Habitat Suitability in the LAA – Existing Conditions



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

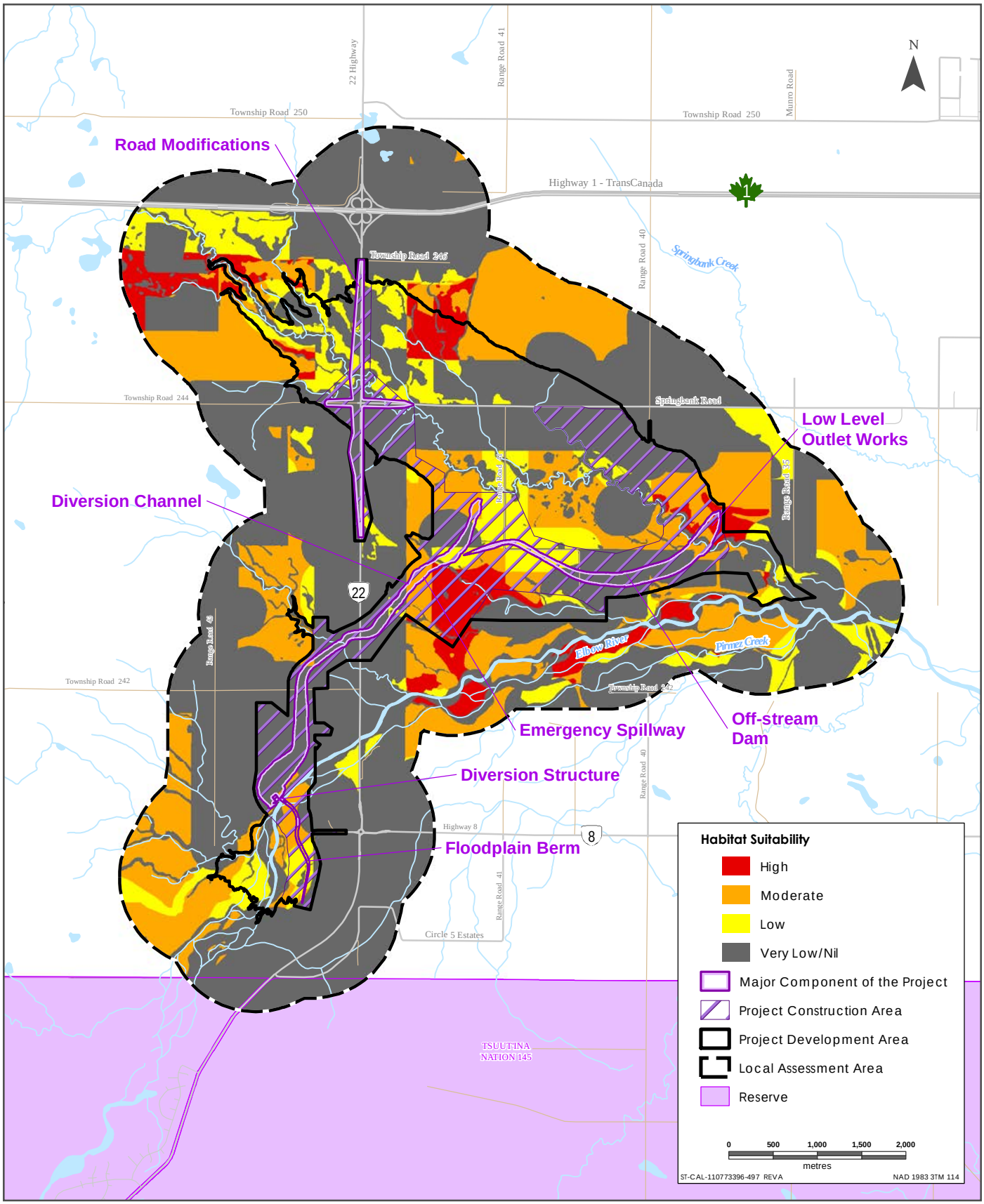
Sprague's Pipit Habitat Suitability in the LAA – Existing Conditions

Stantec



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

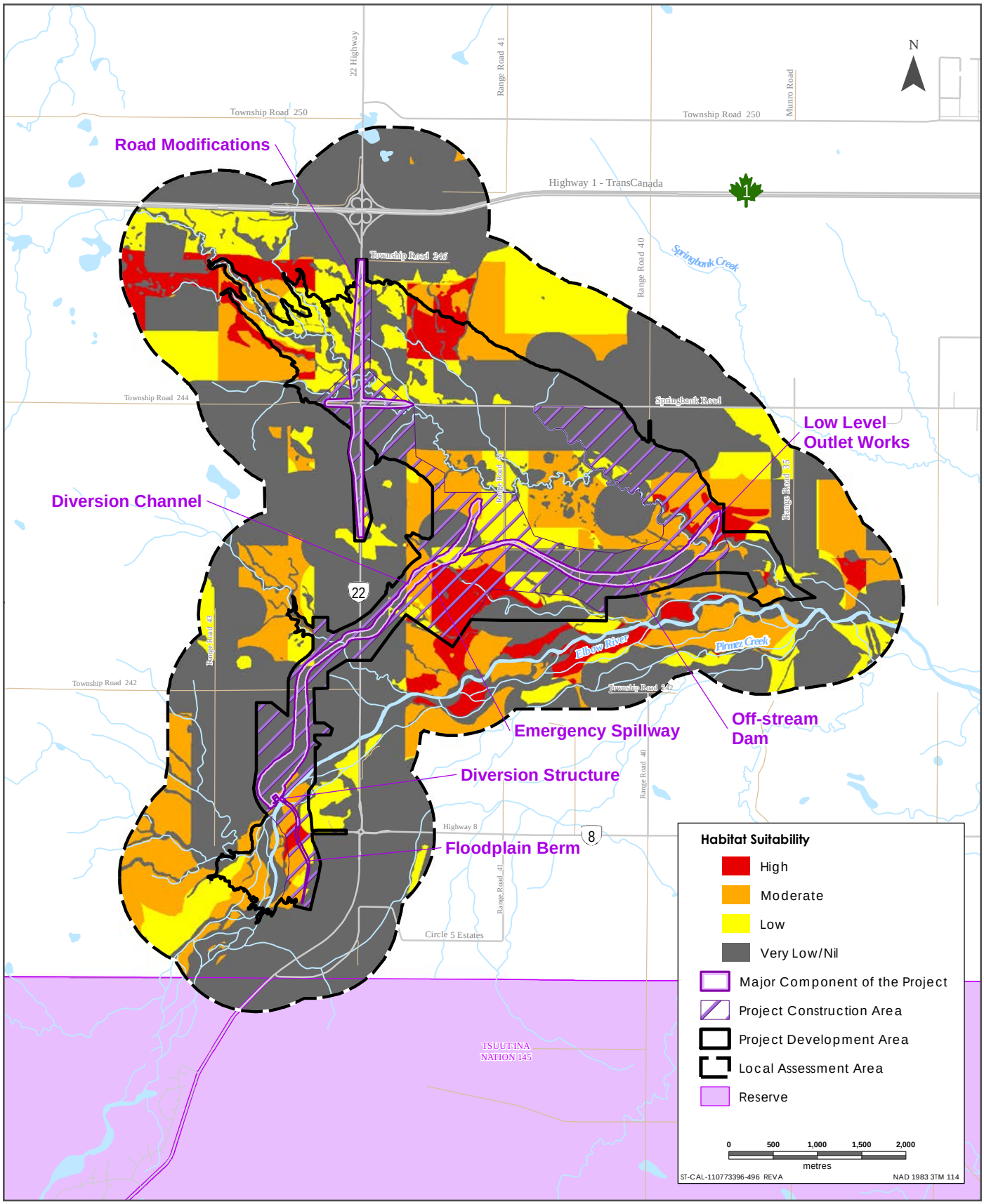
Northern Leopard Frog Habitat Suitability in the LAA – Existing Conditions



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

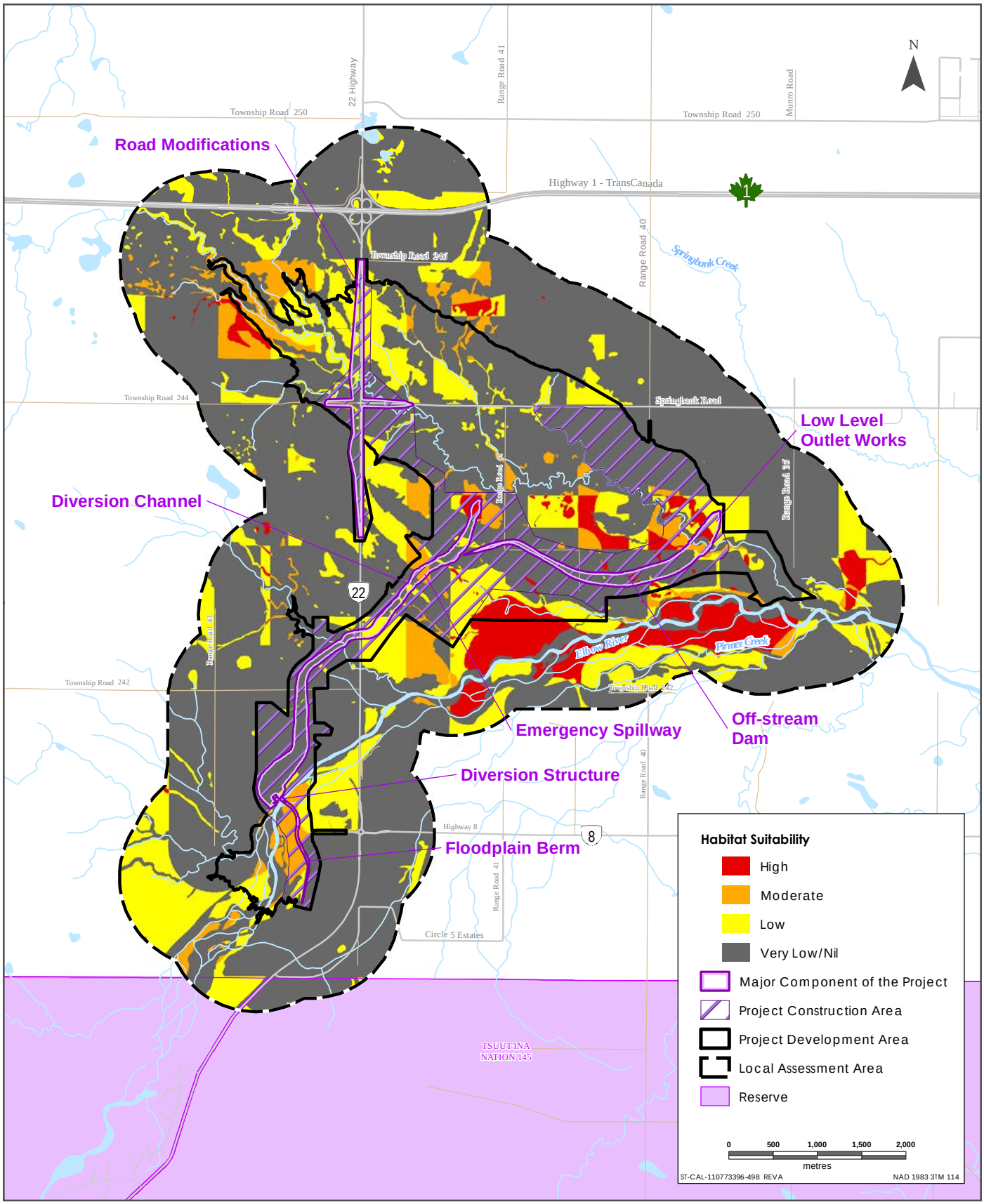
Elk Winter Feeding Habitat Suitability in the LAA – Existing Conditions

Stantec



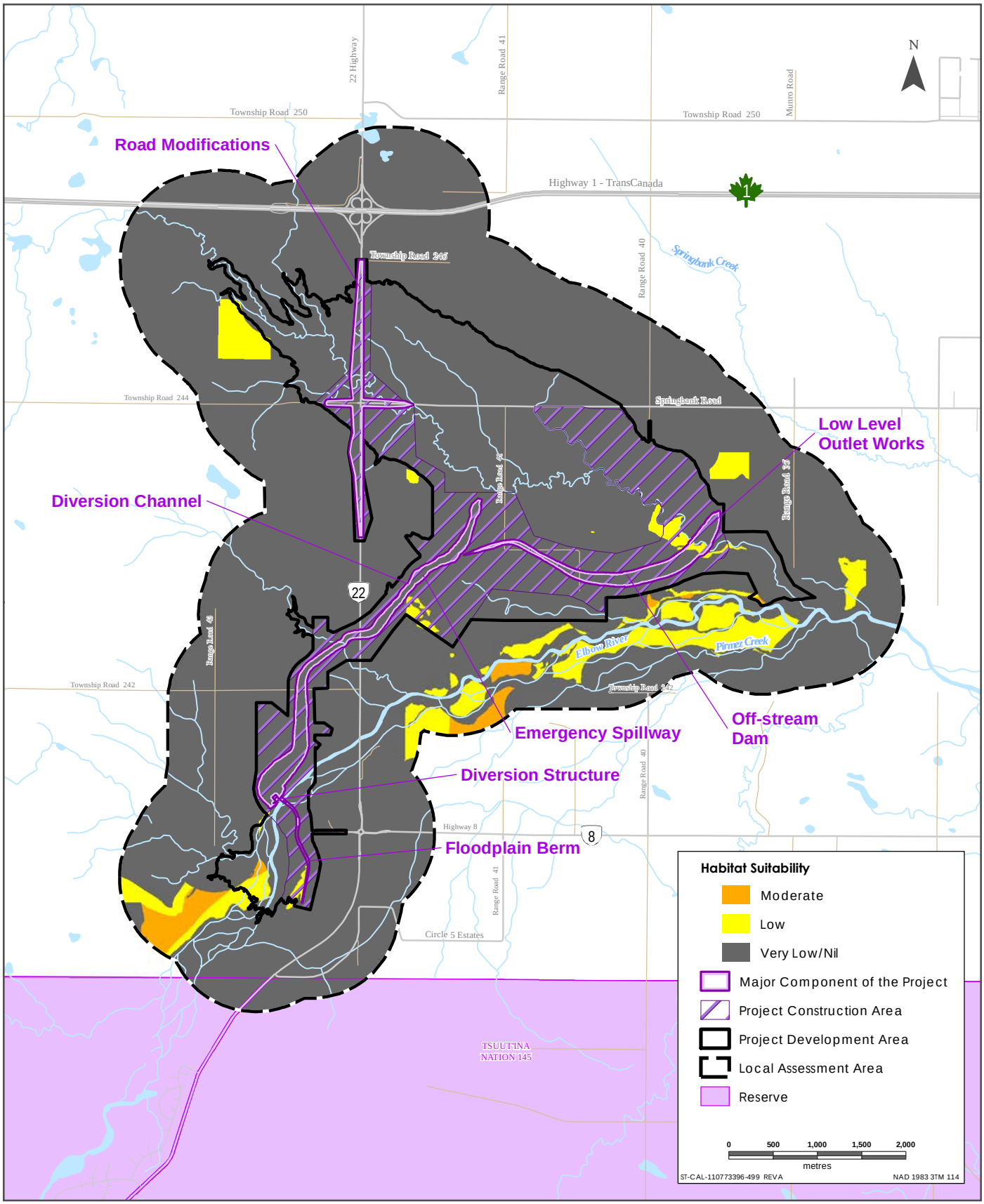
Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Elk Summer Feeding Habitat Suitability in the LAA – Existing Conditions



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Grizzly Bear Spring Feeding Habitat Suitability in the LAA – Existing Conditions



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Grizzly Bear Summer Feeding Habitat Suitability in the LAA – Existing Conditions

Stantec

11.2.2.5 Wildlife Observations

Wildlife species, including SOMC observed in the LAA during field surveys, are described in Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report; following is a summary.

The FWMIS database contained historical observations of 14 SOMC in the RAA. During the breeding bird survey, 79 bird species were recorded, including incidentals. Eight of those species are SOMC: olive-sided flycatcher, western wood-pewee, alder flycatcher, least flycatcher, eastern kingbird, bank swallow, Cape May warbler, and Baltimore oriole. Barn swallow, another songbird SOMC, was observed incidentally during the winter track survey. A total of 632 territories of 52 species of songbird and woodpeckers were analysed. Mixed forest habitat contained the highest species richness, followed by shrubland and broadleaf forest habitat. Similarly, breeding bird density overall was highest in mixed forest and broadleaf forest. Clay-colored sparrow (*Spizella pallida*), house wren (*Troglodytes aedon*) and savannah sparrow (*Passerculus sandwichensis*) had the highest densities in the LAA.

During amphibian surveys (nocturnal and visual), an estimated 52 boreal chorus frogs and 26 wood frogs were detected. No amphibian SOMC were observed. Ten sora (*Porzana carolina*) were observed within the LAA during systematic broadcast surveys and seven were observed incidentally. No yellow rail or Virginia rail were detected.

Several raptor stick and platform nests were observed in the LAA, including an active bald eagle stick nest along the Elbow River. This nest occurs in the construction area near the off-stream dam and low-level outlet. Most of the active stick nests observed were occupied by red-tailed hawks. Several waterbird species were also observed, two of which are SOMC: great blue heron (*Ardea herodias*) and sora. In total, 16 waterbird species were observed in the LAA, with mallard (*Anas platyrhynchos*) as the most observed species.

Nine medium to large mammal species were recorded during the remote camera survey. White-tailed deer (*Odocoileus virginianus*) were the most commonly detected species (n=2,433), followed by elk (*Cervus canadensis*) (n=796). Winter tracking surveys conducted during 2015 and 2017 showed similar results where deer were encountered most frequently, followed by coyote and elk. Overall, wildlife track counts were relatively higher along the Elbow River compared to other areas surveyed in the LAA. Grizzly bear and cougar were also detected along the Elbow River during the remote camera survey.

Three of five key indicators were detected during field surveys: olive-sided flycatcher, elk, and grizzly bear. Sprague's pipit and northern leopard frog were not detected during field surveys.

Piikani Nation members also conducted a site visit of the proposed Project area as part of the Project-specific Indigenous Engagement program, and identified wildlife, including a bald eagle, golden eagle, and a young moose. White-tailed deer, mule deer, and elk tracks were observed in the Project area, in addition to beaver habitat. Evidence of grizzly bear foraging for roots was identified by Piikani Nation members within the PDA. Observations of grizzly bears within the PDA have also been made by landowners.

Government biologists confirmed radio-collared grizzly bears have been observed in the LAA and RAA, including the Elbow River and surrounding habitat (Stenhouse 2016 pers. comm.; Paszkowski 2016 pers. comm.). Most observations show grizzly bears using areas west of the LAA such as near Bragg Creek, Jumping Pound, and Sibbald Creek Trail (Jorgenson 2016; Stenhouse 2016 pers. comm). One male grizzly bear was documented over a two-month period travelling eastwards from the Livingstone BMA (BMA 5) into the foothills, including the areas around Okotoks and Millarville before returning to the mountains (Paczkowski 2016 pers. comm.). This animal did not move through the PDA, but passed approximately 2 km south of the proposed diversion structure.

11.2.2.6 Biodiversity

Existing landscape diversity and community (habitat) diversity in the RAA is described in Sections 10.2.2.1and 10.2.2.2, and 10.2.2.3 (Vegetation and Wetland). Existing habitat connectivity (fragmentation) is described in Section 10.4.2. Wildlife habitat abundance is described in Section 11.2.2.4.

11.3 PROJECT INTERACTIONS WITH WILDLIFE AND BIODIVERSITY

Table 11-9 identifies project components and physical activities that might interact with wildlife and biodiversity during construction and dry operations. Interactions are identified by check marks and are discussed in detail in Section 11.4 in the context of effects pathways, standard and project-specific mitigation and residual effects.

Table 11-9 Project-Environment Interactions with Wildlife and Biodiversity during Construction and Dry Operations

Project Components and Physical Activities	Environmental Effects			
	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Biodiversity
Construction				
Clearing	✓	✓	✓	✓
Channel excavation	✓	✓	✓	✓
Water diversion construction	✓	✓	✓	✓
Dam and berm construction	✓	✓	✓	✓
Low-level outlet works construction	✓	✓	✓	✓
Road construction	✓	✓	✓	✓
Bridge construction	✓	✓	✓	✓
Lay down areas	✓	✓	✓	✓
Borrow extraction	✓	✓	✓	✓
Reclamation	✓	✓	✓	✓
Dry Operations				
Maintenance	✓	✓	✓	✓
NOTES: ✓ = Potential interaction – = No interaction				

11.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON WILDLIFE AND BIODIVERSITY

11.4.1 Analytical Assessment Techniques

11.4.1.1 Wildlife

Habitat suitability models are used to assess direct and indirect changes in habitat for five key wildlife indicators. Specifically, land units in the LAA are rated for their ability to provide life requisites (e.g., food, cover, and nesting habitat) for each key indicator species. Key biophysical or spatial variables that influence habitat selection are identified and measured based on scientific literature, biophysical and spatial information as well as professional knowledge of each species.

Change in habitat for key indicator species is presented and discussed in terms of changes to areas (ha) of high, moderate, low, and very low to nil suitability habitat. For the purposes of determining the Project residual effects for key indicators, high and moderate suitability habitat are considered preferred habitat. Indirect loss caused by sensory disturbance is represented using species- and disturbance-specific ZOI. For each key indicator species, a description of model development, assumptions, and ZOI for existing disturbances are provided in Volume 4, Appendix H, Attachment 11A. For assessment purposes, the industrial development ZOI for each key indicator is applied to the construction area and permanent structures. Reclamation of the construction area is accounted for when assessing habitat suitability.

Effect on change in movement and change in mortality risk are assessed qualitatively, based on peer-reviewed and technical literature, professional judgement, and project experience.

11.4.1.2 Biodiversity

Biodiversity is assessed using the indicators identified in Table 11-2. The assessment of effects is based on the removal and disturbance of habitat (i.e., habitat loss) and the fragmentation of habitat [i.e., habitat patch analysis; see Section 10 (vegetation and wetlands assessment)], and effects on bird and amphibian species richness, relative abundance, and associated habitat (see Volume 4, Appendix H).

11.4.2 Change in Habitat

11.4.2.1 Project Pathways

Through the Project-specific Indigenous Engagement program, Tsuut'ina Nation and Ermineskin Cree Nation expressed concern for changes in wildlife habitat as a result of the Project, including a loss, reduction, or alteration of ungulate, bear, and migratory bird habitat, and loss or alteration of wetland habitat as a result of construction of the diversion channel and off-stream dam. Samson Cree Nation also expressed concern regarding a loss, reduction or alteration of suitable wildlife habitat with specific concerns regarding sensitive grizzly bear habitat (MLT 2011; Riversdale 2015).

During construction, vegetation removal has potential to result in direct habitat loss, reduction, or alteration, which can cause displacement of wildlife into other, less suitable habitat. Construction activities also have potential to result in indirect effects due to sensory disturbance (e.g., noise and artificial light), which can reduce habitat effectiveness in the LAA. Samson Cree Nation noted concern regarding sensory disturbance to wildlife populations (MLT 2011). The potential for sensory disturbance would occur primarily during the construction phase when increased noise levels associated with heavy machinery, potential blasting events (i.e., diversion channel excavation), and increased levels of human activity occur in the LAA.

The effects of sensory disturbance on wildlife during construction would vary with disturbance type (e.g., blasting), wildlife species, as well as road type and traffic volume (Northrup et al. 2012; Buchanan et al. 2014; Prokopenko 2016). Elk and grizzly bear typically avoid habitat near high traffic volume roads, which results in reduced habitat effectiveness (Benn and Herrero 2002; Gibeau et al. 2002; Northrup et al. 2012; Buchanan et al. 2014; Prokopenko 2016). In certain cases, elk (Robinson et al. 2010; Rogala et al. 2011) and grizzly bears (Gibeau et al. 2002; Pruvot et al. 2014) can habituate to or tolerate human activity where preferred forage overlaps into disturbed areas.

Many songbird species rely on vocalizations to attract mates and defend territories, and it is therefore reasonable to assume that noise disturbance can affect otherwise suitable breeding habitat (Brumm 2004; Habib et al. 2007; Sutter et al. 2016). Amphibians, such as northern leopard frog, also vocalize to attract mates, and anthropogenic noise has been shown to alter call rates in males (Sun and Narins 2005; Cunnington and Fahrig 2010).

Potential sensory disturbance is expected to decrease during the dry operations phase when the levels and frequency of human disturbance would be reduced.

11.4.2.2 Mitigation

Construction activities including vegetation removal and ground disturbance have the potential to affect habitat directly and indirectly for SOMC and key indicators in the LAA including migratory birds and species at risk. Mitigation measures to reduce potential effects on wildlife habitat for SOMC are described below:

- Where possible, temporary workspaces and access roads will be in areas that avoid wildlife features and native vegetation (e.g., shrubland, treed areas, wetlands). Existing access roads and previously disturbed areas will be used, where feasible.
- Pre-construction surveys will be conducted to identify wildlife features (e.g., nests, dens) and appropriate site-specific mitigation developed.
- Vegetation removal will be avoided during the Restricted Activity Period (RAP) for nesting migratory birds and raptors. RAPs are primarily based on Environment and Climate Change Canada (ECCC) guidance to avoid risk of incidental take of migratory birds (ECCC 2016). ECCC direction to protect bird nests in the foothills parkland and prairie ecozone of Alberta, with consideration of migratory bird species at risk, is from April 15 to August 31 (Gregoire 2014 pers. comm.). The recommended RAP to avoid destruction and disturbance to raptor nests is from February 15 to August 15 (SRD 2011, ESRD 2013, Government of Alberta 2017b). Therefore, the combined RAP dates to avoid is from February 15 to August 31.
- If vegetation removal is scheduled to occur within the RAP for migratory birds and raptors, a qualified wildlife biologist would inspect the site for active nests within seven days of the start of the proposed construction activity (e.g., vegetation removal, blasting).

- If an active nest or den is found, it will be subject to a provincial or federal disturbance setback buffer and site-specific mitigation. Table 11-10 and Table 11-11 provide setback distances for SOMC with potential to occur in the PDA.
- Where possible, construction activities during the RAP for the KWBZ identified along the Elbow River (December 15 to April 30) will be avoided or reduced. This would limit potential sensory disturbance to wintering ungulates (ESRD 2015a, Government of Alberta 2017b). If construction activities must occur during this time period, a wildlife mitigation and monitoring plan will be developed in consultation with regulators, which would include monitoring ungulate habitat use and response to human disturbance.
- Where possible, lights will be focused internally to the work site to reduce potential sensory disturbance to wildlife in the surrounding habitat.
- Temporary work spaces will be reclaimed using native species that are compatible with pre-construction site conditions, as outlined in the reclamation plan.

Table 11-10 Recommended Restricted Activity Timing and Distance Setbacks for Wildlife SOMC

Species [a]	Wildlife Key Areas	Restricted Activity Dates	Level of Disturbance		
			Low [b]	Medium [c]	High [d]
Birds					
Sharp-tailed grouse	Lek	Mar. 15 – June 15	500 m	500 m	500 m
		June 16 – Mar. 14	100 m	100 m	500 m
Golden eagle Bald eagle Prairie falcon Peregrine falcon	Nesting sites	Mar. 15 – July 15	1,000 m	1,000 m	1,000 m
		July 16 – Mar. 14	50 m	100 m	1,000 m
Osprey	Nesting sites	Apr. 1 – Aug. 31	300 m	500 m	750 m
		Sept. 1 – Mar. 31	-	200 m	750 m
Northern goshawk	Nesting sites	Mar. 15 – Aug. 31	200 m	500 m	500 m
		Sept. 1 – Mar. 14	-	-	500 m
Barred owl	Nesting sites	Mar. 1 – Aug. 15	100 m	400 m	500 m
		Aug. 16 – Feb. 28/29	-	-	500 m
American white pelican Great blue heron	Nesting colony	Apr. 1 – Aug. 31	1000 m	1000 m	1000 m
		Sept. 1 – Mar. 31	100 m	100 m	1,000 m

Table 11-10 Recommended Restricted Activity Timing and Distance Setbacks for Wildlife SOMC

Species [a]	Wildlife Key Areas	Restricted Activity Dates	Level of Disturbance		
			Low [b]	Medium [c]	High [d]
Upland sandpiper Long-billed curlew Short-eared owl Sprague's pipit	Active nest and surrounding habitat	Apr. 1 – July15	100 m	100 m	100 m
Pied-billed grebe	Nesting site	Apr. 15 – July 15	100 m	500 m	500 m
Horned grebe	Nesting site	Apr. 15 – July 15	200 m	500 m	500 m
Western grebe	Nesting site	Apr. 1 – July 31	500 m	1000 m	1,000 m
		Aug. 1 – Mar. 31	-	200 m	1,000 m
Forster's tern	Nesting site	May 1 – July 31	100 m	200 m	200 m
		August 1 – April 30	-	100 m	200 m
Black tern	Nesting site	May 1 – July 31	200 m	300 m	1,000 m
		August 1 – April 30	-	200 m	1,000 m
Pileated woodpecker	Nesting site	Apr. 1 – July 15	-	100 m	100 m
		July 16 – Mar. 31	-	-	100 m
Mammals					
Grizzly bear	Den	Oct. 1 – Apr. 30	200 m	500 m	750 m
Herptiles					
Northern leopard frog Western toad	Ponds used for living, breeding or hibernating	Year-round	100 m	100 m	100 m
Wandering (terrestrial) garter snake Red-sided garter snake	Hibernacula	Year-round	200 m	200 m	500 m

NOTES:

[a] Species are classified by their status in Alberta. See Volume 4, Wildlife and Biodiversity Technical Data Report for detailed status. Setback distances apply to all known wildlife key areas/sites.

[b] Activities which do not include vegetation clearing and are short-term and infrequent, e.g., surveying, monitoring

[c] Activities that are high in frequency involving vehicles and alter some habitat, e.g., seismic drilling

[d] Activities that are high in frequency involving vehicles and permanently alter habitat through vegetation clearing, soil disturbance, or changes to hydrology, e.g., buildings, roads

SOURCES: SRD (2011); Government of Alberta (2017b)

Table 11-11 Environment Canada Recommended Activity Timing and Distance Setbacks for Wildlife SOMC in the Prairie and Parkland Region

Species	Wildlife Key Areas	Restricted Activity Dates	Level of Disturbance		
			Low [c]	Medium [d]	High [e]
Birds					
Horned grebe [b,f]	Nest	Apr. 1 – Aug. 31	100 m	100 m	100 m
Peregrine falcon [a]	Nest	Apr. 1 – Aug. 15	300 m	500 m	1,000 m
Yellow rail [a]	Nest	May 1 – July 15	100 m	150 m	350 m
Long-billed curlew [a]	Nest	Apr. 15 – July 15	100 m	200 m	200 m
Short-eared owl [a]	Nest	Apr. 1 – July 31	100 m	200 m	200 m
Common nighthawk [b]	Nest	May 1 – Aug. 31	50 m	100 m	200 m
Olive-sided flycatcher [b]	Nest	May 1 – Aug. 31	50 m	150 m	300 m
Loggerhead shrike [a]	Nest	May 1 – Aug. 15	100 m	250 m	400 m
Barn swallow [b]	Nest	May 1 – Aug. 31	100 m	100 m	100 m
Sprague's pipit [a]	Nest	May 1 – Aug. 31	50 m	200 m	350 m
Chestnut-collared longspur [b]	Nest	May 1 – Aug. 31	200 m	200 m	200 m
McCown's longspur [a]	Nest	May 1 – July 31	25 m	100 m	200 m
Bobolink [b]	Nest	May 1 – Aug. 31	200 m	200 m	200 m
Rusty blackbird [b]	Nest	May 1 – July 31	50 m	150 m	300 m
Herptiles					
Northern leopard frog [a]	Breeding pond, wintering site	Year-round	50 m	200 m	400 m
Western toad [a]	Breeding pond, wintering site	Year-round	50 m	200 m	400 m

NOTES:

[a] Time and distance setbacks from Environment Canada (2009)

[b] Time and distance setbacks from Gregoire, P. (Personal Communication 2014)

[c] Low activity – surveying; drive by; trails, low use and less than one pass per week; Flowline 2" or less, plowed in

[d] Medium activity – pipeline 10" or less, plowed in; pipeline 6 inches or less and trenched; seismic low footprint; trails, less than 50 km/hr and all season and one or more passes per day.

[e] High activity – permanent structures (e.g., roads, buildings, compressor stations, oil batteries, straddle plants, power lines, pig station, riser stations); pipeline 8 inches or greater and trenched

[f] Distance from the high-water mark of the wetland or waterbody containing the nest

11.4.2.3 Project Residual Effects

A summary of changes in wildlife habitat in the LAA is provided in Table 11-12. Table 11-13 summarizes the change (ha) in habitat for key indicators for the construction and dry operations relative to the existing conditions. The habitat suitability models are used to assess both direct loss of habitat within the 4,860 ha LAA and indirect habitat loss from sensory disturbance. Changes in patch metrics are provided in Section 10.4.2 (vegetation and wetlands assessment).

Construction Phase

Within the Project construction area (734 ha), 34% is annual crop, dugouts, hayland, and disturbed lands (Table 11-12), which provide relatively low or very low to nil habitat suitability for wildlife. Remaining habitat types most directly affected include shrubland (up to 85.3 ha) and grassland (up to 89.7 ha). Smaller amounts of wetland (up to 29.5 ha) and mixed forest (up to 34.8 ha) would be affected by construction (Table 11-12). Construction activities would decrease the abundance of habitat in the LAA for SOMC and key indicators dependent on shrubland and grassland (e.g., elk, eastern kingbird), as well as SOMC dependent on wetlands (e.g., waterfowl, sora, amphibians) and mixed forest (e.g., barred owl, least flycatcher) (Volume 4, Wildlife and Biodiversity Technical Data Report).

The Project construction area consists of 168 ha of permanent structures with the remaining area represented by temporary workspace (566 ha). Although there is some uncertainty regarding how much temporary workspace would be used during construction, all habitat would be directly affected due to vegetation removal and grading associated with construction. Therefore, the amount of direct habitat loss in the Project construction area is a conservative estimate. All temporary workspaces would be reclaimed following construction, which would result in a temporary disturbance for species dependent on grassland habitats.

Foothills Ojibway First Nation stated that important wildlife habitat features such as bear dens, squirrel trees, bird habitat, mineral and salt licks, and calving areas need to be identified and protected (Lifeways 2012). Site specific mitigation for wildlife habitat features identified during pre-construction surveys would reduce the residual effects of the Project.

Overall, change in habitat varies by habitat type and species during construction. Project residual effects are considered moderate in magnitude because a measurable change in the abundance and distribution of wildlife in the LAA is possible, but a measurable change in the abundance of wildlife in the RAA is unlikely. The duration would be short-term for species dependent on early seral vegetation communities (e.g., herbaceous, grassland) that would be available following reclamation. However, the duration of residual effects would be long-term for other species dependent on mature forest, such as the olive-sided flycatcher, where formerly forested areas would likely remain non-forested for the life of the Project or take decades to regrow. Timing for construction is considered seasonal and regulatory because construction

would have greater potential to affect some SOMC at different times than others, but also might occur during a restricted activity period.

Dry Operations Phase

The amount of land cover affected would be reduced for species dependent on grasses and herbaceous vegetation following construction because these areas would be reclaimed. Overall, upland cover types in the LAA would be reduced by up to13.8% during construction compared to existing conditions, but with reclamation increase during dry operations resulting in a 2.6% reduction in upland cover types. Similarly, the change in wetland abundance would be reduced by 9.5% during construction, compared to the existing conditions, and by 4.9% during dry operations, compared to the existing conditions (Table 11-12). Crop and hayland in the PDA would be left fallow following construction as land users will not be permitted in the area. Crop and hayland are expected to convert to tame pasture over time (Table 11-12), which provides relatively more suitable wildlife habitat for grassland dependent species such as elk and grassland songbirds with general habitat requirements (e.g., vesper sparrow, savannah sparrow).

Overall, the change in habitat would be moderate in magnitude during dry operations because a measurable change in the abundance and distribution of wildlife in the LAA is possible, but a measurable change in the abundance of wildlife in the RAA is unlikely. The duration would be long-term because the residual effect is expected to last for the life of Project; however, the frequency of indirect effects (i.e., sensory disturbance) would be limited to irregular events during maintenance activities. Timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Table 11-12 Change in Vegetation and Wetland Cover Type Abundance in the LAA

Cover Type	Land Unit [a,b]	Area of Vegetation and Wetland Cover Types in the LAA (ha)			Change from Existing Condition			
					Construction		Dry Operations	
		Existing Condition	Construction	Dry Operations	ha	%	ha	%
Broadleaf Forest	b2 Hairy wild rye Aw	0.2	0.2	0.2	0.0	0.0	0.0	0.0
	d1 Pine grass Aw	21.3	21.3	21.3	0.0	0.0	0.0	0.0
	e1 Snowberry-silverberry Aw-Pb	89.8	88.6	88.6	-1.2	-1.3	-1.2	-1.3
	f2 Red osier dogwood Pb-Aw	67.1	65.3	65.3	-1.8	-2.6	-1.8	-2.6
	g2 Horsetail Aw-Pb	73.4	73.4	73.4	0.0	0.0	0.0	0.0
Coniferous Forest	b4 Hairy wild rye Sw	59.1	59.1	59.1	0.0	0.0	0.0	0.0
	d3 Pine grass-Sw	6.8	6.8	6.8	0.0	0.0	0.0	0.0
	g1 Horsetail Sw	179.3	168.3	168.3	-11.0	-6.1	-11.0	-6.1
Mixed Forest	b3 Hairy wild rye Aw-Sw-Pl	109.9	101.0	101.0	-8.9	-8.1	-8.9	-8.1
	d2 Pine grass-Sw-Pl-Aw	2.5	2.5	2.5	0.0	-0.8	0.0	-0.8
	e2 Snowberry-silverberry Sw	81.9	79.0	79.0	-2.8	-3.5	-2.8	-3.5
	e4 Snowberry-silverberry Sw-Aw	16.1	9.6	9.6	-6.5	-40.3	-6.5	-40.3
	f1 Red osier dogwood Sw	85.7	69.1	69.1	-16.6	-19.4	-16.6	-19.4

Table 11-12 Change in Vegetation and Wetland Cover Type Abundance in the LAA

Cover Type	Land Unit [a,b]	Area of Vegetation and Wetland Cover Types in the LAA (ha)			Change from Existing Condition			
					Construction		Dry Operations	
		Existing Condition	Construction	Dry Operations	ha	%	ha	%
Shrubland	e3 Shrubland - mesic/rich	99.0	80.4	81.9	-18.6	-18.8	-17.0	-17.2
	f3 Shrubland - subhygric/rich	309.5	242.8	243.1	-66.7	-21.6	-66.4	-21.5
Native Grassland	b5 Grassland - submesic/medium	37.9	23.0	41.9	-14.9	-39.3	4.0	10.6
	c1 Rough fescue	381.8	306.9	372.9 [d]	-74.8	-19.6	-8.9	-2.3
	d0 Grassland - mesic/medium [c]	0.0	0.0	<0.1	0.0	0.0	<0.1	-
	e0 Grassland - mesic/medium [c]	0.0	0.0	21.8	0.0	0.0	21.8	-
	f4 Grassland - subhygric/rich	5.4	5.4	70.3	0.0	0.0	64.9	1,197.0
	g0 Grassland - hygric/rich [c]	0.0	0.0	9.4	0.0	0.0	9.4	-
Upland Subtotal		***1,626.7***	***1,402.6***	***1,584.8***	***-223.9***	***-13.8***	***-41.7***	***-2.6***
Open Water	Open Water	283.5	253.0	279.9	-30.6	-10.8	-3.6	-1.3
Open Water Subtotal		***283.5***	***253.0***	***279.9***	***-30.6***	***-10.8***	***-3.6***	***-1.3***
Ephemeral Waterbody	Ephemeral Waterbody	5.0	4.7	4.9	-0.3	-6.3	0.0	-1.0
Graminoid Marsh	Temporary graminoid marsh	92.9	82.4	87.4	-10.5	-11.4	-5.5	-5.9
	Seasonal graminoid marsh	102.7	93.8	98.1 [e]	-8.8	-8.6	-4.5	-4.4
	Semi-permanent graminoid marsh	34.7	26.0	30.4	-8.7	-25.1	-4.3	-12.5

Table 11-12 Change in Vegetation and Wetland Cover Type Abundance in the LAA

Cover Type	Land Unit [a,b]	Area of Vegetation and Wetland Cover Types in the LAA (ha)			Change from Existing Condition			
					Construction		Dry Operations	
		Existing Condition	Construction	Dry Operations	ha	%	ha	%
Shallow Open Water	Shallow open water with submersed and/or floating aquatic vegetation	7.2	7.2	7.2	0.0	0.0	0.0	0.0
	Saline shallow open water with submersed and/or floating aquatic vegetation	0.9	0.9	0.9	0.0	0.0	0.0	0.0
Shrubby Swamp	Seasonal shrubby swamp	5.3	5.0	5.0	-0.3	-5.4	-0.3	-5.4
Wooded Mixedwood Swamp	Seasonal wooded mixedwood swamp	20.3	20.3	20.3	0.0	0.0	0.0	0.0
Shrubby Fen	Moderate-rich shrubby fen	42.6	41.8	41.8	-0.8	-1.8	-0.8	-1.8
Graminoid Fen	Moderate-rich graminoid fen	0.0	0.0	0.1 [f]	0.0	0.0	0.1	-
Wetland Subtotal		***311.6***	***282.1***	***296.3***	***-29.5***	***-9.5***	***-15.3***	***-4.9***
Agricultural	Annual crop	547.2	422.3	408.6	-124.8	-22.8	-138.5	-25.3
	Dugout	2.0	1.9	1.9	-0.1	-3.5	-0.1	-3.5
	Hayland	469.5	393.8	386.6	-75.7	-16.1	-82.8	-17.6
	Tame pasture	1,325.2	1,126.2	1,488.1	-199.0	-15.0	162.9	12.3

Table 11-12 Change in Vegetation and Wetland Cover Type Abundance in the LAA

Cover Type	Land Unit [a,b]	Area of Vegetation and Wetland Cover Types in the LAA (ha)			Change from Existing Condition			
					Construction		Dry Operations	
		Existing Condition	Construction	Dry Operations	ha	%	ha	%
Disturbed Land	Disturbed land [g]	294.6	978.1	413.7	683.5	232.0	119.1	40.4
Anthropogenic Subtotal		***2,638.5***	***2,922.3***	***2,699.0***	***283.9***	***10.8***	***60.6***	***2.3***
Grand Total		**4,860**	**4,860**	**4,860**	**-**	**-**	**-**	**-**

NOTES:

Calculations completed on non-rounded numbers. Values presented in table have been rounded.

Aw – aspen (*Populus tremuloides*)

Pb – balsam poplar (*Populus balsamifera*)

Pl – lodgepole pine (*Pinus contorta*)

Sw – white spruce (*Picea glauca*)

[a] Upland land units (ecosites) were classified using Range Plant Communities and Range Health Assessment Guidelines for the Foothills Parkland Subregion of Alberta (ESRD 2012c).

[b] Wetland land units classified using the Alberta Wetland Classification System (ESRD 2015b).

[c] A zero ecosite phase indicates that the overstorey vegetation has been cleared, but ecosite moisture and nutrient regime remain unchanged.

[d] Assumes ecosites cleared of vegetation and reclaimed with native seed mix would reestablish to a modified grassland c (Submesic/rich) ecosite due to disturbance by the project during the construction phase.

[e] Assumes wetland tree and shrub layers would be removed through vegetation clearing and would become graminoid dominated marshes.

[f] Vegetation clearing of shrubs of shrubby fen is predicted to become graminoid dominated fen.

[g] Disturbed land includes industrial facilities, disturbed land, transportation and rural residential land unit types.

Olive-sided Flycatcher

During construction, the Project could result in the direct and indirect loss and alteration of 1.5 ha (26.2%) of high and 39.3 ha (23.8%) of moderate suitability olive-sided flycatcher habitat (Table 11-13). This is a conservative estimate because mitigation to reduce the construction footprint to already disturbed areas would reduce residual effects. Small amounts of high and moderate suitability habitat in the construction area would be reclaimed initially as grassland; however, any forested habitat that is cleared might take between 10 and 25 years to regrow. The amount of high and moderate suitability habitat lost during dry operations would be reduced by 10.1% and 18.5%, respectively, relative to existing conditions.

There would be potential displacement of olive-sided flycatcher during construction, however, there are remaining conifer and mixed forests available in the LAA (495 ha) and RAA (14,027 ha) that could provide breeding habitat (see Table 11-12). In addition, if construction activities occur during the breeding bird RAP, proposed mitigation (i.e., nest search and setback buffers) for SOMC are expected to reduce potential sensory disturbance.

Overall, the magnitude of the residual effect on olive-sided flycatcher breeding habitat is considered high because more than 10% of high and moderate habitat suitability in the LAA would be affected during both construction and dry operations. Although the construction period would be relatively short and portions of the construction area would be reclaimed, the loss of mature forest and potential nest trees is considered a long-term loss that would continue through the dry operations phase.

Sprague's Pipit

There is no high or moderate suitability Sprague's pipit habitat in the LAA; therefore, construction would only affect 30.7% of low suitability habitat (Table 11-13). Although reclamation of the construction area using native grasses would create more (by 4.2%) grassland habitat compared to existing conditions, the application of ZOIs and patch size requirements would not provide suitable (high and moderate combined) habitat during dry operations (Table 11-13).

The potential for displacement of Sprague's pipit during construction is limited because the LAA provides relatively low suitability habitat. Nonetheless, if construction activities occur during the breeding bird RAP, proposed mitigation (i.e., nest search and setback buffers) for SOMC are expected to reduce potential sensory disturbance.

Overall, the magnitude of the residual effect on Sprague's pipit breeding habitat is considered low because there is no high and moderate suitability habitat to be affected in the LAA during either construction or dry operations. The construction period would be relatively short and portions of the construction area would be reclaimed, which would reduce residual effects on grassland habitat abundance during dry operations.

Northern Leopard Frog

During construction, the Project would result in the direct and indirect loss and alteration of 22.3 ha (40.5%) of high and 23.0 ha (24.5%) of moderate suitability northern leopard frog breeding habitat (Table 11-13). However, a small amount of high and moderate suitability habitat in the construction area would be reclaimed, which would reduce the amount of wetland habitat loss by 9.7% for high suitability habitat and 0.3% of moderate suitability habitat, relative to existing conditions (Table 11-13). Overall, 3.8% of suitable (high and moderate combined) breeding habitat is affected during dry operations.

Overall, the magnitude of the residual effect on northern leopard frog breeding habitat is considered high during construction because more than 10% of high and moderate habitat suitability in the LAA would be affected; however, mitigation to avoid disturbance of wetlands would reduce residual effects during construction. The construction period would be relatively short. During dry operations, the magnitude would be moderate because between 1% and 10% of high and moderate habitat suitability in the LAA would be affected for the long-term.

Elk

During construction, the Project would result in the direct and indirect loss and alteration of 116.9 ha (52.4%) of high and 376.7 ha (37.1%) of moderate suitability elk winter feeding habitat (Table 11-13). However, because grassland habitat that occurs in the construction area would be reclaimed for dry operations, the amount of habitat affected would be 31.9% for high suitability winter habitat, and 23.5% for moderate suitability winter habitat, relative to existing conditions (see Table 11-13).

During construction, the Project would result in the direct and indirect loss and alteration of 127.7 ha (46.4%) of high and 358.8 ha (44.1%) of moderate suitability elk summer feeding habitat (Table 11-13). However, because grassland habitat that occurs in the construction area would be reclaimed for dry operations, the amount of habitat affected would be 27.9% for high suitability summer habitat, and 27.4% for moderate suitability summer habitat, relative to existing conditions (see Table 11-13).

Overall, the magnitude of the residual effect on elk feeding habitat (winter and summer) is considered high because more than 10% of high and moderate habitat suitability would be affected in the LAA during both construction and dry operations. However, the construction period would be relatively short and portions of the construction area would be reclaimed, which would reduce residual effects on feeding habitat at the dry operations phase. T

Grizzly Bear

During construction, the Project would result in the direct and indirect loss and alteration of 117.1 ha (51.1%) of high and 126.6 ha (52.7%) of moderate suitability spring feeding habitat (Table 11-13). However, because most of the spring feeding habitat would be reclaimed in the construction area for dry operations, the amount of high and moderate suitability habitat would be reduced by 16.2% and by 36.3%, respectively, compared to existing conditions (see Table 11-13).

The Project would result in the loss and alteration of a small amount of moderate suitability summer feeding habitat in both the construction (7.0%) and dry operations (5.6%) phase (Table 11-13). No high suitability summer feeding habitat exists within the LAA; therefore, the Project would not have an effect on this type of habitat.

Overall, the magnitude of the residual effect on spring grizzly bear feeding habitat is considered high because more than 10% of high and moderate habitat suitability in the LAA would be affected during both construction and dry operations. The residual effects on summer feeding habitat is considered moderate in magnitude because between 1% and10% of moderate habitat suitability in the LAA would be affected during both construction and dry operations (Table 11-13). Grizzly bears have large home ranges, so although the Project would reduce suitable spring and summer feeding habitat by more than 10% in the LAA, higher suitability grizzly bear habitat occurs west of the Project in the RAA. The construction period would be relatively short and portions of the construction area would be reclaimed, which would reduce residual effects on spring feeding habitat during dry operations.

Table 11-13 Change in Habitat for Key Indicators in the LAA

Key Indicators	Habitat Suitability Rating	Existing Conditions	Construction	Dry Operations	Change Existing Conditions to Construction		Change from Existing Conditions to Dry Operations	
		ha	ha	ha	ha	%	ha	%
Olive-sided flycatcher	High	5.7	4.2	5.1	-1.5	-26.2	-0.6	-10.1
	Moderate	164.8	125.6	134.4	-39.3	-23.8	-30.4	-18.5
	Low	272.1	235.7	263.2	-36.4	-13.4	-8.9	-3.3
	Very low to nil	4,417.3	4,494.4	4,457.2	77.2	1.7	40.0	0.9
Sprague's pipit	High	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moderate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low	880.4	610.1	817.7	-270.3	-30.7	-62.7	-7.1
	Very low to nil	3,979.5	4,249.8	4,042.2	270.3	6.8	62.7	1.6
Northern leopard frog	High	54.9	32.7	49.6	-22.3	-40.5	-5.3	-9.7
	Moderate	94.0	71.0	93.7	-23.0	-24.5	-0.3	-0.3
	Low	241.1	167.4	192.0	-73.8	-30.6	-49.1	-20.4
	Very low to nil	4,469.8	4,588.9	4,524.6	119.1	2.7	54.7	1.2
Elk - winter	High	223.0	106.1	151.9	-116.9	-52.4	-71.0	-31.9
	Moderate	1,016.7	640.0	777.9	-376.7	-37.1	-238.8	-23.5
	Low	451.7	352.7	480.5	-99.0	-21.9	28.8	6.4
	Very low to nil	3,168.6	3,761.1	3,449.6	592.6	18.7	281.0	8.9

Table 11-13 Change in Habitat for Key Indicators in the LAA

Key Indicators	Habitat Suitability Rating	Existing Conditions	Construction	Dry Operations	Change Existing Conditions to Construction		Change from Existing Conditions to Dry Operations	
		ha	ha	ha	ha	%	ha	%
Elk -summer	High	275.0	147.3	198.4	-127.7	-46.4	-76.6	-27.9
	Moderate	813.6	454.7	590.3	-358.8	-44.1	-223.2	-27.4
	Low	663.8	580.7	700.2	-83.1	-12.5	36.4	5.5
	Very low to nil	3,107.6	3,677.1	3,371.0	569.6	18.3	263.5	8.5
Grizzly bear - spring	High	228.9	111.9	190.2	-117.1	-51.1	-38.7	-16.9
	Moderate	240.4	113.8	153.1	-126.6	-52.7	-87.2	-36.3
	Low	854.9	830.5	831.6	-24.4	-2.8	-23.3	-2.7
	Very low to nil	3,535.7	3,803.7	3,683.3	268.0	7.6	147.6	4.2
Grizzly bear - summer	High	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moderate	54.0	50.2	51.0	-3.8	-7.0	-3.0	-5.6
	Low	243.4	167.0	200.0	-76.3	-31.4	-43.4	-17.8
	Very low to nil	4,562.6	4,642.7	4,609.0	80.1	1.8	46.4	1.0

11.4.3 Change in Movement

11.4.3.1 Project Pathways

Through the Project-specific Indigenous Engagement program, Stoney Nakoda Nations reported the potential for the Project to affect the migration of local wildlife, and subsequently affect the transmission of traditional knowledge (see Section 14.7 and 14.8.5), as well as drive away and minimize the availability of local wildlife. Samson Cree Nation expressed concerns regarding effects to wildlife trails and changes to migration patterns for other projects (Riversdale 2015, SCN 2015b, MLT 2011), and stated that reclamation efforts are often unsuccessful and that wildlife migration patterns are affected for the long term (SCN 2015a).

Construction activities associated with the development of project structures, access roads as well as road realignments have potential to create physical barriers or sensory disturbance that might hinder wildlife movement in the LAA. Although construction activities have potential to temporarily alter wildlife movement for SOMC in the short-term, longer term effects on wildlife movement (e.g., deer and elk) might occur during dry operations when permanent structures, fencing and new access roads are present. Specifically, the diversion channel, floodplain berm, off-stream dam, and associated fencing around the PDA might create hindrances to wildlife movement during dry operations. The extent to which these project structures are perceived as hindrances (i.e., permeable, semi-permeable) or impermeable barriers would vary by wildlife species, location within the PDA (e.g., riparian, upland) and project design features (e.g., use of rip-rap, slope gradient).

For example, ungulates and amphibians typically find exposed rip-rap difficult to cross (Austin and Garland 2001; Ruediger et al. 2005; AZDOT 2006; Dodd et al. 2007; Clevenger 2011; Harper and Morley 2012). These materials would be partially used in the construction of the diversion channel and floodplain berm. Fences can also disrupt daily and seasonal ungulate movement (Government of Alberta 2011; Paige 2012; Visscher et al. 2016); however, fences can be modified to allow wildlife (e.g., deer and elk) to move across the landscape and reduce injuries (Government of Alberta 2011; Paige 2012; Visscher et al. 2016). In addition, physical barriers to movement have the potential to reduce landscape connectivity, especially for species with limited dispersal capabilities such as amphibians, which can affect both local and regional population viability (Cushman 2006).

11.4.3.2 Mitigation

Project construction activities and structures have potential to affect wildlife movement in the LAA during both construction and dry operation phases. Mitigation measures to reduce potential effects on wildlife movement are described below:

- Construction activities will be avoided during the RAP for the KWBZ identified along the Elbow River (December 15 to April 30). This would reduce potential effects on wildlife movement and wintering ungulates (ESRD 2015a). If construction during the RAP cannot be avoided, site-specific mitigation will be developed in consultation with AEP.
- The side slopes and bottom of the diversion channel will be vegetated, except under the proposed bridges and at Pirmez Creek. Vegetated areas would provide a more conducive material to move across the channel.
- The diversion channel will be built with 3H:1V side slopes, which is within the range that most large mammals (e.g., elk,) are known to traverse (McCorquodale 2003; Frair et al. 2005; Mao et al. 2005; The Bow Corridor Ecosystem Advisory Group 2012).
- To maintain ungulate movement within the KWBZ, the floodplain berm will be revegetated with materials conducive for ungulate movement. The section of reinforced concrete (approximately 250 m) closest to the Elbow River will be covered with topsoil and seeded with native grasses. The central portion of the floodplain berm includes approximately 550 m of exposed riprap, where sections will be filled with substrate finer than riprap, such as sand, gravel and vegetation to allow for more walkable sections (Austin and Garland 2001; Huijser et al. 2008; Clevenger 2011). The south portion, furthest from the Elbow River, will be a 450 m earthen embankment vegetated with native grasses.
- Where fencing is proposed to restrict livestock access to project structures (e.g., diversion channel), wildlife-friendly fencing will be installed to allow ungulate passage.

11.4.3.3 Project Residual Effects

Construction associated with the diversion channel, floodplain berm and off-stream dam, and dry operations activities have the potential to create physical or sensory barriers to amphibians and medium to large sized mammals (e.g., ungulates and bears), including key indicators. These activities are less likely to affect movement of birds.

Olive-sided Flycatcher and Sprague's Pipit

Because birds can fly over terrestrial disturbances, the Project has limited potential to affect olive-sided flycatcher and Sprague's pipit movement during construction. No tall structures would be erected that birds can fly into; therefore, the dry operations phase also has limited potential to affect their movement.

The magnitude of the residual effect during both construction and the dry operations phase is predicted to be low because a measurable change in the abundance of birds, including migratory birds, in the LAA is unlikely. However, temporary local shifts in distributions might occur where birds would avoid disturbed areas. During construction, duration of the effect is short-term and a continuous event because altered movement within the LAA is limited to the construction phase, which is estimated to last approximately 36 months. During the dry operations phase, permanent structures would result in residual effects that are predicted to be continuous and occur over the long-term. Timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Northern Leopard Frog

Construction of project structures and temporary work spaces might create physical barriers where amphibians attempt to travel between breeding and overwintering wetlands (e.g., northern leopard frog). Depending on the timing of construction activities, adherence to recommended RAPs for amphibians as well as site-specific mitigation (see Sections 11.4.2.2 and 11.4.4.2) would reduce potential effects on amphibian movement. During the dry operations phase, temporary disturbances within the proposed off-stream reservoir would be reclaimed. Although a majority of the diversion channel and floodplain berm would be crossable, the sections of rip rap in these project structures might still act as a barrier to amphibian movement between breeding and overwintering habitats.

The magnitude of the residual effect during both construction and the dry operations phase is predicted to be moderate because a measurable change in the abundance and distribution of amphibians in the LAA is possible. However, a measurable change in the abundance of amphibians in the RAA is unlikely. During construction, duration is short-term and a continuous event because altered movement within the LAA is limited to the construction phase. During the dry operations phase, permanent structures would result in residual effects that are predicted to be continuous and occur over the long-term. Timing for construction is considered seasonal because construction would have greater potential to affect northern leopard frog movement at different times than others. For dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Elk

Construction activities associated with the diversion channel, floodplain berm and off-stream dam have the potential to create physical or sensory barriers to ungulate movement, including elk (known to use the Elbow River and surrounding upland habitats). Reducing the amount of time of construction activities that occur outside of the RAP in KWBZ (e.g., blasting events) would reduce potential sensory disturbance and effects on ungulate movement.

During dry operations, the project structures have potential to alter ungulate movement in the LAA. Foothills Ojibway First Nation stated that wildlife corridors should be maintained (Lifeways 2012). The floodplain berm is in a KWBZ and the current floodplain berm design includes the use of exposed rip-rap. Although these materials are unsuitable for ungulate crossing (Austin and Garland 2001; Clevenger 2011), proposed mitigation to cover rip-rap at regular intervals with more suitable materials should reduce potential effects on ungulate movement and facilitate passage.

Although the diversion channel is not located in a KWBZ, there is potential for the 4.7 km structure to alter ungulate movement through upland habitats where elk have been observed (see Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report). Through the Project-specific Indigenous Engagement program, Stoney Nakoda Nations recommended that wildlife crossings be implemented in the Project area. Approximately 1.4 km of the northern section of the diversion channel (farthest from the KWBZ) will be lined with rip-rap, as well as sections (approximately 100 m long) under the proposed bridges, and the section (~150 m) of the diversion channel that would intersect Pirmez Creek. However, the remaining length of the diversion channel (approximately 2.5 km) will be covered with top soil and grass, making it crossable for ungulates. Ungulates that encounter sections of rip-rap will be deflected to crossable sections.

The proposed 25% gradient (4H:1V) side slope of the diversion channel should not have an adverse effect on elk movement because elk are known to move and forage in terrain with 30-40% gradients (McCorquodale 2003; Frair et al. 2005). If elk and other wildlife become tolerant of the diversion channel, it has the potential to act as a sensory barrier where wildlife might use the sloped, vegetated areas as cover from Highway 22 traffic noise. Vertical concrete walls and rip-rap will be installed across the entrance of the diversion inlet. Elk or other ungulates travelling along the north side of the Elbow River would likely move upland to where the slope of the diversion channel is passable in order to move around the diversion structure.

The intersection of Highway 22 and Springbank Road is proposed to be raised an average of 5 m, with the highest point being 10 m at the creek north of Springbank Road. The proposed side slope of 33% gradient is within the range (17-45%) of terrain that elk can move in (McCorquodale 2003; Frair et al. 2005; Mao et al. 2005). These slopes will be vegetated along the sides, which will be beneficial to wildlife movement. Although deer and elk tend to use wildlife overpasses more than wildlife underpasses (Clevenger et al. 2009), the placement of a 3.67 m diameter culvert at the bottom of the raised intersection could function as a passageway for smaller ungulates and wildlife to pass under the road onto the other side.

The off-stream dam will be designed with a relatively moderate slope (29% gradient, 3.5H:1V) and vegetated with native grasses. Therefore, it is unlikely this structure would pose a hindrance to ungulate movement.

Overall, because the Project includes the installation of permanent structures and the diversion channel would have un-crossable gaps of rip rap, the magnitude of residual effects on elk and other ungulates (e.g., deer and moose) during construction and the dry operations phase is predicted to be moderate because a measurable change in the abundance and distribution of ungulates in the LAA is possible. However, a measurable change in the abundance of ungulates in the RAA is unlikely. Timing for construction is seasonal and regulatory because construction would have greater potential to affect some elk movement at different times than others, but also might occur during a restricted activity period (e.g., KWBZ). For dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

During construction, duration of the effect is short-term and a continuous event because altered movement within the LAA is limited to the construction phase, which is estimated to last approximately two years. During the dry operations phase, permanent structures would result in residual effects that are predicted to be continuous and occur over the long-term. The degree to which elk might habituate to the project structures and maintain daily or seasonal movements is uncertain; however, elk can habituate to other human activities if human and physical disturbances are relatively constant and predictable (Thompson and Henderson 1998).

Grizzly Bear

Construction and dry operations of the Project have the potential to create physical or sensory barriers to grizzly bear movement, especially near the Elbow River and surrounding riparian habitat. Grizzly bears typically travel along the easiest routes between forage areas such as valley bottoms, creeks and rivers, and mountain passes (ESGBP 1998), avoiding areas of open pasture and preferring to move along forested edges for cover in more developed landscapes (Jorgenson 2016).

Although data from government radio-collared grizzly bears have indicated there is some grizzly bear use of upland habitats that occur west of the LAA, data from field surveys suggest grizzly bear movement is more common along the Elbow River valley where bears travel between mountain and foothill habitats. Therefore, the diversion structure and floodplain berm are more likely to affect grizzly bear movement than the diversion channel and off-stream dam. Mitigation for the floodplain berm would allow the structure to be passable for bears and other large carnivores, and as with elk, any bears travelling along the north side of the Elbow River would likely move upland to where the slope of the diversion channel is passable in order to move around the diversion structure. Although grizzly bears might still travel in the upland portions of the LAA, the diversion channel (including sections of exposed rip-rap) should not hinder grizzly bear movement. Depending on the timing of construction activities, there is potential to increase sensory disturbance and affect movement during spring and fall when grizzly bears might be travelling along the Elbow River floodplain.

During dry operations, the diversion structure and floodplain berm might still result in sensory disturbance to grizzly bears if maintenance activities overlap potential seasonal use along the Elbow River.

Overall, the residual effects on grizzly bear movement during construction and dry operations is predicted to be adverse and low in magnitude because a measurable change in the abundance of wildlife in the LAA is unlikely, although temporary local shifts in distributions might occur. During construction, duration of the effect is short-term and a continuous event because altered movement within the LAA is limited to the construction phase. During the dry operations phase, permanent structures would result in residual effects on movement that are predicted to be continuous and occur over the long-term. Timing for construction is seasonal and regulatory because construction would have greater potential to affect grizzly bear movement at different times than others. For dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

11.4.4 Change in Mortality Risk

11.4.4.1 Project Pathways

Samson Cree Nation expressed concerns regarding increased direct and indirect mortality (MLT 2011). For example, during construction, vegetation removal and ground disturbance can result in physical destruction of wildlife habitat features (e.g., nests, dens, roosts, hibernacula) and increase mortality risk for wildlife. Construction activities can also cause mortality from nest failure due to sensory disturbance. Sensory disturbance associated with construction activities and use of access trails can affect nest site selection and contribute to nest failure in some songbird species such as Sprague's pipit (Sutter et al. 2016; Ludlow et al. 2015). Raptors such as bald eagle have been shown to have higher rates of nest abandonment and nest failure if human activity occurs near to active nests (USFWS 2015).

Construction activities might also result in animal-vehicle collisions (AVC) and increased wildlife-human conflict (e.g., bears). Ktunaxa Nation expressed concerns about Project effects on wildlife resulting from increased vehicle access (KNC 2010). AVC might occur from increased traffic volumes or displacement from the construction area to other locations where wildlife might cross existing roads more frequently. For example, road realignments and modifications at the intersection of Highway 22 and Springbank Road could alter local traffic patterns, potentially increasing traffic volumes on other roadways in the RAA. SOMC with the potential to occur in the LAA—including birds, mammals, and amphibians—are susceptible to road mortality (Lodé 2000; Ament et al. 2008; Garrah et al. 2015). Ungulates are particularly vulnerable to road mortality due to their use of roadway habitat (Dodd et al. 2006; Grosman et al. 2011; Bissonette and Rosa 2012). Between 2004 and 2014, approximately 81% of AVC on Highway 22 involved deer, 9% involved elk, and 8% involved moose (Alberta Transportation 2017). Moreover, construction activity in ungulate wintering range could add stress to ungulates, causing an

increase in energy expenditure, the potential to use less favourable habitat, and face higher predation risk (ESRD 2015a). An increase in wildlife-human conflict could result from attractants (e.g., garbage) in the PDA that might cause wildlife to enter the construction area while humans are still present.

Amphibians and reptiles are especially vulnerable to road mortality compared to other taxa (Mazerolle 2004; Garrah et al. 2015); however, areas of high mortality risk are largely associated with close proximity of roadways to breeding wetlands and other important habitat features (e.g., hibernation sites) that amphibians and reptiles might travel between (Garrah et al. 2015).

Overall, the dry operations phase has limited potential to result in increased direct mortality risk because there will be no ground disturbance (e.g., vegetation clearing) during maintenance activities as well as substantially less human activity and vehicle traffic compared to the construction phase. The reduction in on-site activity would reduce the likelihood of project-related wildlife mortality and wildlife-human conflict (e.g., grizzly bears), compared to the construction phase. There is, however, potential for project structures to alter wildlife movement for some species (see Section 11.4.3), which might result in increased road crossing frequency and increased mortality risk.

11.4.4.2 Mitigation

Construction activities and, to lesser extent, dry operations, have potential to increase mortality risk to SOMC in the LAA and RAA. Mitigation measures to reduce mortality risk are described below:

- Seasonally appropriate surveys will be undertaken to identify key habitat and habitat features (e.g., wetlands, nests) of SOMC before undertaking construction.
- Identified wildlife features will be avoided during construction activities, as identified by the appropriate signage and/or fencing. The Environmental Inspector(s) or designate and Wildlife Resource Specialist(s) will recommend the appropriate setback distance for identified wildlife features.
- Vegetation removal will be avoided during the RAP for nesting migratory birds and raptors. RAPs are primarily based on ECCC guidance to avoid risk of incidental take of migratory birds (ECCC 2016). ECCC direction to protect bird nests in the foothills parkland and prairie ecozone of Alberta, with consideration of migratory bird species at risk, is from April 15 to August 31 (Gregoire 2014 pers. comm.). The recommended RAP to avoid destruction and disturbance to raptor nests is from February 15 to August 15 (SRD 2011, ESRD 2013, Government of Alberta 2017b). Therefore, the combined RAP dates to avoid is from February 15 to August 31.

- If vegetation removal is scheduled to occur within the RAP for migratory birds and raptors, a qualified wildlife biologist will inspect the site for active nests within seven days of the start of the proposed vegetation removal or ground disturbance and appropriate mitigation developed.
- If an active nest or den is found, it will be subject to a recommended setback buffer and site-specific mitigation measures developed in consultation with regulators (see Table 11-10 and Table 11-11 for setback buffers specific to SOMC with potential to occur in the PDA).
- All construction traffic will adhere to safety, road closure regulations, and other access measures and guidelines for the construction area and associated access roads.
- Wildlife or livestock will not be harassed or fed. Waste will be stored in wildlife-proof containers and wildlife awareness training will be provided to staff on site to reduce human-wildlife conflict (e.g., bears, see Jorgenson 2016).
- Personnel will not be permitted to have dogs at the construction site. Firearms are not permitted in project vehicles or on the construction footprint, or at associated project facilities. Incidents with wildlife will be reported to an Alberta Transportation representative.
- Sightings of species of interest will be reported to the environmental inspector(s) or designate. Protection measures might be implemented and the sighting will be recorded.
- If previously unidentified listed or sensitive wildlife species or their site-specific habitat (e.g., dens, nests are identified during construction), then the occurrence will be reported to the environmental inspector(s) or designate.
- Unanticipated wildlife issues encountered during construction will be discussed and resolved by the environmental inspector(s) or designate, wildlife resource specialist(s), and the responsible regulatory agencies, if necessary.
- Unauthorized vehicles will be prevented from access from public roads by using gates.

11.4.4.3 Project Residual Effects

During construction, mortality risk to wildlife would be reduced because of pre-construction surveys as well as implementation of other mitigation such as adherence to RAPs and setback distances. Direct mortality risk to wildlife during dry operations would be minimal because human interaction with wildlife species would be limited to maintenance activities along permanent access roads and project structures, and would be infrequent. For all species listed below, timing for construction is seasonal because construction would have greater potential to affect mortality risk of key indicators at different times than others. Timing for construction for olive-sided flycatcher, Sprague's pipit, and elk are regulatory because construction might occur during a restricted activity period. For dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Olive-sided Flycatcher and Sprague's Pipit

Mitigation to reduce the risk of incidental take is the planning of vegetation clearing activities to occur outside the RAPs for nesting migratory birds and raptors. If clearing needs to be completed within a RAP, a pre-clearing nest search would be conducted with setbacks applied to active nests.

Overall, the magnitude of the residual effect during both construction and dry operations is expected to be low because a measurable change in the abundance of migratory birds in the LAA is unlikely. The geographic extent of the residual effect would largely be confined to the PDA; however, sensory disturbance from project activities, which can lead to nest failure, can extend into the LAA. The duration of the residual effect during construction is short-term because increased mortality risk is limited to the construction phase and vegetation clearing would occur at multiple irregular events. The residual effect on mortality risk would be reversible once construction activities cease. However, the duration is long-term during dry operations because the residual effect would continue for the life of the Project.

Northern Leopard Frog

Amphibian mortality risk during construction and dry operations is largely dependent on the proximity of breeding wetlands to roadways. Most amphibian observations (no amphibian SOMC) occurred within the off-stream reservoir. Range Road 41 and Springbank Road are the nearest roadways to these breeding wetlands. During construction, temporary access roads into the off-stream reservoir would further increase the risk of road mortality for amphibians. During dry operations, permanent access roads would be built in the PDA where no roadways existed before (e.g., along the off-stream dam, diversion channel, and floodplain berm), potentially increasing the risk of driving over amphibians. However, fewer amphibian observations were made at the proposed project structure locations.

Overall, the magnitude of the residual effect is expected to be low as a measurable change in the abundance of amphibians in the LAA is unlikely. The geographic extent of the residual effect during construction would largely be confined to the PDA in the short-term; however, an increase in traffic volume in the LAA and RAA is expected to occur. The geographic extent of the residual effect during the dry operations phase would largely be confined to the LAA because traffic volumes in the RAA are expected to return to existing conditions. Although the increase in mortality risk is considered low during dry operations, the duration is long-term because permanent access roads would exist and be used for the life of the Project.

Elk and Grizzly Bear

AVC and human interactions are the greatest mortality risk to elk and grizzly bears, and other large mammals. Increased traffic volumes can lead to higher AVC risks; however, the increase is expected to be limited during construction. During construction, increases in traffic volume

would be mitigated by having workers shuttled to the work site. Mitigation to reduce wildlife-human interactions would also reduce residual effects on mortality risk for elk and grizzly bear, including other wildlife. During dry operations, traffic volumes would be expected to decrease back to those observed at existing conditions.

Overall, the magnitude of the residual effect is expected to be low because a measurable change in the abundance of wildlife in the LAA is unlikely. The geographic extent of the residual effect during construction would extend into the LAA and RAA as traffic volumes increase; however, during dry operations, the residual effect would be confined to the LAA because traffic volumes in the RAA are expected to return to existing conditions. The duration of the residual effect during construction would be short-term and occur at multiple irregular events. During dry operations, the duration is long-term because the residual effect would continue for the life of the Project.

11.4.5 Change in Biodiversity

11.4.5.1 Project Pathways

During construction, the Project has potential to change biodiversity due to changes in species, community, and landscape diversity. Landscape diversity can be affected through habitat fragmentation, patch isolation and edge effects. Through the Project-specific Indigenous Engagement program, Tsuut'ina Nation noted the potential for the Project to increase habitat fragmentation. One of the most common consequences of habitat fragmentation is an increase in the abundance of edge-influenced habitat and its adverse effects on species diversity and the restrictions in species movement (Government of Alberta 2015b). The degree of contrast along an edge might influence wildlife movement because some species might be reluctant to move across hard edges, or the boundary between the patches can be a barrier to movement (Wiens et al. 1985). Change in movement is discussed in Section 11.4.3 (Wildlife).

Habitat fragmentation also results in a decrease in patch size, which can lead to isolation of habitat patches and affect species diversity (Dunning et al.1992; Fahrig 2003). Because some wildlife species have minimum patch size requirements (e.g., Sprague's pipit), reducing patch size beyond a certain threshold can result in reduced habitat suitability for some species (i.e., patches that are too small to sustain a local population or individual territories [Fahrig 2003]).

Although project effects on species richness and relative abundance are difficult to assess without monitoring, the Project has potential to affect bird and amphibian species richness and relative abundance through the loss and alteration of land cover types. For example, vegetation clearing and soil disturbances would facilitate the dispersal of non-native plants, which can alter the native vegetation community that wildlife species rely on for habitat and forage.

11.4.5.2 Mitigation

Mitigation recommended for change in habitat (Sections 10.3.1 and 11.4.3), change in movement (Section 11.4.3) and change in mortality risk (Section 11.4.4) would also mitigate potential changes in biodiversity; there are no additional mitigation measures recommended for biodiversity.

11.4.5.3 Project Residual Effects

Landscape diversity is unlikely to be affected by construction and dry operations because the number, size, and edge of habitat patches in the RAA would not change as a result of the Project (see Section 10.4.2). The diversion channel has potential to fragment habitat in the LAA and reduce landscape connectivity if wildlife do not cross; however, wildlife species richness and abundance are not expected to be influenced by habitat fragmentation from the Project in the RAA.

The Project would reduce the amount of upland, wetland, and riparian habitat in the LAA, but the number of cover types would not change. Cover types affected by the Project are also available in the RAA. See Sections 10.4.3 and 10.4.4 for details on changes to vegetation community and plant species diversity, respectively.

Change in habitat in the LAA would affect wildlife species dependent on a variety of upland and wetland communities (see Section 11.4.2). However, proposed mitigation, including reclamation, is expected to reduce potential effects on wildlife species richness and relative abundance.

The Project has little potential to affect breeding bird species richness and relative abundance (i.e., density). Shrubland and grassland, which make up 8.4% and 8.8% of the LAA, respectively, would be the most affected native upland habitats during construction in terms of size (see Section 11.4.2.3). Shrubland and grassland would be reduced by up to 20.8% and 21.1% in the LAA, respectively, during construction (see Table 11-12). Reclamation after construction would result in an additional 91 ha of grassland habitat in the LAA during dry operations, a 21% increase from existing conditions. Numerous bird SOMC rely on these habitats such as Sprague's pipit, Baird's sparrow, loggerhead shrike, and long-billed curlew. However, shrubland and grassland habitats in the LAA have lower species richness and relative abundance compared to other habitat types (Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report). In addition, many non-SOMC bird species observed in shrubland and grassland habitats were also observed in other habitat types, suggesting that although shrubland and grassland habitats would be reduced in the construction area, species richness in the LAA is unlikely to measurably change.

Breeding bird species richness and relative abundance is highest in mixed forest, which makes up 6.1% of the LAA, and would be reduced by up to 11.8% during construction (see Table 11-12). Mixed forest would be reclaimed to grassland during dry operations. Mixed forest composes 6.2% of the wildlife RAA, whereas grassland and shrubland composes 27.2% and 2.6%, respectively. Because mixed forest has relatively higher bird species richness and relative abundance than grassland or shrubland, and is limited on the landscape, changes to mixed forest habitat would potentially have a greater effect on bird species diversity in the RAA than changes to grassland and shrubland habitat.

Graminoid marsh makes up 4.7% of the LAA, but would be the most affected wetland habitat during construction (see Section 11.4.2.3), and would be reduced by up to 12.2% during construction. Amphibian relative abundance was highest in graminoid marsh habitat (Volume 4, Appendix H). Although no amphibian SOMC were observed, amphibian relative abundance is typically used as an indicator of wetland health and aquatic diversity (Pollet and Bendell-Young 2000; Guzy et al. 2012; Government of Alberta 2015b). Proposed mitigation and the avoidance of wetlands, where possible, would reduce the residual effects on amphibians and aquatic diversity.

Although there would be limited potential for the Project to interact with the various components of biodiversity during the dry operations phase (e.g., no further loss or vegetation removal of any native land cover types), the dispersal of weeds and other non-native plants during construction have the potential to affect plant and wildlife species and community diversity; however, weed mitigation during construction (see Section 10.3.1) would reduce residual effects.

Overall, the change in biodiversity is predicted to be low in magnitude because measurable changes in plant (upland and wetland) communities are not expected to affect sustainability of community, landscape, and wildlife diversity in the LAA or RAA, and there would be no effects on rare ecological communities. The duration would be short-term for wildlife species dependent on early seral vegetation communities (e.g., herbaceous, grassland) that would be available following reclamation. However, the duration of residual effects would be long-term for wildlife species dependent on mature forest where formerly forested areas would likely remain non-forested for the life of the Project. The relatively small changes in landscape diversity (e.g., patch size), also suggests the magnitude of residual effects on biodiversity are relatively low and would not threaten the long-term persistence or viability of wildlife in the RAA. Timing for construction is seasonal and regulatory because construction would have greater potential to affect some SOMC at different times than others, but also might occur during a restricted activity period. For dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

11.4.6 Summary of Project Residual Effects

Table 11-14 summarizes the residual effects of the Project on wildlife and biodiversity.

Table 11-14 Project Residual Effects on Wildlife and Biodiversity during Construction and Dry Operations

Residual Environmental Effect	Residual Effects Characterization								
	Project Phase	Timing	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic
Change in Habitat	C	S/R	A	L-H	LAA	ST/LT	S	R	D
	O	N/A	A	L-H	LAA	LT	IR	R	D
Change in Movement	C	S/R	A	L-M	LAA	ST	C	R	D
	O	N/A	A	L-M	LAA	LT	C	R	D
Change in Mortality Risk	C	S/R	A	L	RAA	ST	IR	R	D
	O	N/A	A	L	LAA	LT	IR	R	D
Change in Biodiversity	C	S/R	A	L	RAA	ST/LT	S	R	D
	O	N/A	A	L	LAA	LT	IR	R	D

KEY

See Table 11-5 for detailed definitions

Project Phase
C: Construction
O: Dry Operation

Timing Consideration
T: Time of day
S: Seasonality
R: Regulatory

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: project development area
LAA: local assessment area
RAA: regional assessment area

Duration:
ST: Short-term;
LT: Long-term

N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological and Socio-Economic Context:
D: Disturbed
U: Undisturbed

11.4.7 Additional Assessments

11.4.7.1 Sora

Sora (*Porzana carolina*) is not listed under the *Species at Risk Act* (SARA) or the *Alberta Wildlife Act* (AWA) (Government of Alberta 2015a). It has not been designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Sora is a migratory bird species designated as *sensitive* under the *General Status of Alberta Wild Species* (Government of Alberta 2017c) and protected under the MBCA. Sora was chosen as an additional key wildlife indicator to represent bird species dependent on wetlands because the pathways for potential project effects on migratory birds would be similar for other wetland-dependent birds represented under the MBCA.

Methods for Existing Conditions

A habitat suitability model is used to assess potential direct (i.e., habitat loss) and indirect (i.e., sensory disturbance) effects on changes in habitat abundance in the LAA for sora. A four-class rating scheme (high, moderate, low, very low to nil) rates the suitability of each ecosite or land cover class to provide key life requisites (e.g., feeding, breeding) for sora. Indirect loss caused by sensory disturbance is estimated using disturbance-specific zones of influence. The life requisite rated for sora is breeding habitat. A description of model development, assumptions, and zones of influence for sora are provided below.

Distribution

Sora is a common rail that occurs throughout North America. As a migratory bird, sora occurs in Alberta only during the breeding season (May to August) (FAN 2007). The species occurs in all Natural Regions in Alberta but occurs more frequently in the Grassland and Parkland Natural Regions where suitable wetland habitat is present (FAN 2007).

Ecology and Key Habitat Requirements

Sora breed in wetlands with abundant emergent vegetation and variable amounts of open water that may be shallow (less than 20 cm) or moderately deep (20 cm to 45 cm) (Johnson and Dinsmore 1986; Zimmerman et al. 2002; Niemuth 2005; FAN 2007). These habitat attributes are characteristic of a variety of wetland types including graminoid marshes that may be seasonal, semi-permanent or permanent. Emergent vegetation is typically dominated by abundant sedges (*Carex* spp.), cattail (*Typha* spp.) and bulrush (*Scirpus* spp.) (Johnson and Dinsmore 1986, Niemuth 2005). Sora have been reported to occur less frequently in wetlands with large amounts (>95%) of open water (Zimmerman et al. 2002).

Habitat Use and Life Requisites

Breeding (nesting) habitat is the life requisite rated for the sora. Breeding habitats provide suitable nest sites as well as resources for other life requisites such as foraging, shelter and security. Therefore, although the habitat suitability model represents nesting (reproduction) habitat, the ratings inherently include a portion of other living requirements. Suitable areas for nesting include wetlands with shallow water and abundant emergent vegetation.

Ratings Assumptions

Habitat suitability model ratings for sora breeding habitat use the following assumptions:

- Sora prefer wetlands with abundant emergent vegetation for breeding. Therefore, all graminoid-dominated wetlands are rated high suitability (e.g., graminoid marsh) whereas shrub-dominated wetlands (e.g., shrubby fen) are rated low. Any waterbodies with little or no emergent vegetation are rated very low to nil.

- Permanency of water is also an important criterion for successful reproduction, which was used to modify suitability ratings. Specifically, waterbodies that dry up would not provide sufficient food sources (e.g., seeds, invertebrates), which reduces habitat suitability. Therefore, waterbodies classified as ephemeral (Class I) are rated very low to nil, and graminoid-dominated wetlands classified as temporary (Class II) are reduced by two classes (i.e., rated low). Seasonal (Class III) and semi-permanent (Class IV) graminoid wetlands are rated high whereas shallow open water is rated moderate suitability. Permanent (Class V) wetlands are reduced by one class (rated moderate) because they typically include larger areas of open water and less vegetation interspersion, which reduces habitat suitability (Zimmerman et al. 2002).

Ratings Adjustment for Disturbances

Although anthropogenic noise can affect bird behavioral and avoidance responses as well as interfere with bird communication (Ortega 2012), there is limited information on the potential indirect effects (i.e., sensory disturbance) of anthropogenic activities specific to sora habitat use. Nonetheless, Alberta Environment and Parks (SRD 2011) recommends a 100 m setback to protect wetland values including wetland-dependent wildlife species. In addition, ECCC (2017) also recommends a range of setback distances for human activities that might affect common waterbirds and waterfowl, which also includes setbacks up to 100 m. As such, this setback buffer was used as a zone of influence and assigned to varying levels of sensory disturbance based on factors such as noise level or perceived visual impediments. No zones of influence are applied to agricultural areas.

The following rating adjustments were applied to estimate the zone of influence associated with each disturbance type:

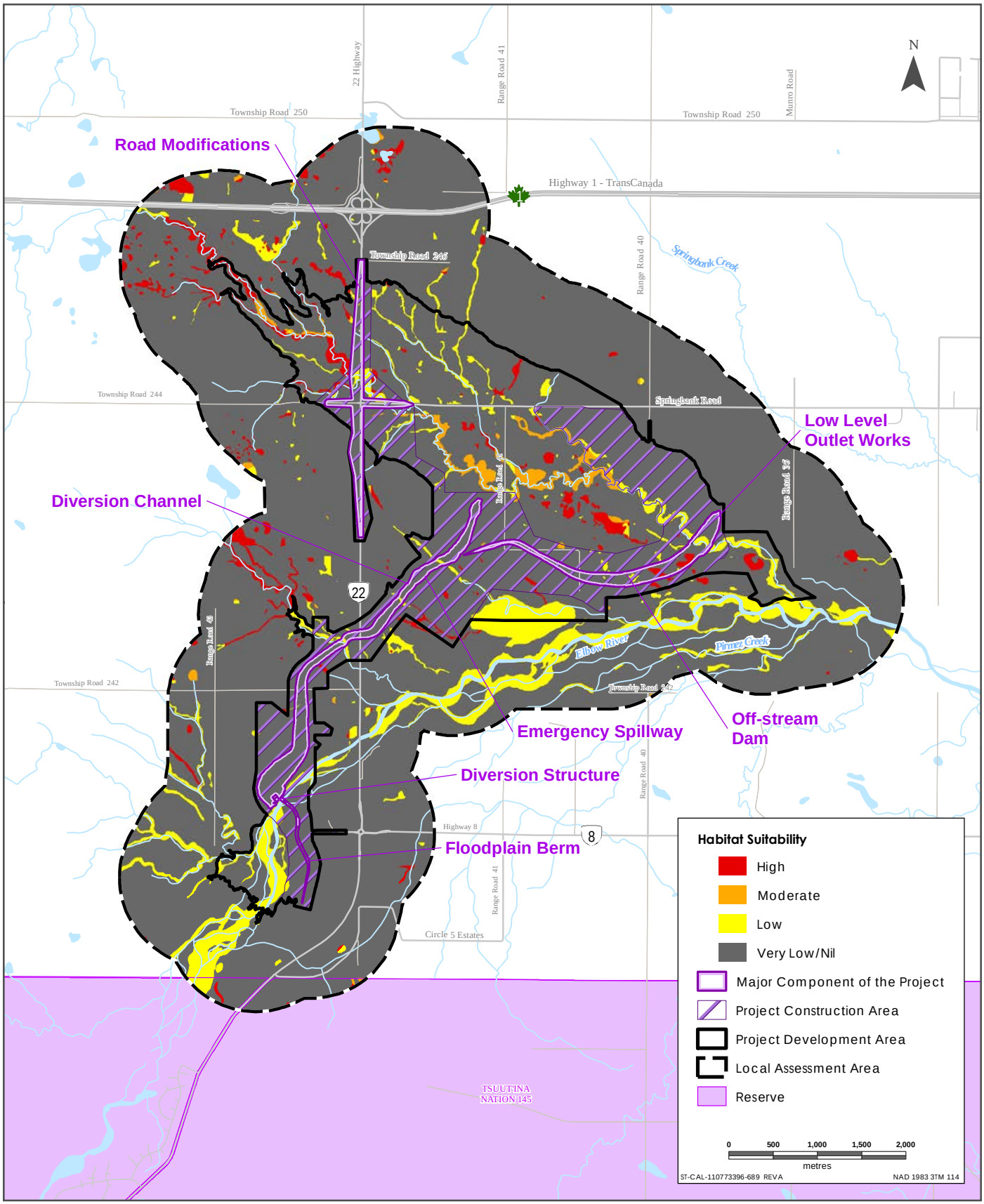
- Industrial development, and primary and secondary roads are considered high disturbance; therefore, suitability ratings were reduced by two classes if these anthropogenic features occurred within 100 m of potential breeding wetlands.
- Tertiary roads and rural residential are considered a moderate disturbance and suitability ratings reduced by one class if these anthropogenic features occurred within 100 m of potential breeding wetlands.

Existing Conditions Overview

The majority (96.7%) of the LAA consists of low and very low to nil suitability breeding habitat for sora, with the remainder represented by 109.7 ha (2.3%) of high and 48.6 ha (1.0%) of moderate suitability habitat (Table 11-15). Moderate and high suitability habitat occurs throughout the LAA where a variety of wetlands, including graminoid marshes, shallow open water, as well as slow-moving sections of creeks provide potential breeding habitat (Figure 11-10).

Table 11-15 Wildlife Habitat Abundance for Sora in the LAA

Key Indicator	Habitat Suitability Rating	Area (ha)	Percent of Total LAA
Sora	High	109.7	2.3
	Moderate	48.6	1.0
	Low	349.4	7.2
	Very low to nil	4,352.2	89.6



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Sora Habitat Suitability in the LAA – Existing Conditions

Change in Habitat

During construction, vegetation removal has potential to result in direct habitat loss, reduction, or alteration, which can cause displacement of marsh birds into other, less suitable habitat. Landscape alteration can also result in reduced habitat use for some marsh bird species due to potential marsh isolation (Smith and Chow-Fraser 2010). Construction activities also have potential to result in indirect effects caused by increased disturbance (e.g., noise and artificial light, presence of workers), which can reduce habitat effectiveness in the LAA. Most birds rely on vocalizations to attract mates and defend territories, and it is therefore reasonable to assume that noise disturbance can affect otherwise suitable breeding habitat whereby birds avoid the area or incur costs associated with behavioural changes to overcome the noise (Brumm 2004; Habib et al. 2007; Ortega 2012; Sutter et al. 2016). The potential for sensory disturbance would occur primarily during the construction phase when increased noise levels associated with heavy machinery, potential blasting events (i.e., diversion channel excavation), and increased levels of human activity and traffic volumes occur in the LAA.

Mitigation to reduce the residual effects of the Project on marsh birds (including sora), is (where possible) to locate temporary workspaces and access roads in areas that avoid wetlands. Existing access roads and previously disturbed areas will be used, where feasible. Where possible, focusing lights on habitats that surround the work site during evening hours will be avoided. This would reduce potential sensory disturbance to nocturnal marsh birds like sora. Temporary work spaces will be reclaimed using native species that are compatible with pre-construction site conditions, as outlined in the reclamation plan (Volume 4, Appendix D).

Vegetation removal will be avoided during the RAP for nesting marsh birds. RAPs are primarily based on ECCC guidance to avoid risk of incidental take of migratory birds (ECCC 2016). ECCC direction to protect bird nests in the foothills parkland and prairie ecozone of Alberta, with consideration of migratory bird species at risk, extends from April 15 to August 31 (Gregoire 2014 pers. comm.).

If vegetation removal is scheduled to occur within the RAP for migratory birds, a qualified wildlife biologist will inspect the site for active nests within seven days of the start of the proposed vegetation removal or ground disturbance and appropriate mitigation measures will be developed as required. If an active nest is found, it will be subject to a recommended setback buffer and site-specific mitigation measures developed in consultation with regulators (see Table 11-10 and Table 11-11 for timing and setback distances specific for migratory marsh bird SOMC with potential to occur in the PDA).

During construction, the Project would result in the direct and indirect loss and alteration of 17.8 ha (16.2%) of high and 12.6 ha (25.9%) of moderate suitability sora breeding habitat (Table 11-16). However, a small amount of high and moderate suitability habitat in the construction area would be reclaimed, which would reduce the amount of wetland habitat loss to 8.1% of high suitability habitat and 3.8% of moderate suitability habitat (Table 11-16). Overall, 7.2% of sora breeding habitat (high and moderate combined) would be affected during dry operations.

Overall, the magnitude of the residual effect on sora breeding habitat is considered high during construction because more than 10% of high and moderate habitat suitability in the LAA would be affected; however, mitigation to avoid the removal of wetlands where possible would reduce residual effects during construction. The construction period would be relatively short. During dry operations, the magnitude would be moderate because between 1% and 10% of high and moderate habitat suitability in the LAA would be affected for the long-term. Timing for construction is seasonal and regulatory because construction would have greater potential to affect sora habitat during the breeding season, but also might occur during a restricted activity period. For dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Table 11-16 Change in Habitat for Sora in the LAA

Key Indicators	Habitat Suitability Rating	Existing Conditions	Construction	Dry Operations	Change Existing Conditions to Construction		Change from Existing Conditions to Dry Operations	
		ha	ha	ha	ha	%	ha	%
Sora	High	109.7	91.9	100.8	-17.8	-16.2	-8.8	-8.1
	Moderate	48.6	36.0	46.8	-12.6	-25.9	-1.8	-3.8
	Low	349.4	297.9	337.0	-51.6	-14.8	-12.4	-3.5
	Very low to nil	4,352.2	4434.1	4375.2	81.9	1.9	23.1	0.5

Change in Movement

The Project has little potential to affect bird movement in the LAA for marsh birds like sora because birds can fly over terrestrial disturbances. Additionally, no tall structures would be erected that might affect migration patterns, flyways, local movement, and seasonal habitat use. Temporary local shifts in distributions might occur where marsh birds could avoid areas with increased noise levels.

The magnitude of the residual effect during both construction and the dry operations phase is predicted to be low because a measurable change in the abundance of sora and other marsh birds in the LAA is unlikely. During construction, duration of the effect is a short-term event because altered movement of migratory birds within the LAA is limited to the construction phase. During the dry operations phase, permanent structures would result in residual effects that are predicted to be continuous and occur over the long-term. For construction and dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Change in Mortality Risk

During construction, potential for direct marsh bird mortality or nest destruction could occur through vegetation removal and ground disturbance, thus increasing direct mortality risk for marsh birds. Construction activities can also cause indirect mortality from nest failure due to sensory disturbance. Sensory disturbance associated with construction activities and use of access trails can affect nest site selection and contribute to nest failure in some bird species (Ortega 2012; Ludlow et al. 2015; Sutter et al. 2016). Dry operations have limited potential to result in increased direct mortality risk because there would be no ground disturbance (e.g., no vegetation clearing) during maintenance activities as well as substantially less human activity and vehicle traffic compared to the construction phase.

Mitigation to reduce the risk of incidental take is for vegetation removal to be avoided during the RAP for nesting marsh birds. RAPs are primarily based on ECCC guidance to avoid risk of incidental take of migratory birds (ECCC 2016). ECCC direction to protect bird nests in the foothills parkland and prairie ecozone of Alberta, with consideration of migratory bird species at risk, extends from April 15 to August 31 (Gregoire 2014 pers. comm.).

If vegetation removal is scheduled to occur within the RAP for migratory birds, a qualified wildlife biologist would inspect the site for active nests within seven days of the start of the proposed vegetation removal or ground disturbance and appropriate mitigation would be developed. If an active nest is found, it would be subject to a recommended setback buffer and site-specific mitigation measures developed in consultation with regulators (see Table 11-10 and Table 11-11 for timing and setback distances specific for migratory marsh bird SOMC with potential to occur in the PDA.

No tall structures would be erected in the PDA that might provide additional perching opportunities for birds of prey (e.g., hawks, owls, eagles) to hunt from and there is no expected increase in the amount of edge habitat in the PDA (see Sections 10.4.2 and 11.4.5) to increase mortality risk for sora or other marsh birds. In addition, if active nests are found, setback buffers would also reduce the risk of predators, such as small mammals (e.g., weasel) that may follow human scents, from predating nests. As such, the Project is unlikely to have an effect on changes to predator/prey relationships and species composition balance for sora or other marsh birds; therefore, it has limited potential to affect marsh bird populations.

Overall, the magnitude of the residual effect during both construction and dry operations is expected to be low because a measurable change in the abundance of sora and other marsh birds in the LAA is unlikely. The geographic extent of the residual effect would largely be confined to the PDA; however, sensory disturbance from project activities, which can lead to nest failure, can extend into the LAA. The duration of the residual effect during construction is short-term because increased mortality risk is limited to the construction phase and could occur at multiple irregular events during vegetation clearing and increased vehicle traffic. The residual effect on mortality risk would be reversible (i.e., return to existing conditions) after construction activities cease; however, the duration is long-term during dry operations. Timing for construction is seasonal and regulatory because construction would have greater potential to affect mortality risk for sora at different times than others, but also might occur during a restricted activity period. For dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Summary of Project Residual Effects on Sora

The residual effects for sora are characterized in Table 11-17.

Table 11-17 Project Residual Effects on Sora during Construction and Dry Operations

Residual Environmental Effect	Residual Effects Characterization								
	Project Phase	Timing	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Habitat	C	S/R	A	H	LAA	ST	S	R	D
	O	N/A	A	M	LAA	LT	IR	R	D
Change in Movement	C	N/A	A	L	LAA	ST	C	R	D
	O	N/A	A	L	LAA	LT	C	R	D
Change in Mortality Risk	C	S/R	A	L	LAA	ST	IR	R	D
	O	N/A	A	L	LAA	LT	IR	R	D

KEY

See Table 11-5 for detailed definitions

Project Phase
C: Construction
O: Dry Operation

Timing Consideration
T: Time of day
S: Seasonality
R: Regulatory

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: project development area
LAA: local assessment area
RAA: regional assessment area

Duration:
ST: Short-term;
LT: Long-term

N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological and Socio-Economic Context:
D: Disturbed
U: Undisturbed

11.4.7.2 Migratory Birds

Although the olive-sided flycatcher, sora, and Sprague's pipit were used as key indicators to focus the assessment (see Sections 11.1.2 and 11.4.1-11.4.4), the information presented below provides a further assessment of migratory birds and their habitat as well as potential changes in movement and mortality risk during Project construction and dry operations. In addition, the potential effects of fragmentation on migratory birds is also discussed. For a more detailed discussion of potential effects of fragmentation on landscape diversity see Sections 10.4.2 and 11.4.5.

Methods for Existing Conditions and Overview of Existing Conditions

Wildlife field surveys were conducted in the LAA to estimate wildlife abundance and distribution, assess wildlife habitat suitability, and identify wildlife features that might require mitigation. Field surveys targeted SOMC, as well as migratory birds that could potentially occur in the LAA. The following wildlife surveys targeting migratory and non-migratory birds were conducted in the LAA:

- rail, June 2016
- breeding bird, June 2016
- raptor nest and waterfowl area search, June 2016

Detailed descriptions of survey methods and results are provided in Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report.

During the breeding season, mixed forest habitat contained the highest species richness for songbirds and woodpeckers, followed by shrubland and broadleaf forest habitat. Similarly, breeding bird density for songbirds and woodpeckers was highest in mixed forest and broadleaf forest. Clay-colored sparrow (*Spizella pallida*), house wren (*Troglodytes aedon*) and savannah sparrow (*Passerculus sandwichensis*) had the highest densities in the LAA. Ten sora (*Porzana carolina*) were observed within the LAA during systematic broadcast surveys and seven were observed incidentally. No yellow rail or Virginia rail were detected. Several raptor stick and platform nests were observed in the LAA, including an active bald eagle stick nest along the Elbow River. This nest occurs in the construction area near the off-stream dam and low-level outlet. Most of the active stick nests observed were occupied by red-tailed hawks. Several waterbird species were also observed, two of which are SOMC: great blue heron (*Ardea herodias*) and sora. In total, 16 waterbird species were observed in the LAA, with mallard (*Anas platyrhynchos*) as the most observed species.

During spring and fall migration, several migratory land bird species that breed in the boreal and parkland regions (e.g., warblers, sparrows, flycatchers) are likely to use the forested and shrubland areas of the LAA as stop overs for feeding and resting (FAN 2007; eBird 2018). Grassland birds are likely to use tame pasture and native grassland vegetation (FAN 2007; eBird 2018). Waterfowl and shorebirds typically congregate at large waterbodies during migration, however, larger waterbodies exist outside the LAA. For example, FWMIS data for the RAA show trumpeter swan staging areas to the northwest of the LAA along the Trans-Canada Highway. Additionally, some non-migratory birds as defined by Article I of the MBCA, such as osprey, broad-winged hawk, northern harrier, and Swainson's hawk, do migrate and are likely to use their associated habitats (see Table 11-18) for feeding in the LAA (FAN 2007; eBird 2018).

Fewer migratory birds would use the LAA for feeding and loafing during winter; however, some migratory bird species are known winter residents and have potential to occur in the LAA including species dependent on forested and shrubland areas (e.g., black-capped chickadee, red-breasted nuthatch, common redpoll, blue jay) as well as open grassland (e.g., snow bunting, horned lark), and open water (e.g., waterfowl, American dipper) habitat (FAN 2007; National Audubon Society 2010; eBird 2018). Non-migratory birds with winter residency within the LAA would also use forested (e.g., northern saw-whet owl, great grey owl), open grassland (e.g., rough-legged hawk, golden eagle), and open water (e.g., bald eagle) habitat (FAN 2007; National Audubon Society 2010; eBird 2018).

Change in Habitat

During construction, vegetation removal has potential to result in direct habitat loss for migratory birds and fragmentation of migratory bird habitat, which can cause displacement of birds into other, less suitable habitat. Construction activities also have potential to result in indirect effects caused by increased disturbance (e.g., noise and artificial light, presence of workers), which can reduce habitat effectiveness in the LAA. Many migratory songbirds rely on vocalizations to attract mates and defend territories; noise disturbance can affect otherwise suitable breeding habitat whereby birds avoid the area or incur costs associated with behavioural changes to overcome the noise (Brumm 2004; Habib et al. 2007; Ortega 2012; Sutter et al. 2016). The potential for sensory disturbance would occur primarily during the construction phase when increased noise levels associated with heavy machinery, potential blasting events (i.e., diversion channel excavation), and increased levels of human activity occur in the LAA. During dry operations, there is no potential for further direct habitat loss or fragmentation (i.e., no clearing of vegetation to occur), and potential sensory disturbance is expected to decrease during dry operations when the levels and frequency of human disturbance would be reduced.

Mitigation to reduce the residual effects of the Project on migratory birds is (where possible) to locate temporary workspaces and access roads in areas that avoid native vegetation (e.g., shrubland, treed areas, wetlands). Existing access roads and previously disturbed areas will be used, where feasible. Where possible, focusing lights on habitats that surround the work site during evening hours will be avoided. This would reduce potential sensory disturbance to migratory birds. Temporary work spaces will be reclaimed using native species that are compatible with pre-construction site conditions, as outlined in the reclamation plan (Volume 4, Appendix D).

Vegetation removal will be avoided during the RAP for nesting migratory birds and non-migratory birds (e.g., raptors). RAPs are primarily based on ECCC guidance to avoid risk of incidental take of migratory birds (ECCC 2016). ECCC direction to protect bird nests in the foothills parkland and prairie ecozone of Alberta, with consideration of migratory bird species at risk, extends from April 15 to August 31 (Gregoire 2014 pers. comm.). The recommended RAP to avoid destruction and disturbance to raptor nests extends from February 15 to August 15 (SRD 2011, ESRD 2013, Government of Alberta 2017b). Therefore, the combined RAP recommended to avoid disturbance to migratory birds as well as other nesting bird species (e.g., raptors) extends from February 15 to August 31.

If vegetation removal is scheduled to occur within the RAP for migratory birds and raptors, a qualified wildlife biologist will inspect the site for active nests within seven days of the start of the proposed vegetation removal or ground disturbance and appropriate mitigation measures will be developed as required. If an active nest or den is found, it will be subject to a recommended setback buffer and site-specific mitigation measures developed in consultation with regulators (see Table 11-10 and Table 11-11 for timing and setback distances specific for migratory and non-migratory bird species at risk with potential to occur in the PDA).

All native cover types in the LAA provide breeding and foraging habitat for several migratory bird species. Some habitats provide relatively more structural diversity, which can result in higher abundances and/or species richness (see Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report, Table 3-1). Table 11-18 provides a summary of habitat associations for select migratory and non-migratory bird species, which were used to assess changes in migratory and non-migratory bird habitat.

Table 11-18 Examples of Migratory and Non-Migratory Birds with Potential to Occur in the LAA and Their Associated Cover Type

Cover Type	Migratory Birds	Non-migratory Birds [a]
Broadleaf Forest	Baltimore oriole, warbling vireo, ovenbird	Red-tailed hawk, Cooper's hawk, broad-winged hawk
Coniferous Forest	Olive-sided flycatcher, boreal chickadee, ruby-crowned kinglet, yellow-rumped warbler	Great gray owl, northern hawk owl, northern pygmy owl, northern goshawk
Mixed Forest	Least flycatcher, western tanager, white-throated sparrow, rose-breasted grosbeak, Tennessee warbler, yellow bellied-sapsucker	Barred owl, boreal owl, northern saw-whet owl, red-tailed hawk, sharp-shinned hawk
Shrubland	Loggerhead shrike, alder flycatcher, eastern kingbird, mountain bluebird	Red-tailed hawk, Swainson's hawk, sharp-tailed grouse
Native Grassland	Sprague's pipit, Baird's sparrow, savannah sparrow, vesper sparrow	Short-eared owl, golden eagle, Swainson's hawk, northern harrier, prairie falcon, sharp-tailed grouse
Open Water	American wigeon, gadwall, mallard, northern shoveler, northern pintail, green-winged teal, blue-winged teal, cinnamon teal	Osprey, bald eagle, double-crested cormorant
Shallow Open Water		Northern harrier, rough-legged hawk
Ephemeral Waterbody		
Graminoid Marsh	Yellow rail, sora, Nelson's sparrow, LeConte's sparrow	
Graminoid Fen		
Shrubby Swamp	Song sparrow, Lincoln's sparrow, swamp sparrow, house wren, alder flycatcher	
Shrubby Fen		
Wooded Mixedwood Swamp		

NOTE:
[a] Non-migratory birds as defined by Article I of the *Migratory Birds Convention Act, 1994*.

Construction Phase

Within the Project construction area (734 ha), 34% is annual crop, dugouts, hayland, and disturbed lands (see Table 11-12), which provides relatively low habitat suitability for migratory birds. Remaining native habitat types most affected by Project construction include shrubland (up to 20.9% [85.3 ha]) and grassland (up to 21.1% [89.7 ha]). Construction activities would therefore decrease the abundance of habitat in the LAA for migratory birds dependent on shrubland (e.g., loggerhead shrike, alder flycatcher, eastern kingbird, mountain bluebird), and grassland (e.g., Sprague's pipit, Baird's sparrow, savannah sparrow, vesper sparrow). Although tame pasture is not native and is considered as a component of the agricultural land cover type, some grassland-associated migratory birds can still use it for breeding and foraging. During construction, up to 15.0% (199.0 ha) of tame pasture would be affected.

Smaller amounts of wetland (up to 9.4% [29.5 ha]) and mixed forest (up to 11.8% [34.8 ha]) habitat would also be affected during construction, relative to shrubland and grassland (see Table 11-12). The loss of wetlands would affect migratory birds such as sora, Lincoln's sparrow, and various waterfowl species. There is relatively less habitat available in the LAA for migratory birds that are dependent on broadleaf and coniferous forest. Only up to 1.2% (3.0 ha) and 4.5% (11.0 ha) of broadleaf and coniferous forest would be affected by construction, respectively (see Table 11-12). Therefore, migratory birds dependent on coniferous (e.g., olive-sided flycatcher, boreal chickadee, ruby-crowned kinglet, yellow-rumped warbler) and broadleaf forest (e.g., Baltimore oriole, warbling vireo, ovenbird) are less likely to be affected by construction. Fragmentation of migratory bird habitat during construction would be minimal because the change in the size, number, and edge length of habitat patches in the RAA would remain relatively unchanged (see Sections 10.4.2 and 11.4.5).

For non-migratory birds, such as bald eagle, red-tailed hawk, and great gray owl, changes to terrestrial habitat (e.g., upland cover types) during construction would be similar as described for migratory birds for each habitat association. Although wetlands are not necessarily used as breeding habitat for raptors, wetlands are an important part of the landscape that can provide potential prey opportunities.

The construction area consists of 168 ha of permanent structures and temporary workspace is 566 ha. Although there is some uncertainty regarding how much temporary workspace would be used during construction, all habitat is assumed to be directly affected due to vegetation removal and grading associated with construction. Therefore, the amount of direct habitat loss in the PDA is a conservative estimate. All temporary workspaces would be reclaimed following construction.

Residual effects on changes in migratory and non-migratory bird habitat will vary by habitat type and associated bird species during construction. Project residual effects are moderate in magnitude during construction because a measurable change in the abundance and distribution of migratory and non-migratory birds in the LAA is possible, but a measurable change in the abundance of migratory and non-migratory birds in the RAA is unlikely. The duration would be short-term, and a single event for migratory birds that are dependent on early seral vegetation communities (e.g., herbaceous, grassland), which would be available following reclamation. However, the duration of residual effects would be long-term for other bird species that are dependent on mature forest, such as the olive-sided flycatcher and great gray owl, where forested areas would remain non-forested after construction of permanent structures or take decades to regrow following reclamation of temporary workspaces. Timing for construction is seasonal and regulatory because construction would have greater potential to affect some migratory birds at different times than others, but also might occur during a restricted activity period.

Dry Operations Phase

During dry operations, grassland habitat types would increase in the short-term following reclamation by up to 21.5% (91.2 ha) more than existing conditions (see Table 11-12). Crop and hayland in the PDA would be left fallow following construction because land users will not be permitted in the area. Crop and hayland are expected to convert to tame pasture over time, increasing by up to 12.3% (162.9 ha) from existing conditions (see Table 11-12). Tame pasture provides relatively more suitable habitat for grassland-dependent migratory birds with general habitat requirements (e.g., vesper sparrow, savannah sparrow) relative to crop and hayland.

The change in wetland abundance would be reduced by 4.9% during dry operations, compared to construction where 9.4% would be affected (see Table 11-12). This assumes wetland tree and shrub layers would be removed through vegetation clearing and would be reclaimed to graminoid dominated marshes. Habitat for migratory bird species that are dependent on graminoid dominated wetlands (e.g., yellow rail, sora, Nelson's sparrow, Le Conte's sparrow), versus shrubby or treed wetlands, would increase.

For non-migratory birds, changes to habitat during dry operations would be similar as described for migratory birds for each habitat association.

Project residual effects are low in magnitude during dry operations because a measurable change in the abundance of migratory and non-migratory birds in the LAA is unlikely, although temporary local shifts in distributions might occur. The duration would be long-term, however, the frequency of indirect habitat effects (i.e., sensory disturbance) would be limited to irregular events during maintenance activities. Timing is not applicable for dry operations because effects from Project activities would be similar regardless of season or other timing characteristics.

Change in Movement

The Project has potential to affect wildlife movement in the LAA for amphibians and large mammals through the construction of project structures, access roads, and road realignments, which might act as physical barriers to movement. However, birds can fly over terrestrial disturbances. Because no tall structures would be erected that might affect migration patterns, flyways, local movement, and seasonal habitat use, there is limited potential for the Project to affect migratory bird movement during construction and dry operations. Temporary local shifts in distributions might occur where migratory birds could avoid areas with increased noise levels.

The magnitude of the residual effect during both construction and the dry operations phase is predicted to be low because a measurable change in the abundance of migratory birds in the LAA is unlikely. During construction, duration of the effect is a short-term event because altered movement of migratory birds within the LAA is limited to the construction phase. During the dry operations phase, permanent structures would result in residual effects that are predicted to be continuous and occur over the long-term. For construction and dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Change in Mortality Risk

During construction, potential for direct migratory bird mortality or nest destruction could occur through vegetation removal and ground disturbance, thus increasing direct mortality risk for migratory birds. Construction activities can also cause indirect mortality from nest failure due to sensory disturbance. Sensory disturbance associated with construction activities and use of access trails can affect nest site selection and contribute to nest failure in some migratory bird species such as Sprague's pipit (Ludlow et al. 2015; Sutter et al. 2016). Dry operations has limited potential to result in increased direct mortality risk because there would be no ground disturbance (e.g., no vegetation clearing) during maintenance activities as well as substantially less human activity and vehicle traffic compared to the construction phase.

Mitigation to reduce the risk of incidental take is to avoid vegetation removal during the RAP for nesting migratory birds and non-migratory birds (e.g., raptors). RAPs are primarily based on ECCC guidance to avoid risk of incidental take of migratory birds (ECCC 2016). ECCC direction to protect bird nests in the foothills parkland and prairie ecozone of Alberta, with consideration of migratory bird species at risk, extends from April 15 to August 31 (Gregoire 2014 pers. comm.). The recommended RAP to avoid destruction and disturbance to raptor nests extends from February 15 to August 15 (SRD 2011, ESRD 2013, Government of Alberta 2017b). Therefore, the combined RAP to avoid disturbance to migratory birds, as well as other nesting bird species, extends from February 15 to August 31.

If vegetation removal is scheduled to occur within the RAP for migratory birds and raptors, a qualified wildlife biologist would inspect the site for active nests within seven days of the start of the proposed vegetation removal or ground disturbance and appropriate mitigation would be developed. If an active nest or den is found, it would be subject to a recommended setback buffer and site-specific mitigation measures developed in consultation with regulators (see Table 11-10 and Table 11-11 for timing and setback distances specific for migratory and non-migratory bird species at risk with potential to occur in the PDA.

No tall structures would be erected in the PDA that might provide additional perching opportunities for birds of prey (e.g., hawks, owls, eagles) to hunt from and there is no expected increase in the amount of edge habitat in the PDA (see Sections 10.4.2 and 11.4.5) that would increase mortality risk. In addition, if active nests are found, setback buffers would also reduce the risk of predators, such as small mammals (e.g., weasel) that may follow human scents, from predating nests. As such, the Project is unlikely to have an effect on changes to predator/prey relationships and species composition balance; therefore, it has limited potential to affect bird populations.

Overall, the magnitude of the residual effect during both construction and dry operations is expected to be low because a measurable change in the abundance of migratory birds in the LAA is unlikely. The geographic extent of the residual effect would largely be confined to the PDA; however, sensory disturbance from project activities, which can lead to nest failure, can extend into the LAA. The duration of the residual effect during construction is short-term because increased mortality risk is limited to the construction phase and could occur at multiple irregular events during vegetation clearing and increased vehicle traffic. The residual effect on mortality risk would be reversible (i.e., return to existing conditions) after construction activities cease; however, the duration is long-term during dry operations. Timing for construction is seasonal and regulatory because construction would have greater potential to affect some migratory birds at different times than others, but also might occur during a restricted activity period. For dry operations, timing is not applicable because effects from Project activities would be similar regardless of season or other timing characteristics.

Summary of Project Residual Effects on Migratory Birds

The residual effects for migratory birds are characterized in Table 11-19.

Table 11-19 Project Residual Effects on Migratory Birds during Construction and Dry Operations

Residual Environmental Effect	Residual Effects Characterization								
	Project Phase	Timing	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Habitat	C	S/R	A	M	LAA	ST/LT	S	R	D
	O	N/A	A	L	LAA	LT	IR	R	D
Change in Movement	C	N/A	A	L	LAA	ST	C	R	D
	O	N/A	A	L	LAA	LT	C	R	D
Change in Mortality Risk	C	S/R	A	L	LAA	ST	IR	R	D
	O	N/A	A	L	LAA	LT	IR	R	D

KEY

See Table 11-5 for detailed definitions

Project Phase
C: Construction
O: Dry Operation

Timing Consideration
T: Time of day
S: Seasonality
R: Regulatory

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: project development area
LAA: local assessment area
RAA: regional assessment area

Duration:
ST: Short-term;
LT: Long-term

N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological and Socio-Economic Context:
D: Disturbed
U: Undisturbed

11.4.7.3 Species at Risk

A habitat suitability assessment was conducted in the LAA during the spring of 2016 (combined with nocturnal amphibian surveys and remote camera set-up) to provide information on the suitability of habitat for species of management concern including species at risk. The survey was undertaken as a preliminary stage of investigation to collect information on the availability and distribution of habitat in the LAA, and the potential for the occurrence of species of management concern. The information was then used to provide guidance as to what species/groups would require specialized surveys in support of assessing the potential effects of the proposed Project activities. Species range maps and existing data (e.g., FWMIS, eBird, SARA recovery strategies or management plans) were used in addition to the habitat suitability assessment to determine the frequency of occurrence of species at risk in the LAA.

Species-specific information regarding potential Project effects on each species listed under Schedule 1 of SARA and those species listed by COSEWIC are provided in Attachment A, Table A-1. Potential direct and indirect Project effects (i.e., change in habitat, movement, and mortality risk) on each species at risk as well as proposed mitigation is summarized.

The residual effects for species at risk are characterized (Attachment A, Table A-1) based on criteria outlined in Table 11-5; changes are relative to existing conditions. Changes in magnitude for habitat and movement, and changes in geographic extent for mortality risk varies with species.

11.5 DETERMINATION OF SIGNIFICANCE

The assessment of residual effects and determination of significance takes into account available traditional knowledge information, engagement results, review of existing scientific data, and field surveys conducted for the Project. Indigenous groups raised concerns about the Project leading to a loss or disturbance of wildlife habitat, effects of sensory disturbance on wildlife, increased habitat fragmentation, alterations of wildlife migration and movement patterns, animal-vehicle collisions, increased wildlife mortality, and effects to biodiversity (see Section 14.7).

As defined in Section 11.1.6, a significant environmental effect on wildlife and biodiversity is one that threatens the long-term persistence or viability of a wildlife species in the regional assessment area, including effects that are contrary to or inconsistent with the goals, objectives or activities of recovery strategies, action plans and management plans.

With the application of mitigation and environmental protection measures, residual environmental effects on wildlife, including migratory birds, species at risk, biodiversity, and provisions to maintain ungulate movement which was recommended by Indigenous groups are predicted to be not significant. The residual effects on change in habitat, movement, and mortality risk are unlikely to pose a long-term threat to the persistence or viability of a wildlife species including migratory birds and species at risk in the RAA.

11.6 PREDICTION CONFIDENCE

Prediction confidence is considered moderate based on the quality and quantity of available existing conditions data and the effectiveness of proposed mitigation during the construction and dry operations phases. However, there is some uncertainty related to wildlife movement and how various species might respond to the diversion channel, floodplain berm and off-stream dam during dry operations.

11.7 CONCLUSIONS

11.7.1 Change in Habitat

Existing developments, particularly agriculture, rural settlements and transportation corridors have resulted in the loss of wildlife habitat and reduced the suitability of the remaining habitats in the RAA. The Project would result in direct and indirect loss of wildlife habitat during construction and dry operations for SOMC including migratory birds and species at risk; however, the amount of wildlife habitat permanently affected is relatively small compared to the availability of wildlife habitat remaining in the RAA. Although there would be temporary displacement and disturbance to wildlife during construction, a measurable change in the abundance of wildlife in the RAA is unlikely.

11.7.2 Change in Movement

The Project is likely to have a greater adverse effect on ungulate and amphibian movement compared to birds and grizzly bear. Ungulates such as elk have difficulty crossing structures with rip rap, and although no amphibian SOMC (e.g., northern leopard frog) were observed in the LAA, other amphibian species might have difficulty crossing project structures because amphibians have smaller dispersal ranges compared with large mammals. Large mammals would likely be deflected and move around project structures if they choose not to cross over them. The potential adverse effect on wildlife movement could also subsequently affect the transmission of traditional knowledge. No tall structures are being erected that might affect migratory or SARA listed birds flying through the area, and grizzly bear use of the Elbow River valley is more common compared to upland habitats where the diversion channel and off-stream dam would be constructed.

The LAA has three existing highways (i.e., Trans-Canada, Highway 22, and Highway 8), and the RAA includes other highways and a network of secondary roads that currently hinder or have altered wildlife movement. Although the Project would result in additional anthropogenic features on the landscape that might hinder wildlife movement in the LAA, Alberta Transportation made adjustments to accommodate wildlife movement such as revegetating the floodplain berm with materials conducive for ungulate movement. The proposed mitigation is expected to partly reduce potential barrier effects of project structures. However, there is some uncertainty how ungulates and other wildlife would respond to these structures if they are encountered during daily or seasonal movements. Nonetheless, the project residual effects on wildlife movement are unlikely to pose a long-term threat to the persistence or viability of a wildlife species, including species at risk in the RAA.

11.7.3 Change in Mortality Risk

The Project is predicted to have a low risk of wildlife mortality to migratory birds and species at risk because of proposed mitigation (e.g., pre-construction surveys) during the construction phase. During dry operations, it is expected that mortality risk would be further reduced to levels similar to existing conditions. Highways and secondary roads already present in the RAA pose an existing mortality risk to large mammals such as elk and grizzly bear, as well as amphibians travelling between breeding and wintering sites. Overall, mortality risk for these species is expected to be relatively low because the Project would not create additional primary or secondary roads.

11.7.4 Change in Biodiversity

The Project would not result in changes in biodiversity that would threaten the long-term persistence or viability of wildlife or vascular plant species of management concern in the RAA.

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11.9 GLOSSARY

Incidental	Any observation made outside of a specific survey with set protocols.
Incidental take	Unintended wildlife mortality during a specified activity.
Key Wildlife and Biodiversity Zone (KWBZ)	Areas that provide key ungulate habitat and high habitat potential for biodiversity, defined by AEP and guidelines for industrial activity. These zones typically occur along major river valleys.
Restricted activity period (RAP)	The timeframe in which construction and other Project activities are limited based on federal and provincial guidelines. The RAP usually refers to the nesting season for birds or winter activities for ungulates in KWBZs.

Species of Management Concern (SOMC)	Any species that is listed federally as *endangered, threatened,* or *special concern* on any Schedule of the *Species at Risk Act*, designated federally as *endangered, threatened,* or *special concern* by the Committee on the Status of Endangered Wildlife in Canada, listed provincially as *endangered, threatened,* or *special concern*, including species legally protected under the Alberta *Wildlife Act*, and designated provincially as *At Risk, May be at Risk*, or *Sensitive* according to the AEP General Status of Alberta's Wild Species.
Systematic	Any observation made during a specific survey with set protocols.
Zone of Influence (ZOI)	A specified buffer surrounding a disturbance feature considered to cause indirect effects due to sensory disturbance.

Attachment A LIST OF SPECIES AT RISK POTENTIALLY AFFECTED BY THE PROJECT

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Horned grebe (Podiceps auritus)	SC	SC	Breed in small to moderate sized ponds and marshes with emergent vegetation. Graminoid marsh and shallow open water make up 4.9% (238.4 ha) of LAA. Overall, low to moderate suitability breeding habitat.	Four historical observations in RAA in 2006. No field observations. Low to moderate potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (28 ha). During dry operations, reclamation will have reduced the amount of direct habitat loss by 14.3 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-10 and 11-11 for horned grebe timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short Term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed
Western grebe (Aechmophorus occidentalis)	SC	SC	Breed on large lakes and marshes with extensive open water. No potential breeding habitat in LAA.	No historical record in RAA. No field observations. Low potential to occur in LAA.	No potential project effect(s) because no suitable habitat is available in the LAA; low likelihood to occur.	No mitigations required because no suitable habitat is available in the LAA; low likelihood to occur.	No project residual effects because no suitable habitat is available in the LAA; low likelihood to occur.	No project residual effects because no suitable habitat is available in the LAA; low likelihood to occur.

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Yellow rail (Coturnicops noveboracensis)	SC	SC	Breed in sedge marsh habitat. Graminoid marsh and graminoid fen make up 4.7% (230.3 ha) of LAA. Overall, low suitability breeding habitat.	No historical record in RAA. No field observations. Low potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (28 ha). During dry operations, reclamation will have reduced the amount of direct habitat loss by 14.2 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-11 for yellow rail timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Long-billed curlew (Numenius americanus)	SC	SC	Breed in short-grass or mixed-prairie habitat. Native grassland and tame pasture make up 36.0% (1,750.3 ha) of LAA. Overall, moderate suitability breeding habitat.	No historical record in RAA. No field observations. Moderate potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (288.7 ha). During dry operations, reclamation will have increased the amount of habitat by 254.2 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-10 and 11-11 for long-billed curlew timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed
Red knot (Calidris canutus [rufa])	EN	EN	Breed in arctic habitats. Use saline lakeshores during migration. No potential stopover habitat during migration in LAA.	No historical record in RAA. No field observations. Low potential to occur in LAA.	No potential project effect(s) because no suitable habitat is available in the LAA; low likelihood to occur.	No mitigations required because no suitable habitat is available in the LAA; low likelihood to occur.	No project residual effects because no suitable habitat is available in the LAA; low likelihood to occur.	No project residual effects because no suitable habitat is available in the LAA; low likelihood to occur.

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Short-eared owl (Asio flammeus)	SC	SC	Breed in tall grass prairie habitat. Native grassland and tame pasture make up 36.0% (1,750.3 ha) of LAA. Overall, low suitability breeding habitat (i.e., very little tall grass habitat).	No historical record in RAA. No field observations. Low potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (288.7 ha). During dry operations, reclamation will have increased the amount of habitat by 254.2 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-10 and 11-11 for short-eared owl timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed
Common nighthawk (Chordeiles minor)	TH	TH	Breed in short-grass prairie with sparsely vegetated ground, and woodland clearings. Native grassland and tame pasture make up 36.0% (1,750.3 ha) of LAA. Overall, low to moderate suitability breeding habitat.	No historical record in RAA. No field observations. Low to moderate potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (288.7 ha). During dry operations, reclamation will have increased the amount of habitat by 254.2 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-11 for common nighthawk timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Peregrine falcon (Falco peregrinus)	SC	SC	Nest on cliffs, ledges, artificial nest platforms. Potential nesting habitat along Elbow River. Overall, low suitability breeding habitat.	One historical observations in RAA in 2007. No field observations. Low potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration from vegetation clearing during construction. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-10 and 11-11 for peregrine falcon timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Olive-sided flycatcher (Contopus cooperi)[d]	TH	TH	Breed in open and semi-open coniferous and mixed-coniferous forest. High and moderate suitability breeding habitat make up 3.5% (170.5 ha) of LAA.	Three historical observations in RAA in 2010. Three field observations. Moderate potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (40.8 ha). Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. During dry operations, reclamation will have reduced the amount of direct and indirect habitat loss by 31.0 ha from existing conditions. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-11 for olive-sided flycatcher timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: High G: LAA Dur: Long term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: High G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Loggerhead shrike (Lanius ludovicianus excubitorides)	TH	TH	Breed in open country interspersed with shrubs and trees, particularly those with spines or thorns. Shrubland, native grassland, and tame pasture make up 44.4% (2,158.8 ha) of LAA. Overall, moderate suitability breeding habitat.	Two historical observations in RAA in 2013. No field observations. Moderate potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (374.0 ha). During dry operations, reclamation will have increased the amount of habitat by 170.8 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-11 for loggerhead shrike timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed
Bank swallow (Riparia riparia)	TH	TH	Breed in lowland areas along riparian habitat, lakes, reservoirs, and wetlands. Nest in vertical banks, cliffs and bluffs. Potential nesting habitat along Elbow River. Overall, high suitability breeding habitat.	Historical observations in RAA in 2010 and 2012. One breeding colony field observation. High potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. There is currently no specified timing or setback distance provided by ECCC for bank swallow. If a nest is found, species specific mitigation would be developed in consultation with ECCC.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Barn swallow (Hirundo rustica)	TH	TH	Breed in various habitats: open areas with structures and near water. Anthropogenic structures (e.g., bridge, culvert, barns) near water provide nesting sites in LAA. Overall, moderate suitability breeding habitat.	One historical observation in RAA in 2012. One breeding colony field observation. High potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-11 for barn swallow timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Sprague's pipit (Anthus spragueii) [d]	TH	TH	Breed in native mixed-prairie habitat. Habitat fragmentation and small patch size have reduced habitat suitability. No high or moderate suitability habitat exists in the LAA. Low suitability breeding habitat makes up 18.1% (880.4 ha) of LAA. Critical habitat has been partially identified at the Canadian Forces Base Suffield National Wildlife Area. No critical habitat occurs in the LAA.	No historical record in RAA. No field observations. Low potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (270.3 ha).Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. During dry operations, reclamation will have reduced the amount of direct and indirect low suitability habitat loss by 62.7 ha from existing conditions. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-10 and 11-11 for Sprague's pipit timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Baird's sparrow (Ammodramus bairdii)	SC	SC	Breed in native mixed-grass and fescue habitat, scattered with low shrubs. Native grassland makes up 8.7% (425.1 ha) of LAA. Overall, moderate suitability breeding habitat.	No historical record in RAA. No field observations. Low to moderate potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (89.7 ha). During dry operations, reclamation will have increased the amount of habitat by 91.3 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. There is currently no specified timing or setback distance provided by ECCC for Baird's sparrow. If a nest is found, species specific mitigation would be developed in consultation with ECCC.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Bobolink (Dolichonyx oryzivorus)	TH	TH	Breed in open areas with grass and broad-leaved plants. Native grassland and tame pasture make up 36.0% (1,750.3 ha) of LAA. Overall, low suitability breeding habitat.	No historical record in RAA. No field observations. Low potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (288.7 ha). During dry operations, reclamation will have increased the amount of habitat by 254.2 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of nest.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-11 for bobolink timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed
Rusty blackbird (Euphagus carolinus)	SC	SC	Breed in wet coniferous and mixed forests in the boreal. Use cultivated fields, pastures, swamps, and wooded areas during migration. Crop, hayland, tame pasture, swamps, and coniferous/mixed forest make up 59.9% (2,908.8 ha) of LAA. Overall, high suitability stopover habitat.	No historical record in RAA. No field observations. Moderate potential to occur in LAA during spring and fall migration.	**Change in Habitat** Direct habitat loss or alteration from vegetation clearing during construction (445.6 ha). During dry operations, reclamation will have reduced the amount of direct habitat loss by 104.5 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** No potential Project effects; assume no nests.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. See Table 11-11 for rusty blackbird timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Little brown myotis (Myotis lucifugus)	EN	EN	Roost in cavities of trees, rock crevices, or anthropogenic structures. Hibernate in caves or abandoned mines. Broadleaf, coniferous, and mixed forests make up 16.3% (793.1 ha) of LAA. Overall, high suitability roosting habitat. Critical habitat has been partially identified in Wood Buffalo National Park, and Jasper National Park and surrounding area. No critical habitat occurs in the LAA.	One historical observation in RAA in 2007. No field observations. High potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (48.8 ha). During dry operations, reclamation will have reduced the amount of direct habitat loss by 48.8 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** No potential Project effects. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of roost or hibernaculum.	See Section 11.4.2.2 and 11.4.4.2 for mitigation measures. There is currently no specified timing or setback distance provided by ECCC for little brown myotis. If a roost is found, species specific mitigation would be developed in consultation with ECCC.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Long term F: Single event R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Grizzly bear (Ursus arctos) [d]	--	SC	During spring forage in open areas, grasslands, wet meadows, and riparian habitats. During summer/fall forage in berry producing shrubs. High and moderate suitability spring feeding habitat make up 9.7% (469.3 ha) of LAA. High and moderate suitability summer feeding habitat make up 1.1% (54.0 ha) of LAA.	No historical record in RAA. Four field observations. Low to moderate potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (spring 243.7 ha; summer 3.8 ha). Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. During dry operations, reclamation will have reduced the amount of direct and indirect habitat loss by 125.9 ha in the spring and 3.0 ha in the summer from existing conditions. **Change in Movement** Construction and dry operations could result in alteration of movement patterns (daily or seasonal) because of Project structures and sensory disturbance. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of den, vehicle collisions, wildlife-human conflict (e.g., removal of nuisance animals).	See Section 11.4.2.2, 11.4.3.2, and 11.4.4.2 for mitigation measures. See Table 11-10 for grizzly bear timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: High(spring)/ Moderate(summer) G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Movement** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: RAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: High(spring)/ Moderate(summer) G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Movement** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
American badger (Taxidea taxus taxus)		SC	Open grassland, aspen parkland, and agricultural lands. Crop, hayland, tame pasture, grassland, and broadleaf forest make up 62.1% (3,018.8 ha) of LAA. Overall, high suitability habitat.	No historical record in RAA. No field observations. High potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (492.2 ha). During dry operations, reclamation will have reduced the amount of direct habitat loss by 32.8 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** Construction and dry operations could result in alteration of movement patterns (daily or seasonal) because of Project structures and sensory disturbance. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of den, vehicle collisions, wildlife-human conflict (e.g., removal of nuisance animals).	See Section 11.4.2.2, 11.4.3.2, and 11.4.4.2 for mitigation measures. There is currently no specified timing or setback distance provided by ECCC for American badger. If a den is found, species specific mitigation would be developed in consultation with ECCC.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Movement** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: RAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Movement** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Elk (Cervus canadensis)[d,e]	--	--	Forage in mosaic of open grasslands and forest cover, feeding primarily on grasses and forbs in the summer, and browse on deciduous trees and shrub in the winter. High and moderate suitability summer feeding habitat make up 22.4% (1,088.6 ha) of LAA. High and moderate suitability winter feeding habitat make up 25.5% (1,239.7 ha) of LAA.	No historical record in RAA. Several field observations throughout 2017/2018 field surveys. High potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration from vegetation clearing during construction (summer 486.5 ha; winter 493.6 ha). Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. During dry operations, reclamation will have reduced the amount of direct and indirect habitat loss by 299.8 ha in the summer and 309.8 ha in the winter from existing conditions. **Change in Movement** Construction and dry operations could result in alteration of movement patterns (daily or seasonal) because of Project structures and sensory disturbance. **Change in Mortality Risk** Vehicle collisions, wildlife-human conflict (e.g., removal of nuisance animals).	See Section 11.4.2.2, 11.4.3.2, and 11.4.4.2 for mitigation measures (including RAP for KWBZ).	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: High (summer/winter) G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Movement** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: RAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: High (summer/winter) G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Movement** T: N/A Dir: Adverse M: Moderate G: LAA Dur: Long term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Western toad (Anaxyrus boreas)	SC	SC	Graminoid marsh, swamps, shallow open water with emergent vegetation. Wetlands make up 6.4% (311.6 ha) of LAA. Overall, moderate suitability breeding habitat.	No historical record in RAA. No field observations. Low potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (29.5 ha). During dry operations, reclamation will have reduced the amount of direct habitat loss by 15.3 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** Construction and dry operations could result in alteration of movement patterns (daily or seasonal) because of Project structures and sensory disturbance. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of breeding wetland, accidental mortality during vehicle/equipment movement (i.e., less mobile).	See Section 11.4.2.2, 11.4.3.2, and 11.4.4.2 for mitigation measures. See Table 11-10 and 11-11 for western toad timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Movement** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: RAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Movement** T: N/A Dir: Adverse M: Moderate G: LAA Dur: Long term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Northern leopard frog (Lithobates pipiens) [d]	SC	SC	Graminoid marsh, swamps, shallow open water with emergent vegetation. High and moderate suitability breeding habitat make up 3.1% (148.9 ha) of LAA.	No historical record in RAA. No field observations. Low potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (45.3 ha). Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. During dry operations, reclamation will have reduced the amount of direct and indirect habitat loss by 5.6 ha from existing conditions. **Change in Movement** Construction and dry operations could result in alteration of movement patterns (daily or seasonal) because of Project structures and sensory disturbance. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of breeding wetland, accidental mortality during vehicle/equipment movement (i.e., less mobile).	See Section 11.4.2.2, 11.4.3.2, and 11.4.4.2 for mitigation measures. See Table 11-10 and 11-11 for northern leopard frog timing and setback distance.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: High G: LAA Dur: Short term F: Sing event R: Reversible E: Disturbed **Change in Movement** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: RAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Moderate G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Movement** T: N/A Dir: Adverse M: Moderate G: LAA Dur: Long term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

Table A-1 Summary of Project Residual Effects on Species at Risk during Construction and Dry Operations

Species	SARA[a]	COSEWIC[a]	Potential Habitat Use in the LAA at Existing Conditions	Frequency of Occurrence	Potential Project Effect(s)[b]	Key Recommendations/ Mitigation Measures	Project Residual Effects[c]	
							Construction	Dry Operations
Western tiger salamander (Ambystoma mavortium)	--	SC	Semi-permanent and permanent wetlands. Wetlands make up 6.4% (311.6 ha) of LAA. Overall, moderate suitability breeding habitat.	Sixteen historical observations in RAA in 2000. No field observations. Moderate potential to occur in LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (29.5 ha). During dry operations, reclamation will have reduced the amount of direct habitat loss by 15.3 ha from existing conditions. Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** Construction and dry operations could result in alteration of movement patterns (daily or seasonal) because of Project structures and sensory disturbance. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in physical destruction of breeding wetland, accidental mortality during vehicle/equipment movement (i.e., less mobile).	See Section 11.4.2.2, 11.4.3.2, and 11.4.4.2 for mitigation measures. There is currently no specified timing or setback distance provided by ECCC for western tiger salamander. If a breeding wetland is found, species specific mitigation would be developed in consultation with ECCC.	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Movement** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: RAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Movement** T: N/A Dir: Adverse M: Moderate G: LAA Dur: Long term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

NOTES:
[a] Government of Canada 2017 and COSEWIC 2017
EN (endangered), TH (threatened), SC (special concern), IR (in review – year of assessment by COSEWIC).
[b] There are no potential Project effects to change in movement for bird and bat species at risk because no tall structures would be erected that might affect migration patterns, flyways, local movement, and seasonal habitat use.
[c] Project residual effects characterization
T: Timing, Dir: Direction, M: Magnitude, G: Geographic Extent, Dur: Duration, F: Frequency, R: Reversibility, E: Ecological and Socio-Economic Context.
[d] Habitat suitability models were used to assess potential direct (i.e., habitat loss) and indirect (i.e., sensory disturbance) effects on changes in habitat abundance in the LAA for five key indicator species.
[e] Although elk is not a species at risk, it is considered a species of traditional importance to Aboriginal communities and was used as a key indicator.