Appendix D – Environmental Overview Update

AN ENVIRONMENTAL UPDATE FOR THE YELLOWHEAD NORTH ARTERIAL ROAD FUNCTIONAL DESIGN STUDY

Strathcona County
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Edmonton, Alberta

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EXECUTIVE SUMMARY

As part of the Yellowhead North Arterial Road Functional Design Study, Strathcona County has proposed to construct an arterial road (Twp Rd 534) between Sections 13 and 24, 53-23-W4M, connecting Clover Bar Road / Rge Rd. 231 with Highway 21 (Figure 1). In addition, the new road will connect to Rge Rd. 232 to the west as well as have a new link connecting Twp Rd 534 to Rge Rd. 231. In 2005, Westworth Associates Environmental Ltd. completed an initial environmental overview for the proposed road project, however several changes to the initial engineering design for the arterial road were recently finalized. Building upon that work, this report provides an environmental update pursuant to current field assessments and proposed design works associated with the North Yellowhead project area.

To assess project-related environmental risks, a review of existing information was conducted, including published and unpublished reports; maps and aerial photographs; discussions with knowledgeable individuals; and searches of provincial databases. In addition, a field assessment was conducted on April 22, 2009 to document existing fish, wildlife, and vegetation resources. Based on the review of existing information and data collected from field assessments, environmental effects of the proposed culvert replacement project were assessed, and appropriate mitigation measures were identified.

Based on the information collected, the proposed road project will result in some local impacts to fish, wildlife, and vegetation resources. Fisheries and wildlife habitat in the area of the road was considered to be of moderate quality overall, and natural vegetation was restricted to the riparian zone adjacent to Oldman Creek. Potential impacts to fish include sedimentation, introduction of deleterious substances, interruption of fish passage, and temporary loss of fish habitat. Potential wildlife impacts include loss of habitat, direct mortality, sensory disturbance, and disruption of wildlife movement. The impacts that may potentially affect vegetation resources include direct losses, pollutants and dust, and the introduction of invasive species.

Recommended mitigation measures include methods to avoid or minimize erosion and sedimentation during construction, reclamation of watercourse banks and associated riparian habitat as well as prevention and clean-up of accidental spills, restricting clearing to minimal standards within the riparian zones, and scheduling construction to avoid the nesting/natal season. If the recommended mitigation measures are implemented, it is expected that the proposed project will have a minor effect on fish, wildlife, and vegetation within the study area, and that the integrity of these resources will not be compromised.

ACKNOWLEDGEMENTS

The study team gratefully acknowledges the contributions and cooperation of various individuals and agencies during the course of the environmental update. Mr. M. Medhekar of Stantec Consulting Ltd. provided background engineering information and guidance during the course of the project. We also thank Ms. J. Boyd and Ms. C. Found (Alberta Sustainable Resource Development) for their assistance in compiling background information on the natural resources of the region.

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1.0 INTRODUCTION

1.1 Background

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1.2 Objectives

The overall objective of the environmental update was to identify and evaluate any changes to the initial engineering design that was previously completed in 2005 from an environmental perspective. Specific tasks included:

- Reviewing all available information related to the environmental conditions within the project area and highlighting any changes that have occurred since 2005;
- Conducting a high-level field site inspection to document the existing fish, wildlife and vegetation communities;
- Identifying and assessing any potential environmental concerns or constraints with respect to construction, operation, and maintenance of the proposed road; and,
- Detailing operationally-practical mitigation strategies appropriate for resolving specific environmental concerns related to the construction, operation, and maintenance of the proposed road project.

1.3 Project Background

As part of the Yellowhead North Arterial Road Functional Design Study, two crossings of Oldman Creek are proposed. The first crossing of Oldman Creek occurs west of the existing Rge Rd 231. The recommended crossing structure includes a three-span bridge of 24 m each. The span arrangement of the bridge includes provision for wildlife passage along with a small footprint to reduce the effect of the bridge structure on fish and wildlife. The three span bridge will also accommodate high level water and allow construction of the crossing in the dry. The crossing will also allow for potential future development of recreational activities in the Oldman Creek valley. A buried arch and culvert option was also assessed, and while more economical, this option will result in a larger environmental impact on the Oldman Creek valley, and was therefore not recommended.

The second crossing of the Oldman Creek occurs south of the existing Twp Rd 534 and will include twin structures for the accommodation of staged road widening. Each structure will include a single-span 32 m long bridge. Wildlife passage is provided for under the exterior span and the width of the bridge will accommodate high level water and allow for construction of the crossing in the dry.

1.4 Study Area

The project area is located between Sections 13 and 24, 53-23-W4M, just west of Highway 21 and north of the Yellowhead Highway (Highway 16) (Figure 1). Physiographically, it is located within the Edmonton Plain Subdivision of the Eastern Alberta Plains (Pettapiece 1986). These areas are characterized by gently undulating lands that are covered mainly by glacial materials, with hummocky terrain where native vegetation often remains. Generally, these areas are dominated by glaciolacustrine and glaciofluvial deposits, with portions of rock or eolian-based morainal deposits (Pettapiece 1986).

Natural habitats in the vicinity of the project area fall within the Central Parkland Subregion of the Parkland Natural Region (Achuff 1994). This region is characterized mainly by cultivated lands interspersed with a mosaic of pure and mixed aspen-dominated stands, as well as isolated grasslands in drier areas. Common forest vegetation in the area includes trembling aspen, white spruce, rose, pincherry and chokecherry, with an understory of fescue, bluegrass, agrimony, American vetch, and aster. Riparian and wetland vegetation may consist of: reed canary grass, cattails, slough grass, sedges, and asters, with a border of aspen, and saskatoon.

The project area generally experiences short, warm summers and moderately cold winters characteristic of a cool summer humid continental climate. The mean annual temperature for the area is 2.9° C, with average monthly temperature ranging from -13.5° C in January to 16.7° C in July (Environment Canada 2000). Annual rainfall is 354.8 mm, and snowfall is 104.6 cm. Heaviest snowfalls generally occur during December and January. On average, measurable rainfall occurs 75 days of the year, while measurable snowfall occurs 29 days of the year.

Figure 1. Overview of the proposed Yellowhead North Arterial Road location.

2

2.0 METHODS

2.1 Review of Existing Information

Various sources of information were used to assess the status of fish, wildlife, and vegetation resources in the vicinity of the proposed road construction project. Information reviewed included published and unpublished reports, maps, the Fish and Wildlife Management Information System database (FWMIS), the Alberta Natural Heritage Information Center (ANHIC) database, and discussions with knowledgeable staff from Alberta Sustainable Resource Development. Information regarding species of concern in the area was obtained from the General Status of Alberta Wild Species (ASRD 2005) for provincially-listed species and the Committee on the Status of Endangered Wildlife in Canada (2009) listings and Species at Risk Public Registry (2009) for federally-listed species.

2.2 Field Site Inspection

2.2.1 Fish Habitat Assessment

A fish habitat assessment following provincial procedures outlined in the Alberta *Water Act* (Code of Practice for Watercourse Crossings, Alberta Environment 2001) was conducted at the proposed crossings of Oldman Creek on April 22, 2009. Five cross-channel transects were established at representative locations to document channel characteristics and fish habitat attributes within the potential zone of construction impact at each site. One transect was established at each proposed bridge crossing location, while three transects were established 100 m, 200 m, and 300 m downstream. At Crossing 1, a transect was established 100 m upstream of the proposed creek crossing, and at Crossing 2 a transect was established 1000 m upstream from the crossing. The following physical information and fish habitat measurements were recorded at each transect:

- Channel width (m), wetted width (m), water velocity (m/s), and depths (m) at 25, 50, and 75% of the wetted width;
- Bed material including % fines (silts/clay/sand), % gravels, % cobbles and % boulders;
- Bank stability, height (m), and slope (% gradient); and,
- Fish habitat (e.g., % riffles, % runs, and % pools).

The following parameters were also assessed for each section of Oldman Creek located between the transects:

- Cover (%) including the presence of large woody debris, undercut banks, pools, side channels and backwaters, and overstream and instream vegetation;
- Obstructions (e.g., log jams, beaver dams, man-made barriers, etc.) and debris;
- Overall fish habitat (% pool, % riffle, % run);
- Crown closure; and,
- Other areas of fisheries habitat concern.

Channel widths, wetted widths and bank heights were measured with a surveyor's tape and a meter stick while surface water velocity was obtained with a Swoffer 3000-LX Flow Probe. Bed material, bank stability, and fish habitat were estimated visually, while bank slopes were measured using a clinometer. Water depths were measured with a probe and surveyor's tape. Water quality (pH, temperature (^{o}C), conductivity (μS/cm), dissolved oxygen (mg/l), and turbidity (NTU)) was measured using a YSI water quality meter and an Oakton turbidmeter. Representative photos were also taken to document existing aquatic habitat types in the area.

2.2.2 Wildlife and Vegetation Assessments

A reconnaissance-level wildlife assessment was conducted within natural areas located along the proposed road on April 22, 2009. One biologist surveyed the site for important wildlife sign and wildlife habitat and to evaluate the potential occurrence of special status species, based on direct observation and a habitat appraisal. During the wildlife survey general habitat types were recorded as well as habitat value for selected species of important wildlife. A digital camera was used to record images of general habitat and important habitat features or wildlife sign. The overall quality of wildlife habitat within the vicinity of the proposed road was evaluated.

A reconnaissance-level vegetation survey was also conducted on April 22, 2009 at the same time as the wildlife assessment. The objective of the survey was to provide a broad description of vegetation types in the project area. This included an inventory of all wetlands that may potentially be affected by the final alignment of the proposed road. A rare plant survey was not conducted. Stand level attributes that were recorded included the following:

- Common tree and shrub species;
- Approximate structural stage;
- Presence of snags and deadfall; and,
- General stand condition.

2.3 Environmental Overview Update

The environmental overview for the proposed road project involved the following procedure:

- Identifying issues/concerns related to the project;
- Identifying project activities which could have an adverse affect on fish, wildlife, and vegetation resources; and,
- Identifying mitigation measures to reduce or eliminate the adverse effects of identified impacts.

3

3.0 EXISTING ENVIRONMENT

3.1 Historical Information

3.1.1 Species of Concern

Rare and sensitive species are identified at both the provincial and national level. Ranking schemes used in Alberta by Alberta Sustainable Resource Development (ASRD 2005) and across Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2009) and the Species at Risk Public Registry (SARA 2009) are summarized in Table 1.

Table 1. Federal (COSEWIC and SARA) and Provincial (ASRD) status listings for species at risk.

	Rank	Definition
Federal Status	Endangered	Facing imminent extirpation or extinction.
	Threatened	Likely to become endangered if limiting factors are not reversed.
	Special Concern	Particularly sensitive to human activities or natural events.
	Not at Risk	Evaluated and found not to be at risk.
	Data Deficient	Insufficient scientific information is available to support status designation.
Provincial Status	At Risk	Designated as “Endangered” or “Threatened” after formal status assessment.
	May be at Risk	Candidates for detailed risk assessment because of potential risk of extirpation.
	Sensitive	Require special attention or protection to prevent from becoming at risk.
	Secure	Not considered “At Risk”, “May be at Risk”, or “Sensitive”.
	Undetermined	Insufficient Information, knowledge or data available for status evaluation.

A number of rare or sensitive species may occur, or are known to occur, in the study area (Table 2). Seven species (6 birds and 1 amphibian) have been listed by COSEWIC (2009), including 4 “Threatened” species (Canada warbler, common, nighthawk, peregrine falcon, and Sprague’s pipit). Only 4 of these species have received a status listing under the Species at Risk Act (2009), including 2 “Threatened” species (peregrine falcon and Sprague’s pipit). In contrast, 42 species have been listed by Alberta Sustainable Resource Development (2005). The majority of these species are listed as “Sensitive”; however, 1 species is listed as “At Risk” (peregrine falcon) and 4 others as “May be at Risk” (short-eared owl, northern long-eared bat, long-tailed weasel, and Canadian toad).

Table 2. Species of concern that may occur in the Oldman Creek study area (ASRD 2005, COSEWIC 2009, SARA 2009).

Species		Status		
Common Name	**Scientific Name**	**ASRD**	**COSEWIC**	**SARA**
Birds:				
American White Pelican	*Pelecanus erythrorhynchos*	Sensitive		
Bald Eagle	*Haliaeetus leucocephalus*	Sensitive		
Baltimore Oriole	*Icterus galbula*	Sensitive		
Barn Swallow	*Hirundo rustica*	Sensitive		
Barred Owl	*Strix varia*	Sensitive		
Black Tern	*Chlidonias niger*	Sensitive		
Black-backed	*Picoides arcticus*	Sensitive		
Broad-winged Hawk	*Buteo platypterus*	Sensitive		
Brown Creeper	*Certhia americana*	Sensitive		
Canada Warbler	*Wilsonia Canadensis*	Sensitive	Threatened	
Cape May Warbler	*Dendroica tigrina*	Sensitive		
Common Nighthawk	*Chordeiles minor*	Sensitive	Threatened	
Common Yellowthroat	*Geothlypis trichas*	Sensitive		
Eastern Phoebe	*Sayornis phoebe*	Sensitive		
Great Blue Heron	*Ardea herodias*	Sensitive		
Great Gray Owl	*Strix nebulosa*	Sensitive		
Green-winged Teal	*Anas crecca*	Sensitive		
Horned Grebe	*Podiceps auritus*	*Sensitive*		
Least Flycatcher	*Empidonax minimus*	Sensitive		
Lesser Scaup	*Aythya affinis*	Sensitive		
Northern Goshawk	*Accipiter gentilis*	Sensitive		
Northern Harrier	*Circus cyaneus*	Sensitive		
Northern Pintail	*Anas acuta*	Sensitive		
Peregrine Falcon	*Falco peregrinus*	At Risk	Threatened	Threatened
Pied-billed Grebe	*Podilymbus podiceps*	Sensitive		
Pileated Woodpecker	*Dryocopus pileatus*	Sensitive		
Purple Martin	*Progne subis*	Sensitive		
Sharp-tailed Grouse	*Tympanuchus phasianellus*	Sensitive		
Short-eared Owl	*Asio flammeus*	May Be at Risk	Special Concern	Special Concern*
Sora	*Porzana carolina*	Sensitive		
Sprague's Pipit	*Anthus spragueii*	Sensitive	Threatened	Threatened
Swainson's Hawk	*Buteo swainsoni*	Sensitive		
Western Tanager	*Piranga ludoviciana*	Sensitive		
Yellow Rail	*Coturnicops*	Undetermined	Special Concern	Special Concern
Mammals:				
Northern Long-eared Bat	*Myotis septentrionalis*	May Be at Risk		
Silver-haired Bat	*Lasionycteris noctivagans*	Sensitive		
Hoary Bat	*Lasiurus cinereus*	Sensitive		
Long-tailed weasel	*Mustela frenata*	May Be at Risk		
American Badger	*Taxidea taxus*	Sensitive		
Amphibians/Reptiles:				
Western Toad	*Bufo boreas*	Sensitive	Special Concern	Special Concern
Canadian Toad	*Bufo hemiophrys*	May Be at Risk		
Red-sided Garter Snake	*Thamnophis sirtalis*	Sensitive		

* This species has been listed under Schedule 3 because they were assessed prior to 1999 and must be reassessed by COSEWIC using revised standards before they can be assigned to the official list of Species at Risk.

A number of rare plant species have been identified in the vicinity of the proposed crossings (Table 3). Data on the occurrence of rare plants was obtained from the Alberta Natural Heritage Information Centre (ANHIC 2009). Species are ranked on a scale of 1 to 5 using a system developed by the Nature Conservancy. The rating scheme is based on the number of occurrences of a given species and the total area (ha) of a community.

Table 3. Rare plant species that have been identified in the vicinity of the proposed crossings along Oldman Creek.

Common Name	Scientific Name	Ranking[1]
Rhodobryum ontariense	*Rhodobryum ontariense*	S2
Smooth sweet cicely	*Osmorhiza longistylis*	S2
Herriot's sagewort	*Artemisia tilesii*	S2
False dragonhead	*Physostegia ledinghamii*	S2
Crowfoot violet	*Viola pedatifida*	S2

[1] Ranking codes: S1 = ≤ 5 occurrences or very few remaining ha; S2 = 6 – 20 occurrences or few remaining ha; 21 – 100 occurrences, may be rare or abundant in a restricted range; S4 = apparently secure globally, but may be rare in parts of range; S5 = demonstrably secure globally, but may be rare in parts of range. Ranks may be combined to indicate a range (e.g., S2S3 = 6 – 100 occurrences).

3.1.2 Fisheries

The assessment conducted by Westworth Associates Environmental Ltd. (2005) documented the occurrence of white sucker (*Catostomus commersoni*), brook stickleback (*Culaea inconstans*), and fathead minnow (*Pimephales promelas*). A search of the provincial FMIS database confirmed that these species have also been captured during other assessments in Oldman Creek, as well as lake chub (*Couesius plumbeus*) (J. Boyd, Alberta Sustainable Resource Development, personal communication). One additional assessment has been conducted since the original environmental overview was conducted by Westworth Associates Environmental Ltd. in 2005. A fish salvage resulted in the capture of white sucker, brook stickleback, and fathead minnow (J. Boyd, Alberta Sustainable Resource Development, personal communication). No sport fish species are known to occur in Oldman Creek.

3.1.3 Wildlife and Vegetation

A search of the FWMIS wildlife database revealed that a peregrine falcon had been observed in 27-53-23-W4. Peregrine falcons (*anatum* subspecies) are currently listed as 'At Risk' in Alberta (ASRD 2005), and 'Threatened' under Schedule 1 of the federal *Species at Risk Act* (SARA 2009). Short-eared owls were also recorded in the area at 14-53-23-W4. This species is currently listed as 'May Be at Risk' in Alberta (ASRD 2005) and 'Special Concern' under Schedule 3 of the federal *Species at Risk Act* (SARA 2009). In addition, the following species have been observed in the vicinity of the proposed road project, and all are listed as sensitive in Alberta (ASRD 2005) with no federal status: Swainson's hawk, sora, green-winged teal, eastern phoebe, and least flycatcher.

3.1.3.1 Mammals

Ungulates known to occur in the region include moose, white-tailed deer, and mule deer. The region also supports coyote, red squirrel, snowshoe hare, porcupine, American beaver, striped skunk, least weasel, ermine, and muskrat. A number of bat species also likely inhabit the area including little and big brown bats, silver-haired bat, hoary bat, and northern long-eared bat. Several species of small mammals, such as the red-backed vole, meadow vole, deer mouse, and meadow jumping mouse are also known to be common in the area.

3.1.3.2 Birds

Owls that may occur in the area include great horned owl, great gray owl, northern hawk owl, boreal owl, northern saw-whet owl and barred owl. Diurnal raptors such as Coopers hawk, sharp-shinned hawk, northern goshawk, red-tailed hawk, Swainson's hawk, American kestrel, and merlin may also occur in the area. Bald eagles are also known to forage over the North Saskatchewan River in the area. Woodpeckers, including hairy, downy and pileated woodpeckers, are common resident species in the region. Waterfowl and waterbirds, including bufflehead, mallard, and Common goldeneye may also frequent the creek or wetland areas, both during the breeding season as well as in migration. In addition, there are many song bird species that are commonly found in the area during breeding season as well as during the spring and fall migration periods.

3.1.3.3 Amphibians and Reptiles

Four species of amphibians are known to occur in the region including tiger salamander, Canadian toad, boreal chorus frog and wood frog. These species are typically associated with wet habitats including wetlands, damp wooded areas, streams and rivers. One reptile species (red-sided garter snake) also occurs in the region.

3.1.3.4 Vegetation

This region is characterized mainly by cultivated lands interspersed with a mosaic of pure and mixed aspen-dominated stands. Common forest vegetation species includes: trembling aspen, white spruce, rose, pincherry and chokecherry, with an understory of fescue, bluegrass, agrimony, American vetch, and aster. Riparian and wetland vegetation may consist of: reed canary grass, cattails, slough grass, sedges, and asters, with a border of aspen, and saskatoon.

3.2 Field Site Visit

3.2.1 Fish Habitat Assessment

3.2.1.1 Crossing 1

Oldman Creek in the vicinity of Crossing 1 was characterized entirely as beaver impounded habitat with a low and consistent slope over a primarily silt-based channel substrate. In this area, the channel was occasionally confined and the silt-based banks were unstable at several locations. At the proposed crossing location, the creek had a wetted width of 3.5 m, a mean depth greater than 1.5 m, and a mean velocity of 0.7 m/s (Table 1). At the time of assessment, Oldman Creek was in runoff and the creek was flowing at bank full depth. The west bank area was stable with a slope of 15^{o} and a height of 0.9 m, while the east bank was moderately unstable stable with a slope of 80^{o} and a height of 2.0 m (Photos 1 and 2). The habitat at this location was entirely impounded and the substrate consisted of 100% silt. The only exception to the beaver impounded state of the study area was at Transect 5, which was located immediately downstream from a rail line crossing. Upstream from the crossing, a fence had been constructed across the stream to prevent beavers from damming the culvert inlet (Photo 3). The creek flowed through the culvert then was characterized by riffle and run habitat for roughly 100 m before becoming impounded once again. Within the study area, the left bank ranged in height from 0.1 m to 2.0 m and in slope from 15^{o} to 90^{o}, while the right bank ranged in height from 0.1 m to 2.0 m and in slope from 40^{o} to 90^{o} (Table 1).

Fish habitat in the area of the proposed crossing was poor overall, although water quality at the crossing was suitable to support fish (Table 2). Cover was provided primarily by deep water at the time of assessment; however, it is expected that the water depth would continue to provide cover after runoff subsides due to the presence of abundant beaver dams. Overhanging vegetation also provided abundant instream cover throughout the study area. The adjacent riparian vegetation was composed of dense and well established grasses and shrubs, and provided good protection against erosion. However, there were several areas of bank instability throughout the study area.

Spawning Habitat

Spawning habitat at Crossing 1 was considered to be good for forage fish species and moderate for coarse fish. There were no suitable substrates available for gravel spawning sport fish species, as the substrate consisted primarily of silt, and access would be very limited because of the presence of numerous beaver impoundments. Suitable habitat exists for northern pike; however, there is no historical evidence of any sport fish occurring in Oldman Creek.

Species with few specific spawning habitat requirements such as fathead minnow, lake chub, and brook stickleback would be expected to use this area for spawning. There were also some areas of limited cobble substrate which could potentially provide suitable spawning habitat for white or longnose suckers.

Migration and Movement

Because of the presence of numerous beaver dams and the heavily impounded nature of the creek in the vicinity of the proposed creek crossing, the potential for migration in this portion of the system was considered to be poor. Migration would be most likely during the spring freshet, but this would be greatly inhibited by beaver activity.

Nursery and Feeding Habitats

The availability of rearing habitat in the study area was considered to be moderate. Overhanging vegetation was present in sufficient quantities to provide cover and there were some areas of deeper water that would provide opportunities for rearing forage or coarse fish species. The absence of larger sport fish would also contribute to the success of forage fish rearing.

Over-wintering Habitat

The presence of beaver dams would provide sufficient water depth for overwintering; however, the lack of flow could result in low oxygen levels. Only hardy species would be capable of overwintering within the study area. Overwintering potential was considered to be good for forage and coarse fish.

3.2.1.2 Crossing 2

At Crossing 2, Oldman Creek was characterized by diverse habitat features including riffles, runs, and pools, with an irregular meander patterned channel composed of varying combinations of substrate material. In this area, the channel was occasionally confined, partially coupled, and the banks were typically stable. Within the study area, the left bank ranged in height from 0.1 m to 1.1 m and in slope from 25^{o} to 65^{o}, while the right bank ranged in height from 0.1 m to 0.85 m and in slope from 30^{o} to 80^{o} (Table 3). At the proposed crossing location, the creek had a wetted width of 2.3 m, a mean depth of 0.24 m, and a mean velocity of 0.17 m/s (Table 3). The south bank area was stable with a slope of 25^{o} and a height of 0.3 m, while the north bank was moderately unstable with a slope of 80^{o} and a height of 0.85 m (Photos 5 and 6). The habitat at this location was entirely run and the substrate consisted of 70% fines, 20% gravel, and 10% cobble.

Table 4. Fish habitat characteristics of Oldman Creek at the crossing of the Yellowhead North Arterial Road at Crossing 1 (NE-24-53-23-W4).

Parameter	Transect Number				
	1	**2**	**3**	**4**	**5**
UTM	12U 0350662 5940828	12U 0350639 5940915	12U 0350554 5940914	12U 0350472 5940953	12U 0350381 5941025
Transect Location	100 m u/s from crossing	At crossing	100 m d/s from crossing	200 m d/s from crossing	300 m d/s from crossing
Stream Characteristics					
Channel Width (m)	5.5	9.0	4.0	4.8	2.2
Wetted Width (m)	5.5	3.5	4.0	4.8	2.2
Velocity (25%, 50%, 75%) (ms^{-1})	0 / 0 / 0	0.05 / 0.1 / 0.05	0.05 / 0.05 / 0.05	0.05 / 0.05 / 0.05	0.2 / 0.1 / 0.3
Mean Velocity ($m.s^{-1}$)	0	0.07	0.05	0.05	0.2
Depth (25%, 50%, 75%) (m)	>1.5 / >1.5 / >1.5	>1.5 / >1.5 / >1.5	>1.5 / >1.5 / >1.5	>1.5 / >1.5 / >1.5	0.1 / 0.1 / 0.2
Mean Depth (m)	>1.5	>1.5	>1.5	>1.5	0.13
Substrate Composition					
% Silt/Clay/Sand	100	100	100	100	20
% Gravel	-	-	-	-	20
% Cobble	-	-	-	-	40
% Boulder	-	-	-	-	20
Channel Bank Characteristics					
Bank Stability [1] (Left, Right)	S / S	S / M	S / S	S / S	S / S
Bank Height (Left, Right) (m)	0.1 / 0.1	0.9 / 2.0	2.0 / 0.1	0.1 / 0.1	0.5 / 0.9
Bank Slope (Left, Right) (º)	45 / 45	15 / 80	75 / 40	45 / 45	90 / 90
Major Habitat Units					
Cascade/Rapid (%)	-	-	-	-	-
Riffle (%)	-	-	-	-	100
Run (%)	-	-	-	-	-
Pool (%)	-	-	-	-	-
Impoundment (%)	100	100	100	100	-
Cover					
Total cover (% of area)	100	100	100	100	50
Large Woody Debris (% of total)	-	-	-	-	-
Small Woody Debris (% of total)	10	-	-	-	-
Undercut Bank (% of total)	-	10	-	-	20
Instream Vegetation (% of total)	-	-	-	-	10
Overstream Vegetation (% of total)	20	10	20	20	30
Deep Water > 1m (% of total)	70	80	80	80	-
Surface Turbulence (% of total)	-	-	-	-	40

[1] A qualitative scale for bank stability was used where H=highly unstable; M=moderately unstable; U=slightly unstable; S=stable.

Table 5. Water quality parameters measured in Oldman Creek on April 22, 2009.

Parameter	Measurement
Time of Day (24 Hr)	10:15
Water Temperature(^{o}C)	7.99
pH	9.21
Dissolved Oxygen (mg/l)	12.81
Conductivity (µscm^{-1})	641
Turbidity (NTU)	29.8

Photo 1. South (upstream) view of the creek channel and banks at proposed Crossing 1. Note the beaver dam that occurs in the study area.

Photo 2. North (downstream) view of the creek channel and banks at proposed Crossing 1. Note the creek flowing at bank full depth.

Photo 3. South (upstream) view of a beaver dam at a rail line crossing, located approximately 220 m downstream from proposed Crossing 1.

Fish habitat in the area of the proposed crossing was good overall. At the time of assessment, high turbidity provided the most instream cover (29.8 NTU); however, the turbidity is expected to subside as the spring freshet ends. Overstream and instream vegetation also provided significant cover and several areas with undercut banks were also present. The riparian vegetation was composed primarily of coniferous trees, grasses, and shrubs.

Spawning Habitat

Spawning habitat in the study area was considered to be good. There was a diverse assortment of substrates present which would provide suitable spawning habitat for all species present. The available habitat would be suitable for sport fish such as walleye if connectivity with the North Saskatchewan River was established; however, there is no historical evidence of any sport fish present in Oldman Creek. Thus, spawning would be restricted to coarse and forage fish species.

Migration and Movement

Migration potential in the vicinity of the proposed crossing was good, as there were no barriers to migration noted. There was some beaver activity noted in the study area with 1 dam occurring approximately 1000 m upstream from the crossing location.

Nursery and Feeding Habitats

Rearing habitat at Crossing 2 was considered to be good for coarse and forage fish. Aquatic and overhanging vegetation were present in sufficient quantities to provide cover. There were also several small pools and undercut banks identified in the study area.

Over-wintering Habitat

No deep pools or beaver impoundments were present in the study area, and therefore overwintering potential was considered to be poor.

Table 6. Fish habitat characteristics of Oldman Creek at the crossing of the Yellowhead North Arterial Road at Crossing 2 (SE-26-53-23-W4).

Parameter	Transect Number				
	1	2	3	4	5
UTM	12U 0349770 5941338	12U 0348975 5941645	12U 0348841 5941735	12U 0348755 5941611	12U 0348687 5941636
Transect Location	1000 m u/s from crossing	At crossing	100 m d/s from crossing	200 m d/s from crossing	300 m d/s from crossing
Stream Characteristics					
Channel Width (m)	4.3	4.1	1.9	4.2	3.3
Wetted Width (m)	3.4	2.3	1.8	1.9	2.6
Velocity (25%, 50%, 75%) (ms^{-1})	0.1 | 0.1 | 0.05	0.2 | 0.15 | 0.15	0.1 | 0.1 | 0.1	0.1 | 0.15 | 0.2	0.08 | 0.1 | 0.2
Mean Velocity ($m.s^{-1}$)	0.08	0.17	0.1	0.15	0.13
Depth (25%, 50%, 75%) (m)	0.2 | 0.52 | 0.39	0.28 | 0.25 | 0.19	0.38 | 0.38 | 0.33	0.2 | 0.34 | 0.41	0.16 | 0.30 | 0.38
Mean Depth (m)	0.37	0.24	0.36	0.32	0.28
Discharge ($m^3.s^{-1}$)	0.10	0.09	0.07	0.09	0.09
Substrate Composition					
% Silt/Clay/Sand	80	20	55	70	90
% Gravel	20	60	40	20	10
% Cobble	-	20	5	10	-
% Boulder	-	-	-	-	-
Channel Bank Characteristics					
Bank Stability [1] (Left, Right)	S | S	U | S	S | S	S | M	S | S
Bank Height (Left, Right) (m)	0.25 | 0.25	1.1 | 0.3	0.1 | 0.1	0.3 | 0.85	0.2 | 0.3
Bank Slope (Left, Right) (º)	45 | 40	65 | 30	45 | 45	25 | 80	40 | 70
Major Habitat Units					
Cascade/Rapid (%)	-	-	-	-	-
Riffle (%)	-	100	-	-	100
Run (%)	100	-	100	100	-
Pool (%)	-	-	-	-	-
Impoundment (%)	-	-	-	-	-
Cover					
Total cover (% of area)	100	75	100	100	100
Large Woody Debris (% of total)	-	-	-	-	-
Small Woody Debris (% of total)	-	-	-	-	-
Undercut Bank (% of total)	-	-	-	10	10
Instream Vegetation (% of total)	-	20	-	10	10
Overstream Vegetation (% of total)	10	-	20	20	10
Deep Water > 1m (% of total)	-	-	-	-	-
Turbidity (% of total)	90	80	80	60	70

[1] A qualitative scale for bank stability was used where H=highly unstable; M=moderately unstable; U=slightly unstable; S=stable.

Photo 4. East (upstream) view of the creek channel and banks at the proposed Crossing 2 location.

Photo 5. West (downstream) view of the creek channel and banks at the proposed Crossing 2 location.

3.2.2 Vegetation and Wildlife Assessment

Vegetation in the vicinity of Oldman Creek and the wetland was dominated by graminoids and sedges, with a border of woody species and stinging nettles. Common species in this riparian area were reed canary grass, beaked sedge, tall manna grass, stinging nettle, wild mint, horsetail, trembling aspen and pincherry. Stinging nettle, which is considered an invasive weed species, was prominent in the understorey throughout the area.

In the surrounding forested areas adjacent to the creek, the most common plant species included smooth brome, kentucky bluegrass, stinging nettle, dandelion, American vetch, trembling aspen, red osier dogwood and pincherry. The forest in the vicinity of Crossing 1 was composed primarily of deciduous trees (aspen) (Photos 1 and 2), while conifers (black spruce) were dominant to co-dominant throughout Crossing 2 further downstream (Photos 4 and 5). The stands within the creek valley were typically of structural stage 5 (young forest) with some areas of stage 4 (pole sapling) vegetation. The aspen canopy was composed primarily of young trees, indicative of a relatively high disturbance regime, and tended to be quite open. The understory was dominated by grass species, although shrub cover was denser closer to the creek.

The reconnaissance level survey conducted on April 22, 2009 identified moderate quality wildlife habitat limited to the riparian areas surrounding Oldman Creek and a small wetland area located southwest of Crossing 1. Most of the land in the project area was characterized as agricultural crop land or residential development and consequently, Oldman Creek likely functions as a movement corridor for wildlife through this highly developed area. The riparian buffer zone ranged from approximately 100 to 200 m in width throughout the study area, providing a narrow band of natural habitat. The identified wetland was considered to be ephemeral, collecting runoff from the surrounding fields in the spring, then gradually becoming reduced in size throughout the summer and fall. A small 30 m by 10 m pond was located at the northern end of the wetland area. This pond is expected to be the only permanent wetted area based on air photo interpretation.

Within the Oldman Creek riparian zone, several species of birds were observed including mallard, Canada goose, and American robin. It is anticipated that this area would also provide suitable habitat for other waterfowl species as well as migratory song birds, which were not present in the area at the time the assessment was conducted. The creek valley also provides good habitat for deer as evidenced by abundant sign, including tracks, pellets, beds, browsing, and antler rubs. This area could also be used as a movement corridor by moose as well, although no sign was observed. Coyote tracks and scat were also present in the riparian zone and beavers were highly active in the vicinity of Crossing 1.

The only wildlife observed in the small wetland area was a boreal chorus frog that was heard calling. This area would also be suitable for wood frogs and possibly Canadian and western toads. As well, the abundant beaver impoundments on Oldman Creek in the vicinity of Crossing 1 could provide suitable habitat for these species. No waterfowl were observed in the wetland at the time of assessment; however, various waterfowl species could use these areas during the open water period.

4

4.0 ENVIRONMENTAL OVERVIEW UPDATE

The following section describes potential issues/concerns identified for the proposed road construction project and evaluates the potential impacts of project-specific activities on the environment. Technically and economically feasible mitigation strategies aimed at reducing or eliminating these impacts are discussed as well.

4.1 Fisheries

The federal *Fisheries Act* and the provincial *Water Act* require watercourse crossing structures to be designed, constructed, and maintained without harming fish and fish habitat in the watercourse. The bridge projects will require instream construction activities, and will require an assessment of potential habitat loss or other negative effects. Construction of the bridges could affect fish and fish habitat in several ways through:

- Erosion and sedimentation;
- Introduction of deleterious substances in the watercourse;
- Disruption of fish movement; and,
- Loss of habitat.

4.1.1 Sedimentation

Section 36 of the federal *Fisheries Act* and Schedule 2 Part 1 of the Alberta Code of Practice for Watercourse Crossings (Alberta Environment 2001) prohibits the release of sediment in watercourses containing fish and fish habitat. Likely the greatest risks to fish and fish habitat associated with the bridge construction projects are downstream sediment impacts from construction activities near or within the watercourse crossing on Oldman Creek.

4.1.1.1 Potential Project Effects

The effects of erosion and sedimentation on aquatic habitats have been well documented. Excessive erosion and sedimentation can adversely affect fish and aquatic invertebrate populations (Cordone and Kelly 1961, Newcombe and MacDonald 1991, Clarke et al. 1998, McCarthy et al. 1998). Direct impacts on fish include damage to fish gill filaments and the ability to remove oxygen from the water (occasionally resulting in mortality), an increase in the susceptibility to disease, reduction in swimming ability, and impairment of reproduction, growth and survival (Wallace and Strong-Duffin 1985).

Indirect impacts on fish include reduced visibility causing impaired feeding behaviour, reduced density and diversity of prey items such as insect larvae and benthic invertebrates by smothering, and the loss of spawning, rearing and overwintering habitat through the reduction in substrate porosity (Wallace and Strong-Duffin 1985). In addition, primary productivity (i.e. benthic and planktonic flora) may be reduced through the reduction of light intensity due to increased turbidity (Wallace and Strong-Duffin 1985), resulting in a loss of fish cover and a significant impact to the food chain.

Impacts can result from erosion and sedimentation in both the short- and long-term. Short-term impacts are those erosion and sediment release events directly associated with construction practices and are of concern only during the period of construction activity (Alberta Environment 2001). These short-term impacts can include the release of sediment into watercourses through runoff from storm events over disturbed work areas, instream construction, groundwater runoff from excavations, construction of watercourse crossings, disturbance of dust, destabilization of banks, and cleaning of construction equipment. Any unconfined construction activities near watercourses can release sediments into the water. Additionally, work on the bank areas that disturb the vegetation layer (e.g., stabilization or regrading) can lead to bank erosion if any water flow or rainfall is introduced to the area. Ineffective stormwater management during construction can also lead to the release of sediments from disturbed areas, construction material, equipment, or unprotected substrate stockpiles in the vicinity of the watercourse.

Long-term impacts are generally a result of a chronic problem in the design of a watercourse crossing or channel, or in the reclamation of areas disturbed by construction activities (Alberta Environment 2001, McCullah 2002). Sources of long-term and chronic releases of sediment into streams include destabilized banks and streambeds, scour on banks and streambeds from poorly installed pilings or abutments, runoff over unvegetated and disturbed areas, runoff from road surfaces, and drainage from highway ditches down approach slopes.

4.1.1.2 Mitigation

Short Term Erosion and Sediment Control

The standards for carrying out works (Schedule 2, Part 1 of the Alberta Code of Practice; Alberta Environment 2001) and the *Fisheries Act* require measures to be implemented to avoid or minimize impairment of water quality by reducing the amount of sediment entering the waterbody. Mitigation measures that can be implemented at the watercourse crossing include:

- Conducting any instream work during the driest time of the year (This Class C watercourse has a restricted activity period of April 16 to June 30, Alberta Environment 2001);
- Construction activities at the work site must be conducted under dry conditions and completely isolated from the watercourse (particularly activities that require the excavation of the streambed) using appropriate isolation structures such as berms;
- Pumps for dewatering the instream construction areas should have outflows directed towards a stable vegetated area, sediment bag, splash pad, or flow dissipating sheet so that sediments will not flow back to the watercourse;
- The right of way and access to the construction site should be kept to a minimum and clearly delineated from the surrounding area. Disturbance of all areas outside of the right of way should be minimized;
- Terrestrial runoff should be controlled with filter or silt fences in the construction area that have been placed and maintained in a manner that contains and protects flow over bare soil;
- Topsoil removed from the construction site should be stockpiled away from the watercourse and runoff from such stockpiles protected (e.g., silt fencing);
- Bare soil on banks or in the construction footprint should be stabilized as early as possible by revegetation, erosion control matting, or a combination of both;
- Work must be suspended temporarily in the event of storms or other weather that would increase the potential of erosion and sedimentation; and,
- An erosion and sedimentation control plan along with emergency sediment control provisions should be developed and implemented at the construction site.

Long Term Erosion and Sediment Control

Appropriate long-term erosion and sediment control measures should be implemented to ensure the long-term integrity of the construction work, and to ensure that sediments will not enter the watercourse after construction activities are completed:

- Reclamation and stabilization of the site should be initiated as soon as practically possible. Initial stabilization might have to be undertaken using intercepting fences and other protection structures until permanent vegetation has become established;
- Rapid revegetation of exposed soil should prevent or minimize the occurrence of long-term sedimentation problems near the construction area. Willow plugs or live willow stakes should be planted wherever shrubs were present prior to construction. In areas where shrubs are not desirable, an approved native seed mix should be applied as soon as possible. If less than 4 weeks of the growing season remain, seeding/revegetation should take place at the beginning of the next growing season;

- Stream sections that are expected to receive higher erosional pressure (for example outside bends) should be protected with bioengineering structures of appropriate stability to withstand expected flows; and,
- All construction-related structures and materials should be removed from the site upon completion of the works and prior to restabilization and revegetation of the disturbed areas.

4.1.2 Introduction of Deleterious Substances

4.1.2.1 Potential Project Effects

In addition to sedimentation, there is potential for a number of deleterious substances to be released into watercourses within the Yellowhead north arterial road project area. Accidental spills of contaminants and toxins into the watercourse from construction activities can result in immediate fish mortalities, or longer-term effects (including reduced survival rates) associated with deformities during sensitive early life-history development, and contamination of aquatic food resources. Floating oil may reduce the amount of air that can be exchanged at the air and water interfaces, reducing the dissolved oxygen in the water column and affecting aquatic plants and animals (Hart 1974). Free and emulsified oil can also directly affect gill function of fish, reducing respiration capabilities. Finally, oil can cover substrate (including spawning beds) and benthic invertebrates, affecting fish habitat and food resources (Hart 1974). Other materials such as wood preservatives, uncured concrete, paints, grout, lubricants and fertilizers that may be on site during construction and rehabilitation of the area can also be deleterious to fish and aquatic habitat (Poulin and Argent 1997). Wood preservatives can contain creosote, chlorophenols, zinc and copper and are highly toxic to fish. Uncured concrete can kill fish because it lowers the pH of water (Poulin and Argent 1997).

4.1.2.2 Mitigation

To prevent the introduction of deleterious substances into Oldman Creek during construction activities, the following mitigation measures are recommended for implementation during the construction period:

- All building materials should be clean and free of toxic residues;
- All equipment should arrive at the site clean (no external mud, grease, oils, and other deleterious substances). Cleaning and inspection of equipment and machinery is needed also to prevent the transfer of biota of concern (e.g., terrestrial and aquatic weeds, etc.);
- Servicing and washing of construction equipment should be completed regularly and be completed at least 100 m away from the watercourse;
- Collecting and disposing of spent lubricants, oils, etc. should be done at an approved location or in an appropriate manner;

- Risks of fuel spills should be minimized by ensuring; all hoses, containers, and nozzles do not leak; equipping all fuel nozzles with automatic shut-offs; using trained operators stationed at both ends of the hose during fuelling; and, returning remaining fuel in the hose to a storage facility;
- Cast in place concrete should be allowed to cure for at least 48 hrs before entering in contact with fish bearing water;
- Any pressure-treated wood should be allowed to weather for at least 45 days prior to use;
- An ECO plan should be developed for all instream and near stream construction activities and should be reviewed and updated as new situations arise;
- Instream construction activity should be minimized wherever possible. Hydraulic, fuel, and lubrication systems should be in good repair to avoid leakage;
- A spill contingency plan should be prepared prior to the commencement of the work and the crews should be familiar with it; and,
- A designated construction zone should be identified, construction equipment should be kept within this zone, and vegetation and stream banks should not be disturbed outside of this area.

4.1.3 Disruption of Fish Movement

Fish move and/or migrate on a regular basis to feed, seek cover, reproduce, or to reach more favourable habitat. Although some natural, non-permanent barriers to fish movement may exist at times (e.g., beaver dams), the addition of barriers to fish movement through anthropogenic means can have harmful effects on fish populations. Requirements for continuous fish passage through an instream structure are outlined in sections 20(1) and 22(1) of the federal *Fisheries Act* and in Part 1 Schedule 2 of the Alberta Code of Practice for Watercourse Crossings (Alberta Environment 2001). Fish passage potential at Crossing 1 was considered to be poor because of the presence of beaver dams, but there were no permanent barriers to fish passage identified. Migration potential at Crossing 2 was rated as good.

4.1.3.1 Fish Passage during Construction Activities

Potential Project Effects

The installation of watercourse crossing structures has the potential to affect fish passage, and the installation of isolation structures such as berms or coffer dams used to prevent the introduction of sediments and deleterious substances to the watercourse may also trap fish within the working area. Additionally, pumps used for dewatering isolated areas or maintaining downstream flows during construction activities have the potential to result in fish mortality if fish are unable to swim away from the intake and become entrained within the inlet of the pipe or hose (DFO 1995).

The transition of flow to or from temporary channel sections used for flow redirection during construction also has the potential to reduce flows, harming or killing fish within these sections.

Mitigation

The following mitigation measures are recommended to prevent the blockage of fish passage during construction activities:

- Appropriate fish salvage activities should be conducted in any instream work areas separated by barriers, work areas to be dewatered, as well as in existing stream segments to be decommissioned;
- Water pumps should be fitted with intake screens in order to protect fish from being taken into pumps and harmed (DFO 1995); and,
- Construction activities should be conducted outside the restricted activity period to prevent harm to fish, eggs, or fry.

4.1.3.2 Fish Passage within Watercourse Crossing Structures

Potential Project Effects

The preliminary engineering plans for the bridge structure at Crossing 1 call for a clear span bridge with retaining walls constructed outside of the natural channel of Oldman Creek (Appendix 1). Based on the recommended design, there should be no permanent fish passage concerns related to this construction project as there will be no instream structures. At Crossing 2, the preliminary plans call for a three span bridge with two piers to be constructed above the high water mark on either side of the channel (Appendix 2). Therefore, there will be no instream structures and no permanent fish passage issues shall result.

Mitigation

Since bridge design will not result in the need for any instream structures, fish passage will not be affected and no mitigation is required.

4.1.4 Habitat Loss/Alteration

The federal *Fisheries Act* defines fish habitat as those parts of the environment that fish depend on directly or indirectly to carry out their life processes. Section 35 (2) of the *Act* prohibits the harmful alteration, disruption or destruction of fish habitat (HADD) unless authorized by Fisheries and Oceans Canada. Provincially, the Code of Practice for Watercourse Crossings requires that “Upon the completion of the works, the quantity and productive capacity of the aquatic environment, including fish habitat, at the watercourse crossing site, where technically feasible, and adjacent to the watercourse crossing site must be equivalent to or exceed that which existed prior to the commencing of the works" (Schedule 2, Part 1 (a)).

4.1.4.1 Potential Project Effects

The designs for the bridge structures identified in the preliminary engineering plans (Appendices 1 and 2) do not call for the construction of any instream structures. Therefore, there should be no permanent loss of habitat associated with this construction project. If any instream construction is required and a portion of the stream must be isolated, a temporary loss of habitat may result.

4.1.4.2 Mitigation

If the mitigation measures identified above for controlling the introduction of sediments, maintaining site stability, and preventing the introduction of deleterious substances are followed, no permanent loss or alteration of fish habitat is expected to occur and no additional mitigation measures are required.

4.2 Wildlife

4.2.1 Habitat Loss/Alteration

Habitat loss is defined as the reduction of habitat available for wildlife. This includes not only the loss of habitat for species known to use the area, but also for those species that have the potential to use the area based on habitat suitability and current range distribution. Habitat loss has the potential to reduce the number of nesting, wintering and denning sites for wildlife, as well as to limit resources used for feeding, movement, and other activities. In the case of the proposed Oldman Creek crossings, the direct loss of available land through clearing and road embankments, as well as the alteration of vegetation as a result of dust, sedimentation, and contamination may reduce the amount or quality of habitat available for wildlife. Habitat fragmentation is another potentially negative effect resulting from the proposed project, resulting in the direct loss of movement corridors which may reduce access to areas of quality habitat available for wildlife. However, since most of the area has already been extensively developed for agricultural and residential use, and the recommended crossing structures for Oldman Creek will allow for wildlife movement, the overall effects of habitat loss/alteration on wildlife are expected to be minimal. Nevertheless, several mitigation measures should be implemented to ensure that habitat loss is minimized:

- Restrict clearing to minimal standards within the riparian zones;
- Avoid natural habitat areas for access and staging to avoid further habitat loss;
- Where natural habitats are affected, reclaim as soon as possible using native vegetation. Stabilize and restore disturbed watercourse banks; and,

- Fell trees away from remaining forest to avoid further habitat loss.

4.2.2 Mortality

4.2.2.1 Site Clearing

Site clearing is most often conducted using bulldozers and other heavy equipment and can result in mortality through destruction of nests, dens, and hibernacula, as well as individuals that are unable to avoid or escape the immediate construction area. While some wildlife mortality is unavoidable (e.g., voles, mice and other less mobile species), construction in natural habitats during the breeding and nesting/natal period contravenes the federal *Migratory Birds Convention Act* and provincial *Wildlife Act*, and timing of construction to avoid the nesting period (April 15 to July 31) would greatly reduce losses of migratory birds. If this is not possible, a nest search should be conducted prior to initiation of clearing activities to avoid contravention of the provincial *Wildlife Act* and the federal *Migratory Birds Convention Act*. The nest search, which is conducted by a qualified avian biologist, is used to identify any active nesting locations (e.g., nests with eggs or young). All active nest sites are flagged and a suitable clearing exclusion zone is established (species dependent) until the young have fledged. The following mitigation measures are recommended to minimize the potential for wildlife mortality:

- Scheduling construction to avoid the nesting/natal season (April 15 - July 31) will reduce mortality of wildlife, particularly breeding birds, during the clearing phase of construction;
- Have a qualified professional conduct a nest search to ensure that nests are not impacted if construction must proceed during the nesting/natal season; and,
- Restrict clearing to minimal standards within the riparian zones.

4.2.2.2 Wildlife/Vehicle Collisions

There is potential for animal-vehicle collisions to occur in the study area, particularly if wildlife move out of the Oldman Creek valley. The riparian zone of the Oldman Creek valley is currently being used by deer and other species and likely functions as a movement corridor. Since the preliminary engineering plans for these bridges have identified that the span of the structure will be greater than the width of the channel, this should allow for the passage of wildlife below the crossing structures. Therefore, the potential for wildlife/vehicle collisions should be reduced. However, several other mitigation measures should be implemented to further reduce the likelihood of wildlife/vehicle collisions at either crossing location:

- Wildlife signage should be used in the vicinity of the creek valley during the construction and operations phases to reduce the risk of animal vehicle collisions;
- Final road right-of-way planning should ensure appropriate clearing within the right-of-way to allow motorists a reasonable range of view; and,
- Wildlife/vehicle collisions within the project area should be monitored following construction. If problem areas are later identified during the operation of the road, additional mitigation measures (e.g., fencing, wildlife reflectors) could then be implemented.

4.2.3 Sensory Disturbance

Disturbance from construction, traffic, and other human activities can result in habitat avoidance and a decline in wildlife abundance near road corridors (Trombulak and Frissell 2000). Activities associated with road and bridge construction will likely result in the temporary displacement of wildlife or habitat avoidance proximate to the construction zone as well as deter wildlife from using the existing movement corridor across the road. To minimize the potential effects of sensory disturbance on wildlife, construction should be scheduled to avoid the nesting/natal period (April 15 - July 31) during the clearing phase of construction.

4.2.4 Disruption of Wildlife Movements

The proposed bridges and road may affect wildlife movements and distribution either directly through the creation of physical barriers, or indirectly through disturbance (Trombaluk and Frissell 2000). As discussed previously, the Oldman Creek valley likely functions as a movement corridor for deer and other wildlife species. The use of clear span bridge structures should minimize the effect of the road crossing on wildlife movement within the riparian zone. In addition, however, clearing within the riparian zone should be restricted to minimal standards to reduce habitat fragmentation. Any disturbed areas should be reclaimed with native vegetation species and soon as possible.

4.3 Vegetation and Wetlands

4.3.1 Loss/Alteration of Plant Communities

Some natural habitat within the Oldman Creek riparian zone will be physically replaced by the proposed crossing project through clearing and grading. Important rare plants or plant communities could also be lost during clearing. Erosion and sedimentation during construction may also affect the primary productivity of the vegetation in the study area. Furthermore, the wetland located west of Crossing 1 may also be affected by road construction. The alteration and destruction of wetlands is prohibited under the Alberta *Water Act* and as a result approval from Alberta Environment must be obtained if wetlands will be affected by construction activity. Wetlands should be classified and, if required, a compensation plan should be prepared in accordance with the Provincial Wetlands Restoration/ Compensation Guide (February 2007). Compensation ratios start at 3:1 and increase to 10:1 depending on distance of the restoration site from the original wetland. In addition, the following mitigation measures are recommended to minimize the effects of the road project on vegetation:

- Restricting right-of-way clearing to minimal acceptable standards when possible;
- Staging areas should be designed to minimize disturbance to natural habitat;
- The felling of any trees should be conducted away from the remaining forested areas during clearing which will reduce additional habitat losses;
- Reclamation of disturbed areas should occur in a timely fashion (i.e., within a year) following construction. Native seed mixes and native trees such as aspen and willow should be used for reclamation of disturbed riparian areas. Native seed mixes help maintain biodiversity of an area, improve landscape aesthetics, and assist in the control of weed spread; and,
- Use of appropriate erosion and sediment control methods, including reclamation of right-of-ways and riparian areas.
- A rare plant survey should be conducted prior to initiation of clearing activities within the Oldman Creek riparian zone.

4.3.2 Pollutants and Dust

Adjacent vegetation communities may be affected by contaminated runoff and accidental spills associated with the proposed road construction project. Road construction and vehicle traffic produces dust that settles out on adjacent vegetation communities. Road dust may have direct physiological effects on plants, as well as indirect effects on soil characteristics, including nutrient levels. Some potential exists for accidental spills of deleterious substances, although the environmental effects will greatly depend on the amount and types of substances involved. The following mitigation measures are recommended to minimize the effects of pollutants and dust in the study area:

- Proper maintenance of equipment and storage of fuels during construction;
- Prompt cleanup of any accidental spills;
- The use of herbicides should be restricted in the vicinity of Oldman Creek;
- The use of dust control measures during construction; and,
- Use appropriate erosion and sediment control during construction and operation.

4.3.3 Non-Native Plants and Invasive Weeds

Natural habitats may become colonized by non-native weed species where surface vegetation is disturbed during site clearing, topsoil extraction, access development, or erosion. Weeds may then spread to adjacent areas of native vegetation, reducing their ecological value. Weed species can often colonize exposed soils on bridge approaches, access roads, and staging areas during the construction, operation, and maintenance phases. However, the distribution of invasive weeds will likely be largely confined to these areas. The following mitigation measures are recommended to minimize the potential impacts from invasive species:

- Ensuring that construction equipment has been cleaned prior to use for this project;
- Prompt reclamation of exposed soils along right-of-ways and river banks, as well as protection of topsoil stockpiles (e.g. seeding surface with annual grasses); and,
- Weed control methods, such as spraying, could also be implemented during the construction, reclamation, and maintenance phases of the proposed project.

5

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6.0 PERSONAL COMMUNICATIONS

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7.0 CLOSURE

This report was prepared by Westworth Associates Environmental Ltd. for Strathcona County and Stantec Consulting Ltd. The material in it reflects Westworth Associates Environmental Ltd.'s best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Westworth Associates Environmental Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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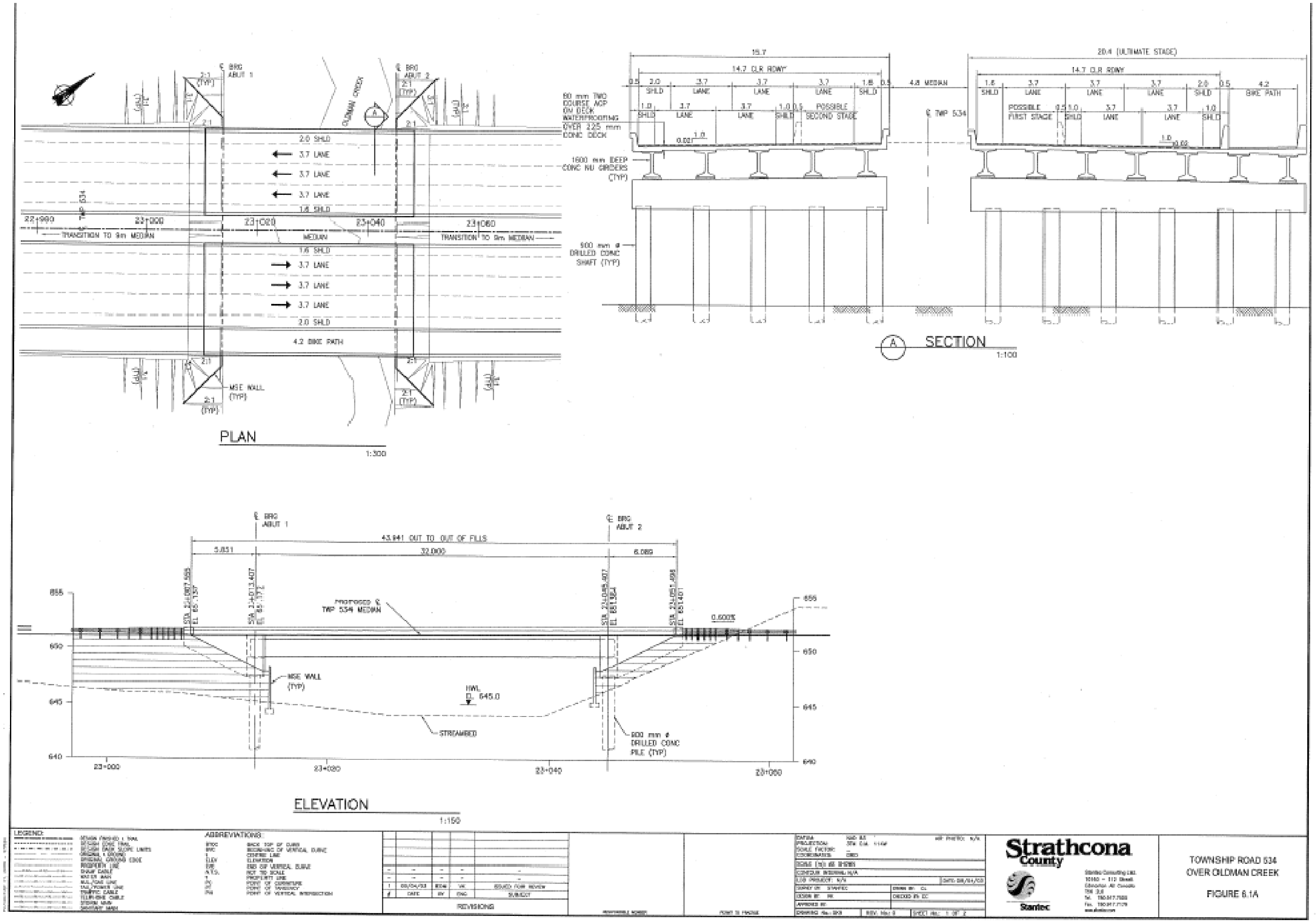
8.0 APPENDICES

Appendix 1. Engineering plans for the bridge structure at Crossing 1 on Oldman Creek.



Appendix 2. Engineering plans for the bridge structure at Crossing 2 on Oldman Creek.