

Appendix 5.2-1
Vegetation Technical Appendix

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A5.2-1-1	2015 and 2016 Vegetation Areas Surveyed
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Vegetation Technical Appendix

Ecological Land Classification

Ecological Land Classification (ELC) mapping was completed within the Vegetation Study Area (SA, as described in Section 5.2.1.1) to ecosite and vegetation subtype, as described in Ecological (Biophysical) Land Classification of Banff and Jasper National Parks (Holland and Coen, 1983). Prior to mapping, the SA was pre-stratified with digitized polygons from Map 10-1, 10-2, and 9-2 of Ecological (Biophysical) Land Classification of Banff and Jasper National Parks (Holland and Coen, 1983), which are large homogenous units of vegetation types mapped at a 1:50,000 scale (CH2M, 2015; Parks Canada, 2011). In addition, hydrology (Natural Resources Canada [NRC], 2007-2011) and anthropogenic disturbance (Alberta Biodiversity Monitoring Institute (ABMI), 2015) were combined into a unified topology prior to mapping. Mapping at a 1:3,000 scale occurred prior to the 2015 vegetation field surveys. Quality assurance and quality control measures were employed to ensure consistency of delineation and attribution throughout the SA and to ensure accuracy of the vegetation community classification.

Using biophysical principles, polygons were delineated into units representing relatively homogenous site conditions that would support similar ecosystems and structural stages within each natural subregion. Each polygon was assigned a single ecosite, vegetation type, and structural stage as per Holland and Coen (1983). Site disturbance attributes were assigned if applicable.

Wetland ecosites were delineated and classified to the Ecological (Biophysical) Land Classification of Banff and Jasper National Parks (Holland and Coen, 1983). Further information on wetlands and their classification according to the Canadian Wetland Classification System is available in Section 5.4 of this report.

Geodatabase Development

Geodatabase development was completed to CH2M internal standards. Domains were used to aid in consistent data entry.

To assist in polygon delineation, a preliminary stratification was completed prior to mapping. The projection used was North American Datum (NAD) 83 UTM Zone 11.

In addition to preliminary stratification, several reference data layers were available to the mappers to assist with imagery interpretation while delineating and attributing polygons. Reference data for the geodatabase used information from the following data layers:

- Contour lines (NRC, 2012)
- Alberta Wildfire Perimeters (Alberta Environment and Sustainable Resource Development [AESRD], 2015)
- ABMI Human Footprint maps (ABMI, 2015)
- Roads and Railways (IHS Inc., 2004a, 2004b, 2015; NRC, 2012)
- 2015 ground plot field data

Vegetation Community Mapping

Upon creation of the geodatabase and pre-stratification as described above, polygon delineation was accomplished with a “heads up” direct to digital system in ArcGIS 10.3. All polygons were delineated in two dimensions with a defined set of rules:

- Polygon delineation was completed at a scale of 1:3,000, with a target minimum polygon size of 0.5 ha and a target minimum polygon width of 50 m.

- Polygons closed at natural subregion boundaries, disturbance boundaries, and SA boundaries.
- Polygon boundaries respected biophysical landscape features primarily, recognizing similarities in canopy composition and changes in structural stage. Stand structure is generally a reflection of disturbance history, not enduring landscape features so it formed the secondary consideration in delineation.

Polygon attribution was completed directly into the geodatabase and followed two basic rules:

- A maximum of one ecosite, vegetation type, and structural stage was allowed per polygon.
- Only accepted ecosite phase and structural stage codes were used.
 - Standardized codes and definitions for units that occur on the landscape but are not defined by an ecosite classification (e.g., waterbodies and anthropogenic disturbance) were used when applicable.
 - Stand conditions will vary considerably within an ecosite depending on disturbance history, stand age and species composition. Table A5.2-1-1 describes mapped structural stages and Table A5.2-1-2 describes mapped stand disturbance attributes.

Table A5.2-1-1. Structural Stage Codes and Descriptions

Structural Stage	Code	Description
Water	0	Open water.
Bryoid, void	1	Non-vegetated or dominated by bryophytes and lichens.
Forb/Graminoid	2	Early successional stage or herbaceous communities maintained by environmental conditions or disturbance.
Low shrub	3a	Early successional stage or shrub communities maintained by environmental conditions or disturbance. Communities dominated by shrub layer vegetation less than 2 m tall.
Tall shrub	3b	Early successional stage or shrub communities maintained by environmental conditions or disturbance. Communities dominated by shrub layer vegetation that are 2–5 m tall.
Pole sapling	4	Trees greater than 5 m tall, typically densely stocked, have overtopped shrub and herb layers; younger stands are vigorous (usually greater than 10–15 years old); older stagnated stands (up to 100 years old) are also included; self-thinning and vertical structure not yet evident in the canopy.
Young forest	5	Self-thinning has become evident and the forest canopy has begun differentiation into distinct layers (dominant, main canopy and overtopped). Time since disturbance is generally 40–80 years but may begin as early as age 30, depending on tree species and ecological conditions.
Mature forest	6	Trees established after the last disturbance have matured; a second cycle of shade-tolerant trees may have become established; understories become well-developed as the canopy opens up; time since disturbance is generally 80–100 years.
Old forest	7	Old, structurally complex stands composed mainly of shade-tolerant and regenerating tree species; snags and coarse woody debris in all stages of decomposition are typical, as are patchy understories; time since disturbance is generally greater than 100 years.

Source: British Columbia (BC) Ministry of Forests and Range and BC Ministry of Environment (2010) with modifications for Alberta.

Table A5.2-1-2. Disturbance Codes and Descriptions

Stand Disturbance	Code	Description
Fire	F	Dead standing trees in canopy from forest fire within the last 40 years.
Insect	B	Dead standing trees in canopy from or other infestation.

Note:

MPB = mountain pine beetle

Quality Assurance and Quality Control

Ecosystem mappers reviewed each other's work for quality and consistency (both within and between mappers) in delineation principals and polygon attribution. Comments provided on polygon quality were reviewed by the ecosystem mapper and appropriate edits were completed after review. For quality assurance, 10 percent of all polygons delineated and attributed were checked.

Limitations of Ecological Land Classification

The polygons delineated for ELC are based on the interpretation of a suite of biophysical attributes based on landscape shape and soil moisture, as well as stand features within each natural subregion. Photo interpretation of ecosystem attributes can be ambiguous due to a number of factors, including limited field surveys at the time of photo interpretation and low resolution of some data sources.

Field Data Collection

In preparation for field surveys in 2015, survey locations were chosen to span the diversity of vegetation types within the SA.

Field data collection to support ELC mapping was conducted within the SA from July 13–24, 2015. A team consisting of a vegetation ecologist and a soils scientist visited field survey locations representative of the range of ecosystem units within the SA, assigning classifications according to the ecosites and vegetation unit types defined in Ecological (Biophysical) Land Classification of Banff and Jasper National Parks (Holland and Coen, 1983). The data collected during these surveys included the following:

- UTM coordinates
- Ecosite
- Vegetation type
- Structural stage
- Soil moisture and nutrient regime
- Soil characteristics
- Slope
- Aspect
- Landscape position
- The dominant vegetation with special attention to indicator species and percent cover of each species

Supplementary Results

Detailed ELC mapping was completed for 97 percent (8,958 ha) of the total SA. A total of 26 ecosites are represented in the mapping area. Detailed descriptions of the ecosites and vegetation unit types mapped for this Project are provided in Ecological (Biophysical) Land Classification of Banff and Jasper National Parks (Holland and Coen, 1983). They are not re-iterated in this report. Table A5.2-1-3 lists the ELC results for ecosites and vegetation unit types present within the SA, proposed 6L530 transmission line route, proposed temporary workspace, proposed Sheridan Substation, and Palisades Generating Station.

Table A5.2-1-3. Ecosite and Vegetation Types Present within the Vegetation SA

Ecosite Label	Vegetation Unit Types Present ^b	Structural Stages	Modifiers	Area of Ecosite Within 1 km Buffer (ha) ^c	Area of Ecosite to be Disturbed (ha) ^c				
					6L530 Route	Temporary Workspace	Sheridan Substation	Palisades Generating Station	Laydown Areas
AT1	C2, C3, C6, H6	2, 3b, 4, 5, 6	--	449.17	1.73	0.21	<.01	0.68	--
	Disturbance	1, 2, 3a	--	83.23	4.67	1.35	0.51	1.64	2.44
	Total	--	--	532.40	6.40	1.55	0.51	2.32	2.44
AT3	C3, H6	2, 4, 5	--	235.47	0.51	--	--	--	--
	Disturbance	1, 2, 3a	--	22.95	0.02	--	--	--	--
	Total	--	--	258.42	0.53	--	--	--	--
DV1	C27, H11, L6	2, 3b, 4, 5	--	38.10	--	--	--	--	--
	Disturbance	1, 2	--	2.16	--	--	--	--	--
	Total	--	--	40.26	--	--	--	--	--
DV2	C27, H11, L6	2, 4, 5	--	217.90	2.34	0.21	--	--	--
	Disturbance	1, 2, 3a	--	18.88	0.31	0.07	--	--	--
	Total	--	--	236.78	2.64	0.27	--	--	--
FR1	C27, C6, L1	3a, 4, 5, 6	B	186.29	<.01	0.02	--	--	--
	Disturbance	2	--	8.93	0.41	--	--	--	--
	Total	--	--	195.23	0.42	0.02	--	--	--
GT1	C3, O4	4, 5, 6	--	21.98	--	--	--	--	--
	Disturbance	--	--	--	--	--	--	--	--
	Total	--	--	21.98	--	--	--	--	--

Table A5.2-1-3. Ecosite and Vegetation Types Present within the Vegetation SA

Ecosite Label	Vegetation Unit Types Present ^b	Structural Stages	Modifiers	Area of Ecosite Within 1 km Buffer (ha) ^c	Area of Ecosite to be Disturbed (ha) ^c				
					6L530 Route	Temporary Workspace	Sheridan Substation	Palisades Generating Station	Laydown Areas
HD1	C3, C16, H6	1, 2, 3a, 3b, 4, 5, 6	--	192.27	0.85	0.79	--	--	--
	Disturbance	1, 2, 3a, 3b	--	36.43	3.47	0.11	--	--	--
	Total	--	--	228.70	4.32	0.90	--	--	--
HD2	H6, O3, O17	2, 3a, 4, 5	--	436.30	1.71	0.27	--	--	--
	Disturbance	1, 2, 3a, 4	--	27.51	1.81	0.14	--	--	--
	Total	--	--	463.81	3.52	0.41	--	--	--
HD3	C2, C3, C27, H6, H11, O3	2, 4, 5, 6	--	767.38	2.68	0.67	--	--	--
	Disturbance	1, 2, 3a, 3b	--	34.68	3.30	0.36	--	--	--
	Total	--	--	802.06	5.99	1.03	--	--	--
HD4	C2, C3, H6, H11	2, 4, 5, 6	B	328.89	1.52	0.26	--	--	2.21
	Disturbance	1, 2, 5	--	30.02	3.46	0.28	--	--	0.09
	Total	--	--	358.92	4.98	0.54	--	--	2.30
NY1	C1	5	--	80.69	--	--	--	--	--
	Disturbance	--	--	--	--	--	--	--	--
	Total	--	--	80.69	--	--	--	--	--
NY3	C2, C5, C6, C19, L1, O5	2, 3a, 4, 5	--	649.80	0.63	--	--	--	--
	Disturbance	1, 2, 3b	--	9.92	0.88	--	--	--	--
	Total	--	--	659.71	1.51	--	--	--	--

Table A5.2-1-3. Ecosite and Vegetation Types Present within the Vegetation SA

Ecosite Label	Vegetation Unit Types Present ^b	Structural Stages	Modifiers	Area of Ecosite Within 1 km Buffer (ha) ^c	Area of Ecosite to be Disturbed (ha) ^c				
					6L530 Route	Temporary Workspace	Sheridan Substation	Palisades Generating Station	Laydown Areas
P	C3, C26, H6, O3, O17	2, 4, 5	--	19.63	0.02	--	--	--	2.79
	Disturbance	1, 2, 3a	--	14.64	0.01	--	--	--	--
	Total	--	--	34.27	0.03	--	--	--	2.79
PR2	C6	4	--	1.44	--	--	--	--	--
	Disturbance	--	--	--	--	--	--	--	--
	Total	--	--	1.44	--	--	--	--	--
PT1	C3, C6, C19, H6	2, 3a, 4, 5, 6	--	594.34	1.99	0.25	--	--	--
	Disturbance	2, 3a	--	13.08	0.63	0.40	--	--	--
	Total	--	--	607.42	2.61	0.65	--	--	--
PT3	C3, C6	4, 5	--	195.91	--	--	--	--	--
	Disturbance	--	--	--	--	--	--	--	--
	Total	--	--	195.91	--	--	--	--	--
PT5	C6, C19, O11	3a, 4, 5	--	255.02	0.34	--	--	--	--
	Disturbance	2	--	2.20	0.25	--	--	--	--
	Total	--	--	257.22	0.59	--	--	--	--
SB4	O4	4	--	3.52	--	--	--	--	--
	Disturbance	--	--	--	--	--	--	--	--
	Total	--	--	3.52	--	--	--	--	--
SC	C2, S7	3b, 4, 5	--	68.68	--	0.23	--	--	--
	Disturbance	2, 3a	--	0.73	0.17	0.02	--	--	--
	Total	--	--	69.40	0.17	0.25	--	--	--

Table A5.2-1-3. Ecosite and Vegetation Types Present within the Vegetation SA

Ecosite Label	Vegetation Unit Types Present ^b	Structural Stages	Modifiers	Area of Ecosite Within 1 km Buffer (ha) ^c	Area of Ecosite to be Disturbed (ha) ^c				
					6L530 Route	Temporary Workspace	Sheridan Substation	Palisades Generating Station	Laydown Areas
TA2	H6, O17	2, 4, 5, 6	F	419.21	1.03	0.06	--	--	--
	Disturbance	1, 2, 3b	--	24.63	1.17	0.11	--	--	--
	Total	--	--	443.84	2.20	0.17	--	--	--
TA3	C2, C16, C26, C27, H6, O3, O17	2, 3a, 4, 5	F	563.26	--	--	--	--	--
	Disturbance	1, 2, 3a	--	6.51	--	--	--	--	--
	Total	--	--	569.77	--	--	--	--	--
VL1	C4, C27, H11, O6, O7, S1, S7	2, 3a, 3b, 4, 5	--	463.07	1.44	--	--	--	--
	Disturbance	1, 2, 3a, 3b	--	28.31	0.64	--	--	--	--
	Total	--	--	491.38	2.09	--	--	--	--
VL3	C4, H11, O3, S1, S7	2, 3a, 3b, 4, 5, 6	F	456.08	1.08	0.19	--	--	0.05
	Disturbance	1, 2, 3a	--	36.35	0.77	0.28	--	--	--
	Total	--	--	492.44	1.84	0.47	--	--	0.05
VL4	C4, H11, S1	2, 3a, 4, 5	--	287.03	0.20	0.07	--	--	--
	Disturbance	1, 2	--	19.99	1.47	0.24	--	--	--
	Total	--	--	307.02	1.67	0.31	--	--	--
VL5	C6, C28, H11, S1, S7	2, 3a, 3b, 4, 5, 6	--	234.63	0.32	0.29	--	--	--
	Disturbance	1, 2, 3a	--	23.58	2.64	0.20	--	--	--
	Total	--	--	258.21	2.96	0.50	--	--	--

Table A5.2-1-3. Ecosite and Vegetation Types Present within the Vegetation SA

Ecosite Label	Vegetation Unit Types Present ^b	Structural Stages	Modifiers	Area of Ecosite Within 1 km Buffer (ha) ^c	Area of Ecosite to be Disturbed (ha) ^c				
					6L530 Route	Temporary Workspace	Sheridan Substation	Palisades Generating Station	Laydown Areas
ZZ	C27, H11, L6, O7, S1, S7	2, 3a, 4, 5, 6	--	21.88	0.03	--	--	--	--
	Disturbance	1, 2, 3a	--	10.70	0.15	--	--	--	--
	Total	--	--	32.58	0.18	--	--	--	--
Other ^a	--	1	--	1,314.38	1.49	0.31	--	--	--
Total Disturbance^d	--	--	--	455.42	26.22	3.54	0.51	1.64	2.53
TOTAL MAPPED AREA^d	--	--	--	8,957.76	46.15	7.37	0.51	2.32	7.59

Notes:

^a Denotes features not classified by an ecosite label (e.g., open water, bare rock).

^b Vegetation types as per Holland and Coen (1983).

^c Areas are approximate.

^d Due to rounding error and overlap of project components, totals presented may be larger than the Project Footprint. There is a 0.5 ha area of temporary workspace located outside of the Vegetation SA that is not included in these totals.

Rare Vegetation Species and Rare Ecological Communities

Supplementary Desktop Results

Previously recorded Element Occurrences (EOs) within 5 km of the Project are summarized in Table A5.2-1-4.

Table A5.2-1-4. Previously Recorded Rare Vegetation and Rare EOs within 5 km of the Project

Common Name	Scientific Name	Type	Provincial Rank(s) ^a	EO ID	Legal Location	Approximate Distance to Project (km) ^b
alpine soil-foam lichen	<i>Stereocaulon glareosum</i>	lichen	S2	16035	SE 21-46-1 W6M	2.4
<i>Andraea</i> moss	<i>Andraea alpestris</i>	moss	S1	2722	NE 21-46-1 W6M	4.5
awl-leaved fork moss	<i>Dicranella subulata</i>	moss	S2S3	3468	NE 21-46-1 W6M	3.3–4.5
bent screw moss	<i>Tortella inclinata</i>	moss	S2S3	16033	NE 21-46-1 W6M	4.4
				4793	NW 2-46-1 W6M	4.8
				4795	NW 5-47-1 W6M to SE 28-46-1 W6M	within buffer
broad-lipped twayblade	<i>Neottia convallarioides</i>	vascular plant	S2	20880	NW 21-47-1 W6M	<0.1
<i>Bryum</i> moss	<i>Bryum calobryoides</i>	moss	S2	3196	NE 17-47-1 W6M to NW 33-46-1 W6M	within buffer
button lichen	<i>Buellia elegans</i>	lichen	S2	5969	SE 24-48-1 W6M	0.3
candle-snuffer moss	<i>Encalypta mutica</i>	moss	S2	3650	NW 2-46-1 W6M	2.8
				3651	NE 5-47-1 W6M	2.2
candle-snuffer moss	<i>Encalypta spathulata</i>	moss	S2S3	16534	SW 26-48-28 W5M	2.8
				23843	NW 2-46-1 W6M	2.2
coastal quillwort	<i>Isoetes maritima</i>	vascular plant	S1	14092	NW 2-46-1 W6M	4.0–4.6
cobblestone lichen	<i>Myriospora heppii</i>	lichen	S1	5135	NW 2-46-1 W6M	0.5
corymbose everlasting	<i>Antennaria corymbosa</i>	vascular plant	S2	16037	NE 21-46-1 W6M	4.4
Crawe's sedge	<i>Carex crawei</i>	vascular plant	S3	11483	NE 10-46-1 W6M to NW 2-46-1 W6M	within buffer
				20681	SE 28-46-1 W6M	0.7
				20738	NE 26-48-28 W5M	<0.1
desert crater lichen	<i>Diploschistes diacapsis</i>	lichen	S1	20990	SW 23-48-28 W5M to NE 13-48-1 W6M	within buffer

Table A5.2-1-4. Previously Recorded Rare Vegetation and Rare EOs within 5 km of the Project

Common Name	Scientific Name	Type	Provincial Rank(s) ^a	EO ID	Legal Location	Approximate Distance to Project (km) ^b
<i>Didymodon</i> moss	<i>Didymodon nigrescens</i>	moss	S1	3591	NW 2-46-1 W6M	1.2
drooping-leaved fork moss	<i>Dicranella palustris</i>	moss	S2S3	3463	NE 21-46-1 W6M	3.1–4.5
Drummond's cinquefoil	<i>Potentilla drummondii</i>	vascular plant	S2	10112	SE 28-46-1 W6M	3.2
fallacious screw moss	<i>Didymodon fallax</i>	moss	S2S3	16031	NE 21-46-1 W6M	4.0–4.5
fan ramalina	<i>Ramalina sinensis</i>	lichen	S3	5066	SW 8-49-27 W5M	3.0
four-fingered pawwort	<i>Barbilophozia quadriloba</i>	liverwort	SU	2304 2302	NW 2-46-1 W6M	3.4
fringe lichen	<i>Anaptychia crinalis</i>	lichen	S2	6092	SW 8-49-27 W5M	2.5
<i>Grimmia</i> moss	<i>Grimmia mollis</i>	moss	S1S2	3740	NE 21-46-1 W6M	5.0
hairy bugseed	<i>Corispermum villosum</i>	vascular plant	S2	24521	SE 2-48-1 W6M	2.4
hairy cinquefoil	<i>Potentilla villosa</i>	vascular plant	SU	10220	SE 28-46-1 W6M	3.0
hairy-leaved beardless moss	<i>Pterygoneurum ovatum</i>	moss	S2S3	4393	SE 35-48-28 W5M	0.5
<i>Herzogiella</i> moss	<i>Herzogiella seligeri</i>	moss	S1	3851	NW 2-46-1 W6M	2.3
Hooker's cinquefoil	<i>Potentilla hookeriana</i>	vascular plant	SU	16214	NE 5-47-1 W6M to NE 5-47-1 W6M	within buffer
				16215	NE 15-46-1 W6M to NE 15-46-1 W6M	within buffer
				20690 20691 20692	NW 27-47-1 W6M to NW 27-47-1 W6M	within buffer
				20693 20700	NW 23-48-28 W5M to NE 13-48-1 W6M	within buffer
				20706	NE 27-47-1 W6M to NE 27-47-1 W6M	within buffer
				20729 20731	SE 20-47-1 W6M to SE 20-47-1 W6M	within buffer

Table A5.2-1-4. Previously Recorded Rare Vegetation and Rare EOs within 5 km of the Project

Common Name	Scientific Name	Type	Provincial Rank(s) ^a	EO ID	Legal Location	Approximate Distance to Project (km) ^b
Hooker's cinquefoil (cont'd)	See above	See above	See above	20738	NE 21-46-1 W6M to SW 22-46-1 W6M	within buffer
				20746	NE 15-46-1 W6M to NE 15-46-1 W6M; SW 33-46-1 W6M to SW 33-46-1 W6M; SW 33-46-1 W6M to NW 28-46-1 W6M; NE 28-46-1 W6M to NE 21-46-1 W6M; NE 5-47-1 W6M to NE 5-47-1 W6M	within buffer
				20748	NE 15-46-1 W6M to NE 15-46-1 W6M	within buffer
				20856	NE 36-48-28 W5M to NE 36-48-28 W5M; NE 36-48-28 W5M to NE 36-48-28 W5M	within buffer
				20867	SW 33-46-1 W6M to SW 33-46-1 W6M; SW 33-46-1 W6M to NW 28-46-1 W6M; NE 28-46-1 W6M to NE 21-46-1 W6M	within buffer
				20706	NE 27-47-1 W6M	<0.1
				20730	SE 20-47-1 W6M	<0.1
				20731	SE 20-47-1 W6M	<0.1
				20855	SE 15-49-27 W5M	<0.1
				20691	NW 27-47-1 W6M	0.2
				20727		
				10126	SE 24-48-1 W6M	0.3
				20700		
				20691	NE 28-47-1 W6M	0.4
20874						
16216	SW 4-47-1 W6M	1.0				
20746						
10138	NE 28-46-1 W6M	1.4				
20746						

Table A5.2-1-4. Previously Recorded Rare Vegetation and Rare EOs within 5 km of the Project

Common Name	Scientific Name	Type	Provincial Rank(s) ^a	EO ID	Legal Location	Approximate Distance to Project (km) ^b
Hooker's cinquefoil (cont'd)	See above	See above	See above	10121	NW 2-46-1 W6M	1.7–4.6
				20756		
				20757		
				20769		
				20772		
				20776		
<i>Hygrohypnum cochlearifolium</i> moss	<i>Hygrohypnum cochlearifolium</i>	moss	S1	3929	NE 21-46-1 W6M	5.0
<i>Hygrohypnum ochraceum</i> moss	<i>Hygrohypnum ochraceum</i>	moss	S2S3	3951	NE 21-46-1 W6M	4.5
<i>Hygrohypnum molle</i> moss	<i>Hygrohypnum molle</i>	moss	S1S2	3942	NE 21-46-1 W6M	4.5
<i>Hygrohypnum smithii</i> moss	<i>Hygrohypnum smithii</i>	moss	S1	3959	NW 2-46-1 W6M	0.5
<i>Hypnum</i> moss	<i>Hypnum procerrimum</i>	moss	S2S3	3985	NE 6-49-27 W5M	0.6
<i>Jaffueliobryum</i> moss	<i>Jaffueliobryum wrightii</i>	moss	S1S2	4972	SW 4-47-1 W6M to NE 21-46-1 W6M	within buffer
June grass - pasture sagewort - wild blue flax	<i>Koeleria macrantha</i> - <i>Artemisia frigida</i> - <i>Linum lewisii</i>	rare ecological community	S2S3	1687	NE 15-46-1 W6M to SE 15-46-1 W6M; NE 28-46-1 W6M; SW 33-46-1 W6M	within buffer to 1.2
				1688	SW 13-48-1 W6M to NW 12-48-1 W6M	within buffer
				1686	SE 15-46-1 W6M	0.2
				1689	SE 22-48-28 W5M	1.5
				1685	NW 2-46-1 W6M	2.4–2.7
leafy braya	<i>Braya humilis</i> ssp. <i>maccallae</i>	vascular plant	S2	7849	SW 4-47-1 W6M; NE 5-47-1 W6M	0.6–1.1
leafy lousewort	<i>Pedicularis racemosa</i>	vascular plant	S1	11032	NE 21-46-1 W6M	<0.1
lens-fruited sedge	<i>Carex lenticularis</i> var. <i>dolia</i>	vascular plant	S1	11709	NW 2-46-1 W6M	0.9
matted bryum	<i>Bryum calophyllum</i>	moss	S2	3082	NE 17-47-1 W6M to NW 33-46-1 W6M	within buffer
Muhlenberg's cord moss	<i>Funaria muhlenbergii</i>	moss	S1	3713	NE 36-48-28 W5M to SW 26-48-28 W5M	within buffer
<i>Orthotrichum</i> moss	<i>Orthotrichum pallens</i>	moss	S2S3	4150	SW 8-49-27 W5M	<0.1

Table A5.2-1-4. Previously Recorded Rare Vegetation and Rare EOs within 5 km of the Project

Common Name	Scientific Name	Type	Provincial Rank(s) ^a	EO ID	Legal Location	Approximate Distance to Project (km) ^b
pasture sedge	<i>Carex petasata</i>	vascular plant	S3	16139	NW 2-46-1 W6M	1.4
pepper-spore lichen	<i>Rinodina polyspora</i>	lichen	S1	5730	NW 21-47-1 W6M to SE 20-47-1 W6M	within buffer
<i>Platydictya</i> moss	<i>Platydictya minutissima</i>	moss	S2	4210	NE 6-49-27 W5M	0.8
<i>Pohlia</i> moss	<i>Pohlia vexans</i>	moss	S1	4291	NE 21-46-1 W6M	4.5
Porsild's bryum moss	<i>Bryum porsildii</i>	moss	S2S3	4045	NW 31-48-27 W5M; SE 35-48-28 W5M	0.3–2.0
<i>Pseudoleskea</i> moss	<i>Pseudoleskea atricha</i>	moss	S2S3	4350	NE 21-46-1 W6M	4.0–4.5
quillwort	<i>Isoetes x truncata</i>	vascular plant	S1	14094	NW 2-46-1 W6M	4.5
<i>Racomitrium aciculare</i> moss	<i>Racomitrium aciculare</i>	moss	S2S3	4404	NE 21-46-1 W6M	4.5
<i>Racomitrium fasciculare</i> moss	<i>Racomitrium fasciculare</i>	moss	S1S3	4408	NE 21-46-1 W6M	4.5
red leaf moss	<i>Bryoerythrophyllum ferruginascens</i>	moss	S1	3042	NW 2-46-1 W6M	1.1
red rock moss	<i>Andreaea nivalis</i>	moss	S1S2	2704	NE 21-46-1 W6M	4.5
snow foam lichen	<i>Stereocaulon rivulorum</i>	lichen	S3	16036	SE 21-46-1 W6M	2.5
<i>Solorinella</i> lichen	<i>Solorinella asteriscus</i>	lichen	S1	5746	SE 16-49-27 W5M	0.2
spatulate grape fern	<i>Botrychium spathulatum</i>	vascular plant	S3	20663	SW 12-48-1 W6M to SW 12-48-1 W6M	within buffer
				20875	NE 7-47-1 W6M	<0.1
spiderplant	<i>Saxifraga flagellaris</i> ssp. <i>setigera</i>	vascular plant	S2	10585	NW 27-47-1 W6M	1.5
spreading stonecrop	<i>Sedum divergens</i>	vascular plant	S2	8472	NW 17-47-1 W6M	4.6
sulphur lichen	<i>Fulgensia fulgens</i>	lichen	S2S3	5366	SE 24-48-1 W6M	0.3
sunken disc lichen	<i>Aspicilia supertegens</i>	lichen	S2	22849	NW 23-48-28 W5M	1.0
sunken-stud lichen	<i>Lecanora beringii</i>	lichen	S2	5426	SE 24-48-1 W6M	0.3
tongue-leaf small-kettle moss	<i>Tayloria lingulata</i>	moss	S2S3	4743	SW 33-46-1 W6M to SE 28-46-1 W6M	within buffer

Table A5.2-1-4. Previously Recorded Rare Vegetation and Rare EOs within 5 km of the Project

Common Name	Scientific Name	Type	Provincial Rank(s) ^a	EO ID	Legal Location	Approximate Distance to Project (km) ^b
western quillwort	<i>Isoetes occidentalis</i>	vascular plant	S1	14093	NW 2-46-1 W6M	4.5
white birch - water birch / common bearberry	<i>Betula papyrifera</i> - <i>Betula occidentalis</i> / <i>Arctostaphylos uva-ursi</i>	rare ecological community	S1	1678	SE 14-49-27 W5M	0.4
white spruce / prickly rose / fern moss	<i>Picea glauca</i> / <i>Rosa acicularis</i> / <i>Abietinella abietina</i>	rare ecological community	S1	1682	NE 9-49-27 W5M to NE 9-49-27 W5M; NE 9-49-27 W5M to SW 8-49-27 W5M; NE 8-49-27 W5M	within buffer to 0.3
				1680	SE 13-48-1 W6M	0.1
				1683	NW 9-49-27 W5M	0.5
				1681	SE 13-48-1 W6M; SE 2-48-1 W6M	1.3–2.5
				1679	NE 17-47-1 W6M; SE 20-47-1 W6M	1.4–1.6
whitebark pine	<i>Pinus albicaulis</i>	vascular plant	S3	18974	NW 17-47-1 W6M	1.6
				23264	NW 17-47-1 W6M; SE 7-47-1 W6M; NW 27-47-1 W6M; NW 21-47-1 W6M; NE 21-46-1 W6M; SW 4-47-1 W6M; SE 28-46-1 W6M; NE 6-47-1 W6M	1.6–3.1
				18054	SE 7-47-1 W6M	1.6
				18596	NW 27-47-1 W6M	1.6
				19770	NW 21-47-1 W6M	1.9–2.1
				23423		
				19051	NE 21-46-1 W6M	2.1
				18879	SW 4-47-1 W6M	2.1
				23306	SE 28-46-1 W6M	2.2
				18052	NE 6-47-1 W6M	2.2
				18038	NE 21-46-1 W6M; SE 28-46-1 W6M	2.2–2.3
19772	SE 28-46-1 W6M	3.1				
wild comfrey	<i>Cynoglossum virginianum</i> var. <i>boreale</i>	vascular plant	S1	20837	SE 14-49-27 W5M	0.1–0.6

Table A5.2-1-4. Previously Recorded Rare Vegetation and Rare EOs within 5 km of the Project

Common Name	Scientific Name	Type	Provincial Rank(s) ^a	EO ID	Legal Location	Approximate Distance to Project (km) ^b
woolly geranium	<i>Geranium erianthum</i>	vascular plant	SH	9009	NE 10-46-1 W6M to NW 2-46-1 W6M	within buffer
woolly willow	<i>Salix calcicola</i>	vascular plant	S2	20882 20884	NE 28-46-1 W6M	0.8–1.0
yellow sedge	<i>Carex flava</i>	vascular plant	S2S3	24769	NE 6-49-27 W5M	0.1
				24772	NE 21-46-1 W6M	0.3
				24776	NW 2-46-1 W6M	0.4
				24771	NW 2-46-1 W6M	5.0

^a Definitions of provincial ranks are summarized in Appendix 5.2-2.

^b Alberta Conservation Information Management System (ACIMS) may buffer the location of an occurrence when mapping precision is low due to the age of the data, the detail submitted or a landowner's wish to withhold the specific location from the public. The occurrence may be located anywhere within the buffer. Distances in this table were measured from the proposed construction right-of-way to the nearest edge of each buffer.

Field Methods

An early season vegetation survey was conducted from June 4–14, 2015 and a late season vegetation survey was conducted from August 7–15, 2015 along selected segments of the proposed 6L530 transmission line route. An early season vegetation survey was conducted from June 8-9, 2016 along selected rerouted segments of the proposed 6L530 transmission line right-of-way. The vegetation survey was comprised of rare vegetation survey and weed survey components, as described in this subsection.

Vegetation surveys were planned based on the results of the desktop review of aerial photographs and provincial database searches. Information collected during the desktop review identified potential rare vegetation species, potential rare ecological communities, and areas of high-potential habitat, and was used to select and prioritize areas for the vegetation surveys. The vegetation surveys focused on areas near known rare plant and rare ecological community occurrences, habitats identified as likely to support rare plants, and representative habitats along the proposed transmission line route. Vegetation surveys focused primarily on lands with native vegetation.

Bryophyte and lichen collections were conducted within the areas surveyed during vegetation surveys and focused on Tracked species known from the area and their preferred habitats; high priority microhabitats for bryophytes and lichens (ABMI, 2014); and representative habitats encountered by the proposed construction right-of-way. The CH2M bryophyte and lichen survey methodology is based on principles from the ABMI (2014), and focuses on collecting as many species as possible from microhabitats followed by submission to bryologists and lichenologists for identification.

Vegetation ecologists followed the methods outlined in the *Sensitive Species Inventory Guidelines* (AESRD, 2013), as well as the *Guidelines for Rare Vascular Plant Surveys in Alberta* (Alberta Native Plant Council, 2012). All vegetation surveys were conducted during phenologically appropriate times for the species being surveyed.

Vegetation ecologists walked each selected segment of the proposed transmission line route, recorded all identifiable species, and searched for rare species and uncommon habitats. A purposeful meander technique was used to survey the proposed transmission line right-of-way. Where microsites with high-potential for rare plants were observed, more detailed searches were performed.

Where rare species were observed, the populations were mapped and photographed, UTM coordinates were recorded, and detailed reporting forms were completed for submission to ACIMS. Species identification was confirmed by other established vegetation ecologists, or by comparison with specimens at an appropriate herbarium. When a rare ecological community was observed, the community was mapped and photographed, and its location was recorded. A full species list was recorded, and percent cover for each species was estimated. Descriptions of the sites and vegetation present were documented on detailed reporting forms for submission to ACIMS.

Supplementary Results

Locations where vegetation surveys were conducted in 2015 and 2016 along the proposed transmission line route are identified in Table A5.2-1-5 by legal location and represented on Figure A5.2-1-1.

Table A5.2-1-5. 2015 Vegetation Survey Locations

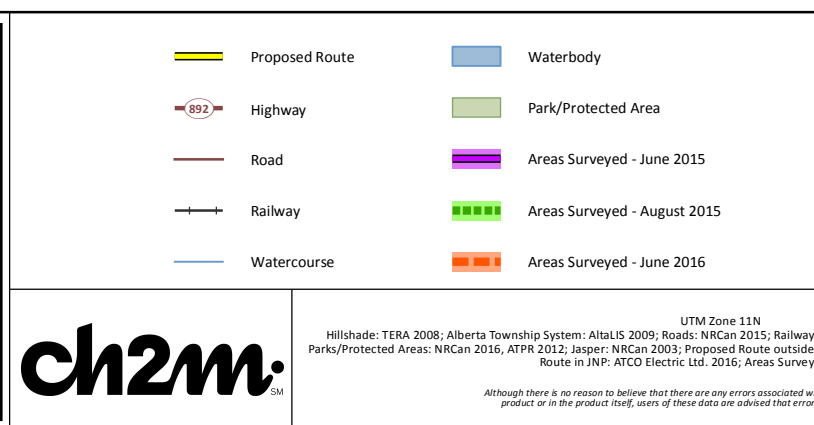
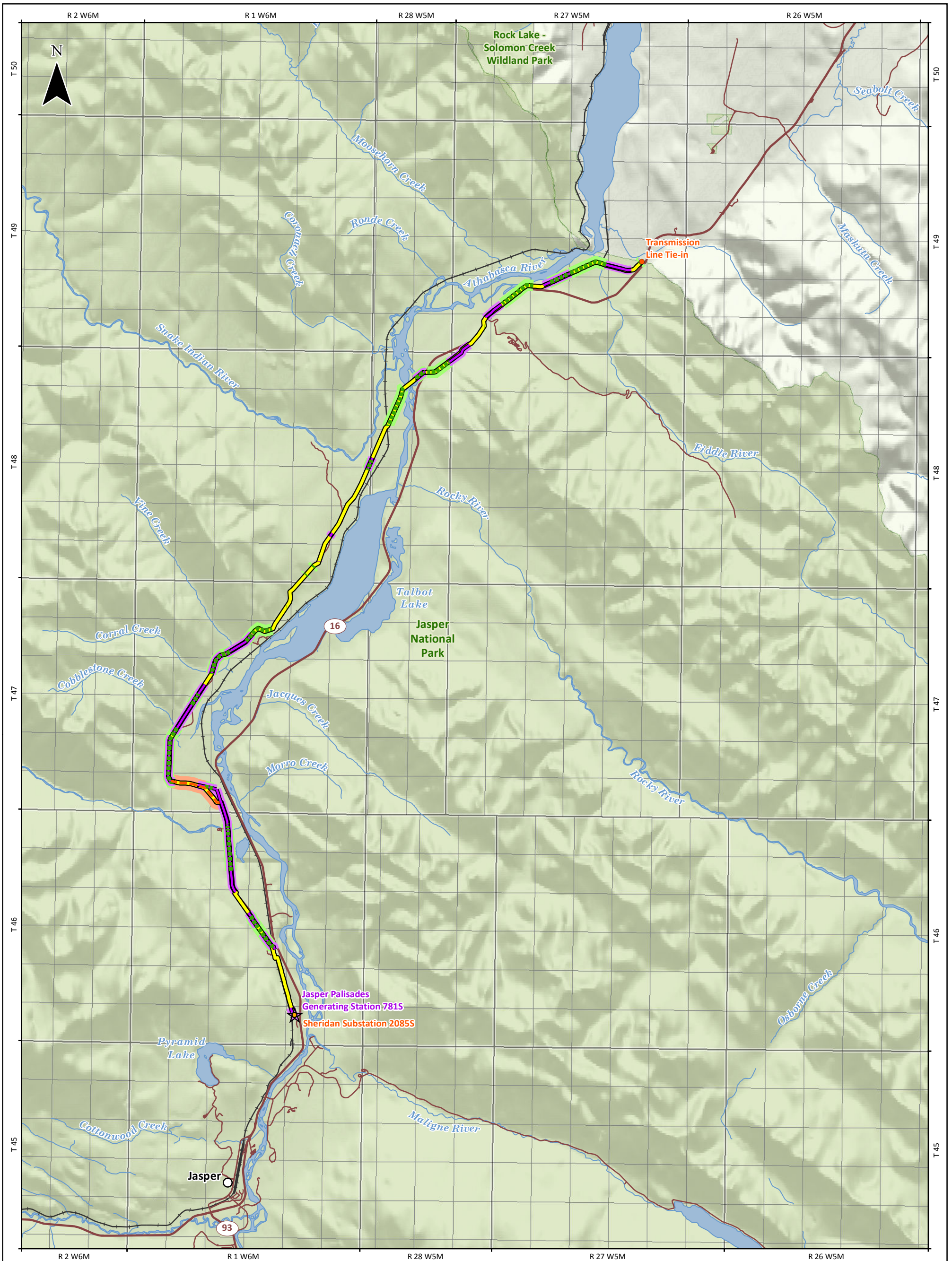
Legal Locations	Year of Survey	Survey Length ^b (km)
S 14-49-27 W5M, S 15-49-27 W5M, SE 16-49-27 W5M, N 9-49-27 W5M	2015	4.2
NW 9-49-27 W5M, E 8-49-27 W5M, SW 8-49-27 W5M	2015	1.7
SW 8-49-27 W5M, SE 7-49-27 W5M, NE 6-49-27 W5M	2015	1.0
SW 6-49-27 W5M, NW 31-48-27 W5M, E 36-48-28 W5M, SW 36-48-28 W5M	2015	2.25
SW 36-48-28 W5M, SE 35-48-28 W5M	2015	0.75
SE 35-48-28 W5M, E 26-48-28 W5M, SW 26-48-28 W5M	2015	1.8
SE 22-48-28 W5M, SE 24-48-1 W6M, NE 13-48-1 W6M	2015	0.5
SW 12-48-1 W6M, SE 11-48-1 W6M	2015	0.2
NE 2-48-1 W6M	2015	0.05
SE 2-48-1 W6M	2015	0.15
SW 2-48-1 W6M	2015	0.05
SE 34-47-1 W6M	2015	0.05
N 27-47-1-6, E 28-47-1 W6M	2015	1.5
NW 27-47-1 W6M, E 28-47-1 W6M, SW 28-47-1 W6M, NW 21-47-1 W6M, NE 20-47-1 W6M	2015	2.6
SE 20-47-1 W6M, N 17-47-1 W6M, SE 17-47-1 W6M, NW 8-47-1 W6M, E 7-47-1 W6M, NE 6-47-1 W6M, NW 5-47-1 W6M	2015	4.8
NE 6-47-1 W6M, NW 5-47-1 W6M, E 5-47-1 W6M, SW 4-47-1 W6M	2016	2.5
SW 4-47-1 W6M, W 33-46-1 W6M, N 28-46-1 W6M, SE 28-46-1 W6M	2015	3.95
SW 22-46-1 W6M, N 15-46-1 W6M	2015	1.7
NW 2-46-1 W6M	2015	0.3

Table A5.2-1-5. 2015 Vegetation Survey Locations

Legal Locations	Year of Survey	Survey Length^b (km)
<i>Total Length Surveyed (km)</i>		27.55
<i>Proportion of Total Route Length Surveyed (percent)</i>		61 percent

^a All distances are approximate.

Detailed information on the occurrences of rare vegetation observed along the proposed transmission line route, including legal locations, abundance and distribution, species description and recommended mitigation measures for occurrences of rare vegetation for which mitigation is warranted, is provided in Tables A5.2-1-6 and A5.2-1-7. Photoplates of observed rare vegetation are presented in Appendix 5.2-4.



ATCO Electric

SCALE: 1:150,000

(All Locations Approximate)

FIGURE A5.2-1-1	
2015 AND 2016 VEGETATION AREAS SURVEYED	
JASPER INTERCONNECTION PROJECT	
June 2017	660380
Mapped By: JDR	Checked By: MB



UTM Zone 11N
 Hillshade: TERA 2008; Alberta Township System: AltaLIS 2009; Roads: NRCAN 2015; Railways: NRCAN 2012; Watercourse, Waterbody: IHS Inc. 2004; Parks/Protected Areas: NRCAN 2016, ATPR 2012; Jasper: NRCAN 2003; Proposed Route outside JNP: ATCO Electric Ltd. 2015; Generating Station, Proposed Route in JNP: ATCO Electric Ltd. 2016; Areas Surveyed: CH2M 2015.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/ Operation Phase ^d					
1	silverberry riparian shrubland (SU, Tracked)	SE 15-49-27 W5M	This community was observed within a 120 m by 50 m area on the west side of the Fiddle River.	This rare ecological community was observed spanning the entirety of the proposed construction right-of-way and extending off of the proposed construction right-of-way in both directions (based on measurements with a hand-held GPS). Part of the community is within a portion of a temporary workspace for the west bank borehole.	The silverberry riparian shrubland (<i>Elaeagnus commutata</i> riparian shrubland) is a rare ecological community that forms small patches on stream terraces. Not well documented in Alberta, it is found on silty alluvial soils on glacial fluvial or lacustrine deposits. Silverberry is the dominant shrub, although willow species, Saskatoon, and choke cherry are often present. The understory tends to be sparse, with a variable species composition, and with a high litter cover (Allen, 2014).	1	2, 6, 9, 10, 11, 12	13, 14	silverberry riparian shrubland 853793	1	11U	442853	5897793
												442763	5897821
2	wild comfrey (S1, Tracked)	NE 9-49-27 W5M	Three patches were observed: One patch consisting of 7 plants within a 10 m by 7 m area, and two single individuals within their own 1 m by 1 m area.	This rare plant is adjacent to the proposed construction right-of-way. The closest patch being the largest (wild comfrey 971157), 9 m northwest of the centerline. The occurrence extending off of the proposed construction right-of-way to the north (based on measurements with a hand-held GPS).	Wild comfrey (<i>Cynoglossum virginianum</i> var. <i>boreale</i> [Fernald] Cooper.) is an herbaceous perennial that grows 40–80 cm tall. It has hairy stems that are leafless below the inflorescence, and has broadly lance-shaped leaves that are stalked below and sessile above (Kershaw et al., 2001). Its small blue flowers grow in elongated racemes, and develop into small, spiny nutlets. Wild comfrey grows in dry woods (Kershaw et al., 2001). This population was observed on the edge of a coniferous forest adjacent to an existing right-of-way, adjacent to the proposed construction right-of-way.	--	2, 4, 6	13, 14	wild comfrey 971157	2	11U	440971	5897157
												440978	5897161
									wild comfrey 939149	--	11U	440939	5897149
									wild comfrey 934901	--	11U	440394	5896901
3	white spruce - prickly rose - fern moss (S1, Tracked)	N 9-49-27 W5M NE 8-49-27 W5M S 8-49-27 W5M	Four patches of this community (two patches approximately 800 m long, one approximately 500 m long and one approximately 200 m long) were observed occurring on the north side of the existing right-of-way extending off of the proposed construction right-of-way to the north.	This rare ecological community was observed immediately adjacent to the proposed construction right-of-way, 6 m northwest of the centerline and extending northward (based on measurements with a hand-held GPS).	The white spruce – prickly rose – fern moss (<i>Picea glauca</i> – <i>Rosa acicularis</i> – <i>Abietinella abietina</i>) rare ecological community is characterized by a dominance of white spruce in the canopy (25–35 percent cover), a well-developed shrub layer dominated by prickly rose (10–20 percent) and a well-developed herbaceous layer dominated by hairy wild rye and twinflower (Allen, 2014). It occurs in montane areas along major rivers, on level to moderately sloping, north-facing sites (Allen, 2014). This rare ecological community was observed immediately adjacent to the proposed construction right-of-way.	1	2, 6, 9, 10, 11	13, 14	white spruce - prickly rose - fern moss 932887	2,3	11U	439932	5896887
												440756	5897050
									white spruce - prickly rose - fern moss 318632	2,3	11U	439318	5896632
											439932	5896887	
									white spruce - prickly rose - fern moss 740186	3	11U	438740	5896186
											438710	5896219	
											439144	5896509	
											439133	5896553	
		438318	5895860										
		438304	5895888										
		438357	5895936										
		438378	5895907										

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/ Operation Phase ^d					
4	Porsild's braya (S1, Tracked)	NW 31-48-27 W5M	4 plants within a 1 m by 1 m area.	This rare plant was observed immediately adjacent to the proposed construction right-of-way, 6 m northwest of the centerline (based on measurements with a hand-held GPS).	Porsild's braya (<i>Braya humilis</i> ssp. <i>porsildii</i> J.G. Harris) is a small perennial herb that grows to 30 cm tall. It has hairy purplish stems, and its leaves are mostly clustered at the base of the plant. Its flowers are white or pinkish, and it produces seed pods about 10 mm long (Kershaw et al., 2001). Porsild's braya grows in moist to dry open woods, and on banks and gravel bars (Kershaw et al., 2001). This population was observed on the existing TCPL roach, immediately adjacent to the proposed construction right-of-way.	1	2, 4, 6	13, 14	Porsild's braya 568799	4	11U	436568	5893799
5	small greasewort (S2S4, Tracked)	NE 36-48-28 W5M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare liverwort was observed on the edge of the proposed construction right-of-way, 5 m northwest of the centerline (based on measurements with a hand-held GPS).	Small greasewort (<i>Aneura pinguis</i> [L. Dum.]) is a greasy-looking mid-green liverwort that varies greatly in size, from 1 cm to greater than 8 cm long (Atherton et al., 2010). Thalli are prostrate or procumbent in dense to loose mats or irregular rosettes (Paton, 1999). The thallus is thick with slightly wavy margins not much thinner than the midrib. Sexual organs are produced on the sides of the thalli, with cylindrical sporophytes common (Atherton et al., 2010). Commonly found in acidic or base-rich moist to wet clay, loam, sand, or peaty soil that is exposed or in the shade (Paton, 1999). It can be found in damp places such as fens, though gravel tracks and waste ground also provide suitable conditions (Atherton et al., 2010). This species was observed growing on soil and rock adjacent to a stream. It was identified following fieldwork from a collection.	--	2, 4, 6	13, 14	small greasewort 455713	4	11U	436455	5893713
6	Hooker's cinquefoil (SU, Tracked)	SE 36-48-28 W5M	1 plant within a 1 m by 1 m area.	This rare plant was observed adjacent to the proposed construction right-of-way, 10 m northwest of the centerline (based on measurements with a hand-held GPS).	Hooker's cinquefoil (<i>Potentilla hookeriana</i> Lehm.) is a small (1–3 cm tall) perennial herb with basal leaves divided into 3–5 leaflets. The leaflets are 10–20 mm long, olive-green on the upper surface and white and densely woolly on their lower surface. Flowers are yellow and 10–12 mm across. Hooker's cinquefoil grows on dry, rocky alpine slopes (Kershaw et al., 2001).	--	2, 4, 6	13, 14	Hooker's cinquefoil 855273	4	11U	435855	5893273
7	silverberry riparian shrubland (SU, Tracked)	SW 36-48-28 W5M	This community was observed occurring on the north side of the existing right-of-way between the two UTM coordinates provided, extending off of the proposed construction right-of-way to the north.	This rare ecological community was observed on the proposed construction right-of-way, 1 m northwest of the centerline and extending off of the proposed construction right-of-way to the north (based on measurements with a hand-held GPS).	See description for this species above (row 1).	1	2, 6, 9, 10, 11	13, 14	silverberry riparian shrubland 193137 silverberry riparian shrubland 156112	5 5	11U 11U	435193 435245 433156 434976	5893137 5893180 5893112 5892979

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/ Operation Phase ^d					
8	yellow sedge (S2S3, Tracked)	NE 26-48-28 W5M SE 35-48-28 W5M	Two patches consisting of hundreds of clumps were observed within a 70 m by 25 m area, on the west side of the Athabasca River.	In the northern patch, the plants were observed throughout the proposed construction right-of-way, extending off right-of-way in both directions (based on measurements with a hand-held GPS). Part of this patch is within a portion of the temporary workspace for the west bank borehole. The southern patch was observed adjacent to the proposed construction right-of-way, 10 m northwest of centerline (based on measurements with a hand-held GPS).	Yellow sedge (<i>Carex flava</i> L.) is a perennial herb with stiff stems up to 60 cm tall. It grows in clumps, and has yellowish-green leaves 2–5 mm wide. The flower clusters are on 3–6 spikes that are usually crowded together, with the uppermost bearing only male flowers. Its fruits (perigynia) are yellowish-brown in colour and 4–6 mm long, with long, bent beaks (Moss, 1983). Yellow sedge grows on lime-rich soils in moist to wet habitats such as open meadows, fens, or swamps (FNA, 1993+). This population was observed on the edge of an existing right-of-way, adjacent to a coniferous forest. It was not observed within the forest.	1	3, 4, 6, 7, 9, 12	13, 14	yellow sedge 265951	5	11U	434265	5891951
												434421	5892432
												434494	5892582
												434295	5892072
												434289	5892008
												434280	5891939
434290	5891988												
9	Hooker's cinquefoil (SU, Tracked)	SE 22-48-28 W5M	Approximately 80 individuals within a 20 m by 7 m area.	This rare plant was observed adjacent to the proposed construction right-of-way, 7 m northwest of the centerline (based on measurements with a hand-held GPS).	See description for this species above (row 6). This population was observed within an open grassland adjacent to an existing right-of-way.	1	2, 4, 6, 7	13, 14	Hooker's cinquefoil 120513	6	11U	433120	5889513
												433128	5889523
10	Porsild's braya (S1, Tracked)	SE 24-48-1 W6M NE 13-48-1 W6M	Approximately 270 plants within a 120 m by 10 m area.	This rare plant was observed spanning the centerline of the proposed construction right-of-way (based on measurements with a hand-held GPS).	See description for this species above (row 4). This population was observed within a treed grassland adjacent to an existing right-of-way.	1	3, 4, 5, 6, 7, 9	13, 14	Porsild's braya 998239	6	11U	432998	5889239
												433006	5889234
												433000	5889235
												433043	5889299
												433055	5889334
433041	5889335												
11	<i>Placynthium</i> lichen (not listed in Alberta)	SE 24-48-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed immediately adjacent to the proposed construction right-of-way, 6 m southeast of the (based on measurements with a hand-held GPS).	<i>Placynthium</i> lichen (<i>Placynthium pulvinatum</i> Øvstedal) is a crustose lichen with a thallus up to 25 mm broad. It consists of round, flattened convex cushions composed of small, pale brown, interwoven sections (areolae) (Øvstedal et al., 2009). The rare fruiting bodies (apothecia) are sessile, flat and black, up to 1 mm broad. <i>Placynthium</i> lichen is a soil-binder and likely restricted to base-rich sands and silts (Øvstedal et al., 2009). This species was collected on the old TCPL roach, growing on moss. It was identified following fieldwork from a collection.	--	2, 4, 6	13, 14	<i>Placynthium</i> lichen 047303	6	11U	433047	5889303

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/ Operation Phase ^d					
12	<i>Solorinella</i> lichen (S1, Tracked)	SW 12-48-1 W6M SE 11-48-1 W6M	Abundant within a 60 m by 1 m area.	This rare lichen was observed on the proposed construction right-of-way, 3 m northwest of the centerline (based on measurements with a hand-held GPS).	<i>Solorinella</i> lichen (<i>Solorinella asteriscus</i> Anzi) forms diffuse, hardly delimited thalli on soil and rock surfaces. It is characterized by comparatively large apothecia that are immersed within a covering layer of thallus tissue when young and rupture at maturity. These apothecia have distinct, more or less triangular lobes that are composed of branched, parallel and more or less radiate thick walled hyphae (Henssen and Lucking, 2002). This occurrence was observed growing on soil on a cutbank adjacent to an existing right-of-way and a white spruce/lodgepole pine forest.	--	2, 3, 4, 5, 6,	13, 14	<i>Solorinella</i> lichen 442402	7	11U	431442 431407	5886402 5886353
13	brown stipplescale lichen (not listed in Alberta)	SE 11-48-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed on the proposed construction right-of-way, 3 m southeast of the centerline (based on measurements with a hand-held GPS).	Brown stipplescale (<i>Placidium lacinulatum</i> [Ach.] Breuss) is a small foliose lichen that is red-brown when dry, and green when wet (Brodo et al., 2001). Its basal scales (squamules) are 2-3 mm in diameter, and grow adjacent to each other but rarely overlap. Brown stipplescale grows on soil in dry areas (Brodo et al., 2001). This occurrence was observed growing on soil on a cutbank adjacent to an existing right-of-way and a white spruce/lodgepole pine forest. This species was identified following fieldwork from a collection. It was collected in the same location as fallacious screw moss (row 14).	--	2, 3, 4, 5, 6,	13, 14	brown stipplescale lichen 439388	7	11U	431439	5886388
14	fallacious screw moss (S2S3, Tracked)	SE 11-48-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare moss was observed on the proposed construction right-of-way, 3 m southeast of the centerline (based on measurements with a hand-held GPS).	Fallacious screw moss (<i>Didymodon fallax</i> [Hedw.] Zand.) is a loosely-tufted moss with shoots that grow to 1.5 cm tall (Atherton et al., 2010). Its 1–2 mm long leaves are distantly spaced along the stem, and become twisted when dry. False beard-moss grows on shallow soil by water courses and pools, and occasionally on disturbed ground (Atherton et al., 2010). This occurrence was observed growing on soil on a cutbank adjacent to an existing right-of-way and a white spruce/lodgepole pine forest. This species was identified following fieldwork from a collection. It was collected in the same location as brown stipplescale lichen (row 13).	--	2, 3, 4, 5, 6,	13, 14	fallacious screw moss 439388	7	11U	431439	5886388

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/ Operation Phase ^d					
15	fingered jelly lichen (S2, Tracked)	NE 2-48-1 W6M	Abundant within a 10 m by 12 m area.	This rare lichen was observed adjacent to the proposed construction right-of-way, 10 m west of the centerline (based on measurements with a hand-held GPS).	Fingered jelly lichen (<i>Collema cristatum</i> var. <i>cristatum</i> [L.] F.H. Wigg.) is a dark olive to black foliose lichen (Degelius, 1954). The lobes of its thallus are often ascending and are usually rather short, thin and broad, often looking irregularly branched. Reproductive structures (apothecia) are usually few, large (up to at least 5 mm in diameter), concave and have finely scalloped (crenulate) margins (Degelius, 1954). Fingered jelly lichen usually grows on calcareous rocks or associated soil or mosses (Brodo et al., 2001; Degelius, 1954). This population was observed on a rock face adjacent to Celestine Lake road and existing right-of-way.	--	2, 4, 6	13, 14	fingered jelly lichen 911277	7	11U	430911 460924	5885277 5885275
16	largeleaf fissidens moss (S2S3, Tracked)	SE 34-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare moss was observed on the proposed construction right-of-way, 4 m northwest of the centerline (based on measurements with a hand-held GPS).	Largeleaf fissidens moss (<i>Fissidens grandifrons</i> Brid.) is a large aquatic moss that grows to 10–15 cm (Vitt et al., 1988). It has rigid, nearly linear leaves that are two-ranked with the base folded and partly enclosing the leaf next above it, as in an iris (Vitt et al., 1988). Largeleaf fissidens moss grows submerged in waterfalls and fast-moving streams (Vitt et al., 1988). This species was identified following fieldwork from a collection. The population was observed to be submerged within a watercourse.	--	2, 3, 4, 5, 6, 11, 12	13, 14	largeleaf fissidens moss 575411	8	11U	429575	5883411
17	Hooker's cinquefoil (SU, Tracked)	NW 27-47-1 W6M	Approximately 20 individuals within a 10 m by 8 m area.	This rare plant was observed spanning the centerline of the proposed construction right-of-way (based on measurements with a hand-held GPS).	See description for this species above (row 6). This population was observed within an existing right-of-way.	1	2, 4, 6, 7	13, 14	Hooker's cinquefoil 907453	8	11U	428907 428919	5882453 5882448
18	smooth cliff brake (S2, Tracked)	NW 27-47-1 W6M NE 28-47-1 W6M	Three patches were observed of approximately 150 individuals within a 200 m by 20 m area.	This rare plant was observed immediately adjacent to the proposed construction right-of-way, 6 m southeast of centerline (based on measurements with a hand-held GPS).	Smooth cliff-brake (<i>Pellaea glabella</i> ssp. <i>occidentalis</i> [E. E. Nelson] Windham) is a densely tufted, perennial fern. Stalks are slender and reddish-brown to brown. Leaflets are similar-sized throughout the stem; the lowest ones may be lobed. Spores occur in clusters (sori) on the underside of the leaves along the margins. Western smooth cliff-brake grows on dry limestone rocks (Moss, 1983). Population was observed growing in crevices on a calcareous rock wall.	--	2, 4, 6	13, 14	smooth cliff brake 204330	9	11U	428204 428204 428178 428178	5882330 5882289 5882298 5882266
									smooth cliff brake 122226	9	11U	428122 428130	5882226 5882221
									smooth cliff brake 102192	9	11U	428102 428098	5882192 5882198
19	silverberry riparian shrubland (SU, Tracked)	SW 28-47-1 W6M	This community was observed within an approximately 50 m by 20 m area occurring along the banks of the watercourse between the UTM coordinates provided.	This rare ecological community was observed spanning the entirety of the proposed construction right-of-way, extending off of the proposed construction right-of-way in both directions (based on measurements with a hand-held GPS).	See description for this community above (row 1).	1	2, 3, 4, 5, 6, 9, 10, 11,12	13, 14	silverberry riparian shrubland 242586	9	11U	427242 427273 427260 427227	5881586 5881580 5881505 5881524

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/Operation Phase ^d					
20	largeleaf fissidens moss (S2S3, Tracked)	NW 21-47-1 W6M	Greater than 50 clumps within a 40 m by 5 m area.	This rare moss was observed adjacent to the proposed construction right-of-way, 10 m west of the centerline (based on measurements with a hand-held GPS).	See description for this species above (row 16). Population was observed growing on rocks within a watercourse in this area. It was more abundant in areas where the creek was shaded by trees.	--	2,3, 4, 5, 6, 11, 12	13, 14	largeleaf fissidens moss 512004	9	11U	426512	5881004
												426531	5881034
												426576	5881065
												426549	5881036
21	Hooker's cinquefoil (SU, Tracked)	SE 20-47-1 W6M	Two patches were observed, the one to the north consisting of approximately 250 plants in a 17 m by 30 m area, and the one to the south consisting of 4 individuals within a 2 m by 2 m area.	Both patches were observed adjacent to the proposed construction right-of-way, 9 m southeast of the centerline (based on measurements with a hand-held GPS).	See description for this species above (row 6). Population observed within an herbaceous meadow adjacent to an existing right-of-way, surrounded by shrubby areas and mature white spruce.	1	2, 4, 6, 7	13, 14	Hooker's cinquefoil 038950	9, 10	11U	426038	5879950
		NW 17-47-1 W6M							Hooker's cinquefoil 559198			10	11U
22	hairy shadow lichen (S2, Tracked)	NE 7-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed adjacent to the proposed construction right-of-way, 10 m east of the centerline (based on measurements with a hand-held GPS).	Hairy shadow lichen (<i>Phaeophyscia hirsuta</i> [Mereschk.] Moberg) is a small foliose lichen (Brodo et al., 2001). The thallus is dark grayish brown and lacking conspicuous spots, with short, narrow lobes mostly 0.5–1 mm wide. Fine, greenish soredia can be found along on the lobe tips, and fine, stiff almost transparent hairs on the top surface and edges of the lobe tips. Hairy shadow lichen grows on tree bark and rock (Brodo et al., 2001). This species was observed growing on a standing dead stump within a mature Douglas-fir/white spruce forest. It was identified following fieldwork from a collection.	--	2, 4, 6	13, 14	hairy shadow lichen 680618	10, 11	11U	424680	5877618
23	yellow sedge (S2S3, Tracked)	NE 6-47-1 W6M	Approximately 1,000 clumps within a 220 m by 25 m area.	This rare plant was observed spanning the centerline of the proposed construction right-of-way (based on measurements with a hand-held GPS).	See description for this species above (row 8). This population was observed within an existing right-of-way.	1	4, 6, 7, 9, 12	13, 14	yellow sedge 603325	11	11U	424603	5876325
												424670	5876117
												424627	5876319
												424687	5876114
24	Hooker's cinquefoil (SU, Tracked)	NE 5-47-1 W6M	Six patches consisting of approximately 160 individuals were observed within a 100 m by 20 m.	This rare plant was observed on the centerline of the proposed construction right-of-way, extending off of the proposed construction right-of-way in both directions (based on measurements with a hand-held GPS). Five of the six patches were observed within the proposed construction right-of-way.	See description for this species above (row 6). Population observed on both sides of an existing road within an herbaceous meadow with scattered lodgepole pine.	1	2, 4, 6, 7	13, 14	Hooker's cinquefoil 253689	11	11U	426253	5875689
									Hooker's cinquefoil 237648			11	11U
									Hooker's cinquefoil 237691			426230	5875675
									Hooker's cinquefoil 237691	11	11U	426237	5875691
									Hooker's cinquefoil 229720	--	11U	426229	5875720
									Hooker's cinquefoil 200738	11	11U	426200	5875738
									Hooker's cinquefoil 186762			426193	5875758

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/ Operation Phase ^d					
25	Porsild's braya (S1, Tracked)	SW 4-47-1 W6M NW 33-46-1 W6M	Seven patches consisting of approximately 250 individuals were observed within a 725 m by 40 m area.	This rare plant was observed on the centerline of the proposed construction right-of-way, extending off of the proposed construction right-of-way in both directions (based on measurements with a hand-held GPS). Four of the seven patches were observed within the proposed construction right-of-way.	See description for this species above (row 4).	1	3, 4, 5, 6, 7, 9	13, 14	Porsild's braya 889004	12	11U	426889 426897	5875004 5875013
									Porsild's braya 928848	--	11U	426928 426915	5874848 5874873
									Porsild's braya 957769	--	11U	426957	5874769
									Porsild's braya 021635	12	11U	427021 427040	5874635 5874635
									Porsild's braya 066499	12	11U	427066	5874499
									Porsild's braya 083400	12	11U	427083	5874400
25 (cont'd)	See above	See above	See above	See above	See above	See above	See above	Porsild's braya 066339	--	11U	427066 427068	5874339 5874349	
26	dwarf notchwort (SU, Tracked)	SW 33-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare liverwort was observed on the proposed construction right-of-way, 3 m east of the centerline (based on measurements with a hand-held GPS).	Dwarf notchwort (<i>Lophozia badensis</i> [Gott. Ex Rabenh.] Schiffn.) is a leafy liverwort that grows in thin, dense mats (Paton, 1999). It varies in colour from bright yellowish to dull greenish brown, and grows to 1.2 cm long with leafy shoots up to 1.5 mm wide. Dwarf notchwort grows on moist soil and mosses beside lakes, streams and rivers (Paton, 1999). This species was observed growing on mineral soil within a wet meadow, and was identified following fieldwork from a collection. It was collected in the same location as narrow mushroom-headed liverwort (row 27).	--	2, 3, 4, 5, 6, 7, 11	13, 14	dwarf notchwort 142812	12	11U	427142	5873812
27	narrow mushroom-headed liverwort (S2S3, Tracked)	SW 33-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare liverwort was observed on the proposed construction right-of-way, 3 m east of the centerline (based on measurements with a hand-held GPS).	Narrow mushroom-headed liverwort (<i>Preissia quadrata</i> [Scop.] Nees) is a small grayish-green thallose liverwort. The pores on its upper surface have four cells that bulge into a hole (Vitt et al., 1988). The female portion of the plant (archegonia) are umbrella-like structures with ridged caps that grow 1–2 cm tall. It grows on calcareous mineral soil along stream banks and in rock crevices (Vitt et al., 1988). This species was observed growing on mineral soil within a wet meadow, and was identified following fieldwork from a collection. It was collected in the same location as dwarf notchwort (row 26).	--	2, 3, 4, 5, 6, 7, 11	13, 14	narrow mushroom-headed liverwort 142812	12	11U	427142	5873812

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/Operation Phase ^d					
28	Crawe's sedge (S3, Tracked)	SW 33-46-1 W6M	5 plants within a 10 cm by 10 cm area.	This rare plant was observed on the edge of the proposed construction right-of-way, 5 m east of the centerline (based on measurements with a hand-held GPS).	Crawe's sedge (<i>Carex crawei</i> Dewey) is a perennial herb with stiff but slender stems 5–30 cm tall. The plant is found singly or in small clumps, and arises from rhizomes (Kershaw et al., 2001). The flower clusters are on 2–5 widely spaced stalked spikes, with the uppermost spike containing only male flowers. Crawe's sedge is found in calcareous meadows, lime-rich wetlands as well as on lakeshores and in moist woods (Kershaw et al., 2001). This population was observed within an existing right-of-way east of Snaring Road. It was observed co-occurring with Greenland primrose (see row 29).	--	2, 4, 6	13, 14	Crawe's sedge 171384	12, 13	11U	427171	5873384
29	Greenland primrose (S2, Tracked)	SW 33-46-1 W6M	105 individuals within a 17 m by 5 m area.	This rare plant was observed adjacent to the proposed construction right-of-way, 9 m east of the centerline (based on measurements with a hand-held GPS).	Greenland primrose (<i>Primula egaliksensis</i> Wormsk.) is a small perennial herb, usually growing 6–18 cm high (Kershaw et al., 2001). With thin, egg-shaped to spatula-shaped leaves in a basal rosette, the flowering stalk is leafless. Flowers are violet or deep lilac (sometimes white) with a yellow eye. It grows in wet meadows and on wet, calcareous lakeshores and riverbanks (Kershaw et al., 2001). Plants were observed in wet depressions in calcareous open soil within a black spruce wetland on the east side of Snaring road. It was observed co-occurring with Crawe's sedge (see row 28).	--	2, 4, 6	13, 14	Greenland primrose 175384	12, 13	11U	427175 427178	5873384 5873368
30	Hooker's cinquefoil (SU, Tracked)	SW 33-46-1 W6M NW 28-46-1 W6M	Approximately 10 plants within a 3 m by 1 m area.	This rare plant was observed adjacent to the proposed construction right-of-way, 8 m west of the centerline (based on measurements with a hand-held GPS).	See description for this species above (row 6).	--	2, 4, 6	13, 14	Hooker's cinquefoil 178128	12, 13	11U	427178 427174	5873128 5873204
31	Hooker's cinquefoil (SU, Tracked)	NE 28-46-1 W6M SE 28-46-1 W6M NE 21-46-1 W6M	Two patches were observed: the northern patch consists of one plant within a 1 m by 1 m area, and the southern patch consists of 1000+ plants within an approximately 850 m by 30 m area.	The northern patch was observed immediately adjacent to the proposed construction right-of-way, 6 m west of the centerline (based on measurements with a hand-held GPS). The southern patch was observed spanning the centerline of the proposed construction right-of-way (based on measurements with a hand-held GPS).	See description for this species above (row 6). This population was observed along the length of Snaring Road, on both sides of the road.	1	2, 4, 6, 7, 9, 10	13, 14	Hooker's cinquefoil 223615 Hooker's cinquefoil 255210	13	11U	427223 427255 427439	5872615 5872210 5871425
32	yellow sedge (S2S3, Tracked)	NE 28-46-1 W6M	50–100 clumps within a 20 m by 20 m area.	This rare plant was observed on the edge of the proposed construction right-of-way, 5 m east of the centerline (based on measurements with a hand-held GPS).	See description for this species above (row 8). This population was observed within a wet meadow.	--	2, 4, 6	13, 14	yellow sedge 240599	13	11U	427240 427238 427271	5872599 5872574 5872593

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Map Sheet No	Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/ Operation Phase ^d					
33	narrow mushroom-headed liverwort (S2S3, Tracked)	NE 28-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare liverwort was observed adjacent to the proposed construction right-of-way, 7 m east of the centerline (based on measurements with a hand-held GPS).	See description for this species above (row 27). This species was observed on the silty edge of a pool adjacent to a culvert and was identified following fieldwork from a collection. It was observed co-occurring with willow feather moss (see row 34).	--	2, 4, 6	13, 14	narrow mushroom-headed liverwort 240566	13	11U	427240	5872566
34	willow feather moss (S2S3, Tracked)	NE 28-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare moss was observed adjacent to the proposed construction right-of-way, 7 m east of the centerline (based on measurements with a hand-held GPS).	Willow feather moss (<i>Amblystegium varium</i> [Hedw.] Lindb.) is an irregularly and loosely branched moss that forms small patches (Atherton et al., 2010). Its leaves are broadly lance-shaped and up to 1 mm in length, with a long central nerve that almost reaches the leaf tip. Willow feather moss grows on decaying vegetation, wood or soil in wet or marshy areas and along streams and ponds (Atherton et al., 2010). This species was observed on the silty edge of a pool adjacent to a culvert and was identified following fieldwork from a collection. It was observed co-occurring with narrow mushroom-headed liverwort (see row 33).	--	2, 4, 6	13, 14	willow feather moss 240566	13	11U	427240	5872566
35	Hooker's cinquefoil (SU, Tracked)	N 15-46-1 W6M	Four patches were observed, consisting of approximately 275 individuals within a 240 m by 30 m area.	This rare plant was observed spanning the centerline of the proposed construction right-of-way, from 23 m southwest of the centerline to 12 m northeast of the centerline (based on measurements with a hand-held GPS).	See description for this species above (row 6).	1	2, 4, 6, 7, 9, 10	13, 14	Hooker's cinquefoil 783382	--	11U	428783	5869382
									Hooker's cinquefoil 852265	14	11U	428852	5869265
									Hooker's cinquefoil 913195	14	11U	428913	5869195
												428924	5869185
									Hooker's cinquefoil 909170	--	11U	428909	5869170

Table A5.2-1-6. Occurrences of Rare Vegetation Species and Rare Ecological Communities Observed During 2015 and 2016 Vegetation Surveys that Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-Way Centerline	Discussion	Mitigation			Vegetation Map Label	Vegetation Zone	Easting	Northing
						Planning Phase ^b	Construction Phase ^c	Post-Construction/Operation Phase ^d				

^a Definitions of provincial ranks and designations are summarized in Appendix 5.2-2.

^b Mitigation measures recommended for implementation during the Planning Phase of the Project include:

- 1 If feasible, schedule construction to occur after the seed set period to enhance the survival of the population.

^c Mitigation measures recommended for implementation during the Construction Phase of the Project include:

- 2 Avoid the plant species or community and flag and fence off the occurrence (EPP [Attachment 1] Section 6.1 and Appendix L) (e.g., narrow footprint, leave a gap in strippings pile, extend road or watercourse bores).
- 3 Narrow the construction right-of-way, to the extent feasible, in the vicinity of the rare plant population or rare ecological community.
- 4 Avoid taking extra temporary workspace in this area.
- 5 Realign the travel lane or workspaces to avoid the site (EPP [Attachment 1] Appendix L).
- 6 Inform all users of access restrictions along native vegetation segments and in the vicinity of flagged or fenced sites (EPP [Attachment 1] Appendix L).
- 7 Temporarily cover the site with geotextile pads, flex net or rig mats to prevent ground vegetation disturbance and reduce compaction of the area of vegetation concern (EPP [Attachment 1] Appendix L). If matting is expected to be needed for more than one season and will not be in constant use during this time (e.g., matting installed during winter will remain until the following winter), matting should be removed prior to the growing season and replaced immediately before construction activities resume.
- 8 Transplant portions of sod containing the plants of concern or the feature that houses the plants (e.g., log, rock). Move to a suitable receiving site off the footprint (see Axys and Walker, 1998 – Section 5.2.8.2).
- 9 If surface salvage is necessary, conduct separate soil salvage within the area of concern: store topsoil separately from grade spoil or borrow material, identify with labelled stakes or flags, and replace to the location from where it was stripped (see Axys and Walker, 1998 – Section 5.2.3.2).
- 10 Reduce strippings salvage, grading or grubbing to the extent practical to protect plant root systems.
- 11 Reduce clearing shrubs/trees in the area to the extent possible to allow the original species composition, shade, structure, and moisture retention to persist.
- 12 Re-contour to match pre-disturbance site conditions, so that drainage is not altered (see Axys and Walker, 1998 – Section 5.2.9.2).

^d Mitigation measures recommended for implementation during the Post-Construction/Operation Phase of the Project include:

- 13 Restrict the general application of herbicide within 30 m of area, during the operational phase. Spot spraying, wicking, mowing, or hand-picking are acceptable measures for weed control in these areas.
- 14 Conduct post-construction monitoring to assess mitigation success (e.g., for 5 years commencing in the first full growing season following clean-up).

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Eastings	Northing
1	wild comfrey (S1, Tracked)	SW 14-49-27 W5M	Four patches were observed consisting of a total of 12 individuals within a 20 m by 410 m area.	This rare plant was observed off of the proposed construction right-of-way, 16 m north of the centerline and extending northward (based on measurements with a hand-held GPS).	Location occurs on the edge of a coniferous forest adjacent to an existing right-of-way.	Wild comfrey (<i>Cynoglossum virginianum</i> var. <i>boreale</i> [Fernald] Cooper.) is an herbaceous perennial that grows 40–80 cm tall. It has hairy stems that are leafless below the inflorescence, and has broadly lance-shaped leaves that are stalked below and sessile above (Kershaw et al., 2001). Its small blue flowers grow in elongated racemes, and develop into small, spiny nutlets. Wild comfrey grows in dry woods (Kershaw et al., 2001).	wild comfrey 776543	11U	443776	5897543
									443789	5897557
									443789	5897557
							wild comfrey 681586	11U	443681	5897586
									443688	5897589
		443696	5897584							
		wild comfrey 645588	11U	443645	5897588					
		wild comfrey 392654	11U	443392	5897654					
2	dwarf bulrush (S3, Watched)	SE 16-49-27 W5M	Approximately 100 stems within a 2 m by 1 m area.	This rare plant was observed off of the proposed construction right-of-way, 27 m northwest of the (based on measurements with a hand-held GPS).	This species is on the ACIMS Watched list (AEP, 2016a). Mitigation is not recommended for species on the Watched list.	Dwarf bulrush (<i>Trichophorum pumilum</i> [Vahl] Schinz & Thell.) is a perennial herb 5–20 cm tall with round, stiff, wiry stems and rhizomes. The flower clusters are single, egg-shaped spikelets, with scales that are chestnut brown with a green midvein (Kershaw et al., 2001). Dwarf bulrush grows in calcareous fens.	dwarf bulrush 358354	11U	441358	5897354
3	Johansen's didymodon moss (S2S3, Tracked)	NE 9-49-27 W5M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare moss was observed off of the proposed construction right-of-way, 28 m northwest of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection.	Johansen's didymodon moss (<i>Didymodon johansenii</i> [Williams] Crum) is a small reddish-brown moss that grows in tufts (FNA, 1993+). With stems up to 1.5 cm tall, Johansen's didymodon moss has non-keeled leaves that are erect-appressed when dry and spreading when moist. Leaf tips have a club-shaped leaf appendage that tends to fall off at maturity in a form of specialized asexual reproduction. This moss grows on limestone outcrops and cliffs, boulder crevices, slopes and alluvial plain forest at moderate to high elevations (FNA, 1993+).	Johansen's didymodon moss 963174	11U	440963	5897174
4	<i>Pellia</i> liverwort (SU, Tracked)	NE 9-49-27 W5M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare liverwort was observed off of the proposed construction right-of-way, 27 m northwest of the centerline (based on measurements with a hand-held GPS).	<i>Pellia</i> specimens were sent to a bryologist for identification; however, the samples could only be identified to the genus. There are only two <i>Pellia</i> liverwort species that occur in Alberta and both species are on the ACIMS Tracking List (AEP, 2016b) but are ranked SU (unrankable) due to lack of information (AEP, 2016b). Both species that occur in Alberta are thought to be common by professional bryologists and mitigation is not recommended (Belland, 2014, 2015, pers. comm.).	<i>Pellia</i> liverworts are found in acidic conditions by watercourses, rivers, ditches as well as other moist habitats including wet woodlands, marshes and wet outcrops (Atherton et al., 2010).	<i>Pellia</i> liverwort species 807101	11U	440807	5897101
5	<i>Lecidea</i> lichen (not listed in Alberta)	NW 9-49-27 W5M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 22 m northwest of the centerline (based on measurements with a hand-held GPS).	<i>Lecidea</i> lichen is not currently listed in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	<i>Lecidea</i> lichen (<i>Lecidea beringeriana</i> A. Massal.) has a granular, greenish to greenish gray thallus. The reproductive structures (apothecia) are red-brown and rather flat, often with a persistent and smooth prominent margin (Brodo et al., 2001).	<i>Lecidea</i> lichen 538973	11U	440538	5896973
6	wild comfrey (S1, Tracked)	SW 8-49-27 W5M	1 plant within a 1 m by 1 m area.	This rare plant was observed off of the proposed construction right-of-way, 21 m northwest of the centerline (based on measurements with a hand-held GPS).	This occurrence is located off of the proposed construction right-of-way.	See description for this species above (row 1).	wild comfrey 901321	11U	438901	5896321

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Easting	Northing
7	dwarf bulrush (S3, Watched)	SW 36-48-28 W5M	Three subpopulations were observed, approximately thousands of stems within a 35 m by 150 m area.	This rare plant was observed on the centerline of the proposed construction right-of-way, extending off of the proposed construction right-of-way to the north (based on measurements with a hand-held GPS).	See discussion for this species above (row 2).	See description for this species above (row 2).	dwarf bulrush 245180	11U	435245	5893180
							dwarf bulrush 187141	11U	435187	5893141
							dwarf bulrush 156112	11U	435156	5893112
8	Parry's sedge (S3, Watched)	SW 36-48-28 W5M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is approximated by the UTM coordinate.	This rare plant was observed off of the proposed construction right-of-way, 26 m southeast of the centerline (based on measurements with a hand-held GPS).	This species is on the ACIMS Watched list (AEP, 2016a). Mitigation is not recommended for species on the Watched list.	Parry's sedge (<i>Carex parryana</i> Dewey) is a loosely tufted perennial herb approximately 15–40 cm tall. Reddish-tinged at the base, the leaves are clustered near the base with persistent dried leaves remaining from previous years. The inflorescence consists of 3–5 erect, stalkless or stiffly short-stalked 1.5–3 cm long spikes with female flowers usually at the tip. The egg-shaped perigynia are hairless, 2-ribbed and scarcely beaked. Parry's sedge grows in moist open meadows, swales and low ground near water (Kershaw et al. 2001).	Parry's sedge 151069	11U	435151	5893069
9	Crawe's sedge (S3, Tracked)	NE 26-48-28 W5M	Two patches were observed: The eastern patch consisting of approximately 200 stems within a 40 m by 5 m area, and the western patch consisting of approximately 20 stems within a 5 m by 2 m area.	This rare plants were observed off of the proposed construction right-of-way, 25 m southeast and 16 m northwest of the centerline, respectively (based on measurements with a hand-held GPS).	This population was observed within a moist meadow, off of the proposed construction right-of-way.	Crawe's sedge (<i>Carex crawei</i> Dewey) is a perennial herb with stiff but slender stems 5–30 cm tall. The plant is found singly or in small clumps, and arises from rhizomes (Kershaw et al., 2001). The flower clusters are on 2–5 widely spaced stalked spikes, with the uppermost spike containing only male flowers. Crawe's sedge is found in calcareous meadows, lime-rich wetlands as well as on lakeshores and in moist woods (Kershaw et al., 2001).	Crawe's sedge 295072	11U	434295	5892072
							Crawe's sedge 321030	11U	434321	5892030
									434337	5892068
10	dwarf bulrush (S3, Watched)	NE 26-48-28 W5M	Hundreds of stems within a 100 m by 30 m area.	This rare plant was observed on the proposed construction right-of-way, 2 m southeast of the centerline and extending off right-of-way to the west (based on measurements with a hand-held GPS).	See discussion for this species above (row 2).	See description for this species above (row 2).	dwarf bulrush 337068	11U	434337	5892068
									434262	5891951
11	cryptic rosette lichen (SU, Tracked)	SE 24-48-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed immediately adjacent to the proposed construction right-of-way, 6 m southeast of the centerline (based on measurements with a hand-held GPS).	Cryptic rosette lichen is currently unrankable in Alberta due to lack of information (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Cryptic rosette lichen (<i>Physciella chloantha</i> [Ach.] Essl.) is a pale to dark greenish or brownish gray foliose lichen with lobes 0.3–1 mm across. Small, lip-shaped reproductive structures (soralia) are present on the lobe margins and tips. Apothecia are uncommon, with very dark brown disks. Cryptic rosette lichen is found on hardwoods and occasionally on rock (Brodo et al., 2001).	cryptic rosette lichen 047303	11U	433047	5889303
12	<i>Collema</i> lichen (not listed in Alberta)	SE 24-48-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed immediately adjacent to the proposed construction right-of-way, 6 m southeast of the centerline (based on measurements with a hand-held GPS).	<i>Collema</i> lichen is not currently listed in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	This occurrence was identified as <i>Collema</i> cfr <i>substellata</i> ^b . A description for <i>Collema substellata</i> has not yet been published. At the genus level, <i>Collema</i> lichens are foliose lichens that become gelatinous when wet. The underside of the thalli of <i>Collema</i> lichens occasionally possess white tomentum but never rhizines (attachment structures). The thallus of a <i>Collema</i> lichen can range from black to olive to dark yellow. They thrive in a variety of habitats, both moist and dry (Brodo et al., 2001).	<i>Collema</i> lichen 047303	11U	433047	5889303
13	<i>Collema</i> lichen (not listed in Alberta)	SE 11-48-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed on the proposed construction right-of-way, 3 m southeast of the centerline (based on measurements with a hand-held GPS).	See discussion for this species above (row 12).	See description for this species above (row 12).	<i>Collema</i> lichen 439388	11U	431439	5886388

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Eastings	Northing
14	earthscale lichen (S2S3, Tracked)	SE 11-48-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed on the proposed construction right-of-way, 3 m southeast of the centerline (based on measurements with a hand-held GPS).	Earthsacle lichen is ranked S2S3 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Earthsacle lichen (<i>Catapyrenium cinereum</i> [Pers.] Korber) has a thallus consisting of brown to gray-pruinose, notched scale-like structures (squamules) that turn green when wet. These squamules are approximately 1–3 mm across with a black lower cortex and dark attachment structures (hyphae). Earthscale lichen is found on soil in dry areas (Brodo et al., 2001).	earthsacle lichen 439388	11U	431439	5886388
15	dwarf bulrush (S3, Watched)	SW 2-48-1 W6M	Thousands of stems within a 6 m by 25 m area.	This rare plant was observed spanning the centerline of the proposed construction right-of-way (based on measurements with a hand-held GPS).	See discussion for this species above (row 2).	See description for this species above (row 2).	dwarf bulrush 380722	11U	430396 430380 430402 430391	5884741 5884722 5884735 5884727
16	ring <i>Pellia</i> (SU, Tracked)	SW 2-48-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare liverwort was observed immediately adjacent to the proposed construction right-of-way, 6 m southeast of the centerline (based on measurements with a hand-held GPS).	Ring <i>Pellia</i> is ranked SU in Alberta (AEP, 2016b), however, it is thought to be common by professional bryologists and mitigation is not recommended (Belland, 2014, 2015, pers. comm.).	Ring <i>Pellia</i> (<i>Pellia neesiana</i> [Gottsche] Limpr.) is a dioecious liverwort (male and female reproductive structures are on separate individuals). This species has thalli that are approximately 1 cm wide, often with a reddish or purple tint and a sharp aromatic smell. The female plants develop a short, vertical tube of tissue around the sex organ that is not closely toothed at the mouth. Ring <i>Pellia</i> grows on acidic ground in ditches, wet grassland, marshes, wet woodland, on rocky banks, stream sides, and occasionally on gravelly forest tracks (Atherton et al., 2010).	ring <i>Pellia</i> 402735	11U	430402	5884735
17	Hooker's cinquefoil (SU, Tracked)	NE 28-47-1 W6M	2 plants within a 1 m by 1 m area.	This rare plant was observed off of the proposed construction right-of-way, 20 m southeast of the centerline (based on measurements with a hand-held GPS).	This population was observed off of the proposed construction right-of-way.	Hooker's cinquefoil (<i>Potentilla hookeriana</i> Lehm.) is a small (1–3 cm tall) perennial herb with basal leaves divided into 3–5 leaflets. The leaflets are 10–20 mm long, olive-green on the upper surface and white and densely woolly on their lower surface. Flowers are yellow and 10–12 mm across. Hooker's cinquefoil grows on dry, rocky alpine slopes (Kershaw et al., 2001).	Hooker's cinquefoil 068143	11U	428068	5882143
18	worm buttons (S2, Tracked)	SE 28-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 23 m southeast of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This rare lichen was observed off of the proposed construction right-of-way.	Worm buttons (<i>Buellia elegans</i> Poelt) is a crustose lichen with a thallus consisting of long white lobes 1–2 cm long and 0.3–1 cm broad. The fruiting bodies (apothecia) are dull black and slightly convex. Worm buttons grows on soil in dry, open, usually calcareous areas (Thompson, 1997).	worm buttons 947992	11U	427947	5881992
19	blackberry scale ^b (S1S2, Tracked)	SE 28-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 23 m southeast of the centerline (based on measurements with a hand-held GPS).	Blackberry scale is ranked S1S2 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Blackberry scale (<i>Psora cfr globifera</i> [Ach.] A. Massal.) ^b is composed of shiny reddish-brown, yellow-brown to greenish brown scale-like structures (squamules) 2–5 mm across. Reproductive structures (apothecia) are dark red-brown to almost black, slightly convex to hemispherical, 0.7–2 mm in diameter. Blackberry scale is found mainly on rock but occasionally on soil (Brodo et al., 2001).	blackberry scale 947992	11U	427947	5881992
20	dark shadow lichen (S3, Tracked)	SE 28-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 23 m southeast of the centerline (based on measurements with a hand-held GPS).	Dark shadow lichen is ranked S3 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Dark shadow lichen (<i>Phaeophyscia sciastra</i> [Ach.] Moberg) is a very dark greenish gray foliose lichen, appearing almost black. Its narrow lobes (0.15–0.5 mm across) have coarse, black granular reproductive structures (isidia or isidia-like soredia) along the lobe margins, especially in older parts of the thallus. Dark shadow lichen is found on exposed rocks (especially sandstone) (Brodo et al., 2001).	dark shadow lichen 947992	11U	427947	5881992

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Eastings	Northing
21	<i>Placidium</i> lichen (SU, Tracked)	SE 28-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 23 m southeast of the centerline (based on measurements with a hand-held GPS).	Smooth shadow lichen is currently unrankable in Alberta due to lack of information (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	<i>Placidium</i> lichen (<i>Placidium squamulosum</i> [Ach.] Breuss) has a thallus consisting of thick red-brown scale-like structures (squamules) that turn green when wet. These squamules are approximately 2–3 mm across with black dots scattered over the surface. It exhibits sparse clumps of attachment hyphae, and lacks attachment structures called rhizines. <i>Placidium</i> lichen is found on soil in dry areas (Brodo et al., 2001).	<i>Placidium</i> lichen 947992	11U	427947	5881992
22	<i>Acarospora</i> lichen (not listed in Alberta)	SW 28-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 26 m southeast of the centerline (based on measurements with a hand-held GPS).	<i>Acarospora</i> lichen is not currently listed in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	<i>Acarospora</i> lichen (<i>Acarospora moenium</i> [Vainio] Räsänen) is composed of minute peltate scale-like structures (squamules) approximately 0.2 mm in diameter. These squamules are generally pale pink or pale gray, becoming brown where rubbed and are often very dispersed, resting on a bed of black soredia (Smith et al., 2009).	<i>Acarospora</i> lichen 223500	11U	427223	5881500
23	<i>Leptogium</i> lichen (not listed in Alberta)	SW 28-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 26 m southeast of the centerline (based on measurements with a hand-held GPS).	<i>Leptogium</i> lichen is not currently listed in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	<i>Leptogium</i> lichen (<i>Leptogium pulvinatum</i> [Hoffm.] Otálora) has a foliose thallus 1–4 cm wide formed by compactly united erect lobes. The thallus lobes are often deeply divided, shiny, and grayish-brown to dark brown in colour and 2–6 mm wide. Reproductive structures (apothecia) are rare, 0.2–0.8 mm in diameter, with a concave brown to red-brown disc. <i>Leptogium</i> lichen occurs among mosses at the base of trees, directly over tree bark, or on walls, rocks or soil (Otálora et al., 2008).	<i>Leptogium</i> lichen 223500	11U	427223	5881500
24	split-peg lichen (S2S4, Tracked)	SW 28-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 26 m southeast of the centerline (based on measurements with a hand-held GPS).	Split-peg lichen is ranked S2S4 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Split-peg lichen (<i>Cladonia symphylicarpa</i> [Ach.] Fr.) is a two-part lichen. The scaly primary thallus (squamules) are large, gray-green and strap-shaped or deeply lobed (Brodo et al., 2001). The rarely produced secondary, erect stalks (podetia) are greenish gray, relatively short (10–15 mm tall) and stocky. Split-peg lichen is found in open areas on thin or sandy soil, especially those areas rich in calcium (e.g., over limestone) (Brodo et al., 2001).	split-peg lichen 223500	11U	427223	5881500
25	hairy shadow lichen (S2, Tracked)	NW 21-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 20 m east of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This rare lichen was observed off of the proposed construction right-of-way.	Hairy shadow lichen (<i>Phaeophyscia hirsuta</i> [Mereschk.] Moberg) is a small foliose lichen (Brodo et al., 2001). The thallus is dark grayish brown and lacking conspicuous spots, with short, narrow lobes mostly 0.5–1 mm wide. Fine, greenish soredia can be found along on the lobe tips, and fine, stiff almost transparent hairs on the top surface and edges of the lobe tips. Hairy shadow lichen grows on tree bark and rock (Brodo et al., 2001).	hairy shadow lichen 572010	11U	426572	5881010
26	<i>Ramalina</i> lichen (not listed in Alberta)	NW 21-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 20 m east of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This rare lichen was observed off of the proposed construction right-of-way.	<i>Ramalina</i> lichen (<i>Ramalina</i> sp. 1 sensu Goward, 1999) is an undescribed medium- to large-sized fruticose lichen (Goward, 1999). It exhibits a “shredded” habit and generally broad, flattened branches that bear scattered, diffuse reproductive structures (soredia) over the lower surface. This species is found localized over trees and shrubs in open forests at lower elevations (Goward, 1999).	<i>Ramalina</i> lichen 572010	11U	426572	5881010
27	camouflage lichen ^b (S3, Tracked)	NW 21-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 20 m east of the centerline (based on measurements with a hand-held GPS).	Camouflage lichen is ranked S3 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Camouflage lichen (<i>Melanohalea</i> cfr <i>subelegantula</i> [Essl.] O. Blanco et al.) ^b is a flat branched thalose lichen. The majority of <i>Melanohalea</i> lichens are brown to dark brown in colour. Different forms and branching patterns of the isidia (asexual reproductive structures) is how species of <i>Melanohalea</i> lichens are distinguished from one another (Brodo et al., 2001).	camouflage lichen 572010	11U	426572	5881010

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Easting	Northing
28	smooth shadow lichen (S2S4, Tracked)	NW 21-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 20 m east of the centerline (based on measurements with a hand-held GPS).	Smooth shadow lichen is ranked S2S4 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Smooth shadow lichen (<i>Phaeophyscia ciliata</i> [Hoffm.] Moberg) is a small foliose (leafy) lichen with pale gray to brown flat lobed thalli. The lower surface is black with abundant black rhizines (attachment structures) with white tips which can resemble cilia. Abundant apothecia (reproductive structures) are dark brown disks with prominent margins. Smooth shadow lichen grows on deciduous trees and wood and occasionally mosses over rock (Brodo et al., 2001).	smooth shadow lichen 572010	11U	426572	5881010
29	powder-tipped shadow lichen (S2?, Tracked)	NE 7-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 20 m east of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This rare lichen was observed off of the proposed construction right-of-way.	Powder-tipped shadow lichen (<i>Phaeophyscia adiantola</i> [Essl.] Essl.) is a small foliose lichen with a thallus composed of dark greenish gray, gray-brown or brown lobes 0.5–1 mm wide (Brodo et al., 2001). These lobes exhibit very coarse reproductive structures (soredia) along the margins and at the tops of the lobes. The lower surface of the thallus has abundant and conspicuous black attachment structures (rhizines) with white tips. Powder-tipped shadow lichen is common on shaded mossy granitic rocks and tree bark (Brodo et al., 2001).	powder-tipped shadow lichen 693687	11U	424693	5877687
30	bare-bottomed sunburst lichen (S3, Tracked)	NE 7-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 20 m east of the centerline (based on measurements with a hand-held GPS).	Bare-bottomed sunburst lichen is ranked S3 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Bare-bottomed sunburst lichen (<i>Xanthomendoza fulva</i> [Hoffm.] Søchting, Kärnefelt & S. Kondr.) is a foliose lichen. Its thallus is dark red-orange to medium orange with finely divided or rounded lobes 0.2–0.6 mm wide (Brodo et al., 2001). Apothecia are rare, but pycnidia are common and resemble dark orange pimples. Bare-bottomed sunburst lichen is found on bark, wood and rarely on rock (Brodo et al., 2001).	bare-bottomed sunburst lichen 693687	11U	424693	5877687
31	crescent frost lichen (S3, Tracked)	NE 7-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 20 m east of the centerline (based on measurements with a hand-held GPS).	Crescent frost lichen is ranked S3 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Crescent frost lichen (<i>Physconia perisidiosa</i> [Erichsen] Moberg) is a lichen with a gray-brown to dark brown thallus that has a frosted appearance, at least in patches, with a black lower surface. The lobes are mostly 0.5–1.5 mm across, relatively short and commonly overlap like shingles (Brodo et al., 2001). The small soralia are crescent- or lip-shaped and contain coarse soredia (Brodo et al., 2001). Crescent frost lichen grows on bark, less frequently on rock or soil.	crescent frost lichen 693687	11U	424693	5877687
32	<i>Hypogymnia</i> lichen (not listed in Alberta)	SE 7-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 16 m east of the centerline (based on measurements with a hand-held GPS).	<i>Hypogymnia</i> lichen is not currently listed in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	<i>Hypogymnia</i> lichen (<i>Hypogymnia dichroma</i> Goward) has a closely appressed thallus up to 5–6 cm across with thin, irregularly branched lobes. The upper surface is usually distinctly two-toned, fading from chestnut brown to whitish inwards. <i>Hypogymnia</i> lichen is primarily epiphytic on conifers, but can be found on rock (Goward et al., 2012).	<i>Hypogymnia</i> lichen 660023	11U	424660	5877023
33	shaded cladonia lichen (S2S4, Tracked)	SE 7-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 16 m east of the centerline (based on measurements with a hand-held GPS).	Shaded cladonia lichen is ranked S2S4 in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Shaded cladonia lichen (<i>Cladonia umbricola</i> Tønsberg & Ahti) is highly variable in appearance, with thin, finely divided stalks with asexual reproductive structures (soredia). Reproductive structures (apothecia or pycnidia) are often present and bright red (Brodo et al., 2001). Shaded cladonia lichen is found mainly in shaded habitats, almost exclusively on rotting wood (Brodo et al., 2001).	shaded cladonia lichen 660023	11U	424660	5877023

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Easting	Northing
34	fan ramalina (S3, Tracked)	SE 7-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 16 m east of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This rare lichen was observed off of the proposed construction right-of-way.	Fan ramalina (<i>Ramalina sinensis</i> Jatta) is a shrubby fruticose lichen that grows to 3.5 cm long and 2 cm broad (Brodo et al., 2001). Its thallus is fan-shaped and variously branched, and produces 2.5 mm wide apothecia (sexual reproductive structures) on its margins. Fan ramalina grows on twigs and branches of trees and shrubs in open areas (Brodo et al., 2001).	fan ramalina 660023	11U	424660	5877023
35	fringed chocolate chip lichen (S2S3, Tracked)	NW 5-47-1 W6M	This species was previously delineated during surveys for the Kinder Morgan Trans Mountain Project. Thirteen stakes were observed during the 2016 field survey, but only one plant was observed.	This rare lichen was observed off of the proposed construction right-of-way.	This rare lichen was observed off of the proposed construction right-of-way on calcareous soil on the edge of a small wetland adjacent to a road.	Fringed chocolate chip lichen (<i>Solorina spongiosa</i>) is a foliose lichen with deeply cup-like apothecia 1.5-4.0 mm wide and two types of thallus. A narrow, tattered collar of thallus around a large, red-brown apothecia contains green alga-containing tissue. The lower surface of this thallus pale or dark without a cortex. The remaining thallus consists of a mat of cyanobacteria and is sometimes brownish and areolate and sometimes gelatinous and barely lichenized (Brodo et al., 2001)	fringed chocolate chip lichen 890085	11U	424890	5876085
36	Porsild's braya (S1, Tracked)	NW 5-47-1 W6M	Two patches were observed: 6 individuals within a 1 m by 2 m area within a small roadside wetland, and approximately 40 individuals in a 10 m by 10 m area in a linear roadside ditch.	This rare plant was observed off of the proposed construction right-of-way.	Population was observed off of the proposed construction right-of-way, on calcareous soil within a small wetland and within a linear ditch north of the wetland, both adjacent to the road.	Porsild's braya (<i>Braya humilis</i> ssp. <i>porsildii</i> J.G. Harris) is a small perennial herb that grows to 30 cm tall. It has hairy purplish stems, and its leaves are mostly clustered at the base of the plant. Its flowers are white or pinkish, and it produces seed pods about 10 mm long (Kershaw et al., 2001). Porsild's braya grows in moist to dry open woods, and on banks and gravel bars (Kershaw et al., 2001).	Porsild's braya 890085 Porsild's braya 888112	11U 11U	424890 424888 424886	5876085 5876112 5876116
37	yellow sedge (S2S3, Tracked)	NW 5-47-1 W6M	Two patches were observed: approximately 150 individuals throughout a small 10 m by 5 m roadside wetland and approximately 3,500 individuals within a 200 m by 10 m area in a linear roadside ditch.	This rare plant was observed off of the proposed construction right-of-way.	Population was observed off of the proposed construction right-of-way, throughout a small wetland and within a linear ditch north of the small wetland, both adjacent to the road.	Yellow sedge (<i>Carex flava</i> L.) is a perennial herb with stiff stems up to 60 cm tall. It grows in clumps, and has yellowish-green leaves 2.5 mm wide. The flower clusters are on 3-6 spikes that are usually crowded together, with the uppermost bearing only male flowers. Its fruits (perigynia) are yellowish-brown in colour and 4-6 mm long, with long, bent beaks (Moss, 1983). Yellow sedge grows on lime-rich soils in moist to wet habitats such as open meadows, fens or swamps (FNA, 1993+).	yellow sedge 890085 yellow sedge 888112	11U 11U	424890 424888 424862	5876085 5876112 5876281
38	dwarf bulrush (S3, Watched)	NW 5-47-1 W6M	Within a linear roadside ditch in a 10 m by 10 m area.	This rare plant was observed off of the proposed construction right-of-way.	This species is on the ACIMS Watched list (AEP, 2016a). Mitigation is not recommended for species on the Watched list.	See description for this species above (row 2).	dwarf bulrush 888112	11U	424888 424886	5876112 5876116
39	Hooker's cinquefoil (SU, Tracked)	NE 5-47-1 W6M	Two patches were observed: the western patch consisted of 4 individuals within a 1 m by 1 m area, and the eastern patch consisted of approximately 100 individuals within an 11 m by 10 m area, extending off of the proposed construction right-of-way in both directions.	This rare plant was observed off of the proposed construction right-of-way, from 107 m to 129 m northeast of the centerline (based on measurements with a hand-held GPS).	Population was observed within an open meadow with sparse lodgepole pine and white spruce. This occurrence was observed off of the proposed construction right-of-way.	See description for this species above (row 17).	Hooker's cinquefoil 267823 Hooker's cinquefoil 306815	11U 11U	426267 426306 426301	5875823 5875815 5875817
40	Porsild's braya (S1, Tracked)	NE 5-47-1 W6M	20 individuals within an 11 m by 4 m area.	This rare plant was observed off of the proposed construction right-of-way, 130 m northeast of the centerline (based on measurements with a hand-held GPS).	Population was observed within an open meadow with sparse lodgepole pine and white spruce. This occurrence was observed off of the proposed construction right-of-way.	See description for this species above (row 36).	Porsild's braya 306815	11U	426306 426301	5875815 5875817

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Easting	Northing
41	crescent frost lichen (S3, Tracked)	SW 4-47-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 192 m north of the centerline (based on measurements with a hand-held GPS).	See discussion for this species above (row 31).	See description for this species above (row 31).	crescent frost lichen 754368	11U	426754	5875368
42	<i>Solorinella</i> lichen (S1, Tracked)	NW 33-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 24 m west of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This occurrence was observed off of the proposed construction right-of-way.	<i>Solorinella</i> lichen (<i>Solorinella asteriscus</i> Anzi) is a type of. It forms diffuse, hardly delimited thalli on soil and rock surfaces. It is characterized by comparatively large apothecia that are immersed within a covering layer of thallus tissue when young and rupture at maturity. These apothecia have distinct, more or less triangular lobes that are composed of branched, parallel and more or less radiate thick walled hyphae (Henssen and Lucking, 2002).	<i>Solorinella</i> lichen 061380	11U	427061	5874380
43	altai blister lichen (S1?, Tracked)	NW 33-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 24 m west of the centerline (based on measurements with a hand-held GPS).	Altai blister lichen is ranked S1? in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	Altai blister lichen (<i>Toninia tristis</i> ssp. <i>asiae-centralis</i> [Th. Fr.] Th. Fr.) has a brown thallus with convex to flattened irregular scale-like projections (squamules), some with deep depressions or pores (Brodo et al., 2001). Black dots often cover the thallus. Altai blister lichen is found over soil and in rock crevices (Brodo et al., 2001).	altai blister lichen 061380	11U	427061	5874380
44	detritus rim lichen (not listed in Alberta)	NW 33-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 24 m west of the centerline (based on measurements with a hand-held GPS).	Detritus rim lichen is not currently listed in Alberta (AEP, 2016c), however, it is thought to be a common species by professional lichenologists and mitigation is not recommended (Goward, 2015, pers. comm.).	The thallus of detritus rim lichen (<i>Lecanora zosteriae</i> [Ach.] Nyl.) grows within the substrate and is virtually invisible at the surface (Brodo et al., 2001). Its reproductive structures (apothecia) are broad (0.4–1.6 mm in diameter), thin, flat and dull red-brown to smoky brown or almost black with a thin whitish to pale brown margin. Detritus rim lichen is found on dead wood and other dead vegetation (Brodo et al., 2001).	detritus rim lichen 061380	11U	427061	5874380
45	dwarf bulrush (S3, Watched)	W 33-46-1 W6M	Five subpopulations were observed, approximately thousands of stems within a 45 m by 655 m area.	This rare plant was observed spanning the centerline of the proposed construction right-of-way and extending off the proposed construction right-of-way in both directions (based on measurements with a hand-held GPS).	See discussion for this species above (row 2).	See description for this species above (row 2).	dwarf bulrush 108186 dwarf bulrush 142542 dwarf bulrush 091966 dwarf bulrush 103866 dwarf bulrush 128618	11U 11U 11U 11U 11U	427108 427107 427142 427137 427091 427092 427090 427098 427103 427109 427128 427108	5874186 5874195 5873542 5873894 5873966 5873954 5873950 5873948 5873866 5873855 5873618 5873740
46	Hooker's cinquefoil (SU, Tracked)	SW 33-46-1 W6M	12 individuals within a 1 m by 1 m area.	This rare plant was observed off of the proposed construction right-of-way, 21 m west of the centerline (based on measurements with a hand-held GPS).	This occurrence was observed off of the proposed construction right-of-way.	See description for this species above (row 17).	Hooker's cinquefoil 128618	11U	427128	5873618

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ²)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Eastings	Northing
47	Greenland primrose (S2, Tracked)	NW 28-46-1 W6M SW 33-46-1 W6M	15 plants within a 3 m by 1 m area.	This rare plant was observed off of the proposed construction right-of-way, 24 m west of the centerline (based on measurements with a hand-held GPS).	Population observed within a moist, open black spruce forest west of Snaring Road. This occurrence was observed off of the proposed construction right-of-way.	Greenland primrose (<i>Primula egaliksensis</i> Wormsk.) is a small perennial herb, usually growing 6-18 cm high (Kershaw et al., 2001). With thin, egg-shaped to spatula-shaped leaves in a basal rosette, the flowering stalk is leafless. Flowers are violet or deep lilac (sometimes white) with a yellow eye. It grows in wet meadows and on wet, calcareous lakeshores and riverbanks (Kershaw et al., 2001).	Greenland primrose 158159	11U	427158 427159	5873159 5873169
48	turgid scorpion moss (S2S3, Tracked)	NW 28-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare moss was collected in two adjacent locations off of the proposed construction right-of-way, 23 m and 30 m west of the centerline, respectively (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This occurrence was observed off of the proposed construction right-of-way.	Turgid scorpion moss (<i>Pseudocalliergon turgescens</i> [T. Jens.] Loeske) is a rather robust, large moss with weakly branched shoots and a yellow to yellow-brown colour (FNA, 1993+). Its leaves have short, single or double nerves that do not reach the leaf tip (Atherton et al., 2010)). Turgid scorpion moss grows in open, non-forested lime-rich wetland habitats at low to high elevations (FNA, 1993+).	turgid scorpion moss 163136 turgid scorpion moss 160084	11U 11U	427163 427160	5873136 5873084
49	yellow sedge (S2S3, Tracked)	NW 28-46-1 W6M	20 clumps within a 10 m by 10 m area.	This rare plant was observed off of the proposed construction right-of-way, 13 m east of the centerline (based on measurements with a hand-held GPS).	Observed within a wet meadow. This occurrence was observed off of the proposed construction right-of-way.	See description for this species above (row 37).	yellow sedge 209006	11U	427209	5873006
50	dwarf bulrush (S3, Watched)	NE 28-46-1 W6M	Hundreds of stems within a 130 m by 30 m area.	This rare plant was observed off of the proposed construction right-of-way, 7 m east of the centerline (based on measurements with a hand-held GPS).	See discussion for this species above (row 2).	See description for this species above (row 2).	dwarf bulrush 238574	11U	427238 427229	5872574 5872703
51	ring <i>Pellia</i> (SU, Tracked)	NE 28-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare liverwort was observed on the edge of the proposed construction right-of-way, 5 m east of the centerline (based on measurements with a hand-held GPS).	See discussion for this species above (row 16).	See description for this species above (row 16).	ring <i>Pellia</i> 238566	11U	427238	5872566
52	<i>Hypogymnia</i> lichen (not listed in Alberta)	NE 28-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 8 m east of the centerline (based on measurements with a hand-held GPS).	See discussion for this species above (row 32).	See description for this species above (row 32).	<i>Hypogymnia</i> lichen 258360	11U	427258	5872360
53	<i>Orthotrichum</i> moss (S3, Watched)	SW 22-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare moss was observed off of the proposed construction right-of-way, 21 m northeast of the centerline (based on measurements with a hand-held GPS).	This species is on the ACIMS Watched list (AEP, 2016b). Mitigation is not recommended for species on the Watched list.	<i>Orthotrichum</i> moss (<i>Orthotrichum pellucidum</i> Lindb.) is a moss that grows up to 2.5 cm tall. Its stiff, closely erect-appressed stem leaves are lance-shaped and entire. Reproductive structures are borne on stalks 1-1.5 mm high. <i>Orthotrichum</i> moss is found on calcareous or siliceous boulders and cliff faces in xeric areas, often in direct sunlight (FNA, 1993+).	<i>Orthotrichum</i> moss 350014	11U	428350	5870014
54	fan ramalina (S3, Tracked)	SW 22-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 21 m northeast of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This occurrence was observed off of the proposed construction right-of-way.	See description for this species above (row 34).	fan ramalina 350014	11U	428350	5870014

Table A5.2-1-7. Occurrences of Rare Vegetation Observed During 2015 and 2016 Vegetation Surveys that Do Not Warrant Mitigation

Row Number	Common Name (Rank ^a)	Legal Location	Abundance and Distribution	Relation to Proposed Construction Right-of-way Centerline	Discussion	Description	Feature ID	Zone	Easting	Northing
55	<i>Hypogymnia</i> lichen (not listed in Alberta)	NW 15-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 14 m northeast of the centerline (based on measurements with a hand-held GPS).	See discussion for this species above (row 32).	See description for this species above (row 32).	<i>Hypogymnia</i> lichen 627608	11U	428627	5869608
56	chestnut pelt lichen (not listed in Alberta)	NW 15-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 14 m northeast of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This occurrence was observed off of the proposed construction right-of-way.	Chestnut pelt lichen (<i>Peltigera castanea</i> Goward, Goffinet & Miadl.) is a foliose lichen previously known from the <i>Peltigera didactyla</i> complex (Goffinet et al., 2003). The lichens in this complex have a brownish gray to brown thallus, with small, concave lobes that bear round patches of blue-gray granula soredia on the upper surface. As the lichen matures, these patches will close over and will produce red-brown, saddle-shaped fruiting bodies on erect marginal lobes. Lichens of the <i>Peltigera didactyla</i> complex grow on soil or among rocks (Brodo et al., 2001).	chestnut pelt lichen 627608	11U	428627	5869608
57	<i>Ramalina</i> lichen (not listed in Alberta)	NW 15-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 14 m northeast of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This occurrence was observed off of the proposed construction right-of-way.	See description for this species above (row 26).	<i>Ramalina</i> lichen 627608	11U	428627	5869608
58	split-peg lichen (S2S4, Tracked)	NW 15-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed on the edge of the proposed construction right-of-way, 5 m southwest of the centerline (based on measurements with a hand-held GPS).	See discussion for this species above (row 24).	See description for this species above (row 24).	split-peg lichen 197187	11U	428917	5869187
59	June grass - pasture sagewort - wild blue flax (S2S3, Tracked)	NE 15-46-1 W6M	A 30 m by 3 m patch.	This rare ecological community was observed off of the proposed construction right-of-way, 15 m southwest of the centerline (based on measurements with a hand-held GPS).	This occurrence was observed off of the proposed construction right-of-way.	The June grass – pasture sagewort – wild blue flax community (<i>Koeleria macrantha</i> – <i>Artemisia frigida</i> – <i>Linum lewisii</i> community) is a dry, Montane community of fluvial, morainal and eolian landforms. Generally found on coarse textured and calcareous soils, June grass is usually dominant, with pasture sagewort, wild blue flax, littleleaf pussytoes and gaillardia characteristic co-occurring species. Unvegetated bare soil is also common in this community (Allen, 2014).	June grass - pasture sagewort - wild blue flax 913164	11U	428913 428930	5869164 5869158
60	muffin pelt (not listed in Alberta)	NW 2-46-1 W6M	This species was determined by specimen collection, so abundance and distribution are not known. The specimen that was identified by specialists is represented by the UTM coordinate.	This rare lichen was observed off of the proposed construction right-of-way, 28 m west of the centerline (based on measurements with a hand-held GPS).	This species was identified following fieldwork from a collection. This occurrence was observed off of the proposed construction right-of-way.	A description for muffin pelt (<i>Peltigera conspersa</i>) has not yet been published. At the genus level, <i>Peltigera</i> lichens are foliose lichens with lobes measuring up to 40 mm wide with their upper surfaces ranging from tomentose to smooth. The underside of the thalli of <i>Peltigera</i> lichens usually possess white to black "veins". The thallus of <i>Peltigera</i> lichen can range from green to brown to gray. They thrive most often on soil or mossy rock as well as some tree trunks in humid habitats (Brodo et al., 2001).	muffin pelt 784450	11U	429784	5866450

^a Definitions of provincial ranks and designations are summarized in Appendix 5.2-2.^b The addition of 'cfr' indicates that the identification is the best possible determination based on the condition of the collected specimen (which was too young or of poor condition).

Weed Species

Field Methods

Weed surveys were conducted as a component of the vegetation surveys. Weeds of management concern per the Alberta *Weed Control Regulation* and those identified as species of concern by JNP were reviewed prior to field surveys. These weeds (as well as other species commonly considered to be invasive, whether agronomics, native species, or introduced species [AESRD, 2012]) were recorded at all locations where they were observed during the survey. Classes were assigned for the density and distribution of each species, and numerical density distribution codes were assigned for all weed species observed during the survey, following the density distribution guide provided in the Alberta Sustainable Resource Development (ASRD) *Rangeland Health Assessment Guide* (Adams et al., 2009). Nomenclature of weed species follows the Alberta *Weed Control Regulation* (Province of Alberta, 2010). For species that are not listed in the regulation, nomenclature followed the ACIMS list of vascular plants in Alberta (AEP, 2016a).

Supplementary Results

A list of non-native and invasive plants observed during the 2015 and 2016 field surveys can be found in Table A5.2-1-8.

Table A5.2-1-8. Weed Species Observed During the 2015 and 2016 Vegetation Surveys

Legal Location ^a	Land Use	Weed Species ^{b,c}	Density ^d	Distribution ^e	Area of Infestation ^f	Limitations of Treatment	Comments
SE 14-49-27 W5M	riparian area	perennial sow-thistle	4	12	>50 m x 5 m	watercourse	--
		tall buttercup	2	10	>50 m x 20 m		
	quad trail	ox-eye daisy	2	8	10 m x 5 m	--	--
		tall buttercup	1	2	20 m x 5 m		
SW 14-49-27 W5M	existing right-of-way	tall buttercup	1	2	1 m x 7 m	--	--
SE 15-49-27 W5M	riparian area (Fiddle River)	Canada thistle (creeping thistle)	1	2	1 m x 1 m	watercourse	--
		caraway	2	2	1 m x 1 m		
		ox-eye daisy	2	2	1 m x 1 m		
		perennial sow-thistle	5	1	100 m x 20 m		
		tall buttercup	2	5	10 m x 2 m		

Table A5.2-1-8. Weed Species Observed During the 2015 and 2016 Vegetation Surveys

Legal Location ^a	Land Use	Weed Species ^{b,c}	Density ^d	Distribution ^e	Area of Infestation ^f	Limitations of Treatment	Comments
SW 15-49-27 W5M	marsh ^g	Canada thistle (creeping thistle)	1	6	150 m x 25 m	wetland	--
		perennial sow-thistle	2	4	10 m x 5 m		
		perennial sow-thistle	1	6	100 m x 25 m		
		perennial sow-thistle	1	3	10 m x 5 m		
		sweet clover species	2	3	5 m x 5 m		
SE 16-49-27 W5M	marsh ^g	Canada thistle (creeping thistle)	1	3	5 m x 5 m	wetland	--
		perennial sow-thistle	1	3	5 m x 5 m		
		tall buttercup	2	3	2 m x 1 m		
NE 9-49-27 W5M	coniferous forest	perennial sow-thistle	1	2	5 m x 5 m	--	--
SW 8-49-27 W5M	swamp ^g	Canada thistle (creeping thistle)	2	6	70 m x 30 m	wetland	Extends off right-of-way
		perennial sow-thistle	2	6	70 m x 30 m		
	native	Canada thistle (creeping thistle)	2	2	1 m x 1 m	watercourse	--
		ox-eye daisy	1	2	1 m x 5 m	watercourse	--
	creek bank (Mountain Creek)	tall buttercup	1	2	1 m x 1 m		
		perennial sow-thistle	2	5	450 m x 50 m	--	--
	clearing	quackgrass	1	5	50 m x 30 m	--	--
		timothy	1	5	50 m x 30 m	--	--
		tufted vetch	3	8	50 m x 500 m	--	--

Table A5.2-1-8. Weed Species Observed During the 2015 and 2016 Vegetation Surveys

Legal Location ^a	Land Use	Weed Species ^{b,c}	Density ^d	Distribution ^e	Area of Infestation ^f	Limitations of Treatment	Comments
NE 6-49-27 W5M	clearing	alfalfa	1	1	100 m x 20 m	--	--
		black medick	2	4	100 m x 20 m	--	--
		creeping thistle (Canada thistle)	2	5	100 m x 20 m	--	--
		ox-eye daisy	1	5	100 m x 20 m	--	--
		smooth brome	4	6	100 m x 20 m	--	--
		tufted vetch	2	10	100 m x 20 m	--	--
		white sweet-clover	1	5	100 m x 20 m	--	--
	forest	creeping thistle (Canada thistle)	2	4	600 m x 20 m	--	--
		perennial sow-thistle	3	3	450 m x 15 m	--	--
	existing right-of-way	caraway	3	3	1 m x 1 m	--	--
tall buttercup		1	2	200 m x 7 m	--	--	
existing right-of-way	ox-eye daisy	2	3	5 m x 5 m	--	--	
SW 6-49-27 W5M	existing right-of-way	caraway	2	4	10 m x 5 m	--	--
	forest	creeping thistle (Canada thistle)	2	3	3 m x 1 m	--	--
	existing right-of-way	rough cinquefoil ^h	--	--		--	--

Table A5.2-1-8. Weed Species Observed During the 2015 and 2016 Vegetation Surveys

Legal Location ^a	Land Use	Weed Species ^{b,c}	Density ^d	Distribution ^e	Area of Infestation ^f	Limitations of Treatment	Comments
SW 36-48-28 W5M	existing right-of-way	cicer milk vetch	2	5	50 m x 10 m	near watercourse	--
		perennial sow-thistle	4	10	10 m x 5 m	near watercourse	--
		spotted knapweed	1	5	20 m x 10 m	watercourse	--
	roadside	spotted knapweed	1	3	25 m x 80 m	--	--
		spotted knapweed	1	3	10 m x 20 m	--	--
	riparian area (Athabasca River Side Channel)	perennial sow-thistle	3	10	50 m x 5 m	watercourse	--
SW 26-48-28 W5M	existing right-of-way	creeping thistle (Canada thistle)	--	7	--	--	--
		dog mustard	--	--	--	--	--
		perennial sow-thistle	--	7	--	--	--
		redtop	--	11	--	--	--
		Russian-thistle	--	3	--	--	--
		white sweet-clover	--	2	--	--	--
SE 22-48-28 W5M	existing right-of-way	creeping thistle (Canada thistle)	3	3	6 m x 3 m	--	--
SE 13-48-1 W6M	native	Russian-thistle	--	--	--	--	--
NW 27-47-1 W6M	existing right-of-way	creeping thistle (Canada thistle)	1	3	5 m x 5 m	--	evidence of spraying
		perennial sow-thistle	2	6	100 m x 10 m	--	--
		perennial sow-thistle	2	5	50 m x 20 m	--	--
SE 28-47-1 W6M	road side	perennial sow-thistle	4	3	8 m x 1 m	--	--

Table A5.2-1-8. Weed Species Observed During the 2015 and 2016 Vegetation Surveys

Legal Location ^a	Land Use	Weed Species ^{b,c}	Density ^d	Distribution ^e	Area of Infestation ^f	Limitations of Treatment	Comments
SW 28-47-1 W6M	existing right-of-way	ox-eye daisy	2	4	5 m x 1 m	--	--
		ox-eye daisy	1	4	10 m x 5 m	--	--
	riparian area (Vine Creek)	perennial sow-thistle	2	3	2 m x 1 m	--	--
		rough cinquefoil ^h	2	3	4 m x 1 m	--	--
NW 21-47-1 W6M	existing right-of-way	ox-eye daisy	1	3	5 m x 5 m	--	--
	riparian area (Corral Creek)	perennial sow-thistle	1	3	5 m x 3 m	watercourse	--
		ox-eye daisy	1	4	15 m x 3 m	watercourse	--
NE 20-47-1 W6M	existing right-of-way	creeping thistle (Canada thistle)	4	3	1 m x 1 m	near watercourse	--
		ox-eye daisy	1	1	1 m x 1 m	near watercourse	--
NE 17-47-1 W6M	existing right-of-way	perennial sow-thistle	1	6	50 m x 5 m	near wetland	--
		quackgrass	3	3	50 m x 30 m	near wetland	--
	marsh ^g	creeping thistle (Canada thistle)	1	1	--	wetland	--
		perennial sow-thistle	2	10	10 m x 10 m	wetland	--
	existing right-of-way	creeping thistle (Canada thistle)	1	3	5 m x 5 m	--	--
		ox-eye daisy	1	8	50 m x 5 m	near wetland	--
		tall hawkweed	1	2	10 m x 10 m	--	--
NW 17-47-1 W6M	roadside	ox-eye daisy	3	3	3 m x 1 m	--	--
		ox-eye daisy	2	8	52 m x 50 m	--	--
		perennial sow-thistle	1	1	N/A	--	single plant
	existing right-of-way	creeping thistle (Canada thistle)	1	1	--	--	--

Table A5.2-1-8. Weed Species Observed During the 2015 and 2016 Vegetation Surveys

Legal Location ^a	Land Use	Weed Species ^{b,c}	Density ^d	Distribution ^e	Area of Infestation ^f	Limitations of Treatment	Comments
SW 17-47-1 W6M	existing right-of-way	rough cinquefoil ^h	1	3	2 m x 2 m	--	--
NW 8-47-1 W6M	roadside	perennial sow-thistle	2	3	5 m x 1 m	--	--
NE 7-47-1 W6M	existing right-of-way	ox-eye daisy	2	3	3 m x 3 m	--	--
	existing right-of-way	perennial sow-thistle	1	5	10 m x 2 m	--	--
SE 7-47-1 W6M	dry watercourse	annual hawk's-beard	1	2	5 m x 5 m	watercourse	--
		tall hawkweed	1	3	10 m x 5 m	watercourse	--
		creeping thistle (Canada thistle)	3	3	5 m x 5 m	--	--
	existing right-of-way	absinthe wormwood	1	1	1 m x 1 m	--	--
		ox-eye daisy	1	4	30 m x 5 m	--	--
		quackgrass	2	3	3 m x 3 m	--	--
	dry watercourse	ox-eye daisy	2	4	2 m x 2 m	--	--
		perennial sow-thistle	2	3	4 m x 2 m	--	--
		tall hawkweed	3	10	15 m x 10 m	--	--
	existing right-of-way	ox-eye daisy	1	2	700 m x 10 m	--	--
ox-eye daisy		2	3	2 m x 5 m (on each side)	nearby wildlife blind	--	
ox-eye daisy		1	3	1 m x 1 m	--	--	

Table A5.2-1-8. Weed Species Observed During the 2015 and 2016 Vegetation Surveys

Legal Location ^a	Land Use	Weed Species ^{b,c}	Density ^d	Distribution ^e	Area of Infestation ^f	Limitations of Treatment	Comments
NE 6-47-1 W6M	roadside	perennial sow-thistle	2	3	10 m x 10 m	--	--
	existing right-of-way	cicer milk vetch	4	3	3 m x 3 m	--	--
		ox-eye daisy	1	8	1500 m x 30 m	wetland	--
		perennial sow-thistle	1	5	1500 m x 30 m	wetland	--
		tall buttercup	1	3	5 m x 5 m	wetland	--
		creeping thistle (Canada thistle)	--	5	--	--	--
NW 5-47-1 W6M	roadside	perennial sow-thistle	--	3	--	--	--
		ox-eye daisy	--	3	--	--	--
SW 4-47-1 W6M	roadside	perennial sow-thistle	--	8	--	--	--
		smooth brome	--	5	--	--	--
NE 28-46-1 W6M	roadside	rough cinquefoil ^h	2	3	8 m x 1 m	--	--
SW 22-46-1 W6M	--	ox-eye daisy	2	3	1 m x 1 m	--	--
NW 15-46-1 W6M	existing right-of-way	creeping thistle (Canada thistle)	3	7	300 m x 10 m	--	--
	existing right-of-way	ox-eye daisy	1	5	600 m x 10 m	--	--
	existing right-of-way	quackgrass	4	3	150 m x 20 m	--	--
NE 15-46-1 W6M	existing right-of-way	smooth brome	3	3	50 m x 10 m	--	--
		tufted vetch	2	3	5 m x 5 m	watercourse	--
		timothy	2	3	5 m x 5 m	watercourse	--
	clearing/railway	yellow toadflax (common toadflax)	3	6	5 m x 10 m	railway	--

Table A5.2-1-8. Weed Species Observed During the 2015 and 2016 Vegetation Surveys

Legal Location ^a	Land Use	Weed Species ^{b,c}	Density ^d	Distribution ^e	Area of Infestation ^f	Limitations of Treatment	Comments
SE 15-46-1 W6M	clearing	creeping thistle (Canada thistle)	3	3	3 m x 2 m	waterbody/railway	--
		ox-eye daisy	2	3	1 m x 1 m	waterbody/railway	--
	clearing/railway	Dalmatian toadflax	2	10	30 m x 10 m	railway	--
NW 2-46-1 W6M	existing right-of-way	Dalmatian toadflax	1	1	single plant	--	single plant
		spotted knapweed	--	--	--	--	--

^a UTM coordinates are available for Noxious weed infestations.

^b **Bold** font denotes Prohibited Noxious and Noxious weed species.

^c Nomenclature of weed species follows the Alberta *Weed Control Regulation* (Province of Alberta, 2010). For species that are not listed in the *Regulation*, nomenclature follows the ACIMS list of elements in Alberta – vascular plants (AEP, 2016a).

^d Density code definitions are provided in Appendix 5.2-4.

^e Distribution code definitions are provided in Appendix 5.2-4.

^f All areas are approximate.

^g Refer to Section 5.4 for a full description of wetlands crossed by the Project routes.

^h This is a native species according to the ACIMS list of elements in Alberta (AEP, 2016a), but it is listed as a weed of concern within the Integrated Pest Management (IPM) Plan (Shepherd, 2015).

Forest Health

Field Methods

During vegetation surveys, vegetation ecologists looked for trees with discoloured needles and pitch tubes, noting these occurrences on field sheets and identifying them on field maps.

References

Personal Communications

CH2M wishes to acknowledge those people identified in the Personal Communications for their assistance in supplying information and comments incorporated into this report.

Belland, Rene. 2014. University of Alberta Devonian Botanic Garden Herbarium Curator. Edmonton, Alberta. Personal Communication with CH2M. September December 1, 2014.

Belland, Rene. 2015. University of Alberta Devonian Botanic Garden Herbarium Curator. Edmonton, Alberta. Personal Communication with CH2M. September 8, 2015.

Goward, Trevor. 2015. Lichen Identification. Enlichened Consulting Inc. Clearwater, British Columbia. Personal Communication with CH2M. September 1, 2015.

Literature Cited

Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz, and A. Burkinshaw. 2009. *Rangeland Health Assessment for Grassland, Forest and Tame Pasture*. Revised April 2009. Pub. No. T/044. Alberta Sustainable Resource Development, Lands Division, Rangeland Management Branch. Edmonton, Alberta. 128 pp.

Alberta Biodiversity Monitoring Institute (ABMI). 2014. *Terrestrial Field Data Collection Protocols (Abridged Version) 2014-03-21*. Edmonton, AB. 59 pp.

Alberta Biodiversity Monitoring Institute (ABMI). 2015. *Human Footprint Inventory (2012 Version 1.0) (digital file)*. Edmonton, AB. Available: <http://www.abmi.ca>. Acquired: March 2015. Last Update Check: March 13, 2015.

Alberta Environment and Parks (AEP). 2016a. *Alberta Conservation Information Management System (ACIMS)*. List of Elements in Alberta – Vascular Plants (July 2015). http://www.albertaparks.ca/media/6255149/all_elements_plants_vascular_july2015.xlsx. Accessed February 11, 2016.

Alberta Environment and Parks (AEP). 2016b. *Alberta Conservation Information Management System (ACIMS)*. List of Elements in Alberta – Non-vascular Plants (July 2015). <http://www.albertaparks.ca/media/6255121/acims-list-of-elements-in-alberta-non-vascular-plants.xlsx>. Accessed February 11, 2016.

Alberta Environment and Parks (AEP). 2016c. *Alberta Conservation Information Management System (ACIMS)*. List of Elements in Alberta – Lichens (October 2015). <http://www.albertaparks.ca/media/6255135/acims-list-of-elements-in-alberta-lichens.xlsx>. Accessed February 11, 2016.

Alberta Environment and Sustainable Resource Development (AESRD). 2012. *Weed Management on Industrial Sites R&R/12-01*. Edmonton, Alberta. 7 pp.

Alberta Environment and Sustainable Resource Development (AESRD). 2013. *Sensitive Species Inventory Guidelines*. Edmonton, Alberta. 128 pp.

Alberta Environment and Sustainable Resource Development (AESRD). 2015. *Alberta Wildfire Perimeters: 1931 to 2014 (digital file)*. Edmonton, AB. Available: <http://wildfire.alberta.ca/wildfire-maps/historical-wildfire-information/spatial-wildfire-data.aspx>. Acquired: May 4, 2015. Update Interval: Annually.

- Alberta Native Plant Council. 2012. *Alberta Native Plant Council Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update*. Edmonton, Alberta. 22 pp.
- Allen, L. 2014. *Alberta Conservation Information Management System Ecological Community Tracking List*. Alberta Tourism, Parks and Recreation. Edmonton, Alberta. 125 pp.
- Atherton, I., S. Bosanquet, and M. Lawley, Eds. 2010. *British Mosses and Liverworts: A Field Guide*. British Bryological Society, Plymouth, United Kingdom. 848 pp.
- Axys Environmental Consulting Ltd. and David Walker and Associates (Axys and Walker). 1998. *Best Available Methods for Common Leaseholder Activities*. Prepared for Line Leaseholder Working Group, Jasper National Park. 144 pp.
- British Columbia Ministry of Forests and Range and British Columbia Ministry of Environment. 2010. *Field Manual for Describing Terrestrial Ecosystems 2nd Edition*. Land Management Handbook No. 25. Victoria, BC. 257 pp.
- Brodo, I., S.D. Sharnoff, and S. Sharnoff. 2001. *Lichens of North America*. Yale University Press. New Haven, Connecticut. 795 pp.
- CH2M 2015 mentioned
- Degelius, G. 1954. *The lichen genus Collema in Europe: morphology, taxonomy, ecology*. *Symbolae Botanicae Upsalienses* 13:1–499.
- Flora of North America Editorial Committee (FNA), Eds. 1993+. *Flora of North America North of Mexico*. 16 + Vols. Oxford University Press, New York, New York.
- Goffinet, B., J. Miadlikowska and T. Goward. 2003. *Phylogenetic inferences based on nrDNA sequences support five morphospecies within the Peltigera didactyla complex (lichenized Ascomycota)*. *The Bryologist* 106: 349-364.
- Goward, T. 1999. *The Lichens of British Columbia Illustrated Keys*. Part 2 – Fruticose Species. British Columbia Ministry of Forests, Research Branch. Victoria, British Columbia. 291 pp.
- Goward, T., T. Spribille, T. Ahti and C.J. Hampton-Miller. 2012. *Four new sorediate species in the Hypogymnia austerodes group (lichens) from northwestern North America, with notes on thallus morphology*. *The Bryologist* 115(1):84-100.
- Henssen, A. and R. Lucking. 2002. *Morphology, anatomy and onogeny in the Asterothyriaceae (Ascomycota: Ostropales), a misunderstood group of lichenized fungi*. *Annales Botanici Fennici* 39: 273-299.
- Holland, W.D., and G.M. Coen, Eds. 1983. *Ecological (Biophysical) Land Classification of Banff and Jasper National Parks*. Edmonton, AB: Alberta Institute of Pedology. 600 pp.
- IHS Inc. 2004a. *IHS Hydro Line Data (digital file)*. Calgary, AB. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: June 2011. Last Update Check: November 16, 2015.
- IHS Inc. 2004b. *IHS Hydro Region Data (digital file)*. Calgary, AB. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: June 2011. Last Update Check: November 16, 2015.
- IHS Inc. 2015. *IHS Road Segments (digital file)*. Calgary, AB. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: December 17, 2015. Update Interval: Monthly.
- Kershaw, L., J. Gould, D. Johnson, and J. Lancaster, Eds. 2001. *Rare Vascular Plants of Alberta*. University of Alberta Press and Canadian Forest Service, Edmonton, Alberta. 484 pp.
- Moss, E.H. 1983. *Flora of Alberta*. Second Edition. Revised by J.G. Packer. University of Toronto Press, Toronto, Ontario. 687 pp.

Natural Resources Canada. 2007-2011. *National Hydro Network (digital files)*. Sherbrooke, QC. Available: <http://www.geobase.ca/geobase/en/data/nhn/index.html>. Acquired: April 2012. Last Update Check: May 2012.

Natural Resources Canada. 2012. *CanVec - Relief and Landforms - 1200009 Elevation Point (digital file)*. Sherbrooke, QC. Available: <http://geogratis.cgdi.gc.ca/geogratis/en/download/topographic.html>. Acquired: June 2012. Last Update Check: November 2012.

Øvstedal, D.G., T. Tønsberg, and A. Elvebakk. 2009. *The Lichen Flora of Svalbard*. *Sommerfeltia*. 33:1-393.

Otálora, M.A.G., I. Martinez, M.C. Molina, G. Aragon and F. Lutzoni. 2008. *Phylogenetic relationships and taxonomy of the Leptogium lichenoides group (Collemtaceae, Ascomycota) in Europe*. *Taxon* 57(3): 907-921.

Parks Canada. 2011. *Jasper National Park Ecological Land Classification, Roads, Rail and Boundary of Jasper National Park of Canada, P.O. Box 10, Jasper, AB T0E 1E0 (digital files)*. Edmonton, AB. Received by ATCO Electric: September 1, 2011. Received by CH2M: September 1, 2015.

Paton, J.A. 1999. *The Liverwort Flora of the British Isles*. Harley Books, Essex, England. 626 pp.

Province of Alberta. 2010. *Weed Control Act: Weed Control Regulation*. Alberta Regulation 19/2010. Alberta Queen's Printer, Edmonton, Alberta. 8 pp.

Shepherd, L. 2015. *Jasper National Park Integrated Pest Management Plan 2015 Frontcountry and Wilderness Areas*. Jasper National Park, Jasper AB. 18 pp.

Smith, C. W., A. Aptroot, B. J. Coppins, A. Fletcher, O. L. Gilbert, P. W. James and P. A. Wolseley, Eds. 2009. *Lichens of Great Britain and Ireland*. The British Lichen Society, London, England. 1046 pp.

Thompson, J. 1997. *American Arctic Lichens: the Microlichens*. University of Wisconsin Press, Madison, Wisconsin. 736 pp.

Vitt, D., J. Marsh and R. Bovey. 1988. *Mosses, Lichens and Ferns of Northwest North America*. Lone Pine Publishing, Edmonton, AB. 296 pp.

GIS Data and Mapping References

Alberta Biodiversity Monitoring Institute (ABMI). 2015. Human Footprint Inventory (2012 Version 1.0) (digital file). Edmonton, AB. Available: <http://www.abmi.ca>. Acquired: March 2015. Last Update Check: March 13, 2015.

Alberta Environment and Sustainable Resource Development. 2015a. Alberta Conservation Information Management System (ACIMS) Element Occurrences (Part 1: Non-sensitive) (digital file). Edmonton, AB. Available: [http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-\(acims\)/download-data.aspx](http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims)/download-data.aspx). Acquired: July 2015. Last Update Check: December 15, 2015.

Alberta Environment and Sustainable Resource Development. 2015b. Alberta Conservation Information Management System (ACIMS) Element Occurrences (Part 2: Sensitive, by township) (digital file). Edmonton, AB. Available: [http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-\(acims\)/download-data.aspx](http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims)/download-data.aspx). Acquired: July 2015. Last Update Check: December 15, 2015.

Alberta Environment and Sustainable Resource Development (AESRD). 2015c. Alberta Wildfire Perimeters: 1931 to 2014 (digital file). Edmonton, AB. Available: <http://wildfire.alberta.ca/wildfire-maps/historical-wildfire-information/spatial-wildfire-data.aspx>. Acquired: May 4, 2015. Update Interval: Annually.

- AltaLIS. 2009. Alberta Township System version 4.1 (digital file). Calgary, AB. Available: <http://www.altalis.com>. Acquired: October 2009. Last Update Check: December 15, 2015.
- ATCO Electric Ltd. 2016a. Jasper Palisades Generating Station 781S (digital files). Edmonton, AB. Received: Jan. 27, 2016. Last Update Check: Jan. 27, 2016.
- ATCO Electric Ltd. 2016b. 6L530 Proposed Route inside Jasper National Park (digital files). Edmonton, AB. Received: Feb. 3, 2016. Last Update Check: Feb. 3, 2016.
- CH2M. 2015b. Areas Surveyed - June 2015 (digital files). Calgary, AB. Created: July 9, 2015. Last Update Check: July 9, 2015.
- CH2M. 2015c. Areas Surveyed - August 2015 (digital files). Calgary, AB. Created: February 26, 2015. Last Update Check: February 26, 2015.
- CH2M. 2016. Areas Surveyed - June 2016 (digital files). Calgary, AB. Created: July 2016. Last Update Check: July 27, 2016.
- IHS Inc. 2004a. IHS Hydro Line Data (digital file). Calgary, AB. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: June 2011. Last Update Check: November 16, 2015.
- IHS Inc. 2004b. IHS Hydro Region Data (digital file). Calgary, AB. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: June 2011. Last Update Check: November 16, 2015.
- IHS Inc. 2015. IHS Road Segments (digital file). Calgary, AB. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: December 17, 2015. Update Interval: Monthly.
- Natural Resources Canada. 2007-2011. National Hydro Network (digital files). Sherbrooke, QC. Available: <http://www.geobase.ca/geobase/en/data/nhn/index.html>. Acquired: April 2012. Last Update Check: May 2012.
- Natural Resources Canada. 2012a. CanVec -Transportation - 1020009 Railway (digital file). Sherbrooke, QC. Available: <http://geogratis.gc.ca/geogratis/en/download/topographic.html>. Acquired: June 2012. Last Update Check: November 2012.
- Natural Resources Canada. 2012b. CanVec - Relief and Landforms - 2610009 Elevation Point Imperial (digital file). Sherbrooke, QC. Available: <http://geogratis.gc.ca/geogratis/en/download/topographic.html>. Acquired: June 2012. Last Update Check: November 2012.
- Natural Resources Canada. 2012c. CanVec - Relief and Landforms - 1200009 Elevation Point (digital file). Sherbrooke, QC. Available: <http://geogratis.gc.ca/geogratis/en/download/topographic.html>. Acquired: June 2012. Last Update Check: November 2012.
- Natural Resources Canada. 2015a. National Road Network – Alberta (digital file). Sherbrooke, QC. Available: [http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/-/\(urn:iso:series\)geobase-national-road-network-nrn/?sort-field=relevance](http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/-/(urn:iso:series)geobase-national-road-network-nrn/?sort-field=relevance). Acquired: January 2016. Last Update Check: January 8, 2016.
- Natural Resources Canada. 2015b. Canadian Geographical Names (digital file). Ottawa, ON. Available: <http://ftp2.cits.nrcan.gc.ca/pub/geobase/official/cgn/>. Acquired: December 2015. Last Update Check: December 15, 2015.
- Natural Resources Canada. 2016. Canada Lands Administrative Boundaries Level 1 (digital file). Ottawa, ON. Available: <http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/eb3757cc-d08b-5e62-9a44-3a8534ff3249.html>. Acquired: January 2016. Last Update Check: January 8, 2016.
- Parks Canada. 2011. Jasper National Park Ecological Land Classification, Roads, Rail and Boundary of Jasper National Park of Canada, P.O. Box 10, Jasper, AB T0E 1E0 (digital files). Edmonton, AB. Received by ATCO Electric: September 1, 2011. Received by CH2M: September 1, 2015.

TERA Environmental Consultants. 2008. Hillshade. Derived from Natural Resources Canada, Earth Sciences Sector, Centre for Topographic Information. 2000-2008. Canadian Digital Elevation Data 50k (digital files). Sherbrooke, QC. Available: <http://www.geobase.ca/geobase/en/data/cded/index.html>. Acquired: 2008. Last Update Check: December 2010.

Appendix 5.2-2
Potential Rare Vascular Plant Species
in the Rocky Mountain - Montane
Natural Subregion Crossed by the
Proposed Route

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
Vascular Plants				
<i>Adenocaulon bicolor</i>	pathfinder	Moist woods and thickets. Flowering from June to September.	S2 ^a	--
<i>Adiantum aleuticum</i>	western maidenhair fern	Moist forests, rocks, rocky scree and banks. Sporulating from summer to fall	S2 ^a	--
<i>Agrostis mertensii</i>	northern bent grass	Moist slopes. Flowering from July to August.	S2 ^a	--
<i>Allium geeyeri</i>	Geyer's onion	Wet meadows and stream banks. Flowering from June to July.	S2 ^a	--
<i>Antennaria corymbosa</i>	corymbose everlasting	Open woods and meadows. Flowering in August.	S2 ^a	--
<i>Antennaria luzuloides</i>	silvery everlasting	Dry rocky sites. Flowering in July.	S1 ^a	--
<i>Aquilegia jonesii</i>	Jones' columbine	Talus slopes, rock crevices. Flowering in July.	S1 ^a	--
<i>Arenaria longipedunculata</i>	sandwort	Moist, gravelly areas. Flowering from spring to summer	S2 ^a	G3G4 ^c
<i>Arnica longifolia</i>	long-leaved arnica	Rocky slopes and cliffs. Flowering from July to August.	S2 ^a	--
<i>Arnica louiseana</i>	Lake Louise arnica	Exposed tundra slopes and calcareous rock slides. Flowering from July to August.	S2 ^a	G3 ^c
<i>Arnica parryi</i>	nodding arnica	Open woods, grassy slopes, scree slopes. Flowering from July to August.	S2 ^a	--
<i>Artemisia borealis</i>	northern wormwood	Rocky alpine slopes. Flowering from mid to late summer.	S2S3 ^a	--
<i>Artemisia tridentata</i>	big sagebrush	Dry hills. Flowering from August to September.	S2 ^a	--
<i>Boechera calderi</i>	Calder's rockcress	Exposed rocky ridges, meadows, open forests near timberline. Flowering June to August.	S2 ^a	--
<i>Boechera collinsii</i>	Collins' rockcress	Rocky and gravelly hillsides, prairies, open woods and floodplains. Flowering May to June.	S1 ^a	--
<i>Boechera lemmonii</i> [<i>Arabis lemmonii</i>]	Lemmon's rock cress	Mesic alpine/subalpine slopes. Flowering from July to August.	S3 ^a	--
<i>Boechera pendulocarpa</i>	dangle-pod rockcress	Rock outcrops and gravelly slopes. Flowering April to July.	S1 ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Botrychium ascendens</i>	ascending grape fern	Stream floodplain habitats dominated by deciduous shrubs. Flowering in late spring to midsummer.	S3 ^a	G3 ^c
<i>Botrychium campestre</i>	field grape fern	Sandy soils ditches. Flowering from early spring to late summer.	S3 ^a	G3G4 ^c
<i>Botrychium crenulatum</i>	scalloped grape fern	Dry, open areas. Flowering from mid spring to late summer.	S3 ^a	G3 ^c
<i>Botrychium hesperium</i>	western grape fern	Mesic grassy slopes, wooded areas. Flowering from early spring to early fall.	S3 ^a	--
<i>Botrychium michiganense</i>	Michigan grape fern	Open, grassy areas.	SU ^a	G3 ^c
<i>Botrychium pallidum</i>	pale moonwort	Open fields, occasionally shaded habitats.	S2 ^a	G3 ^c
<i>Botrychium paradoxum</i>	paradoxical grape fern	Moist grassy slopes in mountains. Flowering from early to late summer.	S1 ^a	G3G4 ^c
<i>Botrychium pedunculosum</i>	stalked grape fern	Floodplain bottoms. Leaves appearing in late spring and dying in late fall.	S1 ^a	G2G3 ^c
<i>Botrychium simplex</i>	dwarf grape fern	Moist meadows and shores. Flowering from mid spring to early fall.	S2 ^a	--
<i>Botrychium spathulatum</i>	spatulate grape fern	Meadows and open forests.	S3 ^a	G3 ^c
<i>Botrychium x watertonense</i>	Waterton grape fern	Grassy openings in coniferous forests in mountains. Flowering in early summer.	S1 ^a	--
<i>Braya glabella</i> ssp. <i>purpurascens</i> [<i>Braya purpurascens</i>]	alpine braya	Moist scree slopes. Flowering from June to August.	S1S2 ^a	--
<i>Braya humilis</i>	low braya	Moist to dry forests, river bars, scree slopes and gravelly slopes in the montane to alpine zones.	S3 ^a	--
<i>Braya humilis</i> ssp. <i>maccallae</i>	leafy braya	Gravelly river flats. Flowering from May to June	S2 ^a	G5T1T2Q ^c
<i>Brickellia grandiflora</i>	large-flowered brickellia	Dry slopes, shores and roadsides. Flowering from July to September.	S2 ^a	--
<i>Bromus latiglumis</i>	Canada brome	Moist banks. Flowering from late June to August.	S1 ^a	--
<i>Bupleurum americanum</i>	thorough-wax	Dry hillsides.	S2 ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Camassia quamash</i> var. <i>quamash</i>	blue camas	Moist to wet meadows. Flowering from May to July.	S3 ^a	G5T3T5 ^c
<i>Carex aperta</i>	open sedge	Low wet ground; open wetlands. Flowering from July to August.	S2 ^a	--
<i>Carex cordillerana</i>	cordilleran sedge	Grassy slopes, rich soil. Fruiting from May to July	S1 ^a	G3G4 ^c
<i>Carex crawei</i>	Crawe's sedge	Calcareous meadows. Flowering from June to July.	S3 ^a	--
<i>Carex epapillosa</i> [<i>Carex heteroneura</i> var. <i>epapillosa</i>]	blackened sedge	Moist to dry mountain meadows. Flowering from July to August.	S1 ^a	G5TNR ^c
<i>Carex flava</i>	yellow sedge	Bogs, swamps, shorelines and wet, sandy sites in the lowland and montane zones.	S2S3 ^a	--
<i>Carex infirmivervia</i>	weak-nerved sedge	Woodland and woodland edges. Fruiting from late spring to summer	S1 ^a	--
<i>Carex lenticularis</i> var. <i>dolia</i>	lens-fruited sedge	Moist lake shores and marshes; river flats and streambanks. Fruiting from August to September	S1 ^a	G5T3 ^c
<i>Carex mertensii</i>	purple sedge	Moist montane woods and streambanks. Flowering from May to July.	S2 ^a	--
<i>Carex paysonis</i>	Payson's sedge	Mountain meadows. Flowering from July to September.	S2 ^a	--
<i>Carex petasata</i>	pasture sedge	Dry grassland and open woods. Flowering from May to July.	S3 ^a	--
<i>Carex saximontana</i>	Rocky Mountain sedge	Moist woods or thickets. Fruiting from late May to mid-July	S1 ^a	--
<i>Carex tahoensis</i>	Lake Tahoe sedge	Subalpine Forests and alpine fell-fields.	S1 ^a	--
<i>Carex tinctoria</i>	tinged sedge	Meadows and open woodlands. Flowering from May to July.	SH ^a	--
<i>Carex vesicaria</i>	blister sedge	Swamps and marshes. Flowering in July.	S1 ^a	--
<i>Chenopodium incanum</i>	hoary goosefoot	Sandy grounds, dry plains and hillsides. Flowering from June to September.	S1 ^a	--
<i>Cirsium scariosum</i>	elk thistle	Open woods and slopes. Flowering from June to September.	S2 ^a	--
<i>Conimitella williamsii</i>	conimitella	Open montane slopes. Flowering in June.	S2 ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Corispermum villosum</i>	hairy bugseed	Sandy places (dunes, shores etc.).	S2 ^a	--
<i>Crepis atribarba</i>	slender hawk's-beard	Dry, grassy slopes, moderate elevations. Flowering from June to July.	S2 ^a	--
<i>Cryptantha minima</i>	tiny cryptanthe	Dry eroded, prairie slopes. Flowering from May to June.	S2 ^a Endangered ^b	Endangered ^d Threatened ^e
<i>Cynoglossum virginianum</i> var. <i>boreale</i>	wild comfrey	Dry to moist woods. Flowering from June to July.	S1 ^a	--
<i>Cypripedium montanum</i>	mountain lady's-slipper	Moist woods. Flowering from June to August.	S2 ^a	--
<i>Cystopteris montana</i>	mountain bladder fern	Springy or damp calcareous places. Sporulating from summer to fall	S3 ^a	--
<i>Deschampsia elongata</i>	slender hair grass	Meadows and open slopes. Flowering from June to July.	S2 ^a	--
<i>Dichanthelium acuminatum</i> [<i>Panicum acuminatum</i>]	hot-springs millet	Marshy places, around hot springs. Flowering in June.	S2 ^a	--
<i>Downingia laeta</i>	downingia	Muddy shores, often alkaline. Flowering from July to August.	S3 ^a	--
<i>Draba densifolia</i>	dense-leaved whitlow-grass	Talus slopes and alpine/subalpine ridges. Flowering in August.	S2 ^a	--
<i>Draba macounii</i>	Macoun's whitlow-grass	Alpine/subalpine slopes. Flowering from July to August.	S3 ^a	G3G4 ^c
<i>Draba porsildii</i>	Porsild's whitlow-grass	Moist banks and turfy slopes. Flowering from June to July.	S3 ^a	G3G4 ^c
<i>Dryopteris filix-mas</i>	male fern	Wooded slopes.	S1S2 ^a	--
<i>Eleocharis engelmannii</i>	Engelmann's spike-rush	Wet places. Flowering from June to September.	S2 ^a	--
<i>Epilobium glaberrimum</i> ssp. <i>fastigiatum</i>	pale willowherb	Rocky mountain slopes and streambanks, moist forests and meadows. Flowering in August. Produces fruit from August to September.	S1 ^a	--
<i>Epilobium lactiflorum</i>	white willowherb	Moist streambanks and moist slopes to alpine elevations. Flowering from June to August.	S3 ^a	--
<i>Epilobium leptocarpum</i>	slender-fruited willowherb	Moist, open stony slopes. Flowering from July to August.	S2 ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Erigeron divergens</i>	spreading fleabane	Dry gravelly or sandy areas. Flowering from May to July.	S1 ^a	--
<i>Erigeron flagellaris</i>	creeping fleabane	Dry open woods. Flowering from June to August.	S2 ^a	--
<i>Erigeron radicans</i>	dwarf fleabane	Dry ridges, scree slopes. Flowering from late May to July.	S3 ^a	G3G4 ^c
<i>Festuca occidentalis</i>	western fescue	Dry wooded slopes; associated with lodgepole pine and trembling aspen. Flowering from May to July.	S2 ^a	--
<i>Festuca subulata</i>	bearded fescue	Moist thickets and shaded banks. Flowering in July.	S1 ^a	--
<i>Gayophytum racemosum</i>	low willowherb	Open slopes and disturbed ground. Flowering from June to August.	S1 ^a	--
<i>Gentiana calycosa</i>	mountain gentian	Moist subalpine and alpine meadows.	S2 ^a	--
<i>Gentiana fremontii</i>	marsh gentian	Turfy slopes. Flowering in June.	S3 ^a	--
<i>Geranium erianthum</i>	woolly geranium	Moist woods and grassy slopes. Flowering from June to August.	SH ^a	--
<i>Gnaphalium microcephalum</i>	tall common cudweed	Dry open sites, often sandy or rocky areas. Flowering in August.	SH ^a	--
<i>Gnaphalium viscosum</i>	clammy cudweed	Meadows, openings in woods. Flowering from July to September.	SH ^a	--
<i>Gymnocarpium disjunctum</i>	western oak fern	Moist forests, glades, rocky slopes and streambanks.	S3 ^a	--
<i>Gymnocarpium jessoense</i>	northern oak fern	Rock crevices.	S2 ^a	--
<i>Heuchera glabra</i>	alpine alumroot	Moist scree, ledges and slopes at timberline. Flowering from July to August.	S1 ^a	--
<i>Hippuris montana</i>	mountain mare's-tail	Mossy banks and shallow streams. Flowering from July to August.	S1 ^a	--
<i>Hypopitys monotropa</i> [<i>Monotropa hypopithys</i>]	pinetop	Moist woods; saprophytic in coniferous woods. Flowering in July.	S3 ^a	--
<i>Iliamna rivularis</i>	mountain hollyhock	Mountain slopes, meadows and streambanks. Flowering in July.	S1 ^a	--
<i>Iris missouriensis</i>	western blue flag	Moist meadows and stream banks. Flowering from June to July.	S2 ^a	Special Concern ^{d,e}
<i>Isoetes maritima</i>	coastal quillwort	Shallow waters and lakeshores. Flowering in late August.	S1 ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Isoetes occidentalis</i>	western quillwort	Submerged, often in deep water. Flowering in late August.	S1 ^a	--
<i>Isoetes x truncata</i>	quillwort hybrid	Immersed in and around lakes and ponds. Flowering in late August.	S1 ^a	--
<i>Juncus nevadensis</i>	Nevada rush	Wet areas. Flowering from July to August.	S1 ^a	--
<i>Juncus parryi</i>	Parry's rush	Mountain slopes and meadows. Flowering in July.	S2 ^a	--
<i>Larix occidentalis</i>	western larch	Moist mountain slopes, moderate to low elevations. Cones mature from May to June.	S2 ^a	--
<i>Leptosiphon septentrionalis</i> [<i>Linanthus septentrionalis</i>]	linanthus	Dry hillsides and plains. Flowering from May to June.	S2 ^a	--
<i>Lewisia pygmaea</i> var. <i>pygmaea</i>	dwarf bitter-root	Dry, rocky alpine/subalpine slopes. Flowering from late May to August.	S2 ^a	--
<i>Lewisia rediviva</i>	bitter-root	Dry, southwest exposure, desert flats. Flowering from July to August.	S1 ^a	--
<i>Lilaea scilloides</i>	flowering quillwort	Slough margins and mudflats. Flowering in July.	S3 ^a	--
<i>Lithophragma glabrum</i>	smooth rockstar	Meadows and springs, moist slopes. Flowering from July to August.	S2 ^a	--
<i>Lithophragma parviflorum</i>	small-flowered rockstar	Moist meadows and open woods. Flowering from May to July.	S2 ^a	--
<i>Lomatium cous</i>	biscuit-root	Dry open slopes. Cypress Hills conglomerate. Flowering in May.	S1 ^a	--
<i>Lupinus lepidus</i>	alpine lupine	Dry gravelly openings and rock outcrops in the lowland zone.	S2 ^a	--
<i>Lupinus minimus</i>	least lupine	River flats and open gravelly areas. Flower in June.	S2 ^a	G3G4 ^c
<i>Lupinus polyphyllus</i>	large-leaved lupine	Moist woods. Flowering from mid-June to early September.	SU ^a	--
<i>Melica smithii</i>	melic grass	Moist subalpine woodlands. Flowering in July.	S2 ^a	--
<i>Melica spectabilis</i>	onion grass	Moist woods. Flowering in August.	S2 ^a	--
<i>Mertensia lanceolata</i>	lance-leaved lungwort	Prairie slopes and hillsides. Flowering from June to July.	S2 ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Mertensia longiflora</i>	large-flowered lungwort	Moist slopes and meadows. Flowering from May to June.	S2 ^a	--
<i>Microseris nutans</i>	nodding scorzonella	Open montane woods and grassy slopes. Flowering from April to July.	S2 ^a	--
<i>Microsteris gracilis</i> ssp. <i>gracilis</i> [<i>Phlox gracilis</i> ssp. <i>gracilis</i>]	slender phlox	Dry to moist, open ground. Flowering in June.	S1 ^a	--
<i>Mimulus floribundus</i>	small yellow monkeyflower	Moist montane banks. Flowering in July.	S2 ^a	--
<i>Montia linearis</i>	linear-leaved montia	Moist to dry sandy plains, hills and woodlands; disturbed areas. Flowering from May to July.	S2 ^a	--
<i>Najas flexilis</i>	slender naiad	Ponds and streams. Flowering from July to August.	S3 ^a	--
<i>Nemophila breviflora</i>	small baby-blue-eyes	Moist meadows and woods. Flowering from June to July.	S3 ^a	--
<i>Neottia banksiana</i> [<i>Listera caurina</i>]	western twayblade	Moist coniferous forests. Flowering from June to July.	S2 ^a	--
<i>Neottia convallarioides</i> [<i>Listera convallarioides</i>]	broad-lipped twayblade	Boggy woods and meadows. Flowering from July to September.	S2 ^a	--
<i>Oenothera flava</i>	low yellow evening-primrose	Dry slopes and flats; on moist sandy soil. Flowering from July to August.	S3 ^a	--
<i>Osmorhiza longistylis</i>	smooth sweet cicely	Moist woods. Flowering in June.	S3 ^a	--
<i>Oxytropis campestris</i> var. <i>davisii</i>	northern locoweed	Alpine/subalpine and subalpine meadows and dry ridges. Flowering from June to August.	S2? ^a	G5T3 ^c
<i>Packera contermina</i>	Arctic butterweed	Rocky alpine slopes. Flowering from early July to late August.	S2 ^a	G3G4 ^c
<i>Packera subnuda</i>	ragwort	Moist alpine/subalpine meadows and streambanks. Flowering from June to September.	S2 ^a	--
<i>Packera subnuda</i> var. <i>subnuda</i>	alpine meadow groundsel	Moist to mesic streambanks, seepages and meadows from the upper montane to alpine zones.	S2 ^a	--
<i>Pedicularis racemosa</i>	leafy lousewort	Dry open areas at high elevations. Flowering from July to August.	S1 ^a	--
<i>Pellaea gastonyi</i>	Gaston's cliff brake	Limestone crevices. Flowering from summer to fall.	S2 ^a	G2G3 ^c

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Pellaea glabella</i>	smooth cliff brake	Dry limestone rocks. Sporulating from summer to fall.	S3 ^a	--
<i>Pellaea glabella</i> ssp. <i>occidentalis</i>	smooth cliff brake	Calcareous cliffs and ledges. Sporulating from summer to fall.	S2 ^a	--
<i>Pellaea glabella</i> ssp. <i>simplex</i>	smooth cliff brake	Calcareous cliffs and ledges. Sporulating from summer to fall.	S2 ^a	--
<i>Phacelia linearis</i>	linear-leaved scorpionweed	Dry open slopes and shores. Flowering from June to July.	S3 ^a	--
<i>Phacelia lyallii</i>	Lyall's scorpionweed	Scree slopes.	S2 ^a	G3 ^c
<i>Phegopteris connectilis</i>	northern beech fern	Moist woodlands.	S3 ^a	--
<i>Philadelphus lewisii</i>	mock orange	Moist mountain woods. Flowering from July to August.	S1 ^a	--
<i>Phlox alyssifolia</i>	blue phlox	Dry, eroded, stony, grassland ridge-slopes.	S2 ^a	--
<i>Physaria arctica</i> [<i>Lesquerella arctica</i> var. <i>purshii</i>]	northern bladderpod	Dry, sandy or calcareous slopes and ridges; river flats. Flowering from June to July.	SNA ^a	G4TNR ^c
<i>Physocarpus malvaceus</i>	mallow-leaved ninebark	Rocky ravines, hillsides and coniferous forest. Flowering from July to August.	S1 ^a	--
<i>Pinus albicaulis</i>	whitebark pine	Timber-line belt of the Rocky Mountains.	S3 ^a Endangered ^b	G3G4 ^c Endangered ^{d,e}
<i>Pinus flexilis</i>	limber pine	Exposed rocky slopes and hilltops to subalpine elevations.	S3 ^a Endangered ^b	Endangered ^e
<i>Pinus monticola</i>	western white pine	Open rocky slopes in mountains. Cones mature from May to June.	S2 ^a	--
<i>Piperia unalascensis</i>	Alaska bog orchid	Dry to moist coniferous forests, grassy slopes, meadows, thickets and streambanks. Flowering from June to August.	S2 ^a	--
<i>Piptatherum exiguum</i> [<i>Oryzopsis exigua</i>]	little rice grass	Dry open ground or open woods. Flowering from June to August.	S2 ^a	--
<i>Poa stenantha</i>	narrow-leaved bluegrass	Open woods; often on talus slopes. Flowering in August.	S2 ^a	--
<i>Polygonum austinae</i> [<i>Polygonum douglasii</i> ssp. <i>austinae</i>]	Austin's knotweed	Moist to dry grasslands, shrublands, rocky slopes and forest openings. Flowering from June to October.	S1 ^a	--
<i>Polygonum bistortoides</i>	western bistort	Moist to mesic meadows in the subalpine and alpine zones	S2 ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Polygonum engelmannii</i>	Engelmann's knotweed	Moist to dry grasslands, shrublands, rocky slopes and forest openings in the steppe and montane zones.	S2 ^a	G5T3T5 ^c
<i>Polygonum minimum</i>	least knotweed	Dry ground; sandy soil and rock outcrops. Flowering from July to August.	S2 ^a	--
<i>Polypodium hesperium</i>	western polypody	Moist rocky outcrops. Sporulating from summer to fall.	S1 ^a	--
<i>Potentilla hookeriana</i>	Hooker's cinquefoil	Dry rocky slopes to alpine elevations. Flowering from July to August.	SU ^a	--
<i>Potentilla macounii</i>	Macoun's cinquefoil	Dry, grassy slopes and cliffs. Flowering from June to August.	S1 ^a	G1G2 ^c
<i>Potentilla multisecta</i>	smooth-leaved cinquefoil	Dry alpine/subalpine slopes. Flowering in June.	S2 ^a	GNR ^c
<i>Potentilla pulcherrima</i>	soft cinquefoil	Dry to moist meadows, grasslands, rocky slopes, open forests, and roadsides in the montane zone.	S1 ^a	--
<i>Potentilla subjuga</i>	Colorado cinquefoil	Prairie slopes to alpine/subalpine meadows. Flowering from spring to early summer.	SH ^a	--
<i>Potentilla villosa</i>	hairy cinquefoil	Rocky outcrops, scree slopes, alpine/subalpine meadows. Flowering from June to August.	SU ^a	--
<i>Prenanthes sagittata</i>	purple rattlesnakeroot	Moist banks and thickets. Flowering from July to August.	S1 ^a	G3G4 ^c
<i>Primula egaliksensis</i>	Greenland primrose	Wet meadows and shores. Flowering from June to July.	S2 ^a	--
<i>Pteridium aquilinum</i>	bracken fern	Dry to wet forest margins, peat bogs, avalanche tracks, clearings, roadsides, burns, dry openings in forest and meadows, from the lowland and steppe to subalpine zones.	S2S3 ^a	--
<i>Pteridium aquilinum</i> var. <i>latiusculum</i>	bracken fern	Dry to wet forest margins, peat bogs, avalanche tracks, clearings, roadsides, burns, dry openings in forest and meadows, from the lowland and steppe to subalpine zones.	SU ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Pteridium aquilinum</i> var. <i>pubescens</i>	bracken fern	Dry to wet forest margins, peat bogs, avalanche tracks, clearings, roadsides, burns, dry openings in forest and meadows, from the lowland and steppe to subalpine zones.	SU ^a	G5T3T5 ^c
<i>Pyrola picta</i>	white-veined wintergreen	Coniferous woods. Flowering from July to August.	S1 ^a	--
<i>Ranunculus glaberrimus</i>	early buttercup	Prairie grassland and meadows. Flowering from May to June.	S3 ^a	--
<i>Ribes inerme</i>	mountain gooseberry	Moist to dry streambanks, woodlands and forests in the lowland, montane and subalpine zones.	S2? ^a	--
<i>Ribes laxiflorum</i>	mountain currant	Wet woods. Flowering in June.	S2 ^a	--
<i>Romanzoffia sitchensis</i>	Sitka romanzoffia	Moist rocks and ledges to alpine elevations. Flowering from July to August.	S2 ^a	--
<i>Salix boothii</i>	Booth's willow	Moist to wet streambanks and meadows in the montane and subalpine zones.	S3 ^a	--
<i>Salix calcicola</i>	woolly willow	Flood plain of North Saskatchewan River. Flowering in spring.	S2 ^a	--
<i>Salix sitchensis</i>	Sitka willow	Alluvial soil (Athabasca River). Flowering in May.	S2 ^a	--
<i>Selaginella wallacei</i>	Wallace's little club-moss	Dry rocky slopes in mountains.	S1 ^a	--
<i>Stellaria obtusa</i>	meadow chickweed	Damp meadows and streambanks. Flowering from June to July.	S1 ^a	--
<i>Suksdorfia ranunculifolia</i>	white suksdorfia	Moist mossy rocks. Flowering from June to July.	S1 ^a	--
<i>Suksdorfia violacea</i>	blue suksdorfia	Rock crevices, mossy banks. Flowering from May to July.	S1 ^a	--
<i>Symphotrichum spathulatum</i>	western mountain aster	Mesic meadows and open forests in the lowland and montane zones.	SH ^a	--
<i>Taxus brevifolia</i>	western yew	Moist woods in mountains; west of continental divide. Flowering from April to June.	S1 ^a	--
<i>Thuja plicata</i>	western red cedar	Cool, moist mountain slopes. Cones appear from April to May.	S2 ^a	--
<i>Torreyochloa pallida</i> var. <i>pauciflora</i>	few-flowered salt-meadow grass	Wet places. Flowering from June to August.	S1 ^a	--

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
<i>Triantha occidentalis</i> ssp. <i>montana</i>	western false-asphodel	Wet, calcareous sites. Flowering in summer.	S1 ^a	--
<i>Trillium ovatum</i>	western wakerobin	Moist woods. Flowering from May to June.	S1 ^a	--
<i>Trisetum canescens</i>	tall trisetum	Moist woods. Flowering from May to July.	S2 ^a	GNR ^c
<i>Trisetum cernuum</i>	nodding trisetum	Moist woods.	S2 ^a	GNR ^c
<i>Trisetum wolfii</i>	awnless trisetum	Moist woods. Flowering from July to August.	S2 ^a	--
<i>Tsuga heterophylla</i>	western hemlock	Moist coniferous forest, with <i>Picea engelmannii</i> and <i>Abies lasiocarpa</i> at moderate elevations; shade tolerant.	S1 ^a	--
<i>Viola glabella</i>	yellow wood violet	Mesic to moist streambanks, woodlands and forests in the lowland to alpine zones.	S2 ^a	--
<i>Viola praemorsa</i> ssp. <i>linguifolia</i>	broad-leaved yellow prairie violet	Open areas, rocky hillsides. Flowering in July.	S2 ^a	--
<i>Woodsia glabella</i>	smooth woodsia	Moist calcareous rocks and shaded cliffs. Sporulating from summer to early fall.	S2 ^a	--

Sources: AEP 2015a, AEP 2015b, AESRD 2014, Argus and Pryer 1990, COSEWIC 2015, Douglas et al. 2002, FNA Editorial Committee 1993+, Government of Canada 2015, Kershaw et al. 2001, Moss 1983, NatureServe 2015, Porsild and Cody 1980, Williston 2001.

Notes:

- ^a Provincial (S) ranks are assigned by Alberta Parks (2015). Ranks range from 1 (five or fewer occurrences) to 5 (demonstrably secure under present conditions), however, only species on the ACIMS Tracking and Watch lists are included in this table. All definitions below are adapted from NatureServe (2015) unless noted otherwise.
- S1 = Critically Imperiled: At high risk of extirpation in the province due to very restricted range, very few populations or occurrences, very steep declines, severe threats or other factors.
- S2 = Imperiled: At risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats or other factors.
- S3 = Vulnerable: At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats or other factors.
- S4 = Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats or other factors.
- S5 = Secure: At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.
- S#S# = Range Rank: A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the status of the species.

Table A5.2-2. Potential Rare Vascular Plant Species in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Name	Common Name	Habitat	Provincial Designations	Federal/Global Designations
a (cont'd)	SH =	Possibly Extirpated: Known from only historical records but still some hope of rediscovery. There is evidence that the species may no longer be present in the jurisdiction, but not enough to state this with certainty.		
	SU =	Unrankable: Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.		
	S#?	Unranked: provincial rank not yet assessed.		
	Q =	Questionable taxonomy: Taxonomic status is questionable; numeric rank may change with taxonomy.		
	T =	Designates a rank associated with a subspecies.		
b		Alberta's <i>Wildlife Act</i> . A species legislated as Endangered or Threatened under the <i>Wildlife Act</i> or designated Special Concern by the Endangered Species Conservation Committee using definitions based on those used by the Committee on the Status of Endangered Wildlife in Canada (AESRD 2014) (see Note 5).		
c		Global (G) ranks are based on species status world-wide and follow a system parallel to that for Provincial Ranks (Note 1), ranging from 1 (5 or fewer occurrences) to 5 (demonstrably secure under present conditions). Only Global Ranks of concern (G1 to G3) or questionable ranks are displayed, range ranks (G#G#) which include a G1 to G3 ranking are also included (e.g., G3G4) (as defined by NatureServe 2015). Global ranks were obtained from Alberta Parks (2014).		
d		<i>Species at Risk Act (SARA)</i> . SARA establishes Schedule 1 as the list of species to be protected on all federal lands in Canada. The <i>Act</i> also applies to all lands in Canada for Schedule 1 bird species cited in the <i>Migratory Birds Convention Act</i> and Schedule 1 aquatic species as determined by Fisheries and Oceans Canada.		
		Endangered: A species that is facing imminent extirpation or extinction.		
		Threatened: A species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.		
		Special Concern: A species that may become a Threatened or an Endangered species because of a combination of biological characteristics and identified threats.		
e		Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2015). Species listed as 'Extirpated', 'Not at Risk' or 'Data Deficient' were generally not included in the table without other noteworthy factors being present.		
		Endangered: A species facing imminent extirpation or extinction.		
		Threatened: A species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.		
		Special Concern: A species that may become a Threatened or an Endangered species because of a combination of biological characteristics and identified threats.		

References

- Alberta Environment and Parks. 2015a. *Alberta Conservation Information Management System (ACIMS)*. Website: [http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-\(acims\).aspx](http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims).aspx). Accessed: Month Year.
- Alberta Environment and Parks. 2015b. *Current element occurrence data emails*. Alberta Conservation Information Management System. Edmonton, AB.
- Alberta Environment and Sustainable Resource Development. 2014. *Species Assessed by Alberta's Endangered Species Conservation Committee*. Updated July 4, 2014. Fish and Wildlife Policy Branch. Edmonton, AB. 2 pp.

- Argus, G.W. and K.M. Pryer. 1990. *Rare Vascular Plants in Canada*. Canadian Museum of Nature, Ottawa.
- Committee on the Status of Endangered Wildlife in Canada. 2015. *Canadian Species at Risk*. Website: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm. Accessed: Month Year.
- Douglas, G.W., D. Meidinger and J.L. Penny. 2002. *Rare Native Vascular Plants of British Columbia*. 2nd Edition. Province of British Columbia.
- Flora of North America Editorial Committee. 1993+. *Flora of North America North of Mexico*. 12+ vols. Oxford University Press. New York, NY. Website: <http://www.fna.org>. Accessed: April 2012.
- Government of Canada. 2015. *Species at Risk Public Registry*. Website: <http://www.sararegistry.gc.ca/>. Accessed: Month Year.
- Kershaw, L., J. Gould, D. Johnson and J. Lancaster. 2001. *Rare Vascular Plants of Alberta*. University of Alberta Press, Edmonton, Alberta. 484 pp.
- Klinkenberg, B., Ed. 2013. "E-Flora BC: *Electronic Atlas of the Flora of British Columbia*. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver, BC." Accessed February 11, 2016. <http://www.geog.ubc.ca/biodiversity/eflora/>.
- Moss, E.H. 1983. *Flora of Alberta*. Second Edition. Revised by J.G. Packer University of Toronto Press, Toronto, Ontario. 687 pp.
- NatureServe. 2015. *NatureServe Explorer - An Online Encyclopedia of Life*. Website: <http://www.natureserve.org/explorer/index.htm>. Accessed: Month Year.
- Porsild, A. and W. Cody. 1980. *Vascular Plants of Continental Northwest Territories, Canada*. National Museum of Natural Sciences, National Museum of Canada. Ottawa, Ontario. 667 pp.
- Williston, P. 2001. *The Botrychiaceae of Alberta*. Alberta Environment. Edmonton, Alberta. 57 pp.

Appendix 5.2-3
Potential Rare Ecological Communities
in the Rocky Mountain - Montane
Natural Subregion Crossed by the
Proposed Route

Table A5.2-3. Potential Rare Ecological Communities in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Names	Common Names	Provincial and Global Ranks ^a
Forest/Woodland		
<i>Abies bifolia</i> - <i>Pinus flexilis</i> - <i>Populus tremuloides</i> / <i>Thalictrum venulosum</i>	subalpine fir - limber pine - aspen/veiny meadow rue	S2?
<i>Betula papyrifera</i> / <i>Betula occidentalis</i> / <i>Arctostaphylos uva-ursi</i>	white birch/water birch/common bearberry	S1
<i>Larix occidentalis</i> / <i>Rubus parviflorus</i>	western larch/thimbleberry	S1
<i>Picea glauca</i> / <i>Betula pumila</i> - <i>Salix bebbiana</i> / <i>Carex eburnea</i>	white spruce/dwarf birch - beaked willow/bristle-leaved sedge	S1?
<i>Picea glauca</i> / <i>Abietinella abietina</i>	white spruce/fern moss	S2S3
<i>Picea glauca</i> / <i>Rosa acicularis</i> / <i>Abietinella abietina</i>	white spruce/prickly rose/fern moss	S1
<i>Picea glauca</i> / <i>Shepherdia canadensis</i> / <i>Abietinella abietina</i>	white spruce/Canada buffaloberry/fern moss	S2
<i>Pinus contorta</i> / <i>Cornus stolonifera</i> woodland	lodgepole pine/red-osier dogwood woodland	S2?, G2G3
<i>Pinus flexilis</i> - <i>Pseudotsuga menziesii</i> / <i>Juniperus</i> spp./ <i>Arctostaphylos uva-ursi</i>	limber pine - Douglas-fir/juniper species/common bearberry	S2
<i>Pinus flexilis</i> / <i>Arctostaphylos uva-ursi</i> - <i>Juniperus horizontalis</i>	limber pine/common bearberry - creeping juniper	S2
<i>Pinus flexilis</i> / <i>Arctostaphylos uva-ursi</i> woodland	limber pine/common bearberry woodland	S2, G4
<i>Pinus flexilis</i> / <i>Festuca campestris</i> woodland	limber pine/mountain rough fescue woodland	S1S2, G3
<i>Pinus flexilis</i> / <i>Juniperus communis</i> woodland	limber pine/common juniper woodland	S1S2, G5
<i>Pinus flexilis</i> scree woodland	limber pine scree woodland	S1S2, G3Q
<i>Populus angustifolia</i> / <i>Cornus stolonifera</i>	narrow-leaved cottonwood/red-osier dogwood	S2S3, G4
<i>Populus angustifolia</i> / <i>Symphoricarpos occidentalis</i>	narrow-leaf cottonwood/buckbrush	S2S3
<i>Populus balsamifera</i> - <i>P. tremuloides</i> / <i>Alopecurus alpinus</i> - <i>Calamagrostis canadensis</i>	balsam poplar - aspen/alpine foxtail - bluejoint	S1S2
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> - (<i>Populus tremuloides</i>)/ <i>Heracleum lanatum</i> forest	black cottonwood - (aspen)/cow parsnip forest	S2, G2
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> - <i>Picea engelmannii</i> / <i>Cornus stolonifera</i> forest	black cottonwood - Engelmann spruce/red-osier dogwood forest	S1S2, G2G3
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> - <i>Picea engelmannii</i> / <i>Equisetum arvense</i> forest	black cottonwood - Engelmann spruce/common horsetail forest	S1S2, G2?
<i>Populus balsamifera</i> ssp. <i>Trichocarpa</i> - conifer/ <i>Calamagrostis canadensis</i> forest	black cottonwood - conifer/bluejoint forest	S1S2, G2?
<i>Populus tremuloides</i> - <i>Abies bifolia</i> - <i>Picea engelmannii</i> / <i>Streptopus amplexifolius</i> forest	aspen - subalpine fir - Engelmann spruce/clasping-leaved twisted-stalk forest	S1S2, G2G3

Table A5.2-3. Potential Rare Ecological Communities in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Names	Common Names	Provincial and Global Ranks ^a
<i>Populus tremuloides/Leymus innovatus - Aster conspicuus</i> avalanche community	aspen/hairy wild rye - showy aster avalanche community	S2
<i>Populus tremuloides/Rubus parviflorus</i>	aspen/thimbleberry	S2
<i>Pseudotsuga menziesii/Angelica</i> spp. forest	Douglas-fir/angelica spp. forest	S1S2, G2?
<i>Pseudotsuga menziesii - Pinus flexilis/Juniperus communis/Festuca campestris</i>	Douglas-fir - limber pine/ground juniper/mountain rough fescue	S2
Shrubland		
<i>Amelanchier alnifolia/Pseudoroegneria spicata</i> shrubland	saskatoon/bluebunch wheat grass shrubland	S2S3, G3G4Q
<i>Betula occidentalis - Amelanchier alnifolia/Artemisia campestris - Elymus lanceolatus (Agropyron dasystachyum)</i>	water birch - saskatoon/plains wormwood - northern wheat grass	S1
<i>Betula occidentalis</i> montane shrubland	water birch montane shrubland	S1S2, G3G4
<i>Elaeagnus commutata</i> riparian shrubland	silverberry riparian shrubland	SU, G2Q
<i>Populus tremuloides - Amelanchier alnifolia</i> avalanche chute shrubland	aspen - saskatoon avalanche chute shrubland	S1S2, G3?
<i>Rhamnus alnifolia</i> shrubland	alder-leaved buckthorn shrubland	S1S2, G3
<i>Salix bebbiana/Cornus stolonifera</i>	beaked willow/red-osier dogwood	S3?
<i>Salix bebbiana/Rubus idaeus/Geranium richardsonii</i>	beaked willow/wild red raspberry/wild white geranium	S2
<i>Salix drummondiana/Calamagrostis canadensis</i> shrubland	Drummond's willow/bluejoint shrubland	S1, G3
Dwarf Shrubland		
<i>Arctostaphylos uva-ursi/Pseudoroegneria spicata</i> dwarf shrubland	common bearberry/bluebunch wheat grass dwarf shrubland	S2S3, G2G3
Shrub Herbaceous		
<i>Artemisia tridentata</i> ssp. <i>vaseyana - Amelanchier alnifolia</i>	big sagebrush - saskatoon slope community	S1
<i>Artemisia tridentata</i> ssp. <i>vaseyana - Rhamnus alnifolia</i>	big sagebrush - alder-leaved buckthorn	S1
Herbaceous		
<i>Danthonia parryi - Festuca idahoensis - Festuca campestris</i>	Parry oat grass - Idaho fescue - mountain rough fescue	SU
<i>Elymus lanceolatus - Antennaria parviflora</i>	northern wheat grass - small-leaved everlasting	S1
<i>Elymus lanceolatus - Artemisia dracuncululus - Artemisia frigida</i>	northern wheat grass - dragonwort - pasture sagewort	S1
<i>Elymus lanceolatus - Artemisia frigida</i>	northern wheat grass - pasture sagewort	S2S3

Table A5.2-3. Potential Rare Ecological Communities in the Rocky Mountain - Montane Natural Subregion Crossed by the Proposed Route

Scientific Names	Common Names	Provincial and Global Ranks ^a
<i>Elymus lanceolatus</i> - <i>Elymus trachycaulus</i>	northern wheat grass - slender wheat grass	S1
<i>Elymus lanceolatus</i> - <i>Stipa comata</i>	northern wheat grass - needle-and-thread	S2
<i>Elymus trachycaulus</i> - <i>Koeleria macrantha</i>	slender wheat grass - June grass	SU
<i>Festuca campestris</i> - <i>Pseudoroegneria spicata</i> grassland	mountain rough fescue - bluebunch wheat grass grassland	S1S2, G4
<i>Festuca idahoensis</i> - <i>Pseudoroegneria spicata</i> grassland	Idaho fescue - bluebunch wheat grass grassland	S1S2, G4
<i>Koeleria macrantha</i> - <i>Artemisia frigida</i> - <i>Linum lewisii</i>	June grass - pasture sagewort - wild blue flax	S2S3
<i>Pseudoroegneria spicata</i> - <i>Carex obtusata</i>	bluebunch wheat grass - blunt sedge	S1
<i>Pseudoroegneria spicata</i> grassland	bluebunch wheat grass grassland	S1
<i>Pseudoroegneria spicata</i> - <i>Leymus innovatus</i> - <i>Aster conspicuus</i>	bluebunch wheat grass - hairy wild rye - showy aster	S1
<i>Stipa columbiana</i> - <i>Lupinus sericeus</i> herbaceous vegetation	Columbia needle grass - silky perennial lupine herbaceous vegetation	S2S3, G2G3
<i>Stipa richardsonii</i> - <i>Koeleria macrantha</i> - <i>Antennaria parvifolia</i>	Richardson's needle grass - June grass - small-leaved everlasting	S2S3
<i>Xerophyllum tenax</i> herbaceous vegetation	bear-grass herbaceous vegetation	S1S2, GNR
Sparsely Vegetated		
<i>Pascopyrum smithii</i> - <i>Pyrocoma uniflora</i>	western wheat grass - one-flowered ironplant	S1
<i>Populus angustifolia</i> /recent alluvial	narrow-leaf cottonwood/recent alluvial	S2S3

Source: Allen 2014

Notes:

^a Provincial (S) and Global (G) ratings range from S1 (5 or fewer occurrences or very few remaining hectares) to S5 (demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery). Ranks may be combined (e.g., S1S2). This indicates a larger margin of error than ranks assigned a "?" qualifier. Ratings that are not of concern (4-5) are not included, unless they are part of a range rank (e.g., G3G4).

? = Element is not yet ranked (i.e., S?), or has an inexact numerical rank (e.g., S1?).

U = Unrankable: currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

Q = Denotes questionable taxonomy or classification of the type.

NR = Unranked: provincial conservation status not yet assessed.

(W) = on Watch list, not Tracking List.

References

Allen, L. 2014. *Alberta Conservation Information Management System Ecological Community Tracking List*. Alberta Tourism, Parks and Recreation, Edmonton, Alberta. Website: http://albertaparks.ca/media/3259838/tracked_watched_list_ecological_communities_full_report.pdf.

Appendix 5.2-4
Photoplates



Photo A5.2-4-1. View of brown stipple scale observed at 1-11-48-1 W6M on June 14, 2015.



Photo A5.2-4-2. View of chestnut pelt lichen habitat observed at NW 15-46-1 W6M on June 5, 2015.



Photo A5.2-4-3. View of Crawe's sedge observed at SW 33-46-1 W6M on August 9, 2015.



Photo A5.2-4-4. View of dwarf bulrush observed at SW 17-49-27 W5M on August 8, 2015.



Photo A5.2-4-5. View of dwarf notchwort habitat observed at NW 33-46-1 W6M on August 15, 2015.



Photo A5.2-4-6. View of false beard-moss habitat observed at 1-11-48-1 W6M on June 14, 2015.



Photo A5.2-4-7. View of fan ramalina habitat observed at 4-22-46-1 W6M on June 5, 2015.



Photo A5.2-4-8. View of fingered jelly lichen observed at 10-2-48-1 W6M on June 14, 2015.

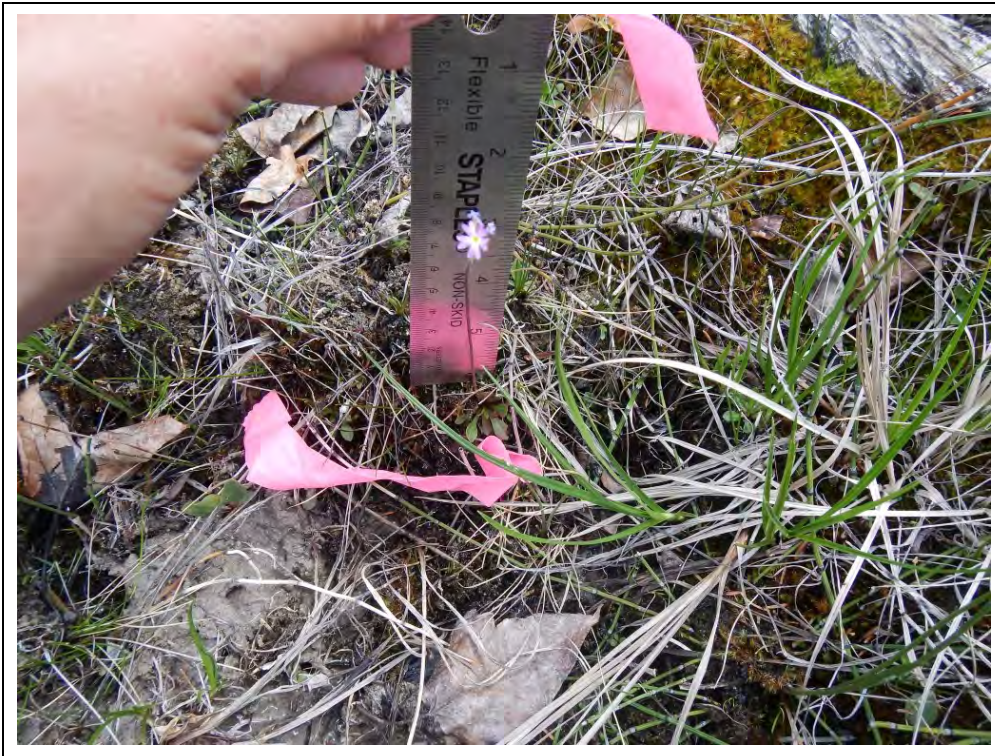


Photo A5.2-4-9. View of Greenland primrose observed at 3-33-46-1 W6M on June 8, 2015.



Photo A5.2-4-10. View of hairy shadow lichen observed at 9-7-47-1 W6M on June 6, 2015.



Photo A5.2-4-11. View of Hooker's cinquefoil observed at 1-22-48-28 W5M on June 14, 2015.



Photo A5.2-4-12. View of Johansen's didymodon moss observed at 15-9-49-27 W5M on June 13, 2015.



Photo A5.2-4-13. View of largeleaf fissidens moss observed at 3-21-47-1 W6M on June 9, 2015.



Photo A5.2-4-14. View of muffin pelt habitat observed at NW 2-46-1 W6M on June 5, 2015.



Photo A5.2-4-15. View of narrow mushroom-headed liverwort habitat observed at 10-28-46-1 W6M on June 10, 2015.



Photo A5.2-4-16. View of Placynthium lichen habitat observed at 1-24-48-1 W6M on June 14, 2015.



Photo A5.2-4-17. View of Porsild's braya observed at 14-33-46-1 W6M on June 7, 2015.



Photo A5.2-4-18. View of powder-tipped shadow lichen habitat observed at 16-7-47-1 W6M on June 6, 2015.



Photo A5.2-4-19. View of Ramalina lichen habitat observed at NW 15-46-1 W6M on June 5, 2015.



Photo A5.2-4-20. View of small greasewort habitat observed at 9-36-48-28 W5M on June 11, 2015.



Photo A5.2-4-21. View of smooth cliff brake observed at NW 27-47-1 W6M on August 11, 2015.



Photo A5.2-4-22. View of soil stars habitat observed at 11-33-46-1 W6M on June 7, 2015.



Photo A5.2-4-23. View of turgid scorpion moss habitat observed at 10-2-48-1 W6M on June 8, 2015.



Photo A5.2-4-24. View of wild comfrey observed at 9-14-49-27 W5M on June 12, 2015.



Photo A5.2-4-25. View of willow feather moss habitat observed at 10-28-46-1 W6M on June 10, 2015.



Photo A5.2-4-26. View of worm buttons habitat observed at 8-28-47-1 W6M on June 9, 2015.
















Photo A5.2-4-27. View of yellow sedge observed at SE 26-48-28 W5M on August 12, 2015.



Photo A5.2-4-28. Potential mountain pine beetle damage observed at NE 5-47-1 W6M on June 7, 2015.

Appendix 5.2-5
Weed Distribution and Density Classes

Table A5.2-5 Weed Distribution Classes

Class	Description of Abundance in Polygon	Distribution
0	None	
1	Rare	
2	A few sporadically occurring individual plants	
3	A single patch	
4	A single patch plus a few sporadically occurring plants	
5	Several sporadically occurring plants	
6	A single patch plus several sporadically occurring plants	
7	A few patches	
8	A few patches plus several sporadically occurring plants	
9	Several well-spaced patches	
10	Continuous uniform occurrences of well-spaced plants	
11	Continuous occurrence of plants with a few gaps in the distribution	
12	Continuous dense occurrence of plants	
13	Continuous occurrence of plants with a distinct linear edge in the polygon	

Source: Adams et al., 2009.

Appendix A5.2.5-2. Weed Density Codes

Density Code	Definition
1	< 1 plant/m ²
2	2-5 plants/m ²
3	6-10 plants/m ²
4	> 10 plants/m ²

Source: British Columbia Ministry of Forests, Lands and Natural Resources, 2016.

References

Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz, and A. Burkinshaw. 2009. *Rangeland Health Assessment for Grassland, Forest and Tame Pasture*. Revised April 2009. Pub. No. T/044. Alberta Sustainable Resource Development, Lands Division, Rangeland Management Branch. Edmonton, Alberta. 128 pp.

British Columbia Ministry of Forests, Lands and Natural Resources. 2016. *Invasive Alien Plant Program Site and Invasive Plant Survey Record*.

https://www.for.gov.bc.ca/hra/Publications/invasive_plants/Forms/FS1260.pdf. Accessed February 11, 2016.

Appendix 5.2-6
Observed Plant Species – By Type and
Common Name

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
Trees	
Alaska birch	<i>Betula neolaskana</i>
aspen	<i>Populus tremuloides</i>
balsam poplar	<i>Populus balsamifera</i>
black spruce	<i>Picea mariana</i>
Douglas-fir	<i>Pseudotsuga menziesii</i>
lodgepole pine	<i>Pinus contorta</i>
mountain maple	<i>Acer glabrum</i>
white birch	<i>Betula papyrifera</i>
white spruce	<i>Picea glauca</i>
Shrubs	
Athabasca willow	<i>Salix athabascensis</i>
Barclay's willow	<i>Salix barclayi</i>
beaked willow	<i>Salix bebbiana</i>
bog willow	<i>Salix pedicellaris</i>
bracted honeysuckle	<i>Lonicera involucrata</i>
bristly black currant	<i>Ribes lacustre</i>
buckbrush	<i>Symphoricarpos occidentalis</i>
Canada buffaloberry	<i>Shepherdia canadensis</i>
choke cherry	<i>Prunus virginiana</i>
common Labrador tea	<i>Rhododendron groenlandicum</i>
creeping juniper	<i>Juniperus horizontalis</i>
Drummond's willow	<i>Salix drummondiana</i>
dusky willow	<i>Salix melanopsis</i>
dwarf birch	<i>Betula pumila</i>
Farr's willow	<i>Salix farriae</i>
flat-leaved willow	<i>Salix planifolia</i>
green alder	<i>Alnus viridis</i>
ground juniper	<i>Juniperus communis</i>
hoary willow	<i>Salix candida</i>
low-bush cranberry	<i>Viburnum edule</i>
myrtle-leaved willow	<i>Salix myrtillifolia</i>
northern gooseberry	<i>Ribes oxycanthoides</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
pin cherry	<i>Prunus pensylvanica</i>
prickly rose	<i>Rosa acicularis</i>
red-osier dogwood	<i>Cornus stolonifera</i>
river alder	<i>Alnus incana</i> ssp. <i>tenuifolia</i>
narrow-leaf willow	<i>Salix exigua</i>
saskatoon	<i>Amelanchier alnifolia</i>
Scouler's willow	<i>Salix scouleriana</i>
shining willow	<i>Salix lucida</i>
shrubby cinquefoil	<i>Dasiphora fruticosa</i>
shrubby willow	<i>Salix arbusculoides</i>
silverberry	<i>Elaeagnus commutata</i>
smooth willow	<i>Salix glauca</i>
snowberry	<i>Symphoricarpos albus</i>
water birch	<i>Betula occidentalis</i>
white meadowsweet	<i>Spiraea betulifolia</i>
wild red raspberry	<i>Rubus idaeus</i>
Forbs, Dwarf Shrubs	
alpine aster	<i>Aster alpinus</i>
alpine bearberry	<i>Arctostaphylos rubra</i>
alpine bistort	<i>Bistorta viviparum</i>
alpine goldenrod	<i>Solidago multiradiata</i>
alpine hedsarum	<i>Hedysarum alpinum</i>
alpine milk vetch	<i>Astragalus alpinus</i>
alpine mouse-ear chickweed	<i>Cerastium beeringianum</i>
American brooklime	<i>Veronica americana</i>
American milk vetch	<i>Astragalus americanus</i>
Arctic aster	<i>Eurybia sibirica</i>
ascending purple milk vetch	<i>Astragalus laxmannii</i> var. <i>robustior</i>
biennial sagewort	<i>Artemisia biennis</i>
bishop's-cap	<i>Mitella nuda</i>
blue columbine	<i>Aquilegia brevistyla</i>
blunt-fruited sweet cicely	<i>Osmorhiza berteroi</i>
blunt-leaved bog orchid	<i>Platanthera obtusata</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
blunt-leaved sandwort	<i>Moehringia lateriflora</i>
Bodin's milk vetch	<i>Astragalus bodinii</i>
bracted bog orchid	<i>Coeloglossum viride</i>
broad-leaved fireweed	<i>Chamerion latifolium</i>
broad-leaved water-plantain	<i>Alisma triviale</i>
buck-bean	<i>Menyanthes trifoliata</i>
bunchberry	<i>Cornus canadensis</i>
Canada anemone	<i>Anemone canadensis</i>
Canada goldenrod	<i>Solidago canadensis</i>
chamaerhodos	<i>Chamaerhodos erecta</i>
club willowherb	<i>Epilobium clavatum</i>
common bearberry	<i>Arctostaphylos uva-ursi</i>
common bladderwort	<i>Utricularia vulgaris</i>
common blueberry	<i>Vaccinium myrtilloides</i>
common blue-eyed grass	<i>Sisyrinchium montanum</i>
common butterwort	<i>Pinguicula vulgaris</i>
common comandra	<i>Comandra umbellata</i>
common fireweed	<i>Chamerion angustifolium</i>
common horsetail	<i>Equisetum arvense</i>
common mare's-tail	<i>Hippuris vulgaris</i>
common pepper-grass	<i>Lepidium densiflorum</i>
common pink wintergreen	<i>Pyrola asarifolia</i>
common red paintbrush	<i>Castilleja miniata</i>
common scouring-rush	<i>Equisetum hyemale</i>
common yarrow	<i>Achillea millefolium</i>
compound-leaved fleabane	<i>Erigeron compositus</i>
cow parsnip	<i>Heracleum maximum</i>
cream-colored vetchling	<i>Lathyrus ochroleucus</i>
cut-leaved anemone	<i>Anemone multifida</i>
dewberry	<i>Rubus pubescens</i>
dwarf Canadian primrose	<i>Primula mistassinica</i>
dwarf false asphodel	<i>Tofieldia pusilla</i>
dwarf mistletoe	<i>Arceuthobium americanum</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
dwarf raspberry	<i>Rubus arcticus</i>
dwarf scouring-rush	<i>Equisetum scirpoides</i>
early blue violet	<i>Viola adunca</i>
early yellow locoweed	<i>Oxytropis sericea</i>
elegant hawkbeard	<i>Askellia elegans</i>
elegant milk-vetch	<i>Astragalus eucosmus</i>
elephant's-head	<i>Pedicularis groenlandica</i>
evergreen violet	<i>Viola orbiculata</i>
fairybells	<i>Prosartes trachycarpum</i>
felwort	<i>Gentianella amarella</i>
few-flowered ragwort	<i>Packera pauciflorus</i>
field mouse-ear chickweed	<i>Cerastium arvense</i>
fleshy stitchwort	<i>Stellaria crassifolia</i>
floating-leaf pondweed	<i>Potamogeton natans</i>
fragile bladder fern	<i>Cystopteris fragilis</i>
gaillardia	<i>Gaillardia aristata</i>
golden aster	<i>Heterotheca villosa</i>
graceful cinquefoil	<i>Potentilla gracilis</i>
greenish-flowered wintergreen	<i>Pyrola chlorantha</i>
Greenland primrose	<i>Primula egaliksensis</i>
harebell	<i>Campanula rotundifolia</i>
heal-all	<i>Prunella vulgaris</i>
heart-leaved Alexanders	<i>Zizia aptera</i>
heart-leaved arnica	<i>Arnica cordifolia</i>
hooded ladies'-tresses	<i>Spiranthes romanzoffiana</i>
Hooker's cinquefoil	<i>Potentilla hookeriana</i>
hornwort	<i>Ceratophyllum demersum</i>
Indian milk vetch	<i>Astragalus aboriginum</i>
Kalm's lobelia	<i>Lobelia kalmii</i>
lance-leaved paintbrush	<i>Castilleja occidentalis</i>
large-leaved white water-crowfoot	<i>Ranunculus aquatilis</i>
large-leaved yellow avens	<i>Geum macrophyllum</i>
late yellow locoweed	<i>Oxytropis monticola</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
lesser rattlesnake plantain	<i>Goodyera repens</i>
Lindley's aster	<i>Symphyotrichum ciliolatus</i>
littleleaf pussytoes	<i>Antennaria microphylla</i>
long-leaved chickweed	<i>Stellaria longifolia</i>
low braya	<i>Braya humilis</i>
low goldenrod	<i>Solidago missouriensis</i>
lyre-leaved rock cress	<i>Arabidopsis lyrata</i>
Macoun's gentian	<i>Gentianopsis macounii</i>
many-flowered yarrow	<i>Achillea alpina</i>
marsh aster	<i>Symphyotrichum borealis</i>
marsh violet	<i>Viola palustris</i>
marsh yellow cress	<i>Rorippa palustris</i>
meadow horsetail	<i>Equisetum pratense</i>
mealy primrose	<i>Primula incana</i>
moonwort	<i>Botrychium lunaria</i>
narrow-leaved bur-reed	<i>Sparganium angustifolium</i>
narrow-leaved collomia	<i>Collomia linearis</i>
narrow-leaved hawkweed	<i>Hieracium umbellatum</i>
narrow-leaved puccoon	<i>Lithospermum incisum</i>
narrow-leaved willowherb	<i>Epilobium leptophyllum</i>
nodding onion	<i>Allium cernuum</i>
northern bastard toadflax	<i>Geocaulon lividum</i>
northern bedstraw	<i>Galium boreale</i>
northern fairy candelabra	<i>Androsace septentrionalis</i>
northern grass-of-parnassus	<i>Parnassia palustris</i>
northern green bog orchid	<i>Platanthera huronensis</i>
northern hedysarum	<i>Hedysarum boreale</i>
northern ragwort	<i>Packera streptanthifolius</i>
northern starflower	<i>Trientalis borealis</i>
northern stitchwort	<i>Stellaria calycantha</i>
northern white mountain avens	<i>Dryas integrifolia</i>
northern willowherb	<i>Epilobium ciliatum</i>
one-flowered wintergreen	<i>Moneses uniflora</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
one-sided wintergreen	<i>Orthilia secunda</i>
owl-clover	<i>Orthocarpus luteus</i>
pale coralroot	<i>Corallorhiza trifida</i>
palmate-leaved coltsfoot	<i>Petasites frigidus</i> var. <i>palmatus</i>
pasture sagewort	<i>Artemisia frigida</i>
plains cinquefoil	<i>Potentilla bipinnatifida</i>
plains wormwood	<i>Artemisia campestris</i>
Porsild's braya	<i>Braya humilis</i> ssp. <i>porsildii</i>
prairie cinquefoil	<i>Potentilla pensylvanica</i>
prairie crocus	<i>Anemone patens</i>
prairie sagewort	<i>Artemisia ludoviciana</i>
purple clematis	<i>Clematis occidentalis</i>
purple milk vetch	<i>Astragalus agrestis</i>
red and white baneberry	<i>Actaea rubra</i>
red-seeded sandwort	<i>Minuartia rubella</i>
reflexed locoweed	<i>Oxytropis deflexa</i>
reflexed rockcress	<i>Boechera retrofracta</i>
rosy everlasting	<i>Antennaria rosea</i>
round-leaved bog orchid	<i>Platanthera orbiculata</i>
round-leaved orchid	<i>Galearis rotundifolia</i>
saline shooting star	<i>Dodecatheon pulchellum</i>
scapose hawk's-beard	<i>Crepis runcinata</i>
seaside arrow-grass	<i>Triglochin maritima</i>
showy aster	<i>Eurybia conspicua</i>
showy everlasting	<i>Antennaria pulcherrima</i>
showy goldenrod	<i>Solidago nemoralis</i>
showy locoweed	<i>Oxytropis splendens</i>
silverweed	<i>Potentilla anserina</i>
Sitka columbine	<i>Aquilegia formosa</i>
slender arrow-grass	<i>Triglochin palustris</i>
small bladderwort	<i>Utricularia minor</i>
small bur-reed	<i>Sparganium natans</i>
small northern grass-of-parnassus	<i>Parnassia parviflora</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
small wood anemone	<i>Anemone parviflora</i>
small-flowered rocket	<i>Erysimum inconspicuum</i>
small-leaf pondweed	<i>Potamogeton pusillus</i>
small-leaved everlasting	<i>Antennaria parvifolia</i>
smooth aster	<i>Symphotrichum laevis</i>
smooth cliff brake	<i>Pellaea glabella</i>
smooth fleabane	<i>Erigeron glabellus</i>
snakeroot	<i>Sanicula marilandica</i>
sparrow's-egg lady's-slipper	<i>Cypripedium passerinum</i>
spiny-edged little club-moss	<i>Selaginella selaginoides</i>
spreading dogbane	<i>Apocynum androsaemifolium</i>
spreading sweet cicely	<i>Osmorhiza depauperata</i>
spurred gentian	<i>Halenia deflexa</i>
star-flowered Solomon's-seal	<i>Maianthemum stellata</i>
sticky false asphodel	<i>Triantha glutinosa</i>
sticky goldenrod	<i>Solidago simplex</i>
stiff goldenrod	<i>Solidago rigida</i>
striped coralroot	<i>Corallorhiza striata</i>
swamp horsetail	<i>Equisetum fluviatile</i>
sweet-flowered androsace	<i>Androsace chamaejasme</i>
sweet-scented bedstraw	<i>Galium triflorum</i>
tall larkspur	<i>Delphinium glaucum</i>
tall lungwort	<i>Mertensia paniculata</i>
tall white bog orchid	<i>Platanthera dilatata</i>
thread-leaved pondweed	<i>Stuckenia filiformis</i>
three-flowered avens	<i>Geum triflorum</i>
three-leaved Solomon's-seal	<i>Maianthemum trifolia</i>
three-toothed saxifrage	<i>Saxifraga tricuspidata</i>
tufted loosestrife	<i>Lysimachia thyrsoiflora</i>
twinflower	<i>Linnaea borealis</i>
twining honeysuckle	<i>Lonicera dioica</i>
two-grooved milk vetch	<i>Astragalus bisulcatus</i>
variegated horsetail	<i>Equisetum variegatum</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
veiny meadow rue	<i>Thalictrum venulosum</i>
Virginia grape fern	<i>Botrychium virginianum</i>
wandering daisy	<i>Erigeron peregrinus</i>
water parsnip	<i>Sium suave</i>
water smartweed	<i>Persicaria amphibium</i>
western Canada violet	<i>Viola canadensis</i>
western dock	<i>Rumex occidentalis</i>
western fairy candelabra	<i>Androsace occidentalis</i>
western wood lily	<i>Lilium philadelphicum</i>
white camas	<i>Zigadenus elegans</i>
wild blue flax	<i>Linum lewisii</i>
wild comfrey	<i>Cynoglossum virginianum</i>
wild licorice	<i>Glycyrrhiza lepidota</i>
wild lily-of-the-valley	<i>Maianthemum canadense</i>
wild mint	<i>Mentha arvensis</i>
wild sarsaparilla	<i>Aralia nudicaulis</i>
wild strawberry	<i>Fragaria virginiana</i>
wild vetch	<i>Vicia americana</i>
woodland strawberry	<i>Fragaria vesca</i>
woolly cinquefoil	<i>Potentilla hippiana</i>
wormseed mustard	<i>Erysimum cheiranthoides</i>
yellow false dandelion	<i>Agoseris glauca</i>
yellow lady's-slipper	<i>Cypripedium parviflorum</i>
yellow mountain avens	<i>Dryas drummondii</i>
yellow mountain saxifrage	<i>Saxifraga aizoides</i>
yellow prairie violet	<i>Viola nuttallii</i>
yellow water crowfoot	<i>Ranunculus gmelinii</i>
yellow wood violet	<i>Viola glabella</i>
Grasses, Sedges, Rushes	
alpine bluegrass	<i>Poa alpina</i>
alpine rush	<i>Juncus alpinoarticulatus</i>
Arctic bluegrass	<i>Poa arctica</i>
beautiful sedge	<i>Carex concinna</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
Bebb's sedge	<i>Carex bebbii</i>
bluebunch fescue	<i>Festuca idahoensis</i>
bluejoint	<i>Calamagrostis canadensis</i>
bristle-leaved sedge	<i>Carex eburnea</i>
bristle-stalked sedge	<i>Carex leptalea</i>
brown sedge	<i>Carex buxbaumii</i>
California oat grass	<i>Danthonia californica</i>
Canada wild rye	<i>Elymus canadensis</i>
common cattail	<i>Typha latifolia</i>
common great bulrush	<i>Schoenoplectus tabernaemontani</i>
common tall manna grass	<i>Glyceria grandis</i>
Crawe's sedge	<i>Carex crawei</i>
creeping spike-rush	<i>Eleocharis palustris</i>
drooping wood-reed	<i>Cinna latifolia</i>
dwarf bulrush	<i>Trichophorum pumilum</i>
elk sedge	<i>Carex garberi</i>
fowl bluegrass	<i>Poa palustris</i>
fowl manna grass	<i>Glyceria striata</i>
foxtail barley	<i>Hordeum jubatum</i>
fringed brome	<i>Bromus ciliatus</i>
golden sedge	<i>Carex aurea</i>
great bulrush	<i>Schoenoplectus acutus</i>
green needle grass	<i>Nassella viridula</i>
green sedge	<i>Carex viridula</i>
hair-like sedge	<i>Carex capillaris</i>
hairy wild rye	<i>Leymus innovatus</i>
Indian rice grass	<i>Achnatherum hymenoides</i>
inland bluegrass	<i>Poa interior</i>
inland sedge	<i>Carex interior</i>
June grass	<i>Koeleria macrantha</i>
Kentucky bluegrass	<i>Poa pratensis</i>
knotted rush	<i>Juncus nodosus</i>
long-styled rush	<i>Juncus longistylis</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
low sedge	<i>Carex duriuscula</i>
mountain timothy	<i>Phleum commutatum</i>
mud sedge	<i>Carex limosa</i>
narrow reed grass	<i>Calamagrostis stricta</i>
needle spike-rush	<i>Eleocharis acicularis</i>
northern bog sedge	<i>Carex gynocrates</i>
northern reed grass	<i>Calamagrostis stricta</i> ssp. <i>inexpansa</i>
northern wheatgrass	<i>Elymus lanceolatus</i>
one-spike cotton grass	<i>Eriophorum scheuchzeri</i>
Pumpelly brome	<i>Bromus pumpellianus</i>
purple oat grass	<i>Schizachne purpurascens</i>
purple reed grass	<i>Calamagrostis purpurascens</i>
red fescue	<i>Festuca rubra</i>
reed canary grass	<i>Phalaris arundinacea</i>
Richardson needle grass	<i>Achnatherum richardsonii</i>
Richardson's sedge	<i>Carex richardsonii</i>
Rocky Mountain fescue	<i>Festuca saximontana</i>
rocky-ground sedge	<i>Carex saxatilis</i>
Ross' sedge	<i>Carex rossii</i>
rough cinquefoil	<i>Potentilla norvegica</i>
rush-like sedge	<i>Carex scirpoidea</i>
russett cotton grass	<i>Eriophorum chamissonis</i>
scabrous black sedge	<i>Carex atratiformis</i> ssp. <i>raymondii</i>
sheathed sedge	<i>Carex vaginata</i>
short-awned sedge	<i>Carex microglochin</i>
showy sedge	<i>Carex spectabilis</i>
simple bog-sedge	<i>Kobresia simpliciuscula</i>
slender rush	<i>Juncus tenuis</i>
slender wheatgrass	<i>Elymus trachycaulus</i>
slender wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>
small bottle sedge	<i>Carex utriculata</i>
small-fruited bulrush	<i>Scirpus microcarpus</i>
smooth wild rye	<i>Elymus glaucus</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
spike trisetum	<i>Trisetum spicatum</i>
sun-loving sedge	<i>Carex inops</i>
sweet grass	<i>Anthoxanthum hirtum</i>
thin-leaved cotton grass	<i>Eriophorum viridi-carinatum</i>
thread-leaved sedge	<i>Carex filifolia</i>
toad rush	<i>Juncus bufonius</i>
tufted bulrush	<i>Trichophorum cespitosus</i>
tufted hair grass	<i>Deschampsia cespitosa</i>
two-seeded sedge	<i>Carex disperma</i>
two-stamened sedge	<i>Carex diandra</i>
water sedge	<i>Carex aquatilis</i>
western wheatgrass	<i>Pascopyrum smithii</i>
white-grained mountain rice grass	<i>Oryzopsis asperifolia</i>
wire rush	<i>Juncus balticus</i>
yellow sedge	<i>Carex flava</i>
<i>Mosses, Liverworts, and Lichens</i>	
Acarospora lichen	<i>Acarospora moenium</i>
abraded camouflage lichen	<i>Melanelixia subaurifera</i>
altai blister lichen	<i>Toninia tristis</i> ssp. <i>asiae-centralis</i>
Austria <i>Timmia</i> moss	<i>Timmia austriaca</i>
bare-bottomed sunburst lichen	<i>Xanthomendoza fulva</i>
bearded jellyskin lichen	<i>Leptogium saturninum</i>
bent beak tufa moss	<i>Hymenostylium recurvirostrum</i>
Bering dot lichen	<i>Mycobilimbia berengeriana</i>
bighorn cladonia lichen	<i>Cladonia cornuta</i>
field dog lichen	<i>Peltigera rufescens</i>
blackberry scale	<i>Psora globifera</i>
blistered rock tripe lichen	<i>Umbilicaria hyperborea</i>
blunt extinguisher moss	<i>Encalypta procera</i>
blunt-leaved bristle moss	<i>Orthotrichum obtusifolium</i>
blunt pincerwort	<i>Cephalozia pleniceps</i>
blushing scale	<i>Psora decipiens</i>
<i>Brachythecium</i> moss species	<i>Brachythecium</i> sp.

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
<i>Brachythecium</i> moss	<i>Brachythecium turgidum</i>
broom moss	<i>Dicranum scoparium</i>
brown stipple-scale lichen	<i>Placidium lacinulatum</i>
<i>Bryum</i> moss	<i>Bryum lisae</i> var. <i>cuspidatum</i>
<i>Bryum</i> moss species	<i>Bryum</i> sp.
camouflage lichen	<i>Melanohalea subelegantula</i>
<i>Campylium</i> moss	<i>Campylium hispidulum</i>
candy lichen	<i>Immadophila ericetorum</i>
carpet pixie-cup	<i>Cladonia pocillum</i>
<i>Catoscopium</i> moss	<i>Catoscopium nigrum</i>
chestnut pelt lichen	<i>Peltigera castanea</i>
<i>Collema</i> lichen	<i>Collema substellata</i>
common beard moss	<i>Schistidium apocarpum</i>
common foam lichen	<i>Stereocaulon paschale</i>
common green <i>Bryum</i> moss	<i>Bryum pseudotriquetrum</i>
common powderhorn lichen	<i>Cladonia coniocraea</i>
concentric pelt lichen	<i>Peltigera elisabethae</i>
copper wire moss	<i>Pohlia nutans</i>
<i>Cratoneuron</i> moss	<i>Cratoneuron filicinum</i>
crescent frost lichen	<i>Physconia perisidiosa</i>
crinkled snow lichen	<i>Flavocetraria nivalis</i>
cryptic rosette lichen	<i>Physciella chloantha</i>
curled snow lichen	<i>Flavocetraria cucullata</i>
dark shadow lichen	<i>Phaeophyscia sciastra</i>
detritus rim lichen	<i>Lecanora zosteriae</i>
dimpled jellyskin lichen	<i>Leptogium pseudofurfuraceum</i>
dog lichen	<i>Peltigera canina</i>
dwarf notchwort	<i>Lophozia badensis</i>
earth-scale lichen	<i>Catapyrenium cinereum</i>
earth wrinkles, blue blister lichen	<i>Toninia sedifolia</i>
elegant beaked moss	<i>Eurhynchium pulchellum</i>
elegant sunburst lichen	<i>Xanthoria elegans</i>
<i>Encalypta</i> moss species	<i>Encalypta</i> sp.

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
erect-fruited iris moss	<i>Distichium capillaceum</i>
fallacious screw moss	<i>Didymodon fallax</i>
fan ramalina	<i>Ramalina sinensis</i>
felt <i>Cladonia</i> lichen	<i>Cladonia phyllophora</i>
fingered jelly lichen	<i>Collema cristatum</i>
<i>Fissidens</i> moss	<i>Fissidens crispus</i>
fringed chocolate chip lichen	<i>Solorina spongiosa</i>
fuscous moss	<i>Dicranum fuscescens</i>
fragile screw moss	<i>Tortella fragilis</i>
giant <i>Calliergon</i> moss	<i>Calliergon giganteum</i>
golden moss	<i>Tomentypnum nitens</i>
goldenleaf <i>Campylium</i> moss	<i>Campylium chrysophyllum</i>
green rock-posy	<i>Rhizoplaca melanophthalma</i>
green-tongue liverwort	<i>Marchantia polymorpha</i>
ground frost lichen	<i>Physconia muscigena</i>
hairy screw moss	<i>Syntrichia ruralis</i>
hairy shadow lichen	<i>Phaeophyscia hirsuta</i>
hairy threadwort	<i>Blepharostoma trichophyllum</i>
<i>Hamatocaulis</i> moss	<i>Hamatocaulis vernicosus</i>
hammered shield lichen	<i>Parmelia sulcata</i>
hoary rosette lichen	<i>Physcia aipolia</i>
hooded rosette lichen	<i>Physcia adscendens</i>
hooded tube lichen	<i>Hypogymnia physodes</i>
hooked-leaved fern moss	<i>Thuidium recognitum</i>
<i>Hypogymnia</i> lichen	<i>Hypogymnia dichroma</i>
<i>Hygrohypnum</i> moss	<i>Hygrohypnum luridum</i>
<i>Hypnum</i> moss	<i>Hypnum vaucheri</i>
Iceland lichen	<i>Cetraria ericetorum</i>
inclined-fruited didymodon	<i>Distichium inclinatum</i>
Johansen's didymodon moss	<i>Didymodon johansenii</i>
Knieff's hook moss	<i>Drepanocladus aduncus</i>
knight's plume moss	<i>Ptilium crista-castrensis</i>
largeleaf fissidens moss	<i>Fissidens grandifrons</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
leather lichen	<i>Dermatocarpon miniatum</i>
<i>Lecidea</i> lichen	<i>Lecidea beringeriana</i>
<i>Leptobryum</i> moss	<i>Leptobryum pyriforme</i>
<i>Leptogium</i> lichen	<i>Leptogium pulvinatum</i>
<i>Limprichtia</i> moss	<i>Limprichtia revolvens</i>
Lindberg's <i>Hypnum</i> moss	<i>Hypnum lindbergii</i>
lustrous camouflage lichen	<i>Melanohalea exasperatula</i>
maidenhair moss	<i>Fissidens adianthoides</i>
many-flowered <i>Pylaisia</i> moss	<i>Pylaisiella polyantha</i>
mealy shadow lichen	<i>Phaeophyscia orbicularis</i>
<i>Meesia</i> moss	<i>Meesia triquetra</i>
mountain scale	<i>Psora himalayana</i>
mossbane rim-lichen	<i>Lecanora epibryon</i>
muffin pelt	<i>Peltigera conspersa</i>
narrow mushroom-headed liverwort	<i>Preissia quadrata</i>
naugehyde liverwort	<i>Ptilidium pulcherrimum</i>
opal nodding moss	<i>Pohlia cruda</i>
orange rock-posy	<i>Rhizoplaca chrysoleuca</i>
<i>Orthotrichum</i> moss	<i>Orthotrichum pellucidum</i>
<i>Orthotrichum</i> moss species	<i>Orthotrichum</i> sp.
pale-bellied dog-lichen	<i>Peltigera ponojensis</i>
pale-footed horsehair lichen	<i>Bryoria fuscescens</i>
pebbled pixie-cup	<i>Cladonia pyxidata</i>
<i>Pellia</i> liverwort species	<i>Pellia</i> sp.
pellucid fork moss	<i>Dichodontium pellucidum</i>
pepper-spore lichen	<i>Rinodina roscida</i>
<i>Philonotis</i> moss	<i>Philonotis fontana</i>
pipecleaner moss	<i>Rhytidium rugosum</i>
<i>Placidium</i> lichen	<i>Placidium squamulosum</i>
<i>Placynthium</i> lichen	<i>Placynthium pulvinatum</i>
<i>Plagiomnium</i> moss	<i>Plagiomnium ellipticum</i>
<i>Platydictya</i> moss	<i>Platydictya jungermannioides</i>
powder-tipped shadow lichen	<i>Phaeophyscia adiaetola</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
powdered beard lichen	<i>Usnea lapponica</i>
powdered tube lichen	<i>Hypogymnia bitteri</i>
purple horn-toothed moss	<i>Ceratodon purpureus</i>
<i>Ramalina</i> lichen	<i>Ramalina</i> sp 1 sensu Goward 1999
red leaf moss	<i>Bryoerythrophyllum recurvirostre</i>
red-stemmed pipecleaner moss	<i>Rhytidiadelphus triquetrus</i>
reindeer lichen	<i>Cladonia mitis</i>
revolute <i>Hypnum</i> moss	<i>Hypnum revolutum</i>
<i>Rhizomnium</i> moss	<i>Rhizomnium gracile</i>
ring <i>Pellia</i>	<i>Pellia neesiana</i>
<i>Sanionia</i> moss	<i>Sanionia uncinata</i>
scaly pelt lichen	<i>Peltigera praetextata</i>
<i>Schistidium</i> species	<i>Schistidium</i> sp.
Schreber's moss	<i>Pleurozium schreberi</i>
<i>Scorpidium</i> moss	<i>Scorpidium scorpioides</i>
shaded cladonia lichen	<i>Cladonia umbricola</i>
sharp twisted moss	<i>Tortula mucronifolia</i>
showy bristle moss	<i>Orthotrichum speciosum</i>
sieve lichen	<i>Cladonia multiformis</i>
silvery <i>Bryum</i> moss	<i>Bryum argenteum</i>
slender-stemmed hair moss	<i>Ditrichum flexicaule</i>
small greasewort	<i>Aneura pinguis</i>
small mousetail moss	<i>Myurella julacea</i>
smooth cladonia lichen	<i>Cladonia gracilis</i> ssp. <i>turbinata</i>
smooth shadow lichen	<i>Phaeophyscia ciliata</i>
Solorinella lichen	<i>Solorinella asteriscus</i>
spiny shield lichen	<i>Cetraria aculeata</i>
split-peg lichen	<i>Cladonia symphycarpa</i>
split-peg lichen	<i>Cladonia cariosa</i>
stair-step moss	<i>Hylocomium splendens</i>
star rosette lichen	<i>Physcia stellaris</i>
striate-fruited extinguisher moss	<i>Encalypta rhaptocarpa</i>
studded leather lichen	<i>Peltigera aphthosa</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
tar-jelly	<i>Collema tenax</i>
toothed <i>Plagiomnium</i> moss	<i>Plagiomnium cuspidatum</i>
toothless grimmia	<i>Grimmia anodon</i>
tree-hair lichen	<i>Bryoria fremontii</i>
tree jelly lichen	<i>Collema subflaccidum</i>
trumpet lichen	<i>Cladonia fimbriata</i>
tufted moss	<i>Aulacomnium palustre</i>
tumid notchwort	<i>Lophozia ventricosa</i>
tundra sulphur lichen	<i>Fulgensia bracteata</i>
turgid scorpion moss	<i>Pseudocalliergon turgescens</i>
twisted moss	<i>Tortella tortuosa</i>
waterside feather moss	<i>Brachythecium rivulare</i>
waxyleaf moss	<i>Dicranum polysetum</i>
white-rim lichen	<i>Squamarina lentigera</i>
willow feather moss	<i>Amblystegium varium</i>
wiry fern moss	<i>Abietinella abietina</i>
wolf lichen	<i>Letharia vulpina</i>
wooden soldiers	<i>Cladonia botrytes</i>
worm buttons	<i>Buellia elegans</i>
wrinkle lichen	<i>Vulpicida pinastri</i>
yellow starry fen moss	<i>Campylium stellatum</i>
yellowhorn pixie lichen	<i>Cladonia bacilliformis</i>
Weeds, Agronomics	
absinthe wormwood	<i>Artemisia absinthium</i>
alfalfa	<i>Medicago sativa</i>
alsike clover	<i>Trifolium hybridum</i>
annual bluegrass	<i>Poa annua</i>
annual hawk's-beard	<i>Crepis tectorum</i>
bird's-foot trefoil	<i>Lotus corniculatus</i>
black medick	<i>Medicago lupulina</i>
bluebur	<i>Lappula squarrosa</i>
Canada thistle (creeping thistle)	<i>Cirsium arvense</i>
caraway	<i>Carum carvi</i>

Table A5.2-6. Observed Plant Species – By Type and Common Name

Common Name	Scientific Name
cicer milk vetch	<i>Astragalus cicer</i>
common dandelion	<i>Taraxacum officinale</i>
common goat's-beard	<i>Tragopogon dubius</i>
common plantain	<i>Plantago major</i>
Dalmatian toad-flax	<i>Linaria dalmatica</i>
dog mustard	<i>Erucastrum gallicum</i>
flixweed	<i>Descurainia sophia</i>
hemp-nettle	<i>Galeopsis tetrahit</i>
ox-eye daisy	<i>Leucanthemum vulgare</i>
perennial sow-thistle	<i>Sonchus arvensis</i>
quackgrass	<i>Elymus repens</i>
red clover	<i>Trifolium pratense</i>
redtop	<i>Agrostis stolonifera</i>
Russian-thistle	<i>Salsola kali</i>
sheep fescue	<i>Festuca ovina</i>
shepherd's-purse	<i>Capsella bursa-pastoris</i>
smooth brome	<i>Bromus inermis ssp. inermis</i>
sweet clover species	<i>Melilotus sp.</i>
spotted knapweed	<i>Centaurea stoebe ssp. micranthos</i>
tall buttercup	<i>Ranunculus acris</i>
tall hawkweed	<i>Pilosella piloselloides</i>
tall hedge mustard	<i>Sisymbrium loeselii</i>
timothy	<i>Phleum pratense</i>
tufted vetch	<i>Vicia cracca</i>
white clover	<i>Trifolium repens</i>
white sweet-clover	<i>Melilotus alba</i>
wild buckwheat	<i>Fallopia convolvulus</i>
yellow toadflax (common toadflax)	<i>Linaria vulgaris</i>

Notes:

Bold font denotes Noxious weed species.

Where the Alberta Weed Control Regulation name for a species differs from the ACIMS list of all elements (AEP, 2015b), the ACIMS name has been provided in brackets alongside the *Weed Control Regulation* name.

The status of species as native or not is according to the list of all elements in Alberta (AEP, 2016b, 2016c).

Appendix 5.5-1
Wildlife Species at Risk

A list of wildlife species at risk that have the potential to interact with the Project is provided below in Table A5.5-1A. Refer to Section 5.5.1.2 of the DIA for details related to the methodology used to produce the table.

Table A5.5-1A. Wildlife Species at Risk with Potential to Interact with the Project

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
MAMMALS				
Moose	<i>Alces alces</i>	Muskegs, brushy meadows, small groves of aspen or coniferous trees, particularly where such habitat adjoins lakes, ponds, or streams.	—	Protected Species, Part 2 ^d
Gray wolf	<i>Canus lupus</i>	Current habitat is restricted to forested areas.	—	Protected Species, Part 2 ^d
Wapiti (elk)	<i>Cervus elaphus</i>	Areas of woodland mixed with open grassland at forest edges and in mountain meadows.	—	Protected Species, Part 2 ^d
Big brown bat	<i>Eptesicus fuscus</i>	Forests, parks, farms, old buildings; summer roosts in tree crevices, under loose bark or in old buildings; nursery colonies in protected areas such as tree crevices or old buildings; hibernates in caves, mines, or old buildings.	S4S5 (T.h) ^a	—
Wolverine	<i>Gulo gulo</i>	Boreal forests, tundra, subalpine areas.	S3 (T) ^a May Be At Risk ^c	Special Concern ^e
Sagebrush vole	<i>Lagurus curtatus</i>	Confined to those areas of the grassland where sagebrush is common.	S3 (T) ^a	—
Silver-haired bat	<i>Lasionycteris noctivagans</i>	Roosts in the cavities of old, decaying trees, including woodpecker holes and behind loose bark. Forages in openings.	S3 (T.h) ^a Sensitive ^c	—
Canada lynx	<i>Lynx canadensis</i>	Coniferous and mixed forests.	S4 (W) ^a Sensitive ^c	—
Water vole	<i>Microtus richardsoni</i>	Alpine meadows in the vicinity of swift, clear streams.	S3 (T) ^a Sensitive ^c	—
Long-eared myotis	<i>Myotis evotis</i>	River valleys and coulees.	S3S4 (W) ^a	—
Little brown myotis	<i>Myotis lucifugus</i>	Roosts in buildings, large decaying trees, and rock crevices/caves. Forages in a variety of habitats, especially wetlands.	S5 (T.h) ^a	Endangered ^{e,f}
Northern myotis	<i>Myotis septentrionalis</i>	Mature or old-growth deciduous/coniferous forest	S2S3 (T.h) ^a May Be At Risk ^c	Endangered ^{e,f}

Table A5.5-1A. Wildlife Species at Risk with Potential to Interact with the Project

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
Long-legged myotis	<i>Myotis volans</i>	Rocky outcrops and caves.	SU (T.h) ^a	—
Mule deer	<i>Odocoileus hemionus</i>	Edges of coniferous forests, hilly areas, and mixed-wood forests	—	Protected Species, Part 2 ^d
White-tailed deer	<i>Odocoileus virginianus</i>	Aspen groves, wooded river flats and coulees.	—	Protected Species, Part 2 ^d
Mountain goat	<i>Oreamnos americanus</i>	Known to frequent a salt lick along the Icefields Parkway in Jasper National Park. In or near alpine areas throughout the year, moving only in winter to south and southwest facing slopes or to windswept ridges where snow cover is minimal.	—	Protected Species, Part 1 ^d
Bighorn sheep	<i>Ovis canadensis</i>	Migrate seasonally between low grassy slopes and alpine meadows.	—	Protected Species, Part 1 ^d
Fisher	<i>Pekania pennanti</i>	Dense coniferous forests.	S3S4 (W) ^a Sensitive ^c	—
Cougar	<i>Puma concolor</i>	Dense coniferous forests, wooded valleys, swamps.	S4 (W) ^a	Protected Species, Part 2 ^d
Southern mountain caribou	<i>Rangifer tarandus caribou</i>	High elevation alpine, subalpine parkland and subalpine forests; low elevation conifer forests where predator abundance and predation risk is low.	S1 (T) ^a Threatened ^b At Risk ^c	Protected Species, Part 2 ^d Endangered ^e Threatened ^f
Black bear	<i>Ursus americanus</i>	Common in open forests throughout the mixed-wood, foothill, and montane life zones. Partial clearings and edge habitat.	—	Protected Species, Part 2 ^d
Grizzly bear, western population	<i>Ursus arctos horribilis</i>	Open areas, river valleys and brush lands.	S2 (T) ^a Threatened ^b At Risk ^c	Special Concern ^e Protected Species, Part 1 ^d
BIRDS				
Northern goshawk	<i>Accipiter gentilis</i>	Mature mixedwood forest with high canopy closure.	S3S4 (W) ^a Sensitive ^c	—
Northern pintail	<i>Anas acuta</i>	Open areas with seasonal shallow ponds, marshes, and reedy shallow lakes with drier margins.	S4S5 (W) ^a Sensitive ^c	—

Table A5.5-1A. Wildlife Species at Risk with Potential to Interact with the Project

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
Green-winged teal	<i>Anas crecca</i>	Wooded ponds and streams. Nests in upland area in dense cover, often in shrubs or sedges. In grassland subregions, typically nests in sedges on low ground near sloughs.	S4S5 (W) ^a Sensitive ^c	—
Golden eagle	<i>Aquila chrysaetos</i>	Rocky outcrops, sparsely treed mountain slopes, and grassland habitats with coulees, steep riverbanks and canyons.	S3 (W) ^a Sensitive ^c	—
Lesser scaup	<i>Aythya affinis</i>	Permanent and semi-permanent wetlands with tall, dense herbaceous vegetation for nesting.	S5 (W) ^a Sensitive ^c	—
Gray-cheeked thrush	<i>Catharus minimus</i>	Scrub willow, alders, and dwarf spruce. Occurrence records are from the Caribou Mountains and Jasper National Park.	SU (T) ^a	—
Brown creeper	<i>Certhia americana</i>	Coniferous and mixed mature forests.	S3S4 (W) ^a Sensitive ^c	—
Black tern	<i>Chlidonias niger</i>	Shallow lakes, marshes, sloughs, ponds, and wet meadows.	S4 (W) ^a Sensitive ^c	—
Common nighthawk	<i>Chordeiles minor</i>	Open forest and forest clearings (e.g., logged or burned areas, natural woodland clearings), grasslands, rock outcrops and flat gravel rooftops of buildings. Typically nest in open areas near logs, boulders, grassy clumps and shrubs.	S4 (T) ^a Sensitive ^c	Threatened ^{e,f}
Northern harrier	<i>Circus cyaneus</i>	Open areas near wetlands or marshy meadows.	S5 (W) ^a Sensitive ^c	—
Olive-sided flycatcher	<i>Contopus cooperi</i>	Forests and woodlands, burned areas with standing dead trees, taiga, subalpine coniferous forest, and mixed coniferous-deciduous forest, especially near wetland areas.	S3 (T) ^a May Be At Risk ^c	Threatened ^{e,f}
Western wood-pewee	<i>Contopus sordidulus</i>	Conifer and mixedwood forest, forest edges and woodlands; poplar forests and riparian areas.	S4 (W) ^a Sensitive ^c	—
Black swift	<i>Cypseloides niger</i>	Cliff faces in canyons/ cliffs by waterfalls or seepages. Known only from two nesting sites in Alberta (Johnston's Canyon and Maligne Canyon).	SU (T) ^a	Endangered ^e

Table A5.5-1A. Wildlife Species at Risk with Potential to Interact with the Project

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
Pileated woodpecker	<i>Dryocopus pileatus</i>	Mature forests with large trees.	S3S4 (W) ^a Sensitive ^c	—
Pacific-slope flycatcher	<i>Empidonax difficilis</i>	Moist woods, groves, shady canyons.	SU (W) ^a	—
Least flycatcher	<i>Empidonax minimus</i>	Deciduous and mixedwood forests.	S5 (W) ^a Sensitive ^c	—
Cordilleran flycatcher	<i>Empidonax occidentalis</i>	Coniferous and deciduous woodlands along streams or ravines.	SU (W) ^a	—
Willow flycatcher	<i>Empidonax traillii</i>	Shrubbery along streams or lake edges or open areas. Localized in southwest Alberta.	S3S4 ^a	—
Rusty blackbird	<i>Euphagus carolinus</i>	River groves, wooded swamps, and muskeg.	S4 (T) ^a Sensitive ^c	Special Concern ^{e,f}
Peregrine falcon, <i>anatum</i> subspecies	<i>Falco peregrinus anatum</i>	Cliffs near water, open fields, swamps, and marshes.	S2S3 (T) ^a Threatened ^b At Risk ^c	Special Concern ^{e,f} Protected Species, Part 1 ^d
American kestrel	<i>Falco sparverius</i>	Open or partly open habitats (e.g., grasslands, farmland, and watercourses) with scattered trees or woodlands.	S5 (W) ^a Sensitive ^c	—
Common yellowthroat	<i>Geothlypis trichas</i>	Areas with dense, low vegetation (e.g., wetlands, early successional forests, forests with dense understory vegetation).	S4 (W) ^a Sensitive ^c	—
Northern pygmy-owl	<i>Glaucidium gnoma</i>	Large stands of coniferous or mixedwood forest with openings.	S3 (W) ^a Sensitive ^c	—
Sandhill crane	<i>Grus canadensis</i>	Marshes, bogs adjacent to ponds.	S4 (W) ^a Sensitive ^c	—
Bald eagle	<i>Haliaeetus leucocephalus</i>	Typically nest in mature trees along forest edges; often associated with lakes or rivers.	S4 (W) ^a Sensitive ^c	—
Barn swallow	<i>Hirundo rustica</i>	Open areas near water. Often nest in overhangs of man-made structures (e.g., barns, bridges), cliffs or caves.	S4 (W) ^a Sensitive ^c	Threatened ^e
Harlequin duck	<i>Histrionicus histrionicus</i>	Fast flowing streams surrounded by forests or patches of willow.	S3 (T) ^a Special Concern ^b Sensitive ^c	—

Table A5.5-1A. Wildlife Species at Risk with Potential to Interact with the Project

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
Hooded merganser	<i>Lophodytes cucullatus</i>	Ponds, lakes, and rivers that have fish available and woodland to provide nesting habitat.	S2S3 (T) ^a	—
Clark's nutcracker	<i>Nucifraga columbiana</i>	Coniferous forests in mountainous areas.	S4 (W) ^a Sensitive ^c	—
Osprey	<i>Pandion haliaetus</i>	Trees or man-made structures (e.g., utility poles) near waterbodies.	S4 (W) ^a Sensitive ^c	—
Western tanager	<i>Piranga ludoviciana</i>	Mature mixedwood forests.	S3S4 (W) ^a Sensitive ^c	—
Horned grebe	<i>Podiceps auritus</i>	Shallow ponds and marshes. Nest along edge of emergent vegetation near open water.	S3 (W) ^a Sensitive ^c	Special Concern ^e
Sora	<i>Porzana carolina</i>	Wetlands with a mix of both shallow and moderately deep water and emergent vegetation.	S5 (W) ^a Sensitive ^c	—
Bank swallow	<i>Riparia riparia</i>	Open areas, often near water. Nesting near the top of steep banks associated with inland water, gravel pits, and road embankments. Nesting in the same area in successive years is common.	S4 (W) ^a	Threatened ^e
Calliope hummingbird	<i>Selasphorus calliope</i>	Avalanche slopes, burns, shrubby meadows.	S2B (T) ^a	—
Red-naped sapsucker	<i>Sphyrapicus nuchalis</i>	Deciduous forests (especially aspen and cottonwood); harvested coniferous forests.	SU (W) ^a	—
Brewer's sparrow	<i>Spizella breweri</i>	Grassland Subregions (prairie subspecies): semi-arid plains with short grass and low shrubs (mainly sage brush). Mountain Subregions (mountain subspecies): meadows with thickets of dwarf birch and willow.	S3S4 (W) ^a Sensitive ^c	—
Great gray owl	<i>Strix nebulosa</i>	Mature forests.	S4 (W) ^a Sensitive ^c	—
Barred owl	<i>Strix varia</i>	Mature mixedwoods with open areas; lakeshores and stream valleys.	S3S4 (W) ^a Special Concern ^b Sensitive ^c	—
Northern hawk owl	<i>Surnia ulula</i>	Open coniferous or mixedwoods, muskeg.	S3S4 (W) ^a	—

Table A5.5-1A. Wildlife Species at Risk with Potential to Interact with the Project

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
REPTILES				
Wandering garter snake	<i>Thamnophis elegans</i>	Broad habitat preference: frequents (but not restricted to) ponds or marshes or ditches or dugouts in all habitat types.	S4 (W.h) ^a Sensitive ^c	—
Red-sided garter snake	<i>Thamnophis sirtalis</i>	Broad habitat preference: frequents (but not restricted to) ponds or marshes or ditches or dugouts and streams in all habitat types.	S4 (W) ^a Sensitive ^c	—
AMPHIBIANS				
Long-toed salamander	<i>Ambystoma macrodactylum</i>	Shallow areas of permanent ponds to semiarid sagebrush deserts and alpine meadows.	S3 (T) ^a Special Concern ^b Sensitive ^c	—
Western toad	<i>Anaxyrus boreas</i>	Forested areas, wet shrublands, avalanche slopes, meadows, clearcuts, streamsides, and shallow pond edges; often with dense shrub cover.	S3 (T) ^a Sensitive ^c	Special Concern ^{e,f}
Columbia spotted frog	<i>Rana luteiventris</i>	Found associated with permanent water.	S3 (T) ^a Sensitive ^c	—

Sources: AEP, 2015b; AEP, 2015c; AEP, 2015d; AESRD, 2014; Banfield, 1974; COSEWIC, 2015; Federation of Alberta Naturalists, 2007; Government of Canada, 2016; NatureServe, 2015; Parks Canada, 2015c; Russell and Bauer, 1993; Semenchuk, 1992; Smith, 1993; Stebbins, 1966.

Notes:

- ^a Provincial (S) ranks are assigned by AEP (2015b). Only Ranks S1 to S3 or a rank involving S1 to S3 (e.g., S3S4) are included in this table, as well as all species on the ACIMS Tracking and Watch lists. All definitions below are adapted from NatureServe (2015), unless otherwise noted.
- S2 = Imperiled: At risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
- S3 = Vulnerable: At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
- S4 = Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
- S5 = Secure: At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.
- S#S# = Range Rank: A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the status of the species.
- (W) = Watch List: Elements that are not currently considered as high conservation concern, but there is some information to suggest that they may become rare should there be substantial alterations to the species' habitats or population (AEP, 2015b).

- (W.h) = Watch List for Hibernacula: elements for which ACIMS is collecting detailed information on known locations of hibernacula only (AEP, 2015c).
- (T) = Tracking List: Species that ACIMS is actively collecting information on and processing element occurrences 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 (AEP, 2015b).
- (T.h) = Tracking List for Hibernacula: elements for which ACIMS is collecting detailed information on known locations of hibernacula only (AEP, 2015c).
- ^b Alberta's *Wildlife Act*. A species legislated as Endangered or Threatened under the *Wildlife Act* or designated Special Concern by the ESCC using definitions based on those used by the COSEWIC (AESRD, 2014) (see Note 5).
- ^c Status designation assigned in the 2010 General Status of Alberta Wild Species (AEP 2015d). Definitions below are from AEP (2015d). This table only includes designations of At Risk, May Be At Risk, and Sensitive.
- At Risk: Any species known to be at risk after formal detailed status assessment and legal designation as Endangered or Threatened in Alberta.
- May Be At Risk: Any species that may be at risk of extinction or extirpation, and is therefore a candidate for detailed risk assessment.
- Sensitive: Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.
- ^d Species listed on Part 1 or Part 2 of the Schedule 3, Protected Species under the Canada National Parks Act. Species listed on Part 1 are generally considered Threatened and are at greater risk than species listed on Part 2, which are generally considered Protected (Parks Canada, 2015c).
- ^e COSEWIC (2015). This table only includes designations of Endangered, Threatened or Special Concern.
- Endangered: A species facing imminent extirpation or extinction.
- Threatened: A species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
- ^f SARA. SARA establishes Schedule 1 as the list of species to be protected on all federal lands in Canada. The Act also applies to all lands in Canada for Schedule 1 bird species cited in the *MBCA*. This table only includes designations of Endangered, Threatened and Special Concern.
- Endangered: A species that is facing imminent extirpation or extinction.
- Threatened: A species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
- Special Concern: A species that may become a Threatened or an Endangered species because of a combination of biological characteristics and identified threats.
- Status designations that are not applicable are denoted by “—” (e.g., designations of species that have not been assessed or that are not considered to have special conservation status).

A list of wildlife species at risk that have documented FWMIS occurrences within 1 km of the Project is provided below in Table A5.5-1B. Refer to Section 5.5.1.2 of the DIA for details related to the methodology used to produce the table. Note that the absence of species occurrences in a FWMIS search does not indicate that those species are absent from the selected FWMIS search area. As the FWMIS database is populated by crowd-sourced data (i.e., species occurrences and their geographic location are reported to AEP by the public) and is therefore biased towards species that are especially common and/or easy to see/identify, the precision, accuracy, and extent of these data can only approximate the wildlife community within a given search area.

Table A5.5-1B. FWMIS Records for Occurrences of Wildlife Species at Risk within 1 km of the Project

Common Name	Scientific Name	Provincial Designation	Federal Designation
Grizzly bear, western population	<i>Ursus arctos horribilis</i>	Threatened ^a At Risk ^b	Special Concern ^c Protected Species, Part 1 ^d
Barred owl	<i>Strix varia</i>	Special Concern ^a Sensitive ^b	—
Common yellowthroat	<i>Geothlypis trichas</i>	Sensitive ^b	—
Harlequin duck	<i>Histrionicus histrionicus</i>	Special Concern ^a Sensitive ^b	—
Least flycatcher	<i>Empidonax minimus</i>	Sensitive ^b	—
Pileated woodpecker	<i>Dryocopus pileatus</i>	Sensitive ^b	—
Columbia spotted frog	<i>Rana luteiventris</i>	Sensitive ^b	—
Long-toed salamander	<i>Ambystoma macrodactylum</i>	Special Concern ^a Sensitive ^b	—
Western toad	<i>Anaxyrus boreas</i>	Sensitive ^b	Special Concern ^{c,e}

Source: AEP, 2015a.

^a Alberta provincial designation includes species listed as Endangered or Threatened under the Alberta *Wildlife Act* or as Special Concern by the ESCC (AESRD, 2014).

^b Status designation assigned in the 2010 General Status of Alberta Wild Species (ASRD, 2012).

^c Species listed as Endangered, Threatened or Special Concern by COSEWIC (2015).

^d Species listed on Part 1 of the Schedule 3, Protected Species under the *CNPA*. Species listed on Part 1 are generally considered Threatened and are at greater risk than select other species listed on the *CPNA* (Parks Canada, 2015c).

^e Species listed as Endangered, Threatened, or Special Concern on Schedule 1 of *SARA* (Government of Canada, 2016).

— = Status designations that are not applicable are denoted by “—” (e.g., designations of species that have not been assessed or that are not considered to have special conservation status).

Appendix 5.5-2
Wildlife Field Data Collection Methods

Field Data Collection Methods

Wildlife field studies were conducted from June 24 to 27, 2015 along select segments of the Project route options. Wildlife surveys were conducted to collect information on wildlife presence, distribution, and habitat use along and adjacent to the Project route options. Provincial protocols were used to assist in the design of the wildlife field program. Consultation was completed with Parks Canada to discuss and comment on the methods proposed prior to the field studies being conducted.

Wildlife survey methods are described in the following section. The wildlife surveys were completed by professionals with experience in the survey methods, knowledge of the wildlife species with potential to occur in the SA, and familiarity with the location of the Project. Wildlife observations, evidence of wildlife use, and wildlife habitat features were documented during the field surveys and their location recorded (i.e., field data sheets, UTM coordinates taken with a hand-held GPS, and photographs).

Raptor Survey

Raptor surveys were conducted using aerial and ground search methods. The aerial raptor survey was completed using protocols provided for boreal and foothills raptors (aerial surveys) in the *Sensitive Species Inventory Guidelines* (AESRD, 2013) and was conducted on June 24, 2015 to search for stick nests. Parks Canada's *Wildlife Flight Guidelines* (Parks Canada, 2015d) have a prescribed flight altitude limits of 500 m above ground level; therefore, the aerial overflight was not conducted at low level.

The aerial overflight was conducted using a Bell 206 Jet Ranger equipped with rear bubble windows. The length of the Project routes and 100 m on both sides of the proposed transmission line rights-of-way were flown on June 24 2015. In addition, areas of suitable raptor nesting habitat with potential to support species with setback distances of 750 m to 1,000 m (i.e., bald eagle, peregrine falcon, and osprey) were investigated further.

To provide consistent survey effort, constant altitude and speed were maintained. The locations of stick nests and areas with high potential for raptor nesting were recorded during the aerial raptor survey.

The survey was conducted during suitable weather conditions (good visibility, no precipitation, and winds less than 20 km/h). During the aerial overflight, additional information collected included a general perspective and review of the broader landscape (i.e., Project Footprint and adjacent areas), land use, vegetation cover types, the level and extent of the existing human disturbance in the area, and potential areas of wildlife importance (e.g., lakes and wetlands, mineral licks), as well as potential routing constraints from a wildlife habitat perspective.

The ground search survey for raptor nests was conducted in conjunction with other wildlife surveys (such as waterfowl and Columbia ground squirrel surveys) along the Project route options in areas with potential to support raptor nesting. Ground surveys for raptor species were conducted from June 24 to 27, 2015. The ground survey was conducted during daylight hours and under satisfactory weather conditions, including seasonally normal temperatures, good visibility, no precipitation, and light winds (i.e., less than 20 km/h).

Information recorded when an active or inactive nest was found included date, weather conditions, noise level, GPS location, species, status of nest, raptor sign, and habitat description.

Essential habitat surveys, as described in the *Sensitive Species Inventory Guidelines* (AESRD, 2013), were not conducted given the combined length of the Project route options. The combination of aerial surveys, ground searches, and emphasis on areas with higher potential to support breeding raptors informed the assessment of potential Project effects on wildlife and wildlife habitat, and Project planning.

Waterfowl Surveys

Prior to the waterfowl surveys, a desktop review was conducted to identify suitable wetlands and waterbodies located within 1 km of the main Project route. Waterfowl surveys were conducted from June 25 to 27, 2015. Observers positioned themselves at a good vantage point to observe the wetland or waterbody. At each survey point, both acoustic and visual records of waterfowl were recorded. Binoculars were used to observe species at a distance and to confirm identification. The approximate location, species, age, sex (where possible), and number of all birds detected were recorded at each wetland or waterbody.

Columbian Ground Squirrel Surveys

Columbian ground squirrel surveys were conducted using point count and call-playback methods. Columbian ground squirrel surveys were completed using guidance from *Survey Protocol for the Richardson's Ground Squirrel* (Downey, 2003) and were conducted from June 26 to 27, 2015 to search for colonies. Prior to the Columbian ground squirrel surveys, a desktop review was conducted to identify suitable high-elevation habitats (such as open alpine meadows) situated within 1 km of the main Project route.

Based on the desktop review, predetermined survey transects in suitable habitat were selected, and point count locations were separated at 800 m along each transect. Observers positioned themselves at a good vantage point to observe the surrounding habitat. Observers used binoculars and rotated 360 degrees (four 90 degree quadrants), counting each ground squirrel during a 2-minute period. The number of Columbian ground squirrels observed in each quadrant was recorded.

Upon completion of each point count, a handheld caller (FoxPro Wildfire) was used to play a Columbian ground squirrel alarm call for 30 seconds while facing each 90° quadrant and counting each ground squirrel observed. The call-playback survey was used to potentially induce any individuals within the vicinity of the observers to appear and determine whether call-playback surveys assisted in increasing observations.

Surveys were conducted when ground squirrels actively forage. Morning surveys began approximately 75 minutes after sunrise until 12:00 p.m. Afternoon surveys began at approximately 4:00 p.m. until 75 minutes before sunset. Surveys did not occur during extreme temperatures, inclement weather or high winds.

Incidental Wildlife Observations

Incidental wildlife observations include all wildlife observations recorded when travelling to and from or between survey locations and non-focal species observed during surveys. All incidental wildlife observations (visual/auditory) and sign (such as tracks, scat/pellets, foraging), as well as habitat features (such as stick nests), were recorded during field surveys. Where possible, information recorded for each observation included the date, time, species, number, age and sex, general habitat description, and GPS location. Photographs were also taken where warranted.

Appendix 5.5-3
Wildlife Species Observed during the
Wildlife Field Studies

A list of wildlife species observed during the wildlife field studies (including incidentals) is found below in Table A5.5-3. Refer to Section 5.5.1.3 of the DIA for general details related to the methodology and for a formal account of results. Appendix 5.5-2 provides a comprehensive overview of wildlife field studies methodology.

Table A5.5-3. Wildlife Species Observed During Wildlife Field Studies

Common Name	Scientific Name	Provincial Designation	Federal Designation	Observation Type	Survey
MAMMALS					
Elk	<i>Cervus canadensis</i>	--	Protected Species, Part 2 ^c	Pellets, tracks	Incidental
Gray wolf	<i>Canus lupus</i>	--	Protected Species, Part 2 ^c	Tracks	Incidental
Mountain goat	<i>Oreamnos americanus</i>	--	Protected Species, Part 1 ^c	Visual	Incidental
Red squirrel	<i>Tamiasciurus hudsonicus</i>	--	--	Auditory, visual	Incidental
White-tailed deer	<i>Odocoileus virginianus</i>	--	Protected Species, Part 2 ^c	Visual	Incidental
BIRDS					
Alder flycatcher	<i>Empidonax alnorum</i>	--	--	Auditory	Incidental
American crow	<i>Corvus brachyrhynchos</i>	--	--	Auditory, visual	Incidental
American redstart	<i>Setophaga ruticilla</i>	--	--	Auditory	Incidental
American robin	<i>Turdus migratorius</i>	--	--	Auditory, visual	Incidental
Bank swallow	<i>Riparia riparia</i>	--	Threatened ^b	Colony, Visual	Incidental
Black-capped chickadee	<i>Poecile atricapillus</i>	--	--	Auditory	Incidental
Belted kingfisher	<i>Megaceryle alcyon</i>	--	--	Visual	Incidental
Cedar waxwing	<i>Bombycilla cedrorum</i>	--	--	Visual	Incidental
Chipping sparrow	<i>Spizella passerina</i>	--	--	Auditory, visual	Incidental
Clay-colored sparrow	<i>Spizella pallida</i>	--	--	Auditory	Incidental
Common goldeneye	<i>Bucephala clangula</i>	--	--	Visual	Waterfowl
Common loon	<i>Gavia immer</i>	--	--	Auditory, visual	Waterfowl
Common raven	<i>Corvus corax</i>	--	--	Auditory	Incidental
Common yellowthroat	<i>Geothlypis trichas</i>	Sensitive ^a	--	Auditory	Incidental
Dark-eyed junco	<i>Junco hyemalis</i>	--	--	Auditory, visual	Incidental
Hummingbird sp.	Unidentified species	--	--	Visual	Incidental

Table A5.5-3. Wildlife Species Observed During Wildlife Field Studies

Common Name	Scientific Name	Provincial Designation	Federal Designation	Observation Type	Survey
Killdeer	<i>Charadrius vociferus</i>	--	--	Auditory, visual	Incidental
Least flycatcher	<i>Empidonax minimus</i>	Sensitive ^a	--	Auditory	Incidental
Le Conte's sparrow	<i>Ammodramus leconteii</i>	--	--	Auditory	Incidental
Lincoln's sparrow	<i>Melospiza lincolni</i>	--	--	Auditory, visual	Incidental
Mallard	<i>Anas platyrhynchos</i>	--	--	Visual	Waterfowl
Merlin	<i>Falco columbarius</i>	--	--	Visual	Incidental
Northern flicker	<i>Colaptes auratus</i>	--	--	Visual	Incidental
Palm warbler	<i>Setophaga palmarum</i>	--	--	Auditory	Incidental
Red-breasted nuthatch	<i>Sitta canadensis</i>	--	--	Auditory	Incidental
Red-tailed hawk	<i>Buteo jamaicensis</i>	--	--	Auditory, visual	Incidental
Red-winged blackbird	<i>Agelaius phoeniceus</i>	--	--	Auditory, visual	Incidental
Ruby-crowned kinglet	<i>Regulus calendula</i>	--	--	Auditory	Incidental
Solitary sandpiper	<i>Tringa solitaria</i>	--	--	Visual	Incidental
Song sparrow	<i>Melospiza melodia</i>	--	--	Auditory	Incidental
Swainson's thrush	<i>Catharus ustulatus</i>	--	--	Auditory	Incidental
Tennessee warbler	<i>Oreothlypis peregrina</i>	--	--	Auditory, visual	Incidental
Warbling vireo	<i>Vireo gilvus</i>	--	--	Auditory	Incidental
White-throated sparrow	<i>Zonotrichia albicollis</i>	--	--	Auditory	Incidental
White-winged crossbill	<i>Loxia leucoptera</i>	--	--	Auditory, visual	Incidental
Wilson's snipe	<i>Gallinago delicata</i>	--	--	Visual	Incidental
Yellow warbler	<i>Dendroica petechia</i>	--	--	Auditory	Incidental
Yellow-rumped warbler	<i>Setophaga coronata</i>	--	--	Auditory, visual	Incidental
AMPHIBIANS					
Frog sp.	Unidentified species	--	--	Tadpoles	Incidental

Table A5.5-3. Wildlife Species Observed During Wildlife Field Studies

Common Name	Scientific Name	Provincial Designation	Federal Designation	Observation Type	Survey
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^a Status designation assigned in the 2010 General Status of Alberta Wild Species (ASRD, 2012).

^b Species listed as Endangered, Threatened or Special Concern by COSEWIC (2015).

^c Species listed on Part 1 or Part 2 of the Schedule 3, Protected Species under the Canada National Parks Act. Species listed on Part 1 are generally considered Threatened and are at greater risk than species listed on Part 2, which are generally considered Protected (Parks Canada, 2015c).

Status definitions and their references are provided in Appendix 4.5-1.

-- Status designations that are not applicable are denoted by "--" (e.g., designations of species that have not been assessed or that are not considered to have special conservation status).

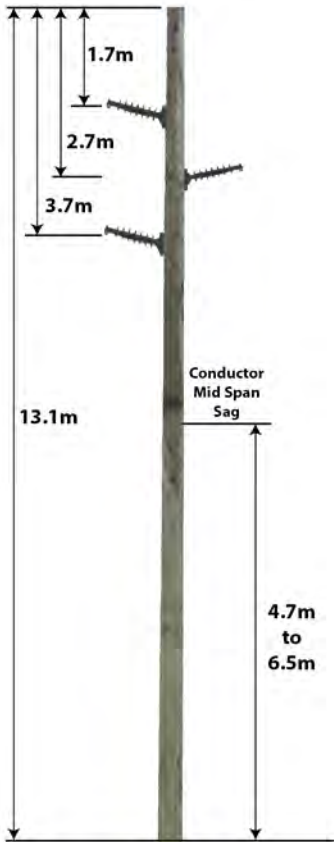
Appendix 5.7-1 Visualizations

Figure 1

Visual Simulation - Celestine Road
For the Proposed NCR
Jasper Interconnection Project

660380
April 2016

3D MODEL



TECHNICAL DETAILS

Typical 69 kV Single Circuit
Horizontal Post Structure

Approximate Dimensions

Height: 13.1 m

Between Structures: 110 m

Photograph Date: Sept 10, 2015

Regional Location: Snaring Road

KP Location: 31.0

View Direction: Southwest

BEFORE PROJECT



AFTER PROJECT



LOCATION & VIEWPOINT

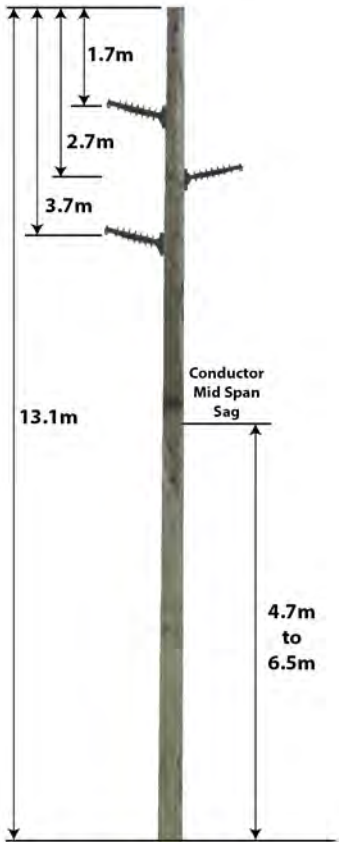


Figure 2

Visual Simulation - Snaring Road
For the Proposed NCR
Jasper Interconnection Project

660380
April 2016

3D MODEL



TECHNICAL DETAILS

Typical 69 kV Single Circuit
Horizontal Post Structure

Approximate Dimensions

Height: 13.1 m

Between Structures: 110 m

Photograph Date: Sept 10, 2015

Regional Location: Snaring Road

KP Location: 31.0

View Direction: Southwest

BEFORE PROJECT



AFTER PROJECT



LOCATION & VIEWPOINT



○ Proposed Post Structure



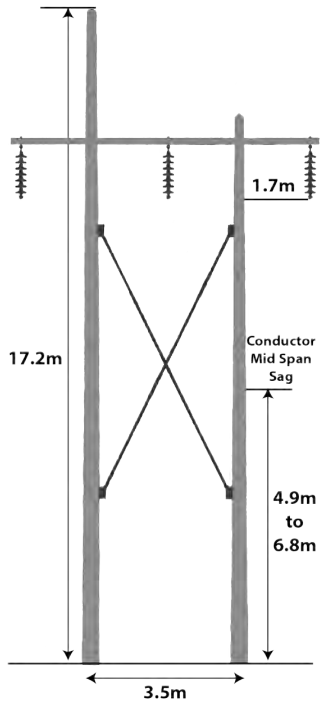
Figure 3

Visual Simulation - Jasper Lake
off of Highway 16, directly across
from Windy Point

For the Proposed NCR
Jasper Interconnection Project

660380
April 2016

3D MODEL



TECHNICAL DETAILS

Typical 69 kV Single Circuit
H - Frame Structure

Approximate Dimensions

Height: 17.2 m

Max.Width: 7.2 m

Between Structures: 230 m

Photograph Date: Sept 10, 2015

Regional Location: Jasper Lake

View Direction: Northwest

BEFORE PROJECT



AFTER PROJECT



LOCATION & VIEWPOINT

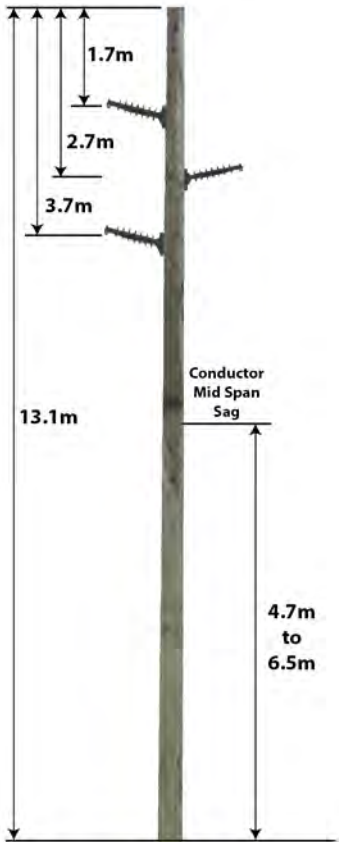


Figure 4

Visual Simulation - Pocahontas
For the Proposed NCR
Jasper Interconnection Project

660380
May 2016

3D MODEL



TECHNICAL DETAILS

Typical 69 kV Single Circuit
Horizontal Post Structure

Approximate Dimensions

Height: 13.1 m

Between Structures: 110 m

Photograph Date: Sept 10, 2015

Regional Location: Pocahontas

KP Location: 16

View Direction: Northeast

BEFORE PROJECT



AFTER PROJECT



LOCATION & VIEWPOINT

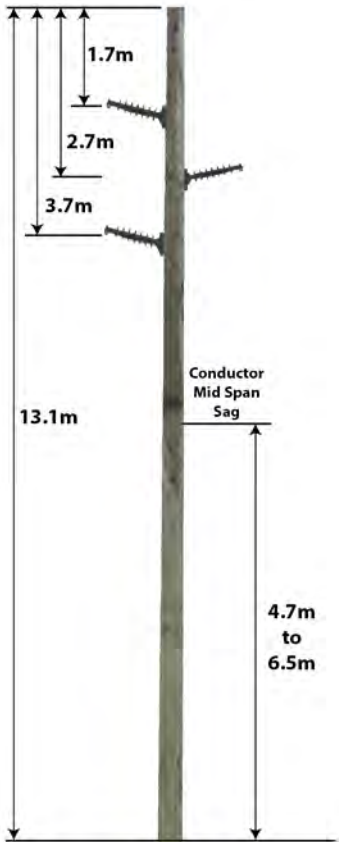


Figure 5

Visual Simulation - Pocahontas
For the Proposed NCR
Jasper Interconnection Project

660380
May 2016

3D MODEL



TECHNICAL DETAILS

Typical 69 kV Single Circuit
Horizontal Post Structure

Approximate Dimensions

Height: 13.1 m

Between Structures: 110 m

Photograph Date: Sept 10, 2015

Regional Location: Pocahontas

KP Location: 16

View Direction: Southwest

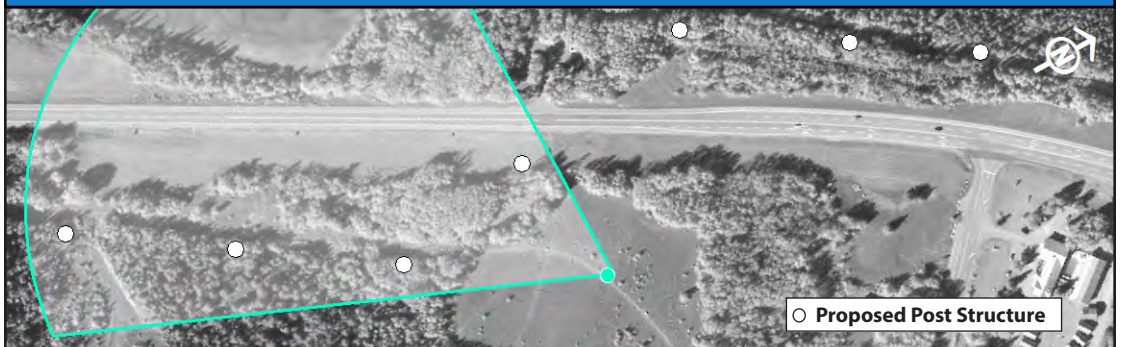
BEFORE PROJECT



AFTER PROJECT



LOCATION & VIEWPOINT



Reclamation and Remediation

6.1 Reclamation

Reclamation measures will be implemented in areas affected by Project activities during and following construction, and will consider the extent and type of Project disturbance and site-specific issues. Reclamation measures implemented during construction are both preventative and interim measures targeting soil handling, water, and erosion control activities, whereas final reclamation measures focus on reclaiming the natural topography, revegetating disturbed soils, and removing temporary access.

A detailed Project Reclamation Plan will be developed to address final reclamation measures and will be designed based on reclamation requirements established during the Project Planning Period, including input from stakeholders, regulators, and ATCO Electric. As a component of the Reclamation Plan, a post-construction assessment process and schedule will be established.

The following sections outline and discuss construction reclamation measures as part of the work site cleanup activities.

6.1.1 Construction Reclamation Measures

The primary goal of construction reclamation is to reduce residual effects and return the disturbed lands to a stable, non-erosive condition. Table 6.1-1 provides information on the reclamation measures to be implemented during cleanup as part of the construction phase. These reclamation measures have been selected to prevent and/or mitigate, to the extent practical, any potential residual effects that construction activities may have on the Project.

Table 6.1-1. Construction Reclamation Measures

Issue or Potential Effect	Background Information	Key Reclamation Measures^a
Construction Access and Existing Operations Access Roads	Access roads are either existing roads or access specifically built or upgraded for temporary use during construction. Following construction, access roads will be reclaimed.	<ul style="list-style-type: none"> All drainage pathways affected by access road construction will be recontoured to restore pre-existing flow patterns. Access roads will be blocked to prevent future vehicular access.
Contaminated Lands	Areas where impacts have been identified during environmental investigations prior to site decommissioning will be addressed	<ul style="list-style-type: none"> Remediate all impacts above regulatory guidelines following site decommissioning and before reclamation activities.
Topsoil Salvage and Storage	Topsoil is salvaged; organic and mineral soil is stored separately.	<ul style="list-style-type: none"> Accurately salvage topsoil to preserve plant propagules (i.e., root pieces, seed, and spores) and woody debris. As a general rule, salvage will be in accordance with the EPP (Appendix 1) and as outlined in Section 5. Upon completion of construction, topsoil (organic and mineral soil) is replaced correctly with sufficient compaction.
Erosion	Following topsoil replacement, some areas of the Project Footprint may be susceptible to wind or water erosion.	<ul style="list-style-type: none"> Regrade areas with vehicle ruts or erosion gullies. Apply applying erosion control measures (e.g., mulching/woody debris, tackifiers) where required to stabilize soils until final reclamation. Establish vegetation covers where needed to stabilize sensitive soils.

^a See Project EPP, Appendix 1

6.1.2 Post-Construction Monitoring

In Attachment 1 of the Terms of Reference for the Project, Parks Canada has provided MO/DERs for PCM (Parks Canada, 2015). MO/DERs focus on outcomes for vegetation, aquatic ecosystems, soil and terrain, wildlife habitat and populations, potential leaks and spill, archaeological, cultural and historical resources, and visual aesthetics. ATCO Electric will return newly disturbed areas to pre-disturbance state as described in the MO/DERs. The MO/DERs will be verified prior to construction to establish a baseline of pre-disturbance status and conditions and trajectories. Section 7.0 provides information on PCM and details on how ATCO Electric will meet the MO/DERs.

6.2 Environmental Site Assessment and Remediation

Proposed construction activities at Palisades include the commissioning of the transmission line and Sheridan Substation in May 2018 and subsequent decommissioning of Palisades, to be completed by May 2019. As part of the decommissioning activities, ATCO Electric will reduce the current fence line to a smaller area around the Sheridan Substation (Figure 6.2-1). Under Section 15(2) of the *CNPA*, lands outside the new reduced fence line will revert to the Crown.

Further environmental site assessment of areas underneath infrastructure, following decommissioning and removal, will be conducted at Palisades located at NW 2-46-1 W6M including the area within Palisades allocated for the future Sheridan site (Figure 6.2-1). Following supplemental environmental site assessments, remediation measures will be implemented, where warranted.

6.2.1 Regulatory Context

Based on previous environmental investigations and remedial works completed to date at Palisades, the Residential/Parkland land use criterion is applicable in conjunction with the following guidelines:

- Soils:
 - Canada-wide Standard for Petroleum Hydrocarbons (PHCs) in Soil (Canadian Council of Ministers of the Environment [CCME], 2011) for PHC F1 through F4 soil parameters and *Canadian Environmental Quality Guidelines for the Protection of Environmental and Human Health* (CCME, 1999 [and updates]) for all other soil parameters
 - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP, 2016)
- Groundwater/surface water:
 - *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME, 2011) and *Guidelines for Canadian Drinking Water Quality* (Health Canada, 2014)
 - *Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites* (Federal Contaminated Sites Action Plan, 2010)

6.2.2 Site Description

Palisades has been in operation since 1974 and is a thermal diesel and natural gas-fueled generating plant. The facility currently consists of nine permanent and two skid mounted generation units. Nine of the generation units are internal combustion driven power generating units, and two units are gas turbine driven. Six of the generation units are housed in the main generation building and the other five units are located north of the main generation building (Figure 6.2-1) (ATCO Electric, 2011).

Infrastructure used in the power generating process includes a number of radiators and compressors located throughout the site. Three aboveground storage tanks (ASTs) containing diesel fuel, glycol, and waste oil are located north of the radiators. A building housing all the switchgear equipment is located south of the radiators. A fire-suppression building with a 400 m³ reservoir is onsite in order to protect

the power plant and surrounding area. A substation is located on the west side of the site. In addition, there is a water injection system used to operate one or two of the generation units (Advisian, 2016a).

An onsite domestic non-potable water well (the ATCO Electric Plant Water Well) is located to the southeast of the operations building. The site is surrounded by forest to the east, west, and north with a pumping station operated by KMC located approximately 150 m south of the site.

Historical infrastructure reported in Advisian (2016b) is shown in Figure 6.2-1 and includes:

- A storage shed (located in the northwest corner of the site)
- A former used oil filter storage (south of CUL 330)
- Treated water storage tank (east of CUL 330)
- An operations building and CUL 189 (north of CUL 47)
- CUL 191 generating unit (south of CUL 368)
- Septic tank in the southwest corner of the site
- CUL 190/330 generating units (in the location of the current switchgear building)
- CUL 198 generating unit
- 2 diesel aboveground storage tanks (AST) (one in the former septic field and one on the northeast side of the site)
- Propane bullet (northeast side of the site)
- Two underground storage tanks (USTs) (near diesel UST area, exact location unknown)

6.2.2.1 Existing Monitoring Infrastructure

A groundwater monitoring network is present on the site (Figure 6.2-1), including two groundwater monitoring wells installed by ATCO Electric near the former septic tank on the southwestern corner of the site. In addition, seven wells (five on the south, one on the northeast, and one on the northwest corners of the site) and four recovery wells were installed by KMC following a rupture of their line in the early 1990s located approximately 150 m south of Palisades.

6.2.3 Historical Environmental Investigations and Remediation Work

There have been multiple environmental investigations and remediation work completed at Palisades site. In general, these environmental investigations were initiated to assess potential operational impacts when infrastructure was removed, to collect baseline data when equipment was added when the site was expanded, or to confirm the presence and extent of impacts following a release.

A brief summary of these historical environmental investigations and remediation activities is provided below.

6.2.3.1 Historical Environmental Investigations

Advisian (2016a) reported that a Phase I Environmental Site Assessment completed internally by ATCO Electric in 2001 to document the Palisades infrastructure and activities that were potential sources of contamination from 1990 to 1999.

A 2000 combined Phase II/III Environmental Site Assessment conducted in the vicinity of the former septic tank and AST in the southwest portion of the site, found concentrations of benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbon (PHC) fractions F1 to F4, and glycols were below the Tier 1 guidelines (1994) to 6 m belowground surface (mbgs) (Thurber Environmental Consultants Ltd. [Thurber], 2001).

A soil baseline Environmental Site Assessment in support of the site expansion in the former septic tank area as well as northwest of the Operation Building in 2002 similarly found glycol and PHC concentrations below guidelines at 3 mbgs (Thurber, 2002).

In 2006, a limited Phase II Environmental Site Assessment investigation, again within the vicinity of the former septic tank in the southwest corner of the site, reported PHC F2, F3, and F4 concentrations from boreholes advanced to a maximum depth of 9.6 mbgs exceeded the applied guidelines at select locations (Thurber, 2007a).

In 2013, Phase II Environmental Site Assessments were completed for the CAT Rental Unit Area and the CUL 330 generating unit and ASTs onsite. The CAT Rental Unit Area located immediately north of the Operations Building was assessed for operational impacts to soil. Surficial staining and hydrocarbon odours were noted while sampling. PHC F2 and F3 concentrations exceeded applied guidelines in select soil samples in three boreholes up to 2 mbgs. Select metals exceeded guidelines in surface samples at two locations. A second Phase II Environmental Site Assessment was completed in the area of the CUL 330 generating unit and ASTs, located north of the Auxiliary Switch Gear Building. Total metals, BTEX, PHC F1 to F4, and glycol concentrations were below the applicable guidelines in all samples.

In addition to soil investigations, groundwater monitoring, and recovery wells were installed by KMC to monitor a 1993 methyl tertiary butyl ether (MTBE) spill that occurred on their pipeline south of Palisades. Additional monitoring wells were installed by KMC as part of a site risk management plan (Thurber, 2009a).

6.2.3.2 Historical Remediation

In July 1990, surface staining was removed surrounding a 23,000L diesel tank; no analytical testing was completed (Advisian, 2016b).

Five releases were identified by Advisian (2016b) to have occurred on the site as noted in historical reports; all spills were reported to have been cleaned up, however, no records exist for confirmatory sampling.

Prior to 1993, two USTs were present in the northern portion of the site (exact location unknown) and visual PHC and odour was observed. The USTs were removed in 1993, and 46 m³ of impacted soil was excavated and removed, although there is no record of confirmatory samples collected.

Based on identified impacts in the 2006 Phase II Environmental Site Assessment (Thurber, 2007a) for the southwest portion of the site, remedial excavation of impacted soil was initiated and completed in 2007 (Thurber, 2007b). Existing infrastructure limited access to the area and not all impacted soil was removed due to poor accessibility. Subsequent sampling detected PHC F2 and F3 concentrations greater than guidelines along the northern and southern boundaries of the remediated area (Thurber, 2009b). A risk management plan was implemented to manage the residual PHC impacts (Thurber, 2009a).

In 2013, a supplemental Environmental Site Assessment was conducted to assess areas along the northern and southern boundaries of the area in the southwestern portion of the site previously remediated in 2007 (WorleyParsons Canada Services Ltd., 2014). The area of remaining impacted material was delineated and excavated (WorleyParsons Canada Services Ltd., 2014). After confirmatory sampling indicated contaminant concentrations were below guidelines for both northern and southern boundaries, Parks Canada provided a closure letter on September 23, 2014, for the southwestern portion of the site (Parks Canada, 2014).

6.2.3.3 2015 Phase I and II Environmental Site Assessments

In 2015, Advisian (2016a) conducted a Phase I Environmental Site Assessment.

The 2015 Phase I Environmental Site Assessment (Advisian, 2016a) identified a total of 28 onsite and two offsite Areas of Potential Environmental Concern (APECs) based on historical site activities, previous environmental investigations, and remedial work. Potential Contaminants of Concern (PCOCs) identified were PHCs, salinity, glycols, metals, fecal coliforms, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, volatile organic carbons, sterilants, and MTBE. Based on the results of the Phase I Environmental Site Assessment investigation, a Phase II Environmental Site Assessment was recommended.

The 2015 Phase II Environmental Site Assessment (Advisian, 2016b) was completed to confirm or refute subsurface contamination. Soil sampling included 64 boreholes advanced in areas identified as potential sources of subsurface contamination in the 2015 Phase I Environmental Site Assessment (Advisian, 2016a). Groundwater laboratory data collected by KMC from the KMC monitoring well network onsite was also evaluated as part of the Phase II investigation.

Soil Analytical Results. Values for pH were slightly outside the guideline range (6 to 8) at BH15-02 (3.5–4.0 m; 8.01), BH15-04 (0.6–1.0 m [8.03] and 3.0–3.5 m [8.03]), BH15-15 (0.6–1.0 m; 8.03), and BH15-56 (0.6–1.0 m; 8.03). Advisian (2016b) concluded elevated pH values may be naturally occurring based on slightly higher pH within one meter of the surface at BH15-56, a background borehole located in the undeveloped northwest corner of the site.

Electrical Conductivity (EC) values exceeded the applied guideline at BH15-04 (2.5–3.0 m), located south of the Operations Building; however, reported EC values were below the guideline at 3.0–3.5 mbs.

The Sodium Absorption Ratio (SAR) value exceeded the applied guideline at BH15-10 (0.6–1.0 m), located northwest of the Operations Building. Advisian (2016b) attributed the elevated SAR values to localized soluble sodium based on the shallow depth and proximity to an onsite service roadway.

Arsenic concentrations exceeded the applied guideline at BH15-52 (0.6-1.0 m), located south of the New/Auxiliary Switch Gear Building, but were below the guideline at 2.5-3.0 mbgs.

All PHC parameter concentrations were detected below their respective regulatory detection limits (RDL).

Groundwater Analytical Results. The depth to groundwater at the site has been measured to be greater than 24 mbgs (Advisian, 2016b).

Based on the December 2015 monitoring data collected by KMC, a slightly higher groundwater elevation relative to other monitoring wells onsite was measured at the southwest corner of the site, with predominant groundwater flow to the northeast towards the Athabasca River. The lateral hydraulic gradient was approximately 0.001 m/m (Advisian, 2016b).

All dissolved PHC parameters were below their respective RDLs at all monitoring wells including the ATCO Electric Plant Water Well.

MTBE exceeded the applied guideline at one KMC monitoring well (MW 45), located in the northwest portion of the site, in August and November 2015. The MTBE concentrations at all monitoring wells were below the RDL in October 2015 and below the applied guideline in December 2015.

6.2.4 Recommendations

Based on the current understanding of site conditions, historical assessments and remediation programs, additional areas, as shown on Table 6.2-1, are recommended for further assessment before construction of the Sheridan Substation and following the decommissioning of Palisades

Table 6.2-1. Recommended Assessment and Remediation Measures

Issue or Potential Effect	Current Constraint	Recommended Action
EC Exceedance	EC measurements above guidelines at BH15-04 located south of facility septic system	<ul style="list-style-type: none"> Collect and analyze additional soil samples to laterally delineate the extent of the EC impacts in the vicinity of BH15-04 Remove and dispose of EC impacted soil
SAR Exceedance	SAR ratios above guidelines at BH15-10 located northwest of Operations Building	<ul style="list-style-type: none"> Collect and analyze additional soil samples to refine the extent of the SAR impacts in the vicinity of BH15-10 Remove and dispose of SAR impacted soil.
PHC Exceedance	Staining and hydrocarbons above guidelines at CAT Rental Unit Area in 2013, but not in 2015	<ul style="list-style-type: none"> Collect and analyze additional soil samples to investigate and delineate the extent of the historical PHC impacts in the vicinity of BH15-04 Remove and/or remediate PHC impacted soil
Arsenic Exceedance	Arsenic concentrations above guidelines near surface at BH15-02	<ul style="list-style-type: none"> Collect and analyze additional soil samples to refine the extent of the arsenic impacts in the vicinity of BH15-02 Remove and dispose of arsenic impacted soil
Toluene, Benzene, and MBTE Exceedance in the Drinking Water Well	Although the well is not being used for drinking water, it should not be used for industrial use (cleaning equipment) and could be a potential preferential flow pathway for toluene, benzene and MBTE impacts in the groundwater	<ul style="list-style-type: none"> Decommission the ATCO Electric Plant Water Well as per the Province of Alberta <i>Water Act</i> (Province of Alberta, 2014)

Table 6.2-1. Recommended Assessment and Remediation Measures

Issue or Potential Effect	Current Constraint	Recommended Action
Incomplete Confirmatory Data in the Septic Field	Parameters specific for septic fields were not analyzed in confirmatory sampling	<ul style="list-style-type: none"> Collect confirmatory samples to confirm closures for parameters specific for septic fields (fecal coliforms, phosphorus, salinity, nitrates, etc.)

Further environmental site investigations and remediation efforts will need to be scheduled with consideration of the timing of the decommissioning of Palisades and construction of the Sheridan Substation. Decommissioning and investigation of APECs of the areas of the future Sheridan Substation will need to be investigated and any impacts encountered to be remediated before construction of the substation can occur.

6.3 References

6.3.1 Literature Cited

- Alberta Environment and Parks. (AEP). 2016. *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*. February 2, 2016.
- ATCO Electric Ltd. (ATCO Electric). 2011. *Palisades Power Plant Improvement Projects Environmental Assessment Report*. 26 pp.
- Advisian. 2016a. *Phase I Environmental Site Assessment, Jasper Palisades Power Plant, NW-02-046- 01 W6M*. File No. 307075-01295-500. January 8, 2016.
- Advisian. 2016b. *Phase II Environmental Site Assessment, Jasper Palisades Power Plant, NW-02-046- 01 W6M*. File No. 307075-01295-600. February 19, 2016.
- Canadian Council of Ministers of the Environment (CCME). 1999 (and updates). *Canadian Environmental Quality Guidelines for the Protection of Environmental and Human Health Canadian Council of Ministers of the Environment*. Winnipeg, MB.
- Canadian Council of Ministers of the Environment (CCME). 2011. *CCME Canada-wide Standard for Petroleum Hydrocarbons (PHC) in Soil Canadian Environmental Quality Guidelines*. Canadian Council of Ministers of the Environment. Winnipeg, MB.
- Federal Contaminated Sites Action Plan. 2010. *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*. Federal Contaminated Sites Action Plan.
- Health Canada. 2014. *Guidelines for Canadian Drinking Water Quality: Summary Table*. Federal-Provincial-Territorial Committee on Health and the Environment. August 2012.
- Parks Canada. 2015. *Terms of Reference for ATCO Electric’s Jasper Interconnection Power Line Project Detailed Impact Analysis*. August 2015. Jasper, Alberta. 26 pp.
- Parks Canada. 2014. “Re: Jasper Palisades Power Plant (NW-02-046-01 W6M)” letter to ATCO. September 23, 2014.
- Province of Alberta. 2014. *Water Act*. Revised Statutes of Alberta 2000 Chapter W-3. Current as of December 17, 2014. Published by Alberta Queen’s Printer.
- Thurber Environmental Consultants Ltd. (Thurber). 2001. *Phase II/III Environmental Site Assessment ATCO Electric Ltd. Jasper Palisades Power Plant Near Jasper, Alberta. NW-2-46-1 W6M*. October 2001. File No. 17-393-204.

Thurber Environmental Consultants Ltd. (Thurber). 2002. *Baseline Environmental Site Assessment ATCO Electric Ltd. Jasper Palisades Power Plant Alterations Near Jasper, Alberta.*

NW1/4-2- 46-1 W6M. September 25, 2002. File No. 17-393-290.

Thurber Environmental Consultants Ltd. (Thurber). 2007a. *Limited Phase II Environmental Site Assessment Palisades Generating Station Near Jasper, Alberta NW-2-46-1 W6M.* January 2007.

File No. 17-393-457.

Thurber Environmental Consultants Ltd. (Thurber). 2007b. *Phase III Environmental Site Assessment Palisades Generating Station Near Jasper, Alberta.* July 2007. File No. 17-393-462.

Thurber Environmental Consultants Ltd. (Thurber). 2009a. *Site Remediation Palisades Generating Station Near Jasper, Alberta NW-2-46-1 W6M.* April 2009. File No. 17-393-464.

Thurber Environmental Consultants Ltd. (Thurber). 2009b. *Risk Management Plan Palisades Generating Station Near Jasper, Alberta (NW-2-46-1 W6M).* April 2009. File No. 17-393-464.

WorleyParsons Canada Services Ltd. 2014. *Supplemental Site Assessment and Remedial Excavation, Jasper Palisades Power Plant (NW-02-046-01 W6M).* File No. 307075- 01295-100-101. March 2014.

Monitoring and Follow-up

ATCO Electric will conduct pre-construction monitoring along the proposed route ahead of construction activities in order to catalogue the existing environmental conditions, and identify any additional areas of concerns, such as sensitive terrain, high quality wildlife habitat, presence of weeds or invasive species, steep slopes, areas prone or at risk of erosion, or areas already disturbed or affected by human activity. Prior to the construction start-up, ATCO Electric Environmental Advisors and Parks Canada Environmental Surveillance Officers will provide a Project Environmental Orientation to all work crews, contractors, supervisors, and managers to advise them on the related regulations, required work permits, conditions of work, environmental concerns, and the mitigation measures that should be employed. The findings in this pre-construction monitoring event will be used, along with the Best Available Methods for Common Leaseholder Activities Guidelines (Axys and Walker, 1998), the Project EPP (Appendix 1), baseline environmental conditions and the MO/DERS, to assist with reclamation and remediation through the development of a Reclamation Release Plan (RRP).

Environmental Advisors will work with the project team and Parks Canada ESOs to implement and ensure adherence to mitigation measures through continuous onsite monitoring during project working days and close consultation and advisement of workers, supervisors, and managers. Daily work plans will be reviewed by Environmental Advisors and compared to the Project EPP, DIA submission, permits, weather and ground conditions to ensure compliance and minimal environmental impacts. During high risk work – such as soil excavation, blasting, in-water work - on-site surveillance by Environmental Advisors will be in place to protect the integrity of sensitive sites such as wetlands, riparian areas, bed and banks of rivers, or rare ecosites. Monitoring will include assessment of suspended sediment levels, performances of stream crossings, and visual assessments of bank stability. Where required, additional control and monitoring will be considered in order to ensure the successful protection of wildlife, vegetation communication, and ensure reclamation.

ATCO Electric will return newly disturbed areas to pre-disturbance state as described in the MO/DERS. The MO/DERS will be verified prior to construction to establish a baseline of pre-disturbance status and conditions. A comprehensive post-construction monitoring event will be completed immediately following construction in order to document deficiencies and complete the RRP. Deficiencies and damages to the environment from construction work, or operations and maintenance, will be identified and prioritized for reclamation. A RRP will be provided to Parks Canada on annual basis for 5 years until reclamation is determined to be on a trajectory to meet the MO/DERS established in the terms of reference, or baseline environmental conditions. Annual monitoring results will be review by ATCO Electric and Parks Canada on a year basis to determine if additional actions are required, or to obtain sign-off when reclamation to MO/DERS or baseline environmental conditions have been met. Annual reclamation activities may include assessment of drainage, soil erosion, topsoil depth and structure, rooting restrictions, soil stability, and presence of invasive or non-native species, weed control activities, and vegetation sampling to determine status of reclamation.

7.1 References

Axys Environmental Consulting Ltd. and David Walker & Associates. 1998. *Best Available Methods for Common Leaseholder Activities*. Jasper, Alberta. 144 pp.

Conclusion

ATCO Electric is proposing to construct and operate the Project connecting JNP with the Alberta electrical network. The current electrical generation network for JNP is nearing the end of its operational life, and ATCO Electric is proposing to construct a new 69-kV single-circuit transmission line spanning approximately 44.7 km from Jasper, Alberta to an AES interconnection point at the JNP boundary at SW 14-49-27 W5M. As part of the Project, ATCO Electric intends to construct a substation located within the Palisades site. When the substation is commissioned, ATCO Electric will decommission Palisades.

ATCO Electric conducted a feasibility study to determine the best solution to continue providing safe and reliable power to JNP for submission to the AESO. AESO determined that the Project, as presented, is the preferred solution.

The Project incorporates many special design and routing considerations to reduce potential adverse effects on the environment, visual resources, visitor experience, heritage resources, and the socio-economic environment. Special design and routing considerations included the following.

- Reducing new disturbance to environmental features by routing the proposed transmission line to follow existing transportation, utility, or oil and gas corridors for 99 percent of the total route length. Where feasible, the Project reuses the existing distribution power line alignment and has the distribution line understrung on the same structure.
- Further reducing new disturbance by locating the new substation within the existing fence line of the Palisades facility on previously disturbed land and decommissioning Palisades. As well as utilizing existing roadways and previously disturbed access routes and laydown areas for temporary workspace to support Project construction.
- Eliminating emissions associated with the operation of the diesel and natural gas-fueled Palisades facility.
- Preserving natural viewsapes by utilizing a specialized structure type in the proposed transmission line design that minimizes the height and width of the required structures.
- Reducing the impact of the Project on visitor experience in JNP by scheduling the proposed transmission line construction during off-peak season.
- Reducing fire risk and the risk of line contacts by using covered conductor technology on some portions of the proposed transmission line.

To date public and Indigenous engagement has included information sessions with interested groups, attendance at a Jasper Chamber of Commerce Annual General Meeting, Project introduction at the Jasper Indigenous forum, and newspaper articles. Following a period of public review and engagement activities, feedback received to date has been primarily positive with overall acceptance that the Project is needed and will be beneficial to JNP. ATCO Electric will consider and respond to the degree possible, the feedback received from the public and Indigenous groups including revisions to the Project (adjustments to Project footprint, timing of construction, mitigation measures). Project revisions or additional mitigation measures will be reflected in the final version of the DIA submitted to Parks Canada.

ATCO Electric submitted this DIA for the Project to meet Parks Canada's requirements under the *Parks Canada Directive on Impact Assessment, 2015*. Identification of the potential effects focuses on the VCs outlined in Terms of Reference for the Project and include:

- Landforms and Soils
- Vegetation
- Aquatic Wildlife and Ecosystems
- Wetlands and Hydrology
- Wildlife and Wildlife Habitat (including sensitive or unique ecosystem features)
- Air Quality and GHG Emissions
- Aesthetics and Visual Resources
- Visitor Experience Impacts
- Heritage Resources
- Socio-economic Impacts

A description of the existing conditions present along the Project Footprint was informed by a desktop review of existing literature and datasets, engagement with Parks Canada as well as field studies completed in 2015 and 2016 for some VCs. Recommended key mitigation measures to avoid or reduce the potential effects are described in Section 5, Effects Assessment. This DIA assessed potential residual effects of the Project that will remain following the implementation of key mitigation measures and characterized these effects. In addition, the DIA considers the Project's contribution to cumulative effects.

Potential effects from accidents and malfunctions, as well the effects of the environment on the Project was assessed. Information on site inspection, reclamation and remediation, monitoring, and consultation is provided.

ATCO Electric has been operating in JNP for many years and has a strong commitment to the environment and safety in its values, policies, and practices. CH2M concludes that potential effects of the Project can be avoided or reduced to acceptable levels based on the application of mitigation as described in the various sections of the DIA.