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Abbreviations

ABMI	Alberta Biodiversity Monitoring Institute
ACIMS	Alberta Conservation Information Management System
AEP	Alberta Environment and Parks
AWCS	Alberta Wetland Classification System
COSEWIC	Committee on the Status of Endangered Wildlife Species in Canada
FWMIS	Fish and Wildlife Management Information System
GPS	global positioning system
GVI	grassland vegetation index
LAA	local assessment area
LCC	Land cover classification
PDA	project development area
RAA	regional assessment area
SARA	*Species at Risk Act*
SOMC	species of management concern
TLRU	traditional land and resource use
TUS	traditional use studies
VC	valued component

10.0 ASSESSMENT OF POTENTIAL EFFECTS ON VEGETATION AND WETLANDS

Biodiversity and associated ecosystem functions that vegetation and wetlands provide are essential to maintaining the health of natural ecosystems. The distribution and diversity of native vegetation and wetlands directly affect ecosystem functions (i.e., carbon sequestration, forage, habitat), environmental cycles (i.e., nutrient cycling, water cycle) and cultural benefits (i.e. spiritual, recreational and esthetic values).

Project activities have the potential to effect distribution and abundance of:

- plant species of management concern (SOMC), including species at risk
- native vegetation communities (upland, wetland and riparian), including ecological communities of management concern
- wetland functions

10.1 SCOPE OF THE ASSESSMENT

10.1.1 Regulatory and Policy Setting

The effects assessment of vegetation and wetlands has been completed in accordance with the *Terms of Reference for Environmental Impact Assessment Report for Alberta Transportation's Proposed Springbank Off-Stream Reservoir Project* (ESRD 2015a) and the *Draft Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* (Canadian Environmental Assessment Agency 2016).

10.1.1.1 Federal Regulations and Policy

Species at Risk Act

The *Species at Risk Act* (SARA), was implemented to protect species at risk in Canada and their critical habitat. The Committee on the Status of Endangered Wildlife Species in Canada (COSEWIC) was established by the SARA to assess and designate wildlife species, including plants, status as extinct, extirpated, endangered, threatened or special concern. Species status is designated using science and traditional knowledge to assess species at risk of extinction or extirpation from Canada. Assessment of the potential for the project to impact plant species listed by COSEWIC.

Federal Policy on Wetland Conservation

Wetlands are defined as land that is saturated for long enough to promote wetland or aquatic processes such as redox in soils, hydrophytic vegetation or various biological activity that are adapted to a wet environment (National Wetlands Working Group 1997).

The objective of the Federal Policy on Wetland Conservation is to conserve wetlands to sustain ecological and socio-economic functions through enhancement and rehabilitation, securement, maintenance and utilization (Government of Canada 1991). Ecological functions include water filtration and storage, flood attenuation, habitat, carbon sequestration, nutrient cycling, and socio-economic functions include hunting and trapping, recreation and tourism, natural heritage areas and agriculture. The Federal Policy on Wetland Conservation applies to wetlands on federal lands and waters and those that receive federal funding (lands under federal jurisdiction). Although the Federal Policy on Wetland Conservation provides guidance on wetland management, management of wetlands is a provincial responsibility and requires approval by Alberta Environment and Parks (AEP).

10.1.1.2 Provincial Regulations and Policies

Wildlife Act

In Alberta, plant species of management concern with legislated protection include species listed federally under *SARA* as well as species listed as endangered or threatened under the *Alberta Wildlife Act*, Wildlife Regulation 143/1997.

Other SOMC in Alberta are those listed as tracked or watched by the Alberta Conservation Information Management System (ACIMS) (ACIMS 2016a), or listed as *at risk*, may be at risk, or *sensitive* by the General Status of Alberta wild Species 2010 (SRD 2011). SOMC that are listed under ACIMS and the General Status of Alberta Wild Species are not protected by specific legislation, restricted timing of works or setback distances; however, they are important contributors to biodiversity in Alberta and are considered rare or uncommon.

In addition to plant SOMC, ecological communities listed as tracked or watched by ACIMS are considered rare (ACIMS 2016a). Rare ecological communities may have land use best management practices, but are not protected by specific legislation.

Alberta Wetland Policy and Water Act

Disturbance to wetlands on private or provincial land requires approval under the Alberta *Water Act* and must follow the goals of the *Alberta Wetland Policy* (Government of Alberta 2013a). The goal of the *Alberta Wetland Policy* is to conserve, restore, protect and manage wetlands in Alberta. The policy covers natural and restored wetlands including fens, bogs, swamps, marshes, creeks, rivers and drainages. Ephemeral waterbodies are areas affected by the water table

near the surface but the effect is not long enough for the water table to alter soils or result in water tolerant vegetation dominating the area (ESRD 2015b). Due to the lack of water-altered soils and water tolerant vegetation, ephemeral waterbodies are not subject to replacement under the *Water Act*, but impact to them are subject to the Act. Ephemeral waterbodies are included in the wetland landscape type.

Effects on wetlands require approval under the *Water Act*.

Weed Control Act

Alberta's *Weed Control Act* requires landowners and disposition holders to destroy plants listed as *prohibited noxious* and control populations of plants listed as *noxious* (regulated weeds). The *Alberta Weed Control Regulation* lists plants designated as *prohibited noxious* or *noxious* because these species are known to have a negative economic impact and degrade native plant communities.

10.1.2 Engagement and Key Concerns

Alberta Transportation held open houses to consult with public stakeholders about the project. Key issues identified related to vegetation and wetlands during this process were changes to diversity and effects on traditionally used plants and species at risk.

Public engagement identified concerns about non-native invasive species. Non-native invasive species—such as Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), timothy (*Phleum pretense*), and sweet clovers (*Melilotus officinalis* and *M. alba*)—are not regulated. However, they are aggressive competitors of native species (Government of Alberta 2010a). When established, they can negatively affect the health of native plant communities (Lancaster et al. 2016 and Government of Alberta 2015a). Information on these species was gathered as part of this assessment.

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 process and will continue until a decision is made by Natural Resources Conservation Board. 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. Alberta Transportation has 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 TUS 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 Environmental Impact Assessment, 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 vegetation and wetland 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. Generally, issues and concerns related to effects of industrial development on vegetation and wetlands, as reported by Indigenous groups through the review of Project-specific and publicly-available TLRU information, include:

- effects on traditional use of plants for harvesting and medicinal use
- loss of wetland area
- effects on sensitive ecosystems
- effects on wetland function

The Tsuut'ina Nation expressed concern that habitat may be damaged, including sensitive fescue grassland and wetland ecosystems, that could result from contaminated sediment left behind from flood waters or debris. The Tsuut'ina Nation also expressed concern that construction activities would result in the loss or alteration of wetland habitat. The Tsuut'ina Nation noted that the Project may have impacts to plant harvesting, including medicinal plants. Tsuut'ina citizens rely on various medicinal plants that grow on the sensitive riparian areas of the Elbow River and its tributaries as well as the wetlands.

The Siksika Nation expressed concern about impact on wetlands and medicinal plants. The Siksika Nation requested to have their "Elders involved when medicinal plants and Traditional Knowledge is being assessed."

The Siksika Nation noted "the seepage area between the reservoir and the Elbow River situated between the intake and discharge channels, that will likely become impacted by water seeping

from the reservoir, access channel or discharge channel and by project construction activities, the downstream waters and riparian areas that will be impacted by instream project construction activity ... and, upstream high bank riparian impacts resulting from the rapid rise in upstream flood waters above levels that would otherwise occur when the flood control structure is raised during a floor to divert waters to the reservoir."

The Siksika Nation noted "During the construction period, there will be substantial instream project work as the control structure and access channels are built. This ...will have obvious instream and riparian impacts on Siksika Traditional Use in areas A [off-stream storage dam], C [downstream Elbow River]and D [upstream high bank riparian impacts] ...."

The Siksika Nation noted "During a major flood there may be an initial upstream surge of water as the gates are raised on the control structure to divert water to the reservoir. This upstream surge may flood high bank riparian areas that would not otherwise be impacted if the flood were permitted to proceed naturally."

Siksika Nation requested the information on plants gathered during the project site investigations be shared with the Nation.

The Piikani Nation expressed concern about impact on wetlands and requested the information on plants gathered during the project site investigations be shared with the Nation.

The Stoney Nakoda Nations expressed concerns about effects on water and wetlands for wildlife, fish, birds, and vegetation.

Kainai First Nation concerned about impact on wetlands and the loss of medicinal plants. The Kainai First Nation requested the information on plants gathered during the project site investigations be shared with the Nation.

The Metis Nation of Alberta (MNA) Region 3 requested to review studies that were undertaken to see what rare plants, archaeological sites, etc. had been discovered, to ensure that no burial sites or medicinal plant sites would be affected.

The Louis Bull Tribe expressed concerns about the loss of medicinal plants.

The Ermineskin Cree Nation expressed concerns about the loss of medicinal plants. Erminsekin Cree Nation expressed concerns about medicinal plants in the area and would like any project built in the area to preserve and allow for natural growth.

As of January 1, 2018, no project-specific intangible concerns were identified with respect to vegetation and wetlands.

10.1.3 Potential Effects, Pathways and Measurable Parameters

Construction and dry operation may affect vegetation and wetlands through loss or alteration of vegetation and wetland species and communities, from dust deposition, or introduction and establishment of regulated weeds and non-native invasive species. Potential environmental effects, the effect pathway and measurable parameters used to assess potential effects on vegetation and wetlands are provided in Table 10-1.

Where possible, assessment of potential effects of construction and dry operation on vegetation and wetlands use measurable parameters that are quantifiable (e.g. area of direct vegetation loss). However, not all effects pathways can be quantified (i.e., indirect effects on plant SOMC, introduction and establishment of regulated weeds). Therefore, some effects on vegetation and wetlands are predicted qualitatively through use of scientific literature, professional judgement and project experience.

Table 10-1 Potential Effects, Effects Pathways and Measurable Parameters for Vegetation and Wetlands

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in landscape diversity	• Fragmentation of native plant community patches arising from native vegetation clearing	• Number of native plant community cover type patches • Mean patch area (ha) of native plant community cover types • Mean perimeter (edge) length (km) of native plant community cover type patches
Change in community diversity	• Direct loss or alteration of native vegetation communities, including riparian lands and ecological communities of management concern arising from native vegetation clearing	• Area (ha) of native upland and wetland plant communities lost or altered • Area (ha) of rare ecological communities lost or altered • Risk of the introduction or spread of weeds and other non-native invasive plant species that are aggressive competitors to native species and rare plants
	• Indirect alteration of native communities, including riparian lands and ecological communities of management concern from the introduction or establishment of regulated weeds and invasive species or deposition of dust	

Table 10-1 Potential Effects, Effects Pathways and Measurable Parameters for Vegetation and Wetlands

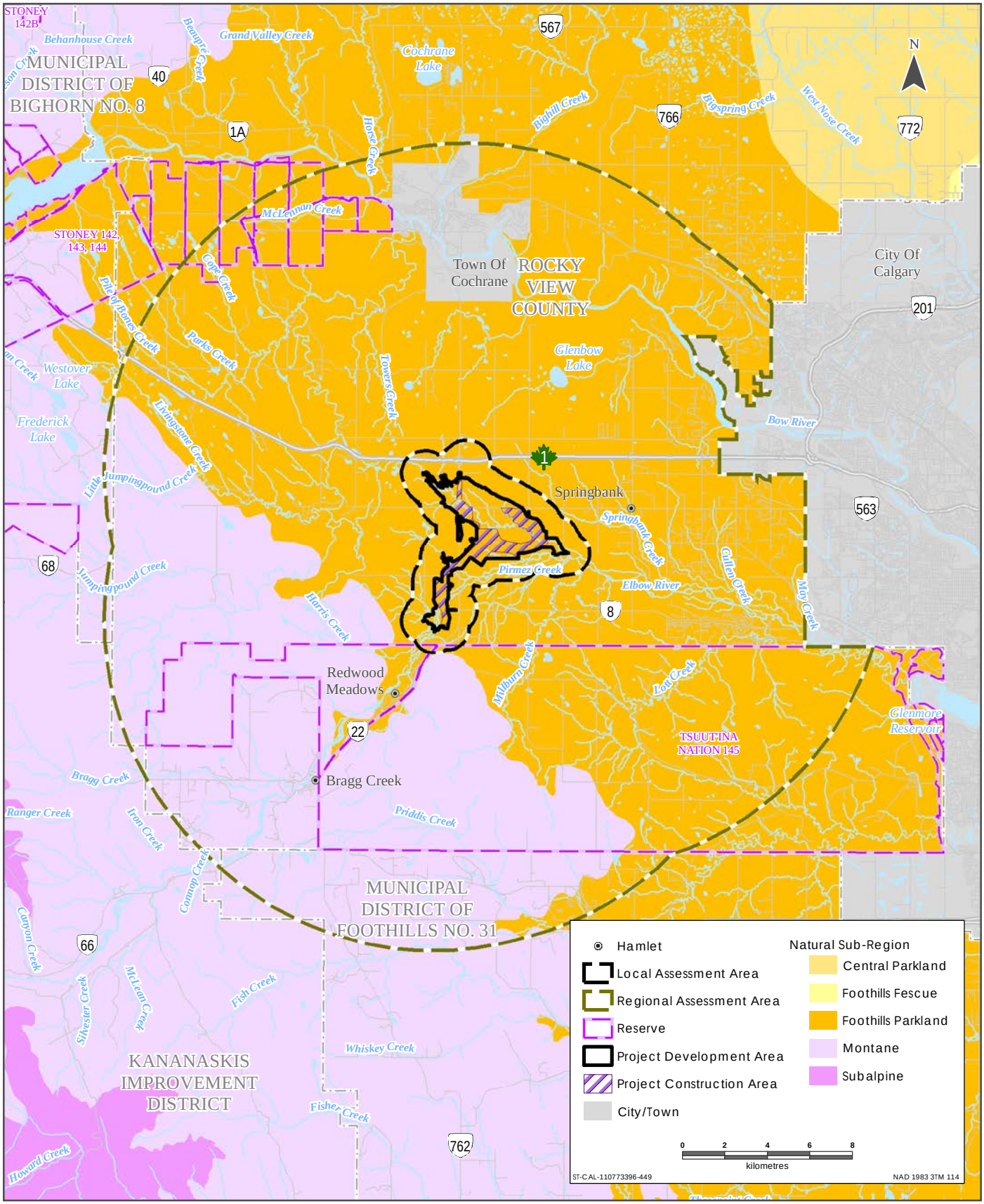
Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in species diversity	• Direct loss of a plant SOMC or traditional use plant species due to vegetation clearing	• Number of SOMC occurrences affected by the Project • Occurrences of traditional plants resources affected by the Project • Area (ha) of *Species at Risk* critical habitat lost or altered (Government of Canada 2016a)
	• Indirect effects on plant SOMC or traditional use plant species from herbicide application to control the spread of regulated weeds	
Change in wetland functions	• Direct loss or alteration of wetland area or change in wetland type from vegetation clearing or deposition of dust • Direct loss or alteration of surface or groundwater flow patterns	• Area (ha) or type of wetland lost or altered • Change in wetland value
	• Indirect loss or alteration of wetland area or wetland type because of vegetation clearing and ground disturbance • Indirect alteration of surface and groundwater flow patterns	

10.1.4 Boundaries

10.1.4.1 Regional Boundaries

Direct and indirect project effects are assessed for vegetation and wetlands using a 4,860 ha local assessment area (LAA), which consists of the project development area (PDA) and a 1 km buffer (Figure 10-1). Changes to community and species diversity and wetland functions are assessed at the LAA scale.

The regional assessment area (RAA) (Figure 10-1) is 102,817 ha, consisting of a 15 km buffer around the PDA. The RAA was selected to assess project-specific effects on vegetation and wetlands in the regional context. The RAA was selected 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. Changes in landscape diversity are assessed for the RAA because these types of changes may affect vegetation composition and structure, which in turn may influence use of the area by wildlife.



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - ERBC, Government of Alberta, Stantec Ltd

Vegetation and Wetlands Spatial Boundaries

Stantec

10.1.4.2 Temporal Boundaries

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 would occur indefinitely (i.e., permanent installation) after construction, with periods of dry operations alternating with flood and post-flood phases.

10.1.5 Residual Effects Characterization

Table 10-2 presents definitions for residual environmental effects on vegetation and wetlands.

Table 10-2 Characterization of Residual Effects on Vegetation and Wetlands

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 vegetation and wetlands relative to existing conditions. Adverse – a residual effect that moves measurable parameters in a direction detrimental to vegetation and wetlands relative to existing conditions. Neutral – no net change in measurable parameters for the vegetation and wetlands relative to existing conditions.
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible – no measurable change in vegetation or wetlands Low – a measurable change in upland native plant communities, but unlikely to affect sustainability in the RAA and no effect on rare ecological communities and plant SOMC Moderate – measurable change affecting the sustainability of upland native plant communities, wetlands or ecological communities and plant SOMC in the LAA, but unlikely to affect sustainability in the RAA High – measurable change affecting the sustainability of upland native plant communities, wetlands or rare ecological communities or plant SOMC in the RAA
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

Table 10-2 Characterization of Residual Effects on Vegetation and Wetlands

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
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
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

10.1.6 Significance Definition

A significant effect on vegetation and wetlands after the application of avoidance and mitigation measures is one that:

- threatens the long-term persistence or viability of a plant species or community in the RAA, including effects that are contrary to or inconsistent with the goals, objectives or activities of recovery plans, action plans and management plans, or
- results in unreplaced loss or disturbances of wetlands that has not been given prior approval by Alberta Environment and Parks, or
- threatens the long-term availability of traditionally use plants within the regional assessment area.

10.2 EXISTING CONDITIONS FOR VEGETATION AND WETLANDS

10.2.1 Methods

Published literature, existing vegetation databases, and technical reports were reviewed for information on existing conditions for vegetation and wetlands in the LAA and RAA. Sources included information on species abundance and distribution, vegetation and wetland plant community composition and traditional use of plants within the RAA and LAA. Field surveys of the PDA were also conducted.

10.2.1.1 Existing Data

Vegetation and wetland data in the LAA and RAA was obtained from the following published resources:

- Aerial Photography (1927, 1962, 1974, 1979, 1982, 2008 and 2014)
- Agriculture and Forestry Weed Survey Results (Alberta Agriculture and Forestry 2016).
- Alberta Merged Wetland Inventory (AEP 2015a)
- Alberta Conservation and Information Management System (ACIMS 2016b)
- AMEC Earth & Environmental 2009
- Energy East Pipeline Ltd. 2016, Riversdale 2015
- Fish and Wildlife Management Information System (FWMIS, AEP 2015b)
- General Status of Alberta Wild Species (ESRD 2012a)
- Grassland Vegetation Inventory (SRD 2011)
- Natural Regions and Subregions of Alberta (Natural Regions Committee 2006)
- Species at Risk Public Registry (Government of Canada 2016b)

Local Assessment Area Vegetation and Wetland Mapping

Vegetation and wetland communities in the LAA were mapped using grassland vegetation index (GVI), aerial imagery and LiDAR. GVI polygons were subdivided through interpretation of available aerial imagery and LiDAR data. Each GVI polygon was reviewed for variations in texture, colour, slope and topographic position to infer changes in moisture and nutrient regimes and associated changes in vegetation. GVI polygons were divided if more than one land unit or ecosite was observed to a minimum polygon size of 0.125 ha. Upland land units (ecosites) were classified using Range Plant Communities and Range Health Assessment Guidelines for the Foothills Parkland Subregion of Alberta (ESRD 2012b).

Historical aerial photography corresponding to dry, wet, and near normal conditions were used to help identify and classify wetlands and ephemeral waterbodies and their boundaries. Current and historical aerial photographs were reviewed for water permanence: the presence of standing water and areas lacking standing water, but with evidence of past standing water (i.e., bare ground, presence of salt or carbonates, patchy vegetation). The Alberta Merged Wetland Inventory (AEP 2015b) spatial layer was also consulted to assist in the identification and classification of wetlands. Wetlands were mapped following the *Alberta Wetland Identification and Delineation Directive* (Government of Alberta 2015a).

Mapping was reviewed following field surveys and revised where necessary.

Wetlands were classed to wetland type using the *Alberta Wetland Classification System* (ESRD 2015b). Wetland type was determined by the vegetation zone representing the deepest and most permanent water, occupying greater than 25% of the total wetland or waterbody area.

Regional Assessment Area Vegetation and Wetland Mapping

Vegetation and wetland mapping in the RAA was done to cover type level. Cover types are less detailed than ecosite phase and represent broader groupings of dominant canopy type and strata (e.g., broadleaf forest, shrubland, native grassland), and land use (e.g., agricultural, settled). Mapping at the RAA was done to cover type level because the level of detail needed to map to ecosite level was not available throughout the RAA.

Cover types were derived by integrating GVI, Phase -1 Project Area (SRD 2011) and Alberta Biodiversity Monitoring Institute (ABMI) Land Cover Classification (LCC) spatial data (ABMI 2010). GVI classifies the landscape into five broad land classes (upland, wetland, agricultural, industrial and settled), which are further classified into 32 site types (SRD 2011). Each polygon can be attributed with up to four different site types (complex polygon). Within each polygon, the percentage of the area representing each site type is also provided.

GVI upland site types did not provide enough information about dominant vegetation canopy type and strata (e.g., broadleaf forest, shrubland), and focused mostly on soil characteristics (e.g., sandy, clayey) LCC classifies the landscape into eleven land cover classes, and unlike GVI, gives information on dominant canopy type and strata. Therefore, GVI site types were used to classify wetlands, agriculture, industrial and settled land classes, and LCC was used to classify upland land classes.

To calculate number, area and perimeter of patches at the RAA, complex GVI polygons were simplified to the dominant site type occupying the greatest proportion of the polygon. Where site type proportions were equal, site types were prioritized from high to low based on the sensitivity of the site type. For example, wetland site types are sensitive to disturbance and were given a higher priority over agricultural site types. The resulting dominant GVI site types and unchanged LCC polygons were grouped into cover types at the RAA scale. Developed, pits, rural and urban cover types were grouped into the disturbed cover type. The agriculture cover type is made up of agriculture, crop (irrigated) and crop (non-irrigated) cover types. Lotic (coniferous), lotic (deciduous), lotic (herbaceous) and lotic (shrub) were grouped in the riparian cover type. Lotic (river) and lentic (open water) were grouped in to the water cover type. The wetland cover type is made up of lentic (alkali), lentic (seasonal), lentic (semi-permanent to permanent) and lentic (temporary). Tame pasture or hay (irrigated), tame pasture or hay non-irrigated were grouped into tame pasture or hay. Remaining cover types were not grouped.

Due to the scale of GVI spatial data, wetland area may be overestimated in the RAA. The Alberta Merged Wetland Inventory spatial data (AEP 2015a) identifies and classifies wetlands in Alberta and integrates spatial data from the Ducks Unlimited Wetland Inventory (Ducks Unlimited Canada 2006) in the RAA. Although the Alberta Merged Wetland Inventory data was reviewed and used to inform mapping, it was not used at this scale because it is older than GVI.

Species and Ecological Communities of Management Concern

Prior to conducting field surveys, the ACIMS element occurrence database (ACIMS 2016b) was reviewed for rare ecological community and SOMC occurrences in the RAA. Species and ecological community tracking and watch list for the for the Foothills Parkland Natural Region (ACIMS 2016c) was also used to help direct rare plant survey locations, focusing on areas with higher potential for rare plants, such as sandy blowouts, and identifying plant species and ecological communities of management concern with potential to occur in the PDA.

Traditional Use Plants

Traditional use plants were identified through Project-specific TUS conducted by potentially affected Indigenous groups, through the results of Alberta Transportation's Engagement program, and through a review of publicly-available literature. The following sources were reviewed:

- Energy East Project Consolidated Application Environmental and Socio-economic Assessment Volume 25, Binder 2: Mitigation Tables – Prairies Region Traditional Land and Resource Use Information and Mitigation Tables Piikani Nation (Energy East Pipeline Ltd. 2016)
- Kainai First Nation Traditional Land Use and Occupancy Study Summary report for the Montana Alberta Tie Ltd. International Power Line Project (AMEC Earth & Environmental 2009)
- Piikani First Nation Traditional Land Use and Occupancy Study Supplemental Environmental Impact Assessment for the Montana Alberta TIE LTD. International Power Line Project. (AMEC Earth & Environmental 2010)
- Eastern Alberta DC Transmission Line, Application 1607153, Proceeding I.D. No. 1069. Samson Cree Nation Affidavits (MacPherson Leslie & Tyerman LLP Lawyers 2011)
- Oral statement at public hearing for the Enbridge NGP, Northern Gateway Pipelines Inc. Hearing Order OH-4-2011. Joint Review Panel Hearings. Samson Cree Nation (Enbridge 2012)
- Prince Rupert Gas Transmission Project Section 33 Aboriginal Consultation Part C – Aboriginal Consultation Application for an Environmental Assessment Certificate. (Trans Mountain Pipeline ULC 2013)
- Hearing Order GH-002-2015 NOVA Gas Transmission Ltd. Volume 3: Samson Cree Nation Oral Traditional Evidence (National Energy Board 2015)
- Benga Mining Ltd. Grassy Mountain Coal Project, Section H: Aboriginal Groups Consultation and Assessment Grassy Mountain Coal Project (Riversdale Resources 2015) Springbank Off-Stream Reservoir Project. Letter to Canadian Environmental Assessment Agency (Tsuut'ina Nation 2016)

Plants listed in the reports were considered traditionally used by Indigenous communities. Some traditionally used species may not have been documented because traditionally used species names did not correspond to recognized common names used in Alberta.

Regulated Weeds

Historical weed data from Calgary (Alberta Agriculture and Forestry 2016) was compiled to determine which regulated weed species have potential to occur in the RAA. Observations of regulated weeds were recorded during field surveys of the PDA.

Wetland Functions

Wetland function was assessed using the *Alberta Wetland Rapid Assessment Tool – Estimate of Relative Wetland Value by Section* (Government of Alberta 2015c).

10.2.1.2 Field Surveys

Field surveys were conducted in the PDA to evaluate vegetation and wetland mapping, and to confirm the presence of regulated weeds and non-native invasive plants, SOMC, wetlands, ecological communities of management concern, and traditionally used plant species.

SOMC and Rare Ecological Community Surveys

Surveys for SOMC and ecological communities of concern were targeted, focusing on native plant communities, wetlands, riparian areas, and locations of previously documented SOMC. Unusual areas with variable micro-sites not visible from aerial photographs were surveyed as encountered in the field.

Survey methods followed the Alberta Native Plant Council Guidelines for Rare Vascular Surveys (Alberta Native Plant Council 2012), with at least two surveys per quarter section conducted to account for different flowering times of plants, one spring and one summer. At each survey site, a 10 x 10 m plot was established within the plant community. A meander survey was completed within the plot and continued until no new plant species were found. Site information, including slope and slope position, moisture and nutrient regime, light conditions and ground cover (e.g. litter, bare ground), were recorded and used to classify each site to ecosite phase. Easting and northing coordinates were collected using a handheld global positioning system unit (GPS). Specimens requiring further examination or species confirmation were collected, with the exception of plants where seed heads or flowers required for identification to species level were unavailable or where plant populations were small (i.e., less than 50 plants).

If a tracked or watch list species was encountered, easting and northing coordinates were recorded. Photographs were taken of the specimen and notes made on the development stage and health. A population estimate was made and, if possible, the extent delineated. If more than 50 plants were present, a specimen was collected for confirmation by the herbarium. Scientific names of plant species follow the Integrated Taxonomic Information System (2016), common names follow ACIMS (ACIMS 2016b).

Wetland Surveys

Wetlands were surveyed in June, July and August. Wetlands were surveyed following the *Alberta Wetland Identification and Delineation Directive* (Government of Alberta 2015b).

Soils, hydrology and vegetation were examined to confirm a wetland or ephemeral waterbody was present and, if so, classify the feature according to the AWCS. The following methods were used:

- Soils were examined using a shovel to a depth of 29 cm, the active rooting zone, in the outermost community of the potential wetland. The depth, texture, color, structure and abundance of redox features (i.e., gleys and mottling) in each soil horizon were recorded. Redox features in the upper soil profile develop under conditions of inundation or saturation over a long period of time and are, therefore, used to determine the extent of each wetland and waterbody. The area was considered a wetland if redox features were recorded within the top 29 cm and plant species characteristic of wet conditions were also recorded. Areas were considered ephemeral waterbodies if they lacked hydric soil indicators in the top 29 cm, but had plant species characteristic of ephemeral flooding.
- Wetland and ephemeral waterbody hydrology indicators were assessed qualitatively by:
  - observing whether surface water was present at the site
  - looking for evidence of recent saturation or ponding
  - observing the topography of the site, including any landscape features that would lead to water accumulation. Evidence of these features includes watermarks on woody vegetation or anthropogenic features, sediment or drift deposits and algal crusts. Quantitative measurements of hydrological indicators include water depth and depth to saturation (depth at which soil pores are saturated).
- Vegetation communities larger than 10 by 10 m (or equivalent) were sampled within the wetland and ephemeral waterbody using three 1 m^2 vegetation subplots, for wetland intersected by major components of the project and one 1 m^2 vegetation subplot in for the rest of the sampled wetlands within the PDA. Discontinuous communities were sampled by placing subplots in different patches of the same community. Each subplot was assessed for percent cover of dominant vascular species and percent cover of total vascular species, non-vascular species, litter, bare ground and open water. Outside the subplots, a random meander was conducted to document less common species. Unidentifiable species were collected for later identification.

The boundary of assessed wetlands and ephemeral waterbodies was also walked in the field. GPS tracks were collected and used to assist with mapping refinement.

10.2.2 Existing Condition Overview

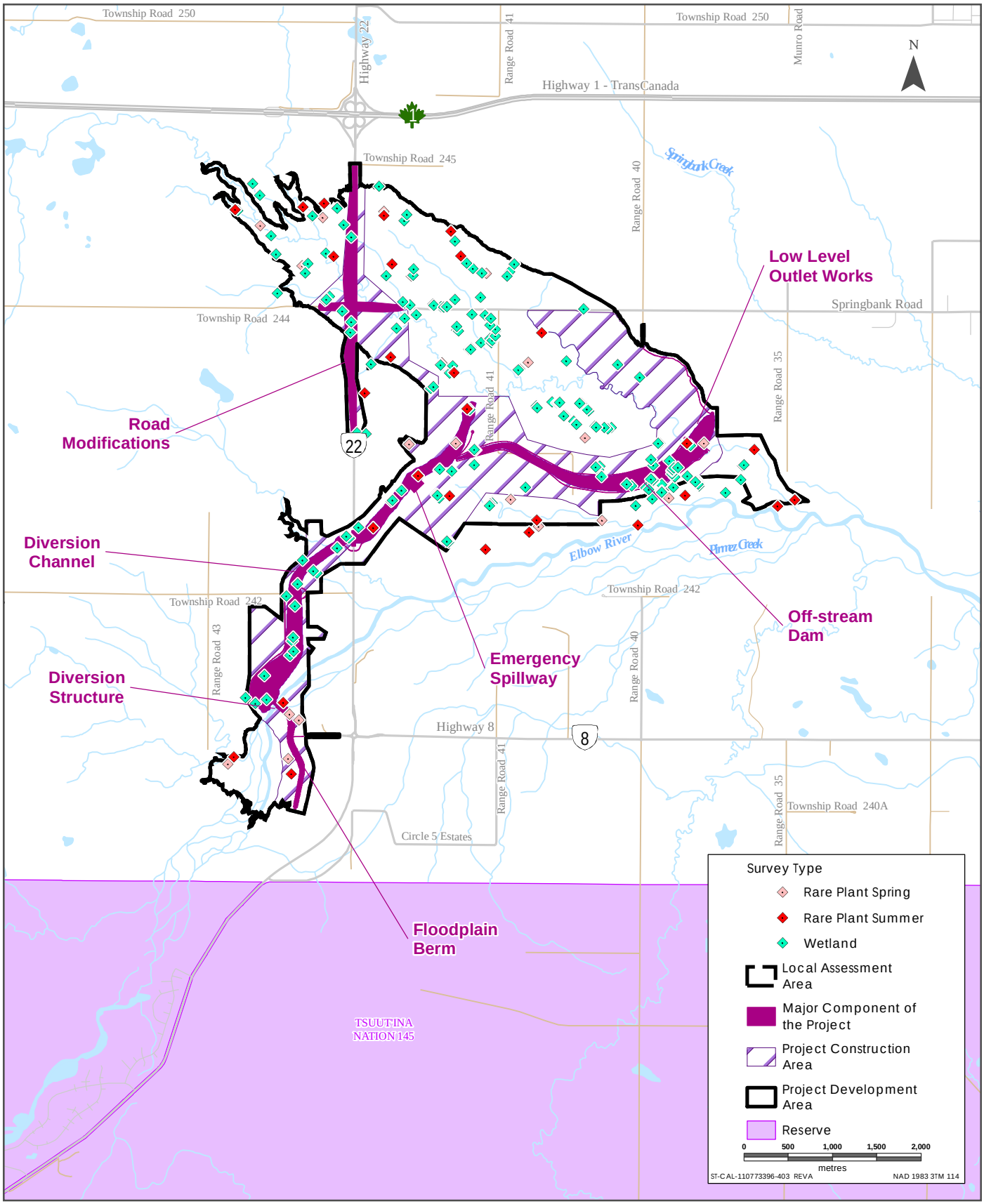
In 2016, 250 site locations were surveyed in the PDA, which included spring (20) and summer (28) rare plant surveys and wetland surveys (202) (Figure 10-2). Twenty spring rare plant surveys were conducted from June 20 – 24, 2016 and 28 summer rare plant surveys were conducted from August 22 – 26, 2016. The 202 wetland surveys were completed on June 25, July 4 to 11 and August 26, 2016.

10.2.2.1 Landscape Diversity

The current state of vegetation and wetlands within the RAA is the result of past land use, mainly agriculture and settlement. Currently, the landscape of the RAA is a mosaic of agriculture and native grassland cover types with small remnant vegetation patches largely less than 5 ha in size (Table 10-3). Coniferous and broadleaf forest cover types also exist as numerous patches, with the average patch being 33.9 and 19.7 ha, respectively. However, the distribution of coniferous and broadleaf patch areas is skewed, with most patches being less than the average area in size. Wetlands and riparian cover types are generally small patches, with most being less than 5 ha.

Table 10-3 Vegetation and Wetlands Patches in the RAA

Cover Type	Number of Patches	Average Patch Area (ha)	Average Patch Edge (km)
Broadleaf Forest	300	33.9	2.9
Coniferous Forest	390	19.7	2.2
Mixed Forest	189	33.6	2.9
Shrubland	124	21.6	2.1
Native Grassland	785	35.6	2.7
Exposed Land	32	2.2	0.6
Water	428	3.9	1.2
Riparian	154	6.8	1.9
Wetland	268	3.6	0.9



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

Field Survey Locations

Stantec

10.2.2.2 Community Diversity

The LAA is largely composed of agriculture land (48.2%), with annual crop and tame pasture being the dominant land units (Figure 10-3, Table 10-4). The most common native plant communities within the LAA are forested areas (16.3%), native grasslands (8.7%) and shrubland (8.4%).

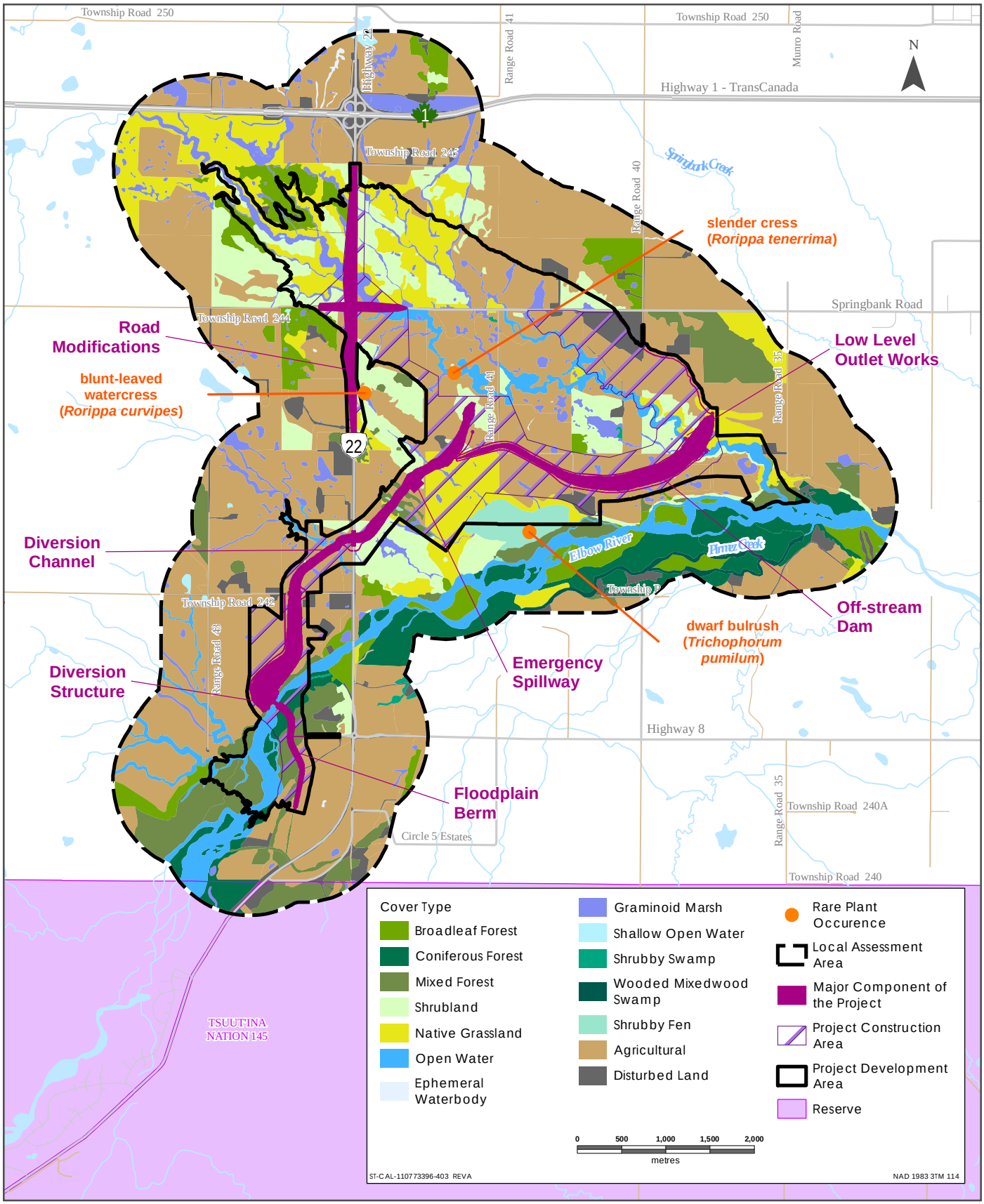
Forested areas are largely restricted to areas bordering the Elbow River and large patches near the intersection of Range Road 40 and Springbank Road, and west of Highway 22 near Township Road 244 (Figure 10-3, Table 10-4). Mixed forest is the most common forest type, occupying 296 ha (6.1% of the LAA), followed by roughly equal area of broadleaf (252 ha, 5.2% of the LAA) and coniferous forest (245 ha, 5.0% of the LAA). Thirteen forest ecosite phases were mapped with most occupying less than 90 ha.

Native grassland is largely ecosite phase c1 – rough fescue (382 ha, 7.9% of the LAA) and shrubland areas are mostly beaked willow (*Salix bebbiana*) f3 ecosite phase (309 ha, 6.4% of the LAA). Native grassland and shrublands are more common in the northwest portion of the LAA, particularly bordering Highway 22 and near Highway 1, and east of Highway 22 on the north side of the Elbow River.

Wetlands occupy 6.4% of the total area (Table 10-4). The most common wetland type is seasonal graminoid marsh (102.7 ha, 2.1% of the LAA) followed by temporary graminoid marsh (92.9 ha, 1.9% of the LAA). The remaining wetland types each occupy less than 1% of the LAA and consist mainly of moderate-rich shrubby fen (42.6 ha), semi-permanent graminoid marsh (34.7 ha) and seasonal wooded mixedwood swamp (20.3 ha). Graminoid marshes, shallow open water and swamps are mineral wetlands (less than 40 cm of peat), whereas shrubby fens are peat-accumulating wetlands (greater than 40 cm of peat) (National Wetlands Working Group 1997).

Wetlands are widely dispersed in the LAA, but most occur along drainages and adjacent to the Elbow River (Figure 10-3). A large wetland occurs just north of Highway 1, a temporary marsh; however, most graminoid marshes are small scattered ponds with an average size of 0.68 ha, occurring mainly in agriculture land. Many wetland types surveyed lacked defined inlets and outlets and appear to be closed basins; however, those with inlets and outlets are located along drainages.

Areas of open water in the LAA are the Elbow River, unnamed watercourses, and drainages. The Elbow River is the largest area of open water in the LAA. Unnamed watercourses are generally tributaries to the Elbow River and likely convey water seasonally for a few months and then likely become dry later in the growing season in most years.



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

Vegetation and Wetlands in the Local Study Area

Stantec

Table 10-4 Vegetation and Wetland Cover Types in the LAA

Cover Type	Land Unit[a,b]	ha	%
Broadleaf Forest	b2 Hairy wild rye Aw	0.2	<0.1
	d1 Pine grass Aw	21.3	0.4
	e1 Snowberry-silverberry Aw-Pb	89.8	1.8
	f2 Red osier dogwood Pb-Aw	67.1	1.4
	g2 Horsetail Aw-Pb	73.4	1.5
Coniferous Forest	b4 Hairy wild rye Sw	59.1	1.2
	d3 Pine grass-Sw	6.8	0.1
	g1 Horsetail Sw	179.3	3.7
Mixed Forest	b3 Hairy wild rye Aw-Sw-Pl	109.9	2.3
	d2 Pine grass-Sw-Pl-Aw	2.5	0.1
	e2 Snowberry-silverberry Sw	81.9	1.7
	e4 Snowberry-silverberry Sw-Aw	16.1	0.3
	f1 Red osier dogwood Sw	85.7	1.8
Shrubland	e3 Shrubland - mesic/rich	99.0	2.0
	f3 Shrubland - subhygric/rich	309.5	6.4
Native Grassland	b5 Grassland - submesic/medium	37.9	0.8
	c1 Rough fescue	381.8	7.9
	f4 Grassland - subhygric/rich	5.4	0.1
Upland Subtotal		***1626.5***	**33.5**
Open Water	Open Water	283.5	5.8
Open Water Subtotal		***283.5***	***5.8***
Ephemeral Waterbody	Ephemeral Waterbody	5.0	0.1
Graminoid Marsh	Temporary graminoid marsh	92.9	1.9
	Seasonal graminoid marsh	102.7	2.1
	Semi-permanent graminoid marsh	34.7	0.7
Shallow Open Water	Shallow open water with submersed and/or floating aquatic vegetation	7.2	0.1
	Saline shallow open water with submersed and/or floating aquatic vegetation	0.9	<0.1
Shrubby Swamp	Seasonal shrubby swamp	5.3	0.1
Wooded Mixedwood Swamp	Seasonal wooded mixedwood swamp	20.3	0.4
Shrubby Fen	Moderate-rich shrubby fen	42.6	0.9
Wetland Subtotal		***311.6***	***6.4***

Table 10-4 Vegetation and Wetland Cover Types in the LAA

Cover Type	Land Unit[a,b]	ha	%
Agricultural	Annual crop	547.2	11.3
	Dugout	2.0	<0.1
	Hayland	469.5	9.7
	Tame pasture	1325.2	27.3
Disturbed Land	Disturbed land[c]	294.6	6.1
	Anthropogenic Subtotal	***2638.4***	***54.3***
	Grand Total	**4860**	**100**

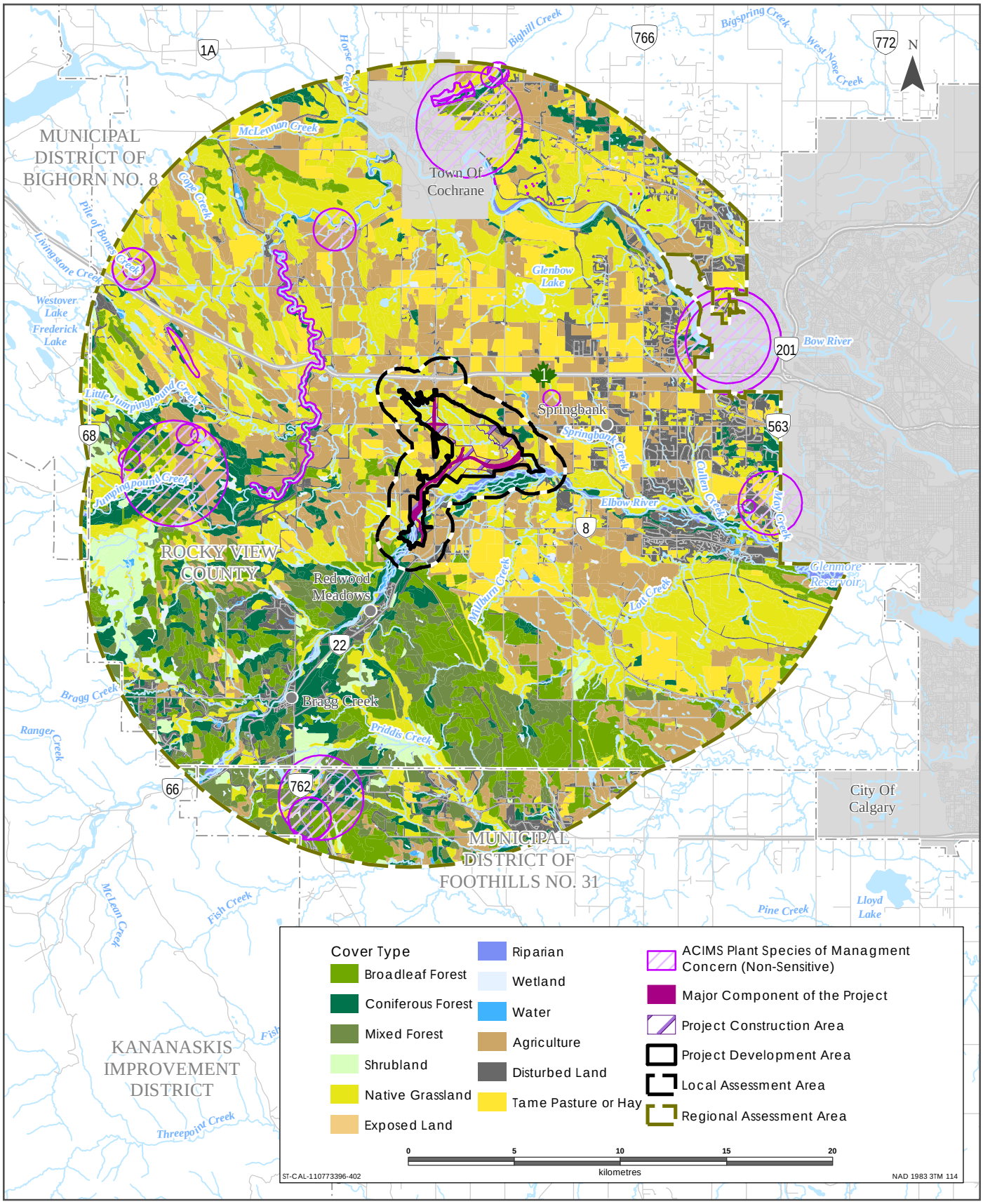
NOTES:
Aw – aspen (*Populus tremuloides*)
Pb – balsam poplar (*Populus balsamifera*)
Pl – lodgepole pine (*Pinus contorta*)
Sw – white spruce (*Picea glauca*)
[a] Upland land units (ecosites) were classified using Range Plant Communities and Range Health Assessment Guidelines for the Foothills Parkland Subregion of Alberta (ESRD 2012b)
[b] Wetland land units classified using the Alberta Wetland Classification System (ESRD 2015b)
[c] Disturbed land includes industrial facilities, disturbed land, transportation and rural residential land unit types

10.2.2.3 Species Diversity

A total of 313 species were observed during 2016 surveys (see Volume 4, Appendix L, Attachment 10A). Forbs represented the majority with 189 species, followed by graminoid plants with 79 species and shrubs with 38 species. The remaining species included three trees and two fern allies.

Plant Species and Ecological Communities of Management Concern

Three ecological communities of management concern were previously documented in the RAA. One fern, two forbs, twelve lichens, two liverworts, fourteen mosses, one shrub and one tree species of management concern have also been previously identified within the RAA (Figure 10-4). The closest previously recorded SOMC to the PDA were, one lichen species, soot lichen (*Cyphelium notarisii*), was observed in native grassland approximately 2 km northeast of the PDA and one shrub species, mountain gooseberry (*Ribes inerme*), was observed along Jumpingpound creek approximately 3.5 km to the west of the PDA (Figure 10-4, Table 10-5). The two species are not listed under SARA or by COSEWIC (Government of Canada 2016b) and are not listed as threatened or endangered under the Alberta General Status Listings (ESRD 2012a). Both species are on the provincial tracking list (ACIMS 2016c).



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - Alberta Environment and Parks (AEP), Alberta Conservation Information Management System (ACIMS), ERBC, Government of Alberta, Stantec Ltd

Vegetation and Wetlands in the Regional Assessment Area

Table 10-5 ACIMS Plant Species of Management Concern Occurrences in the RAA

Plant Form/ Community	Scientific Name	Common Name	Provincial Rank		Federal Rank		Habitat
			ACIMS Rank[a]	Alberta General Status[b]	COSEWIC[c]	SARA[c]	
Ecological Community	*Betula occidentalis* grassland riparian shrubland	water birch grassland riparian shrubland	S2S3	Not listed	Not Listed	Not Listed	found on alluvial terraces, streambanks and abandoned channels[d]
Ecological Community	*Elymus lanceolatus - Stipa comata*	northern wheat grass - needle-and-thread	S2	Not listed	Not Listed	Not Listed	found on gently-sloped floodplains, glaciofluvial or glaciolacustrine deposits[e]
Ecological Community	*Schizachyrium scoparium - Calamovilfa longifolia*	little bluestem - sand grass	S2	Not listed	Not Listed	Not Listed	found on south-facing coarse-textured slopes along rivers and coulees [f]
Fern or Fern Allies	*Pellaea glabella* ssp. *simplex*	smooth cliff brake	S2	Not listed	Not Listed	Not Listed	Calcareous cliffs and ledges[g]
Forb	*Potentilla macounii*	Macoun's cinquefoil	S1	*may be at risk*	Not Listed	Not Listed	Outcrops, gravel banks, rocky outcrops and prairies[g]
Forb	*Ruppia cirrhosa*	widgeon-grass	S3	*sensitive*	Not Listed	Not Listed	Edges of lakes with high sulfur or calcium concentrations[g]
Lichen	*Acarospora veronensis*	cobblestone lichen	S2	Not listed	Not Listed	Not Listed	found on various kinds of rock[h]
Lichen	*Caloplaca trachyphylla*	desert firedot lichen	S2S4	Not listed	Not Listed	Not Listed	exposed rocks in relatively dry areas[h]

Table 10-5 ACIMS Plant Species of Management Concern Occurrences in the RAA

Plant Form/ Community	Scientific Name	Common Name	Provincial Rank		Federal Rank		Habitat
			ACIMS Rank[a]	Alberta General Status[b]	COSEWIC[c]	SARA[c]	
Lichen	*Circinaria hispida*	vagabond lichen	S2S3	Not listed	Not Listed	Not Listed	grows on calcareous soil[i]
Lichen	*Cyphelium notarisii*	soot lichen	S2 – Tracked	Not listed	Not listed	Not listed	pine wood buildings, benches and fences[j]
Lichen	*Diploschistes actinostomus*	crater lichen	S1	Not listed	Not Listed	Not Listed	non-calcareous rock[h]
Lichen	*Diplotomma alboatrum*	lichen	SU	Not listed	Not Listed	Not Listed	rock or soil[h]
Lichen	*Flavopunctelia soredica*	powder-edged speckled green shield lichen	S2S3	*may be at risk*	Not Listed	Not Listed	found on the bark of trees in open woods[h]
Lichen	*Polysporina arenacea*	cobblestone lichen	S2	Not listed	Not Listed	Not Listed	grows on rock[h]
Lichen	*Toninia tristis* ssp. *tristis*	blister lichen	S1?	Not listed	Not Listed	Not Listed	grows on soil or rock[h]
Lichen	*Xanthomendoza montana*	sunburst lichen	S3	Undetermined	Not Listed	Not Listed	grows on woody substrates[k]
Lichen	*Xanthoparmelia camtschadalis*	rock-shield lichen	SU	Not listed	Not Listed	Not Listed	grows on soil or non-calcareous rock[h]
Lichen	*Xanthoparmelia subdecipiens*	rock-shield lichen	S2?	*may be at risk*	Not Listed	Not Listed	grows on soil or non-calcareous rock[h]

Table 10-5 ACIMS Plant Species of Management Concern Occurrences in the RAA

Plant Form/ Community	Scientific Name	Common Name	Provincial Rank		Federal Rank		Habitat
			ACIMS Rank[a]	Alberta General Status[b]	COSEWIC[c]	SARA[c]	
Liverwort	*Calypogeia muelleriana*	liverwort	S2S4	Not listed	Not Listed	Not Listed	lowland grasslands[l]
Liverwort	*Jungermannia atrovirens*	liverwort	SU	Not listed	Not Listed	Not Listed	loose chalk scree on north-facing slopes[i]
Moss	*Brachythecium frigidum*	moss	S1S2	*sensitive*	Not Listed	Not Listed	fallen tree trunk, exposed rock and soil in wet areas[g]
Moss	*Bryum muehlenbeckii*	moss	S2S3	*sensitive*	Not Listed	Not Listed	edges of wetlands in the Montane[m]
Moss	*Bryum turbinatum*	moss	S2S3	*sensitive*	Not Listed	Not Listed	found in low-lands and depressions between sand dunes[l]
Moss	*Dicranum tauricum*	broken-leaf moss	S1S3	*sensitive*	Not Listed	Not Listed	rotten logs and stumps, tree bases and infrequently on humus[g]
Moss	*Didymodon fallax*	fallacious screw moss	S2S3	*sensitive*	Not Listed	Not Listed	exposed soil, silt, sandstone, concrete, culverts shale and calcareous rock[g]
Moss	*Encalypta spathulata*	candle-snuffer moss	S2S3	*sensitive*	Not Listed	Not Listed	found on exposed calcareous soils[g]
Moss	*Grimmia donniana*	Donian grimmia moss	S1S2	*secure*	Not Listed	Not Listed	exposed granite and sandstone[g]

Table 10-5 ACIMS Plant Species of Management Concern Occurrences in the RAA

Plant Form/ Community	Scientific Name	Common Name	Provincial Rank		Federal Rank		Habitat
			ACIMS Rank[a]	Alberta General Status[b]	COSEWIC[c]	SARA[c]	
Moss	*Hennediella heimii*	long-stalked beardless moss	S2S3	*sensitive*	Not Listed	Not Listed	exposed alkaline soils[g]
Moss	*Jaffueliobryum raui*	moss	S2	*sensitive*	Not Listed	Not Listed	dry sandstone or limestone rock[g]
Moss	*Jaffueliobryum wrightii*	moss	S1S2	*sensitive*	Not Listed	Not Listed	dry sandstone or limestone rock[g]
Moss	*Limprichtia cossonii*	moss	SU	Undetermined	Not Listed	Not Listed	found in graminoid fen[n]
Moss	*Pterygoneurum ovatum*	hairy-leaved beardless moss	S2S3	Undetermined	Not Listed	Not Listed	dry saline soils[g]
Moss	*Schistidium pulvinatum*	moss	SU	Not listed	Not Listed	Not Listed	calcareous substrates[l]
Moss	*Seligeria campylopoda*	moss	S2S3	*secure*	Not Listed	Not Listed	calcareous substrates[g]
Shrub	*Ribes inerme*	mountain gooseberry	S2? - Tracked	*secure*	Not listed	Not listed	montane forest[o]
Tree	*Pinus flexilis*	limber pine	S3	*may be at risk*	*endangered*	Not Listed	High montane forest, often at tree-line[g]

Table 10-5 ACIMS Plant Species of Management Concern Occurrences in the RAA

NOTES:

None of these species are listed by COSEWIC or SARA (Government of Canada 2016b)

S1 - Known from five or fewer occurrences or especially vulnerable to extirpation because of other factor(s)

S2 - Known from twenty or fewer occurrences, or vulnerable to extirpation because of other factors

S3 - Known from 100 or fewer occurrences, or somewhat vulnerable due to other factors

S4 - Apparently secure – taxon is uncommon but not rare

SU - Taxon is currently unrankable due to lack of information or due to substantially conflicting information (e.g., native vs. non-native status not resolved)

S#? - Rank is most likely appropriate, but conflicting information exists (e.g., S2? believed to be 6 - 20 occurrences)

S#S# - A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the taxon

SOURCES:

[a] ACIMS 2016c

[b] ESRD 2012a

[c] Species at Risk Act Public Registry (Government of Canada 2016b).

[d] Thompson and Hansen 2002

[e] Allen 2014

[f] High Range Ecological Consultants 2008

[g] Flora of North America 2017

[h] Brodo et al. 2001

[i] NatureServe Explorer 2017

[j] Nash et al. 2004

[k] McMurray et al. 2015

[l] Porely and Hodgetts 2005

[m] Hedderson 1992

[n] Kotowski et al. 2013

[o] Moss 1983

Three plant species of management concern were identified during rare plant surveys in the PDA: blunt-leaved water cress (*Rorippa curvipes*), slender cress (*Rorippa tenerrima*) and dwarf bulrush (*Tricophorum pumilum*) (Table 10-6). Blunt-leaved watercress and slender cress are both listed as *may be at risk* by the Alberta General Status Listings (ESRD 2012a) and tracked by ACIMS (2016c). None of the observed species are listed by SARA or COSEWIC (Government of Canada 2016b). No historical occurrences of SOMC or critical habitat were found in the LAA.

Habitat for many of the species listed in Table 10-5 may be present in the PDA; however, those species' habitat requirements that are within the montane are unlikely to occur in the PDA. None of the species previously identified in the RAA were observed during rare plant surveys.

No historical records of ecological communities of management concern were found within the RAA (ACIMs 2016b) and no rare ecological communities were recorded during field surveys.

A comprehensive list of plant species observed in the PDA and descriptions of SOMC is provided in Volume 4, Appendix L, Attachment 10A.

Table 10-6 Plant Species of Management Concern Observed from Survey of the PDA

Scientific Name	Common Name	ACIMS Rank [a]	Alberta General Status [b]	Number of Occurrences	Habitat [c]	Life History [c]
Rorippa curvipes	blunt-leaved watercress	S3 - Tracked	may be at risk	1	Mud flat, shores, roadsides, stream beds and wet meadows Found on the bank of a drainage.	Annual/ biennial
Rorippa tenerrima	slender cress	S3 - Tracked	may be at risk	1	Mud flat, shores, roadsides, stream beds and wet meadows Found on the bank of a drainage.	Annual/ biennial
Trichophorum pumilum	dwarf bulrush	S3 - Watched	sensitive	1	Calcareous fens Found in a spring-fed, shrubby swamp.	Perennial
NOTES: None of these species are listed by COSEWIC or SARA (Government of Canada 2016b) S3 - Known from 100 or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factors						
SOURCES: [a] ACIMS 2016c [b] ESRD 2012a [c] Kershaw et al. 2001						

Traditional Use Plants

Seventy-seven traditional use plant species were identified through review of traditional ecological knowledge reports (AMEC Earth & Environmental 2009, AMEC Earth & Environmental 2010, MacPherson Leslie & Tyerman LLP Lawyers 2011, Enbridge 2012, Trans Mountain Pipeline ULC 2013, National Energy Board 2015, Riversdale Resources 2015, Tsuut'ina Nation 2016 and Energy East Pipeline Ltd. 2016), to be used by Indigenous communities for food, ceremonies, medicine and lodging. Forty-one of the traditional plant species or genus identified in the traditional ecological reports reviewed were observed within the PDA during field surveys (Table 10-7). There is no indication that these plants on private lands are being used by Indigenous groups.

Table 10-7 Traditional Use Plants Identified in Traditional Ecological Reports and Presence in the PDA

Traditionally Used Name[a]	Scientific Name[b]	Observed in the PDA
alsike clover	*Trifolium hybridum*	✓
aspen	*Populus tremuloides*	✓
bear root	unknown	NA
bearberry, kinnikinnick	*Arctostaphylos uva-ursi*	✓
bitter berry	unknown	NA
black root	unknown	NA
bunchberry	*Cornus canadensis*	✓
camas	*Zigadenus* spp.	✓
caribou weed	*unknown*	NA
cattail	*Typha latifolia*	✓
chokecherry	*Prunus virginiana*	✓
cloudberry, dewberry	*Rubus pubescens*	✓
cohosh, honeysuckle	*Lonicera* spp.	✓
Common plantain, whiteman's foot	*Plantago major*	✓
cottonwood, black cottonwood, poplar	*Populus* spp.	✓
cow parsnip	*Heracleum maximum*	✓
currant	*Ribes* spp.	✓
dandelion	*Taraxacum officinale*	✓
diamond willow fungus	*Trametes suaveolens*	-

Table 10-7 Traditional Use Plants Identified in Traditional Ecological Reports and Presence in the PDA

Traditionally Used Name[a]	Scientific Name[b]	Observed in the PDA
dwarf blueberry	*Vaccinium caespitosum*	-
fireweed	*Chamerion* spp.	✓
frog plant	unknown	NA
fungus (wood, green wood cup)	unknown	NA
goldenrod	*Solidago* spp.	✓
green alder	*Alnus viridis*	✓
high-bush blueberry, huckleberry	*Vaccinium membranaceum*	-
horse grass	unknown	NA
juniper (ground, berry)	*Juniperus* spp.	✓
king root	unknown	NA
Labrador tea, muskeg tea, muskeg leaves	*Rhododendron groenlandicum*	-
lichen (tree)	unknown	NA
low-bush cranberry, mooseberry	*Viburnum edule*	-
mint, peppermint, wild mint	*Mentha arvensis*	✓
moss (spike, sponge)	unknown	NA
mushrooms (chanterelle, morel, pine, puff balls)	unknown	NA
norther beadstraw	*Galium boreale*	✓
northern gooseberry	*Ribes oxyacanthoides*	✓
old-man's beard	*Unsnea* spp.	-
old-man's whiskers	*Galium triflorum*	✓
onion (wild, prairie)	*Allium cernuum*	✓
pigweed (lamb's quarter, red)	*Chenopodium album*	✓
pin cherry	*Prunus pensylvanica*	-
pineapple weed	*Matricaria discoidea*	-
prairie clover	unknown	NA
prairie coneflower	*Ratibida columnifera*	-
rabbit root	*Aralia nudicaulis*	-
red clover	*Trifolium pratense*	✓

Table 10-7 Traditional Use Plants Identified in Traditional Ecological Reports and Presence in the PDA

Traditionally Used Name[a]	Scientific Name[b]	Observed in the PDA
red osier dogwood, nipiswasiskwatew	*Cornus stolonifera*	✓
sage (bush, prairie)	*Artemisia* spp.	✓
saskatoon berry	*Amelanchier alnifolia*	✓
saw-grass	unknown	NA
Silverberry, wolf willow, white sage berry	*Elaeagnus commutata*	✓
smelly root	unknown	NA
soapberry, hoshum	*Shepherdia canadensis*	✓
spruce	*Picea* spp.	✓
stinging nettle	*Urtica dioica*	✓
strawberry	*Fragaria virginiana*	✓
sweet pine, lodgepole pine	*Pinus contorta*	-
sweetgrass	*Anthoxanthum* spp.	-
tiger lily	*Lilium philadelphicum*	-
tumbleweed	*Amaranthus* spp.	-
twinberry	*Lonicera involucrata*	-
western dock	*Rumex occidentalis*	✓
western red cedar	*Thuja plicata*	-
wheat	*Elymus* spp.	✓
white birch	*Betula occidentalis*	✓
wild asparagus	*Asparagus officinalis*	-
wild carrot	*Daucus carota*	-
wild chives	*Allium schoenoprasum*	-
wild potato	*Bistorta vivipara*	✓
wild raspberry	*Rubus idaeus*	✓
wild rice	*Zizania* spp.	-
wild rose	*Rosa* spp.	✓
wild tobacco	unknown	NA
wild turnip	*Raphanus raphanistrum*	-

Table 10-7 Traditional Use Plants Identified in Traditional Ecological Reports and Presence in the PDA

Traditionally Used Name[a]	Scientific Name[b]	Observed in the PDA
willow	*Salix* spp.	✓
yarrow	*Achillea* spp.	✓

NOTES:

[a] Traditional names are those listed in the following sources (AMEC Earth & Environmental 2009, AMEC Earth & Environmental 2010, MacPherson Leslie & Tyerman LLP Lawyers 2011, Enbridge 2012, Trans Mountain Pipeline ULC 2013, National Energy Board 2015, Riversdale Resources 2015, Tsuut'ina Nation 2016 and Energy East Pipeline Ltd. 2016) that have the potential to occur within the RAA

[b] Scientific names are inferred based on Moss 1983, Marles et al. 2000, Royer and Dickenson 2006 and professional judgement

✓ Species observed in PDA during surveys

- Species not observed in PDA during surveys

NA – not assessed as species or genus not specified

Regulated Weeds

Six species listed as *prohibited noxious* and fifteen species listed as *noxious* have been observed in Calgary (Alberta Agriculture and Forestry 2016) and have the potential to occur in the LAA (Table 10-8).

Table 10-8 Historical Weed Records in the RAA

Designation [a]	Scientific Name	Common Name	Propagation [b]
Noxious	*Bromus tectorum*	downy brome	seed
Noxious	*Campanula rapunculoides*	creeping bellflower	rhizomes, root fragments, seed
Noxious	*Cirsium arvense*	Canada thistle	rhizomes, root fragments, seed
Noxious	*Convolvulus arvensis*	field bindweed	rhizomes, seed, root fragments
Noxious	*Echium vulgare*	blueweed	seed, spread by animals and water
Noxious	*Euphorbia esula*	leafy spurge	rhizomes and seeds
Noxious	*Knautia arvensis*	field scabious	seed
Noxious	*Leucanthemum vulgare*	oxeye daisy	rhizomes and seeds
Noxious	*Linaria dalmatica*	dalmation toadflax	rhizomes and seeds
Noxious	*Linaria vulgaris*	yellow toadflax	rhizomes, root fragments, seed

Table 10-8 Historical Weed Records in the RAA

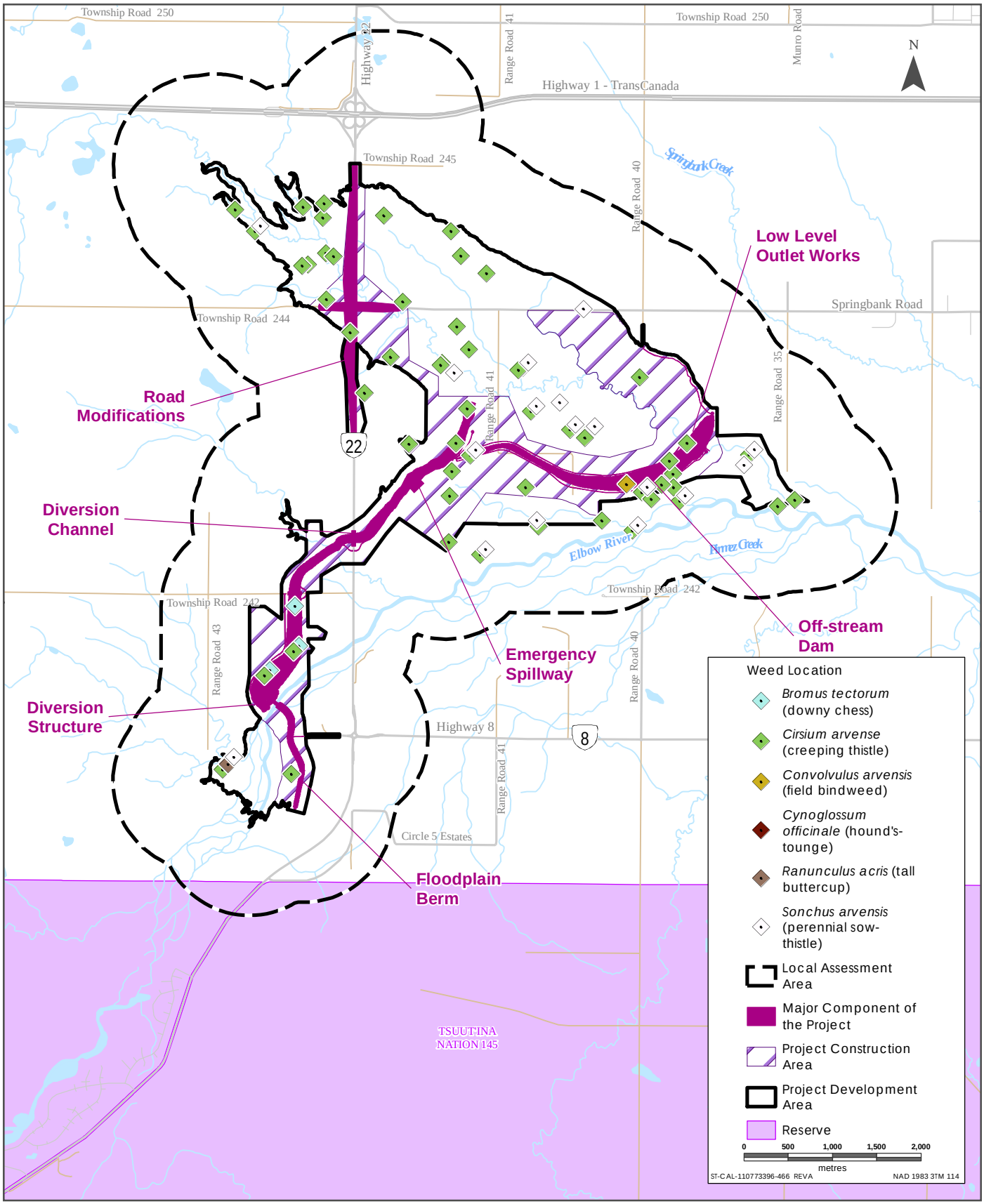
Designation [a]	Scientific Name	Common Name	Propagation [b]
Noxious	*Ranunculus acris*	tall buttercup	seed
Noxious	*Silene latifolia* ssp. *alba*	white cockle	seed, root and stem fragments
Noxious	*Sonchus arvensis*	perennial sowthistle	rhizomes, root fragments, seed
Noxious	*Tanacetum vulgare*	common tansy	rhizomes and seeds
Noxious	*Tripleurospermum perforatum*	scentless chamomile	seed
Prohibited Noxious	*Carduus nutans*	nodding thistle	seed
Prohibited Noxious	*Centaurea diffusa*	diffuse knapweed	Prolific seed production, distributed as tumbleweeds
Prohibited Noxious	*Centaurea solstitialis*	yellow star-thistle	seed
Prohibited Noxious	*Centaurea stoebe*	spotted knapweed	Seed (distributed as tumbleweeds)
Prohibited Noxious	*Lythrum salicaria*	purple loosestrife	seed, stem and root fragments
Prohibited Noxious	*Rhaponticum repens*	Russian knapweed	seed

SOURCES:
[a] *Alberta Weed Control Regulation*
[b] Alberta Invasive Species Council 2014

Six noxious weeds were observed during field surveys of the PDA:

- *Bromus tectorum* (downy chess), three observations
- *Cirsium arvense* (creeping thistle), fifty-nine observations
- *Convolvulus arvensis* (field bindweed), one observation
- *Cynoglossum officinale* (hound's-tongue), one observation
- *Ranunculus acris* (tall buttercup), one observation
- *Sonchus arvensis* (perennial sow-thistle), fifteen observations

Creeping thistle and perennial sow-thistle were found throughout the PDA and were observed to in low percent cover (less than 5%) to common (5-50%) within field survey locations (Figure 10-5)). Both species were observed in a variety of ecosites and land units within agricultural, broadleaf forest, graminoid marshes, along edges of open water, shrubland and shrubby fen cover types. Creeping thistle, was also observed in ephemeral waterbodies, native grassland and mixed forest cover types. Creeping thistle and perennial sow-thistle were most commonly observed seasonal graminoid marshes, 13 and 7 observations, respectively.



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

Regulated Weed Observations

Stantec

Downy cress, field bindweed, hound's tongue and tall buttercup were rarely observed within the PDA and when observed were present with low percent cover within field survey locations. Downy cress was observed in annual crop and once in a temporary graminoid marsh. Field bindweed was observed in a temporary graminoid marsh, hounds tongue was observed in an aspen dominated, pine grass ecosite, and tall buttercup was observed along shores of open water.

Additionally, 20 non-native invasive forb species and 5 non-native invasive graminoid species were observed within the PDA during field surveys (see Volume 4, Appendix L, Attachment 10A). These species had low to dominant (greater than 50%) percent cover within field survey locations.

10.2.2.4 Wetland Functions

Although wetlands and riparian areas in the PDA and LAA have been altered by land use, mostly agriculture, many of the wetlands provide habitat for native plants and wildlife, as well as ground water recharge/discharge, water storage and sediment retention. Additionally, the shrubby fen wetland that is located north of Elbow River in the southern portion of the PDA also sequesters carbon.

Land use has likely reduced the number and extent of wetlands in the LAA as well as resulted in increased soil disturbance, herbicides and pesticide exposure and altered species composition. However, most of the wetlands within the LAA are estimated to be of high or moderate value (Table 10-9). Wetlands within the LAA are likely ranked high or moderate value because most of the wetlands are isolated (without outlets), which results in greater water storage, sediment retention, phosphorus retention and nitrate removal and retention (Government of Alberta 2015c). Seasonal wetlands are the most common wetland type in the LAA. Seasonal wetlands, generally have high percent cover of graminoids and forbs, with low percent cover of open water, which results in increased organic matter export.

Table 10-9 Estimated Area of Wetland Value in the LAA

Wetland Value	Estimated Wetland Value in the LAA	
	ha	%
High (A-Value)	50	41
Moderate (B-Value)	36	29
Moderately Low (C-Value)	30	24
Low (D-Value)	7	6
Total	**123**	**100**
SOURCE: Government of Alberta 2015c		

10.3 PROJECT INTERACTIONS WITH VEGETATION AND WETLANDS

Table 10-10 identifies project components and physical activities that might interact with vegetation and wetlands. These interactions are discussed in Section 10.4 in the context of effects pathways, standard and project-specific mitigation and residual effects.

Table 10-10 Project-Environmental Interaction with Vegetation and Wetlands During Construction and Dry Operations

Project Components and Physical Activities	Environmental Effects			
	Change in Landscape Diversity	Change in Plant Community Diversity	Change in Species Diversity	Change in Wetland Functions
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

10.3.1 Mitigation

Key mitigation measures that would be implemented are listed in Table 10-11.

Table 10-11 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands

Potential Effect	Effect Pathway	Mitigation Measure
Change in landscape diversity	• Fragmentation of native plant community patches arising from native vegetation clearing	• Restrict construction activities to the approved construction footprint.
Change in community diversity	• Direct loss or alteration of native vegetation communities, including riparian lands and ecological communities of management concern arising from native vegetation clearing	• Restrict construction activities to the approved construction footprint. • Native areas disturbed by the Project would be reseeded using an Alberta Transportation native custom seed mix.
	• Indirect alteration of native communities, including riparian lands and ecological communities of management concern from the introduction or establishment of regulated weeds and invasive species or deposition of dust	• Use a cover crop seed mixture to assist in weed and erosion control on exposed soils where warranted. • All equipment will arrive at the Project site clean and free of soil and vegetative debris. • Monitor topsoil and subsoil piles for weed growth during construction and implement corrective measures (e.g., spraying, mowing, hand-pulling) to avoid growth and establishment of regulated weeds. • Use only Certified No.1 seed. unless Certified No. 1 seed is not available for selected reclamation species (i.e., native species). • For control of weeds, a licensed industrial pesticide applicator would be contracted to select and apply all herbicide in compliance with the procedures as outlined in the Code of Practice for Pesticides (Government of Alberta 2010b).

Table 10-11 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands

Potential Effect	Effect Pathway	Mitigation Measure
Change in species diversity	• Direct loss of a plant SOMC or traditional use plant species of due to vegetation clearing	• Restrict all construction activities to the approved construction footprint.
	• Indirect effects on plant SOMC or traditional use plant species from herbicide application to control the spread of regulated weeds	• Use a cover crop seed mixture to assist in weed and erosion control on exposed soils where warranted. • Do not apply herbicide within 30 m of plant species or ecological communities of management concern, wetland or waterbody. Spot spraying, wicking, mowing, or hand picking are acceptable measures for control of regulated weeds in this area. • A licensed industrial pesticide applicator would be contracted to select and apply all herbicide in compliance with the procedures as outlined in the *Code of Practice for Pesticides* (Government of Alberta 2010b).
Change in wetland function	• Direct loss or alteration of wetland area or change in wetland type from vegetation clearing or deposition of dust • Direct loss or alteration of surface or groundwater flow patterns	• Reduce the removal of vegetation in wetlands to the extent possible • Where possible, conduct ground level cutting/mowing/mulching of wetland vegetation instead of grubbing. • Where applicable, in areas not impacted by the permanent Project footprint, if ground conditions are encountered that create potential for rutting, admixing or compaction, minimize ground disturbance by using a protective layer such as matting or biodegradable geotextile and clay ramps or other approved materials between wetland root/seed bed and construction equipment. • A site-specific erosion and sediment control plan will be developed in accordance with Alberta Transportation's Erosion and Sediment Control Manual. An appropriate native seed mix that is suitable for wetlands will be used to reclaim wetland areas.
	• Indirect loss or alteration of wetland area or wetland type because of vegetation clearing and ground disturbance • Indirect alteration of surface and groundwater flow patterns	• Where possible, direct grading/drainage away from wetlands. • Where there are permanent or temporary access roads, maintain cross drainage to allow water to move freely from one side of the road to the other.

10.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON VEGETATION AND WETLANDS

10.4.1 Analytical Assessment Techniques

Construction and dry operations phases are assessed for evaluation of potential effects, compared to existing conditions.

Analysis of change in landscape diversity (number of patches, mean patch area and mean patch perimeter) uses the integrated GVI and LCC spatial data (described in Section 10.2.1.1) within the RAA.

Change in community diversity (change in area of vegetation and wetland cover types) is estimated by comparing the footprint of each of the project phases (construction and dry operations) with vegetation cover types in the LAA.

The construction footprint is 734 ha and includes 168 ha of permanent project structures and approximately 168 ha of temporary disturbance (borrow area, pipeline right of way, construction laydown area and soil stock pile locations). Although the extent of temporary disturbance is known, the actual location of these temporary construction areas has not yet been determined. Therefore, for the analysis on the effect on vegetation and wetlands the entire construction footprint (734 ha) is used.

Dry operations phase consists of reclaimed temporary disturbances and developed permanent project structures. Native upland and wetland vegetation that is disturbed would be reclaimed with Alberta Transportation custom native seed mix, and would be dominated by grass and herb species during this phase. Disturbed land units (industrial facilities, disturbed land, transportation and rural residential land unit types) and agricultural cover types that are disturbed by the Project would be reclaimed using Alberta transportation agronomic seed mix and are predicted to become tame pasture.

10.4.2 Change in Landscape Diversity

Construction and dry operations phases would mostly affect anthropogenic landscape types (Table 10-12). Coniferous forest and native grassland cover types would have portions disturbed or bisected, which would reduce the size of the vegetation patch and increase the number of patches (Figure 10-6 and Figure 10-7). Disturbance to portions or bisecting vegetation patches increases fragmentation in the RAA.

Temporary disturbance would result in native vegetation clearing. Temporary disturbances to native vegetation cover types would be recontoured to blend in with the surrounding landscape (if required) and seeded with an approved native seed mix. This would result in an increase in native grassland cover type patch area and a decrease in patch edge length (Figure 10-7). In areas where trees and shrubs were present prior to disturbance, native trees and shrubs should reestablish over time in reclaimed native upland areas; however, for the dry operations phase it is assumed these areas would become native grassland.

Permanent project features that have vegetation cover (i.e., the dam) are not considered reclaimed because of vegetation maintenance during dry operations, and are considered permanent project disturbance.

Effects on landscape diversity are considered irreversible in areas of permanent project disturbance. The geographic extent of residual effects is expected to be restricted to the PDA, and the duration is expected to be long-term. Timing is seasonal because of differing effects on vegetation clearing and seeding practices in spring/summer versus fall/winter.

Active reclamation of temporally disturbances on native upland areas would use Alberta Transportation custom native seed mix, and it is expected that re-establishment of native vegetation would occur in the PDA; therefore, effects of fragmentation considered reversible in temporary disturbances. The dry operations phase shown in Figure 10-6 and Figure 10-7 includes the effects of reclamation.

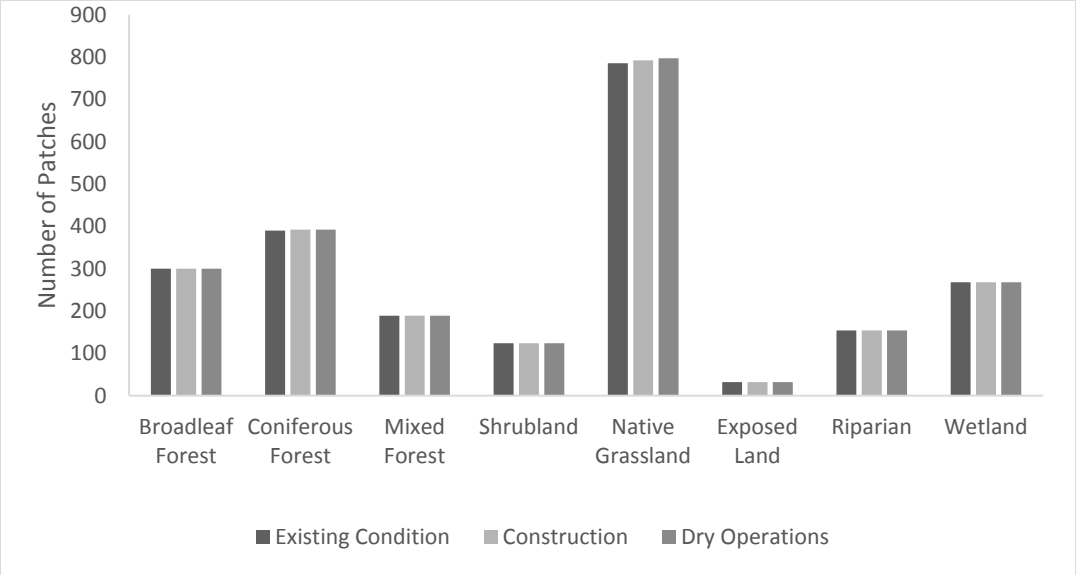


Figure 10-6 Change in the Number Vegetation and Wetland Patches in the RAA

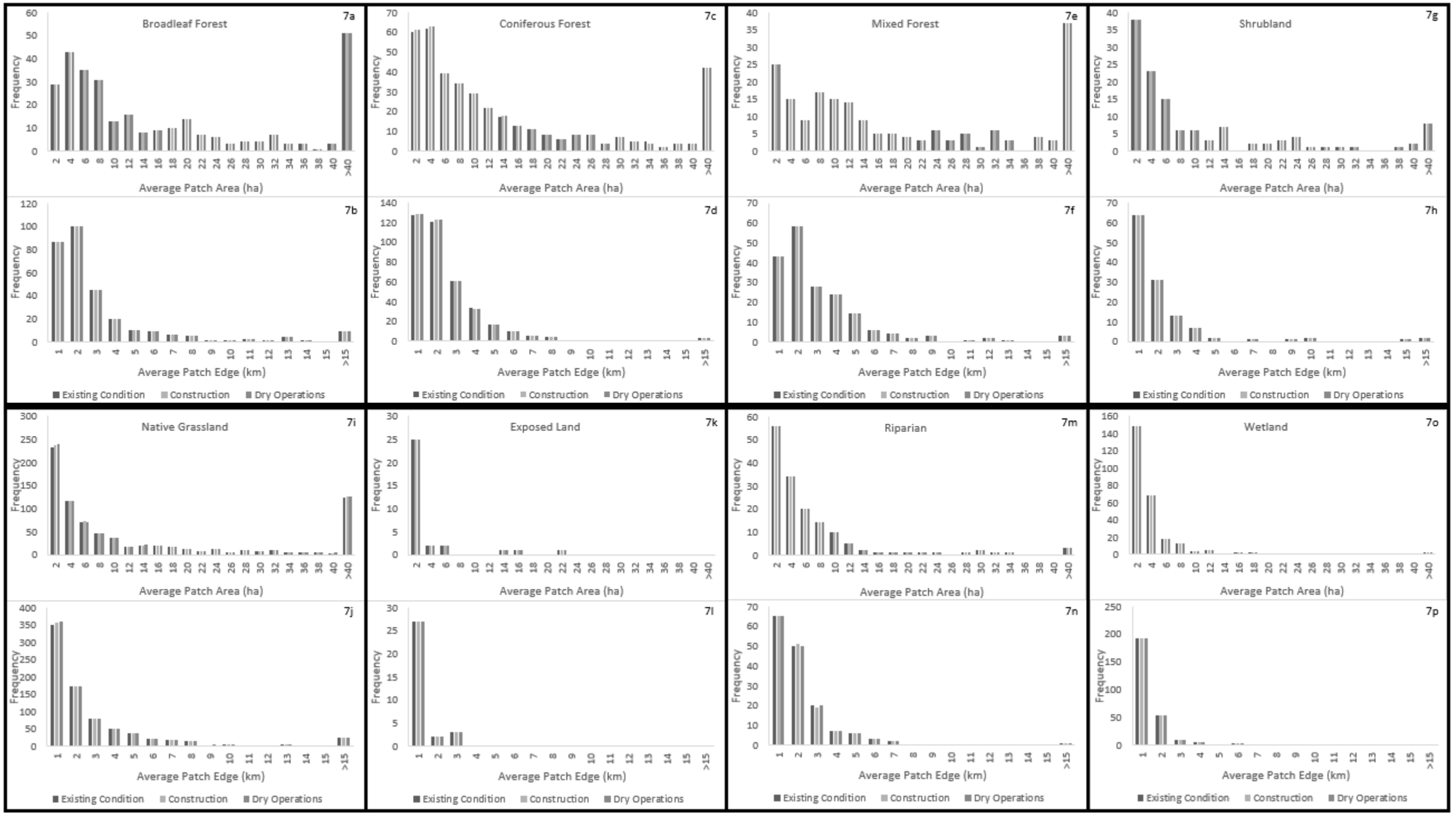


Figure 10-7 Change Vegetation and Wetland Patch Area (ha) and Edge (km) in the RAA

10.4.3 Change in Community Diversity

Construction and dry operations would mostly affect anthropogenic landscape types in the PDA. Temporary clearing of vegetation is expected to remove 223 ha of upland and 29.5 ha of wetland during the construction phase (Table 10-12). Permanent project disturbances would result in the permanent clearing of vegetation and wetlands.

During the construction phase, areas of temporary disturbance would only have above ground vegetation clearing, leaving the soils intact, though there are some areas of soil disturbance. Areas with vegetation clearing only would recover to existing conditions, and areas with soil disturbance would likely take longer for native vegetation to establish and would likely be less similar to existing communities. The exact areas of vegetation clearing and soil disturbance have not yet been determined; therefore, it is assumed that all areas would have soil disturbance. All temporarily disturbed upland ecosites would be reclaimed using an approved custom seed mix, and wetlands would be recontoured and seeded with an approved custom native wetland seed mix. As a result of reclamation, it is anticipated there would be an increase in native grassland cover types (95.4 ha), and a reduction in broadleaf forest (3.0 ha), coniferous forest (11.0 ha), mixed forest (34.9 ha) and shrubland (83.5 ha) cover types during the dry operations phase. Increased dust deposition is anticipated during construction; however; it is expected dust would be removed from vegetation during rain events. No vegetation and wetland land units are completely lost, and no lasting effects on vegetation and wetlands would be anticipated.

Effects on ecological communities of management concern are not anticipated because rare ecological communities were not identified from a review of ACIMS records (ACIMS 2016b) or during field surveys of the PDA.

Table 10-12 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[1] (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
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

Table 10-12 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[1] (ha)			Change from Existing Condition			
					Construction		Dry Operations	
		Existing Condition	Construction	Dry Operations	ha	%	ha	%
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	-0.1	64.9	1197.0
	g0 Grassland - hygric/rich [c]	0.0	0.0	8.7	0.0	0.0	8.7	-
Upland Subtotal		***1626.5***	***1402.6***	***1584.8***	***-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***	***-30.5***	***-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 10-12 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[1] (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	1325.2	1126.2	1488.1	-199.0	-15.0	162.9	12.3

Table 10-12 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[1] (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		***2638.4***	***2922.3***	***2699.0***	***283.9***	***10.8***	***60.6***	***2.3***
Grand Total		**4860**	**4860**	**4860**	**-**	**-**	**-**	**-**

NOTES:

[1] Areas are based on the LAA, although the effects would be restricted to the PDA.

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 2012b)

[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

Regulated weeds and non-native invasive species were recorded at most survey sites and were generally abundant when observed. The seeds of these regulated weed species would likely remain in the seedbank in stockpiled material and are anticipated to persist following construction. The abundance and introduction and establishment of regulated weeds and non-native invasive species would be managed through the mitigation measures.

Active reclamation of areas temporarily disturbed by the Project would occur using Alberta Transportation native custom seed mix, and it is expected that re-establishment of native vegetation would occur in these areas. Additionally, areas where maintenance occurs may require vegetation management (i.e., weed management), but effects are considered reversible. However, because the major project components would be permanent, effects on vegetation and wetlands are considered irreversible. However, where possible, permanent features such as the floodplain berm and dam would be seeded using native species. The geographic extent of residual effects on vegetation and wetlands are expected to be restricted to the LAA, and the duration is expected to be long-term.

Residual project effects are anticipated to be adverse in direction, but low in magnitude because no native upland or wetland land units or ecological communities of management concern are expected to be eliminated from the LAA. Timing seasonal because of differing effects on vegetation and wetlands clearing as well as reclamation activities in spring/summer versus fall/winter.

10.4.4 Change in Species Diversity

10.4.4.1 Species of Management Concern

Effects on plant SOMC from vegetation clearing are not anticipated because none were observed in the PDA. Effects on plant SOMC may still occur as unidentified plant SOMC may be present, including slender cress, blunt-leaved water cress and dwarf bulrush observed during rare plant surveys of the PDA (Section 10.2.2.3), and previously recorded plant SOMC in the RAA (Table 10-5).

Additional SOMC could be present because, for many species, the number of plants fluctuate in response to climatic conditions (e.g., annuals may not germinate in dry years) and occur in low numbers. The foothills parkland has 52 vascular, 26 non-vascular and 22 lichen SOMC listed as tracked (ACIMS 2016c). Many of these species are associated with wetlands and moist depressions, which are common in the LAA.

SOMC occurrences affected during construction would result in residual effects being adverse, but low in magnitude, long-term and likely irreversible because the re-establishment of such species may not always be successful. Geographic extent would be the PDA. Timing seasonal because of differing effects on vegetation clearing in spring/summer versus fall/winter.

10.4.4.2 Traditional Use Plants

The 41 species used for traditional purposes, observed in the PDA, are generally common and widespread species that are generally ranked S5 (ACIMS 2016c). No community type supporting traditional use plants would be lost from the PDA and no plant species used for traditional purposes would be lost from the LAA.

Through the Indigenous engagement program for the Project, Ermineskin Cree Nation, Louis Bull Tribe, Stoney Nakoda Nations, Kainai First Nation, Piikani Nation and Tsuut'ina Nation, have expressed concern regarding the potential for the Project to affect wetlands and riparian areas, and how these impacts would affect harvesting of traditional use plants. The Project would reduce riparian area and potentially reduce wetland area or alter wetland conditions. However, effects would be low in magnitude because changes in community abundance would be limited to temporary disturbances and in the immediate area of the dam, diversion channel and diversion structure.

Therefore, residual project effects are anticipated to be adverse in direction, but low in magnitude. Geographic extent is expected to be restricted to the LAA. Duration is expected be long-term and irreversible because structures would be in place permanently. Timing is seasonal for the availability of traditional use plants.

10.4.5 Change in Wetland Functions

Because no wetland cover types are lost, measurable changes to ground water recharge/discharge, water storage, sediment retention and carbon sequestration would not occur.

Wetland ecological function (i.e., wildlife habitat and plant diversity) would be altered due to vegetation clearing for permanent structures. Dry operations would result in the loss of 16% (8 ha) of the estimated high value wetland area and 36.1 % (13 ha) of moderate wetland area (Table 10-13). Residual project effects are expected to be adverse, moderate in magnitude, restricted to the PAA and long-term. Timing is seasonal because of differing effects on potential wetlands clearing in spring/summer versus fall/winter. Temporary work areas would avoid wetlands wherever possible. Onsite wetland restoration or off-site wetland replacement may offset loss of wetland functions; therefore, effects are expected to be medium-term and reversible.

Before construction, *Water Act* approval would be obtained for disturbances to wetlands.

Table 10-13 Change is Estimated Area of Wetland Value in the LAA

Wetland Value[a]	Estimated Area of Wetland Value in the LAA (ha)		Change from Existing Condition	
	Existing Condition	Dry Operations	ha	%
High (A-Value)	50	42	-8	16.0
Moderate (B-Value)	36	23	-13	36.1
Moderately Low (C-Value)	30	21	-9	30.0
Low (D-Value)	7	7	0	0.0
Total	**123**	**93**	**-30**	**-**

SOURCE:
[a] Government of Alberta 2015c

10.5 SUMMARY OF PROJECT RESIDUAL EFFECTS

Table 10-14 summarizes the residual environmental effects on vegetation and wetlands during construction and dry operations. All residual project effects are expected to occur during construction, be low in magnitude and restricted to the PDA. No effects on plant SOMCs are expected.

Table 10-14 Project Residual Effects on Vegetation and Wetlands during Construction and Dry Operations

Residual Effect	Residual Effects Characterization								
	Project Phase	Timing	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Landscape Diversity	C	S	A	L	PDA	LT	S	I/R[1]	D
Change in Community Diversity	C	S	A	L	PDA	LT	S	R	D
Change in Species Diversity	C	S	A	L	PDA	LT	S	I	D
Change in Wetland Functions	C	S	A	L	PDA	LT	S	R	D

KEY

See Table 10-2 for detailed definitions

Project Phase:
C: Construction
D: Dry Operation

Timing Consideration
S: Seasonality
T: Time of day
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/Socio-Economic Context:
D: Disturbed
U: Undisturbed

NOTE:
[1] Landscape diversity change in the area of permanent project features is irreversible but is reversible for non-permanent project features.

10.6 DETERMINATION OF SIGNIFICANCE

A significant effect on vegetation and wetlands is one that:

- Threatens the long-term persistence or viability of a plant species or community in the RAA, including effects that are contrary to or inconsistent with the goals, objectives or activities of recovery plans, action plans and management plans.
- Results in unreplaced loss or disturbances of wetlands that has not been giving prior approval by Alberta Environment and Parks.
- Threatens the long-term availability of traditionally use plants within the regional assessment area.

Application of mitigation would reduce residual project effects on vegetation and wetlands, including plant and ecological communities of management concern. Residual project effects are predicted to be not significant because the Project would not result in the loss of native upland or wetland cover types, plant SOMC or wetland function in the LAA. Timing is seasonal during construction because disturbance of vegetation and wetlands adjacent to activities is higher is summer than in winter.

Additionally, *Water Act* approval would be obtained for disturbances to wetlands before construction, and permanent disturbance to wetlands would be replaced in accordance with the Alberta Wetland Policy (Government of Alberta 2013a).

10.7 PREDICTION CONFIDENCE

Prediction confidence is moderate, because there is uncertainty around the abundance and distribution of plant and ecological communities of management concern in the LAA; but, mitigation effectiveness is high because they are standard and proven.

10.8 FOLLOW-UP AND MONITORING

The environmental inspector (or designate) would follow established industry best management practices, and would evaluate effectiveness of mitigation during and following the construction phase. Key monitoring issues would include erosion and sediment control and management of regulated weeds. Follow-up programs on the success of reclamation are anticipated for the construction and dry operations phase of the project.

10.9 CONCLUSIONS

Residual effects on vegetation and wetlands during construction and dry operations would not result in the loss of native upland or wetland plant communities or wetland functions from the LAA. Effects on unidentified plant SOMC could occur, but such effects would likely be limited, and likely habitat for plant SOMC does exist elsewhere in the LAA as affected vegetation and wetland land units exist elsewhere in the LAA. Effects on plant communities of management concern are not anticipated.

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10.11 GLOSSARY

Aspect	The compass direction toward which a slope faces
Carbon Sequestration	The natural process where carbon dioxide is absorbed from the atmosphere and held in solid or liquid form
Cover, Percent Cover	An estimation of the total ground area that is covered by an individual plant species when its leaves, stems, flowers etc. are projected onto the ground surface
Ecological Communities of Management Concern	Plant communities tracked by ACIMS, generally ranked S1, S2 and sometimes S3.
Ecosite	Ecological units that develop under similar environmental influences (climate, moisture, nutrients, substrates), frequently linked to particular landforms, slope positions and vegetation associations
Ephemeral Water Body	A shallow water body that temporarily contains water after spring snowmelt or a heavy rainfall and typically dries up within a matter of days to weeks.
Flood Attenuation	The process of water retention in an area and the slow controlled release of that water naturally to a surface water drainage or watercourse

Forb	Primarily broad-leaved flowering plants with net-like veins. For the purpose of simplifying identification, the category can be broadened to include those parallel-veined plants with brightly coloured flowers such as orchids or lilies
Graminoid	Refers to plants which have hollow, jointed stems and leaves in two rows (ranks). Flowers are usually perfect with seeds borne between two scales (palea and lemma). Commonly referred to as grasses
Grassland	An area dominate by grass species occurring on sites that are arid or at least well-drained
Hydrophytic vegetation	Hydrophytic vegetation is a plant that is adapted to life in water or in water-logged soil or substrate
Land Cover Class	Characteristic groupings of vegetation, substrates and landforms that occur at the landscape scale
Lichen	Fungi and certain species of algae that live in a symbiotic relationship whereby the fungus provides structural support, nutrients absorbed from the substrate, and a relatively stable microenvironment. The algae, in turn provide carbohydrates through the process of photosynthesis
Moisture Regime	Represents the available moisture supply for plant growth on a relative scale. It is assessed through an integration of species composition and soil and site characteristics. Moisture regime ranges from very dry to wet
Moss	A small leafy plant lacking any true vascular system or roots
Nutrient regime	The amount of essential nutrients that are available for plant growth. Determining a soil nutrient regime for any given site (on a relative scale from very poor to very rich) requires the consideration of many environmental and biotic parameters
Plant Community	A combination of plants occurring together under a set of environmental conditions reflecting substrate, moisture and nutrient regimes, solar radiation, and site characteristics such as slope, aspect and climate

Plant Species of Management Concern	Species listed as *at risk* or *may be at risk* on the *Species at Risk Act* (Government of Canada 2016b), the Committee on the Status of Endangered Wildlife Species in Canada (Government of Canada 2016b), the General Status of Alberta Wild Species (ESRD 2012a) or tracked by the Alberta Conservation Information Management System (ACIMS), generally ranked S1, S2, and sometimes S3 (ACIMS 2016a).
Regulated Weeds	Plant species listed as *prohibited noxious* or *noxious* in the *Alberta Weed Control Regulation*. Non-native invasive species that are aggressive competitors to native species are also assessed in this report. Exotic species, those that are designated as non-native in origin by ACIMS (2016b), are not considered weeds in this assessment.
Riparian	Plant communities adjacent to a wetland, watercourse or lake that are influenced by elevated water tables and flooding. These plant communities are transitional areas between wetlands and uplands, and as a result have relatively greater species diversity (Clare and Sass 2012).
Sedge	Grass-like herb that grows in marshy places and has an angular stem
Shrub	A woody perennial plant differing from a tree by its low stature (<5 metres) and by usually producing several basal shoots instead of a single trunk
Shrubland	An area dominated by shrubs
Slope	The degree of deviation of a surface from horizontal, measured in a numerical ratio, percent and degree
Soil	The naturally occurring, unconsolidated mineral or organic material at least 10 cm thick that occurs at the earth's surface and is capable of supporting plant growth
S1	Known from five or fewer occurrences or especially vulnerable to extirpation because of other factor(s)
S2	Known from twenty or fewer occurrences, or vulnerable to extirpation because of other factors

S3	Known from 100 or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factors
S4	Apparently secure – taxon is uncommon but not rare; potentially some cause for long term concern due to declines or other factors
S5	Secure – taxon is common, widespread and abundant
S#S#	A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the taxon. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4)
SU	Taxon is currently unrankable due to lack of information or due to substantially conflicting information (e.g., native vs. non-native status not resolved)
SNR	Not ranked – conservation status not yet assessed
SNA	Not Applicable – a conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities (e.g., introduced species)
Tracked Element	Species or ecological communities that ACIMS is actively collecting information on and processing element occurrences (EOs) for because they are elements that current information suggests are rare or of conservation concern due to threats to populations or habitats or documented declines
Traditionally used plants	Plants that are identified and documented to be used by First Nations for food, medicine or spiritual purposes.

Upland Plant Communities	Plant assemblages that exist in areas where the soil is not saturated for extended periods of time (Natural Regions Committee 2006), and were classified at different scales based on the level of information available. At the local assessment area upland plant communities were classified to ecosite phase, and at the regional assessment area were classified to cover type. Ecosites are plant assemblages that develop under similar environmental conditions such as climate, soil moisture and nutrient regime. Plant communities can be further subdivided into ecosite phases, which are distinguished using dominant species in the highest strata. Cover types are broad categories based on dominant canopy cover.
Watched Element	Elements that are currently not considered as high conservation concern but there is some information to suggest that they may become rare should there be significant alterations to the element's habitats or population
Wetland function	Includes water filtration and storage, flood attenuation, habitat, carbon sequestration, and nutrient cycling (Government of Canada 1991). Under the Alberta Wetland Policy, wetland value has been determined by section through examination of five variables: the relative abundance of a wetland type, human uses, water filtration, hydrologic function and habitat (Government of Alberta 2013a).
Wetland Plant Communities	Areas where soils are saturated with water for enough time that water altered soils are present and there is establishment and growth of water tolerant vegetation (National Wetlands Working Group 1997).