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BREEDING BIRD AND GROUND SQUIRREL SURVEYS

Icefields Trail Jasper National Park

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REPORT

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Executive Summary

The Parks Canada Agency is initiating work to conduct a Detailed Impact Analysis (DIA) at Jasper National Park, Alberta, for the Icefields Parkway Trail project. Biological surveys were completed in 2016 in advance of the DIA as specified in the Terms of Reference.

Wildlife surveys completed in 2016 included breeding bird surveys (BBS), following methods adapted from ESRD (2013) and Ralph (1993), and Columbian ground squirrel surveys, following methods adapted from Downey (2003).

During the BBS, completed from July 7 to 11, 2016, 294 individual birds of 29 species were observed. The most common species observed were yellow-rumped warbler *(Setophaga coronata)*, Swainson's thrush *(Catharus ustulatus)* and dark-eyed junco *(Junco hyemalis)*. Mean relative abundance was highest in the Hector 2 (HC2), Tyrrell 1 (TR1) and Hector 1 (HC1) ecosites. Mean species richness was highest in the TR1 and HC2 ecosites. Mean species diversity was highest in TR1, Ishbel 2 (IB2) and Num-Ti-Jah 2 (NT2) ecosites.

A total of 61 Columbian ground squirrels *(Spermophilus columbianus)* were observed at seven plots and four ecosites (Altrude 2 [AL2], Athabasca 1 [AT1], Cyclone 1 [CN1], and Peyto Lake 1 [PL1]) during surveys completed from July 7 to 11, 2016. Pikas were not a targeted species, however, they were incidentally observed at two locations.

Eight bird species provincially listed as Sensitive (ASRD 2010) were observed incidentally during wildlife surveys completed in 2016: barn swallow *(Hirundo rustica)*, Brewer's sparrow *(Spizella breweri)*, brown creeper *(Certhia americana)*, Clark's nutcracker *(Nucifraga columbiana)*, osprey *(Pandion haliaetus)*, pileated woodpecker *(Dryocopus pileatus)*, prairie falcon *(Falco mexicanus)*, and western wood-pewee *(Contopus sordidulus)*. Two federally listed bird species were observed incidentally within the LSA: barn swallow, listed as Threatened by COSEWIC, and Barrow's goldeneye *(Bucephala islandica)*, listed as Special Concern by COSEWIC and on Schedule 1 of the SARA (Government of Canada 2016).

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1.0 INTRODUCTION

The Parks Canada Agency (PCA) is initiating work to conduct a Detailed Impact Analysis (DIA) at Jasper National Park (JNP), Alberta. To support this DIA, various biological studies along the route were completed in the summer and fall of 2016. PCA proposes to construct a hardened surface, multiuse walking and cycling trail along the Icefields Parkway (Highway 93N), from the municipality of Jasper to the Columbia Icefield (approximately 107 km).

1.1 Objectives

The Terms of Reference document details the biological surveys required prior to initiating the Environmental Impact Assessment (EIA) for the proposed Icefields Parkway Trail project. The nature of these surveys is to provide detailed information on specific species and components of the environment in the immediate area of the proposed trail (i.e., 100 m of the proposed alignment). It is anticipated that the details and results obtained from these surveys may be incorporated and used to supplement a future EIA for this proposed project.

1.2 Background

JNP is situated within the Continental Ranges of the Southern Rocky Mountains. The macroclimate for JNP is continental with long cold winters and short cool summers with occasional hot spells (AIP 1983). However, the mountainous topography influences precipitation distribution, winds and intrusion of easterly Arctic air, causing climatic variation over short distances (AIP 1983).

The proposed Icefields Parkway Trail crosses the Montane and Subalpine Ecoregions. The Montane Ecoregion spans the elevation range between 1,000 m and 1,350 m and is characterized by vegetation dominated by Douglas fir *(Pseudotsuga menziesii)*, white spruce *(Picea glauca)*, aspen *(Populus tremuloides)* and grasslands (AIP 1983).

The Subalpine Ecoregion occurs at altitudes between 1,350 m to 2,200 m and is further divided into the Lower Subalpine and Upper Subalpine portions (AIP 1983). The predominant vegetation of the Lower Subalpine is closed coniferous forest, including mature stands dominated by Engelmann spruce *(Picea engelmannii)* and subalpine fir *(Abies lasiocarpa)* and seral stands of lodgepole pine *(Pinus contorta)* (AIP 1983). The Upper Subalpine portion is transitional between Lower Subalpine closed forest and treeless Alpine tundra. It is characterized by open forests and stunted tree growth with some Alpine floristic elements. Forests are usually dominated by Engelmann spruce and subalpine fir, while lodgepole pine is generally absent (AIP 1983).

The diverse habitats within JNP resulting from a broad elevational range and varied terrain support a rich bird community. The Rocky Mountains also represent the contact zone for many bird species characteristic of eastern Canada (e.g. blackpoll warbler *[Setophaga striata*) and western Canada (e.g. varied thrush *[Ixoreus naevius]*) (AIP 1983). Over 280 bird species have been documented within Banff and Jasper National Parks (AIP 1983). Many species are present only for relatively brief periods of time during the breeding season or migration and species diversity and richness is comparatively low in the winter (AIP 1983).

Bird diversity and species richness tends to be higher at low elevations, where several species of flycatchers, warblers and vireos occur (AIP 1983). Thrushes and sparrows are distributed across a wide range of elevations, from valley bottoms up to the alpine. Although species richness tends to be lower in the Alpine Ecoregion, during the breeding season it is inhabited by several specialist species such as white-tailed ptarmigan *(Lagopus leucura)*, American pipit *(Anthus rubescens), and* gray-crowned rosy-finch *(Leucosticte tephrocotis)* (AIP 1983).

JNP supports a large diversity of mammals including eight species of ungulates (AIP 1983). Some species (e.g. caribou *[Rangifer tarandus]* and moose *[Alces alces]*) spend the entire year within the parks while other species (e.g. elk *[Cervus canadensis]* and white-tailed deer *[Odocoileus virginianus]*) may winter outside the park because snow accumulation is too deep for efficient travel and foraging within the park (AIP 1983). The number of ungulates and other prey sustain a variety of carnivores such as wolves *(Canis lupus)*, cougars *(Puma concolor)* and both black bears *(Ursus americanus)* and grizzly bears *(Ursus arctos)*. There is a variety of small and medium sized mammals including seven species of bats, three species of lagomorphs, four species of shrews and 20 species of rodents (AIP 1983).

Amphibians and reptiles are less common. Of the six species, only the western toad *(Bufo boreas)* is widespread, while the remaining species are largely restricted to the lower elevations of the Montane Ecoretion (AIP 1983).

2.0 METHODS

This section presents the methods for each wildlife survey completed for the Project in 2016. Wildlife surveys were selected based on the Terms of Reference document and included field-based surveys for breeding birds (primarily migrant passerines) and Columbian ground squirrel surveys to detect colonies along the route.

Surveys were designed to align with the Alberta *Sensitive Species Inventory Guidelines* (ESRD 2013) and other recognized survey protocols. Surveys were completed at the scale of the Wildlife Local Study Area (LSA), which includes a 100 m buffer on either side of the proposed trail route.

2.1 Breeding Bird Survey

The objectives of the breeding bird survey were to determine the presence, distribution and relative abundance of native, non-invasive songbirds in and around the proposed Project alignment, with a focus on provincially and/or federally listed avian species at risk. Other groups of birds such as hummingbirds, waterfowl, shorebirds, raptors (including owls) and woodpeckers are occasionally observed during point counts, but are not target species in the point count method (Kirk et al. 1996; Schmiegelow et al. 1997) and were therefore treated observations of these species as incidental observations. Breeding bird survey methods were in accordance with standard technical procedures for point counts, based on methods described in Ralph (1993) and the Alberta *Sensitive Species Inventory Guidelines* (ESRD 2013) for boreal and foothill breeding songbirds.

Plot locations were selected within 100 m on either side of the proposed trail route to achieve good, even coverage of the Wildlife LSA and sample representative habitat types. Plots were sampled once (i.e., one replicate). Some plots may have been located slightly outside this 100 m buffer to sample a unique habitat or feature.

Point counts were conducted from half an hour before sunrise until 10 am (ESRD 2013). At each point count plot, the observer waited one minute to allow the birds to adjust to the observer's presence. A ten-minute passive listening period ensued during which all species heard or observed were recorded. Observations were divided into species observed or heard within 50 m, between 50 to 100 m, and greater than 100 m away. Observations were also separated into those observed between zero to three minutes, three to five minutes and five to ten minutes.

The approximate position of each individual bird in relation to the observer was illustrated on a sketch map of the point count plot. The abbreviated species name, sex (if known) and movements of individuals around the point count plot were recorded. Movements of identified species were monitored to reduce the probability of recounting birds in the same plot or in an adjacent plot.

Date, time, observer, point count plot number, GPS waypoint and birds flying through or above the canopy were recorded at each point count plot, as well as all incidental wildlife observations. Notes on land cover type (i.e., ecosite as per the Ecological Land Classification) were also recorded. Birds flying overhead or through the plot, but not making use of the plot, were recorded as incidental observations. To reduce bias in bird detection, point count surveys were not conducted during periods of high winds (greater than 20 km/h) and during precipitation or thick fog because these conditions can interfere with breeding behaviour and the ability of surveyors to detect vocalizations.

The BBS was completed during the bird nesting season for the region, when males are singing to attract mates and maintain territories. Breeding bird surveys were conducted from July 7 to 11, 2016. Although this is outside

the period recommended by ESRD (2013) (June 1 to July 7), survey timing was considered appropriate due to the high elevation of the area, where bird breeding season is delayed relative to lower elevations.

Data Analysis

Songbird community composition is described by calculating relative abundance (i.e., the number of individuals observed), species richness (i.e., the number of different species), and species diversity for each habitat group. Species diversity was calculated using the Shannon diversity index (Krebs 2009, Zar 1999):

$$H = -\sum_{i=1}^{S} p_i \ln p_i,$$

where H is the Shannon diversity index, S is the total number of species in the community (richness), i refers to each individual species, ln is the natural logarithm and p_i is the proportion of individuals recorded at a plot that is made up of a particular species.

The probability of detecting birds depends on a number of factors, such as habitat structure, wind conditions, hearing and identification ability of the observer, song intensity, perch height, and orientation of the songbird and distance from observer (Wolf et al. 1995, Diefenbach et al. 2003). Only birds detected within 50 m of plot centers were included in the descriptions of habitat associations for breeding bird analysis as a means of standardizing detection probability (Nichols et al. 2008).

Specific groups of birds were excluded from breeding bird analyses as these species are not adequately surveyed using standard point count methods (Kirk et al. 1996, Schmiegelow et al. 1997). The following taxonomic bird guilds known to breed in AB are not adequately inventoried by breeding bird point count surveys (Kirk et al. 1996, Schmiegelow et al. 1997):

- Order: Anseriformes (waterfowl: ducks, geese and swans)
- Order: Galliformes (grouse, ptarmigan, pheasants, quails)
- Order: Gaviiformes (loons)
- Order: Podicipediformes (grebes)
- Order: Suliformes (cormorants)
- Order: Pelecaniformes (pelicans, herons)
- Order: Accipitriformes (diurnal raptors: vultures, osprey, eagles, hawks)
- Order: Gruiformes (rails, cranes);
- Order: Charadriiformes (plovers, oystercatchers, stilts and avocets, sandpipers, gulls, terns, jaegers, alcids)
- Order: Columbiformes (doves)
- Order: Strigiformes (owls)
- Order: Caprimulgiformes (nighthawks and poorwills)
- Order: Apodiformes (swifts and hummingbirds);

- Order: Coraciiformes (kingfishers)
- Order: Piciformes (woodpeckers; except red-breasted sapsucker *[Sphyrapicus ruber]* because their peak season corresponds better with the BBS season than other woodpeckers)
- Order: Falconiformes (falcons)
- Order: Passeriformes. Family: Corvidae (crows and jays)

The BBS was conducted to collect data on native, non-invasive songbirds. Therefore, any observations of house sparrow (*Passer domesticus*), European starling *(Sturnus vulgaris)* and brown-headed cowbird *(Molothrus ater)* were excluded from the analysis. Birds not included in the analyses are reported as incidental observations (Section 3.3).

2.2 Columbian Ground Squirrel Survey

The objective of the Columbian ground squirrel *(Spermophilus columbianus)* survey is to document locations of colonies along the proposed trail route. In the absence of established survey protocols for Columbian ground squirrels, survey methods were adapted from protocols for Richardson's ground squirrel surveys (Downey 2003).

The Columbian ground squirrel survey was completed in early July, after the emergence of juveniles from natal burrows and before adult hibernation. Plot locations were established in areas with potentially suitable habitat (i.e. meadows, grasslands and forest openings) within 100 m on either side of the proposed trail route. A two-minute point count was conducted at each plot location, during which all ground squirrels detected within 200 m of plot centre were recorded. Date, time, observer, plot number, GPS waypoint, weather conditions and notes on habitat were recorded at each plot location.

Point counts were conducted from 9:30 am to 1:30 pm to capture the period when ground squirrels are most likely to be actively foraging above ground. Surveys were not conducted during precipitation, temperatures greater than 30^{o}C, or when winds exceeded 29 km/h (> Beaufort 5) because these conditions can affect ground squirrel activity.

2.3 Incidental Observations

Incidental wildlife observations, including mammal, amphibian and bird species of concern were recorded opportunistically. Species of concern were identified as those listed federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the *Species At Risk Act* (SARA), or provincially by AEP (Government of Canada 2016, ASRD 2010). Observations were recorded by handheld GPS units. The number of individuals and their habitat associations were also recorded.

3.0 RESULTS

3.1 Breeding Bird Survey

One hundred and one breeding bird point count plots, representing 20 ecosites, were surveyed from July 7 to 11, 2016 (Table 1; Appendix 1). Weather conditions during the survey consisted of temperatures ranging from 4 to 15°C, light to moderate winds, and variable cloudiness. Light precipitation was encountered on the morning of July 11 but did not appear to significantly affect bird activity.

Table 1: Ecosites Sampled during Breeding Bird Surveys within the Wildlife LSA, 2016.

Ecosection[a]	Ecosite[a]	Number of Plots	Percent of Total Plots
Altrude	AL2	4	4.0
Athabasca	AT1	18	17.8
Baker Creek	BK1	3	3.0
Bryant	BY2	3	3.0
Cyclone	CN1	3	3.0
Consolation Valley	CV1	1	1.0
Fireside	FR1	7	6.9
Hector	HC1	3	3.0
	HC2	2	2.0
	HC4	2	2.0
Hillsdale	HD1	4	4.0
Ishbel	IB2	1	1.0
Moraine Lake	ML2	2	2.0
Num-Ti-Jah	NT2	1	1.0
Norquay	NY3	1	1.0
Pit	P	2	2.0
Pipestone	PP4	2	2.0
Panorama Ridge	PR2	15	14.9
	PR3	1	1.0
	PR6	6	5.9
Patricia	PT1	11	10.9
	PT5	1	1.0
Tyrrell	TR1	1	1.0
Verdant	VD2	3	3.0
Vermillion Lakes	VL3	4	4.0
Total		101	100.0

[a] AIP (1983).
[b] Numbers may not sum exactly due to rounding.

A total of 29 species and 294 individuals were recorded in the Wildlife LSA during the BBS (Table 2). The only species at risk detected was the brown creeper *(Certhia americana)* which is provincially listed as Sensitive (ASRD 2010). The yellow-rumped warbler *(Setophaga coronata)* was the most commonly detected species (n = 52, 33% of plots). Other commonly observed species included the Swainson's thrush *(Catharus ustulatus)* (n = 41; 31% of plots) and dark-eyed junco (*Junco hyemalis*) (n = 42; 22% of plots), which together with yellow-rumped warbler represented nearly half (46%) of total observations.

Table 2: Breeding Bird Observations within the Wildlife LSA Included in Data Analysis.

Species	Total Number Observed	Percent of Total Observations	Percent of Point Count Plots with Detections	Ecosites with Detections[a]	Alberta Status [b]	COSEWIC Status[c]	SARA Status[c]
American robin	11	3.8	9.9	AT1, BY2, CN1, PR2, PR6, PT1, VL3	Secure	-	-
black-capped chickadee	1	0.3	1.0	PT1	Secure	-	-
boreal chickadee	9	3.1	2.0	HC1, PR2	Secure	-	-
brown creeper	3	1.0	2.0	FR1, PR6	Sensitive	-	-
cedar waxwing	17	5.8	8.9	AL2, AT1, BK1, HC1, PR2, PR6, PT1	Secure	-	-
chipping sparrow	19	6.5	14.9	AL2, AT1, BK1, CN1, HC1, HC2, PR2, PT1, TR1	Secure	-	-
clay-coloured sparrow	1	0.3	1.0	TR1	Secure	-	-
dark-eyed junco	42	14.3	21.8	AT1, BK1, CN1, FR1, HC2, IB2, PR2, PR6, PT1, VL3	Secure	-	-
fox sparrow	5	1.7	4.0	CN1, NT2, TR1	Secure	-	-
golden-crowned kinglet	36	12.3	19.8	AL2, AT1, FR1, HC1, HC2, HD1, UB2, PR2, PR6, PT1, VD2, VL3	Secure	-	-
Hammond's flycatcher	6	2.0	5.9	AT1, HD1, VL3	Secure	-	-
hermit thrush	1	0.3	1.0	PR2	Secure	-	-
Lincoln's sparrow	9	3.1	7.9	CN1, HC1, HC2, NT2, PR6, PT1, TR1, VL3	Secure	-	-
mountain chickadee	4	1.4	1.0	AT1	Secure	-	-
orange-crowned warbler	2	0.7	2.0	AT1, TR1	Secure	-	-
Pacific Wren	1	0.3	1.0	PT1	Secure	-	-
pine siskin	5	1.7	4.0	AL2, BY2, HC2, PR2	Secure	-	-
red-breasted nuthatch	1	0.3	1.0	HD1	Secure	-	-
ruby-crowned kinglet	8	2.7	4.0	BY2, HC2, PT1	Secure	-	-
savannah sparrow	1	0.3	1.0	PP4	Secure	-	-
Swainson's thrush	41	14.0	30.7	AL2, AT1, BY2, FR1, HD1, IB2, ML2, P, PR2, PR6, PT1, VD2, VL3	Secure	-	-
Tennessee warbler	4	1.4	3.0	CN1, PT1, VL3	Secure	-	-
Townsend's solitaire	1	0.3	1.0	PR2	Secure	-	-
varied thrush	4	1.4	4.0	HC1, ML2, PR2, PR6	Secure	-	-
white-crowned sparrow	2	0.7	2.0	CN1, NT2	Secure	-	-
white-throated sparrow	6	2.0	5.9	HD1, ML2, PR6, PT1, VL3	Secure	-	-

Table 2: Breeding Bird Observations within the Wildlife LSA Included in Data Analysis.

Species	Total Number Observed	Percent of Total Observations	Percent of Point Count Plots with Detections	Ecosites with Detections[a]	Alberta Status [b]	COSEWIC Status[c]	SARA Status[c]
Wilson's warbler	1	0.3	1.0	CN1	Secure	-	-
yellow-rumped warbler	52	17.7	32.7	AL2, AT1, BK1, BY2, FR1, HC1, HC2, HD1, ML2, NY3, PR2, PR3, PR6, PT1, PT5, TR1, VD2	Secure	-	-

[a] AIP (1983).

[b] ASRD (2010).

[c] Government of Canada (2016).

- = No status.

Relative Abundance, Species Richness, and Species Diversity

Mean relative abundance was highest in the Hector 2 (HC2), Tyrell 1 (TR1) and Hector 1 (HC1) ecosites (10.0, 8.0, and 6.7 birds/plot, respectively; Table 3). Mean species richness was highest in the TR1 and HC2 ecosites (6.0 and 3.5 birds/plot, respectively; Table 3). Mean species diversity was highest in TR1, Ishbel 2 (IB2) and Num-Ti-Jah (NT2) ecosites (1.67, 1.10, and 1.04, respectively; Table 3). There were no bird detections within 50 m of plot centre at BBS plots in the Consolation Valley 1 (CV1) and Hector 4 (HC4) ecosites. Thus, these ecosites had the lowest mean abundance, mean species richness and mean species diversity (Table 3).

Table 3: Breeding Bird Relative Abundance, Species Richness, and Species Diversity by Ecosite in the Wildlife LSA.

Ecosite	Plots		Relative Abundance		Species Richness		Species Diversity	
	Number	Percent (%) of Total Plots	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
AL2	4	4.0	2.00	1.41	2.00	1.41	0.72	0.52
AT1	18	17.8	3.50	4.74	1.67	1.03	0.48	0.44
BK1	3	3.0	2.00	2.65	1.33	1.53	0.32	0.55
BY2	3	3.0	4.00	3.61	2.33	1.53	0.62	0.61
CN1	3	3.0	3.33	3.21	3.00	2.65	0.81	0.88
CV1	1	1.0	0	n/a	0	n/a	0	n/a
FR1	7	6.9	2.71	1.89	2.00	1.29	0.63	0.50
HC1	3	3.0	6.67	9.87	2.33	2.52	0.72	0.74
HC2	2	2.0	10.00	12.73	3.50	3.54	0.80	1.12
HC4	2	2.0	0	0.00	0	0.00	0	0
HD1	4	4.0	2.50	1.73	2.25	1.26	0.68	0.54
IB2	1	1.0	3.00	n/a	3.00	n/a	1.10	n/a
ML2	2	2.0	2.50	0.71	2.50	0.71	0.90	0.29
NT2	1	1.0	4.00	n/a	3.00	n/a	1.04	n/a
NY3	1	1.0	2.00	n/a	1.00	n/a	0	n/a
P	2	2.0	0.50	0.71	0.50	0.71	0	0
PP4	2	2.0	0.50	0.71	0.50	0.71	0	0
PR2	15	14.9	2.13	1.73	1.80	1.42	0.53	0.53
PR3	1	1.0	1.00	n/a	1.00	n/a	0	n/a
PR6	6	5.9	3.67	3.44	2.33	1.86	0.67	0.62
PT1	11	10.9	2.55	1.29	2.27	1.19	0.76	0.46
PT5	1	1.0	1.00	n/a	1.00	n/a	0	n/a
TR1	1	1.0	8.00	n/a	6.00	n/a	1.67	n/a
VD2	3	3.0	2.33	2.08	1.67	1.53	0.56	0.52
VL3	4	4.0	2.75	1.26	2.25	0.96	0.69	0.51
AL2	4	4.0	2.00	1.41	2.00	1.41	0.72	0.52

3.2 Columbian Ground Squirrel Survey

Thirty-one plots, representing 13 ecosites or landscapes, were surveyed during the Columbian ground squirrel survey conducted from July 7 to 11, 2016 (Table 4; Appendix 1). Weather conditions during the survey consisted of temperatures ranging from 10 to 19°C, light to moderate winds, and a few clouds. Light precipitation was encountered at two plots.

Columbian ground squirrels were observed at seven plots and four ecosites (Table 4; Appendix 1). A total of 61 individuals were observed, with the highest number observed in the Athabasca 1 (AT1) ecosite.

Table 4: Columbian Ground Squirrel Observations by Ecosite within the Wildlife LSA, 2016.

	Ecosite[(a)]	Number of Plots	Percent of Total Plots	Plots with Detections	Percent of Plots with Detections	Total Detected
Ecosections[(a)]						
Altrude	AL2	1	3.2	1	100	6
Athabasca	AT1	4	12.9	3	75	49
Cyclone	CN1	1	3.2	1	100	2
Fireside	FR1	1	3.2	0	0	0
Hector	HC1	1	3.2	0	0	0
	HC4	2	6.5	0	0	0
Num-Ti-Jah	NT2	1	3.2	0	0	0
Peyto Lake	PL1	2	6.5	2	100	4
Pipestone	PP4	2	6.5	0	0	0
Verdant	VD2	1	3.2	0	0	0
Vermillion Lakes	VL1	2	6.5	0	0	0
	VL3	4	12.9	0	0	0
Miscellaneous Landscapes[(a)]						
Pit	P	9	29.0	0	0	0
Total		31	100	7	22.6	61

[(a)] AIP (1983).

One golden-mantled ground squirrel *(Spermophilus lateralis)* was also observed in the Pipestone 4 (PP4) ecosite.

Pikas were not targeted during ground squirrel surveys but they were detected incidentally at two locations within the Wildlife LSA (Appendix 1). One pika was heard calling from a talus slope in the Patricia 1(PT1) ecosite and four pikas were observed in a boulder field in the Ishbel 2 (IB2) ecosite.

3.3 Incidental Observations

A total of 603 individual birds, representing 58 species, were recorded incidentally within the Wildlife LSA (Table 5). This includes species observed during BBS but excluded from the data analysis because these records were flyovers, fly-throughs, observed more than 50 m from the plot centre, or represent species not adequately surveyed using the point count method (Section 2.1).

Eight of those species are provincially listed as Sensitive: barn swallow *(Hirundo rustica)*, Brewer's sparrow *(Spizella breweri)*, brown creeper, Clark's nutcracker *(Nucifraga columbiana)*, osprey *(Pandion haliaetus)*, pileated woodpecker *(Dryocopus pileatus)*, prairie falcon *(Falco mexicanus)*, and western wood-pewee *(Contopus*

sordidulus) (ASRD 2010). The barn swallow is also federally listed as Threatened by COSWEIC (Government of Canada 2016). The Barrow's goldeneye *(Bucephala islandica)* is provincially listed as Secure, but federally listed as Special Concern by COSEWIC and on Schedule 1 of the SARA (Government of Canada 2016). Locations of listed species observations are illustrated in Appendix 1.

In addition, six mammal species were observed incidentally within the Wildlife LSA (Table 5).

Table 5: Incidental Wildlife Observations within the Wildlife LSA.

Species[(a)]	Number Observed
Birds	
American crow	24
American robin	47
American three-toed woodpecker	7
barn swallow	3
Barrow's goldeneye	***1***
boreal chickadee	15
Brewer's sparrow	2
brown creeper	1
brown-headed cowbird	1
Cassin's vireo	1
cedar waxwing	10
chipping sparrow	32
Clark's nutcracker	***2***
clay-coloured sparrow	3
common loon	1
common raven	15
dark-eyed junco	45
evening grosbeak	1
fox sparrow	7
golden-crowned kinglet	16
gray jay	11
greater yellowlegs	2
Hammond's flycatcher	2
hermit thrush	25
Lincoln's sparrow	26
Macgillivray's warbler	1
merlin	2
mountain bluebird	1
northern flicker	2
northern waterthrush	1
orange-crowned warbler	3
osprey	2
Pacific Wren	2
Pacific-slope flycatcher	1
pileated woodpecker	4
pine siskin	28
prairie falcon	***1***
red crossbill	1

Table 5: Incidental Wildlife Observations within the Wildlife LSA.

Species[(a)]	Number Observed
red-breasted nuthatch	4
red-tailed hawk	1
ruby-crowned kinglet	4
ruffed grouse	2
rufous hummingbird	1
savannah sparrow	1
solitary sandpiper	1
spotted sandpiper	8
Swainson's thrush	108
Tennessee warbler	7
Townsend's solitaire	5
varied thrush	22
warbling vireo	5
western wood-pewee	1
white-crowned sparrow	18
white-throated sparrow	11
white-winged crossbill	1
Wilson's snipe	8
Wilson's warbler	1
yellow-rumped warbler	45
Mammals	
American pika	5
American pine marten	1
black bear	2
elk	11
mountain goat	6
white-tailed deer	4

[(a)] Species in *italics* and **bold** = provincially (ASRD 2011) or federally listed by COSEWIC or SARA (Government of Canada 2016).

4.0 SUMMARY

4.1 Breeding Bird Survey

During the BBS, completed from July 7 to 11, 2016, 294 individual birds of 29 species were observed. The most common species observed were yellow-rumped warbler, Swainson's thrush and dark-eyed junco. Mean relative abundance was highest in the HC2, TR1 and HC1 ecosites. Mean species richness was highest in the TR1 and HC2 ecosites. Mean species diversity was highest in TR1, IB2 and NT2 ecosites.

Eight bird species provincially listed as Sensitive (ASRD 2010) were observed during breeding bird surveys or incidentally: barn swallow, Brewer's sparrow, brown creeper, Clark's nutcracker, osprey, pileated woodpecker, prairie falcon, and western wood-pewee. Two federally listed species were observed incidentally within the LSA: barn swallow, listed as Threatened by COSEWIC, and Barrow's goldeneye, listed as Special Concern by COSEWIC and on Schedule 1 of the SARA (Government of Canada 2016).

4.2 Columbia Ground Squirrel Survey

A total of 61 Columbian ground squirrels were observed at seven plots and four ecosites (AL2, AT1, CN1, and PL1) during surveys completed from July 7 to 11, 2016. Pikas were incidentally observed at two locations along the proposed alignment.

5.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned

GOLDER ASSOCIATES LTD.

Ilya Povalyaev, B.Sc.
Wildlife Biologist

Corey De La Mare, P.Biol
Principal, Senior Ecologist

https://capws.golder.com/sites/p1659727icefieldstrailbiophysicalfieldsurveys/6000_reporting/6007_breedingbird/jnp icefields report wildlife_reva.docx

6.0 LITERATURE CITED

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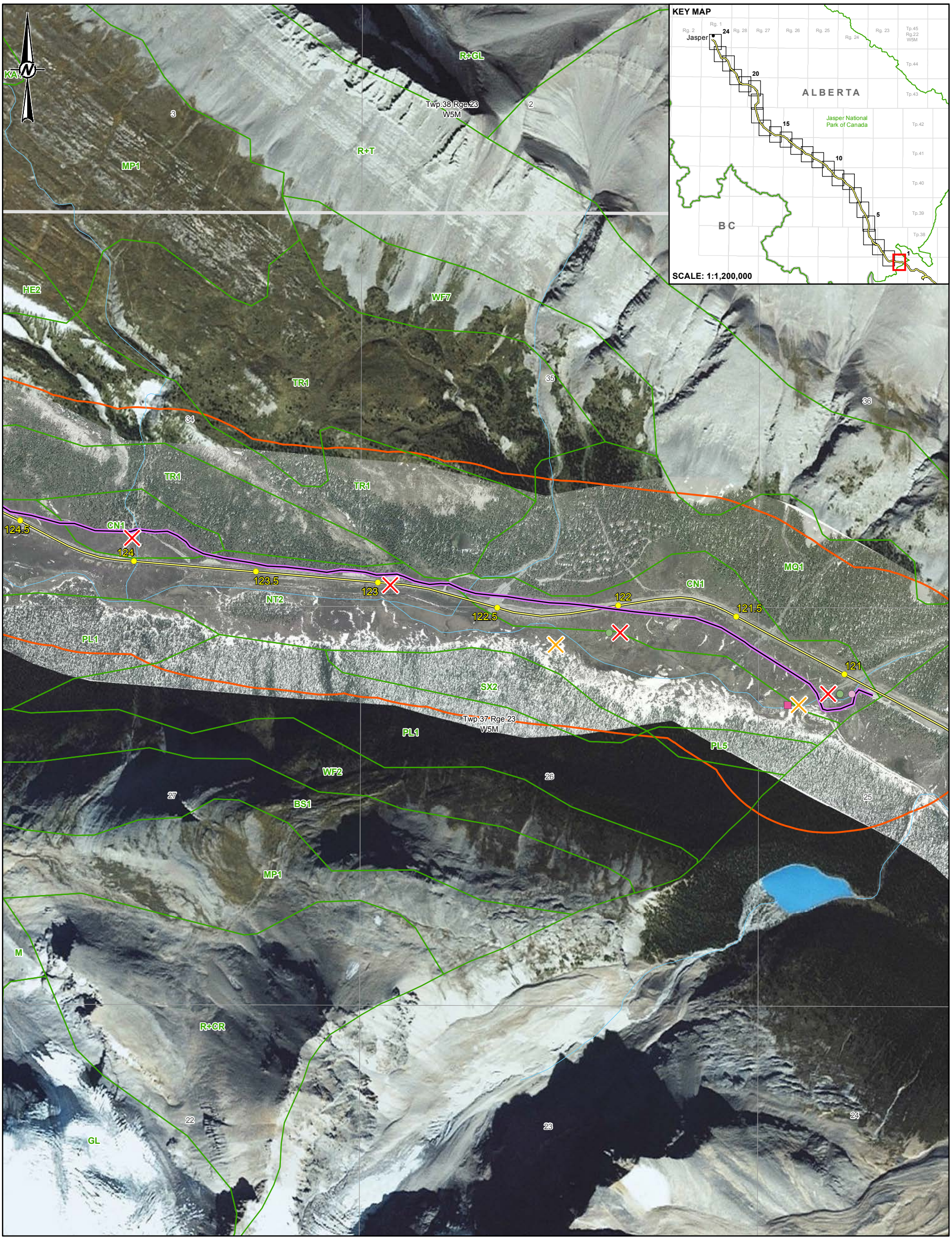
APPENDIX A

Wildlife Survey Locations and Species Observations



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- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- BREWER'S SPARROW
- CLARK'S NUTCRACKER

GROUND SQUIRREL OBSERVATIONS

- COLUMBIAN GROUND SQUIRREL

0 400 800

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REFERENCE(S)

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CONSULTANT
Golder Associates

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APPROVED	CDM

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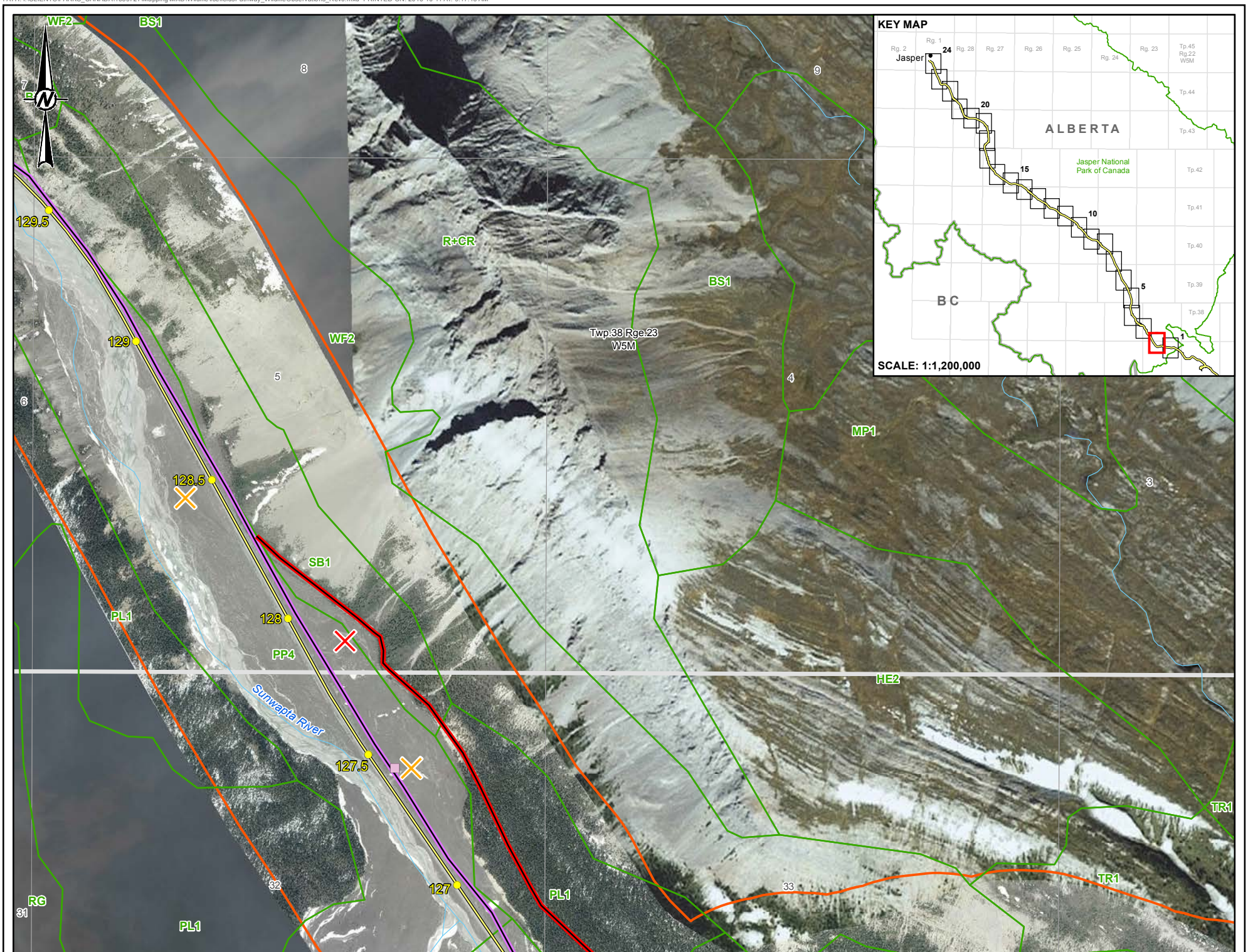

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- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

GROUND SQUIRREL OBSERVATIONS

- COLUMBIAN GROUND SQUIRREL
- GOLDEN-MANTLED GROUND SQUIRREL

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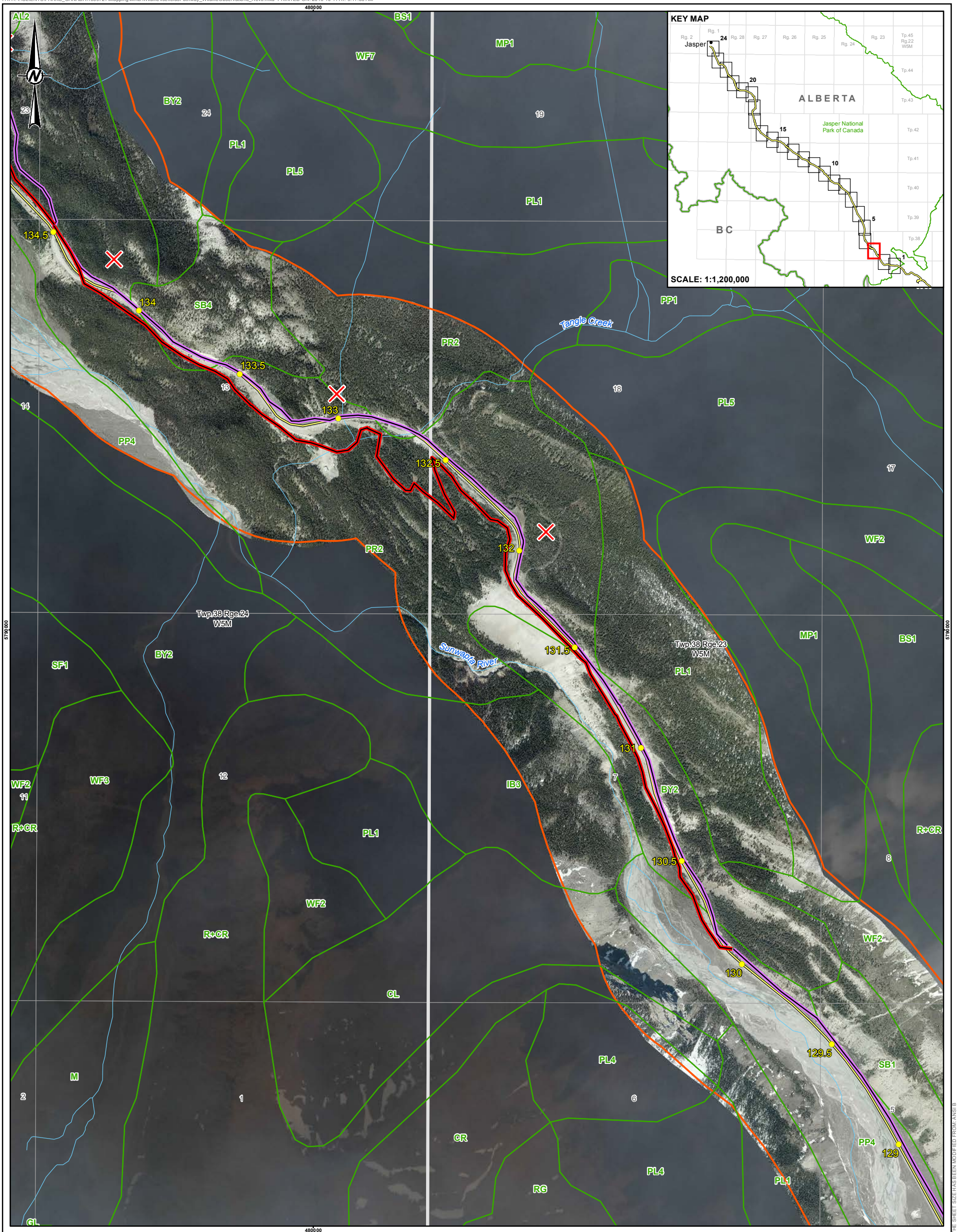

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- WATERCOURSE
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- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION

0 400 800

1:15,000 METRES

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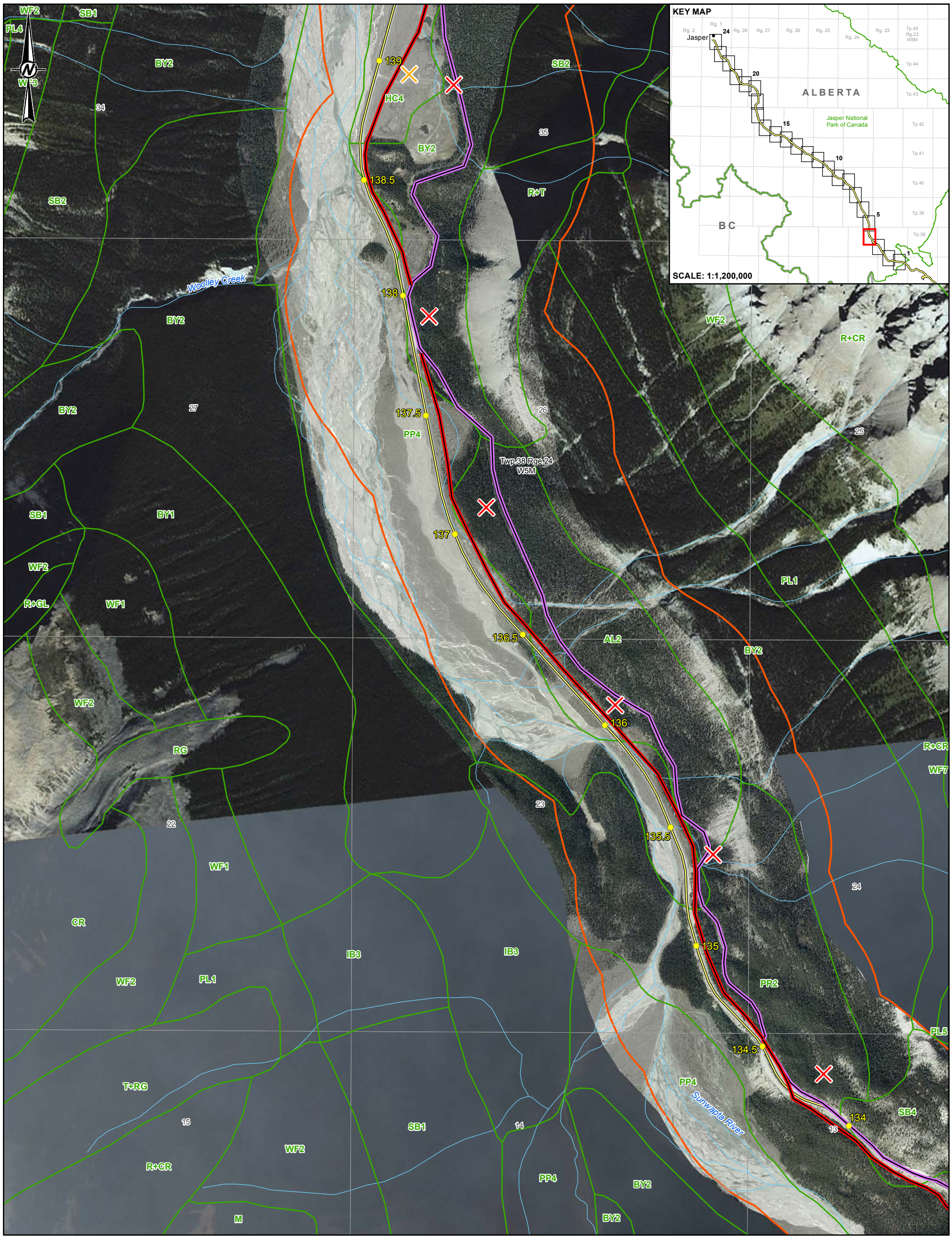

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- PROPOSED TRAIL ROUTE
- WATERCOURSE
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- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

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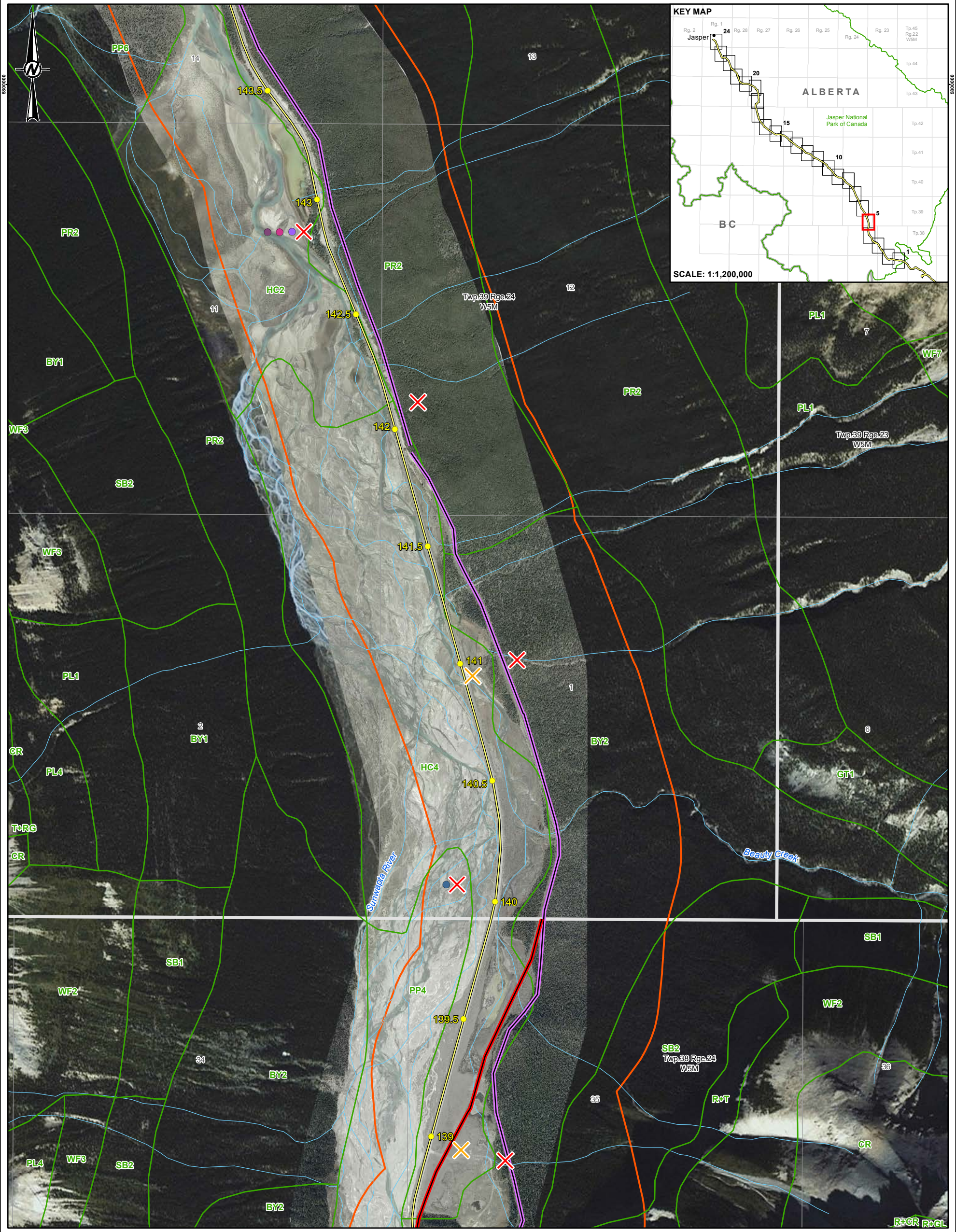

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- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- BARROW'S GOLDENEYE
- BARN SWALLOW
- OSPREY
- PRAIRIE FALCON

0 400 800

1:15,000 METRES

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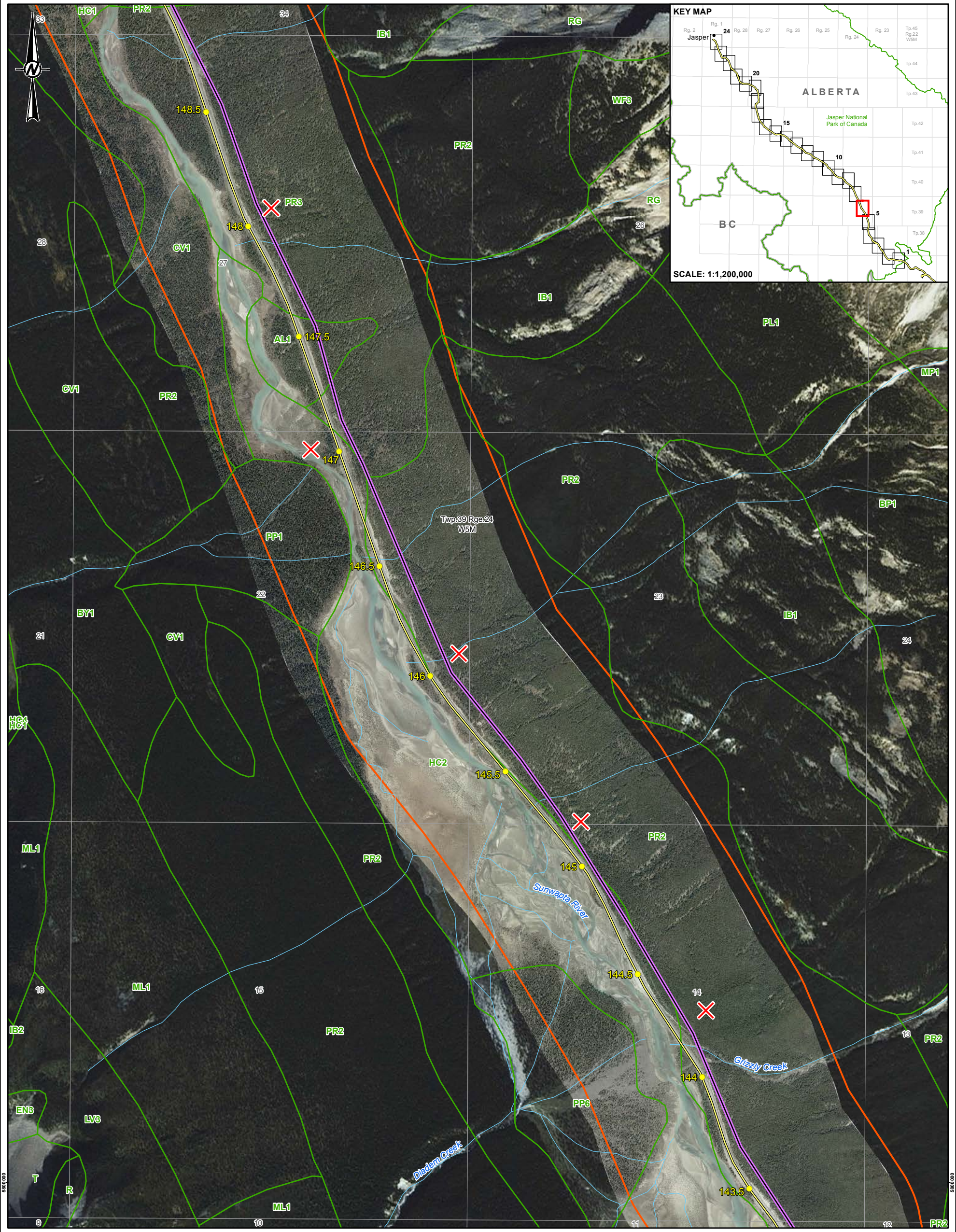

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- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION

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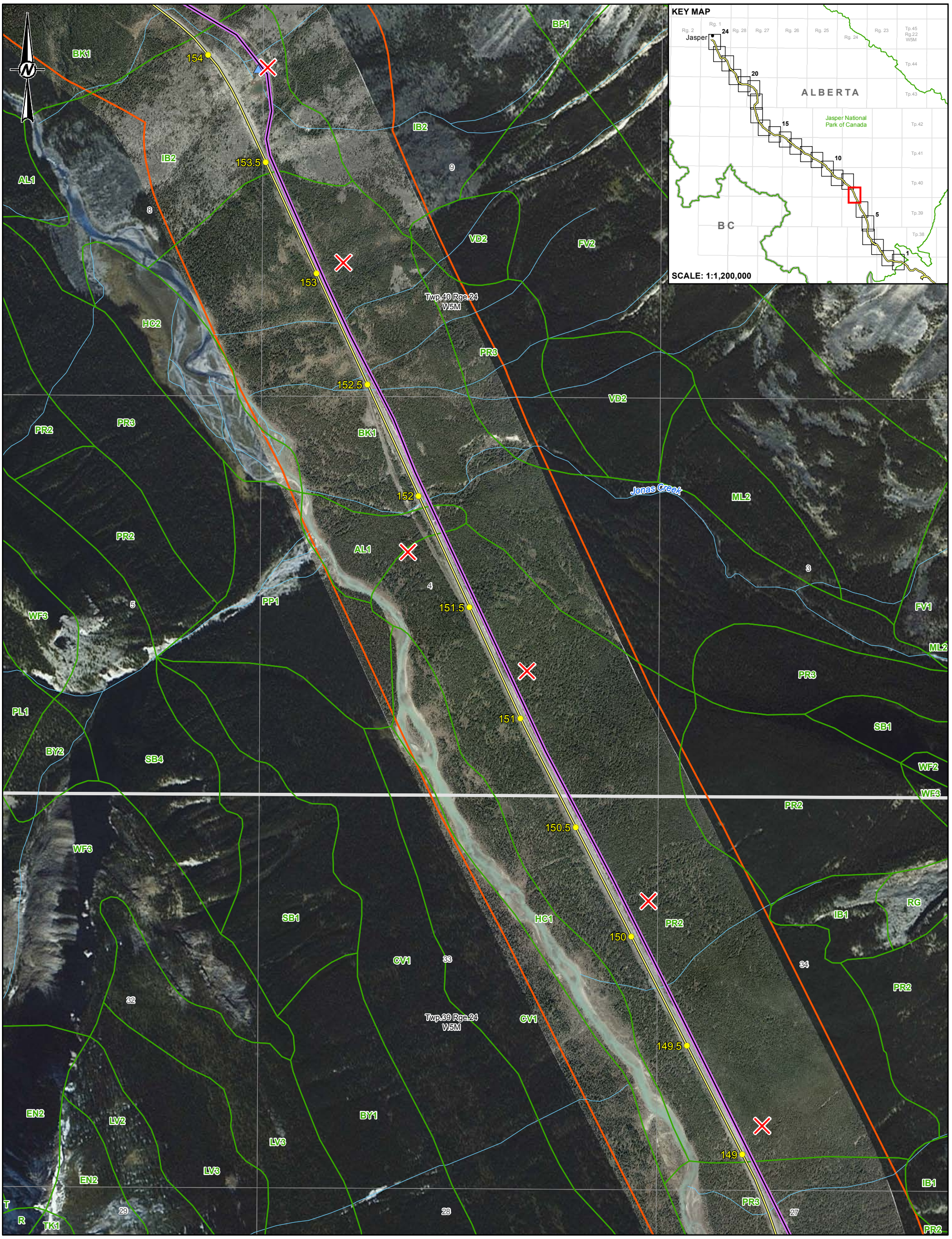

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SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION

PIKA OBSERVATION

- PIKA

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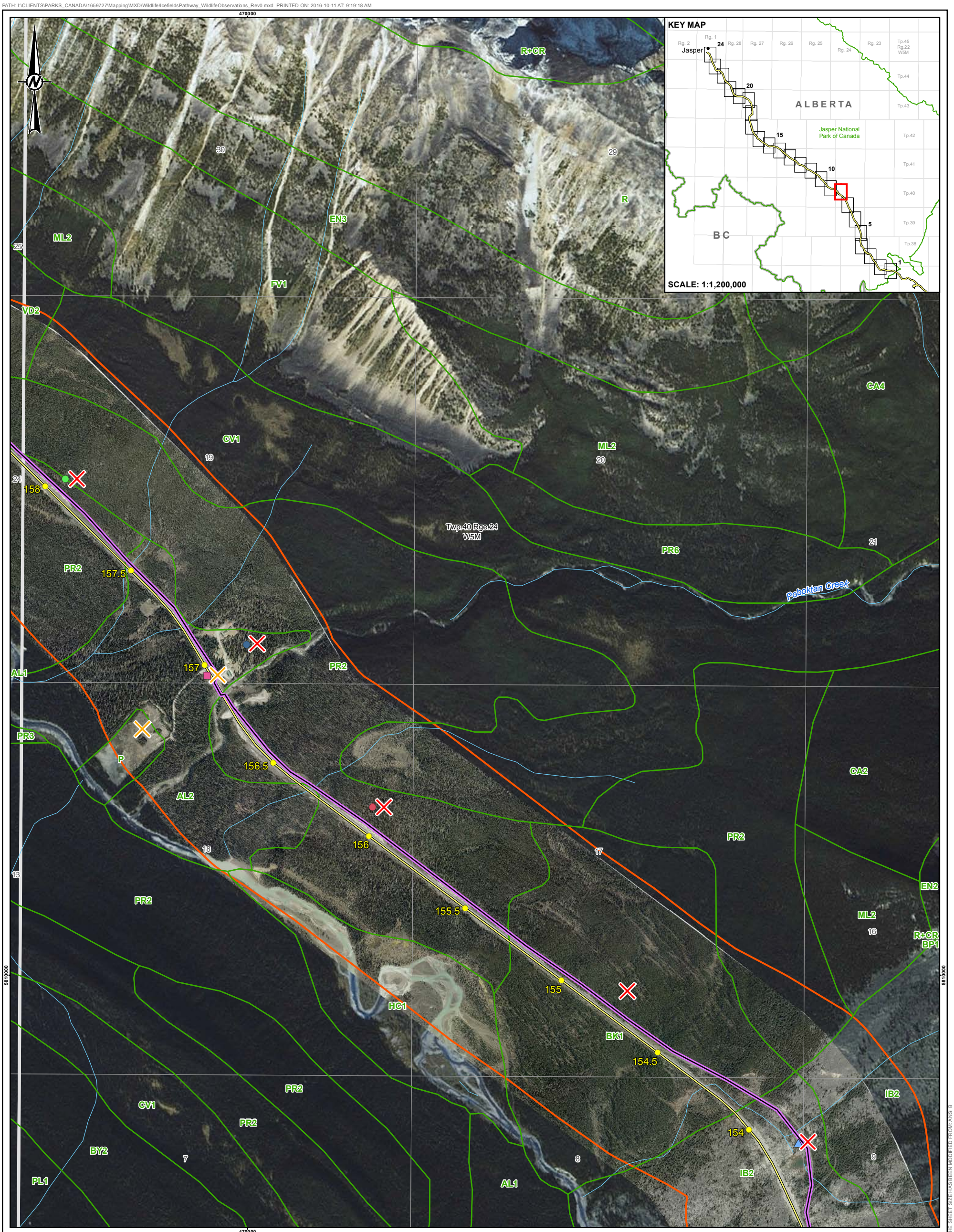

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- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- BROWN CREEPER
- OSPREY
- PILEATED WOODPECKER

GROUND SQUIRREL OBSERVATIONS

- COLUMBIAN GROUND SQUIRREL

PIKA OBSERVATION

- PIKA

0 400 800

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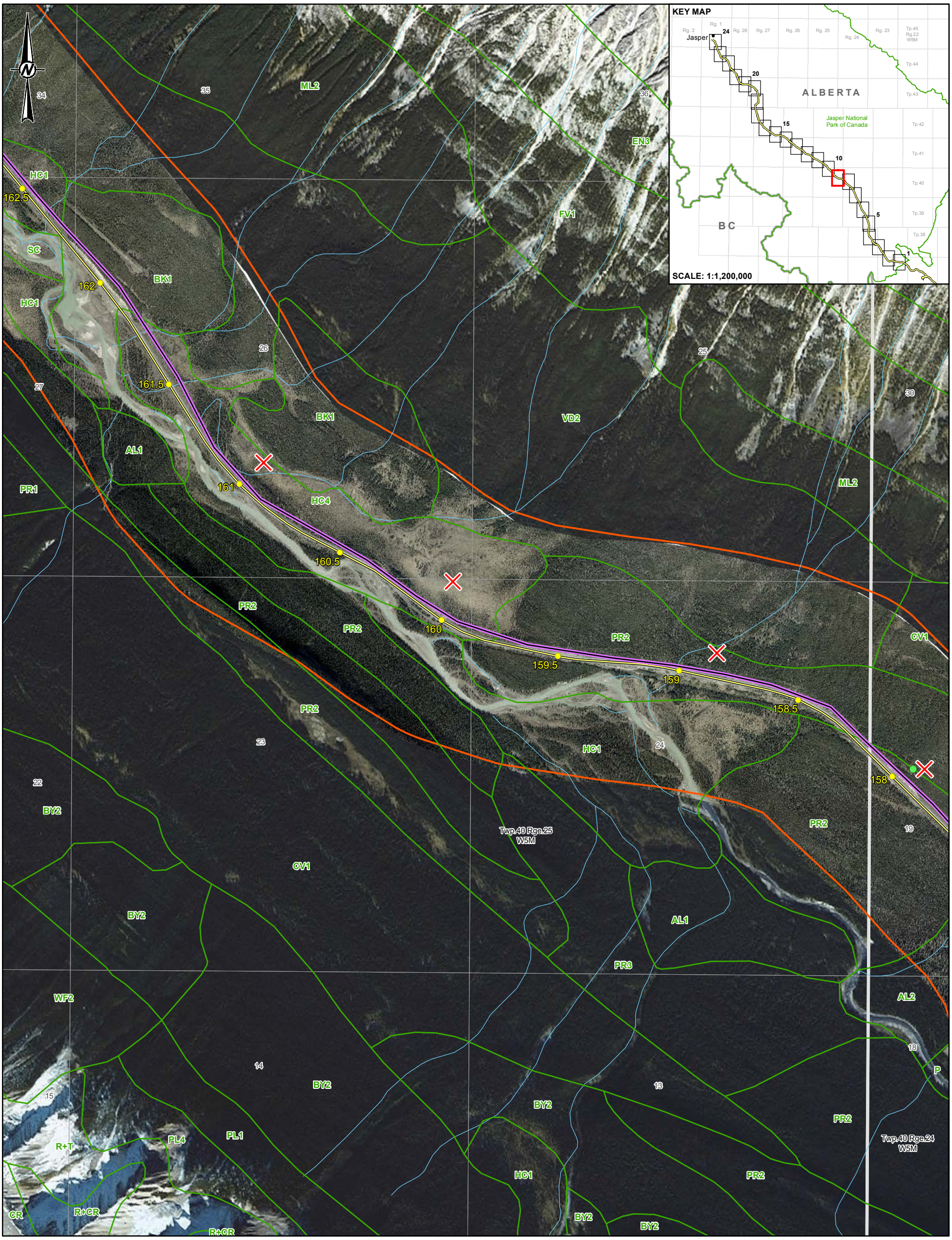

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- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- PILEATED WOODPECKER

0 400 800

1:15,000 METRES

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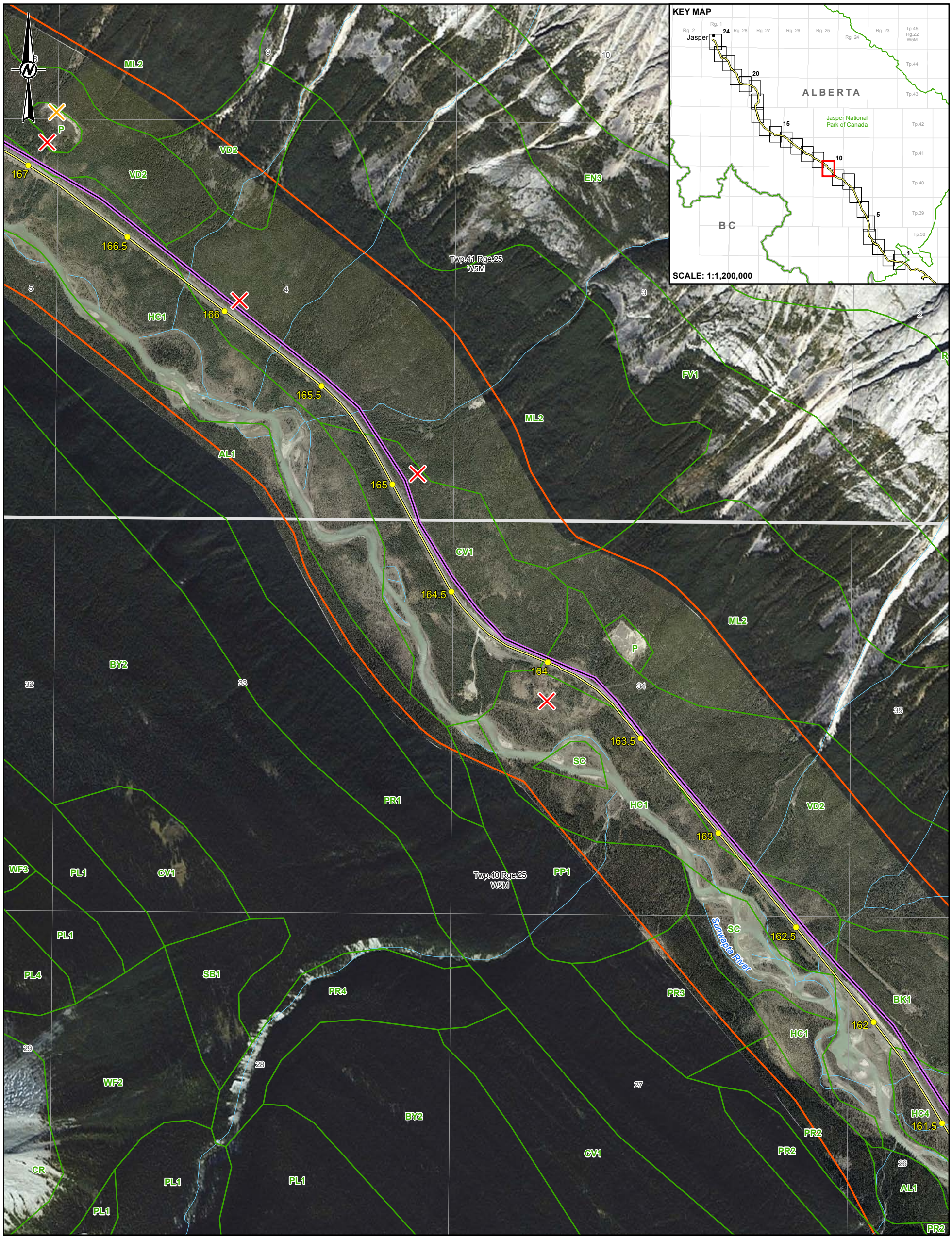

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- HIGHWAY 93N
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

0 400 800

1:15,000 METRES

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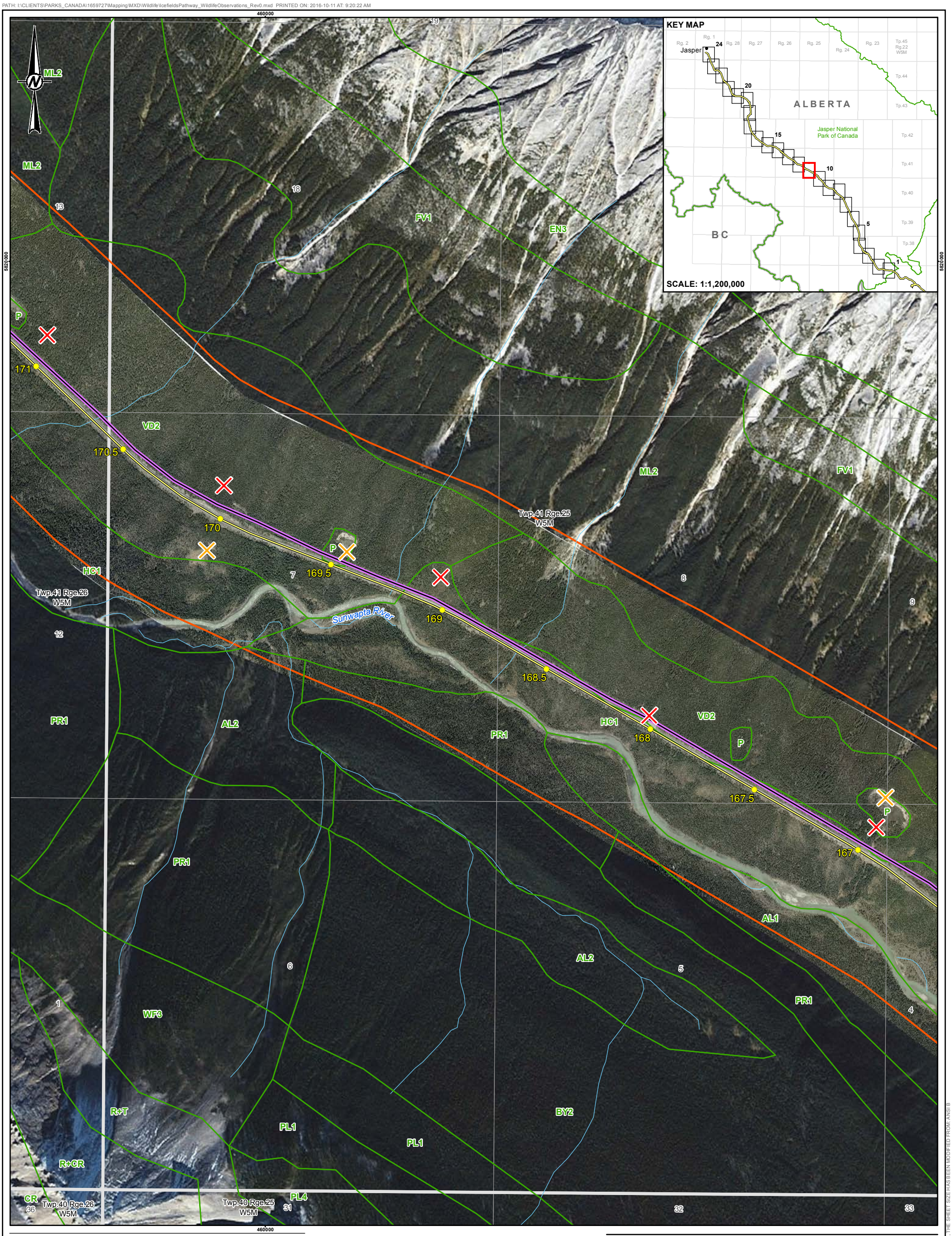

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

0 400 800

1:15,000 METRES

REFERENCE(S)

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
DESIGNED	IP
PREPARED	RC
REVIEWED	IP
APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	11

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25mm

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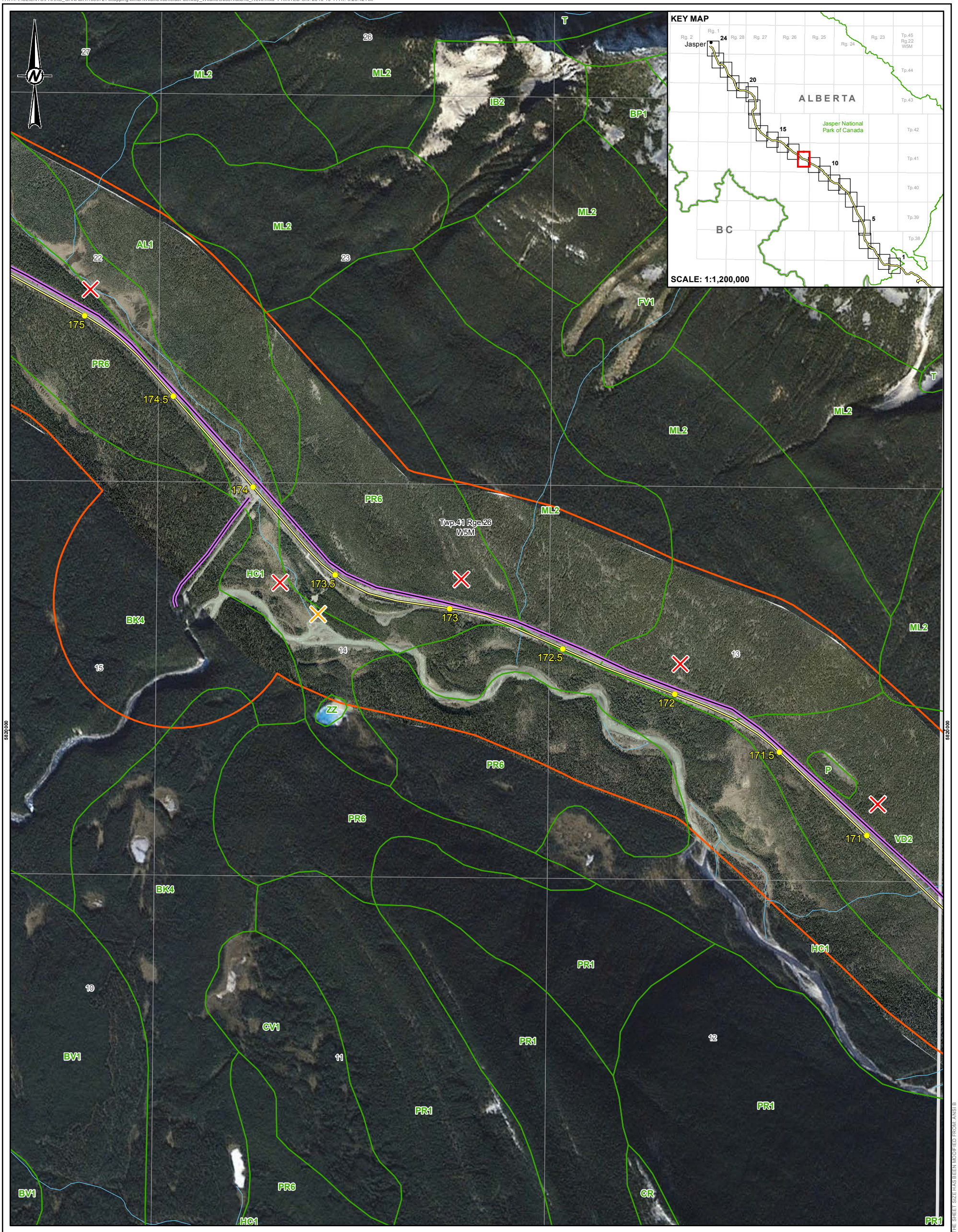

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

0 400 800
1:15,000 METRES

REFERENCE(S)

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
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APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	12

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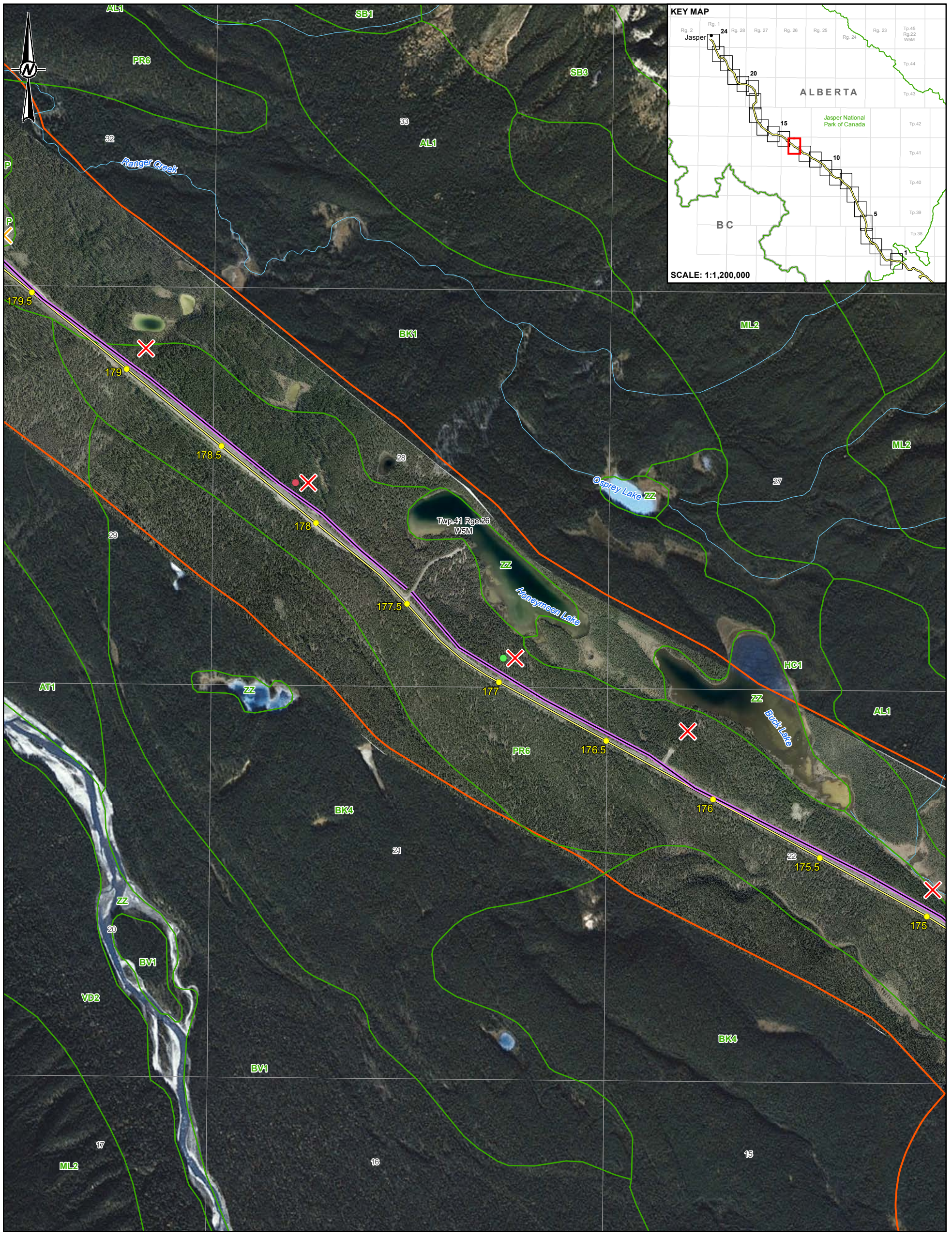

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- BROWN CREEPER
- PILEATED WOODPECKER

0 400 800

1:15,000 METRES

REFERENCE(S)

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
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APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	13

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25mm

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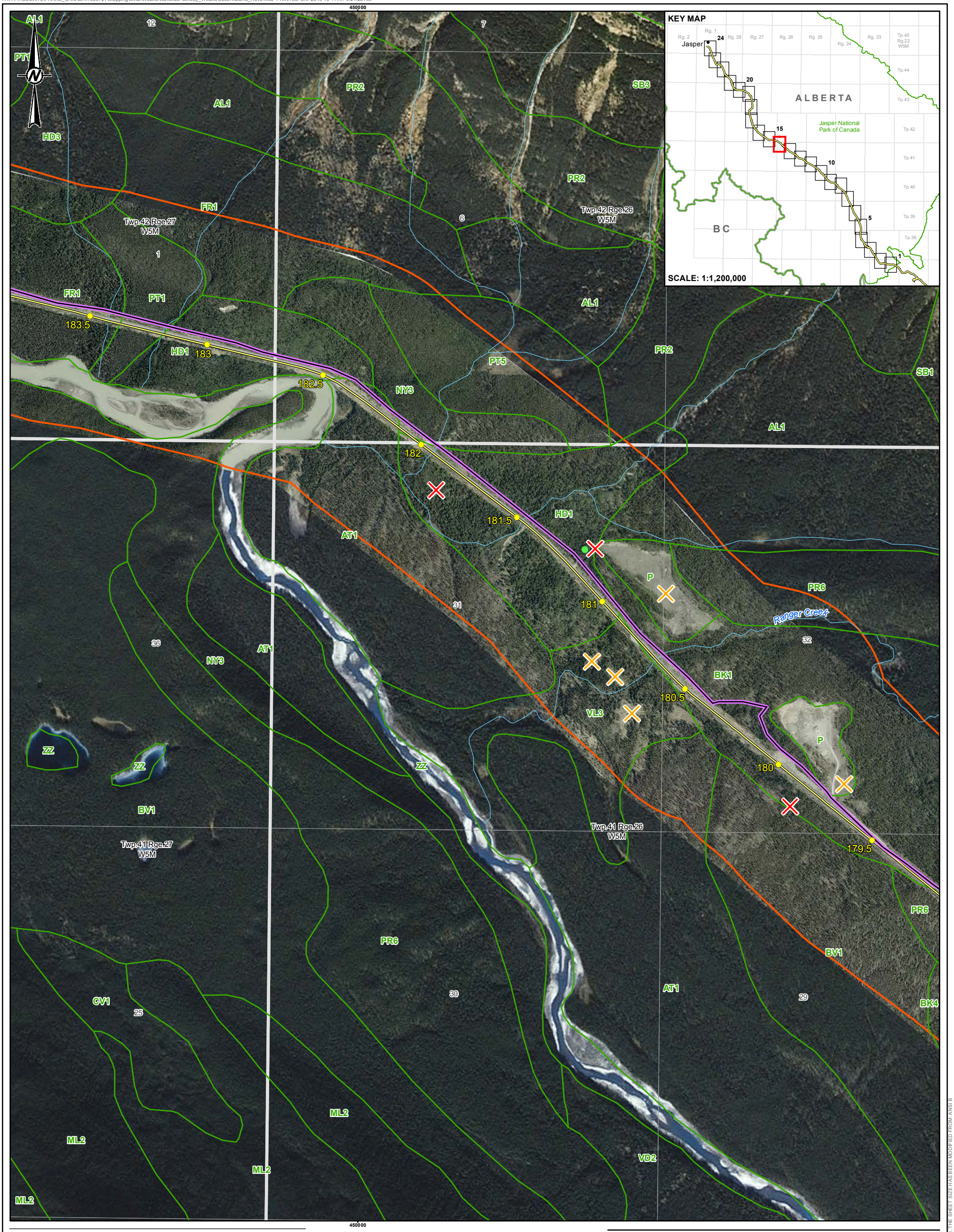

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- PILEATED WOODPECKER

0 400 800

1:15,000 METRES

REFERENCE(S)

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CLIENT
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PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

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APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	14

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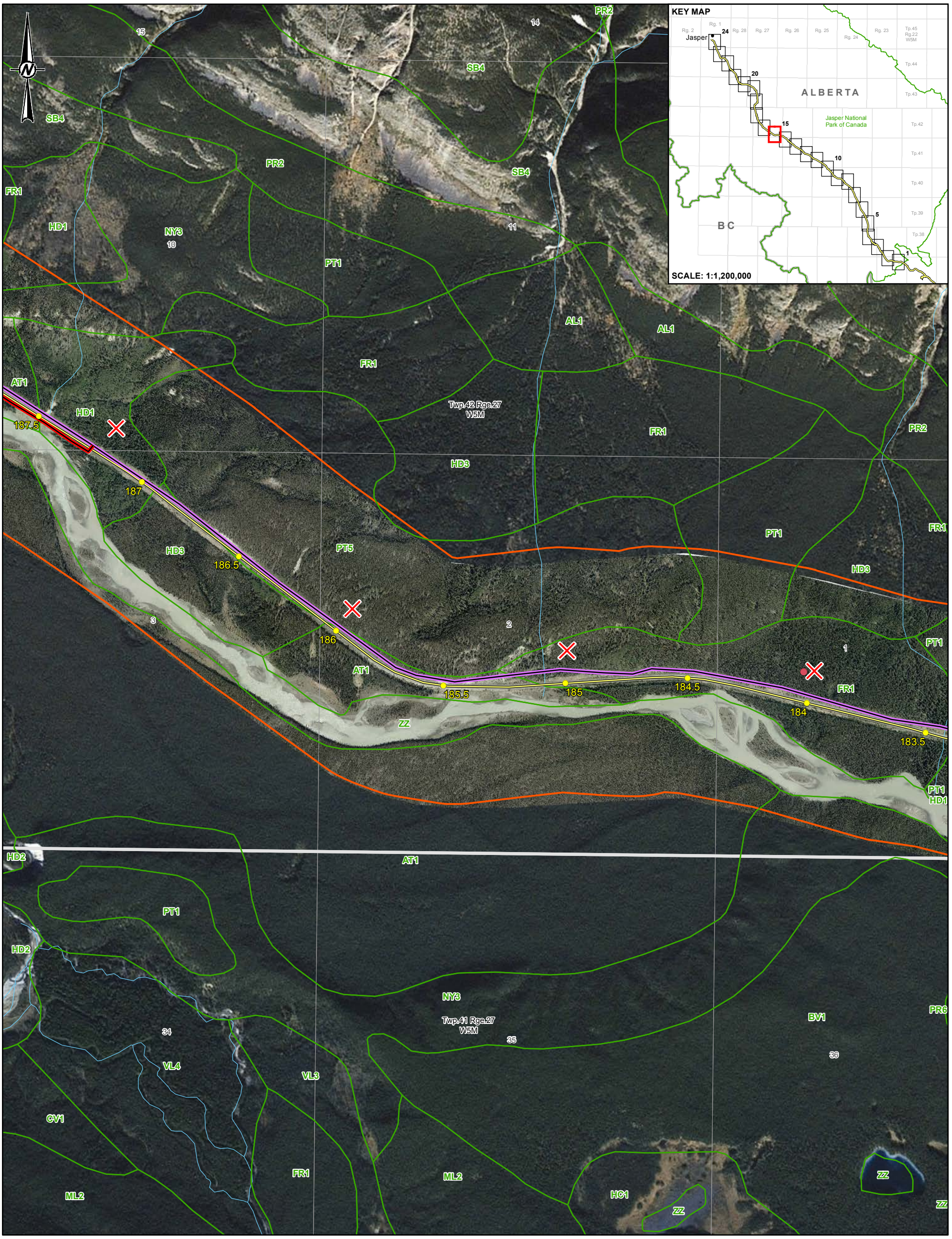

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- BROWN CREEPER

0 400 800

1:15,000 METRES

REFERENCE(S)

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
DESIGNED	IP
PREPARED	RC
REVIEWED	IP
APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	15

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25mm

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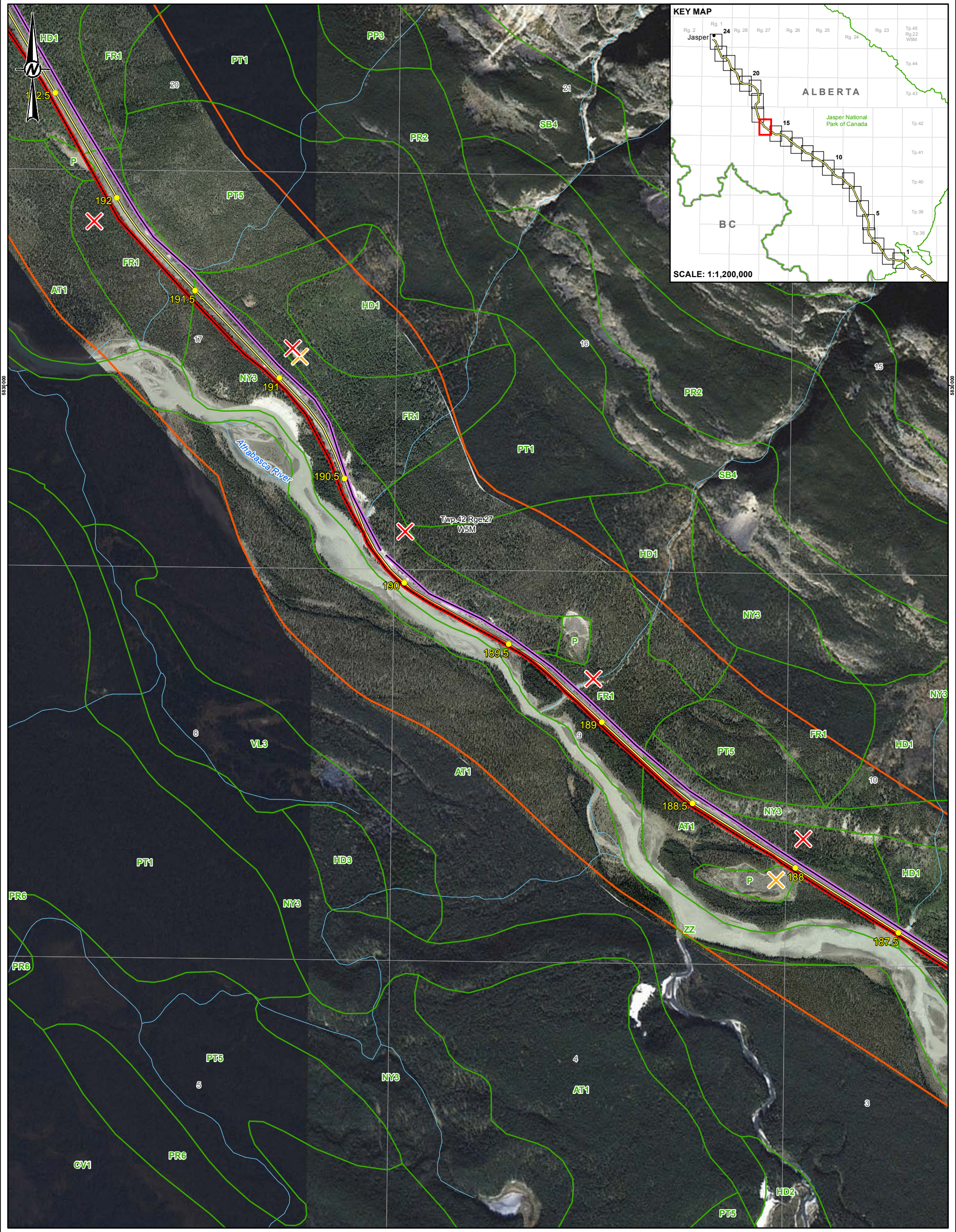
PATH: I:\CLIENTS\PARKS_CANADA\1659727\Mapping\MXD\Wildlife\IcefieldsPathway_WildlifeObservations_Rev0.mxd PRINTED ON: 2016-10-11 AT: 9:22:03 AM



LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

0 400 800

1:15,000 METRES

REFERENCE(S)

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
DESIGNED	IP
PREPARED	RC
REVIEWED	IP
APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	16

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
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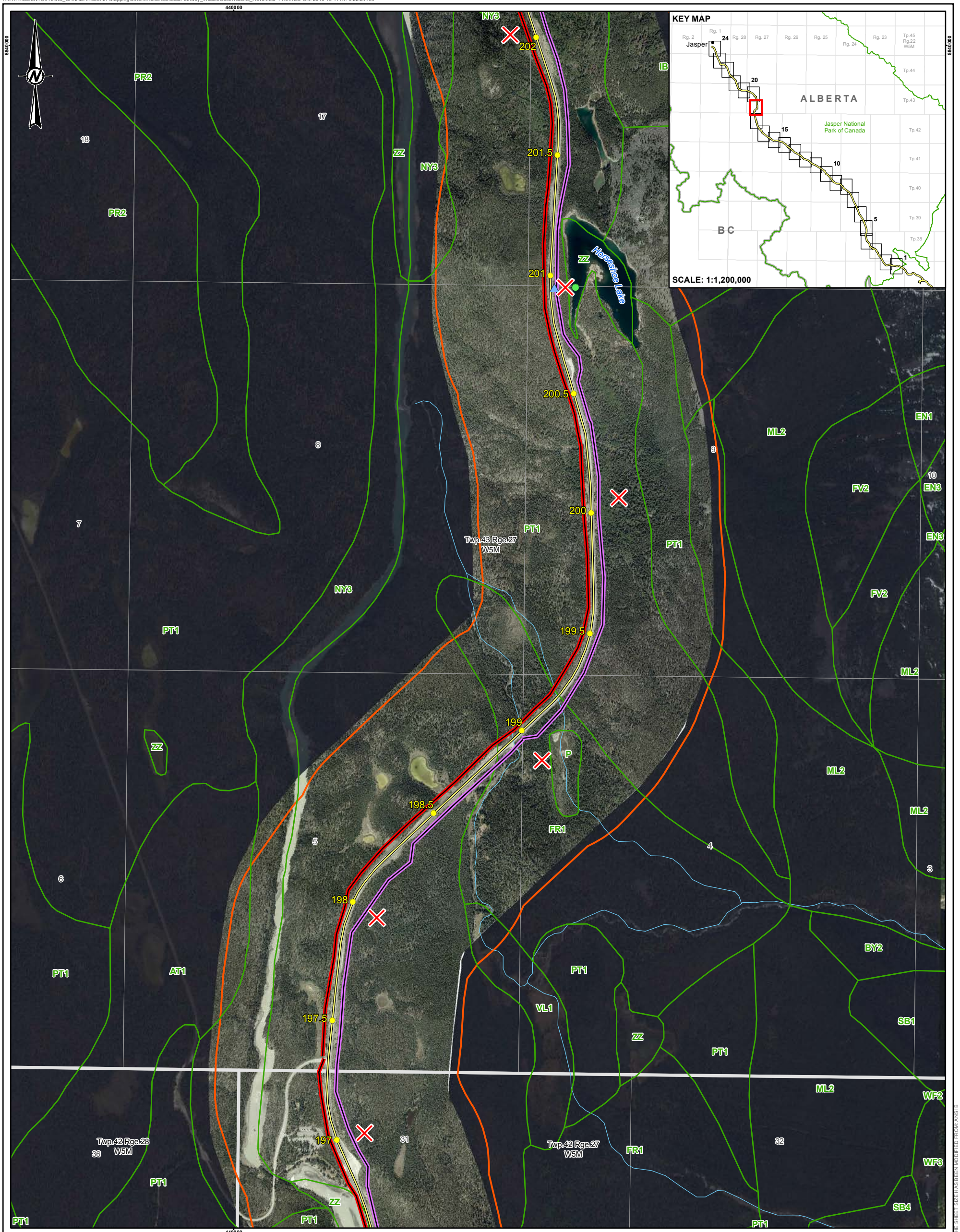

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- PILEATED WOODPECKER

PIKA OBSERVATION

- PIKA

0 400 800

1:15,000 METRES

REFERENCE(S)

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
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PREPARED	RC
REVIEWED	IP
APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

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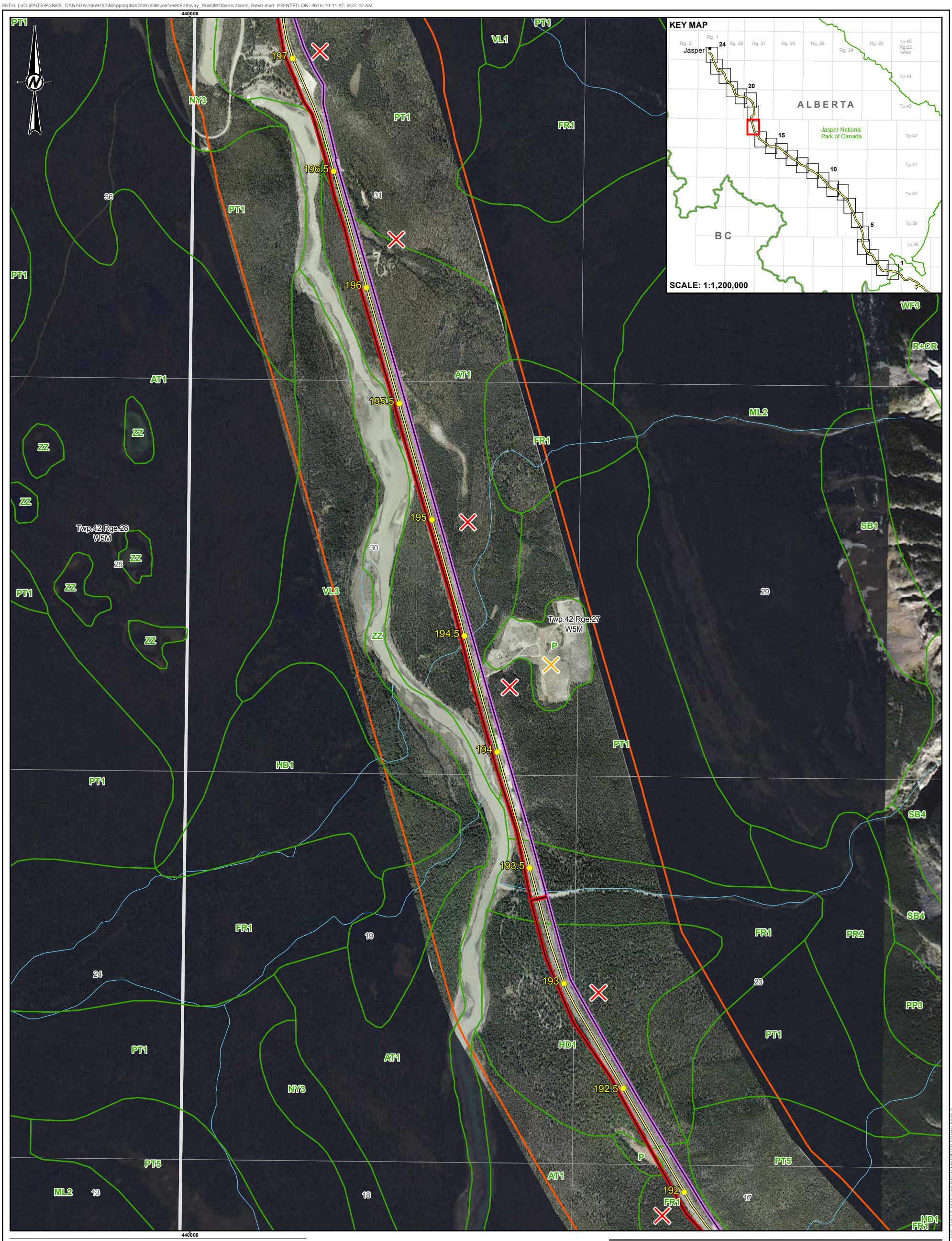

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

0 400 800

1:15,000 METRES

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
DESIGNED	IP
PREPARED	RC
REVIEWED	IP
APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	18

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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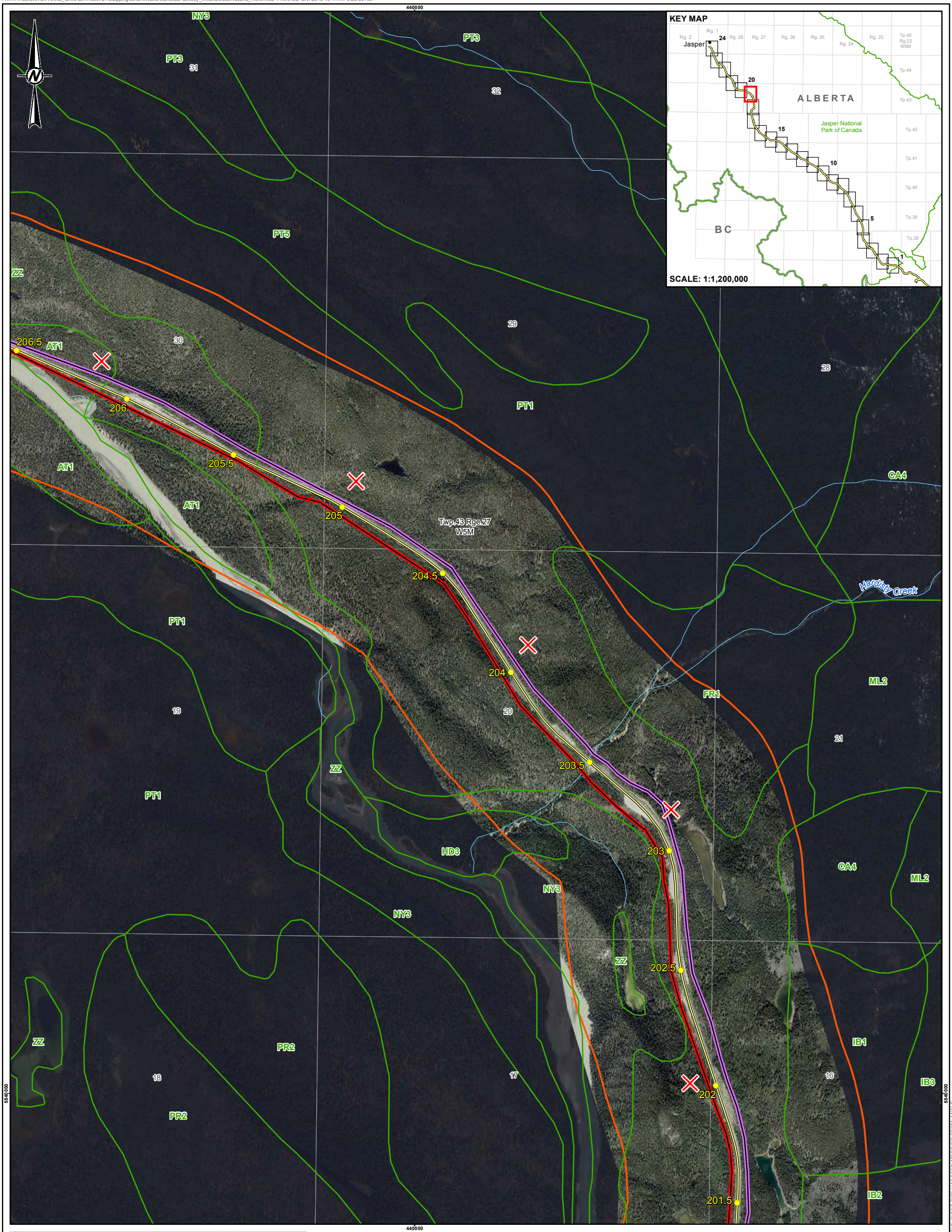

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION

0 400 800

1:15,000 METRES

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TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
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APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	19

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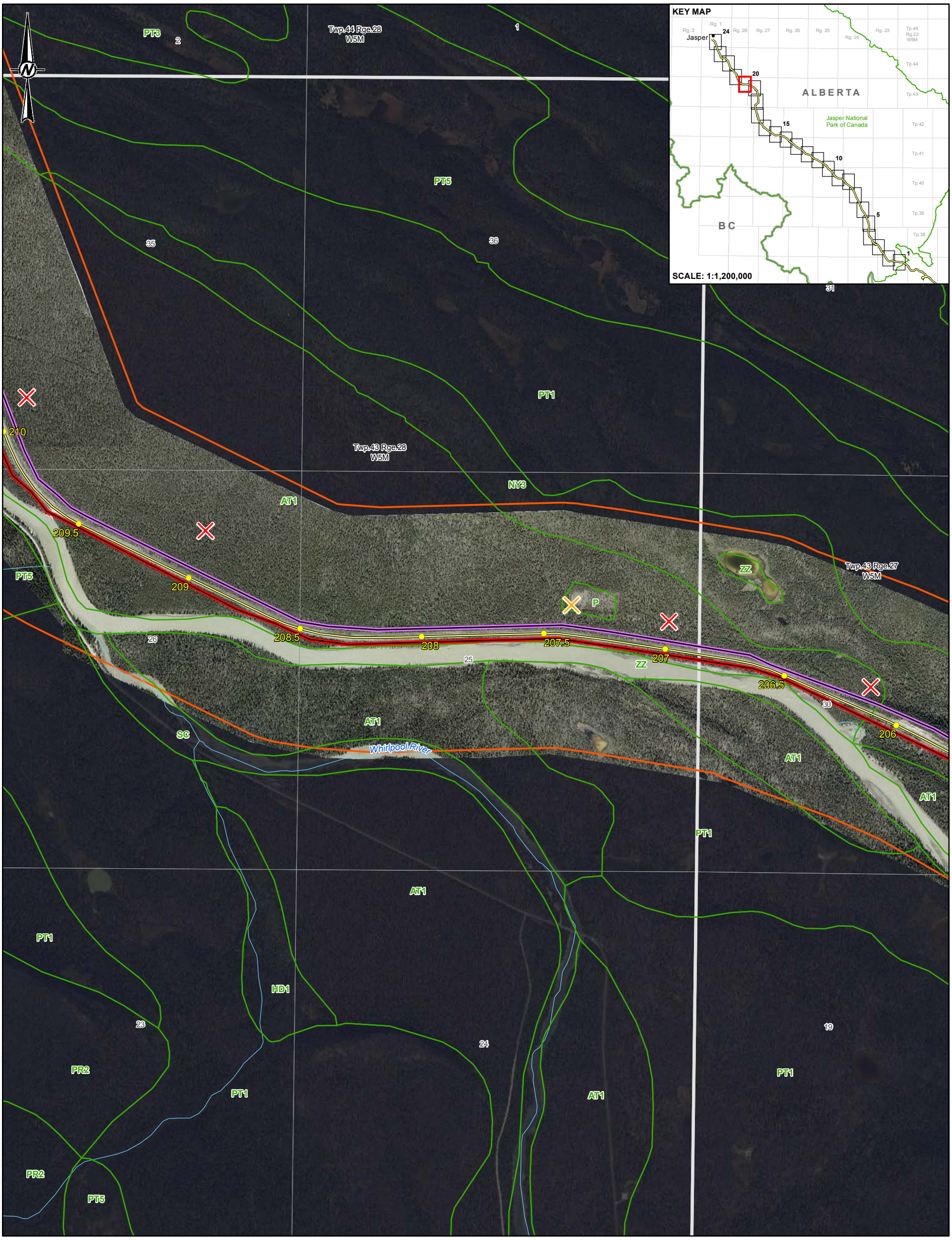

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

0 400 800

1:15,000 METRES

REFERENCE(S)

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PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
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REVIEWED	IP
APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	20

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

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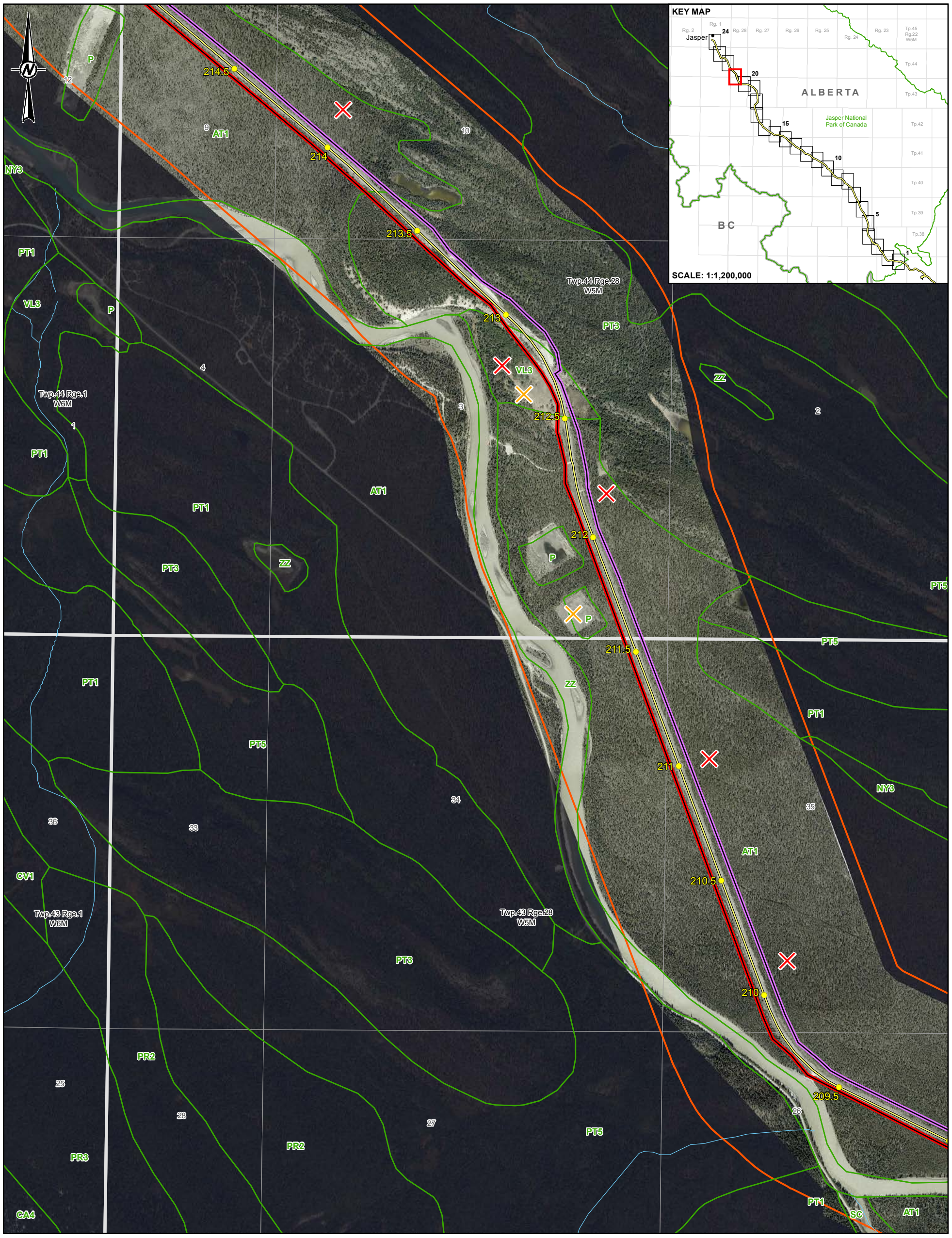

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

0 400 800

1:15,000 METRES

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

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REVIEWED	IP
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PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	21

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

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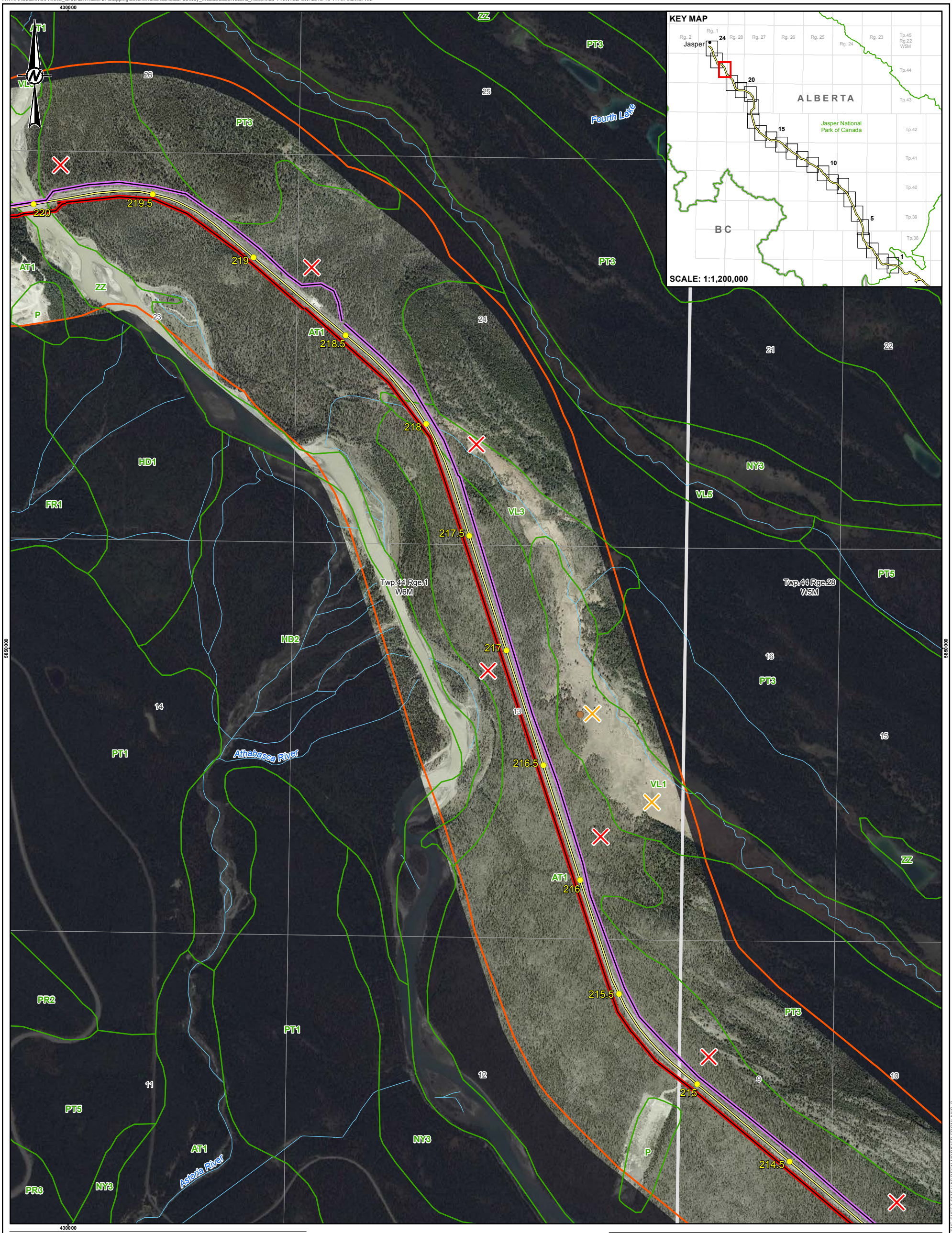

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

BIRD SPECIES AT RISK OBSERVATIONS

- WESTERN WOOD-PEWEE

0 400 800

1:15,000 METRES

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
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PROJECT
JASPER ICEFIELDS PARKWAY

TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

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PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	22

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

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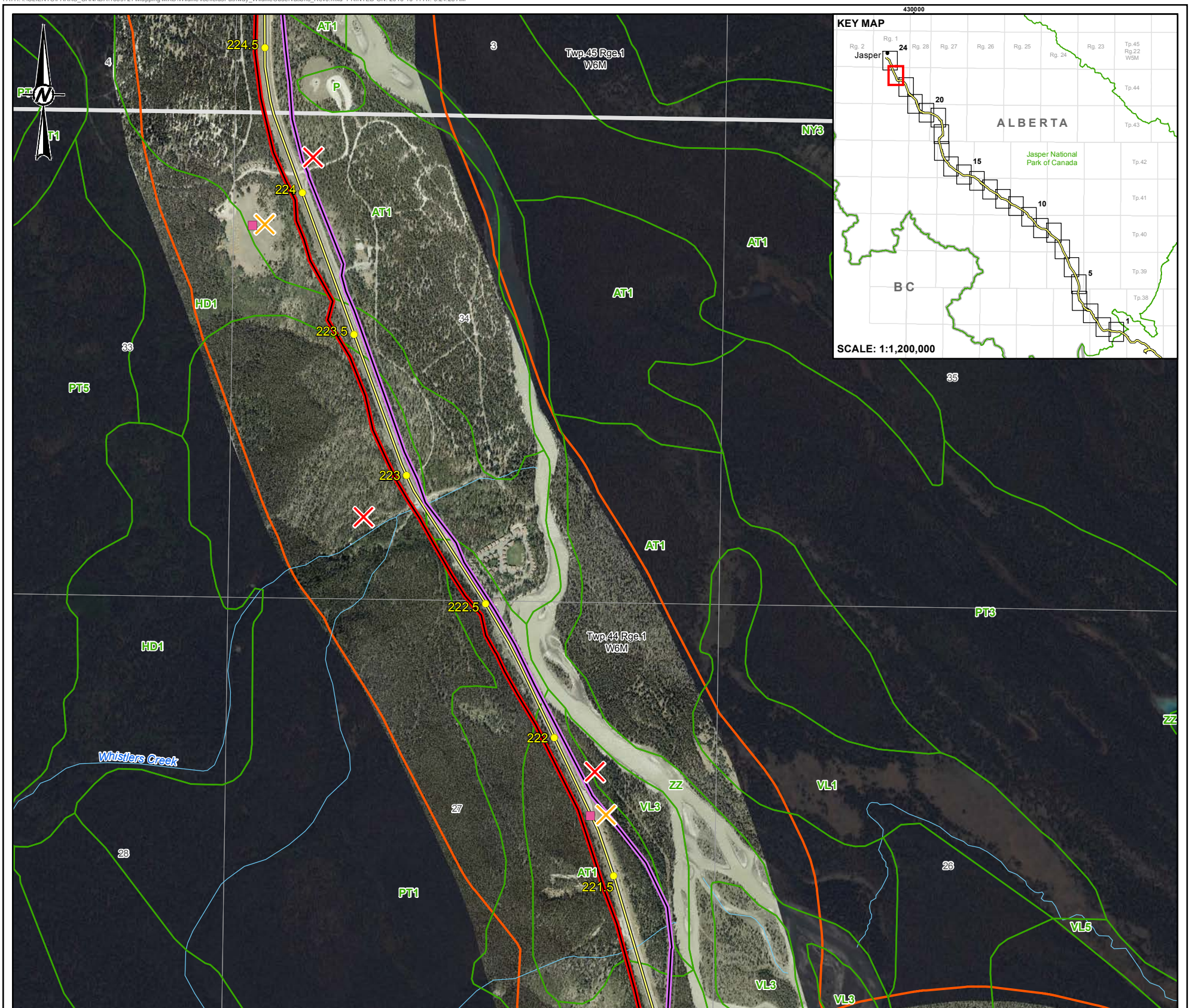

LEGEND

- KILOMETRE POST
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

GROUND SQUIRREL OBSERVATIONS

- COLUMBIAN GROUND SQUIRREL

0 400 800
1:15,000 METRES

REFERENCE(S)

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DATUM: NAD 83 PROJECTION: UTM ZONE 11

CLIENT
PARKS CANADA

PROJECT
JASPER ICEFIELDS PARKWAY

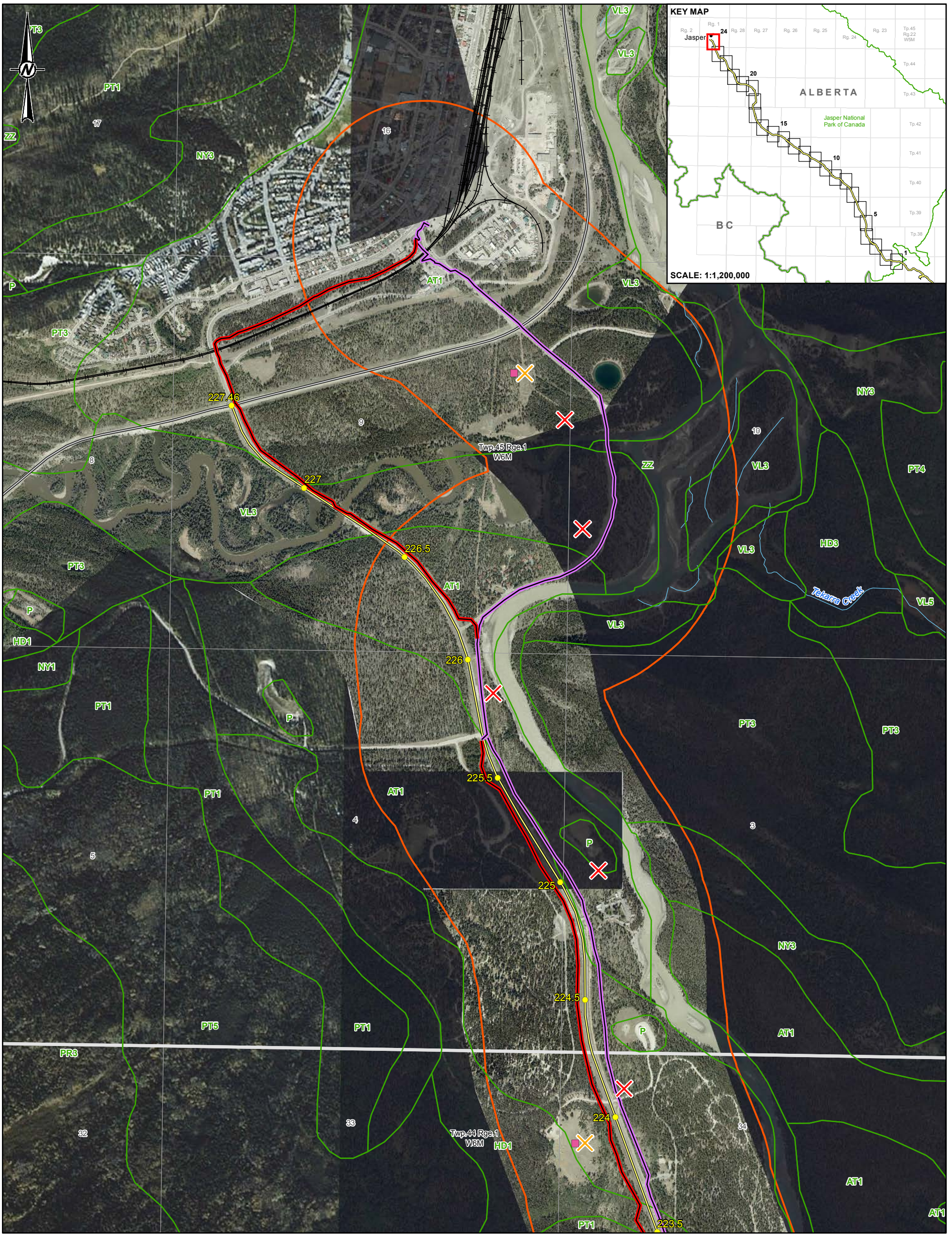
TITLE
WILDLIFE SURVEY LOCATIONS AND SPECIES OBSERVATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-11
DESIGNED	IP
PREPARED	RC
REVIEWED	IP
APPROVED	CDM

PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	23

PATH: I:\CLIENTS\PARKS_CANADA\1659727\Mapping\MXD\Wildlife\IcefieldsPathway_WildlifeObservations_Rev0.mxd PRINTED ON: 2016-10-11 AT: 9:24:51 AM



LEGEND

- KILOMETRE POST
- HIGHWAY 16
- HIGHWAY 93N
- ALTERNATE TRAIL ROUTE
- PROPOSED TRAIL ROUTE
- RAILROAD
- WATERCOURSE
- WILDLIFE LOCAL STUDY AREA
- ECOLOGICAL LAND CLASSIFCATION

SURVEY LOCATIONS

- BREEDING BIRD SURVEY LOCATION
- GROUND SQUIRREL SURVEY LOCATION

GROUND SQUIRREL OBSERVATIONS

- COLUMBIAN GROUND SQUIRREL

0 400 800

1:15,000 METRES

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PROJECT NO.	CONTROL	REV.	FIGURE
1659727	2000	0	24

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

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