APPENDIX E

Environmental Overview

ENVIRONMENTAL ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN

17 STREET CORRIDOR PLANNING - WHITEMUD DRIVE TO KNIGHTSBRIDGE ROAD

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1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

McElhanney Consulting Services Ltd. (MCSL) was retained by the City of Edmonton (The City) to develop an Environmental Assessment (EA) and general recommendations for the proposed corridor upgrades of 17 Street between Whitemud Drive and Knightsbridge Road, Edmonton AB. The EA is intended to identify any sensitive wildlife and fisheries species as well as habitats.

The Alberta Sustainable Resources Development (ASRD) and Fisheries and Oceans Canada (DFO) require that work conducted in and around a watercourse must avoid harmful alteration, disruption or destruction of fish and fish habitat (HADD) (Alberta Environment 2000a, 2000b; Department of Fisheries and Oceans 1991). Both provincial and federal government agencies abide by a 'No Net Loss' guiding principle for fish habitat. As such, following construction, the quantity and productive capacity of the aquatic environment, including fish and riparian habitat at and adjacent to any instream works, must be equivalent to or exceed that which existed prior to the commencement of works.

This document has been prepared to satisfy any Canadian Environmental Assessment Act requirements. The EA has been based on Valued Ecosystem Components or those environmental or socio-economic areas that have value that could potentially be affected by a proposed project.

This report provides information collected during the assessment of the proposed 17 Street Corridor Planning project and general recommendations to ensure that ecosystems, wildlife, vegetation, fish and fish habitat values are protected. The recommendations contained within this report are, in the opinion of the author, sufficient to ensure the requirements of ASRD are met. These requirements are outlined within Part 1, Schedule 2 of the Code of Practice for Watercourses Crossing of the *Water Act* (Alberta Environment 2000a, 2000b). Furthermore, these recommendations are sufficient to meet the 'No Net Loss' guiding principle of DFO (Department of Fisheries and Oceans 1991).

1.2 Background

The City and Strathcona County understand the need for road improvements at this location; in order to accommodate future growth, facilitate smooth traffic movements to larger corridors to ensure timely and safe transportation. As stated in the 2012 Professional Service Agreement between MCSL and The City:

> *'As part of the Northeast Anthony Henday Drive work being completed by the Province of Alberta, significant reconstruction and widening work will be undertaken at the 17 Street/Sherwood Park Freeway interchange. This proposed work has resulted in both the City and Strathcona County examining the long term development of the 17 Street between Whitemud Drive and 105 Avenue. The Transportation Master Plan approved by the*

City encourages improving the level of service for goods movement, which includes widening and upgrading of 17 Street through the developing Maple Ridge Industrial Area. Combined with a commitment by Strathcone County to improvements along 17 Street north of Sherwood Park Freeway, the movement of goods within the Greater Edmonton Area, and access to the Anthony Henday Drive ring road will be improved.

The objective of this study is to develop concept plans for the upgrade of 17 Street between Whitemud Drive and 105 Avenue from the existing two lane undivided rural roadway standard to an ultimate four lane divided and/or five lane undivided urban arterial standard in accordance with the City and Strathcona County design standards. The proposed work will fall within both the City and County jurisdiction, and coordination between jurisdiction will be essential.'

1.3 Legislation and Permitting Requirements

The following is a list of federal, provincial and municipal environmental legislation that might apply to this project.

Federal
Canada *Fisheries Act* (R.S., 1985, c. F-14)
Canada *Migratory Birds Convention Act*, 1994
Canada *Navigable Waters Protection Act* (R.S., 1985, c. N-22)
Canada *Species at Risk Act* (2002, c. 29)
Canadian Environmental Protection Act (1999, c. 33)
Canadian Environmental Assessment Act (1992, c. 37)

Provincial
Alberta Water Act, 2012
Alberta Weed Control Act, 2008
Alberta Wildlife Act

Municipal
City of Edmonton *Enviso-ISO 14001*

2.0 LOCATION

The section of the 17 Street Corridor that this project is concerned with, in the southeast section of the city and intersects with Whitemud Drive at the southern portion and continues north to 105 Avenue or Knightsbridge Road (Figure 1). This area covers Township 52 Range 23 West of the 4 Meridian, covering approximately 7.2 km. The proposed works would involve widening the existing corridor from a two lane rural road to a four lane urban road.

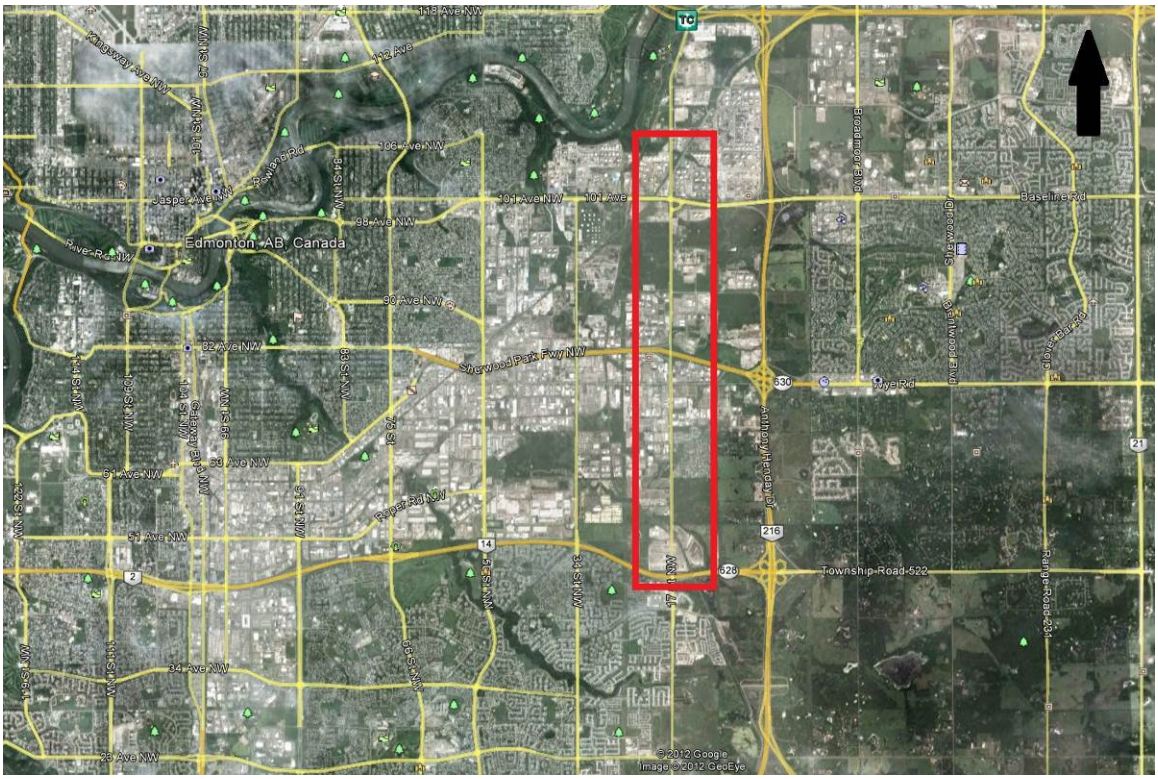

Figure 1: Project Site Location Map (general construction area boxed in red).
*modified Google Earth 2012, map not to scale

3.0 METHODOLOGY

This project was undertaken to meet the requirements of the *Code of Practice for Watercourse Crossings* (Alberta Environment 2000a). As such, the data collected and methods used relate directly to those suggested in these Codes of Practice. For the purpose of this assessment "water body" was defined as per the *Guide to the Code of Practice for Watercourse Crossings, Including Guidelines for Complying with the Code of Practice* (Alberta Environment 2000b). The classification of a watercourse as ephemeral, intermittent, small permanent or large permanent was based on definitions provided by Fisher et. al. (1989).

For sampling purposes, wherever possible, each crossing location was identified as an area 20 m in width and the watercourse was divided into an 'upstream' portion and a 'downstream' portion. The upstream portion covered the area up to 100 m upstream of the upper end of each crossing location and will act as a control site for future reference assessments. The downstream portion of each crossing site is considered the Zone of Impact by ASRD and covers the area from the upstream side of the crossing location to 300 m downstream.

The methodology used to undertake the fish and fish habitat assessments was adapted from the *Reconnaissance (1:20000) Fish and Fish Habitat Inventory: Standards and Procedures, version 2.0* (Resource Inventory Committee of British Columbia 2001). The fish and fish habitat assessment included recording a UTM and legal location, channel width measurements, and substrate and cover descriptions. Water quality parameters including pH, temperature and turbidity were measured where sufficient water was available.

Historical fish data for Fulton and Goldbar Creeks were obtained from the provincial Fisheries and Wildlife Management Information System (FWMIS) and personal communications with Daryl Watters, Fisheries Biologist with the ASRD in Edmonton. Sensitive ecosystems and rare and endangered plants species data was determined using the Alberta Conservation Information Management System (ACIMS) database.

The EA is based on Valued Ecosystem Components (VECs). Under the Canadian Environmental Assessment Act (CEAA), the definition of VECs is as follows:

- Any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern (CEAA 1999).

Natural environment VEC examples include species populations that have been identified as needing protection to sustain and encourage population growth within certain areas. They include wildlife, fish, vegetation and ecosystems.

4.0 RESULTS AND DISCUSSION

Search information for wildlife and fish species for the proposed construction footprint area was generated using a 2 kilometer buffer radius from where Fulton and Goldbar Creek's cross 17 Street (SW 17-52-23-W4M and SW 29-52-23-W4M).

The resources that were consulted to determine species and ecosystems of concern that fall within the proposed development included:

- Species at Risk Act (SARA)
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
- FWMIS
- ACIMS

4.1 Rare and Endangered Wildlife

4.1.1 Wildlife

Database searches revealed no mammal species of concern for this area and at the time of the assessment, no wildlife evidence of use or scat trails were observed. No ungulate winter range has been identified within the project footprint. ASRD does not manage ungulates within the city limites in terms of hunting or recreational activities and doesn't conduct formal surveys (per comm D Anderson, 2012).

The site was evaluated and determined low in wildlife habitat value as the majority of the assessment area of construction lies within the already impacted road right-of-way with both industrial and housing developments.

4.1.2 Birds

Two species of birds were present on the FWMIS list; the peregrine falcon (*Falco peregrinus*) and Swainson's hawk (*Buteo swainsoni*) as potentially occurring within the same jurisdiction as the study area. Of the listed species, there is very little risk that the proposed development would have any impact. The peregrine falcon inhabits open wetlands and nest in cliffs but has established themselves in cities using bridges and tall buildings. The Swainson's hawk can be found in open to semi-open country; deserts, grasslands and wild prairies. This hawk is not particular about nesting sites using a variety of locations including: isolated trees or bushes, riparian areas, around abandoned homesteads even in the ground or ledge. They do migrate to South America for the winter months.

At the time of the assessment, within the marsh wetland a red-winged blackbird (*Agelaius phoeniceus*) was observed, as well as a number of waterfowl including: Canada geese (*Branta canadensis*), American coots (*Fulica americana*), mallards (*Anas platyrhynchos*), lesser scaup's (*Aythya affinis*) and diving ducks (*Aythya* sp.) (Photographs 1 to 4). No bird nests were identified during the site assessment, and no raptors were observed.

The site was evaluated and determined low in bird habitat value for the flacon and hawk as the majority of the assessment area of construction lies within the already impacted road right-of-way with both industrial and housing developments.

In order to address nesting migrants if trees need to be removed, there are two options under the federal Migratory Birds Convention Act (Environment Canada 1994). If harvesting occurs prior to the beginning of the migratory bird breeding period on May 1, no nesting migrants will be disturbed. If delays are encountered and the wood is not removed before May 1, a breeding bird survey can be completed to determine if nesting has initiated within the proposed development area, and whether it involves migrants. If so, site specific protections, such as no disturbance buffers, can be used. If several nests are identified, harvesting may be delayed until after fledging has occurred (approximately July 31).

Photograph 1: Red winged blackbird on the Fulton Wetland, view to the south.

Photograph 2: Canada geese and offspring, view to the north.

Photograph 3: American coots on the Fulton Wetland, view to the west.

Photograph 4: Diving ducks (center of the photo) and mallards (upper right corner of the photo) on Fulton Wetland, view to the north.

4.1.3 Amphibians

Database searches revealed no amphibian's species of concern for this area but frog choruses were heard at the Fulton Wetland.

The site was evaluated and determined to have moderate amphibian habitat values in and around the wetland complexes but a majority of the assessment area of construction still lies within the already impacted road right-of-way with both industrial and housing developments.

4.2 Fisheries Assessment Results

Table 1. Assessment Results and Crossing Plan Summary

MCSL Crossing Number	Watercourse Type	Channel Width at Proposed Crossing Site (m)	Legal Description	Nearest mapped CoP water body*
1	Small Permanent	1.3	SW 17-52-23-W4M	North Saskatchewan River
2	Wetland	N/A	SE 19-52-23-W4M	North Saskatchewan River
3	Small Permanent	2.0	SW 29-52-23-W4M	North Saskatchewan River
4	Wetland	N/A	SW 32-52-23-W4M	North Saskatchewan River

*CoP Code of Practice

4.2.1 Crossing 1: Watercourse Summary

Watercourse Name: Fulton Creek
Watercourse Type: Small Permanent
Alberta Code of Practice Classification:
Restrictive Activity Period:
Legal Description: SW 17-52-23-W4M
UTM Co-ordinates: 12 U 342831.29 m E 5929441.21 m N (NAD83)

Fish Habitat Summary:
Assessment Date: June 14, 2012
Overall Fish Habitat: Moderate
Potential for Fish Presence: Low to Nil

Fish Data

The provincial FWMIS database shows that there are no know species recorded for this watercourse, which has been confirmed by Daryl Watters, ASRD in Edmonton (Appendix A, Government Communication).

Fish Habitat: Upstream of the Proposed Road Upgrade Site (100 m)

Approximately 100 m upstream of the proposed road upgrade site, the watercourse was well defined and flowed in an irregular meander with a riffle run morphology (Photographs 5 and 6). The channel was confined within a vegetated buffer zone with agriculture activities to the north and the City snow dump to the south. The channel and wetted widths were 2.5 m and 2.6 m, respectively. The channel bottom was composed of fine sediments and organics interspersed with cobbles. The banks were vertical and composed of fine sediments. Gradient was 0.5% and crown closure was 95%. Abundant overhanging and instream vegetation was present with moderate amounts of undercut banks. Upland vegetation and riparian composition can be found in Section 4.3.

Fish Habitat: Proposed Road Upgrade Site

At the proposed road upgrade site the watercourse was still defined and flowed in a straight pattern leading upto the existing 1500 mm culvert crossing (Photographs 7 and 8). The channel banks were similar to those characteristics as upstream (Photographs 9 and 10). The channel and wetted width were approximately 1.3 m and 1.2 m wide and as deep as 0.42 m. All other characteristics, including riparian and upland vegetation were similar to those upstream. Water quality measurements included: pH (7.77) and temperature (18.6^{o}C).

Fish Habitat: Downstream of the Proposed Road Upgrade Site (20 m)

Immediately downstream of the culvert outlet and for approximately 20 m, the watercourse flowed onto private property where No Trespassing signs were posted so future investigation was not feasible. The watercourse was less defined flowing out into a horse pasture (Photographs 11 and 12).

A second 1000 mm culvert was located approximately 10 m north of the primary Fulton Creek Culvert, suspect it was an overflow culvert, primarily draining the ditch line from the north. There was no defined watercourse channel upstream or downstream of this structure (Photographs 13 to 15).

Fish and Fish Habitat Summary

Overall fish habitat was poor with a low to nil potential for fish presence at all times of the year. Spawning habitat was not observed and rearing habitat consisted of cover provided by overhanging and instream vegetation and undercut banks. There were no deep pools present for overwintering habitat.

Photograph 5: Fulton Creek, 100 m upstream, upstream view.

Photograph 6: Fulton Creek, 100 m upstream, downstream view.

Photograph 7: Fulton Creek, at the 17 Street culvert inlet, upstream view.

Photograph 8: Fulton Creek, at the 17 Street culvert inlet, downstream view.

Photograph 9: Fulton Creek, at the 17 Street culvert inlet, left bank view.

Photograph 10: Fulton Creek, at the 17 Street culvert inlet, right bank view.

Photograph 11: Fulton Creek, at the 17 Street culvert outlet, upstream view.

Photograph 12: Fulton Creek, at the 17 Street culvert outlet, downstream view.

Photograph 13: Fulton Creek, at the 17 Street inlet of the overflow culvert, upstream view.

Photograph 14: Fulton Creek, at the 17 Street inlet of the overflow culvert, north view along ditch line.

Photograph 15: Fulton Creek, at the 17 Street outlet of the overflow culvert, downstream view.

Watercourse Crossing Method: Permanent Round Bottomed Culvert
Construction using the recommendations described below should have no significant impacts on fish or fish habitat at the crossing site or downstream and will meet the requirements of clause (a) in Part 1, Schedule 2 of the Alberta *Code of Practice for Watercourse Crossings* (Alberta Environment 2000b) and the "No Net Loss" requirements of the DFO (Department of Fisheries and Oceans 1991).

Timing
Construction timing has yet to be determined.

Description of Proposed Works

The crossing of Fulton Creek will include the placement (extension) of a culvert to match exiting (1500mm). Invert levels may be difficult to match with the additional widening of 17 Street and it was noted that the low slope of the existing culvert will likely result in standing water in the culvert. A secondary culvert (1000mm) was also noted as an overflow culvert. Consideration should be given for a single larger culvert as a replacement to the two culverts

Additionally for wildlife passage, a closed bottom culvert, would compliment the exisitng (and future) structures and facilitate the movement of medium to small terrestrial animals, An important part of this type of culvert would be the availability of dry space along side of the flowing water to help create the movement of terrestrial animals. - This type of culvet could also be considered an amphibian tunnel. This structure follows all of the requiements for this option: no critical fish habitat or species at risk, the stream width is less that 2.5 m and a gradiant less than 6%.

Isolation Area
If flowing water or large amounts of standing water are present at the time of construction, an isolation area will be established to minimize or eliminate water flow through the crossing site in order to dry the scheduled instream work area prior to commencement of construction. The isolation area will be maintained throughout the entire culvert installation process. A dam or barrier will be placed temporarily across the channel at a suitable location upstream of the proposed work site to stop water flow. Depending on site conditions, such as a low channel gradient, a downstream dam may be required to prevent water from flowing back into the work site. The upstream and downstream barriers can be constructed of sand bags and tarps, steel plates, wooden planking or any other materials that are not hazardous (non-toxic) to fish and fish habitat. Where possible, suitable natural features such as beaver dams or frozen debris jams can be incorporated into the barriers to reduce construction efforts, as long as these natural features are not disturbed and/or remain in original condition.

Water initially contained within the isolation area may naturally drain out, although a second pumping system may be required to de-water the isolation area and possibly continually remove water throughout the entire construction process. Water removed from the isolation area must be released at a location and in a manner that either prevents water from re-entering the watercourse or allows suitable filtering and/or settling of sediment out of the water before re-entry into the watercourse.

Water flow will be diverted across or around the work site by a flume or pumping system to ensure downstream water flow is maintained at all times to avoid impacting downstream characteristics. All water discharged into the channel downstream of the crossing site must be done in a manner that prevents scouring of the channel bottom and minimizes sedimentation. Therefore, water must be released onto a structure or material that diffuses and slows water velocity.

Water Withdrawal

If pumps are used during construction, the ends of the intake hoses must be screened with a maximum mesh size of 2.54 mm to prevent entrainment or impingement of fish (Department of Fisheries and Oceans 1995). In addition, all discharged water must be released at a location and in a manner that either prevents water from re-entering the watercourse or allows suitable filtering and/or settling of sediment out of the water before re-entry into the watercourse. One hundred percent of downstream flow must be maintained at all times to avoid impacting downstream fish and fish habitat.

Secondary Containment

Any gasoline powered equipment such as pumps and generators must be entirely enclosed or set within a secondary containment structure that is large enough to completely contain all harmful materials should a spill, leak or overflow occur.

Water Turbidity Monitoring

If flowing water is present at the time of construction, water turbidity must be monitored to ensure instream sedimentation is detected. Monitoring should be conducted on an hourly basis with a portable water turbidity measuring unit at a minimum of four sampling locations, including one upstream, one immediately downstream of the isolation area and two further downstream. All measurements should be recorded.

Cleaning of Vehicles, Equipment and Machinery Prior to Construction

Prior to construction, all vehicles, equipment and machinery scheduled to work in and/or along a watercourse will be inspected and found to be clean, free of leaks and in good working condition. All foreign material must be removed, including dirt, mud, debris, grease, oil, hydraulic fluid, coolant or other substances that may negatively impact the water quality of the watercourse at the crossing site or further downstream. All identified leaks must be repaired and then appropriately cleaned. Inspections, cleaning and/or servicing can occur either before the vehicle, equipment or machinery is transported into the field or can be conducted at the work site at a minimum distance of 100 m from the watercourse. All wash water runoff and/or harmful materials must be appropriately controlled to prevent entry into the watercourse including the riparian zone.

Construction Monitoring

During crossing construction, on-site monitoring will be conducted to identify potential sedimentation and possible fluid leaks from vehicles, equipment and machinery that may not be observable to the operator. A spill containment kit should be kept on site that is capable of handling twice the potential volume of a spill.

Riparian Vegetation

During construction, care should be taken to disturb as little of the natural riparian vegetation along the banks and adjacent slopes as possible. Maintaining the original established vegetation around the crossing site will aid ground stabilization and minimize potential erosion and sedimentation. Vehicles, equipment and machinery should not be located within the riparian zone, or at a minimum of 10 m from the channel, to maintain an undisturbed vegetation buffer. All trees that have to be removed from either side of the crossing site should be hand-cut at ground level with the root system retained. However, any disturbances that occur along the banks and farther up the slopes will be re-vegetated as soon as possible with seeding, cuttings and/or plantings to restore the riparian vegetation to original condition. If there are time constraints within the current growing season, re-vegetation will occur on or before June of the following year.

The standard prescribed roadway landscaping seed mixture is Canada #1 Mix which is made up of 30% Argyll Kentucky Bluegrass, 30% Kentucky Bluegrass, 30% Creeping Red Fescue and 10% annual Rye Grass.

Evasive Species/Weed Control

Monitor planting areas for success rate of germination and for weeds bimonthly during the growing season and implement appropriate controls as needed. Controls may include re-seeding, mechanical (such as mowing or hand pulling) or chemical (herbicide) methods. When hand-pulling, care should be taken to remove the roots of the weed species. Regular mowing should occur every 30 days during and post reestablishment. Herbicides should be used only if hand pulling is not feasible (effective or cost effective). The method of application and product used should be selected to eliminate any negative impacts to desirable plant species. Pre-emergent and post-emergent herbicides may be used after one-year establishment period for new plantings has elapsed. After killing weeds with herbicide, any weeds over 5 cm tall must be removed from planting beds and disposed of properly off site.

Sedimentation and Erosion Control

Disturbance of the ground surface and soils of the banks and surrounding slopes will be minimized. The width of the construction right-of-way should be kept to a minimum within 50 m of the watercourse banks. All disturbed areas will be re-contoured to the natural pre-construction condition without causing excessive disturbance or creating large areas of exposed unstable soil. If required, temporary measures can be implemented to minimize potential erosion and sedimentation as well as aid in the re-establishment of natural vegetation. Erosion control materials will be installed on any disturbed areas. Such materials may include coco-matting, straw matting or geotextile fabric, which should be anchored (staked) in place as per manufacturers' recommendations to protect and stabilize exposed ground.

Cross-Berms and Ditches

Cross-berms and ditches control the velocity and direction of surface water flow down long and/or steep slopes. The structure can consist of a shallow ditch or swale hand-cut across the slope with the spoil material piled on the immediate downslope side of the ditch to form a low berm. The entire structure should be approximately 30 cm in height from the bottom of the ditch to the top of the berm. The ditch and berm structure should be angled in order to intercept and divert surface water into the surrounding vegetated

areas and should be completely covered in erosion control materials to prevent sedimentation of the watercourse.

Silt Fences

Silt fences can be used to control surface water flow and should be installed to divert water flowing directly off of the crossing site and adjacent ground surfaces into surrounding vegetation to reduce sedimentation of the watercourse. Once installed, no gaps should be present between the bottom of the silt fences and the ground surface. If required, the lower edge of the silt fence can be dug into the ground surface or secured under the edge of adjacent erosion control materials (if present). Multiple silt fences may be used to control water flow from large receiving areas and/or particularly steep slopes. Silt fences should be used to divert, rather than dam water flow and should be sufficiently supported to withstand high wind and water pressures.

Sandbag Berms

Another option to control surface water flow is to install temporary sandbag berms across the base of the banks or slopes. The sandbags should be wrapped with geotextile fabric with the free end of the fabric secured to the ground surface on the upslope side. No gaps should be present between the bottom of the fabric and the ground surface. Berms can be dug into the ground surface for a better seal. The berms should be wide enough to capture all the surface water flowing from the crossing site to prevent sedimentation of the watercourse.

Channel Bed Replacement

Once back-filling is complete, the entire surface from bank to bank will be capped with original excavation material and/or suitable material that provides a stable channel bottom. The material will be placed uniformly across the channel bed to prevent possible damming and/or diversion of water flow at the crossing site.

Maintenance of Fish Habitat Characteristics

Once construction is complete, the channel bed and banks must be adequately replaced in a manner that maintains original habitat characteristics. The measures are site-specific and may include the addition of various materials and/or features to the crossing site such as individual or multiple logs, woody debris piles, large boulders or pools. Features should be of the same size, quantity and location as found prior to construction. A simple sketch and/or photograph of the crossing site prior to construction can aid in the subsequent re-construction of fish habitat characteristics.

Maintenance of Fish Passage

Given the results of database searches and conversations with government fish biologists, culvert installation does not need to allow for fish passage through the crossing site.

Removal of Isolation Area

Upon completion of the crossing, the isolation area will be removed in a manner that minimizes disturbance and sedimentation of the watercourse. Pumps will be used to remove turbid water and debris from the watercourse when the isolation dams or barriers are removed. In particular, a pump will be set up on the upstream side of the

downstream dam. The upstream dam can then be removed and water allowed to flow through the crossing site. This water flow will wash the sections of newly constructed channel bottom at the inlet and outlet ends of the culvert, which can then be pumped out and released into a vegetated area in a manner that does not allow unfiltered water flow back into the watercourse. Water flow can still be re-directed around the isolation area in order to maintain downstream flow. Once clean water flow has been re-established through the crossing site, the downstream dam and pump can be removed provided that associated sedimentation is expected to be minimal.

Armouring

Any portion of the channel bed and/or banks considered particularly susceptible to erosion will have armouring placed on top of the erosion control materials to aid in stabilization and protection from erosion, particularly during high water levels. Armouring should consist of rock material ('rip-rap'), that is cobble (64 to 256 mm) or preferably boulder (> 256 mm) sized and placed, at a minimum, along the bottom 1.5 m of the banks. Gaps between the armouring material should be minimized.

Post-Construction Assessment

Once construction is complete, the crossing site will be revisited after high water levels in the spring to identify any sedimentation problems and determine the risk of erosion. If excessive sedimentation and/or erosion potential are identified, a QAES should be consulted to assess the potential impacts to fish and fish habitat and provide additional recommendations.

4.2.2 Crossing 2: Watercourse Summary

Watercourse Name: Fulton Wetland
Watercourse Type: Wetland
Alberta Code of Practice Classification: N/A
Restrictive Activity Period: N/A
Legal Description: SE 19-52-23-W4M
UTM Co-ordinates: 12 U 342845.39 m E 5930493.42 m N (NAD83)

Fish Habitat Summary:
Assessment Date: June 12, 2012
Overall Fish Habitat: Poor
Potential for Fish Presence: Low

Fish Data

The provincial FWMIS database shows that there are no know species recorded for this watercourse, which has been confirmed by Daryl Watters, ASRD in Edmonton (Appendix A, Government Communication).

Fish Habitat: Upstream of the Proposed Road Upgrade Site (25 m)

Approximately 25 m upstream of the proposed road upgrade site, the watercourse consisted of a grassed swale which was located within the Maple Ridge housing development. It was directed to a culvert crossing a gravel road access to a small electrical maintenance building, leading to 17 Street. At the time of the assessment that portion of the watercourse was dry (Photographs 16 and 17). There was no defined channel, which was composed of fine sediments to organics. The banks were sloped and composed on the same material as the channel bottom. Gradient of 0.5% and crown closure was 5%. Abundant instream and overhanging vegetation was present. Upland vegetation and riparian composition can be found in Section 4.3.

Fish Habitat: Proposed Road Upgrade Site

At the proposed road upgrade site, the watercourse flowed through a 1000 mm culvert under 17 Street into the wetland on the west side of the road (Photographs 18 to 22). The wetland was located within a heavily industrial development area, with businesses to the north and west and a horse pasture to the south. This wetland was being utilized by several species of waterfowl, birds (Section 4.1.2), amphibians and insects (Photograph 23 and 24).

Fish and Fish Habitat Summary

Overall fish habitat was poor with a low to nil potential for fish presence at all times of the year. There was no spawning habitat observed with no suitable sized gravel patches present. Rearing habitat was poor to moderate with cover provided by overhanging and ponded vegetation with no connectivity to any other watercourses. Overwintering habitat was moderate due to the presence of very deep pools.

Photograph 16: Fulton Wetland, 20 m upstream of the 17 Street culvert inlet, downstream view.

Photograph 17: Fulton Wetland, at the 17 Street culvert inlet, upstream view.

Photograph 18: Fulton Wetland, at the 17 Street culvert outlet, downstream view.

Photograph 19: Fulton Wetland, view to the north from the road.

Photograph 20: Fulton Wetland, view to the west from the road.

Photograph 21: Fulton Wetland, view to the southwest from the road.

Photograph 22: Fulton Wetland, view from the west side, back towards 17 Street, view to the east.

Photograph 23: Fulton Wetland, damselfly.

Photograph 24: Fulton Wetland, marsh fritillary.

Watercourse Crossing Method: Permanent Round Bottomed Culvert
Construction using the recommendations described below should have no significant impacts on fish or fish habitat at the crossing site or downstream and will meet the requirements of clause (a) in Part 1, Schedule 2 of the Alberta *Code of Practice for Watercourse Crossings* (Alberta Environment 2000b) and the "No Net Loss" requirements of the DFO (Department of Fisheries and Oceans 1991).

Timing
Construction timing has yet to be determined.

Description of Proposed Works
There is no direct crossing of the wetland, however the proximity of 17 Street will impact this wetland. As part of the road expansion, steps should be taken to maintain the existing water flow in to the wetland (run-off). Additionally water quality will need to be maintained and/or improved to sustain this wetland.

Isolation Area
If flowing water or large amounts of standing water are present at the time of construction, an isolation area will be established to minimize or eliminate water flow through the crossing site in order to dry the scheduled instream work area prior to commencement of construction. The isolation area will be maintained throughout the entire culvert installation process. A dam or barrier will be placed temporarily across the channel at a suitable location upstream of the proposed work site to stop water flow. Depending on site conditions, such as a low channel gradient, a downstream dam may be required to prevent water from flowing back into the work site. The upstream and downstream barriers can be constructed of sand bags and tarps, steel plates, wooden

planking or any other materials that are not hazardous (non-toxic) to fish and fish habitat. Where possible, suitable natural features such as beaver dams or frozen debris jams can be incorporated into the barriers to reduce construction efforts, as long as these natural features are not disturbed and/or remain in original condition.

Water initially contained within the isolation area may naturally drain out, although a second pumping system may be required to de-water the isolation area and possibly continually remove water throughout the entire construction process. Water removed from the isolation area must be released at a location and in a manner that either prevents water from re-entering the watercourse or allows suitable filtering and/or settling of sediment out of the water before re-entry into the watercourse.

Water flow will be diverted across or around the work site by a flume or pumping system to ensure downstream water flow is maintained at all times to avoid impacting downstream characteristics. All water discharged into the channel downstream of the crossing site must be done in a manner that prevents scouring of the channel bottom and minimizes sedimentation. Therefore, water must be released onto a structure or material that diffuses and slows water velocity.

Water Withdrawal

If pumps are used during construction, the ends of the intake hoses must be screened with a maximum mesh size of 2.54 mm to prevent entrainment or impingement of fish (Department of Fisheries and Oceans 1995). In addition, all discharged water must be released at a location and in a manner that either prevents water from re-entering the watercourse or allows suitable filtering and/or settling of sediment out of the water before re-entry into the watercourse. One hundred percent of downstream flow must be maintained at all times to avoid impacting downstream fish and fish habitat.

Secondary Containment

Any gasoline powered equipment such as pumps and generators must be entirely enclosed or set within a secondary containment structure that is large enough to completely contain all harmful materials should a spill, leak or overflow occur.

Water Turbidity Monitoring

If flowing water is present at the time of construction, water turbidity must be monitored to ensure instream sedimentation is detected. Monitoring should be conducted on an hourly basis with a portable water turbidity measuring unit at a minimum of four sampling locations, including one upstream, one immediately downstream of the isolation area and two further downstream. All measurements should be recorded.

Cleaning of Vehicles, Equipment and Machinery Prior to Construction

Prior to construction, all vehicles, equipment and machinery scheduled to work in and/or along a watercourse will be inspected and found to be clean, free of leaks and in good working condition. All foreign material must be removed, including dirt, mud, debris, grease, oil, hydraulic fluid, coolant or other substances that may negatively impact the water quality of the watercourse at the crossing site or further downstream. All identified leaks must be repaired and then appropriately cleaned. Inspections, cleaning and/or servicing can occur either before the vehicle, equipment or machinery is transported into

the field or can be conducted at the work site at a minimum distance of 100 m from the watercourse. All wash water runoff and/or harmful materials must be appropriately controlled to prevent entry into the watercourse including the riparian zone.

Construction Monitoring

During crossing construction, on-site monitoring will be conducted to identify potential sedimentation and possible fluid leaks from vehicles, equipment and machinery that may not be observable to the operator. A spill containment kit should be kept on site that is capable of handling twice the potential volume of a spill.

Riparian Vegetation

During construction, care should be taken to disturb as little of the natural riparian vegetation along the banks and adjacent slopes as possible. Maintaining the original established vegetation around the crossing site will aid ground stabilization and minimize potential erosion and sedimentation. Vehicles, equipment and machinery should not be located within the riparian zone, or at a minimum of 10 m from the channel, to maintain an undisturbed vegetation buffer. All trees that have to be removed from either side of the crossing site should be hand-cut at ground level with the root system retained. However, any disturbances that occur along the banks and farther up the slopes will be revegetated as soon as possible with seeding, cuttings and/or plantings to restore the riparian vegetation to original condition. If there are time constraints within the current growing season, revegetation will occur on or before June of the following year.

The standard prescribed roadway landscaping seed mixture is Canada #1 Mix which is made up of 30% Argyll Kentucky Bluegrass, 30% Kentucky Bluegrass, 30% Creeping Red Fescue and 10% annual Rye Grass.

Evasive Species/Weed Control

Monitor planting areas for success rate of germination and for weeds bimonthly during the growing season and implement appropriate controls as needed. Controls may include re-seeding, mechanical (such as mowing or hand pulling) or chemical (herbicide) methods. When hand-pulling, care should be taken to remove the roots of the weed species. Regular mowing should occur every 30 days during and post reestablishment. Herbicides should be used only if hand pulling is not feasible (effective or cost effective). The method of application and product used should be selected to eliminate any negative impacts to desirable plant species. Pre-emergent and post-emergent herbicides may be used after one-year establishment period for new plantings has elapsed. After killing weeds with herbicide, any weeds over 5 cm tall must be removed from planting beds and disposed of properly off site.

Sedimentation and Erosion Control

Disturbance of the ground surface and soils of the banks and surrounding slopes will be minimized. The width of the construction right-of-way should be kept to a minimum within 50 m of the watercourse banks. All disturbed areas will be re-contoured to the natural pre-construction condition without causing excessive disturbance or creating large areas of exposed unstable soil. If required, temporary measures can be implemented to minimize potential erosion and sedimentation as well as aid in the re-establishment of natural vegetation. Erosion control materials will be installed on any disturbed areas.

Such materials may include coco-matting, straw matting or geotextile fabric, which should be anchored (staked) in place as per manufacturers' recommendations to protect and stabilize exposed ground.

Cross-Berms and Ditches

Cross-berms and ditches control the velocity and direction of surface water flow down long and/or steep slopes. The structure can consist of a shallow ditch or swale hand-cut across the slope with the spoil material piled on the immediate downslope side of the ditch to form a low berm. The entire structure should be approximately 30 cm in height from the bottom of the ditch to the top of the berm. The ditch and berm structure should be angled in order to intercept and divert surface water into the surrounding vegetated areas and should be completely covered in erosion control materials to prevent sedimentation of the watercourse.

Silt Fences

Silt fences can be used to control surface water flow and should be installed to divert water flowing directly off of the crossing site and adjacent ground surfaces into surrounding vegetation to reduce sedimentation of the watercourse. Once installed, no gaps should be present between the bottom of the silt fences and the ground surface. If required, the lower edge of the silt fence can be dug into the ground surface or secured under the edge of adjacent erosion control materials (if present). Multiple silt fences may be used to control water flow from large receiving areas and/or particularly steep slopes. Silt fences should be used to divert, rather than dam water flow and should be sufficiently supported to withstand high wind and water pressures.

Sandbag Berms

Another option to control surface water flow is to install temporary sandbag berms across the base of the banks or slopes. The sandbags should be wrapped with geotextile fabric with the free end of the fabric secured to the ground surface on the upslope side. No gaps should be present between the bottom of the fabric and the ground surface. Berms can be dug into the ground surface for a better seal. The berms should be wide enough to capture all the surface water flowing from the crossing site to prevent sedimentation of the watercourse.

Channel Bed Replacement

Once back-filling is complete, the entire surface from bank to bank will be capped with original excavation material and/or suitable material that provides a stable channel bottom. The material will be placed uniformly across the channel bed to prevent possible damming and/or diversion of water flow at the crossing site.

Maintenance of Fish Habitat Characteristics

Once construction is complete, the channel bed and banks must be adequately replaced in a manner that maintains original habitat characteristics. The measures are site-specific and may include the addition of various materials and/or features to the crossing site such as individual or multiple logs, woody debris piles, large boulders or pools. Features should be of the same size, quantity and location as found prior to construction. A simple sketch and/or photograph of the crossing site prior to construction can aid in the subsequent re-construction of fish habitat characteristics.

Maintenance of Fish Passage

Given the results of database searches and conversations with government fish biologists, culvert installation does not need to allow for fish passage through the crossing site.

Removal of Isolation Area

Upon completion of the crossing, the isolation area will be removed in a manner that minimizes disturbance and sedimentation of the watercourse. Pumps will be used to remove turbid water and debris from the watercourse when the isolation dams or barriers are removed. In particular, a pump will be set up on the upstream side of the downstream dam. The upstream dam can then be removed and water allowed to flow through the crossing site. This water flow will wash the sections of newly constructed channel bottom at the inlet and outlet ends of the culvert, which can then be pumped out and released into a vegetated area in a manner that does not allow unfiltered water flow back into the watercourse. Water flow can still be re-directed around the isolation area in order to maintain downstream flow. Once clean water flow has been re-established through the crossing site, the downstream dam and pump can be removed provided that associated sedimentation is expected to be minimal.

Armouring

Any portion of the channel bed and/or banks considered particularly susceptible to erosion will have armouring placed on top of the erosion control materials to aid in stabilization and protection from erosion, particularly during high water levels. Armouring should consist of rock material ('rip-rap'), that is cobble (64 to 256 mm) or preferably boulder (> 256 mm) sized and placed, at a minimum, along the bottom 1.5 m of the banks. Gaps between the armouring material should be minimized.

Post-Construction Assessment

Once construction is complete, the crossing site will be revisited after high water levels in the spring to identify any sedimentation problems and determine the risk of erosion. If excessive sedimentation and/or erosion potential are identified, a QAES should be consulted to assess the potential impacts to fish and fish habitat and provide additional recommendations.

4.2.3 Crossing 3: Watercourse Summary

Watercourse Name: Goldbar Creek
Watercourse Type: Small Permanent
Alberta Code of Practice Classification:
Restrictive Activity Period:
Legal Description: SW 29-52-23-W4M
UTM Co-ordinates: 12 U 342930.45 m E 5932275.02 m N (NAD83)

Fish Habitat Summary:

Assessment Date: June 12, 2012
Overall Fish Habitat: Moderate
Potential for Fish Presence: Low to Nil

Fish Data

The provincial FWMIS database shows that there are no know species recorded for this watercourse, which has been confirmed by Daryl Watters, ASRD in Edmonton (Appendix A, Government Communication).

Fish Habitat: Upstream of the Proposed Road Upgrade Site (100 m)

Approximately 100 m upstream of the proposed road upgrade site, the watercourse was well defined and flowed in a straight pattern with a riffle-run morphology (Photographs 25 and 26). The channel and wetted widths were 2.0 m, respectively and composed of fine sediments to organics. The average gradient was 0.5% and crown closure was 0%. A small dry wet area was located to the south, approximately 50 m upstream of the proposed crossing (Photograph 27). Vegetation description can be found in Section 4.3. An unidentified mammal was observed swimming in the upstream section, possibly a muskrat (*Ondatra zibethicua*).

Fish Habitat: Proposed Road Upgrade Site

At the proposed road upgrade site, the watercourse characteristics were similar to those in the upstream section. The channel width narrowed to 1.8 m in order to flow through the culvert. The banks were vertical (Photographs 28 and 29). Moderate amounts of overhanging and instream vegetation was present. Water quality measurements included: pH (8.6) and temperature (17.9^{o}C).

Fish Habitat: Downstream of the Proposed Road Upgrade Site (70 m)

Immediately downstream of the proposed road upgrade site, the watercourse flowed out of the 1800 mm hanging culvert into a plunge pool on the west side of the road (Photographs 30 and 31). At the south end of the plunge pool, water exists though a 2.0 m wide, well defined channel with vertical to undercut banks (Photographs 32 to 34). At that same location there was a wet area, west of the watercourse that drained from the right bank (Photograph 35). The watercourse continued to flow in a southwest direction, bordering on industrial developments. All other characteristics, including riparian and upland vegetation were similar to those upstream and at the proposed site.

Fish and Fish Habitat Summary

Overall fish habitat was moderate with low to nil potential for fish presence at all times of the year. Spawning habitat was poor with no suitable gravels present within the assessment area. Rearing habitat was moderate with cover provided by overhanging and instream vegetation and undercut banks. Overwintering habitat was moderate due to the presence of the plunge pool.

Photograph 25: Goldbar Creek, upstream view from culvert inlet on the east side of 17 Street.

Photograph 26: Goldbar Creek, downstream view to culvert inlet on the east side of 17 Street.

Photograph 27: Goldbar Creek, dry marsh area to the southeast on the east side of 17 Street.

Photograph 28: Goldbar Creek, left bank view on the east side of 17 Street.

Photograph 29: Goldbar Creek, right bank view on the east side of 17 Street.

Photograph 30: Goldbar Creek, upstream view to the culvert outlet on the west side of 17 Street.

Photograph 31: Goldbar Creek, downstream view from the culvert outlet on the west side of 17 Street.

Photograph 32: Goldbar Creek, 20 m downstream, upstream view on the west side of 17 Street.

Photograph 33: Goldbar Creek, 20 m downstream, downstream view on the west side of 17 Street.

Photograph 34: Goldbar Creek, 20 m downstream, left bank view on the west side of 17 Street.

Photograph 35: Goldbar Creek, small pond draining to watercourse on the right bank, upstream view on the east side of 17 Street.

Watercourse Crossing Method: Permanent Round Bottomed Culvert
Construction using the recommendations described below should have no significant impacts on fish or fish habitat at the crossing site or downstream and will meet the requirements of clause (a) in Part 1, Schedule 2 of the Alberta *Code of Practice for Watercourse Crossings* (Alberta Environment 2000b) and the "No Net Loss" requirements of the DFO (Department of Fisheries and Oceans 1991).

Timing
Construction timing has yet to be determined.

Description of Proposed Works

This location is outside of the area for proposed works for the 17 Street Planning Study.

Isolation Area
If flowing water or large amounts of standing water are present at the time of construction, an isolation area will be established to minimize or eliminate water flow through the crossing site in order to dry the scheduled instream work area prior to commencement of construction. The isolation area will be maintained throughout the entire culvert installation process. A dam or barrier will be placed temporarily across the channel at a suitable location upstream of the proposed work site to stop water flow. Depending on site conditions, such as a low channel gradient, a downstream dam may be required to prevent water from flowing back into the work site. The upstream and downstream barriers can be constructed of sand bags and tarps, steel plates, wooden planking or any other materials that are not hazardous (non-toxic) to fish and fish habitat. Where possible, suitable natural features such as beaver dams or frozen debris jams can be incorporated into the barriers to reduce construction efforts, as long as these natural features are not disturbed and/or remain in original condition.

Water initially contained within the isolation area may naturally drain out, although a second pumping system may be required to de-water the isolation area and possibly continually remove water throughout the entire construction process. Water removed from the isolation area must be released at a location and in a manner that either prevents water from re-entering the watercourse or allows suitable filtering and/or settling of sediment out of the water before re-entry into the watercourse.

Water flow will be diverted across or around the work site by a flume or pumping system to ensure downstream water flow is maintained at all times to avoid impacting downstream characteristics. All water discharged into the channel downstream of the crossing site must be done in a manner that prevents scouring of the channel bottom and minimizes sedimentation. Therefore, water must be released onto a structure or material that diffuses and slows water velocity.

Water Withdrawal
If pumps are used during construction, the ends of the intake hoses must be screened with a maximum mesh size of 2.54 mm to prevent entrainment or impingement of fish (Department of Fisheries and Oceans 1995). In addition, all discharged water must be released at a location and in a manner that either prevents water from re-entering the

watercourse or allows suitable filtering and/or settling of sediment out of the water before re-entry into the watercourse. One hundred percent of downstream flow must be maintained at all times to avoid impacting downstream fish and fish habitat.

Secondary Containment

Any gasoline powered equipment such as pumps and generators must be entirely enclosed or set within a secondary containment structure that is large enough to completely contain all harmful materials should a spill, leak or overflow occur.

Water Turbidity Monitoring

If flowing water is present at the time of construction, water turbidity must be monitored to ensure instream sedimentation is detected. Monitoring should be conducted on an hourly basis with a portable water turbidity measuring unit at a minimum of four sampling locations, including one upstream, one immediately downstream of the isolation area and two further downstream. All measurements should be recorded.

Cleaning of Vehicles, Equipment and Machinery Prior to Construction

Prior to construction, all vehicles, equipment and machinery scheduled to work in and/or along a watercourse will be inspected and found to be clean, free of leaks and in good working condition. All foreign material must be removed, including dirt, mud, debris, grease, oil, hydraulic fluid, coolant or other substances that may negatively impact the water quality of the watercourse at the crossing site or further downstream. All identified leaks must be repaired and then appropriately cleaned. Inspections, cleaning and/or servicing can occur either before the vehicle, equipment or machinery is transported into the field or can be conducted at the work site at a minimum distance of 100 m from the watercourse. All wash water runoff and/or harmful materials must be appropriately controlled to prevent entry into the watercourse including the riparian zone.

Construction Monitoring

During crossing construction, on-site monitoring will be conducted to identify potential sedimentation and possible fluid leaks from vehicles, equipment and machinery that may not be observable to the operator. A spill containment kit should be kept on site that is capable of handling twice the potential volume of a spill.

Riparian Vegetation

During construction, care should be taken to disturb as little of the natural riparian vegetation along the banks and adjacent slopes as possible. Maintaining the original established vegetation around the crossing site will aid ground stabilization and minimize potential erosion and sedimentation. Vehicles, equipment and machinery should not be located within the riparian zone, or at a minimum of 10 m from the channel, to maintain an undisturbed vegetation buffer. All trees that have to be removed from either side of the crossing site should be hand-cut at ground level with the root system retained. However, any disturbances that occur along the banks and farther up the slopes will be revegetated as soon as possible with seeding, cuttings and/or plantings to restore the riparian vegetation to original condition. If there are time constraints within the current growing season, revegetation will occur on or before June of the following year.

The standard prescribed roadway landscaping seed mixture is Canada #1 Mix which is made up of 30% Argyll Kentucky Bluegrass, 30% Kentucky Bluegrass, 30% Creeping Red Fescue and 10% annual Rye Grass.

Evasive Species/Weed Control

Monitor planting areas for success rate of germination and for weeds bimonthly during the growing season and implement appropriate controls as needed. Controls may include re-seeding, mechanical (such as mowing or hand pulling) or chemical (herbicide) methods. When hand-pulling, care should be taken to remove the roots of the weed species. Regular mowing should occur every 30 days during and post reestablishment. Herbicides should be used only if hand pulling is not feasible (effective or cost effective). The method of application and product used should be selected to eliminate any negative impacts to desirable plant species. Pre-emergent and post-emergent herbicides may be used after one-year establishment period for new plantings has elapsed. After killing weeds with herbicide, any weeds over 5 cm tall must be removed from planting beds and disposed of properly off site.

Sedimentation and Erosion Control

Disturbance of the ground surface and soils of the banks and surrounding slopes will be minimized. The width of the construction right-of-way should be kept to a minimum within 50 m of the watercourse banks. All disturbed areas will be re-contoured to the natural pre-construction condition without causing excessive disturbance or creating large areas of exposed unstable soil. If required, temporary measures can be implemented to minimize potential erosion and sedimentation as well as aid in the re-establishment of natural vegetation. Erosion control materials will be installed on any disturbed areas. Such materials may include coco-matting, straw matting or geotextile fabric, which should be anchored (staked) in place as per manufacturers' recommendations to protect and stabilize exposed ground.

Cross-Berms and Ditches

Cross-berms and ditches control the velocity and direction of surface water flow down long and/or steep slopes. The structure can consist of a shallow ditch or swale hand-cut across the slope with the spoil material piled on the immediate downslope side of the ditch to form a low berm. The entire structure should be approximately 30 cm in height from the bottom of the ditch to the top of the berm. The ditch and berm structure should be angled in order to intercept and divert surface water into the surrounding vegetated areas and should be completely covered in erosion control materials to prevent sedimentation of the watercourse.

Silt Fences

Silt fences can be used to control surface water flow and should be installed to divert water flowing directly off of the crossing site and adjacent ground surfaces into surrounding vegetation to reduce sedimentation of the watercourse. Once installed, no gaps should be present between the bottom of the silt fences and the ground surface. If required, the lower edge of the silt fence can be dug into the ground surface or secured under the edge of adjacent erosion control materials (if present). Multiple silt fences may be used to control water flow from large receiving areas and/or particularly steep slopes.

Silt fences should be used to divert, rather than dam water flow and should be sufficiently supported to withstand high wind and water pressures.

Sandbag Berms

Another option to control surface water flow is to install temporary sandbag berms across the base of the banks or slopes. The sandbags should be wrapped with geotextile fabric with the free end of the fabric secured to the ground surface on the upslope side. No gaps should be present between the bottom of the fabric and the ground surface. Berms can be dug into the ground surface for a better seal. The berms should be wide enough to capture all the surface water flowing from the crossing site to prevent sedimentation of the watercourse.

Channel Bed Replacement

Once back-filling is complete, the entire surface from bank to bank will be capped with original excavation material and/or suitable material that provides a stable channel bottom. The material will be placed uniformly across the channel bed to prevent possible damming and/or diversion of water flow at the crossing site.

Maintenance of Fish Habitat Characteristics

Once construction is complete, the channel bed and banks must be adequately replaced in a manner that maintains original habitat characteristics. The measures are site-specific and may include the addition of various materials and/or features to the crossing site such as individual or multiple logs, woody debris piles, large boulders or pools. Features should be of the same size, quantity and location as found prior to construction. A simple sketch and/or photograph of the crossing site prior to construction can aid in the subsequent re-construction of fish habitat characteristics.

Maintenance of Fish Passage

Given the results of database searches and conversations with government fish biologists, culvert installation does not need to allow for fish passage through the crossing site.

Removal of Isolation Area

Upon completion of the crossing, the isolation area will be removed in a manner that minimizes disturbance and sedimentation of the watercourse. Pumps will be used to remove turbid water and debris from the watercourse when the isolation dams or barriers are removed. In particular, a pump will be set up on the upstream side of the downstream dam. The upstream dam can then be removed and water allowed to flow through the crossing site. This water flow will wash the sections of newly constructed channel bottom at the inlet and outlet ends of the culvert, which can then be pumped out and released into a vegetated area in a manner that does not allow unfiltered water flow back into the watercourse. Water flow can still be re-directed around the isolation area in order to maintain downstream flow. Once clean water flow has been re-established through the crossing site, the downstream dam and pump can be removed provided that associated sedimentation is expected to be minimal.

Armouring

Any portion of the channel bed and/or banks considered particularly susceptible to erosion will have armouring placed on top of the erosion control materials to aid in stabilization and protection from erosion, particularly during high water levels. Armouring should consist of rock material ('rip-rap'), that is cobble (64 to 256 mm) or preferably boulder (> 256 mm) sized and placed, at a minimum, along the bottom 1.5 m of the banks. Gaps between the armouring material should be minimized.

Post-Construction Assessment

Once construction is complete, the crossing site will be revisited after high water levels in the spring to identify any sedimentation problems and determine the risk of erosion. If excessive sedimentation and/or erosion potential are identified, a QAES should be consulted to assess the potential impacts to fish and fish habitat and provide additional recommendations.

4.2.3 Crossing 4: Watercourse Summary

Watercourse Name: Unnamed Wetland
Watercourse Type: Wetland
Alberta Code of Practice Classification: N/A
Restrictive Activity Period: N/A
Legal Description: SW 32-52-23-W4M
UTM Co-ordinates: 12 U 343011.84 m E 5934289.78 m N (NAD83)

Fish Habitat Summary:

Assessment Date: June 14, 2012
Overall Fish Habitat: Poor
Potential for Fish Presence: Low to Nil

Fish Data

The provincial FWMIS database shows that there are no know species recorded for this watercourse, which has been confirmed by Daryl Watters, ASRD in Edmonton.

Fish Habitat: Upstream of the Proposed Road Upgrade Site (75 m)

Immediately to the east side of 17 Street, there was an unnamed wetland located within a heavily industrial development area, with a petroleum processing plant to the south and agriculture fields to the east. However, this wetland was being utilized by several species of waterfowl, birds (Section 4.1.2), amphibians and insects (Photograph 36 to 38). Upland vegetation and riparian composition can be found in Section 4.3.

Fish Habitat: Downstream of the Proposed Road Upgrade Site (10 m)

At the time of the assessment, a culvert linking the east and west sides of the road could not be located with no evidence of water present on the west side of the road (Photograph 39).

Fish and Fish Habitat Summary

Overall fish habitat was poor with a low to nil potential for fish presence at all times of the year. There was no spawning habitat observed with no suitable sized gravel patches present. Rearing habitat was poor with cover provided by overhanging and ponded vegetation with no connectivity to any other watercourses. Overwintering habitat was moderate due to its potential to be deeper than 0.5 m.

Photograph 36: Unnamed Wetland, northeast view from the east side of 17 Street.

Photograph 37: Unnamed Wetland, north view from the east side of 17 Street.

Photograph 38: Unnamed Wetland, west view from the east side back towards 17 Street.

Photograph 39: Unnamed Wetland, west view from the west side of 17 Street.

Watercourse Crossing Method: Permanent Round Bottomed Culvert

Construction using the recommendations described below should have no significant impacts on fish or fish habitat at the crossing site or downstream and will meet the requirements of clause (a) in Part 1, Schedule 2 of the Alberta *Code of Practice for Watercourse Crossings* (Alberta Environment 2000b) and the "No Net Loss" requirements of the DFO (Department of Fisheries and Oceans 1991).

Timing

Construction timing has yet to be determined.

Description of Proposed Works

This area has been identified as part of the Stormwater Management Plan for the Laurin Industrial Area. Overland flow from 17 Street (south of 92 Avenue) will naturally flow to this area, however the intent of the plan is to utilize this area as an overflow for the wide (dry) storage ditches along 17 Street.

Isolation Area

If flowing water or large amounts of standing water are present at the time of construction, an isolation area will be established to minimize or eliminate water flow through the crossing site in order to dry the scheduled instream work area prior to commencement of construction. The isolation area will be maintained throughout the entire culvert installation process. A dam or barrier will be placed temporarily across the channel at a suitable location upstream of the proposed work site to stop water flow. Depending on site conditions, such as a low channel gradient, a downstream dam may be required to prevent water from flowing back into the work site. The upstream and downstream barriers can be constructed of sand bags and tarps, steel plates, wooden planking or any other materials that are not hazardous (non-toxic) to fish and fish habitat. Where possible, suitable natural features such as beaver dams or frozen debris jams can be incorporated into the barriers to reduce construction efforts, as long as these natural features are not disturbed and/or remain in original condition.

Water initially contained within the isolation area may naturally drain out, although a second pumping system may be required to de-water the isolation area and possibly continually remove water throughout the entire construction process. Water removed from the isolation area must be released at a location and in a manner that either prevents water from re-entering the watercourse or allows suitable filtering and/or settling of sediment out of the water before re-entry into the watercourse.

Water flow will be diverted across or around the work site by a flume or pumping system to ensure downstream water flow is maintained at all times to avoid impacting downstream characteristics. All water discharged into the channel downstream of the crossing site must be done in a manner that prevents scouring of the channel bottom and minimizes sedimentation. Therefore, water must be released onto a structure or material that diffuses and slows water velocity.

Water Withdrawal

If pumps are used during construction, the ends of the intake hoses must be screened with a maximum mesh size of 2.54 mm to prevent entrainment or impingement of fish (Department of Fisheries and Oceans 1995). In addition, all discharged water must be released at a location and in a manner that either prevents water from re-entering the watercourse or allows suitable filtering and/or settling of sediment out of the water before re-entry into the watercourse. One hundred percent of downstream flow must be maintained at all times to avoid impacting downstream fish and fish habitat.

Secondary Containment

Any gasoline powered equipment such as pumps and generators must be entirely enclosed or set within a secondary containment structure that is large enough to completely contain all harmful materials should a spill, leak or overflow occur.

Water Turbidity Monitoring

If flowing water is present at the time of construction, water turbidity must be monitored to ensure instream sedimentation is detected. Monitoring should be conducted on an hourly basis with a portable water turbidity measuring unit at a minimum of four sampling locations, including one upstream, one immediately downstream of the isolation area and two further downstream. All measurements should be recorded.

Cleaning of Vehicles, Equipment and Machinery Prior to Construction

Prior to construction, all vehicles, equipment and machinery scheduled to work in and/or along a watercourse will be inspected and found to be clean, free of leaks and in good working condition. All foreign material must be removed, including dirt, mud, debris, grease, oil, hydraulic fluid, coolant or other substances that may negatively impact the water quality of the watercourse at the crossing site or further downstream. All identified leaks must be repaired and then appropriately cleaned. Inspections, cleaning and/or servicing can occur either before the vehicle, equipment or machinery is transported into the field or can be conducted at the work site at a minimum distance of 100 m from the watercourse. All wash water runoff and/or harmful materials must be appropriately controlled to prevent entry into the watercourse including the riparian zone.

Construction Monitoring

During crossing construction, on-site monitoring will be conducted to identify potential sedimentation and possible fluid leaks from vehicles, equipment and machinery that may not be observable to the operator. A spill containment kit should be kept on site that is capable of handling twice the potential volume of a spill.

Riparian Vegetation

During construction, care should be taken to disturb as little of the natural riparian vegetation along the banks and adjacent slopes as possible. Maintaining the original established vegetation around the crossing site will aid ground stabilization and minimize potential erosion and sedimentation. Vehicles, equipment and machinery should not be located within the riparian zone, or at a minimum of 10 m from the channel, to maintain an undisturbed vegetation buffer. All trees that have to be removed from either side of the crossing site should be hand-cut at ground level with the root system retained. However, any disturbances that occur along the banks and farther up the slopes will be revegetated as soon as possible with seeding, cuttings and/or plantings to restore the

riparian vegetation to original condition. If there are time constraints within the current growing season, revegetation will occur on or before June of the following year.

The standard prescribed roadway landscaping seed mixture is Canada #1 Mix which is made up of 30% Argyll Kentucky Bluegrass, 30% Kentucky Bluegrass, 30% Creeping Red Fescue and 10% annual Rye Grass.

Evasive Species/Weed Control

Monitor planting areas for success rate of germination and for weeds bimonthly during the growing season and implement appropriate controls as needed. Controls may include re-seeding, mechanical (such as mowing or hand pulling) or chemical (herbicide) methods. When hand-pulling, care should be taken to remove the roots of the weed species. Regular mowing should occur every 30 days during and post reestablishment. Herbicides should be used only if hand pulling is not feasible (effective or cost effective). The method of application and product used should be selected to eliminate any negative impacts to desirable plant species. Pre-emergent and post-emergent herbicides may be used after one-year establishment period for new plantings has elapsed. After killing weeds with herbicide, any weeds over 5 cm tall must be removed from planting beds and disposed of properly off site.

Sedimentation and Erosion Control

Disturbance of the ground surface and soils of the banks and surrounding slopes will be minimized. The width of the construction right-of-way should be kept to a minimum within 50 m of the watercourse banks. All disturbed areas will be re-contoured to the natural pre-construction condition without causing excessive disturbance or creating large areas of exposed unstable soil. If required, temporary measures can be implemented to minimize potential erosion and sedimentation as well as aid in the re-establishment of natural vegetation. Erosion control materials will be installed on any disturbed areas. Such materials may include coco-matting, straw matting or geotextile fabric, which should be anchored (staked) in place as per manufacturers' recommendations to protect and stabilize exposed ground.

Cross-Berms and Ditches

Cross-berms and ditches control the velocity and direction of surface water flow down long and/or steep slopes. The structure can consist of a shallow ditch or swale hand-cut across the slope with the spoil material piled on the immediate downslope side of the ditch to form a low berm. The entire structure should be approximately 30 cm in height from the bottom of the ditch to the top of the berm. The ditch and berm structure should be angled in order to intercept and divert surface water into the surrounding vegetated areas and should be completely covered in erosion control materials to prevent sedimentation of the watercourse.

Silt Fences

Silt fences can be used to control surface water flow and should be installed to divert water flowing directly off of the crossing site and adjacent ground surfaces into surrounding vegetation to reduce sedimentation of the watercourse. Once installed, no gaps should be present between the bottom of the silt fences and the ground surface. If required, the lower edge of the silt fence can be dug into the ground surface or secured

under the edge of adjacent erosion control materials (if present). Multiple silt fences may be used to control water flow from large receiving areas and/or particularly steep slopes. Silt fences should be used to divert, rather than dam water flow and should be sufficiently supported to withstand high wind and water pressures.

Sandbag Berms

Another option to control surface water flow is to install temporary sandbag berms across the base of the banks or slopes. The sandbags should be wrapped with geotextile fabric with the free end of the fabric secured to the ground surface on the upslope side. No gaps should be present between the bottom of the fabric and the ground surface. Berms can be dug into the ground surface for a better seal. The berms should be wide enough to capture all the surface water flowing from the crossing site to prevent sedimentation of the watercourse.

Channel Bed Replacement

Once back-filling is complete, the entire surface from bank to bank will be capped with original excavation material and/or suitable material that provides a stable channel bottom. The material will be placed uniformly across the channel bed to prevent possible damming and/or diversion of water flow at the crossing site.

Maintenance of Fish Habitat Characteristics

Once construction is complete, the channel bed and banks must be adequately replaced in a manner that maintains original habitat characteristics. The measures are site-specific and may include the addition of various materials and/or features to the crossing site such as individual or multiple logs, woody debris piles, large boulders or pools. Features should be of the same size, quantity and location as found prior to construction. A simple sketch and/or photograph of the crossing site prior to construction can aid in the subsequent re-construction of fish habitat characteristics.

Maintenance of Fish Passage

Given the results of database searches and conversations with government fish biologists, culvert installation does not need to allow for fish passage through the crossing site.

Removal of Isolation Area

Upon completion of the crossing, the isolation area will be removed in a manner that minimizes disturbance and sedimentation of the watercourse. Pumps will be used to remove turbid water and debris from the watercourse when the isolation dams or barriers are removed. In particular, a pump will be set up on the upstream side of the downstream dam. The upstream dam can then be removed and water allowed to flow through the crossing site. This water flow will wash the sections of newly constructed channel bottom at the inlet and outlet ends of the culvert, which can then be pumped out and released into a vegetated area in a manner that does not allow unfiltered water flow back into the watercourse. Water flow can still be re-directed around the isolation area in order to maintain downstream flow. Once clean water flow has been re-established through the crossing site, the downstream dam and pump can be removed provided that associated sedimentation is expected to be minimal.

Armouring

Any portion of the channel bed and/or banks considered particularly susceptible to erosion will have armouring placed on top of the erosion control materials to aid in stabilization and protection from erosion, particularly during high water levels. Armouring should consist of rock material ('rip-rap'), that is cobble (64 to 256 mm) or preferably boulder (> 256 mm) sized and placed, at a minimum, along the bottom 1.5 m of the banks. Gaps between the armouring material should be minimized.

Post-Construction Assessment

Once construction is complete, the crossing site will be revisited after high water levels in the spring to identify any sedimentation problems and determine the risk of erosion. If excessive sedimentation and/or erosion potential are identified, a QAES should be consulted to assess the potential impacts to fish and fish habitat and provide additional recommendations.

4.3 Sensitive and Non-Sensitive Element Occurrences

A search of ACIMS on June 21, 2012 indicted that there were no records for non-sensitive or sensitive element occurrences (Appendix I). This information is generalized to the level of Township, where requests have to be made for specific Sections. For no element occurrences, instructions from the ACMIS website are as follows and the data print off has been included with this information letter:

> If no element occurrences (sensitive or non-sensitive) and/or no Provincial Protected Areas were found in your area, no further request is needed for most results, however please note this does **not** indicate that occurrences do not exist in this area, the absence of records could indicate that very few inventories/surveys have been done in this part of the province. Record search as follows, in case proof of search is needed at some future point:
>
> - Print the 'Search ACIMS Map', by pressing the 'Print Page' button, printing the web page as a pdf, or taking a screen capture (it may be 'Prt Scn' or something similar)
> - Save/archive the file (or paste the image into a raster/bitmap software (i.e Microsoft Paint, or Apple Paintbrush) if taking screen capture)
> - Be sure 'today's date', 'date file was updated' and 'legal land location' are clearly visible in the image file.
> - Save file, and retain records as needed – ACIMS does not require this file to be sent to us unless we request it.

Given that this project is to upgrade an existing road, no request was made for more information for specific Sections because there is very little to no risk that the proposed development would have any impact on plant species or ecosystem complexes.

The closest Protected Area is Strathcona Science Provincial Park, located along the left bank of the North Saskatchewan River, south of Yellowhead Highway in Sections 6, 7, 8 and 18-53-23-W4M. Sherwood Park was also listed in Sections 1, 2, 11 and 12-52-23-W4M. For both these protected areas, which are outside of the construction footprint, a 100 m buffer has been placed around the sites.

Plant species that were observed in the field consisted of: grasses, thistle (*Cirsium arvense*), eggs and butter (*Linaria vulgaris*), sedges (*Carex* sp.), yarrow (*Achillae* sp.), cattail (*Typha* sp.), buttercup (*Ranunculus* sp.), wild rose (*Rosa acicularis*), vetch (*Vicia americana*), strawberry (*Fragaria virginiana*), clover (*Trifolium hybridum*), duckweed (Lemna minor), horsetails (*Equisetum* sp.), wild onion (*Allium* sp.), *Caragana* sp. and dandelions (*Taraxacum officinale*) (Photographs 36 and 37).

Photograph 36: Eggs and butter.

Photograph 37: *Caragana* sp.

5.0 CONCLUSION

Given the historical disturbance level associated with the initial construction of 17 Street, industrial development and the increase in transportation use, the majority of the plant and wildlife species and sensitive ecosystem associations listed with FWMIS and ACIMS are very unlikely to be found within the proposed development area. Site assessments confirmed low habitat suitability for all listed plant and wildlife species, and determined that no listed ecosystem associations are present. Furthermore, the lack of any fish bearing watercourses within the work footprint limits any potential impacts, but water quality will need to be monitored during construction as both watercourses lead to the North Saskatchewan River (D. Watters e-mail).

MCSL is pleased to offer this Environmental Assessment as a reference during the proposed road upgrade along 17 Street from Whitemud Drive to Knightsbridge Road.

Prepared By

Patty Burt, B.Sc.H., R.P. Bio., P. Biol.
Senior Project Manager
McElhanney Consulting Services Ltd.

6.0 REFERENCES

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Alberta Environment, 2000b: Guide to the Code of Practice for Watercourse Crossings, Including Guidelines for Complying with the Code of Practice. Queen's Printer. Edmonton, Alberta.

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Fisher, G.L., A.G.H. Locke and B.C. Northey, 1989: Stream Crossing Guidelines: Operational Guidelines for Industry. Alberta Forestry, Lands and Wildlife. Edmonton, Alberta.

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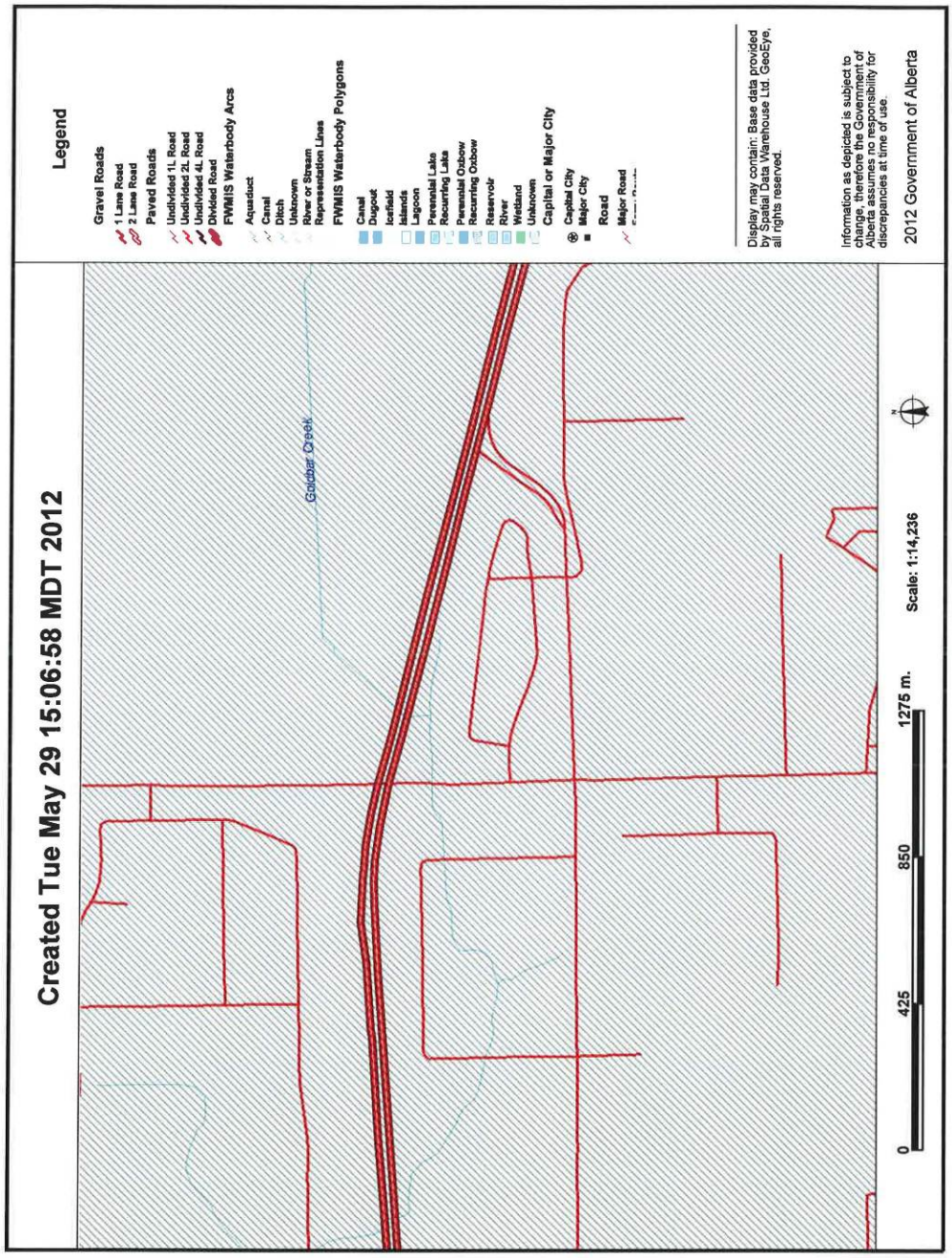
7.0 APPENDIX A – GOVERNMENT DATABASE SEARCHS

Fish and Wildlife Management Information System



Species Summary Report

Species present within the current buffer extent:

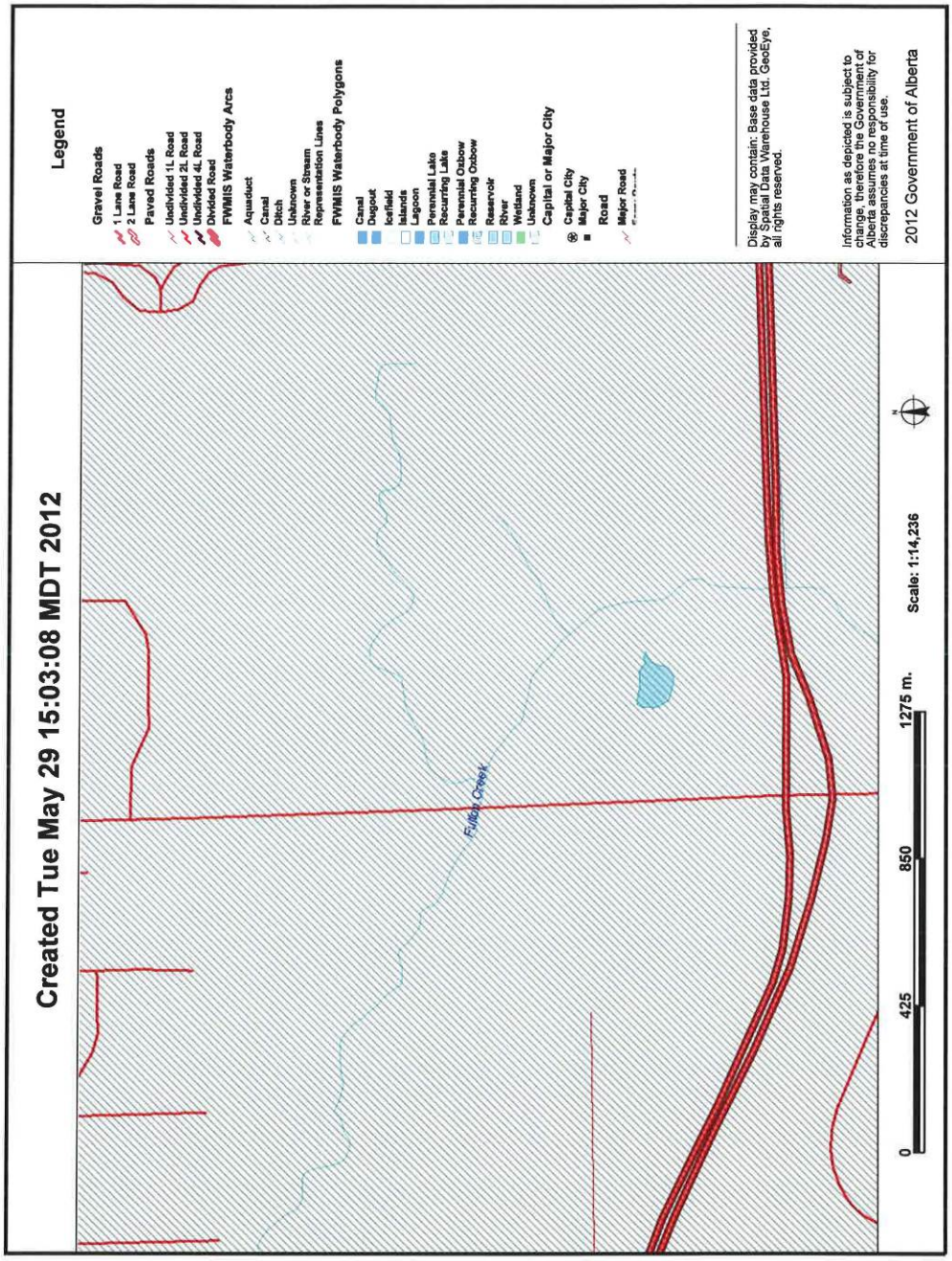
Wildlife Inventory
SWAINSON'S HAWK
Fish Inventory

Layer not visible.

Buffer extent

Centroid (X,Y):	608157, 5925719
Central Meridian:	-115.0
Centroid (Qtr Sec Twp Rng Mer):	NW 17 52 23 4
Buffer radius:	2 kilometers

Fulton Ck


Legend
Gravel Roads
1 Lane Road
2 Lane Road
Paved Roads
Undivided 1L Road
Undivided 2L Road
Undivided 4L Road
Divided Road
FWMIS Waterbody Arcs
Aqueduct
Canal
Ditch
Unknown
River or Stream
Representation Lines
FWMIS Waterbody Polygons
Canal
Dugout
Icefield
Islands
Lagoon
Perennial Lake
Recurring Lake
Perennial Oxbow
Recurring Oxbow
Reservoir
River
Wetland
Unknown
Capital or Major City
Capital City
Major City
Road
Major Road
Display may contain: Base data provided by Spatial Data Warehouse Ltd. GeoEye, all rights reserved.
Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.
2012 Government of Alberta
Created Tue May 29 15:03:08 MDT 2012
Fulton Creek
0
425
850
1275 m.
Scale: 1:14,236

Species Summary Report

Species present within the current buffer extent:

Wildlife Inventory
PEREGRINE FALCON
SWAINSON'S HAWK
Fish Inventory

Layer not visible.

Buffer extent	
Centroid (X,Y):	608082, 5928526
Central Meridian:	-115.0
Centroid (Qtr Sec Twp Rng Mer):	SW 29 52 23 4
Buffer radius:	2 kilometers

Goldbar Creek

Government Communication

Patty Burt

From: Daryl Watters <Daryl.Watters@gov.ab.ca>
Sent: Wednesday, May 30, 2012 8:09 AM
To: Patty Burt
Subject: RE: FMIS request

Hi Patty.....The FWMIS database would house all available data for the two creeks. I'm not aware of any additional data qued for addition to the database.
From a local perspective, Fish and Wildlife manages both watercourses for water quality and does not consider either watercourse to be fish bearing.
Goldbar Creek serves an important function for delivery of good quality water to the North Sask. River.
Because the creek empties to the NSR in a Class A sturgeon habitat, quality of delivered water is important.
Fulton Creek and the Fulton Creek wetland do not appear to support fish; however, ultimately deliver water to the NSR so maintenance of water quality is also an important consideration in project planning.
Hope this helps.

Cheers,

Daryl

Daryl Watters
Fisheries Biologist
ASRD- Fisheries Management
Twin Atria Bldg.
#111, 4999-98 Ave.
Edmonton
T5B 2X3

ph 780-415-1332
fax 780-499-8463
cell 780-499-8463
e-mail daryl.watters@gov.ab.ca

From: Patty Burt [mailto:pburt@mcelhanney.com]
Sent: Tuesday, May 29, 2012 3:57 PM
To: Daryl Watters
Subject: FMIS request

Afternoon Daryl

I am looking for any fish information SRD might have for Fulton and Goldbar Creeks in the vicinity of where they cross 17th Street between Whitemud and Knightsbridge Road. I have used the Fish and Wildlife Public site and am just expanding my search for any local knowledge.

17-52-23-W4M and 29-52-23-W4M

Thank for any help in advance.

1

Alberta Conservation Information Management System

Alberta TPR - ACIMS Data Search Page 1 of 3

Search ACIMS Data

Updated: Mar. 29, 2012
Today: Jun. 21, 2012

1 Select Requester: *
Consultant

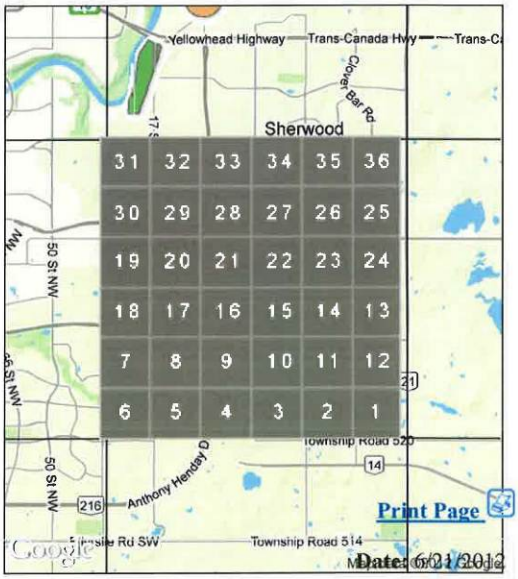
2 Select Reason for Request: *
Environmental Assessment

3 SEC TWP RGE MER
-- 052 23 W4M Submit

(option)
Convert Lat/Long to Township

Layers
- Element Occurrences *(part one, non-sensitive)*
- Element Occurrence *(part two, sensitive)*
- Protected Areas
- Crown Reservation/Notation

* *Required*



Requestor: Consultant
Reason for Request: Environmental Assessment
SEC: -- **TWP:** 052 **RGE:** 23 **MER:** 4

Note: If the map is not displaying 'Refresh' your browser by pushing F5 or Ctrl-R (on PC) or Cmd-R (on Mac)

Table of Results

Sensitive EOs: 0 *(Data Updated: May 2012)*

M-RR-TTT	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Sensitive EOs Found: Next Steps - FAQs #13

Non-sensitive EOs: 0 *(Data Updated: May 2012)*

M-RR-TTT-SS	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Non-sensitive EOs Found: Next Steps - FAQs #13

http://www.tpr.alberta.ca/parks/heritageinfocentre/datarequests/searchdata.aspx 6/21/2012

Alberta TPR - ACIMS Data Search Page 2 of 3

M-RR-TTT-SS	Park Name	Type	IUCN
4-23-052-01	Sherwood Park	NA	II
4-23-052-02	Sherwood Park	NA	II
4-23-052-02	Sherwood Park	NA	II
4-23-052-11	Sherwood Park	NA	II
4-23-052-11	Sherwood Park	NA	II
4-23-052-12	Sherwood Park	NA	II

Next Steps: E-mail Parks or FAQs #14

Data Note:

Sensitive EOs: Data is generalized to the Township level. Information about EOs in a specific Section within the Township must be requested.

PPA: A 100m buffer has been placed around all Protected Areas.

http://www.tpr.alberta.ca/parks/heritageinfocentre/datarequests/searchdata.aspx 6/21/2012

8.0 APPENDIX B - GENERAL RECOMMENDATIONS REGARDING WORKS IN AND AROUND A WATERCOURSE

8.1 Fisheries and Oceans Canada / Alberta Environment

- All projects that occur in and around a water body and may potentially impact fish and/or fish habitat should be reviewed and approved by DFO and ASRD prior to the commencement of works. Depending on the nature of the project, the works will either be covered by the Operational Position Statement or will require review and/or approval through a DFO Letter of Authority. As well, the submission of a Code of Practice notice under the Water Act to ASRD would either be a Notice or reviewed for approval.
- All mitigation measures and/or compensation must be implemented to the satisfaction of DFO and ASRD.
- All changes in plans, specifications, or operating conditions that have the potential to adversely affect fish or fish habitat should be re-submitted to DFO and ASRD for review and approval in writing prior to implementation.

8.2 Machinery and Equipment

- All gasoline powered equipment such as pumps, generators and associated fuel should be stored entirely within a secondary containment structure area located at least 100 m from a watercourse. Containment should have 110% capacity relative to the volume of fuel being stored and be large enough to completely contain all harmful materials should a spill, leak or overflow occur. Trucks carrying large fuel containers should be parked within the containment area.
- Prior to entering within 100 m of a watercourse, all equipment and machinery scheduled to work in and/or along a watercourse should be inspected and found to be clean, free of leaks and in good working condition. As such, all equipment and machinery should have all foreign material removed including dirt, mud, debris, grease, oil, hydraulic fluid or other substances that may impact the water quality or the fish and fish habitat values of the watercourse. As well, all identified leaks will be repaired and then appropriately cleaned. Such inspections, cleaning and/or servicing can occur either before the equipment or machinery is transported into the field or at the work site. Any cleaning and/or servicing of equipment and machinery at the work site should not be conducted in or along a watercourse. Rather, all such works should occur at least 100 m from the watercourse with any runoff controlled to ensure wash materials and/or other substances do not enter the riparian zone or the channel of the water body.
- Machinery and equipment should not be located within the riparian zone or at a minimum of 10 m from the channel, to maintain an undisturbed vegetation buffer along the edge of the watercourse.

8.3 Construction

- All work activities should meet or exceed the construction standards outlined in "Fish Habitat Protection Guidelines and Procedures for Watercourse Crossings in Alberta" (Alberta Transportation, 2001) and "Watercourse Crossings" (Canadian Pipeline Water Crossing Committee, 1999).
- During construction, onsite monitoring will be conducted to identify potential sedimentation and possible fluid leaks from vehicles, equipment and machinery that may not be observable to the operator.
- An emergency spill response kit should be on site at all crossing locations prior to construction. The containment kit should be large enough to handle twice the maximum spill possible.
- Every reasonable effort should be made to minimize the duration of instream work within the proposed schedule of construction. Downstream flow should be maintained at all times.
- Disturbance to the bed and banks of the stream should be minimized and confined to the immediate work site. Any stream banks and approaches to the watercourse disturbed by any activity related to the work project should be stabilized, re-vegetated and reclaimed as soon as possible.
- Effective, short term and long term sediment and erosion control measures should be installed before starting work to prevent the entry of sediment into the watercourse. These measures should be inspected regularly during construction and afterwards to ensure that they are functioning properly and are maintained and/or upgraded as required until vegetation has been re-established on the disturbed area. Sediment should not be released into any waters frequented by fish.
- All spoil materials from construction activities should be deposited, whether temporarily or permanently, above the high water mark of the water body and in such a manner that does not allow entry into the riparian zone or the channel of any water body.
- Where water is pumped from fish habitat, water intakes must be appropriately screened according to DFO's 'Freshwater Intake End of Pipe Fish Screen Guideline' (1995) in order to prevent the entrainment or impingement of fishes during pump operation. Gasoline powered pumps or generators and associated fuel must be enclosed or set within secondary containment large enough to contain all harmful materials should a spill, leak or overflow occur.
- Should the need for dewatering arise, water should be released into a well vegetated area or settling basin and not directly into the watercourse. Water returning to the watercourse should be equal to or exceed the background water quality of the watercourse.

8.4 Reclamation

- All disturbed areas should be reclaimed. Reclamation measures can include use of geotextile fabrics, matting, sandbags, barriers or fences, as well as seeding and planting of disturbed areas with native vegetation.
- Good housekeeping should be practiced with all temporary structures and any equipment or materials associated with construction should be removed following construction completion.
- The bed and bank should be returned to their original pre-construction configuration. Any equipment involved in reclamation activities and operating near any watercourse should be free of external grease, oil, mud or fluid leaks. All fuelling, lubricating and servicing (including repairs and maintenance) of equipment and machinery should be conducted at least 100 m from a water body to ensure that deleterious substances do not enter any watercourse.
- Once construction and reclamation are complete, the bed and banks of the channel at the crossing site should be revisited after high water levels in the spring to identify any sedimentation problems and determine the risk of erosion. If excessive sedimentation and/or erosion potential are identified, additional recommendations maybe required.