Environmental Impact Assessment

Terwillegar Park Footbridge and Recreational Trail, Within Portions of 3-, 10-, 11-, 14-, and 15-52-25 W4M Edmonton, Alberta

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City of Edmonton

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March 2014

Sign-off Sheet

This document entitled Environmental Impact Assessment - Terwillegar Park Footbridge and Recreational Trail, Within Portions of 3-, 10-, 11-, 14-, and 15-52-25 W4M Edmonton, Alberta was prepared by Stantec Consulting Ltd. for the account of City of Edmonton.

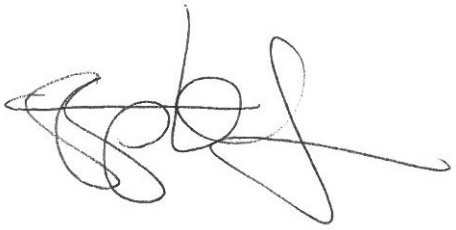

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Table of Contents

EXECUTIVE SUMMARY VII

ABBREVIATIONS IX

GLOSSARY XI

1.0 INTRODUCTION 1.1
1.1 SCOPE 1.1
1.2 STUDY AREA 1.2
1.2.1 North Portion of the Study Area 1.2
1.2.2 South Portion of the Study Area 1.3

2.0 PROJECT OVERVIEW 2.1
2.1 PROJECT RATIONALE AND ALTERNATIVES 2.1
2.1.1 North Trail 2.2
2.1.1.1 Alignment Option 1 ..... 2.2
2.1.1.2 Alignment Option 2 ..... 2.2
2.1.1.3 Alignment Option 3 ..... 2.3
2.1.1.4 Preferred Alignment Option 2.3
2.1.2 South Trail 2.3
2.1.2.1 Alignment Option 1 ..... 2.4
2.1.2.2 Alignment Option 2 ..... 2.4
2.1.2.3 Preferred Alignment Option 2.4
2.1.3 Footbridge 2.5
2.1.3.1 Design Option 1 ..... 2.5
2.1.3.2 Design Option 2 ..... 2.5
2.1.3.3 Design Option 3 ..... 2.5
2.1.3.4 Design Option 4 ..... 2.6
2.1.3.5 Preferred Design Option 2.6
2.2 PROJECT DESCRIPTION 2.6
2.2.1 Vegetation Clearing 2.6
2.2.2 Construction Access Roads 2.7
2.2.3 Laydown Areas 2.8
2.2.4 North Trail 2.9
2.2.5 South Trail 2.10
2.2.6 Footbridge 2.11
2.2.7 Temporary Erosion and Sedimentation Control Measures 2.13
2.2.8 Permanent Erosion and Sedimentation Control Measures and Landscaping 2.15
2.3 CONSTRUCTION TIMING 2.16
2.3.1 North Trail 2.16
2.3.2 South Trail 2.16
2.3.3 Footbridge 2.16

3.0 REGULATORY CONSIDERATIONS 3.1
3.1 FEDERAL LEGISLATION 3.1
3.1.1 Fisheries Act 3.1
3.1.2 Migratory Birds Convention Act, 1994 ..... 3.3
3.1.3 Navigation Protection Act 3.3
3.1.4 Species At Risk Act 3.4
3.2 PROVINCIAL LEGISLATION 3.5
3.2.1 Environmental Protection and Enhancement Act 3.5
3.2.2 Historical Resources Act 3.6
3.2.3 Public Lands Act 3.6
3.2.4 Occupational Health and Safety Act 3.7
3.2.5 Water Act 3.7
3.2.6 Weed Control Act 3.8
3.2.7 Wildlife Act 3.8
3.3 MUNICIPAL LEGISLATION AND PLANS 3.8
3.3.1 City of Edmonton Top of Bank Policy (Policy C542) 3.9
3.3.2 City of Edmonton North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188) 3.9
3.3.3 The City Of Edmonton Drainage Bylaw (Bylaw 16200) 3.9
3.3.4 City of Edmonton Community Standards Bylaw (Bylaw 14600) 3.9
3.3.5 Corporate Tree Management Policy (Policy C456A) 3.10
3.3.6 The City of Edmonton Erosion and Sediment Control Guidelines and Field Manual 3.10
3.3.7 The Way We Live, Edmonton's People Plan 3.11
3.3.8 The Way We Grow, Municipal Development Plan (Bylaw 15100) 3.11
3.3.9 The Way We Move, Transportation Master Plan 3.11
3.3.10 The Way We Green, City of Edmonton Environmental Strategic Plan 3.11
3.3.11 Terwillegar Park Concept Plan Study 3.12

4.0 METHODS 4.1
4.1 DESKTOP REVIEW 4.1
4.1.1 Rare Plant and Rare Ecological Communities 4.1
4.1.2 Rare Wildlife Species 4.4
4.2 FIELD WORK 4.4
4.2.1 Rare Plant and Site Characterization Surveys 4.5
4.2.1.1 Rare Plant Survey Preparation 4.5
4.2.1.2 Field Data Collection 4.6
4.2.1.3 Rare Plant Species 4.6
4.2.1.4 Rare Ecological Communities 4.7
4.2.1.5 Plant Identification 4.7
4.2.2 Weed Identification 4.8
4.2.3 Amphibian Survey 4.8
4.2.4 Breeding Bird Survey 4.8
4.2.5 Fish Habitat Assessment 4.9

4.3 VEGETATION DATA ANALYSIS 4.9
4.3.1 Spatial Analysis (Final Vegetation Mapping) 4.9
4.3.2 Old-Growth Forest 4.9
4.4 ENVIRONMENTAL IMPACT ASSESSMENT 4.10

5.0 DESKTOP REVIEW RESULTS 5.1
5.1 HISTORICAL AERIAL PHOTOGRAPH REVIEW 5.1
5.2 CLIMATE 5.1
5.3 GEOLOGY, SURFICIAL MATERIALS, AND LANDFORM 5.2
5.4 HYDROLOGY 5.2
5.5 VEGETATION 5.3
5.5.1 Alberta Conservation Information Management System Search Results 5.4
5.6 WILDLIFE 5.6
5.6.1 Amphibians and Reptiles 5.6
5.6.1.1 Fisheries and Wildlife Management Information System Search Results 5.6
5.6.2 Birds 5.7
5.6.2.1 Fisheries and Wildlife Management Information System Search Results 5.10
5.6.3 Mammals 5.12
5.6.3.1 Fisheries and Wildlife Management Information System Search Results 5.12
5.7 FISHERIES 5.13
5.7.1 Fisheries and Wildlife Management Information System Search Results 5.14
5.8 LAND USE 5.16
5.9 ARCHAEOLOGY AND HISTORIC RESOURCES 5.16
5.9.1 Statement of Justification 5.16
5.9.2 Historical Resources Impact Assessment for Archaeology 5.17
5.9.3 Historical Resources Impact Assessment for Palaeontology 5.18

6.0 FIELD WORK RESULTS 6.1
6.1 VEGETATION AND RARE PLANT SURVEYS 6.1
6.1.1 Vegetation and Wetland Land Units 6.1
6.1.2 Rare Plants and Rare Ecological Communities 6.3
6.1.3 Old-Growth Forests 6.3
6.1.4 Weed Species 6.4
6.2 WILDLIFE SURVEYS 6.4
6.2.1 Amphibian Survey 6.5
6.2.2 Breeding Bird Survey 6.5
6.2.2.1 Barred Owl 6.7
6.2.2.2 Least Flycatcher 6.8
6.2.2.3 Pileated Woodpecker 6.8
6.2.3 Incidentals and Signs of Wildlife Usage 6.9

6.3 FISH HABITAT ASSESSMENT 6.9

7.0 POTENTIAL IMPACTS, MITIGATION MEASURES, AND RESIDUAL IMPACTS 7.1
7.1 ENVIRONMENTAL COMPONENTS 7.1
7.2 VEGETATION 7.5
7.2.1 North and South Trails 7.6
7.2.1.1 Mitigation Measures 7.7
7.2.1.2 Residual Impacts 7.10
7.2.2 Footbridge 7.11
7.2.2.1 Potential Impacts and Mitigation Measures 7.11
7.3 WILDLIFE 7.12
7.3.1 North and South Trails 7.12
7.3.1.1 Mitigation Measures 7.16
7.3.1.2 Residual Impacts 7.17
7.3.2 Footbridge 7.19
7.3.2.1 Mitigation Measures 7.21
7.3.2.2 Residual Impacts 7.22
7.4 FISHERIES 7.24
7.4.1 Temporary Bridge Construction Access Roads 7.24
7.4.2 Footbridge 7.25
7.4.2.1 Temporary Bridges 7.25
7.4.2.2 Berms, Footbridge Piers, Bank Stabilization 7.27
7.5 WATER QUALITY OF THE NORTH SASKATCHEWAN RIVER 7.30
7.5.1 Temporary Bridge Construction Access Roads 7.30
7.5.2 Temporary Bridges 7.31
7.6 HYDROLOGY 7.33
7.6.1 North and South Trails 7.33
7.6.2 Footbridge 7.34
7.6.2.1 Berms and Footbridge Piers 7.35
7.7 AESTHETICS 7.36
7.7.1 North and South Trails 7.36
7.7.1.1 Mitigation Measures 7.37
7.7.1.2 Residual Impacts 7.37
7.7.2 Footbridge 7.37
7.7.2.1 Mitigation Measures 7.38
7.7.2.2 Residual Impacts 7.38
7.8 NOISE 7.38
7.8.1 Project 7.38
7.8.1.1 Mitigation Measures 7.39
7.8.1.2 Residual Impacts 7.39
7.9 PUBLIC SAFETY 7.39
7.9.1 North and South Trails 7.39
7.9.1.1 Mitigation Measures 7.40
7.9.1.2 Residual Impacts 7.41
7.9.2 Footbridge 7.41

7.9.2.1 Mitigation Measures 7.42
7.9.2.2 Residual Impacts 7.43
7.10 CONTRACTOR SAFETY 7.43
7.10.1 North and South Trails 7.43
7.10.1.1 Mitigation Measures 7.44
7.10.1.2 Residual Impacts 7.44
7.10.2 Footbridge 7.45
7.10.2.1 Mitigation Measures 7.45
7.10.2.2 Residual Impacts 7.45
7.11 ARCHAEOLOGY AND HISTORICAL RESOURCES 7.45

8.0 PUBLIC CONSULTATION 8.1

9.0 SUMMARY 9.1
9.1 EROSION AND SEDIMENTATION CONTROL MITIGATION MEASURES 9.1
9.2 VEGETATION MITIGATION MEASURES 9.1
9.3 WILDLIFE MITIGATION MEASURES 9.2
9.4 HEALTH AND SAFETY MITIGATION MEASURES 9.2
9.5 POLLUTION MITIGATION MEASURES 9.3

10.0 LIMITATIONS AND QUALIFICATIONS 10.1

11.0 REFERENCES 11.1

LIST OF TABLES

Table 4-1 Alberta Conservation Information Management System rankings for rare plants 4.2
Table 4-2 Definitions of general status categories 4.3
Table 4-3 Alberta Conservation Information Management System rankings for rare ecological communities 4.3
Table 4-4 Impact characterization definitions 4.10
Table 5-1 Listed plant species present within a 1 km radius of the Project footprint 5.4
Table 5-2 Listed wildlife species present within a 2 km radius of the Study Area 5.7
Table 5-3 Potential bird species present within the Study Area during the winter 5.8
Table 5-4 Listed bird species present within a 2 km radius of the Study Area 5.11
Table 5-5 Fish species present in the NSR within a 2 km radius of the Footbridge 5.14
Table 6-1 Vegetation and wetland land units within the Vegetation Study Area 6.2
Table 6-2 Rare plant observations within the Vegetation Study Area 6.3
Table 6-3 Weed species and locations within the Vegetation Study Area 6.4
Table 6-4 Bird species recorded during the breeding bird and amphibian surveys 6.5

Table 6-5 Most common bird species recorded in the fixed-radius point-count stations 6.7
Table 7-1 Magnitude definitions 7.2
Table 7-2 Impact characterization summary for environmental elements 7.4

LIST OF FIGURES

Figure 1.1 Site Location Plan 1.2
Figure 4.1 Amphibian and Breeding Bird Survey Locations 4.8
Figure 5.1 Historical and 2011 Flow (M^3/S) in the North Saskatchewan River at Edmonton 5.3
Figure 6.1 Vegetation and Wetland Summary 6.2
Figure 6.2 Species of Management Concern Locations 6.2

LIST OF APPENDICES

APPENDIX A VALUE ENGINEERING WORKSHOP REPORT
APPENDIX B TRAIL ALIGNMENT
APPENDIX C TRAIL ENGINEERING DRAWINGS
APPENDIX D FOOTBRIDGE ENGINEERING DRAWINGS
APPENDIX E EROSION AND SEDIMENTATION CONTROL RECOMMENDATIONS
APPENDIX F RARE PLANT SURVEY LOCATIONS
APPENDIX G FISH HABITAT ASSESSMENT
APPENDIX H HISTORICAL AIR PHOTOS
APPENDIX I GEOTECHINICAL REPORT AND RECOMMENDATIONS
APPENDIX J WILDLIFE SPECIES WITHIN THE NORTH SASKATCHEWAN RIVER VALLEY
APPENDIX K FISH AND WILDLIFE MANAGEMENT INFORMATION SYSTEM SEARCH RESULTS
APPENDIX L HISTORIC RESOURCES REPORTS
APPENDIX M LAND UNIT DESCRIPTIONS
APPENDIX N PLANT SPECIES OBSERVED
APPENDIX O WEED SURVEY FORMS
APPENDIX P PUBLIC ENGAGEMENT SUMMARY REPORT

Executive Summary

Stantec Consulting Ltd. was retained by the City of Edmonton to complete a Municipal Environmental Impact Assessment (MEIA) level assessment Environmental Impact Screening Assessment (EISA) for activities associated with the construction of a footbridge and approximately 7 km of trails. This bridge and trail project will form part the main spine trail within the North Saskatchewan River (NSR) valley (the Project), within portions of 3-, 10-, 11-, 14-, and 15-52-25 W4M, Edmonton, Alberta. The North Saskatchewan River Valley Area Redevelopment Plan (City of Edmonton Bylaw 7188) requires that an environmental impact assessment be completed for the proposed construction. This trail system will form a portion of the trail connection between Devon and Fort Saskatchewan.

The Study Area is divided into two areas. The north portion, which is comprised of a bench above the NSR, is south of the Fort Edmonton Park Footbridge, adjacent to the Edmonton Country Club, and is bordered to the east and south by the NSR. The north portion of the Study Area contains a large agricultural field that has in the past been used for hay production and a large tree stand along the east edge of the agricultural field. The south portion of the Study Area is located within the southeast portion of Terwillegar Park, as well as along the valley slope above the NSR to the west of the Henderson Estates Neighborhood. The south portion of the Study Area is dominated by upland deciduous forest and also contains an open grassy area.

Construction access for the Study Area will be from several locations. There are two options for access to the north portion of the Study Area. Option one will be through the Edmonton Country Club, and Option 2 will be from Woodward Crescent. The south portion of the Study Area will be accessed from Rabbit Hill Road, as well as a small access that will be created for construction of the South Trail along the top of the NSR valley slope. Laydown and stockpile areas will be constructed in each of the north and south portions of the Study Area to support the construction of the Footbridge and the trail systems. Each of these areas will be prepared in a manner determined by the contractor, following the guidelines set out in the MEIA and City of Edmonton guidelines.

Specific mitigation measures that may be employed include:

- Permanent erosion control and sedimentation measures should be implemented and will be the responsibility of the contractor to implement and monitor.
- Soil should be stockpiled and replaced appropriately.
- Steep slopes should be protected with hydromulch/hydroseeding/ESC blankets, and straw wattles and/or silt fences will be used to divert flows around sensitive areas.
- Staged landscaping should be employed and native vegetation should be used during re-seeding.

- All vegetation removal should be done outside of the breeding bird season to avoid conflicts with nesting migratory birds.
- A qualified aquatic environmental scientist (QAES) should be retained to conduct monitoring during in-stream activities.
- All machinery should be maintained and refueled a minimum of 100 m away from the stream bank.
- A spill kit should remain on site at all times.
- Class 2 rip rap should be placed to provide protection to the banks of the NSR.
- Installation of two berms within the NSR should occur outside of the Restricted Activity Period (RAP).
- Silt curtains or other approved alternative should be used for in-stream isolation during construction of the berms.
- Fish salvage within isolated areas should be completed by a QAES prior to starting construction activities.
- Signage prohibiting dogs on sandbars and identifying area(s) for on-leash dogs only outside of the designated Terwilligar Park Off-leash Area should be installed in appropriate locations to notify users of restrictions.
- Waste products should be stored in secure containers and transported to appropriate facilities during construction.

In summary, the project will result in low and moderate magnitude impacts to all ten key environmental elements assessed. Moderate magnitude impacts are:

- Barriers to wildlife movement: impacts are expected to peak during construction, with limited barriers existing during operations of the bridge and trails.

- Plant community composition and rare plants: moderate impacts are expected to occur and will be limited to the project footprint.

- Aesthetics: moderate change in aesthetics resulting from new infrastructure are expected throughout the life of the project and will be confined to the local project area.

- Noise: moderate impacts from noise are expected to peak during construction and be confined to the local area of the project.

- Public and contractor safety: moderate impacts are expected to occur for a short duration (during construction) and will be limited to the local project area.

The remaining environmental elements were assessed as low magnitude impacts for Water Quality of the NSR, Hydrology, Fisheries, Wildlife (Mortality and Habitat loss), Vegetation (Windthrow, Disturbance to wet areas, and Introduction of weeds), Public Safety(Users of the NSR, Residents, and Users of the Country Club), and Contractor Safety (Physical hazards).

Abbreviations

The following are a list of acronyms and abbreviations used within this report.

AARD	Alberta Agriculture and Rural Development
ACIMS	Alberta Conservation Information Management System
ANPC	Alberta Native Plant Council
ATPR	Alberta Tourism, Parks and Recreation
BMPs	Best Management Practices
ºC	Celsius
CCME	Canadian Council of Ministers of the Environment
cm	Centimetre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPESC	Certified Professional in Erosion and Sediment Control
dbh	Diameter at breast height
DFO	Department of Fisheries and Oceans
DLO	Department License of Occupation
EPEA	*Environmental Protection and Enhancement Act*
EPCOR	EPCOR Utilities Inc.
ERCB	Energy Resources Conservation Board
ESC	Erosion and Sediment Control
ESRD	Alberta Environment and Sustainable Resource Development
FAN	Federation of Alberta Naturalists
FWMIS	Fish and Wildlife Information Management System
g	Gram
GPS	Global Positioning System
ha	Hectare
HRA	*Historical Resources Act*
HRIA	Historical Resources Impact Assessment
HRV	Historical Resource Values
km	Kilometre
l	Litre
LSD	Legal Subdivision

m	Metre
mm	Millimetre
m^2	Square metres
m^3/s	Metres cubed per second
MBR	Migratory Birds Regulations
MBCA	*Migratory Birds Convention Act, 1994*
MEIA	Municipal Environmental Impact Assessment
Mg/L	Milligrams per litre
NPA	*Navigation Protection Act*
NSR	North Saskatchewan River
NSRV	North Saskatchewan River Valley
NTU	Nephelometric turbidity units
NWPA	*Navigable Waters Protection Act*
pH	Potential hydrogen
PPE	Personal protective equipment
QAES	Qualified Aquatic Environmental Scientist
RAP	Restricted Activity Period
ROW	Right-of-Way
RVA	River Valley Alliance
SARA	*Species At Risk Act*
SLS	Site Location Study
SoJ	Statement of Justification
SWQGA	Surface Water Quality Guidelines for use in Alberta
TFA	Temporary Field Authorization
TOP	Top of bank
TPFB	Terwillegar Park Footbridge
TSS	Total Suspended Solid
UTM	Universal Transverse Mercator
VSA	Vegetation Study Area
WSC	Water Survey of Canada

Glossary

Alluvial:	A fine-grained fertile soil deposited by water flowing over flood plains or in river beds.
Alluvial Terrace:	A terraced embankment of loose soil material adjacent to the sides of a river valley.
Anthropogenic:	Relating to or resulting from the influence that humans have on the natural world.
Anuran Species:	An amphibian that does not have a tail as an adult and has long powerful hind legs.
Aqua Dam:	A water-filled temporary coffer dam used for river diversions, flood protection, boat ramps, pond liner repair, dewatering, haz-mat control, water storage, and more.
Benthic Organisms:	The animals and plants that live at the bottom of a sea, lake, or deep river.
Boulder:	A rock > 256 mm diameter.
Breeding Bird Season:	The most suitable season for birds to breed.
Bryophytes:	A phylum of nonvascular plants comprising the true mosses and liverworts.
Capacity:	The ability of a biophysical, social, or economic system or structure to adapt to or absorb change without irreversible effects.
Colluvium:	Materials that have reached their present positions as a result of direct, gravity-induced movement involving no agent of transportation such as water or ice.
Common Law:	A law that is largely formed by the decisions previously made by courts and not imposed by other government officials.
Constraint:	Site conditions (e.g., structural, geographic, or environmental) that could result in potentially higher impact from Project activities. The areas identified as having constraints should be avoided or special mitigation measures developed.
Constructability:	A project management technique to review construction processes from start to finish during pre-construction phase. It is used to identify obstacles before construction begins to reduce or prevent errors, delays, and cost overruns.
Dewater:	To remove water from an area, or waterbody (pond, lake or water course).

Direct Impact:	An impact in which the cause-effect relationship has no intermediary effects (i.e., the positive or negative environmental effects created as a direct result of the Project). An example of a direct impact would be that the removal of a stand of trees in a Project area reduces the amount of wildlife habitat.
Duration:	The period of time in which an effect on an environmental component may exist or remain detectable (i.e., the recovery time for a resource, species, or human use).
Ecological Community:	A group of interdependent plants and animals inhabiting the same region and interacting with each other through food and other relationships.
Ecosite Phase:	An ecosite is an ecological unit that develops as a result of similar environmental conditions such as similar soil moisture and nutrient regime. An ecosite phase is a subdivision of an ecosite based on the dominant species present in the canopy. For this project ecosite phase is synonymous with upland and wetland land unit.
Ecotonal:	The transition zone between two different plant communities.
Environmental Component:	The abiotic and biotic factors that make up an environment. A fundamental element of the physical, biological, or socio-economic environment that may be affected by a proposed Project (e.g., water, vegetation, wildlife, fish, land use, etc.).
Effect:	Changes to the environment that are caused by a Project in combination with other past, present, and planned Projects in the region.
Erosion and Sediment Control:	Measures designed to control surface runoff and erosion and to retain sediment on a particular site during the period in which pre-construction and construction related land disturbances, fills, and soil storage occur, and before final improvements are completed.
Flood Plain:	An area of low-lying land across which a river flows that is covered with sediment as a result of periodic flooding.
Fluvial:	Materials transported and deposited by streams and rivers; synonymous with alluvial.
Fossiliferous:	A rock or other geologic deposit that has fossils within it.
Fragmentation:	The breaking up of contiguous blocks of habitat into increasingly smaller blocks as a result of direct loss and/or sensory disturbance (i.e., habitat alienation).
Glaciofluvial:	Materials that exhibit clear evidence of having been deposited by glacial meltwater streams either directly in front of, or in contact with, glacier ice.

Glaciolacustrine:	Lacustrine (sediments that have settled from suspension and underwater gravity flows in bodies of standing fresh water) materials deposited in or along the margins of glacial (ice-dammed) lakes; includes sediments that were released by the melting of floating ice.
Growth Ring:	A concentric ring in the cross-section of a woody stem or trunk, representing the result of one year's growth.
Habitat:	Land and water used by wildlife at some time during their lifecycle. This may include biotic and abiotic aspects such as vegetation, exposed bedrock, water, and topography.
Habitat Class:	The particular group in which an individual habitat type is classified.
Hazard Trees:	Any tree that may fail due to mortality or a structural defect or changed stand conditions and, as a result, may cause property damage or personal injury.
Heart-rot:	A fungal disease that causes the decay of wood at the center of the trunk and branches.
High Paleontological Resource Sensitivity Zone:	An area known to have a high potential to impact paleontological resources during development.
Historic Resources Impact Assessment (HRIA):	A review of the effects that a proposed Project will have on the local and regional historic and prehistoric heritage of an area.
Historic Resource Value:	Is the value placed on a land parcel by the provincial government which identifies the type of protection the parcel receives. The values range from 1 to 5, with parcels valued as 1 receiving the highest protection.
Impact:	Any aspect of a Project that may cause a positive or negative effect (e.g., tree removal during construction). A possible effect of this is loss and fragmentation of wildlife habitat.
Increment borer:	An increment borer is a specialized tool used to age living trees without having to destructively sample. An increment borer enables the user to extract a small core from a tree to count growth rings.
Indirect Impact:	An impact in which the cause-effect relationship (e.g., between the Project's impacts and the ultimate effect on an environmental component) has intermediary effects. Because an interaction with another effect is required to have a cumulative effect (hence, creating intermediary effects), cumulative effects may be considered indirect. An example of an indirect impact would be that the removal of a stand of trees in a Project area reduces the amount of forest cover in the area. This reduction in forest area reduces the number of tree nesting birds that are able to reside in the area. Removing the trees indirectly impacts the local bird population.

Infrastructure:	Any works, buildings, structures, facilities, equipment, apparatus, mechanisms, instruments or machinery belonging to or used in connection with a Project. This includes any storage site or facility, disposal site or facility, access road, haul road, railway, or telecommunication line.
Interstitial Spaces:	An empty space or gap between spaces full of structure or matter.
Liverwort:	A small dense green plant that grows on moist surfaces and resembles a moss.
Magnitude:	The manner in which an environmental component may be affected by a Project (i.e., adverse, beneficial, or neutral). The ultimate long-term trend of the effect.
Master Plan:	A document that describes an overall development concept.
Mesic:	Growing in or characterized by moderate or typical soil moisture conditions.
Microsite:	A small area within an environment with similar environmental conditions such as vegetation cover, soil moisture, soil nutrient, and light regimes.
Microhabitat:	An environment that has a unique set of ecological conditions within a larger habitat and supports distinct flora and fauna.
Mitigation:	The elimination, reduction, or control of an adverse environmental effect of the Project. Mitigation includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation, or any other means.
Migratory Birds:	Birds that have regular seasonal movement (breed in one geographic location and winter in a different location (typically at a large scale).
Mixedwood:	A forest stand composed of both coniferous and deciduous trees species, where either species does not comprise greater than 80 percent cover of the forest stand.
Old Growth:	A long-established forest or woodland that contains a proportion of large old trees and has a relatively stable and diverse community of plants.
Percent Cover:	The proportion of a specific plant species that inhabits a certain area.
Plant Community:	An assemblage of different species of plants growing together in a particular habitat.
Project:	The activity or group of activities proposed by the Proponent. The Project includes all associated construction, operation, and reclamation activities and all phases of development described by the Proponent.
Project Area:	Within the context of this report, Project area includes all portions of the North Saskatchewan River subject to direct disturbance from the Project and associated infrastructure.

Project Component:	The different physical entities and activities that together make up the Project.
Project Footprint:	The land or water area covered by a Project. This includes direct physical coverage (i.e., all lands subject to direct disturbance from the Project and associated infrastructure) and direct effects (i.e., the disturbances that may directly emanate from the Project, such as tree removal).
Residual Impact:	An effect that remains to some degree after mitigation has been applied.
Restricted Activity Period (RAP):	The time period set out in the *Water Act* Code of Practice during which, generally, no activity is permitted within a designated water body.
Riffle Habitats:	Partially to totally submerged pebble to cobble substrate, causing moderate turbulence and ripples, little to no whitewater (some whitewater at points of constriction), moderate velocity (0.2 to 0.5 m/s), usually < 0.5 m depth, and 1 – 4% slope.
Run Habitats:	Runs are typically deep, slow to swift flowing sections (> 0.2 m/s), with gravel to boulder substrate.
Soil Moisture Regime:	The presence or absence either of ground water or water held at a tension of less than 1500 kPa in the soil or in specific horizons during periods of the year.
Slope Position:	Slopes can be divided into crest, upper slope, middle slope, lower slope, toe slope, depression or level. Slope position is the location along a slope.
Species of Management Concern:	Species that have experienced documented or apparent population declines, small or restricted populations, or are dependent on restricted or vulnerable habitats.
Straw Wattles:	A stabilization and filtration product used to remove sediment and other unwanted materials from runoff streams and made from 100% wheat straw.
Structural Stage:	Structural stages are used to categorize forest succession. Natural forest stand succession is categorized into distinct classes based on dominant growth form (i.e., graminoid, shrub, or tree), stand height, and canopy structure. These classes correspond to forest stand succession over time.
Study Area:	Lands subject to direct disturbance from the Project and associated infrastructure (i.e., Project footprint). The Study Area includes areas adjacent to the Project footprint, and is not bounded by legal property boundaries.
Till Plain:	A smooth plain underlain by sediments laid down by the direct action of glacial ice without the intervention of water; materials are typically moved and deposited beneath the ice.

Total Suspended Solids:	Suspended matter consists of silt, clay, fine particles of organic and inorganic matter, soluble organic compounds, plankton, and other microscopic organisms.
Turbidity:	A measure of the lack of clarity or transparency of water caused by biotic and abiotic suspended or dissolved substances.
Unfragmented:	Not fragmented.
Ungulate:	A mammal with hooves.
Upland Area:	Means the generally flat land located above the valley break, escarpment or crest of the valley or ravine.
User Experience:	Generally refers to the psychological aspects of using a trail. A trail alignment that provides varying conditions adjacent to the trail (e.g., different vegetation types or different degrees of enclosure), changing views, and points of interest provides a higher level of user experience.
Value Engineering:	A systematic method to improve the "value" of goods or products and services by using an examination of function.
Vascular Plants:	Plants that possesses specialized sap-conducting tissue.
Vegetation Study Area:	The area within and immediately adjacent to the Project footprint where vegetation data was collected.
Velocity Refugia:	Provides an area of low velocity for fish to seek resting location out fast flowing water.
Watershed:	All lands enclosed by a continuous hydrologic-surface drainage divide and lying upslope from a specified point on a stream.
Wetland Land Unit:	An area of land designated as a wetland.
Windthrow:	The uprooting and overthrowing of trees by the wind.
Zone of Influence:	A geographic area, extending from an action, in which an effect is non-trivial.

1.0 Introduction

The City of Edmonton (the Proponent) retained Stantec Consulting Ltd. (Stantec) to complete a Municipal Environmental Impact Assessment (MEIA) for activities associated with the construction of a 7 km trail system within the North Saskatchewan River (NSR) valley and a new footbridge over the NSR (the Project), within portions of 3-, 10-, 11-, 14-, and 15-52-25 W4M, Edmonton, AB (Study Area, Figure 1.1). Both the trail system and the footbridge are part of the Capital Project being undertaken by the River Valley Alliance (of which the Proponent is a participating municipality). This trail system and footbridge will form one of the many linkages that will facilitate movement through the NSR valley for pedestrians and cyclists, and will ultimately form a portion of the trail connection system between Devon and Fort Saskatchewan.

The *North Saskatchewan River Valley Area Redevelopment Plan* (City of Edmonton Bylaw 7188 [City of Edmonton 2012]) requires that an environmental impact assessment (MEIA) be completed for the proposed work above. This report provides the results of the MEIA and also recommends mitigation measures to prevent significant adverse environmental impacts where applicable.

1.1 SCOPE

The scope of this MEIA is:

- To identify the potential impacts on the physical and biological environment resulting from the construction of the following
  - A trail system within the NSR valley
  - A footbridge over the NSR
  - And associated laydown areas and access roads
- To assess the magnitude, spatial extent, duration, and likelihood of occurrence of the potential environmental impacts from the construction and use of the trail system, footbridge, and associated laydown areas and access roads
- To evaluate the feasibility of mitigating or preventing adverse impacts, and to predict the residual impacts (if any) after mitigation
- To develop a mitigation plan to prevent significant adverse impacts to the environment

This assessment was conducted in accordance with the requirements of the North Saskatchewan River Valley Area Redevelopment Plan (Bylaw No. 7188) (City of Edmonton 2012) and the *Guide to Environmental Review Requirements on the North Saskatchewan River Valley and Ravine System* (City of Edmonton 2000).

1.2 STUDY AREA

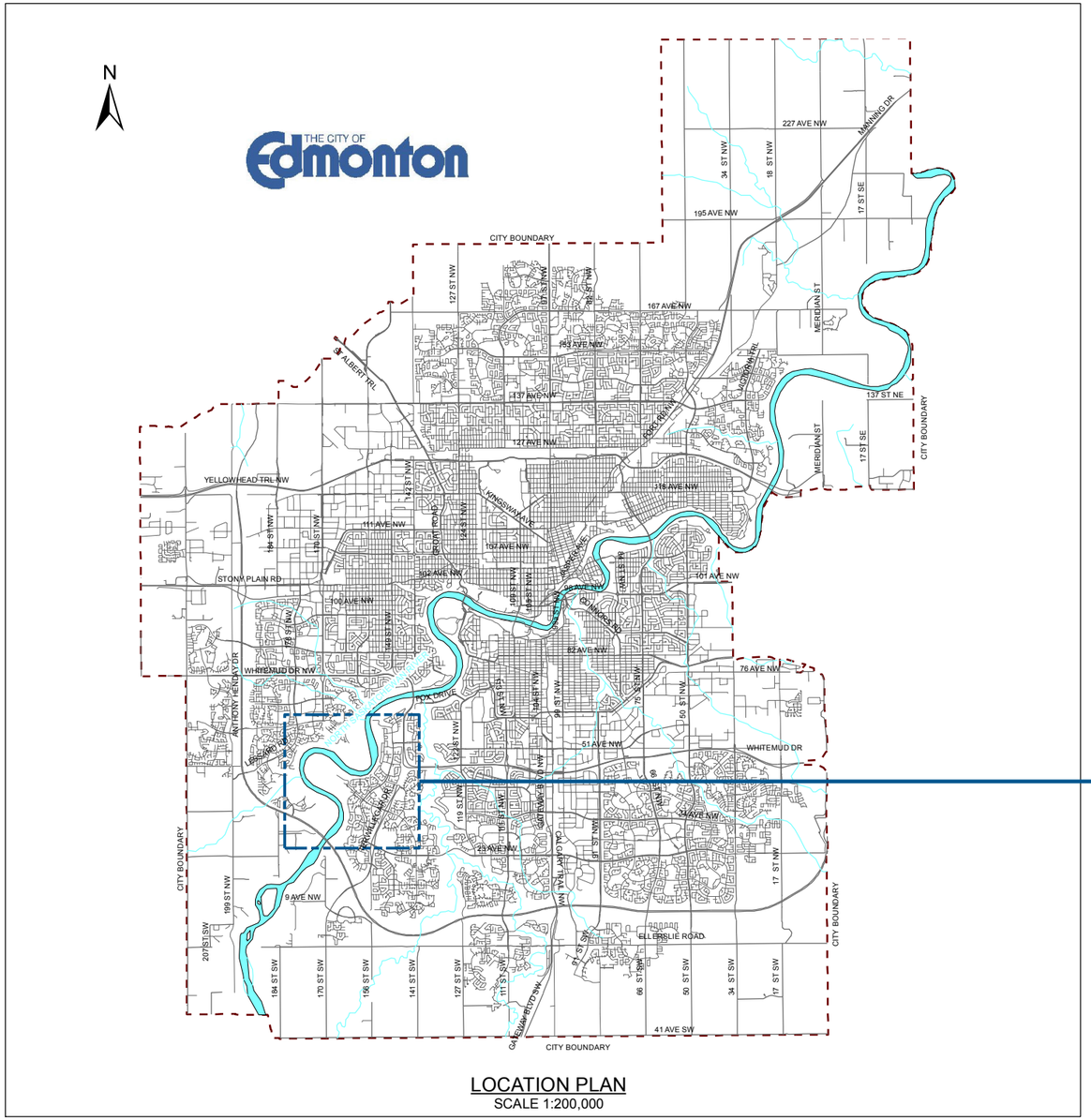
The Study Area is located within the NSR valley and is divided into two portions that are separated by the NSR, which meanders through the Study Area.

1.2.1 North Portion of the Study Area

The north portion of the Study Area contains what is known as River Valley Oleskiw, which is owned by the Proponent and are currently undeveloped. A Master Plan has not yet been developed for this area. This portion of the Study Area, which is comprised of a bench above the NSR, is south of the Fort Edmonton Park Footbridge, adjacent to the Edmonton Country Club, and is bordered to the east and south by the NSR. River Valley Oleskiw contains a large agricultural field (see Section 5.1), and a large tree stand along the east edge of the agricultural field. The tree stand, which is dominated by upland deciduous forest (see Section 6.1), contains an informal trail that originates at the Fort Edmonton Park footbridge and terminates at the south end of the agricultural field near the proposed Footbridge site. A water intake for the Edmonton Country Club is present on the north bank of the NSR. This intake is supplied with power by an aerial power line that is adjacent to the west edge of the agricultural field. A historical site that encompasses a tree stand is present in the south portion of the agricultural field (see Section 5.1).

Two vehicle access points exist for the north portion of the Study Area: the Edmonton Country Club and Woodward Crescent. The Edmonton Country Club access consists of a paved maintenance vehicle and cart path that begins at the Edmonton Country Club clubhouse parking lot. This path travels down the valley slope to the bottom where it turns north and heads back up the golf course. At this point a small dirt road splits off from the paved cart path and enters a storage area at the bottom of the valley slope that currently contains debris and equipment from the Edmonton Country Club. The dirt road passes through this storage area and into the agricultural field, where it joins with a dirt track on the west side of the field (see below).

The second vehicle access point is from Woodward Crescent, which is located in the northwest corner of the north portion of the Study Area. A gravel multiuse trail leads from the south end of Woodward Crescent to the bottom of the valley slope. Slopes in this area may have stability concerns; several slumps with exposed soil and poor vegetation growth are visible along the slope. From here, the gravel trail forks. At the fork, the gravel trail continues on to connect to the paved trail at the entrance to the Fort Edmonton Park footbridge in one direction and turns south to pass through the north end of the tree stand in the other. This southern trail is in fact not a formal trail, but a historic access to the agricultural field that crosses over a small culverted drainage, and enters the agricultural field's northern end. Within the agricultural field the access becomes a dirt track (i.e. two wheel tracks in the grass), and travels along the west edge of the field to the south end, where it terminates. Within the central portion of the agricultural field, the dirt track crosses a shallow ephemeral drainage that flows east across the field, through the tree



LOCATION PLAN
SCALE 1:200,000

Q:\Clients\City_of_Edmonton\Terwillegar_Footbridge\Figures\Fig1_1_Site_Location_20140129.mxd
2/4/2014 alundell

February, 2014
1135-60353

Stantec

Projection: 3TM CM:114° Datum:NAD83
Imagery obtained from City of Edmonton, Transportation Department, 2012.

Study Area
ATS Section Grid

Site Description:
Portions of
3-52-25 W4M
10-52-25 W4M
11-52-25 W4M
14-52-25 W4M
15-52-25 W4M
Edmonton, Alberta

Scale
1:25,000
0 500 1,000 1,500 2,000 2,500 Metres
This map is for reference purposes only

Client/Project
CITY OF EDMONTON
TERWILLEGAR PARK FOOTBRIDGE AND TRAILS

Figure No.
1.1

Title
SITE LOCATION PLAN

stand, and drains into the NSR. The informal trail within the tree stand crosses this drainage, and users of this trail have placed woody debris within the drainage to create a crossing structure.

1.2.2 South Portion of the Study Area

The south portion of the Study Area is located within the southeast portion of Terwillegar Park, as well as along the valley slope above the NSR to the west of the Henderson Estates Neighborhood. This portion of the Study Area is north of Anthony Henday Drive (Hwy 216), and is bordered by the NSR to the north and west, and by Terwillegar Park to the west. Rabbit Hill Road enters the south portion of the Study Area from the east and terminates at a parking lot at the base of the valley slope, within Terwillegar Park. Outfall #101, which services the residential areas to the east, is present within the northeast corner of the south portion of the Study Area. The south portion of the Study Area is dominated by upland deciduous forest (see Section 6.1) and also contains an open grassy area that is designated as part of the off-leash portion of Terwillegar Park, where members of the public can bring their dogs for recreation.

A network of formal granular trails and informal single track trails are present within the south portion of the Study Area and are utilized by various user groups within Edmonton (see Section 5.8). The trail system within Terwillegar Park extends east along Rabbit Hill Road to the residential area at the top of the valley slope, as well as south along the valley slope to the south boundary of the Study Area. An old access road that was built to construct Outfall #101 connects the Terwillegar Park parking lot to Outfall #101.

Much of the south portion of the Study Area is characterized by steep and high slopes descending from the Henderson Estates Neighborhood down to the NSR. The vegetative cover is composed of dense forest (see Section 6.1). A number of slope failures are also noted in the area, with visual evidence of mass collection, long term creep, and exposed soil. Some portions of the slopes may be marginally stable; however, the well-established vegetation aids in maintaining stability.

2.0 Project Overview

The following sections discuss a rationale and alternatives for the Project that were considered prior to selecting the proposed plan as described within this report. These sections also discuss the construction details and timing of the Project.

2.1 PROJECT RATIONALE AND ALTERNATIVES

The Terwillegar Park Footbridge and Trails are being constructed as part of the Capital Project being undertaken by the River Valley Alliance. The footbridge and trail system will form a portion of the trail connection system between Devon and Fort Saskatchewan. To create this connection, trail development is required on both sides of the NSR, as well as the construction of a new bridge to join the trails. For the purposes of this report, the components of the Project will be discussed as North Trail, South Trail, and Footbridge.

During the conceptual and preliminary planning stage of the Project, four alignment options for the trails were considered for each side of the NSR. One of the alignment options for the north side and two of the alignment options for the south side were omitted early in the process. With respect to the bridge, the location is constrained by several factors, but four options for the type of bridge that can be constructed were considered. After the trail alignment options were narrowed down, a value engineering workshop was held with the Proponent and Stantec on June 12, 2013. The purpose of this workshop, which was facilitated by SMA Consulting Ltd., was to perform value engineering on the reduced trail alignment options and the bridge design options identified for the Project and further refine which design options would be the focus of further environmental study and design effort. The value engineering process utilized a defined methodology that considered factors such as constructability, operability, aesthetics, potential environmental impact and cost. The workshop was conducted prior to preliminary design; therefore, the information available to evaluate environmental impacts was limited as no field studies had been conducted yet, and the discussion primarily relied upon the professional judgment of those in attendance at the workshop, including a Professional Biologist. Environmental factors discussed and considered included potential disturbance footprint, tree clearing logistics, noise, fragmentation and other potential to impact wildlife, in-stream isolation measure requirements and feasibility, erosion and sediment control, geotechnical concerns, reclamation requirements and environmental regulatory and approvability issues. The process was undertaken by a cross section of professionals including design engineers, environmental scientists, landscape architects, public consultation specialists, client representatives, etc. SMA Consulting Ltd. prepared a report (Appendix A) that includes the methodology and results of the workshop.

Each of the four trail alignment options on either side of the NSR, as well as the location and design types for the Footbridge, are discussed below. Following the completion of the value engineering session, the environmental impact assessment was developed to gather data and

complete the assessment based on the final trail alignment and bridge design options chosen through the value engineering session.

2.1.1 North Trail

The North Trail will consist of a three metre (m) asphalt trail that will connect the new Terwillegar Footbridge to the existing Fort Edmonton Footbridge and will be designed to the standard of a primary trail. Four alignment options for the North Trail were considered. One of these options was omitted early in the process (i.e., prior to the value engineering workshop). Because the omitted option is located primarily within the agricultural field, it was decided that this option would not provide trail users with a desirable user experience. This option would result in the least amount of tree clearing; however, does not follow the concept identified in the Ribbon of Green Concept Plan for this area (City of Edmonton 1990) and may constrain future master planning for the area. This option will not be discussed further within this report. The three options that were evaluated in the value engineering workshop are discussed below. Each of the three trail options cross an ephemeral drainage that bisects River Valley Oleskiw. Each option also follows pre-existing trails that will require some tree clearing to accommodate the three metre wide asphalt trails.

2.1.1.1 Alignment Option 1

The North Trail alignment within Option 1 connects to the paved trail at the entrance to the Fort Edmonton Park footbridge, immediately enters the tree stand adjacent to the agricultural field, and remains within the tree stand on an existing informal trail until it exits the tree stand at the south end. From there it travels west along the south edge of the agricultural field until it connects with the north end of the Footbridge (Figure 1, Appendix B). This option follows most closely the concept identified in the Ribbon of Green Master Plan (City of Edmonton 1990).

At the north end of this alignment option, grading would be required to create the appropriate slopes for the trail due to the presence of a soil berm along the east edge of the existing trail. This grading would necessitate removal of trees along a portion of the west side of the trail to allow for back sloping to be completed resulting in increased impacts on vegetation and wildlife communities. Of the three options assessed, this option is expected to result in the greatest amount of tree clearing.

The north portion of Option 1 is adjacent to a sandbar within the NSR. Constructing the North Trail along Option 1 could increase the likelihood of trail users walking out onto the sandbar, which could have negative implications for bird species that may be nesting there.

2.1.1.2 Alignment Option 2

The North Trail alignment within Option 2 connects to the paved trail at the entrance of the Fort Edmonton Park footbridge, follows the access trail south to the agricultural field, turns east and travels along the north edge of the agricultural field, cuts into the tree stand via an existing

informal trail, and then remains in the tree stand until it exits at the south end. From here it travels west along the south edge of the agricultural field until it connects with the north end of the Footbridge (Figure 1, Appendix B).

This option follows the Ribbon of Green Master Plan (City of Edmonton 1990) for most of the alignment but avoids the area with the existing berm, thereby avoiding increased impacts on vegetation and wildlife communities, while providing a varied user experience. As well, access to the sandbar is minimized with this routing option.

2.1.1.3 Alignment Option 3

The North Trail alignment within Option 3 is similar to the north portion of Option 2. Option 3 connects to the paved trail at the entrance to the Fort Edmonton Park Footbridge, follows the access trail to the agricultural field, turns east and travels along the north edge of the agricultural field, and cuts into the tree stand via an existing informal trail. Option 3 exits the tree stand via another existing trail, and then travels south along the edge of the agricultural field until it connects with the north end of the Footbridge (Figure 1, Appendix B). This option crosses the ephemeral drainage in a shallower portion of the drainage than the other two options. This option varies somewhat from the concept identified in the Ribbon of Green Master Plan (City of Edmonton 1990) and provides fewer experiences for users along the river.

2.1.1.4 Preferred Alignment Option

For the North Trail, Option 2 was chosen as the preferred alignment over Options 1 and 3 for several reasons. Option 2 does not travel along the entire length of the sandbar as in Option 1, which will reduce potential informal access by trail users to the sandbar. This option also reduces fragmentation of the tree stand as it bisects the tree stand once (whereas Option 3 bisects the tree stand twice), does not require back sloping as in Option 1, thereby requiring less tree clearing than Option 1. This option provides a high level of user experience due to the variety of views types provided by the agricultural field, the tree stand, and the NSR while minimizing potential impacts to vegetation and wildlife communities. Overall, Option 2 was determined to provide the greatest benefit, taking into consideration the constructability of the trail, the potential environmental impacts, and the type of user experience.

2.1.2 South Trail

The South Trail consists of a three metre asphalt trail that will connect the Footbridge with the Terwillegar Park parking lot, and is designed to the standard of a primary trail. A second length of granular trail will be constructed from the parking lot to the pre-existing paved trail at the south end of the Henderson Estates Neighborhood which continues to pass beneath Anthony Henday Drive. This segment of granular trail will be designed to the standard of a secondary trail.

Four alignment options for the South Trail were considered. As discussed above, two of these options were omitted early in the process (i.e., prior to the value engineering workshop). The first omitted option included construction of a new trail from the top of the slope above the Terwillegar Park parking lot to Anthony Henday Drive (i.e., it did not utilize the existing trails in this area). This option was omitted because it was determined that the steep slopes and geotechnical considerations would require a large area of disturbance associated with cuts and fills to create a safe and stable trail, and this level of environmental disturbance was too large given the other potential alignment options. This option will not be discussed further within this report.

The second omitted option included construction of a large portion of the trail at the top of bank, along Heffernan Drive, which would connect with the paved trail that crosses the Anthony Henday Bridge over the NSR. This option was omitted because it travels along the edge of Heffernan Drive, which does not provide a high level of user experience. In addition, it was believed that difficulties would be encountered in crossing a ravine towards the south end of this option. This option will not be discussed further within this report.

The two options that were evaluated in the value engineering workshop are discussed below.

2.1.2.1 Alignment Option 1

Within Option 1, the granular portion of the South Trail climbs the slope above the Terwillegar Park parking lot and at the midway point up the slope begins to switchback several times until it reaches the top of the slope. From this point, Option 1 travels along an existing single track trail to Anthony Henday Drive, with a few deviations from the existing trail in locations where the steep slopes and topography do not support the expansion of the existing trail to the standard of a secondary trail (Figure 1, Appendix B).

2.1.2.2 Alignment Option 2

For the South Trail alignment within Option 2, the South Trail follows the existing trail and climbs the slope above the Terwillegar Park parking lot in one long straight climb, and does not contain any switch backs. Once it reaches the top of the slope, it follows the same alignment as Option 1. This option provides a longer sight line than Option 1, as well as steeper grades on the long ascent (Figure 1, Appendix B).

2.1.2.3 Preferred Alignment Option

For the South Trail, Option 1 was chosen as the preferred alignment over Option 2 for the following reasons:

- Public consultation indicated that shorter lines of sight are more desirable, which are created with the inclusion of switchbacks on the slope above the Terwillegar Park parking lot.
- The trail grades above the parking lot are not as steep due to the inclusion of switchbacks, which was preferred by members of the public.

- The environmental impacts of these two alignment options are similar, though switchbacks will result in increased clearing and grading.

2.1.3 Footbridge

The River Valley Alliance has developed the 2012-2016 Capital Project Map (RVA 2013), which identifies locations within the NSR valley for bridges. One of these locations is the area that is proposed for the Footbridge. Within this area there are several factors constraining the exact location of the Footbridge. On the north side of the NSR, the placement of the Footbridge is constrained by steep and unstable slopes upstream and a historical site in the southeast portion of the agricultural field (Section 5.9). On the south side of the NSR, the placement of the Footbridge is constrained by inaccessibility downstream due to near vertical and unstable slopes, and an existing outfall upstream. Ultimately, the current location was selected due to the geological stability of the banks on both sides of the river, the ease of building a public facility on public lands and the low ecological impact it will have on the landscape (Stantec 2014).

Within the value engineering session, four design options for the Footbridge were considered. Please see Appendix A for additional details of each design.

2.1.3.1 Design Option 1

The first design option that was considered for the Footbridge was a cable stayed bridge with three spans, two pre-cast concrete tower legs, and towers extending 31 m above the asphalt bridge deck, which support the bridge deck through numerous cables. To construct this bridge, berms would be extended approximately 35 m into the NSR from either bank, and would remain in place until after the superstructure is constructed (Appendix A).

2.1.3.2 Design Option 2

A through-arch with three spans was considered for the second bridge design option. The superstructure, which consists of two arches made of coated steel, supports the pre-cast bridge deck with galvanized cable hangers. This type of bridge is constructed on cast in place concrete caisson piers that require berms to be constructed approximately 55 m from the river banks, leaving one third of the channel open. The berms would remain in place until the end span of the superstructure was constructed (Appendix A).

2.1.3.3 Design Option 3

A stressed ribbon was considered as the third bridge design option. This type is bridge is supported on two caisson piers. The bridge deck, which is constructed of pre-cast panels, is suspended from cables that "drape" over the piers and are anchored to the bridge abutments. This removes the requirement for a superstructure that extends above the bridge deck. Each of the three spans sags slightly at the center. To construct the piers, berms would extend approximately 55 m from the river banks, and would be removed once the piers are

constructed. The berms can be narrower than for the other options that were considered because the piers for this design are smaller than for the other options (Appendix A).

2.1.3.4 Design Option 4

The fourth design option that was considered was a truss bridge with three spans. The trusses would be constructed of weathering steel with pre-cast deck panels, and would be supported by cast in place concrete caisson piers. Berms would extend approximately 55 m into the NSR from either bank, and would remain in place for the construction of the piers. The truss would be built on land and moved in place with barges (Appendix A).

2.1.3.5 Preferred Design Option

During the value engineering workshop, it was decided to omit Options 2 and 4 because they did not meet budget or schedule requirements. After comparing Options 1 and 3, it was decided that Option 3 provided the greatest benefit, for the following reasons:

- Sleek structure that is less environmentally intrusive and creates an attraction for visitors
- Provides flexibility for the schedule and an opportunity to optimize the foundation construction
- Perceived to be acceptable to stakeholders and residents
- The stressed ribbon design is the slenderest bridge design option and will require the smallest footprint both on land and in the river, resulting in minimal disturbance to fish and fish habitat, and vegetation and wildlife communities

2.2 PROJECT DESCRIPTION

The following sections contain a description of the project components for the various design options that were chosen above.

The Project is composed of several construction components, including access roads, laydown areas, vegetation clearing, construction of the North and South Trails, and construction of the Footbridge. Each of these components will be protected with interim and final erosion and sedimentation control (ESC) measures, and the final construction component for the Project will be reclamation and re-vegetation of all disturbed areas. Each of these components is discussed in the sections below.

2.2.1 Vegetation Clearing

Prior to the start of construction, vegetation clearing will be required at several locations within the Study Area to accommodate construction activities and various types of equipment required for the Project. Existing trails that will be incorporated into the Project do not have sufficient width to accommodate the planned trail system; therefore, vegetation removal will be

necessary prior to widening the trails. Vegetation removal is planned to be completed outside of the breeding bird season to avoid conflicts with nesting migratory birds.

Vegetation clearing and stumping for the North Trail will be limited to the areas illustrated within TPFB-DD-TA-CL-03 to TPFB-DD-CL-08 (Appendix C), will be approximately 1.04 ha in extent, and will take place along the length of the trail. Vegetation clearing and stumping for the South Trail will be limited to the areas illustrated within TPFB-DD-TA-CL-01, TPFB-DD-TA-CL-02, and TPFB-DD-TG-CL-01 to TPFB-DD-TG-CL-06 (Appendix C), will be approximately 2.22 hectares (ha) in extent, and will be done along the length of the trail. Within the clearing areas, all vegetation will be removed to accommodate widening of the trail, which will include cuts and fills along the slope (see Section 2.2.5). Within the stumping zones, selective stumping of hazard trees will take place. These stumping zones are associated with areas along the slope that will require cuts or fills, which have the potential to impact the root systems of larger trees, causing the trees with the damaged root systems to die. Pre-emptive removal of woody vegetation within the stumping zone will remove the safety hazard of dead trees that may potentially fall into the construction zone or onto the trail once construction is complete. By only removing the portion of the trees above the ground and leaving the root systems intact, the soil will be protected and will continue to be held in place, preventing slumping of the slope from occurring. This will also increase the likelihood that the retained portions of the trees will send up new saplings, which will replace the trees that have been stumped.

Vegetation clearing for the bridge abutments will be limited to the areas illustrated within TPFB-PD-TC1 and TPFB-PD-TC2 (Appendix D). Vegetation clearing for the north abutment will be approximately 0.38 ha and vegetation clearing for the south abutment will be approximately 0.50 ha.

2.2.2 Construction Access Roads

The north portion of the Study Area will have two options for construction access (TPFB-PD-S15b, Appendix D) designated Option 1 and Option 2. The Option 1 access will be from the Edmonton Country Club. Construction traffic will drive to the clubhouse parking lot, down the paved cart path to the bottom of the slope, and then along an access road that will be constructed through the agricultural field to the working area. Slope modifications are not required to the paved portion of this access because it is currently wide enough to accommodate all equipment that will be required for the for the bridge construction. It is anticipated that an additional lift of asphalt will be needed to provide a more solid surface for equipment to travel on. Any damage to the asphalt will be repaired as needed, and the road will be resurfaced at the completion of construction, if required. Topsoil on the access road within the agricultural field will be stripped to a width of 9.0 m and will be stockpiled within the north abutment laydown areas. The road base will be compacted and gravel will be laid on the access to provide a suitable surface for construction traffic and equipment. The total area required for the Option 1 access is approximately 0.50 ha. Because the paved portion of the Option 1 access is currently used by golf course maintenance vehicles as well as golfers traveling in golf carts,

safety will be a primary consideration during construction. Please see Section 7.9 for more details.

The Option 2 access is from Woodward Crescent (TPFB-PD-S15b, Appendix D). Construction traffic will travel from Woodward Crescent to the base of the slope along an existing trail, follow the gravel access road to the agricultural field, and then follow the truck track to the working area, after it crosses the ephemeral drainage within the agricultural field. Topsoil on the access road within the agricultural field will be stripped to a width of 9.0 m and will be stockpiled within the north abutment laydown areas. Option 2 is currently an active transportation corridor used by pedestrians and cyclists to access the River Valley Oleskiw terrace and is the primary west end access to the Fort Edmonton footbridge which provides a connection to Fort Edmonton and the river valley trail system. This route will require that the access be closed for the duration of construction and will require upgrading if used as the primary construction access. The route in its current configuration is suitable for use by light truck traffic and small equipment such as skid steers. The total area required for Option 2 is 1.12 ha.

The south portion of the Study Area will be accessed from Rabbit Hill Road (TPFB-PD-S15a, Appendix D). Construction traffic will travel down this road, and then into the open grassy area to the north of the Terwillegar Park parking lot on a 9.0 m wide access road. From the grassy area, traffic will travel along the South Trail alignment to the working area along a 5.0 m wide access road. Topsoil will be stripped along the portion of the access road between the parking lot and the working area and will be stockpiled with the south abutment laydown area. The road base will then be compacted and gravel will be laid on the access to provide a suitable surface for construction traffic and equipment. Because Terwillegar Park is heavily used by members of the public for various recreational pursuits, safety will be a primary consideration during construction. Please see Section 7.9 for more details.

A small access will be created for construction of the South Trail along the top of the valley slope. This access will connect from Heffernan Drive (TPFB-DD-TG4, Appendix C).

2.2.3 Laydown Areas

Laydown and stockpile areas will be constructed in each of the north and south portions of the Study Area to support the construction of the footbridge and the trail systems. Each of these areas will be prepared in a manner determined by the contractor. The laydown and stockpile areas will be protected with appropriate ESC measures that conform to the City of Edmonton's *Erosion and Sedimentation Control Guidelines* (City of Edmonton 2005a) and the City of Edmonton's *Erosion Control Guideline Field Manual* (City of Edmonton 2005b) (Section 2.2.7).

Within the north portion of the Study Area, a laydown area and a staging area will be constructed to support the development of the Footbridge. The North Abutment Laydown Area (0.81 ha) will be located to the northeast of the Footbridge in the agricultural field, and the North Abutment Stockpile Area (0.5 ha) will also be constructed in the agricultural field, to the northeast of the North Abutment Laydown Area (TPFB-PD-S15b, Appendix D). Both of these

areas will be used to support the construction of the footbridge. An additional laydown area (0.18 ha) will be constructed in the north portion of the agricultural field (TPFB-DD-TA-CL-07, Appendix C) to support the construction of the North Trail.

Within the south portion of the Study Area, a laydown area and a staging area will be constructed to support the development of the Footbridge. The South Abutment Laydown Area a laydown area (0.81 ha) will be located to the northeast of the Terwillegar Park parking lot, and the South Abutment Stockpile Area (0.36 ha) will be located to the northwest of the South Laydown Area (TPFB-PD-S15a, Appendix D). Four additional laydown areas will be constructed in the south portion of the Study Area to support the construction of the South Trail. One laydown area (0.045 ha) will be located at the west end of the Terwillegar Park parking lot (TPFB-DD-TG-CL-01, Appendix C). Two laydown areas are proposed to be located adjacent to each other at the top of the valley slope (0.01 ha), along the west edge of Heffernan Drive, and will be connected to the South Trail through an access road (TPFB-DD-TG4, Appendix C). The fourth laydown area (0.05 ha) will be located at the south end of the South Trail (TPFB-DD-TG-CL-06, Appendix C).

2.2.4 North Trail

The North Trail will connect the existing Fort Edmonton Park footbridge to the Footbridge through River Valley Oleskiw (TPFB-DD-TA-CL-03 to TPFB-DD-TA-CL-08, Appendix C). The entirety of the North Trail will be 3.0 m wide asphalt with a 0.5 m safety shoulder. The structure of the trail will consist of 75 mm ACR asphalt surfacing on 300 mm depth class 3-20A gravel on top of woven geotextile fabric. The geotextile will extend up the edges of the gravel to the native ground (TPFB-PD-TD2, Appendix C).

Please see Section 2.1.1.2 for a description of the alignment of the North Trail. Throughout much of the alignment, the trail follows existing unsurfaced trails. The existing unsurfaced trail within the tree stand ranges from approximately 1.0 m to 2.5 m wide, allowing for minimal tree clearing to complete the paved trail. To follow the existing trails and maintain a user experience of the natural environment the North Trail will avoid extended lengths of straight trail.

One drainage crossing is proposed for the North Trail, at the intersection of an ephemeral drainage course approximately half way along the trail length. The crossing is approximately 9.0 m wide and has 0.75 m elevational change. A 4.2 m wide pedestrian bridge is recommended for this location (TPFB-DD-TA-LG-05, Appendix C).

Two viewpoints will be positioned along the North Trail at key points where views to the NSR are possible with minimal alteration to the grade and natural environment. One viewpoint will be located north of the ephemeral drainage crossing (TPFB-DD-TA-CL-05, Appendix C) and the other will be located approximately 0.6 km south (TPFB-DD-TA-CL-04, Appendix C). Viewpoints will be connected to the asphalt trail with a 1.5 m granular trail and consist of a gravel area, benches, and railings, if required.

2.2.5 South Trail

The South Trail will connect the Footbridge, the Terwillegar Park parking lot, and the asphalt trail serving Anthony Henday Drive. The South Trail is divided into two segments, which differ in substrate type:

- Segment 1: Footbridge to the Terwillegar Park parking lot (asphalt)
- Segment 2: Terwillegar Park parking lot to the asphalt trail serving Anthony Henday Drive (granular)

See Section 2.1.2.1 for a description of the alignment of the South Trail. Segment 1 of the South Trail will be a 3.0 m asphalt trail, similar to the asphalt trail proposed for the North Trail (TPFB-DD-TA-CL-01 and TPFB-DD-TA-CL-02, Appendix C). Segment 1 of the trail is primarily a flat alluvial terrace that has been previously graded and improved during construction of the nearby outfall and will follow this existing access. The existing access road for Outfall #101 is wide enough to accommodate the South Trail without additional tree clearing.

Segment 2 of the South Trail will be a 3.0 m granular trail with a 0.5 m safety shoulder (TPFB-DD-TG-CL-01 to TPFB-DD-TG-CL-06, Appendix C), as previously approved in the *Terwillegar Park Concept Plan Study* (ISL Engineering and Land Services 2009). The structure of the granular trail will consist of 300 millimetres (mm) depth class 3-20A gravel on geotextile fabric, with the geotextile extending up the edges of the gravel to the native ground (TPFB-PD-TD2, Appendix C). This segment of the South Trail will be approximately 2.5 kilometres (km) long, and will follow an existing, well used single track trail with minimal realignments where slopes exceed 10%. Approximately 1.9 km of the trail will be along the existing track with 0.5 km realigned to meet acceptable slope standards. The width of the South Trail will allow for safe passing, and guard rails will be installed where slopes pose a safety hazard. To reduce the extent of the footprint, three wooden retaining walls will be utilized to minimize cut and fill areas. The retaining walls will have heights varying between 0.5 m to 2.0 m, totaling 250 m^2 (TPFB-DD-TG-PR-05, TPFB-DD-TG-PR-06, TPFB-PD-TD1, TPFB-PD-TD2, Appendix C).

Two drainage crossings will be required, both crossing will occur where the South Trail crosses ephemeral drainages. One crossing will be located on the granular portion of the trail (TPFB-DD-TG-CL-06, Appendix C). This crossing structure is proposed to be a small pedestrian bridge, approximately 9 m long or a culvert, with the preference being the bridge structure. The existing trail at this location has slopes exceeding 30%. The approaches to the small pedestrian bridge on both sides will require imported fill and grading to provide reasonable slopes on the trail. The second crossing will occur on the asphalt portion of the trail and will require a 4 m extension of an existing culvert under Rabbit Hill Road, and the replacement of the existing rip rap permanent ESC materials (TPFB-DD-TA-CL-01, Appendix C).

One viewpoint will be positioned along the granular trail at a key point where views to the NSR are possible with minimal alteration to the grade and natural environment (TPFB-DD-TG4,

Appendix C). Similar to the North Trail, viewpoints will consist of a gravel area, benches, and railings, if required.

2.2.6 Footbridge

The Footbridge will be located within the NSR valley, at the boundary of the north and south portions of the Study Area, between the River Valley Oleskiw and Terwillegar Park. This location contains steep vegetated valley slopes on the south bank of the river, and a park-like terrace on the north bank. An access ramp will be constructed on each side of the NSR to allow construction equipment to drive down the river bank and onto 4 m wide and 45 m long temporary bridges (TPFB-PD-S16, Appendix D) that will be installed for the construction of the Footbridge piers and their isolation measures (Section 2.2.6). Both temporary bridges will have three spans, each of which will be supported by three 0.6 m diameter steel pipes that will be driven into pre-drilled holes in the river bed to a depth of 8 m. A small crane will be situated on the bank to drill the holes and drive the pipes to support the first span of each temporary bridge. The crane will be moved onto the temporary bridge as it is constructed to continue drilling the holes and driving the pipes until the temporary bridge is complete. The temporary bridges will remain in place until construction of the piers is complete and the isolation measures can be removed. Once the temporary bridges are removed, the pre-drilled holes will be filled with clean rock cuttings.

The Footbridge will be constructed in the style of a stressed ribbon, which was selected during the value engineering session (see Section 2.1.3). This bridge type is very slender and has a minimalist structure that will be an ideal connection between the trail systems on either side of the NSR.

Each abutment will consist of a slab on grade supported abutment base slab and will have a rectangular footprint of approximately 192 m^2 (TPFB-PD-S08, Appendix D). An inspection chamber will be constructed above each abutment base slab to allow access to the ground anchor heads for future maintenance. A 300 mm roof slab will be placed over the inspection chamber and will be angled to drain water away from the centerlines of the abutment and the footbridge. The roof slab provides an entrance area before the footbridge and may be landscaped with lighting and benches that provide a resting area.

Because a stressed ribbon bridge is a tension structure that exerts a horizontal pull on the abutments, each abutment will be anchored to the underlying bedrock by two means. The native soil at the abutment locations does not have adequate load bearing capacity to resist the vertical pressure due to the loads on the abutment base slabs; therefore, 10 cast in place concrete belled piles will be used at each abutment to support the vertical loads. The belled piles will all be approximately 10 m deep. The four belled piles closest to the footbridge deck will have a shaft diameter of 1.05 m and a bell diameter of 3.15 m. The remaining six belled piles will have a shaft diameter of 0.90 m and a bell diameter of 2.70 m. The concrete piles can resist lateral loads, and will be appropriately reinforced to do so (TPFB-PD-S02, TPFB-PD-S08, Appendix D). In addition to the belled piles, 80 steel bars or steel cable ground anchors will be drilled

between 33 and 35 m into the bank at an approximate 35 degree angle to the horizontal for each abutment (TPFB-PD-S02, TPFB-PD-S08 to TPFB-PD-S10, Appendix D). The horizontal angulation of the ground anchors is designed to resist the tension from the footbridge, and the vertical angulation acts downwards on the abutment base slab. The ground anchors will be pressure grouted, will have double corrosion protection, and will be bonded with competent bedrock. The ground anchor layout, which consists of a grid of 10 rows by eight columns, has been coordinated with the belled pile layout to ensure there is no conflict between the ground anchors and belled piles.

The south abutment will be constructed to the east of Outfall #101, and will parallel the edge of the outfall right-of-way (ROW). The ground anchors will pass below the pipe and manhole of Outfall #101, the belled piles and concrete structure of the south abutment will be outside the outfall ROW, and the nearest ground anchor will be within approximately 2 m of the outfall pipe. Because geotechnical constraints dictate the placement of the south abutment, it must be placed at an appropriate distance from the existing river bank to prevent any compromise to the lateral load resistance of the cast in place belled piles. Therefore, the placement of the abutment and ground anchors in the vicinity of the outfall pipe is required to satisfy the geotechnical requirements.

The design of this abutment was modified so as to not encroach into the outfall right-of-way ROW, which has resulted in dissimilarities between the two abutments. Each abutment is designed to create a positive visual impression, and to aesthetically guide pedestrians onto the footbridge.

The footbridge, which will be approximately 262 m long, will be supported by two in-stream piers that will be supported by cast in place concrete caissons with a diameter of 2438 mm. The bottoms of the caissons have a bell diameter of 3600 mm and will be founded into the bedrock approximately 17 m below the riverbed (TPFB-PD-S05, Appendix D). The pier shafts have a width of 2 m and a length of 10 m at the underside of the footbridge deck (TPFB-PD-S06, Appendix D). The north span of the footbridge will be approximately 85 m long, the middle span will be approximately 100 m long, and the south span will be approximately 77 m (TPFB-PD-S02, Appendix D). It is anticipated that sag for the end spans will be approximately 1.3 m, and the sag for the middle span will be approximately 2.0 m.

The bridge deck will consist of pre-cast high performance concrete deck panels that are approximately 3 m long and 5.35 m wide (TPFB-PD-S11, Appendix D). Six of the deck panels will be cast in place segments, which are referred to as closure pour and will be located at each abutment and on either side of each pier. The closure pours allow for a transition in bridge deck width from that of the deck panel to a greater width at the bridge entrance at the abutments, and at the observation decks over the piers. Each pier will support a cast in place octagonal observation platform that is the closure pour that connects the precast deck panels to the pier (TPFB-PD-S07, Appendix D). The observation platforms will be covered with a raised canopy, the design of which has not been finalized. Each deck panel will have a clear walkway width of 4.5 m. Curbs will be located above the piers, and will be 50 mm high and 275 mm wide (TPFB-PD-

S12, Appendix D). The curbs provide a raised area to mount the handrails, deter round objects from rolling off the bridge, and have 250 mm long recesses to allow for drainage of water off the bridge deck. If required, the recesses can be blocked to facilitate washing of the bridge deck by hydrovac equipment. Adjacent to each curb is a trough measuring 660 mm wide that will house the bearing and stressing cables, which are used to erect and support the footbridge. The bearing cables are used to erect the footbridge, and to hang the concrete deck panels during construction. The stressing cables are then installed within the troughs in the deck panels, are then stressed to provide strength and stiffness to the footbridge. The stressing cables are then grouted, embedding the bearing and stressing cables within the bridge deck. Deck panels will be installed starting with the middle panel in each span and working outwards towards the pier/abutment.

The handrail will be 1.37 to 1.52 m above the bridge deck and support columns will be located every 3 m. Lighting will be installed on the underside of the footbridge to illuminate the piers for watercraft, on the upper side of the footbridge at the observation decks and canopies, on the handrail posts, and at the footbridge entrances. 3 m tall decorative feature light poles are proposed to be used to provide a visual marker on the bridge deck to emphasize these two areas. In addition, the lighting will increase the safety for pedestrians by allowing facial recognition after dark. At this time, it is planned to supply the Footbridge with power from the south side of the NSR. A power line will be trenched down Rabbit Hill Road to the Terwillegar Park parking lot. From here the power line will be trenched into the South Trail alignment to the south entrance of the footbridge. Trenching is expected to be completed with small equipment such as a Ditch Witch, and will be contained within the disturbance footprint of existing accesses. Stantec is currently in discussions with EPCOR Utilities Inc. (EPCOR) to finalize the plan to supply the Footbridge with power. If any alterations to this plan are required, this information will be provided in the form of an addendum if required by the Urban Ecology Unit.

2.2.7 Temporary Erosion and Sedimentation Control Measures

Temporary ESC measures will be installed during each construction component of the Project. The contractor will be responsible for developing a temporary ESC plan that must meet the minimum standards as outlined within the City of Edmonton's *Erosion and Sedimentation Control Guidelines* and the *Erosion and Sedimentation Control Guidelines Field Manual*. Stantec has prepared several documents (Appendix E) that include recommendations for ESC measures that the contractor may use.

The contractor will be limited to working within the Project footprint as illustrated within TPFB-PD-S15a, TPFB-PD-S15b (Appendix D), TPFB-DD-TG-CL-01 to TPFB-DD-TG-CL-06 (Appendix C), and TPFB-DD-TA-CL-01 to TPFB-DD-TA-CL-08 (Appendix C). It is recommended that the contractor consider staged construction for all Project components and that a vegetated buffer be maintained between the working areas and the NSR where ever possible. It is the responsibility of the contractor to develop an Eco Plan that will incorporate the suggested minimum measures as outlined within Erosion and Sedimentation Control Recommendations (Appendix E). Recommendations include the following:

- Site specific grading of the access roads and surrounding disturbance areas to reduce flow rates along the access roads and prevent scouring
- Stumping of fringe trees to maintain the existing ground cover and understory vegetation
- Check dams or permeable berms within drainage swales to reduce flow rates of runoff water
- Straw wattle/silt fence to divert flows around sensitive areas
- Berms/sediment forebay/drainage forebays for containment of overland flows to help to prevent a potential release
- Pumping procedures for dewatering of containment berm/sediment forebay/drainage forebays shall include filtering the pumped water to an undisturbed well vegetated location an appropriate distance from the NSR. Full time monitoring will be required during any pumping activity
- Straw wattle/silt fence for containment of sediment in runoff water and to divert overland flows away from the construction areas
- Hydromulching of exposed surfaces if permanent ESC measures cannot be completed in a timely manner
- ESC measures around all staging/stockpile/laydown areas prior to site use. No material shall be stored or stockpiled adjacent to the NSR
- Monitoring of ESC measures on a weekly basis with additional inspections during and upon completion of rainfall events to ensure measures are performing as intended and are adequate
- A qualified ESC specialist (Certified Professional in Erosion and Sediment Control [CPESC]) is to be retained to inspect the working areas following all stages of completed construction.

Berms have been recommended to provide a construction isolation area surrounding each Footbridge pier. Prior to construction of the berms, floating silt curtains are recommended to be installed. The silt curtains will be anchored to the riverbed with large concrete blocks, and will be suspended from floating buoys (TPFB-PD-S18B, Appendix D). It is the responsibility of the contractor to determine the number of anchors and buoys to hold the silt curtain in place. Once the floating silt curtains are installed, construction of the berms can begin.

The core of the berms will be non-dispersive high plastic clay. The clay will be protected from scouring by the NSR with geotextile filter fabric and Class 2 rock rip rap, which is approximately 300 – 800 mm in diameter. The south berm will be approximately 53 m long and 46 m wide, with a footprint of 2440 m^2. The north berm will be approximately 56 m long and 49 m wide, with a footprint of 2740 m^2. For each berm, the top of the berm face closest to the river bank will have a width of 6 m for construction equipment to work from (TPFB-PD-S18A and TPFB-PD-S18C, Appendix D).

An Aqua Dam has been recommended to be placed parallel to the shoreline of the NSR to allow water to be pumped out of the area on each side of the NSR that will be protected with rip rap (TPFB-PD-S02A, Appendix D). The contractor will be responsible for determining the configuration of the Aqua Dam in conjunction with Stantec. A floating silt curtain will be suspended within the NSR, on the outside edge of the Aqua Dam, prior to installation of the

Aqua Dam. If water is seen to be passing under Aqua Dam, it will be pumped as necessary to a well vegetated area through a screen and allowed to flow back towards the NSR. The Aqua Dam and floating silt curtain must be removed prior to the start of ice formation on the NSR, because ice will damage these ESC measures.

2.2.8 Permanent Erosion and Sedimentation Control Measures and Landscaping

All permanent ESC measures are designed by Stantec and will be the responsibility of the contractor for installation. Re-grading of disturbed areas shall mimic pre-disturbance conditions and drainage patterns, and drainage/flow paths will be minimized to reduce the velocity of runoff water and the potential for erosion to occur. Stockpiled topsoil will be replaced where appropriate. Steep slopes will be protected with hydromulch/hydroseeding/ESC blankets, and straw wattles and/or silt fences will be used to divert flows around sensitive areas.

At the time that the berms are ready to be removed, the Class 2 rip rap used to protect the berms will be removed and placed on the banks of the NSR below the Footbridge and abutments overtop of filter fabric. The City of Edmonton has no specific guideline for the placement of rock riprap but follows Alberta Transportation's guideline (Alberta Transportation 2006). On the north bank of the NSR, the rip rap will cover approximately 1170 m^2 and will extend approximately 45 m upstream and 35 m downstream of the Footbridge (TPFB-PD-S02, Appendix D). On the south bank of the NSR, the rip rap will cover approximately 2395 m^2 and will extend approximately 50 m upstream and 40 m downstream of the Footbridge (TPFB-PD-S02, Appendix D). On the south bank, the rip rap will tie in with the existing rip rap surrounding Outfall #101 to provide continuous soil protection between the two structures, as well as visual continuity. On both sides of the NSR, the rip rap will be keyed into the riverbed approximately 1 m below the current riverbed elevation (TPFB-PD-S18B, Appendix D), and will be backfilled with riverbed material to the original ground level. Live staking of native shrubs will be incorporated into the final rip rap design.

Additional permanent ESC measures may be required in swales constructed to facilitate drainage of areas around the bridge abutments and to convey potential overflow from a nearby manhole that services the storm water system linked to Outfall #101. The specific ESC products used will be determined through detailed design, it is anticipated that they will be contained within the existing project footprint.

Landscaping for the Study Area is recommended to take place in a staged manner. Landscaping plans have been developed for all areas that will be disturbed, and can be found in Drawings TPFB-DD-TG-PR-01 to TPFB-DD-TG-PR-07 and TPFB-DD-TA-RP-01 to TPFB-DD-TA-RP-08 (Appendix C). Plantings have been designed to replace removed vegetation with native species that are typically found within the NSR valley. Species that will be planted throughout the Study Area include, but are not limited to, white spruce (*Picea glauca*), red-osier dogwood (*Cornus stolonifera*), high-bush cranberry (*Viburnum opulus*), prickly rose (*Rosa acicularis*), sandbar willow (*Salix exigua*), and beaked hazelnut (*Corylus cornuta*). Species have been selected for the plan based on their general habitat requirements and tolerances, with species

such as the willows being placed along the NSR banks, and upland shrubs such as beaked hazelnut being placed along the trail system. The shoulders along the North and South Trails will be seeded with a grass species mix that consists of Rocky Mountain fescue (*Festuca saximontana*), alpine bluegrass (*Poa alpina*), awned wheatgrass (*Elymus trachycaulus* ssp. *subsecundus*), junegrass (*Koeleria macrantha*), and northern wheatgrass (*Elymus lanceolatus* ssp. *psammophilus*).

2.3 CONSTRUCTION TIMING

The following sections summarize the potential construction timing for each phase of the project.

2.3.1 North Trail

The proposed construction schedule for the North Trail is as follows:

- Vegetation clearing – April 2014
- Trail grading – May to June 2014
- Trail surfacing – July to August 2014
- Reclamation – June to October 2014, with initial and final measures being completed as required
- ESC measures – installed, monitored, and maintained throughout the life of the Project

2.3.2 South Trail

The proposed construction schedule for the South Trail is as follows:

- Vegetation clearing – November 2014 to February 2015
- Trail grading – May to June 2015
- Trail surfacing – July to August 2015
- Reclamation – June to October 2015, with initial and final measures being completed as required
- ESC measures – installed, monitored, and maintained throughout the life of the Project

2.3.3 Footbridge

The proposed construction schedule for the bridge is as follows:

- Vegetation clearing – March to April 2014
- Contractor to begin preparing the work site – June 2014
- Construct the berms – August 1 to September 15, 2014
- Construct the piers – Winter 2014/2015
- Construct the abutments – Winter 2014 to Spring 2015
- Remove the berms – March, 2015
- Erect the footbridge deck – June to September 2015

- Complete the footbridge – Fall 2015
- Initial reclamation – Fall 2015
- Final reclamation – Summer/Fall 2016
- ESC measures – installed, monitored, and maintained throughout the life of the Project

3.0 Regulatory Considerations

The following sections outline the main federal, provincial, and municipal acts, regulations, bylaws, or plans that may be relevant to certain aspects of the Project components. However, the following is not an all-encompassing list that may pertain to the Project.

3.1 FEDERAL LEGISLATION

The following sections provide a summary of the main applicable federal legislation.

3.1.1 Fisheries Act

The *Fisheries Act* (R.S.C.1985, c. F-14), which is administered by Fisheries and Oceans Canada (DFO) and was first enacted in 1868 as one of Canada's first laws, applies to all fishing zones, territorial seas, and inland waters of Canada, and regulates the protection of fisheries, pollution prevention, the harvesting of fish, and the safe use of fish.

The *Fisheries Act* prohibits the deposit of a deleterious substance of any type in water frequented by fish, or in any place under any conditions where the deleterious substance may enter such water. A deleterious substance is defined as "any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water" (DFO 2013a). Common types of deleterious substances are silt, excess nutrients, toxic contaminants, pesticides, and industrial and municipal waste discharges. The *Fisheries Act* states personnel duty to notify and report if serious harm to fish and/ or a deleterious substance deposit occurs in the water body.

Recent changes to the *Fisheries Act* were included in Bill C-38, which received Royal Assent on June 29, 2012. The revised *Fisheries Act* will:

- Focus the Act's regulatory regime on managing threats to the sustainability and ongoing productivity of Canada's commercial, recreational and Aboriginal fisheries
- Provide enhanced compliance and protection tools
- Provide clarity, certainty and consistency of regulatory requirements through the use of standards and regulations
- Enable enhanced partnerships to ensure agencies and organizations that are best placed to provide fisheries protection services to Canadians are enabled to do so

The new act, which was enacted November 25, 2013, now states that "no person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery."

The three protected classifications of fisheries resources are defined as follows:

- Commercial – fish are harvested under the authority of a license for the purpose of sale, trade, or barter
- Recreational – fish are harvested under the authority of a license for personal use or sport
- Aboriginal – fish are harvested by an Aboriginal organization or any of its members for the purposes of using the fish as food, for social or ceremonial purposes, or for purposes set out in a land claims agreement

There is a requirement to avoid causing serious harm to fish by following best practices such as those described in the measures to avoid harm. The new *Fisheries Act* has implemented a self-assessment tool to determine if the proposed project will require DFO review. Projects located in the following water bodies and that meet the criteria outlined within the self-assessment form do not require DFO review (2012, C-38):

- Approved marine disposal or dumping sites that have been used in the past 10 years
- Tailings impoundment areas
- Artificial water bodies that are not connected to a water body that contains fish at any time during any given year, such as:
  - Private ponds
  - Commercial ponds (e.g., golf course ponds, stocked fishing ponds)
  - Stormwater management ponds
  - Irrigation ponds or channels
  - Agricultural drains and drainage ditches
  - Roadside drainage ditches
  - Quarries and aggregate pits
- Any other water body that does not contain fish at any time during any given year

If project activities are listed below and they meet the associated criteria (if applicable), the project does not require DFO review.

- Bridges, causeways, and culverts
- Cottage, boating, and recreation
- Drainage, flood control, and wastewater management
- Flow management
- Water diversion and re-watering
- Water taking
- Other activities

This legislation will apply for the portions of the Project that alter fish habitat. Through the self-assessment process, it has been determined that a DFO review will be required for this project If it is determined the project will cause serious harm to fish that are part of or that support a commercial, recreational, or Aboriginal fishery, an application for Authorization may be required (2012, C-38).

3.1.2 Migratory Birds Convention Act, 1994

The *Migratory Birds Convention Act, 1994* (S.C. 1994, c. 22) (MBCA) and the *Migratory Birds Regulations* (C.R.C., c. 1035) (MBR) are directed at the protection and preservation of migratory birds and migratory bird habitat. The MBCA and MBR apply to various:

- Migratory game birds, including ducks, geese, swan, cranes, shorebirds, and pigeons
- Migratory insectivorous birds, including chickadees, cuckoos, hummingbirds, robins, swallows, and woodpeckers
- Additional migratory non-game birds, including gulls, herons, loons, and puffins

This legislation contains provisions designed to protect and preserve migratory birds. These include, but are not limited to:

- Prohibition against disturbing, destroying, or taking a nest, egg, or nest shelter of a migratory bird
- Prohibition against depositing or permitting to be deposited oil, oil wastes, or any other substances harmful to migratory birds in any waters or any area frequented by migratory birds

The Minister can issue permits for certain activities related to migratory birds. However, there are no permits for disturbing, destroying, or taking a nest, egg, or nest shelter of a migratory bird, nor for depositing or permitting to be deposited oil, oil wastes or any other substances harmful to migratory birds in any waters or any area frequented by migratory birds. These activities are strictly prohibited by the legislation. Environment Canada can take enforcement action if municipal development activities result in the destruction or disturbance of migratory birds, nests, or eggs.

Clearing of vegetation and disturbance to the Study Area will be required to construct the trail system and bridge. To comply with the MBCA and MBR, the removal of viable nesting habitat must be undertaken when birds are not nesting and raising their young. These periods can vary depending on the particular migratory bird species, but will typically range between February through to the end of August. If it is not possible to schedule vegetation removal outside these critical periods, a breeding bird survey must be completed by a qualified biologist prior to commencing clearing activities.

Once an area has been cleared of vegetation, migratory birds could still nest within the construction area and are protected under the MBCA.

3.1.3 Navigation Protection Act

As of December 14, 2012, the *Navigation Protection Act* (NPA), formally known as the *Navigable Waters Protection Act* (NWPA) (R.S.C. 1985, c. N-22) received Royal Assent; however the changes will not be implemented until April 2014.

The primary objective of the NPA remains unchanged from the previous version of this act, and is to protect Canada's water bodies by prohibiting any activity that may hamper their navigability. This may include such river work activities as:

- Any bridge, boom, dam, causeway, wharf, dock, boathouse, intake, outfall, etc.
- Dredging, dumping of fill, retaining wall, groyne, breakwater
- Submarine or overhead cables, tunnel, pipeline
- Aquaculture facilities
- Any other device, structure, or thing whether similar in character to the above or not

The recently enacted *Jobs and Growth Act, 2012* (Bill C-45) will reduce the number of water bodies subject to the NPA. The amendments are intended to clarify when approval of the Minister of Transportation will be required to build or repair infrastructure in navigable waters. The amendments, which focus on protection to waters considered important for commercial and recreational navigation and aim to improve efficiency of the assessments Transport Canada undertakes on smaller water bodies, include:

- Clearly list the major waterways for which regulatory approval is required prior to the placement or construction of a work and apply the common law to protect navigation in unlisted waterways
- Allow proponents of works in unlisted waters, such as municipalities and provinces, to opt-in and seek approval of their proposed work to give them additional legal certainty by allowing them to choose
- Expand the list of minor works (such as minor repairs on bridges) that can be pre-approved because they pose very little impact on safe navigation

Navigable water bodies protected under the NPA will be those listed in Schedule 2 of the act. Works proposed for all other unlisted water bodies will not be subject to the NPA. Activities considered minor works under the NPA will be subject to the NPA; however, details have not yet been released or put into force. Changes will also include reducing the minimum distance from the water body and the provision for safe access for vessels during construction (Transport Canada 2012).

The NSR has a strong potential to be listed as one of the rivers in Schedule 2 of the NPA. However, regardless, the project will still need to comply with the Common Law right to navigate. Given the effect that construction of this footbridge will have on that right, it is strongly advised that application be made under this legislation, and that if the NSR should happen to not fall under the Schedule 2 water bodies, that the City of Edmonton choose to opt in to the approval process regardless.

3.1.4 Species At Risk Act

The *Species at Risk Act* (S.C. 2002, c. 29) was created to protect wildlife and critical habitat for wildlife to prevent extinction and aid in the recovery of threatened populations on private and

federal land. The act lists wildlife species as *extirpated*, *endangered*, or *threatened* and requires that a recovery program be prepared for species listed under the act. Removal, harassing, destruction, collection, possession, and trading of listed species are prohibited along with disturbance to dens or nesting sites. These restrictions apply to all species listed in Schedule 1 located on Federal Lands, all birds listed in Schedule 1 and the MBCA on both private and Federal lands and all aquatic species listed in Schedule 1 on both private and Federal land.

Stipulated within the act is the protection of "critical habitat" that is key to the survival and/or recovery of listed species. The act aims to protect critical habitat through voluntary programs and environmental stewardship but will apply prohibitions against destruction of habitat, if required. If the Project is expected to destroy critical habitat for species listed in the act, potential regulatory requirements may need to be met depending on jurisdiction and land ownership.

3.2 PROVINCIAL LEGISLATION

The following sections provide a summary of the main applicable provincial legislation.

3.2.1 Environmental Protection and Enhancement Act

The *Environmental Protection and Enhancement Act* (R.S.A. 2000, c. E-12) (EPEA) is directed at ensuring the wise use of the environment through protection and enhancement. It creates a framework in a single act that takes an integrated approach to the protection of air, land, and water. The act strengthens and clarifies Alberta's environmental laws, and also eliminates duplication among existing acts.

One of the act's cornerstones is the guarantee of public participation in decisions affecting the environment. This public involvement includes increased access to information, participation in the Environmental Assessment and Approval Processes, and the right when directly affected to appeal certain decisions.

This approval process acts as an early warning system by identifying and preventing potential problems before a project proceeds. As a further safeguard, approval conditions detail specific operating requirements that projects must meet. Regular inspections and monitoring will ensure projects comply with stringent environmental standards during and after their operation. Failure to comply with this act will result in penalties.

Areas that the act addresses include emissions, release of substances, application and use of herbicides or pesticides, stormwater drainage, and incident reporting requirements. It is the umbrella legislation for erosion and sediment control, leaks/spills, and other environmental incidents. Specific to the Project, this act will apply to the release of substances, use of herbicides or pesticides, and erosion and sedimentation control.

3.2.2 Historical Resources Act

The need to preserve and study historic resources has long been recognized and was officially reflected in the *Historical Resources Act* (R.S.A. 2000, c. H-9)(HRA). Most of Alberta's historic resources fall into one of three categories: buildings and other structures, archaeological sites, and paleontological sites.

The HRA is responsible for the preservation of Alberta's historical resources and provides the framework for Historic Resources Impact Assessments (HRIAs) and mitigative studies. If a project or activity could result in the alteration, damage, or destruction of an historic resource, the Proponent may be required to:

- Conduct an HRIA on lands that may be affected by the activity
- Submit a report to Alberta Culture that discusses the results of the HRIA
- Avoid any historic resources endangered by activity
- Mitigate potential impacts by undertaking comprehensive studies

See Section 5.9 for a description of the historical resources work that has been completed for the Project. Any historical resources encountered during construction must be immediately reported to the Historical Resources Management Branch, pursuant to Section 31 of the HRA. See Section 7.11 for a discussion of mitigation measures that are recommended for the Project.

3.2.3 Public Lands Act

In 1930, Canada transferred control for the natural resources in Alberta to the province. Alberta passed the *Provincial Lands Act* (R.S.A, 1942, c.62) on March 28, 1931, for the administration of lands, minerals, forests, and fisheries, and to control the drilling of gas wells. In 1949, this legislation was amended to become the *Public Lands Act* (R.S.A 2000, c. P-40) (PLA). The bed and shore of all permanent and naturally occurring water bodies (e.g., lakes, streams, and rivers) are considered public land, and are under the jurisdiction of Alberta Environment and Sustainable Resource Development (ESRD), the government agency that enforces the PLA. ESRD may lay claim to the bed and shore of a permanent water body if the water body is determined to be sufficiently permanent to warrant a provincial claim. The extent of the Province's ownership of the bed and shore is limited by the bank of the water body. This is the line along the upper limit of the bed and shore, formed by the normal continuous action or presence of surface water on the land, and forms a natural boundary between the crown-owned bed and shore and privately owned land (Government of Alberta 2013). The 'bed' is the land on which the water sits, and the 'shore' is that part of the bed that is exposed when water levels are not at their normal fullest level (Government of Alberta 2013).

Authority to use public land and the allocation of it is granted through dispositions issued under the provisions of the act. The bed and shore of all permanent and naturally occurring water bodies (e.g., lakes, streams, rivers, etc.) are also considered public land. A disposition is a land use contract that gives specific rights to a land or resource user (i.e., lease, license, or permit).

A Department License of Occupation (DLO) is required for projects that will require the permanent modification of bed and shore for crown claimed water bodies. Because the Project includes a footbridge which requires the construction of two in-stream piers and the placement of rock rip rap within bed and shore of the NSR, a DLO application will be required for the footbridge. A Temporary Field Authorization (TFA) will be required to construct the berms and temporary bridges. A TFA can also allow the construction of the footbridge to begin while the DLO application is being reviewed if the DLO is not processed prior to the start of construction. The trail bridges may require a DLO application if they require construction of any permanent structures within bed and shore of their respective waterways.

3.2.4 Occupational Health and Safety Act

The *Occupational Health and Safety Act* (R.S.A. 2000, c. O-2) protects the personal safety of both workers and employers within the Province of Alberta. It outlines the duties and responsibilities of both employers and employees while conducting work. This act will come into effect during any construction and operation of the development stages pertaining to the construction footprint of the Project.

3.2.5 Water Act

The *Water Act* (R.S.A. 2000, c. W-3) supports and promotes the conservation and management of water in Alberta. In addition, the Act also addresses the following:

- Protects existing water licenses that are in good standing by bringing them forward into and making them subject to the new act
- Protects existing traditional agricultural uses of water through a streamlined, voluntary registration process that "grandfathers" the relative priority of the right according to the date when the water was first used
- Recognizes the importance of protecting Alberta's rivers, streams, lakes, and wetlands by requiring development of a strategy to protect the aquatic environment as part of the provincial water management planning framework
- Prohibits the export of Alberta's water to the United States
- Prohibits any inter-basin transfers of water between Alberta's major river basins

The act prescribes that all water is the property of the Crown and an approval is required to conduct an activity in a water body (s.36). Activity is defined broadly to include placing/constructing works within a water body, and removing or disturbing ground and/or vegetation that results in altering the flow, level, direction and/or location of a water body. Because the Project includes the construction of a footbridge, a Code of Practice Notification is required for the footbridge, while a *Water Act* application is required for any rip rap placed outside the Footbridge right of way (ESRD 2006).

3.2.6 Weed Control Act

The *Weed Control Act* (S.A. 2008, c. W-5.1) regulates the control of *noxious* and *prohibited noxious* weeds in Alberta. It specifies appropriate disposal and storage of weed seeds and dictates that noxious weeds must be controlled and prohibited noxious weeds must be destroyed. Failing to control weed infestations can result in fines or jail time. For this Project, the act will apply to the control of *noxious* and *prohibited noxious* weeds within all areas disturbed or utilized during construction of the Project.

Weed Control Regulation

The Weed Control Regulation (Alta. Reg. 19/2010) is pursuant to the *Weed Control Act* and specifies the weeds that are listed as noxious and prohibited noxious. Examples of regulated weeds include creeping thistle (*Cirsium arvense*), scentless chamomile (*Matricaria perforata*), leafy spurge (*Euphorbia esula*), nodding thistle (*Carduus nutans*), Russian knapweed (*Centaurea repens*), common toadflax (*Linaria vulgaris*), and purple loosestrife (*Lythrum salicaria*).

The act and regulation will dictate the management of weeds within the construction footprint during construction and post-construction. The application of herbicides is controlled through the EPEA) and should be reviewed in the event that herbicide application is required to control any listed weed species.

3.2.7 Wildlife Act

The *Wildlife Act* (R.S.A. 2000, c. W-10) is the main piece of provincial legislation that addresses wildlife. This act regulates various aspects of hunting (i.e., licensing, seasons, draws, etc.), control of diseased animals, damage or threat caused by private animals, and the access restriction to protect wildlife habitat. The act also protects wildlife habitation with respect to nests and dens of endangered animals, upland game birds, and migratory birds defined in the MBCA and *Wildlife Act* year round throughout Alberta.

If the Project is expected to disturb or destroy wildlife habitat for species identified in the act, such as early nesting owls, potential regulatory requirements may need to be met depending on jurisdiction and land ownership. A survey to assess the Study Area for nesting and breeding owls should be conducted by a qualified biologist if tree clearing activities will take place beginning in February. In addition, a survey should be conducted by a qualified biologist for the presence of dens that may contain hibernating mammals.

3.3 MUNICIPAL LEGISLATION AND PLANS

The following sections provide a summary of the main applicable municipal legislation and plans.

3.3.1 City of Edmonton Top of Bank Policy (Policy C542)

Policy C542 (2010) was developed to reasonably protect urban development from environmental hazards, such as slope instability and failure, flooding or fire, while ensuring the preservation of the River Valley and Ravine System as a significant visual and natural amenity feature. The Project will allow the City of Edmonton to meet the purpose of this Policy by providing recreational opportunity within the River Valley and Ravine System for the citizens of Edmonton.

3.3.2 City of Edmonton North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188)

Bylaw 7188 was developed to protect the NSR Valley and Ravine System and to establish principles for future implementation plans and programs for parks development (City of Edmonton 2012). This bylaw envisions the majority of the NSR Valley and Ravine System for use as an environmental protection area and for major urban and natural parks. The key goals of this bylaw are to ensure preservation of the natural character and environment of the NSR Valley and Ravine System; to establish a public recreation area; and to provide the opportunity for recreational, aesthetic, and cultural activities for the benefit of Edmonton residents and visitors.

The construction footprint for the Project is considered to be within the boundaries of Bylaw 7188; therefore, the requirements under this bylaw will need to be met through the preparation of this MEIA and a Site Location Study (SLS) that is being prepared under separate cover. The SLS will be submitted to the City of Edmonton for review and comment.

3.3.3 The City Of Edmonton Drainage Bylaw (Bylaw 16200)

Bylaw 16200 (2014) was developed to regulate connections between private drainage systems and the sewerage system; regulate the use of the sewerage system, including the release of matter into the sewerage system; prevent damage or misuse of the sewerage system; regulate surface drainage on public and private land; and prescribe fees related to the use of the sewerage system. This bylaw requires that an approval be obtained prior to any grading of the Project site.

3.3.4 City of Edmonton Community Standards Bylaw (Bylaw 14600)

Bylaw 14600 was developed to regulate the conduct and activities of people on privately owned property to promote the safe, enjoyable, and reasonable use of such property for the benefit of all citizens within Edmonton (City of Edmonton 2013). Noise control is addressed in this bylaw for residential and non-residential properties during day and night hours. With regards to the Project, construction may not take place on a property on any Sunday or holiday, or between 7:00 pm and 9:00 am. In addition, noise may not exceed 75 decibels at the property line between 7:00 am and 10:00 pm, and may not exceed 60 decibels at the property line between 10:00 pm and 7:00 am. However, if construction must take place outside allowable

hours, or if it is not possible to keep noise levels within the stated limits, a permit granting exception may be obtained from the City Manager.

3.3.5 Corporate Tree Management Policy (Policy C456A)

Policy C456A was developed to protect trees located on City of Edmonton property (City of Edmonton 2010a). Trees within Edmonton, including ornamental and natural treed areas, will be procured, maintained, protected, and preserved. Where damage or loss occurs as a result of non-compliance with this policy, equitable compensation for that damage or loss as described within Policy C456A will be recovered from the entity causing the damage or loss and applied to future tree replacements. All work on City owned trees will be in accordance with the applicable bylaws and policies within Edmonton.

Trees will be protected by implementing the following strategies:

- Ensure orderly development of the City's tree inventory through new plantings, replacement plantings, and proper maintenance
- Adequately protect trees on City property from destruction, loss, or damage. Where salvage is not possible, equitable compensation will be provided to the City
- Provide for a tree reserve account that enables the carry forward of funds received for tree losses and/or damages to be used for future plantings on City property
- Coordinate all City tree planting programs including boulevards, roadway landscaping, parks, and facility developments

To satisfy the requirements of this policy, the Proponent has contacted the City of Edmonton to assess the replacement value for all trees proposed to be cleared for the Project. Stantec and a representative from City of Edmonton Community Services have completed site walks to view all areas that will require tree clearing, and Stantec is currently waiting for the City of Edmonton to provide a compensation value for all trees that are planned to be removed. The Proponent shall provide this compensation to the City as per Policy C456A (City of Edmonton 2010a).

3.3.6 The City of Edmonton Erosion and Sediment Control Guidelines and Field Manual

The Erosion and Sedimentation Control (ESC) Guidelines (Guidelines) (2005a), and the Erosion and Sedimentation Control Field Manual (Field Manual) (2005b) have been prepared to assist owners, developers, consultants, contractors, and City departments and staff, including those of Drainage Services, in understanding ESC issues. These documents are intended as guidance for those involved in meeting the requirements of the City of Edmonton Design and Construction Standards, Volume 3, Drainage for ESC planning and measures.

The Guidelines are intended to fulfill the following needs:

- Provide a consolidated statement of Drainage Services' policies and expectation regarding ESC
- Clarify the respective roles and responsibilities for ESC for Drainage Services, owners and developers, consultants and contractors

- Encourage awareness of and conformance with federal and provincial legislation and with municipal by- laws and standards related to ESC
- Improve communications among all parties responsible for ESC

3.3.7 The Way We Live, Edmonton's People Plan

The Way We Live document (City of Edmonton 2010b) was developed to improve the livability of Edmonton over the next ten years. Its primary six goals are Edmonton is a vibrant, connected, engaged and welcoming city, it celebrates life, it is caring, inclusive and affordable, it is safe, it is attractive, and Edmonton is sustainable. Through this plan, Edmonton has enacted municipal bylaws that protect Edmonton's natural spaces, improves active transportation, and promotes the use of environmental planning. This plan's vision will be a part of this Project by giving guidance to its development, environmental standards, and planning.

3.3.8 The Way We Grow, Municipal Development Plan (Bylaw 15100)

The Way We Grow, Municipal Development Plan (City of Edmonton 2010c) is the City of Edmonton's strategic growth and development plan over the next ten years. It is closely integrated with the *Transportation Master Plan* in that it identifies future growth and development of the City's infrastructure. This plan will give guidance to the City by developing it into a more compact, transit orientated, and sustainable city. This Project is a part of the City of Edmonton's active transportation growth strategy.

3.3.9 The Way We Move, Transportation Master Plan

The Way We Move, Transportation Master Plan (City of Edmonton 2010c) outlines seven strategic goals for the City of Edmonton's 2040 City Vision. These include transportation and land use integration, access and mobility, sustainability, health and safety, transportation mode shift, well maintained infrastructure, and economic vitality. Specifically, Chapter 6 of this Master Plan focuses on Active Transportation, or transportation powered by an individual's own energy. This Project will follow the City's encouragement of developing a more walkable environment. This will require year round maintenance of the trail in order to provide yearly access for all citizens.

3.3.10 The Way We Green, City of Edmonton Environmental Strategic Plan

The Way We Green (2011) is the City of Edmonton's Environmental Strategic Plan and is designed to move the City down a sustainable path. The Plan outlines the City's strategies regarding environmental sustainability and preservation as determined by the objectives laid out in The Way We Grow report. The Plan outlines a number of objectives that work toward the goal of becoming a city with a strong connection to nature. Key objectives of the strategic plan that relate to the proposed project include:

3.3 The City of Edmonton protects, preserves and enhances a system of conserved natural areas within a functioning and interconnected ecological network (The Way We Grow, Strategic Objective 7.1.1).

3.6 The City protects, preserves, and enhances its urban forests.

3.7 The City protects, preserves, and enhances the North Saskatchewan River Valley and Ravine System as Edmonton's greatest natural asset (The Way We Grow, Strategic Objective 7.3.1).

3.8 The City protects, preserves and improves the North Saskatchewan River Valley and Ravine System as an accessible year-round place for recreation and activity for people of all ages (The Way We Grow, Strategic Objective 7.3.2).

3.9 The City mitigates the impact of development upon the natural functions and character of the North Saskatchewan River Valley and Ravine System (The Way We Grow, Objective 7.3.3).

3.10 The City utilizes parks and open spaces to complement and enhance biodiversity, linkages, habitat and the overall health of Edmonton's ecological network (The Way We Grow, Objective 7.4.1).

3.11 The City expands and enhances Edmonton's inventory of parks and open spaces for the ecological, health, recreation and educational benefits they provide (The Way We Grow, Objective 7.4.2).

3.3.11 Terwillegar Park Concept Plan Study

The *Terwillegar Park Concept Plan Study* (ISL Engineering and Land Services 2009) was developed to define an overall concept plan, management objectives and development guidelines for the next ten years. Four concept plan options were initially prepared, of which two were further reviewed and discussed. The final concept plan was chosen based on public input received during open houses and through the project website. The *Terwillegar Park Concept Plan* includes a recommended implementation strategy, which outlined park management guidelines, resource management strategies, a breakdown of the estimated capital costs, and a breakdown of each development phase of the project. The *Terwillegar Park Concept Plan* the Terwillegar Park Concept Plan identifies the location of the proposed footbridge and trail system.

4.0 Methods

The MEIA involved a desktop review of available environmental information (e.g., geological and soils maps, climate data, known flora and fauna in the region), a review of historic aerial photographs, field assessments of the Study Area, and an assessment of potential impacts resulting from construction of the Project. The following sections discuss the methodology used within this MEIA.

4.1 DESKTOP REVIEW

Selected aerial photographs dating from 1949 to 2012 were reviewed, and a summary was compiled detailing relevant changes to the Study Area. Aerial photographs in approximately five to ten year intervals from 1949 to 2008 were obtained from the Alberta Environment and Sustainable Resource Development Air Photo Distribution Office. The 2012 image was obtained from the City of Edmonton Transportation Department, and can be found in Figure 1.1.

Relevant information pertaining to the Study Area was reviewed and summarized as part of the desktop review. Information sources that were reviewed included scientific journals, previous reports, historical resource assessments, reference material and other literature, internet sites, and online databases such as Environment Canada climate normal and the Energy Resources and Conservation Board coal mine maps.

4.1.1 Rare Plant and Rare Ecological Communities

A rare plant is a vascular or non-vascular plant species that, because of biological characteristics or for some other reason, exists in low numbers or in very restricted areas in Alberta (Alberta Tourism, Parks and Recreation [ATPR] 2013a). Rare plants often have restricted spatial, ecological and temporal distributions in variable or diverse environments (Harper 1981).

Rare plants in Canada and the Province of Alberta are recognized and defined within a framework of multi-layered regulatory jurisdictions and criteria that are based on similar categories. Within this regulatory and assessment framework, plant species are documented by the Alberta Conservation Information Management System (ACIMS), which tracks all plant species and ecological communities in the province, assigns provincial rarity levels, and compiles global rankings of the species and ecological communities throughout their worldwide range (ATPR 2013b). Evaluation of species rarity under federal legislation is carried out through the *Species at Risk Act* (S.C. 2002, c. 29)(SARA) as defined by the Committee on the Status of Endangered Wildlife in Canada ([COSEWIC] COSEWIC 2009). SARA defines and lists *extirpated*, *endangered*, *threatened*, and *special concern* species (Schedule 1 and Schedule 2). In addition, species can be given a legal designation of *threatened* or *endangered* under the *Wildlife Act* (Schedule 6).

Species ranks and placement on tracking and watch lists are evaluated regularly by ACIMS. Because species included on watch lists typically have restricted distributions but are common within their range, population declines can result in reclassifying a species from the watch list to the tracking list (ATPR 2013b). For the definitions of provincial rankings see Table 4-1. Species are also ranked and assessed in the *General Status of Alberta Wild Species* (ESRD 2011). For definitions of provincial status, see Table 4-2.

In Alberta, species ranked S1, S2, and occasionally S3 are included on ACIMS's tracking list. These species are rare in the province or are of conservation concern. Species placed on watch lists are species for which ACIMS recommends more information be collected because their distribution is restricted in the province, though they might be common within their range. Species included on watch lists typically have S3, S4, and S5 ranks. Information on both tracking and watch list species are presented in this report. Appropriate mitigation of rare plants is recommended only for S1 and S2 tracking list species.

Table 4-1 Alberta Conservation Information Management System rankings for rare plants

Rank	Definition[1]
SX	Taxon is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
SH	Known from only historical records but still some hope of rediscovery. There is evidence that the taxon may no longer be present, but not enough to state this with certainty.
S1	Known from five or fewer occurrences, or especially vulnerable to extirpation because of other factor(s).
S2	Known from twenty or fewer occurrences, or vulnerable to extirpation because of other factors.
S3	Known from 100 or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factors.
S4	*Apparently Secure* – taxon is uncommon but not rare; potentially some cause for long term concern due to declines or other factors.
S5	*Secure* – taxon is common, widespread, and abundant.
S#S#	A numeric range rank (e.g., S2S3 or S1S3) that is used to indicate any range of uncertainty about the status of the taxon. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4).
SU	Taxon is currently unrankable due to lack of information or due to substantially conflicting information (e.g., native vs. non-native stats not resolved).
SNR	*Not ranked* - conservation status not yet assessed.
SNA	*Not Applicable* – A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities (e.g., introduced species).
S#?	*Inexact Numeric Rank* – applied when a specific rank is most likely appropriate, but for which some conflicting information or unresolved questions remain (e.g., S2? – believed to be 6 – 20 occurrences, but some uncertainty).
NOTE:[1] ATPR 2013d	

Table 4-2 Definitions of general status categories

Rank	Definition[1]
At Risk	Any species known to be at risk after formal detailed status assessment and legal designation as *endangered* or *threatened* in Alberta.
May Be At Risk	Any species that may be at risk of extinction or extirpation, and is therefore a candidate for detailed risk assessment.
Sensitive	Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.
Secure	A species that is not *at risk*, *may be at risk*, or *sensitive*.
Undetermined	Any species for which insufficient information, knowledge, or data is available to reliably evaluate its general status.
Not Assessed	Any species that has not been examined during this exercise.
Exotic/Alien	Any species that has been introduced as a result of human activities.
Extirpated/Extinct	Any species no longer thought to be present in Alberta (*extirpated*) or no longer believed to be present anywhere in the world (*extinct*).
NOTE: [1] ESRD 2011	

As with rare plants, ACIMS also develops tracking lists of plant community elements that are considered high priority because they are rare or special in some way. The tracking lists serve as a focus for data gathering to increase the collective knowledge and understanding of these elements of Alberta's biodiversity (Allen 2013). Rare ecological communities are ranked similarly to rare plants. The two major criteria in determining a community's rank are the total number of occurrences and the total area of the community across its range (Allen 2013). Ranks are assigned based on the best available information and are refined over time. A list of provincial ecological community conservation ranks is provided in Table 4-3.

Table 4-3 Alberta Conservation Information Management System rankings for rare ecological communities

Rank	Definition1
S1	Five or fewer occurrences or very few remaining hectares.
S2	Six to 20 occurrences or few remaining hectares.
S3	21 to 80 occurrences. May be rare and local throughout its range or found locally, even abundantly, in a restricted range (e.g., a single country or Natural Subregion).
S4	Apparently *secure* globally (State / Province wide), though it may be quite rare in parts of its range, especially at the periphery.
S5	Demonstrably *secure* globally (State / Province wide), though it may be quite rare in parts of its range, especially at the periphery.

Rank	Definition1
SNR	Element is *not yet ranked*.
SU	*Unrankable* – currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	*Not Applicable* – a conservation status rank is not applicable because the community is not a suitable target for conservation activities.
S#S#	Range Rank – a numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4). Ranks can be combined to indicate a range (e.g. S2S3 = May be between 6 and 80 occurrences throughout Alberta, but the exact status is uncertain). Combined ranks indicate a larger margin of error than ranks assigned a "?" qualifier.
?	Modifier – can be added to any rank to denote an *inexact numeric rank* (e.g. S1? = Believed to be 5 or less occurrences, but some doubt exists concerning status).
NOTE: [1] Allen 2013	

Historic rare plant species occurrences in and adjacent to the Vegetation Study Area (VSA) (1 km radius) were investigated for both federal and provincial data sources as part of this assessment. A one kilometre radius was used to capture rare species occurrences within the NSR valley, near the Project footprint. All species of conservation concern identified via the ACIMS database inquiry were summarized and referenced to the subnational Status Rank (S Rank) definition (ATPR 2013d). This report documents rare ecological communities, if found, within 1 km radius if the Project footprint that are present on the tracking list defined by ACIMS (ATPR 2013b).

4.1.2 Rare Wildlife Species

A search for occurrences of rare wildlife within two km of the Study Area was conducted through the Fish and Wildlife Information System (ESRD 2012)(FWMIS) database in October 2013. A two km radius was used to capture species with large home ranges (e.g. ungulates, raptors) that have been observed in adjacent areas and whose ranges may overlap with the Study Area. Species of management concern were summarized and referenced to provincial ranking ranging from sensitive, may be at risk, and at risk (ESRD 2011). Definitions of each ranking classification are provided within Table 4-3. Section 4.1.1 provides information related to species designations within SARA and the Wildlife Act.

4.2 FIELD WORK

Several surveys targeting specific environmental components were conducted during the 2013 growing season. The methodology for each survey is discussed in the sections below.

4.2.1 Rare Plant and Site Characterization Surveys

The objective of the vegetation surveys were to classify the vegetation along the proposed trail alignment according to upland and wetland land units based on existing ecological land classifications, identify sensitive environmental conditions as they pertain to vegetation, and provide appropriate mitigation, conservation, and management recommendations, as required. Vegetation along the proposed trail alignment was assessed using rare plant surveys in conjunction with site characterization surveys, and the assessment included both natural (native) plant communities and manicured areas (maintained areas).

During the vegetation assessment, information on plant species and ecological communities of management concern was collected. Species and communities of management concern include:

- Uncommon communities and or those sensitive to watershed disturbance (e.g. old growth forest, wetlands) identified from upland ecosite phase and wetland class mapping
- Rare plants and rare ecological communities
- Noxious and prohibited noxious weeds (*Weed Control Act* [S.A. 2008, c. W-5.1])

4.2.1.1 Rare Plant Survey Preparation

Before field data collection was conducted, historical rare plant and rare ecological community records from the Alberta Conservation Information Management System (ACIMS) were searched (ATPR 2013a). Additionally, a list of rare plant species that have the potential to be found in the NSR valley was compiled from *Rare Vascular Plants of Alberta* (Kershaw et al. 2001) and historical rare plant records available from ACIMS (ATPR 2013b). Habitat information for each rare plant species was researched to determine which species have the highest potential of being located within the NSR valley and provide surveyors with a better understanding of the characteristics and habitats of rare plants that could be found. ACIMS tracking and watch lists were printed for reference in the field.

Target rare plant survey areas were pre-selected before field work and marked on field maps as a starting point for detailed rare plant surveys. These locations were selected in areas with high potential to support rare plants (e.g., transitional or ecotonal areas) across a wide variety of pre-mapped upland and wetland land units. Actual rare plant survey locations were determined during field surveys.

Upland and wetland land units were pre-mapped to determine the distribution of vegetation present in the VSA and provide basic information for planning rare plant and site characterization surveys. The VSA was defined by a 50 m buffer on either side of the trail alignment and the minimum polygon size was 400 m^2 (0.04 ha) and 12.5 m wide (on-ground distance).

Vegetation and wetland land units within the VSA were classified using a Central Parkland Classification system derived from the following sources:

- *A Preliminary Classification of Plant Communities in the Central Parkland Natural Subregion of Alberta* (Wheatly and Bentz 2002) for uplands
- *Stewart and Kantrud Wetland Classification System* (1971) for wetlands
- *Alberta Vegetation Inventory Standards Manual* (Alberta Environmental Protection1991) for agricultural, industrial and settled lands

4.2.1.2 Field Data Collection

Site characterization and rare plant surveys were completed by an ecologist and a rare plant specialist, respectively, and were conducted simultaneously at each survey location. Surveys were conducted within a 50 m buffer of the trail alignments (Vegetation Study Area, VSA, Figure 6.1) on June 10, 11 and 13, 2013 (spring survey) and August 13 and 14, 2013 (summer survey).

Vegetation data gathered within the VSA during the site characterization surveys included percent cover of characteristic tree, shrub, herbaceous, and non-vascular species. Additionally, general site information was recorded, including soil moisture regime, slope and aspect, slope position, and structural stage. Tree stands with the potential to be old-growth were surveyed during the ground plot surveys by tree coring (using an increment borer) and growth ring counting of large, representative individuals in these stands.

Each selected sample site was classified to the appropriate upland or wetland land unit using the Central Parkland Classification system (described in Section 4.2.1.1 and Appendix F).

At each survey site GPS coordinates were recorded and representative site photos were taken. Notes on ecological communities or conditions that may require special consideration were also made.

4.2.1.3 Rare Plant Species

A spring rare plant survey, which focused on vascular plants and bryophytes, was completed within the VSA on June 10, 11 and 13, 2013 (spring survey). A late summer rare plant survey, which focused on vascular rare plants, was completed within the VSA between August 13 and 14, 2013. While only one survey is required for bryophytes, two survey intervals are recommended for vascular plant species to allow for capture of a range of blooming and seeding periods (Lancaster 2000).

At each pre-selected target survey site, a random meander walk within the plant community was completed. Unusual areas with variable micro-sites not visible from aerial photographs were targeted on the ground. A comprehensive species list was compiled at each site until no new species were found. Specimens requiring further examination or species confirmation were collected, with the exception of plants where seed heads or flowers required for identification to species level were unavailable or where plant populations were small (i.e., no more than 1 in 50,

Alberta Native Plant Council 2006). Detailed vegetation information (tree, shrub, and understory species) was collected at rare plant survey sites throughout the Study Area and each site was classified to the appropriate upland ecosite phase or wetland class.

For bryophytes, all microhabitat types present at a site were examined for presence of species. Sampling of bryophytes by microhabitat is the recommended protocol of the Alberta Biodiversity Monitoring Protocol (Doubt and Belland 2000). Species that can be identified on the basis of macroscopic features were noted. Species that require microscopic examination for correct species identification were collected. As collections are required to define almost all rare bryophyte species, determination of population size and extent is not possible.

4.2.1.4 Rare Ecological Communities

Observations for rare ecological communities within the VSA were made during the 2013 rare plant surveys. If a rare community was identified as unique or unusual, it was sampled to document its plant species composition and condition.

The sampling standard includes:

- Sampling tree species and cover in a 20 by 20 m plot
- Sampling shrubs and understory species in a 10 by 10 m plot
- Recording the UTM location
- Photographing the ecological community
- Recording physical parameters, including aspect, slope, and soil moisture regime

The plant community assemblage was compared with those rare ecological communities listed in ACIMS (ATPR 2013b). If the plant community assemblage was similar to an identified rare ecological community, it was assigned rare status.

4.2.1.5 Plant Identification

Plant specimens collected in the field requiring further examination were identified. Collected vascular plant species were identified by a botanist while collected bryophytes were identified by a bryologist.

Comprehensive species lists were then referenced to ACIMS tracking and watch lists and SARA to ensure all plants considered to be rare were identified.

Species names follow the *Flora of Alberta* (Moss 1983) for vascular plants with taxonomic changes adopted by ACIMS (ATPR 2013b) for rare plants. Common names for vascular plants, if recognized, follow ACIMS (ATPR 2013c). For bryophyte species, naming conventions follow Anderson (1990) for the *Sphagnum* genus, Anderson et al. (1990) for other mosses, and Stotler and Crandall-Stotler (1977) for liverworts, with taxonomic changes adopted by ACIMS (2013d, Internet site) for rare plants. Common names for bryophytes, if recognized, follow ACIMS (ATPR 2013c).

4.2.2 Weed Identification

Occurrences of species identified as *prohibited noxious* (Schedule 1) or *noxious* (Schedule 2) in the *Weed Control Regulation* were also included at each survey site. Occurrences of these species were recorded on a weed survey form taken from the *R&R / 03-4 Weeds on Industrial Development Sites – Regulations and Guidelines* (ESRD 2003).

4.2.3 Amphibian Survey

A nocturnal acoustic amphibian survey was conducted on May 16, 2013 at seven locations (Figure 4.1) from 30 minutes after sunset to 2:00 am. Survey dates coincided with the breeding season of amphibians when they produce loud vocalizations that allow them to be identified by their species specific calls.

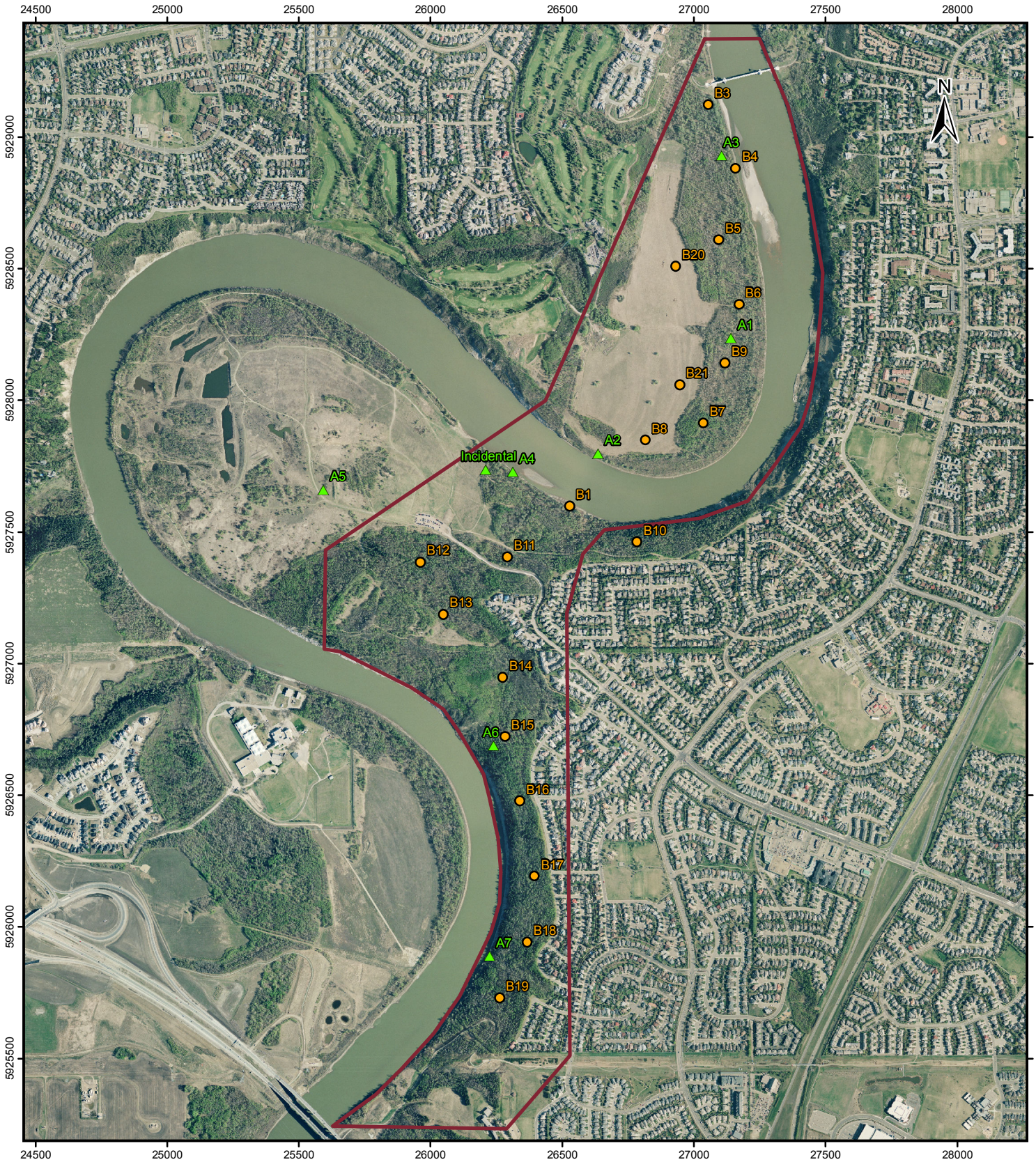
The survey consisted of a two minute period of silence to eliminate any disturbance caused by the arrival of observers followed by a five minute listening period where all amphibian species detected were recorded. The amphibian survey was conducted at wind speeds below 20km/h (i.e., Beaufort 3) and conditions not exceeding a light rain to optimize the ability of observers to effectively hear all amphibians vocalizing.

Incidental wildlife species encountered during the amphibian survey were also recorded.

4.2.4 Breeding Bird Survey

A breeding bird survey was conducted at 20 locations (Figure 4.1) on June 18, 2013, from sunrise until 10:00 am during the peak breeding period for migratory songbirds. Point count locations were selected based on habitat classes available in the Study Area and were spaced out by at least 300 m to prevent double counting of birds.

A modified fixed-radius point count sampling procedure (Bibby et al. 1993) was used to document bird species diversity and abundance as well as habitat associations. Surveys consisted of a five minute period of listening where all birds heard vocalizing or observed within 50 m of the point were recorded. Surveys were preceded by two minutes of silence to minimize any disturbance caused by the arrival of observers. A five minute survey period was used to achieve a greater coverage of the Study Area. It has been shown that shorter survey times are more efficient as they minimize the introduction of bias due to the movement of birds into and out of the survey area (Granholm 1983) and that most species present are detected within the first few minutes of a point count (Lynch 1995, Shiu and Lee 2003). Surveys were not conducted during periods of wind exceeding 19km/h (i.e., Beaufort 3) and strong rain; because these conditions have been shown to decrease bird activity and hinder the ability of observers to effectively detect birds.



Q:\Clients\City_of_Edmonton\Terwillegar_Footbridge\Figures\Fig4_1_AmphibianandBreedingBirdSurveyLocations.mxd February, 2014

2014 - 02 - 04 alundell 1135-60353

Stantec

Study Area

Amphibian Survey Location

Bird Survey Location

Projection: 3TM CM:114° Datum: NAD 83
Imagery obtained from City of Edmonton Transportation, 2012

1:20,000 0 250 500 750 1,000 1,250 Metres

This map is for reference purposes only

Client/Project

CITY OF EDMONTON
TERWILLEGAR PARK FOOTBRIDGE AND TRAILS

Figure No.

4.1

Title

AMPHIBIAN AND BREEDING BIRD SURVEY LOCATIONS

Incidental observations of birds detected outside the 50 m point count radius during the survey time and/or observed during travel between survey locations were also recorded. Incidental wildlife observations (of non-bird species) were also recorded.

4.2.5 Fish Habitat Assessment

Qualified Stantec personnel conducted a fish and fish habitat assessment along the NSR from August 27 to 29, 2013 (Appendix G). The assessment was conducted in accordance with standard protocols outlined in the Code of Practice (Alberta Environment [AENV] 2007). Fish habitat mapping was assessed using the Large River Classification System developed by R.L. & L. Environmental Services Ltd. (O'Neil and Hildebrand 1986). This system is used for large rivers that predominantly provide minimal in-stream channel units such as pools, riffles, or runs. The Project area extended from approximately 850 m upstream to 1,400 m downstream of the proposed footbridge location.

Fish species composition, relative abundance and life history stages within the Project area covered all available habitat types for an approximate length of 3 km (Appendix G).

4.3 VEGETATION DATA ANALYSIS

Data analysis methods used to determine final vegetation and wetland mapping and the presence or absence of old growth is described below.

4.3.1 Spatial Analysis (Final Vegetation Mapping)

Ground level information from both site characterization and rare plant field surveys was used in conjunction with aerial photograph interpretation to refine the preliminary vegetation and wetland map units for the VSA. The final vegetation and wetland map was used to assess the distribution of vegetation and wetland land units within the VSA.

4.3.2 Old-Growth Forest

Old-growth forests are typically identified as stands that are self-regenerating (i.e., having a specific structure that is maintained) where the structure includes juvenile, mature, dying, and decaying trees of the same species. While there is not a universal definition for old-growth forests for forestry applications, they are usually defined using criteria involving age and/or stand structural characteristics. The approach used here follows the age-based definition proposed by Schneider (2000) for boreal forests. For this assessment, old-growth forest is defined according to the age of trees, using the following criteria:

- White spruce, black spruce (*Picea mariana*) and tamarack (*Larix laricina*) stands 140 years and older
- Pine (jack pine [*Pinus banksiana*] and lodgepole pine [*Pinus contorta* var. *latifolia*) stands and mixed coniferous leading stands 120 years and older

- Deciduous and mixed deciduous leading stands 100 years and older

It is not well known whether stands of these ages exhibit distinctive structural or compositional features considered characteristic of old-growth in northern Alberta.

Trees were cored within the VSA as part of the rare plant and site characterization surveys. The cores were dried and the number of growth rings was recorded for each core sample. The age of the tree cores were used to determine if the stand met the criteria to be classified as old growth forest.

4.4 ENVIRONMENTAL IMPACT ASSESSMENT

The direct and indirect impacts of the proposed Project were characterized based on the magnitude of the impact, its spatial extent, duration of the impact, and its likelihood of occurring after mitigation measures have been applied (Noble 2006). Definitions of spatial extent, duration, and likelihood are provided in Table 4-4. Specific definitions for magnitude are particular to the environmental element being considered. For example, vegetation impact magnitude relates to total area of vegetation disturbance and pre-disturbance species composition, since this may have an effect on re-vegetation success, post-construction species composition of re-vegetated areas, and invasion by weedy/undesirable species. These variables are not applicable to other environmental elements, therefore specific definitions are needed. The definitions of magnitude are provided in Table 7-1 and are based upon generally accepted knowledge and professional judgment.

Table 4-4 Impact characterization definitions

Parameter	Definition
Magnitude	Low – See Section 7.1 Moderate – See Section 7.1 High – See Section 7.1
Spatial Extent	Project – direct impact is only measurable within the confines of the proposed Project Local – direct impact is measurable within 1 km of the proposed Project Regional – direct impact is measurable within 25 km of the proposed Project
Duration	Short – direct impact is measurable for 1-5 years Medium – direct impact is measurable for 6-15 years Long – direct impact is measurable for 16+ years
Likelihood of Occurrence	Low – there is less than 25% chance of the impact occurring Moderate – there is between 25 to 74% chance of the impact occurring High – there is >75% chance of the impact occurring

Environmental components that were assessed include:

- Water Quality of the North Saskatchewan River
- Hydrology
- Fisheries
- Wildlife
- Vegetation
- Aesthetics
- Noise
- Public Safety
- Contractor Safety
- Archaeological and Historical Resources

Potential impacts to each component as a result of the Project were determined. Mitigation measures designed to reduce and/or eliminate the impact were proposed and discussed. The residual impacts (i.e., the remaining impact once mitigation measures are applied) were then determined, discussed, and characterized as per Table 4-4.

5.0 Desktop Review Results

This section provides information on the landscape and land uses within Study Area and is intended to provide context for the discussions in later sections of this report. This section includes a historical air photo review, brief site description of the land within and surrounding the Study Area, as well as results from the database inquiries from both the ACIMS and the FWMIS databases, a desktop review of pertinent biophysical information and archeology and historical resource review.

5.1 HISTORICAL AERIAL PHOTOGRAPH REVIEW

The review of historical aerial photographs (see Appendix H) indicates that vegetation and land use within the Study Area has predominantly persisted in its historical form since 1949. A large agricultural field has endured within the north portion of the Study Area throughout the photographic record, and several sandbars are intermittently visible within the NSR throughout the photographic record. Present day Edmonton Country Club is visible since the earliest photograph available (i.e.,1949). Present day Terwillegar Park appears to be an agricultural field in 1949; however, the development of a gravel pit and access road to the gravel pit appears in the 1962 photograph. Development of the gravel pit continues until 1982, after which it appears to have been reclaimed to include several ponds that persist until present day. Present day Rabbit Hill Road extends down the valley slope into present day Terwillegar Park within the 1987 photograph. Beginning in 1982, residential development encroaches on the southeast edge of the Study Area, and continues to encroach in this area and on the northwest edge of the Study Area throughout the photographic record. From 1967 to 1977, a wetland was visible on the northeast edge of present day Terwillegar Park; however, it appears that development pressures and tree clearing caused the wetland to disappear from the photographs after 1977. The Fort Edmonton Park footbridge appears in the north portion of the Study Area in 2012.

5.2 CLIMATE

The climate of the proposed trail development within the City of Edmonton is continental, with warm summers and cool winters. Climate data (1971 to 2000) collected at the Edmonton International Airport, to the south of the Study Area, are shown below (Environment Canada 2013):

- Mean daily maximum temperature (°C) 8.5
- Mean daily minimum temperature (°C) -3.8
- Mean annual rainfall (mm) 374.8
- Mean annual precipitation (mm) 482.7
- Mean annual hours of sunshine 2288.6

5.3 GEOLOGY, SURFICIAL MATERIALS, AND LANDFORM

Major deposits in the vicinity of the Study Area are alluvial, glaciolacustrine, and Edmonton Formation bedrock (Kathol and McPherson 1975). The glaciolacustrine deposits consist mainly of sands with some silts and clays. The alluvial deposits consist of alluvial gravel, sand, and silt in the form of river terrace. The Edmonton Formation consists of fine-grained bentonitic sandstone and siltstone integrated with bentonitic silty clay sandstone.

A geotechnical study completed by Thurber Engineering Ltd. (2013b) revealed that the north portion of the Study Area is underlain by alluvial clays over alluvial gravel and sand, which is over clay shale and sandstone bedrock. The south portion of the Study Area is underlain by topsoil and a thin clay layer, over shallow bedrock. The west portion of the Study Area is underlain by alternating alluvial clay and sand over gravelly sand, over clay shale bedrock and sandstone. The geotechnical report concluded that the trail development and location of the Footbridge were feasible. Please see Appendix I for the full geotechnical report. Thurber Engineering Ltd. (2013a) also provided a letter (included as part of Appendix I) with preliminary design and construction recommendations regarding the Footbridge and trail system. Recommendations were made specifically for construction of the footbridge piers, abutments, abutment support piles, and ground anchors.

Energy Resource Conservation Board Coal Mine Map Viewer (Energy Resource Conservation Board 2013) was queried for coal mines in the vicinity of the Footbridge because coal mining along the NSR was a common historical occurrence. No coal mines were identified within the Project vicinity).

The landform associated with the Study Area consists of the NSR valley. The valley consists of steep valley walls and fluvial features. The valley walls are steeply sloping towards the top of bank (TOB) but decrease in slope towards the bottom of the valley.

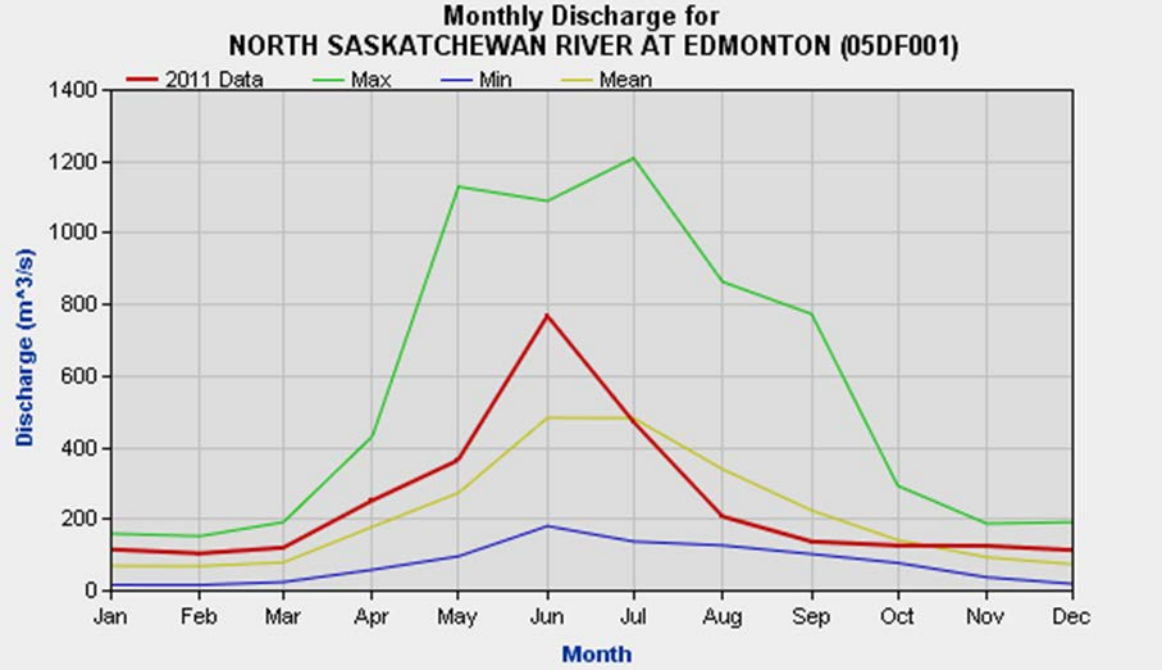
5.4 HYDROLOGY

The headwaters of the NSR originate in Banff National Park from the toe of the Saskatchewan Glacier in the Columbia Icefields. Within Alberta, the NSR flows for over 1,000 km before it enters Saskatchewan near Lloydminster. Flow in the NSR is regulated by two dams in the upper reaches of the NSR. The Brazeau Dam on the Brazeau River became operational in 1965 while the Big Horn Dam on the main stem of the NSR was commissioned in 1972. The drainage area of the NSR in Alberta is approximately 57,000 km^2; within the region of the City of Edmonton at monitoring station No. 05DF001 (Environment Canada 2013). The drainage basin areas are approximately 28,100 km^2.

Historical flow data from 1911 – 2011 (the most current data available) for the North Saskatchewan at Edmonton (Water Survey of Canada Station No. 05DF001) are presented on Figure 5.1 (WSC 2013). Monthly mean discharge ranges from approximately 70 m^3/s during the

winter months to 484 m^3/s during high flows in June. Based on historical data, the annual mean discharge at this station was 209 m^3/s.

Figure 5.1 Historical and 2011 flow (m^3/s) in the North Saskatchewan River at Edmonton



Data from: Environment Canada 2013

5.5 VEGETATION

The NSR valley is a provincially significant natural area because it is a major ecological corridor that traverses the Province of Alberta (City of Edmonton 2008). The NSR valley is situated within the Central Parkland Natural Subregion (Central Parkland), which is located within the Parkland Natural Region (Natural Regions Committee [NRC] 2006). The Central Parkland is a large subregion (approximately 50,000 km^2), which forms a substantial band across the central and west-central parts of the province. This subregion is a large transition zone between the Boreal Forest Natural Region to the north and the Grassland Natural Region to the south. The Central Parkland is under heavy pressure from agriculture, and only a small portion of this subregion remains in a natural condition. Under natural conditions, the Central Parkland is dominated by undulating till plains and hummocky uplands, and the native remnants are a mosaic of aspen (*Populus tremuloides*) dominated forest stands on moist sites intermixed with prairie vegetation on drier sites. Stands of aspen dominated forest are found throughout the Central Parkland and have understories dominated by saskatoon (*Amelanchier alnifolia*), prickly rose, and beaked hazelnut. Stands dominated by balsam poplar (*Populus balsamifera*) occur on moist, nutrient rich sites, and often have aspen and white spruce intermixed within the stand (NRC 2006).

5.5.1 Alberta Conservation Information Management System Search Results

No rare ecological communities have been historically found within or near the Project footprint (Figure 6.1) (ATPR 2013a). Historically, five rare vascular, and one non-vascular plant have been identified within or near the project footprint (Table 5-1). Descriptions of each rare vascular and non-vascular species are provided below.

Table 5-1 Listed plant species present within a 1 km radius of the Project footprint

Species			Conservation Status		
Family	**Scientific Name**	**Common Name**	**Alberta Wild Species Rank[1]**	**ACIMS Rank[2]**	**Last Observed**
Apiaceae	*Osmorhiza longistylis* (Torr.) DC.	smooth sweet cicely	*May Be At Risk*	S2	July 11, 2007
Asteraceae	*Doellingeria umbellata* var. *pubens* (Gray) Britt.	flat-topped white aster	*May Be At Risk*	S2	July 12, 2007
Cyperaceae	*Carex vulpinoidea* Michx.	fox sedge	*May Be At Risk*	S2	June 1998
Najadaceae	*Najas flexilis* (Willd.) Rostk. & Schmidt	slender naiad	*May Be At Risk*	S2	July 11, 2007
Poaceae	*Muhlenbergia racemosa* (Michx.) B.S.P.	marsh muhly	*May Be At Risk*	S2	Aug 18, 2002
Scouleriaceae	*Scouleria aquatica* Hook. in Drumm.	moss	S2	Secure	June 11, 1979

NOTES:
[1] ESRD 2011
[2] ATPR 2013b

Each of the species listed within Table 5-1 are discussed below.

Smooth Sweet Cicely

Smooth sweet cicely is ranked S2 (ATPR 2013b) and has a status of *may be at risk* according to the Alberta Wild Species rank (ESRD 2011). This vascular species is generally found in moist woodlands and has small white flower clusters that have persistent bracts (Kershaw et al. 2001).

Flat-Topped White Aster

Flat-topped white aster is also ranked S2 (ATPR 2013b) and has a status of *may be at risk* according to the Alberta Wild Species rank (ESRD 2011). This vascular species is generally found in moist woodlands and swamp edges (Kershaw et al. 2001) and has been found at multiple sites in and around the Study Area (Figure 6.1). This aster is a perennial that is distinguished from the common variety by the presence of fine hairs.

Fox Sedge

Fox sedge is a vascular plant that is provincially ranked S2, known from 20 or fewer occurrences, or vulnerable to extirpation due to other factors (ATPR 2013b), and has a status of *may be at risk* according to the Alberta Wild Species rank (ESRD 2011). This species prefers non-saline and non-acidic soils that are usually found in swamps and wet meadow land units (Kershaw et al. 2001). This sedge ranges in size from 20 cm to 90 cm tall, and grows in dense clumps.

Slender Naiad

Slender naiad is ranked S2 (ATPR 2013b) and has a status of *may be at risk* according to the Alberta Wild Species rank (ESRD 2011). This species is an aquatic vascular species that can be found in ponds and streams. This species is an annual plant that reproduces by seed; however, under certain conditions the base of the plant may survive over winter.

Marsh Muhly

Marsh muhly is ranked S2 (ATPR 2013b) and has a status of *may be at risk* according to the Alberta Wild Species rank (ESRD 2011). This vascular species has been found along stream banks and eroded banks. This species prefers drier sites and can also be found along the edges of woodlands and meadows (Kershaw et al. 2001). Marsh muhly is a perennial that is distinguished from the common bog muhly (*M. glomerata*) by the presence of hairs along the lower half of the lemmas only.

Scouleria aquatica

Scouleria aquatica is a non-vascular species that is ranked S2 (ATPR 2013b) and has a status of *may be at risk* according to the Alberta Wild Species rank (ESRD 2011). This species does not have a common name in Alberta, but is known as stream side moss in the province of British Columbia. This species can be submerged or emergent and can be found in the littoral zone of large rivers (Mackinnon et al.1999). The littoral zone is the area along the river that includes the high water mark (an area that is rarely inundated with water) to the shoreline that is permanently submerged.

5.6 WILDLIFE

The Study Area is located in the NSR Valley and Ravine System. Prior biophysical studies conducted in this area (e.g., EPEC 1981, Strong and MacCallum 1984, Strong et al. 1985) have suggested that the NSR Valley and Ravine System supports a large diversity of species as a result of the wide range of habitats available. The young aspen forest and shrub communities provide habitat for several small shrub and forb-dependent wildlife species while the mature forest stands provide foraging, breeding and shelter habitat for other wildlife species.

A total of 225 species have the potential to occur within the Study Area. These species include 178 birds, 47 mammals, and seven herptiles (see Appendix J) (City of Edmonton 2008). Many of these species are considered species of management concern. Twenty percent (i.e., 46 species) of the 225 species that may occur in the Study Area are listed either federally and/or provincially (Appendix J).

5.6.1 Amphibians and Reptiles

Amphibians and reptiles represent less than five percent of species that have the potential to occur in the Study Area (City of Edmonton 2008). Common amphibians and reptiles that may be found within Edmonton consist of wood frog (*Lithobates sylvatica*), boreal chorus frog (*Pseudacris maculata*), and red-sided garter snake (*Thamnophis sirtalis parietalis*) (City of Edmonton 2008). However, it is believed that less common species such as tiger salamander (*Ambystoma tigrinum*), plains garter snake (*Thamnophis radix*), Canadian toad (*Anaxyrus hemiophrys*), and western toad (*Anaxyrus boreas*) also occur within Edmonton. Western toads have been recorded around Big Lake in the northwest corner of Edmonton (AMEC 2002; Stantec 2007) while Canadian toads have been recorded in the Clover Bar waste management area in early 2000 and from Terwillegar park in 2004 and 2005 (Browne 2009).

5.6.1.1 Fisheries and Wildlife Management Information System Search Results

A search was performed within FWMIS regarding information on species of management concern occurring in the Study Area. The FWMIS database search identified the occurrence of one amphibian species of management concern within 2 km of the Study Area. The search results from FWMIS can be found in Appendix K. See Table 5-4 for details on wildlife species, and their provincial and federal listing.

Table 5-2 Listed wildlife species present within a 2 km radius of the Study Area

Species			Conservation Status		
Family	**Scientific Name**	**Common Name**	**Alberta Wild Species Rank[1]**	**Wildlife Act[2]**	**SARA[3]**
Bufonidae	*Anaxyrus hemiophrys*	Canadian toad	*May Be At Risk*	N/A	*Special Concern*

NOTES:
[1] ESRD 2011
[2] ESRD 2012
[3] Government of Canada 2012

Species of management concern identified in the FWMIS database search are discussed below.

Canadian Toad

The Canadian toad was historically distributed in the Grassland, Aspen Parkland, and Boreal Forest Natural Regions. The species is considered to be among the most aquatic toads. It inhabits meadows, willow bogs, and wetlands that contain emergent vegetation such as common cattail (*Typha latifolia*) and bulrushes (*Scirpus* spp.) with mudflats; however, they are also often found in rivers and lakes (Russell and Bauer 2000). Breeding occurs between May and July in Alberta. During the breeding season, eggs are laid and larvae develop in shallow water of lakes, ponds, quiet streams, marches, potholes, and roadside ditches. In Alberta, this species moves to their hibernation area in mid-September where they will burrow up to 117 cm in the soil to overwinter (Hamilton et al. 1998).

The Canadian toad is listed as *may be at risk* by ESRD (2011) in Alberta. Although the species has been poorly studied in the Province, population declines have been reported, especially in the Aspen Parkland and Prairies. These declines are thought to have been caused by disturbance to hibernation areas, aquatic and terrestrial habitat loss, climate change, and disease (Hamilton et al. 1998). It is possible that Canadian toads breed along the shores of the NSR or in the water features at the western portion of Terwillegar Park in or adjacent to the Study Area. The presence of Canadian toads was last confirmed in Terwillegar Park in 2005, and a survey in the same area in 2007 did not detect the species (Browne 2009).

5.6.2 Birds

Although the total number of bird species varies in the literature, it is estimated that birds represent approximately 80 percent of wildlife species that may occur in the Study Area. According to the City of Edmonton (2008), 178 bird species occur within Edmonton, while Spencer (1976) recorded 73 bird species in four ravines in the NSR Valley and Ravine System during 1972 and 1973, and EPEC (1981) estimated that 150 bird species occur within the NSR

Valley and Ravine System. However, a large number of these species are neo-tropical migrants and are only present during the breeding season. Outside of the breeding season, resident and regional migrants can be present in the Study Area (e.g. owls, waxwings, jays and crows, grouse, chickadees). Urban areas, including Edmonton, are also home to a number of non-native species of birds (e.g., consisting of European starling [*Sturnus vulgaris*), gray partridge [*Perdrix perdrix*], house sparrow [*Passer domesticus*], ring-necked pheasant [*Phasianus colchius*], and rock pigeon [Columbia livi]) are considered exotic and are not native to the Study Area). The Edmonton Christmas Bird Count conducted in December 2012 confirmed the presence of 60 bird species, mostly year-round residents or species in their wintering range. See Table 5-2 for a list of species detected during the 2012 Edmonton Christmas Bird Count (National Audubon Society 2013). See Appendix J for a detailed list of bird species found in the Edmonton Area and their provincial and federal listing.

Table 5-3 Potential bird species present within the Study Area during the winter

Family	Scientific Name	Common Name
Accipitridae	*Accipiter cooperii*	Cooper's hawk
	Accipiter gentilis	northern goshawk
	Buteo lagopus	rough-legged hawk
	Haliaeetus leucocephalus	bald eagle
Alcedinidae	*Megaceryle alcyon*	belted kingfisher
Anatidae	*Anas platyrhynchos*	mallard
	Aythya affinis	lesser scaup
	Branta canadensis	Canada goose
	Bucephala clangula	common goldeneye
	Mergus merganser	common merganser
Bombycillidae	*Bombycilla cedrorum*	cedar waxwing
	Bombycilla garrulus	bohemian waxwing
Certhiidae	*Certhia americana*	brown creeper
Columbidae	*Columba livia*	rock pigeon
Corvidae	*Corvus brachyrhynchos*	American crow
	Corvus corax	common raven
	Cyanocitta cristata	blue jay
	Pica hudsonia	black-billed magpie

Family	Scientific Name	Common Name
Emberizidae	*Junco hyemalis*	dark-eyed junco
	Spizella arborea	American tree sparrow
	Spizella passerina	chipping sparrow
	Zonotrichia albicollis	white-throated sparrow
	Zonotrichia leucophrys	white-crowned sparrow
Falconidae	*Falco columbarius*	merlin
	Falco mexicanus	prairie falcon
	Falco rusticolus	gyrfalcon
Fringillidae	*Acanthis flammea*	common redpoll
	Acanthis hornemanni	hoary redpoll
	Carpodacus mexicanus	house finch
	Carpodacus purpureus	purple finch
	Coccothraustes vespertinus	evening grosbeak
	Loxia curvirostra	red crossbill
	Loxia leucoptera	white-winged crossbill
	Pinicola enucleator	pine grosbeak
	Spinus pinus	pine siskin
	Spinus tristis	American goldfinch
Laniidae	*Lanius excubitor*	northern shrike
Paridae	*Poecile atricapillus*	black-capped chickadee
	Poecile hudsonicus	boreal chickadee
Passeridae	*Passer domesticus*	house sparrow
Phasianidae	*Bonasa umbellus*	ruffed grouse
	Perdix perdix	gray partridge
Picidae	*Colaptes auratus*	northern flicker
	Dryocopus pileatus	pileated woodpecker
	Picoides dorsalis	American three toed woodpecker
	Picoides pubescens	downy woodpecker
	Picoides villosus	hairy woodpecker
Regulidae	*Regulus satrapa*	golden-crowned kinglet

Family	Scientific Name	Common Name
Sittidae	*Sitta canadensis*	red-breasted nuthatch
	Sitta carolinensis	white-breasted nuthatch
Strigidae	*Aegolius acadicus*	northern saw whet owl
	Aegolius funereus	boreal owl
	Asio flammeus	short-eared owl
	Bubo scandiacus	snowy owl
	Bubo virginianus	great horned owl
	Strix varia	barred owl
	Surnia ulula	northern hawk owl
Sturnidae	*Sturnus vulgaris*	European starling
Turdidae	*Ixoreus naevius*	varied thrush
	Myadestes townsendi	Townsend's solitaire
	Turdus migratorius	American robin

A wide range of habitats are available for birds within Edmonton; however, Strong and MacCallum (1984) observed a preference for the mixedwood habitats associated with ravines for breeding species, while deciduous habitats were preferred by wintering birds. Common breeding birds in mixedwood habitats include the yellow warbler (*Setophaga petechia*), house wren (*Troglodytes aedon*), clay-colored sparrow (*Spizella pallida*), red-eyed vireo (*Vireo olivaceus*), song sparrow (*Melospiza melodia*), least flycatcher (*Empidonax minimus*), American redstart (*Setophaga ruticilla*), and the savannah sparrow (*Passerculus sandwichensis*) (Strong and MacCallum 1984).

5.6.2.1 Fisheries and Wildlife Management Information System Search Results

A search was performed within FWMIS regarding information on species of management concern occurring in the Study Area. The FWMIS database search confirmed the occurrence of two bird species of management concern within 2 km of the Study Area. The search results from FWMIS can be found in Appendix K. See Table 5-3 for details on wildlife species, and their provincial and federal listing.

Table 5-4 Listed bird species present within a 2 km radius of the Study Area

Species			Conservation Status		
Family	**Scientific Name**	**Common Name**	**Alberta Wild Species Rank[1]**	**Wildlife Act[2]**	**SARA[3]**
Falconidae	*Falco peregrinus anatum*	peregrine falcon	*At Risk*	*Threatened*	*Special Concern*
Strigidae	*Asio flammeus*	short-eared owl	*May Be At Risk*	*Data deficient*	*Not At Risk*

NOTES:
[1] ESRD 2011
[2] ESRD 2012
[3] Government of Canada 2012

Species of management concern identified in the FWMIS database search are discussed below.

Peregrine Falcon

The peregrine falcon is a small raptor that favors cliffs near water for nesting but may use tall buildings when cliffs are not available. This species mainly hunts from perches or while flying in open fields, swamps, and marshes. Small birds comprised over 75% of the peregrine falcon's diet; however, it may also consume small mammals, amphibians, fish, or insects occasionally (White et al. 2002). The subspecies *Falco peregrinus anatum* is the only subspecies of 18 worldwide that breeds in Alberta. Peregrine falcons migrate south to coastal habitats in late August to early October for wintering (Federation of Alberta Naturalists [FAN] 2007). The Alberta population usually winters in Mexico but some birds have been observed as far as Brazil (APFRT 2005). The subspecies *anatum* returns to Alberta in mid-May for breeding (FAN 2007).

The peregrine falcon has declined between 1950 and 1970 due to the extensive use of organochlorine pesticides (particularly DDT), which resulted in the thinning of the species' eggshell and ultimately in the inability to reproduce. Only one breeding pair was found during a province wide survey in 1970, while 50 to 60 breeding pairs were found in 2000. The number of peregrine falcons is increasing due to decreased pesticide use (Alberta Peregrine Falcon Recovery Team 2005); however, these numbers are still relatively low and the species is still susceptible to nest disturbance and contamination. Peregrine falcons are currently listed as *at risk* by ESRD (ESRD 2011). Originally listed as *endangered* under the *Wildlife Act*, the species was down-listed to *threatened* (ESRD 2012). Similarly, the species was down-listed from *threatened* to *special concern* in 2012 in SARA (Government of Canada 2012). It is possible that peregrine falcons nest on cliffs of the NSR in or adjacent to the Study Area or use open spaces such as the agricultural field in the north portion of the Study Area to forage.

Short-Eared Owl

The short-eared owl is medium sized, with a small facial disk and short ear tufts. This species is mainly found within the Grassland Natural Region; however, their range can extend into the Parkland, Boreal Forest, Foothills, and Rocky Mountain Natural Regions as well (FAN 2007). Preferred breeding habitat consists of locations with suitable cover and adjacent food resources such as grassland, brushy meadow, marshland, pasture, cropland, and cleared areas (FAN 1992). The short-eared owl routinely nests on the ground and relies heavily on small mammal populations for food (Clayton 2000). This species is primarily a resident and overwinters in their breeding ranges, especially in southern Alberta. If migration occurs, migrants return to Alberta in March and April (FAN 1992).

Short-eared owls are listed as *may be at risk* by ESRD (ESRD 2011) and as *special concern* under SARA (Government of Canada 2012). It is considered a species of management concern as a result of habitat loss and degradation. The largest declines in Alberta were observed in the Boreal Forest and Parkland Natural Regions. The species has declined by 3% every year for the past 40 years. Land use changes such as cultivation of natural habitat or conversion to development, changing farming practices, and loss of grasslands to later stages of community succession have contributed to the loss of habitat (COSEWIC 2008; FAN 2007). It is unlikely that the species nests in the Study Area, but it is possible that it forages in the Study Area in open spaces such as the agricultural field.

5.6.3 Mammals

According to the City of Edmonton (2008), mammals represent approximately 20 percent of species that may occur in the Study Area. Small mammals common in the Greater Edmonton area include beaver (*Castor canadensis*), muskrat (*Ondatra zibethica*), snowshoe hare (*Lepus americanus*), Franklin's ground squirrel (*Citellus franklinii*), northern flying squirrel (*Glaucomys sabrinus*), porcupine (*Erethizon dorsatum*), red squirrel (*Tamiasciurus hudsonicus*), skunk (*Mephitis mephitis*), white-tailed jack rabbit (*Lepus townsendii*), deer mice (*Peromyscus maniculatus*), red backed vole (*Microtus microtus*), shrews (Family *Soricidae*), western jumping mice (*Zapus princeps*), house mouse (*Mus musculus*), and big brown bat (*Eptesicus fuscus*) (EPEC 1981; City of Edmonton 2008). Some larger mammals such as white-tailed deer (*Odocoileus virginianus*), mule deer *(Odocoileus hemionus*), moose (*Alces alces*), coyote (*Canis latrans*), and red fox (*Vulpes vulpes*) are also commonly observed in the NSR valley and ravine system. Other large mammals including black bear (*Ursus americanus*), Canada lynx (*Lynx canadensis*), and cougar (*Puma concolor*) may also be observed occasionally within the Study Area because the NSR valley is part of a large ecological corridor that provides connectivity across the province that may be used by these large mammals (EPEC 1981).

5.6.3.1 Fisheries and Wildlife Management Information System Search Results

A search was performed within FWMIS regarding information on species of management concern occurring in the Study Area. The FWMIS database search did not return any results for

mammal species of management concern within 2 km of the Study Area. The search results from FWMIS can be found in Appendix K.

5.7 FISHERIES

ESRD identifies the NSR as a Class C watercourse with a restricted activity period (RAP) of September 16 to July 31 based on the Code of Practice St. Paul Area Map (AENV 2006).

In the vicinity of the Study Area, sport fish species including burbot (*Lota lota*), goldeye (*Hiodon alosoides*), lake sturgeon (*Acipenser fulvescens*), mooneye (*Hiodon tergisus*), northern pike (*Esox lucius*), sauger (*Sander canadensis*), and walleye (*Sander vitreus*) are found throughout various times of the year (ESRD 2013b). The lake sturgeon is listed as *Endangered* in the Saskatchewan River basin under COSEWIC (COSEWIC 2006) and *Threatened* by Alberta's Endangered Species Conservation Committee (ESRD 2004). The current General Status of Alberta Wild Species report lists the status of lake sturgeon as undetermined (ESRD 2013a).

Sport fish species such as burbot, goldeye, mooneye, mountain whitefish (*Prosopium williamsoni*), northern pike, sauger, and walleye are found in the NSR. Lake sturgeon, a sport fish species that is gaining popularity with anglers, is currently under study by Alberta Fish and Wildlife (ESRD 2013b). Longnose sucker (*Catostomus catostomus*), shorthead redhorse (*Moxostoma macrolepidotum*), and white suckers (*Catostomus commersoni*) are the most common coarse fish species, with occasional encounters of quillback (*Carpiodes cyprinus*), mountain suckers (*Catostomus platyrhynchus*), and silver redhorse (*Moxostoma anisurum*). Brook stickleback (*Culaea inconstans*), emerald shiner (*Notropis atherinoides*), longnose dace (*Rhinichthys cataractae*), lake chub (*Couesius plumbeus*), spottail shiner (*Notropis hudsonius*), trout-perch (*Percopsis omiscomaycus*), and spoonhead sculpin (*Cottus ricei*) are the most common "minnow" species occurring in the Project area. Fathead minnow (*Pimpephales promelus*), pearl dace (*Margariscus margarita*), and river shiner (*Notropis blennius*) are occasionally found but are not as abundant as the aforementioned minnow species. Invasive species including goldfish (*Carassius auratus*) and northern crayfish (*Orconectes virilise*) are found throughout the NSR and connecting tributaries (ESRD 2013b).

ESRD developed construction timing constraints in and around fish-bearing streams to protect various fish species during critical spawning, hatching, and migration periods. These constraints have been developed on a stream-by-steam basis and have been adopted by DFO for use in Alberta. Under the *Code of Practice for Watercourse Crossings* (Alberta Environment 2003), these timing constraints are referred to as the Restricted Activity Period (RAP) which is defined as the time period during which fish migration, fish spawning, egg incubation, fry emergence, and early fry development are likely to occur in a water body. The NSR is a Class C water body with a RAP of September 16 to July 31 (Alberta Environment 2006). Discussions with ESRD are required if construction is to occur inside the designated RAP.

5.7.1 Fisheries and Wildlife Management Information System Search Results

A FWMIS search was conducted on June 17, 2013 to provide historical records of sensitive fish and wildlife species recorded in the vicinity of the proposed footbridge location. The information obtained from the internet mapping framework application was used to develop a 2 km search query. Historical records show that 19 species of fish representing 11 families (including one crayfish) have been recorded in NSR within a 2 km radius of the Footbridge (Table 5-5) (ESRD 2013b).

Table 5-5 Fish species present in the NSR within a 2 km radius of the Footbridge

Species			Conservation Status		
Family Name	**Scientific Name**	**Common Name**	**Alberta Wild Species Rank[1]**	**Wildlife Act[2]**	**SARA[3]**
Acipenseridae	*Acipenser fulvescens*	lake sturgeon	*Undetermined*	*Threatened*	N/A
Cyprinidae	*Notropis atherinoides*	emerald shiner	*Secure*	N/A	N/A
	Pimpephales promelus	fathead minnow	*Secure*	N/A	N/A
	Couesius plumbeus	lake chub	*Secure*	N/A	N/A
	Rhinichthys cataractae	longnose dace	*Secure*	N/A	N/A
	Margariscus margarita	pearl dace	*Undetermined*	N/A	N/A
	Notropis hudsonius	spottail shiner	*Secure*	N/A	N/A
Catostomidae	*Catostomus catostomus*	longnose sucker	*Secure*	N/A	N/A
	Moxostoma macrolepidotum	shorthead redhorse	*Secure*	N/A	N/A
	Catostomus commersoni	white sucker	*Secure*	N/A	N/A
Cottidae	*Cottus ricei*	spoonhead sculpin	*May Be At Risk*	N/A	N/A
Esocidae	*Esox lucius*	northern pike	*Secure*	N/A	N/A
Gadidae	*Lota lota*	burbot	*Secure*	N/A	N/A
Gasterosteidae	*Culaea inconstans*	brook stickleback	*Secure*	N/A	N/A
Hiodontidae	*Hiodon alosoides*	goldeye	*Undetermined*	N/A	N/A
	Hiodon tergisus	mooneye	*Undetermined*	N/A	N/A
Malacostraca	*Orconectes virilis*	northern crayfish	*Undetermined*	N/A	N/A

Species			Conservation Status		
Family Name	**Scientific Name**	**Common Name**	**Alberta Wild Species Rank[1]**	**Wildlife Act[2]**	**SARA[3]**
Percopsidae	*Percopsis omiscomaycus*	trout-perch	*Secure*	N/A	N/A
Salmonidae	*Sander vitreus*	walleye	*Secure*	N/A	N/A
NOTES: [1] ESRD 2011 [2] ESRD 2012 [3] Government of Canada 2012					

None of the fish species known to occur in the Study Area are federally listed under SARA or provincially listed as at *risk*, *may be at risk*, or *sensitive* (ESRD 2013b). Lake sturgeon are listed as e*ndangered* in the Saskatchewan River basin under COSEWIC (COSEWIC 2006; GOC 2012) and *threatened* by Alberta's Endangered Species Conservation Committee (ESRD 2004). The current *General Status of Alberta Wild Species 2010* report lists the status of lake sturgeon as undetermined (ESRD 2013b). Species with conservation status rankings of *may be at risk* or *threatened* and species of conservation concern are discussed below.

Lake Sturgeon

The lake sturgeon in Alberta is a unique species consisting of only two populations — one in the South Saskatchewan River system and one in the NSR system. Lake sturgeon are identified as covered in five lines of amour known as scutes along body, with an asymmetrical caudal fin and four barbels on the snout. Quality habitat consists of productive shoals with areas of cobble, gravel and fine substrates. Deep pools provide rearing and feeding habitat for lake sturgeon. Overwintering also occurs in deep pools ideally in depths over 1.5 m that do not freeze to the bottom and have an adequate oxygenated water supply (Scott 1973). Lake sturgeon spawn in the spring (April to June) and migration is active during this time. After spawning, the eggs disperse and adhere to substrates on the bottom of the NSR (Nelson 1992).

Classified as *undetermined* in 2010 by ESRD and *threatened* by the *Wildlife Act*, lake sturgeon populations are in declined due to habitat degradation and fragmentation, and over-harvesting. Inherent biological characteristics make population recovery difficult. The population in the NSR system is in a vulnerable state, consisting of possibly fewer than 1,000 fish (ESRD 2013c). Within the Project area, lake sturgeon could be found during spawning in the spring between April and June. Moderate rearing and feeding habitat is present; however overwintering habitat is insufficient with few overwintering pools.

Spoonhead Sculpin

Spoonhead sculpin are bottom dwellers found in gravel/ cobble substrates in large rivers and lakes. With a broad flattened head, this prehistoric looking fish has a pre-opercular spine with a strong upward curve. Spawning occurs in the spring over cobble substrates.

Classified as *may be at risk*, minimal information is known on spoonhead sculpin in Alberta and population declines are assumed to be due to habitat degradation (ESRD 2013c). This species is susceptible to sedimentation caused by various events including heavy rainfall, spring flooding and constructions activities as it resides under cobble and gravel materials at the streambed.

5.8 LAND USE

Currently, the Study Area experiences a variety of land uses that generally fall within three categories: residential, abandoned agricultural, and recreational. The residential areas are located along the margins of the Study Area on both sides of the NSR, above the top of the NSR valley slopes. The abandoned agricultural area, which consists of a large grassy meadow, is located in the north portion of the Study Area and is known as River Valley Oleskiw.

Recreational uses take place throughout the Study Area. In the north portion of the Study Area, which is adjacent to the Fort Edmonton Park footbridge, recreational uses consist of, but may not be limited to, mountain biking, walking, running, and bird watching along informal trails, and cross country skiing. In the south portion of the Study Area, which encompasses a portion of Terwillegar Park, recreational uses consist of, but may not be limited to, mountain biking, walking, hiking, running, dog walking (off-leash area available), bird watching, orienteering, and cross country skiing. Aquatic activities that may take place on the NSR in and in the vicinity of the Study Area may include kayaking, canoeing, boating, fishing, swimming, and tubing.

There are several organized user groups who host events within the south portion of the Study Area, such as the Salomon 5 Peaks cross country race, Kokanee Redbike weekly rides, Edmonton Overlanders Orienteering Club weekly orienteering, Sourdough Raft Race Association River Fest, and United Cycle Be Strong Off Road Duathlon.

The Edmonton Queen Riverboat, which docks at Rafter's Landing at 9734 98 Ave, Edmonton, may travel upstream to Terwillegar Park. A beach on the north edge of Terwillegar Park may be used as an alternative dry dock location for the boat.

The proposed footbridge and trails is compatible with the existing land uses of these areas.

5.9 ARCHAEOLOGY AND HISTORIC RESOURCES

The following section is a compilation of the archaeology and historical resource results including a statement of justification and a historical resource assessment for both archaeology and paleontology.

5.9.1 Statement of Justification

A Statement of Justification (SoJ) (Appendix L) was completed for the Project footprint, with the exception of the construction access trails and related infrastructure. The SoJ found that 17 previous archaeological studies have been conducted in the vicinity of the Project footprint,

including three HRIAs that were completed in the same area as the Project. The records review found that 21 previously recorded historical resource sites are located within 1 km of the Project footprint. At the time that the SoJ was completed, one significant site (FiPj-124) was located within the proposed Footbridge and Trail footprint. This multi-component buried campsite yielded 101 artifacts including lithic material, faunal remains and fire broken rock during a deep testing program completed in 2002. The Footbridge footprint was in conflict with the site area; however, since the SoJ was completed, the location of the north abutment for the Footbridge was relocated to avoid site FiPj-124. No recorded Historic Structures are within the immediate vicinity of the Project.

Given the presence of numerous previously recorded sites, a significant site in the Project footprint, and crossing of the NSR, the Project is considered to have high archaeological potential. Most of the project footprint is situated on lands with a high palaeontological resource sensitivity zone. Along the terraces, there is potential for impact to early postglacial deposits that may contain vertebrate fossils, plants, and molluscs. Along the valley slopes, especially in Sections 3 and 10-52-25 W4M, there is potential for disturbance of fossiliferous bedrock of the Horseshoe Canyon Formation. Depending on the methods used, there is potential for substantial subsurface disturbance in building the trail system and footbridge. Based on the above review and historical resource potential, an HRIA was recommended for archaeology and a palaeontological HRIA with field studies was recommended.

5.9.2 Historical Resources Impact Assessment for Archaeology

The field reconnaissance for the HRIA for Archaeology was conducted in late August 2013 under Permit Number 13-166 (Appendix L). All of the lands associated with the proposed development were subject to visual inspections and subsequently shovel tested as conditions and perceived historical resources potential warranted. During the HRIA, two archaeological sites with Historical Resource Values (HRV) 4 ratings were revisited (campsite FiPj-124 and bison kill site FiPj-125). FiPj-124 was initially recorded to the west of the proposed Project. Based on the findings of the HRIA, the boundaries of this historical site were expanded and impacts to the site may now occur. As such, additional shovel testing and up to 24 m^2 of excavation, in two blocks of 10 and one block of four is recommended for the portion of site FiPj-124 within the Project footprint. A small portion of bison kill site FiPj-125 is also located within the Project and was revisited under the current permit. Due to the depth (1.3 m) of the cultural deposits no additional artifacts were encountered during the site revisit. Deep testing and mitigative measures such as excavation are not recommended for FiPj-125 as they will create unnecessary disturbance to this site. Subsurface disturbance due to the construction of the trail is not anticipated to impact this site. While further work at FiPj-125 relative to this project is not recommended, it is recommended that the current HRV 4 rating and *Historical Resources Act* requirements for this site be maintained.

Historical Resources Act (HRA) clearance relative to archaeological resources was recommended for the Project, with the exception of site FiPj-124. Additionally, provisional clearance for the Project was recommended relative to site FiPj-125 as the anticipated disturbance created by the trail upgrades will not disturb the deep deposits within which the site

is located. It was further recommended that the previously issued *Historical Resources Act* requirements for sites FiPj-124 and FiPj-125 and HRV 4 ratings for these sites be maintained.

Alberta Culture agreed and issued Schedule "B" indicating that avoidance or further study would be necessary for sites FiPj-124 and FiPj-125. "If avoidance is not feasible for site FiPj-124 then the requirements are:

- Additional shovel testing in the site areas where the Footbridge footing and the construction of asphalt trail will occur to determine if there are any other activity areas.
- Stage 1 Excavation in which up 24 m^2 are excavated, preferably in contiguous units. The excavations are to focus on areas of positive tests including but not limited to ST 4, 5, 6, and ST 11 in the area of the north bridge footing and ST 8, 9, and 10 in the area of the trail. At least one square metre in each locale is to be excavated to approximately 80-90 cm below surface to determine if there are deeper palaeosols/cultural components present. The consultant is to consult with the Regional Archaeologist to determine when to stop excavation of these exploratory units.
- The consultant is to consult with the Regional Archaeologist after completion of 12 m^2 of excavation to determine if remaining excavations are warranted.
- Radiocarbon dates are to be obtained if suitable organic material is recovered in a sound context.
- Further studies may be required based on Stage 1 results.
- Any future development in the vicinity of this site will require further studies (i.e., the proposed construction access trail).

Relative to site FiPj-125 "avoidance or further studies are required: There are no further requirements for the site relative to the current Project (trail and footbridge). However, if the site is threatened by any type of future development (such as construction access), additional studies will be required prior to development proceeding."

As noted in the HRIA final report, any changes or additions to the Project must be reviewed in terms of historical resource concerns and the potential need for further assessment.

5.9.3 Historical Resources Impact Assessment for Palaeontology

To meet the HRA requirement, palaeontological field studies were conducted for a HRIA for Palaeontology on July 13, 2013, under Permit Number 13-041, issued to E. Frampton of Stantec Consulting Ltd (Appendix L).

The banks of the NSR are underlain by recent fluvial sand of low palaeontological potential. Bedrock occurs on the valley slopes east and west of the crossing location, but at the Footbridge the bedrock is overlain by thick deposits of recent fluvial sand. Bedrock is not likely to be disturbed by construction. The likelihood of impacts to palaeontological resources is considered low and no further palaeontological work or monitoring was recommended for the Footbridge.

On the north side of the NSR valley, the north trail occurs entirely along the floodplain and is underlain by glaciofluvial gravel and recent fluvial sand of low palaeontological potential. Construction of the North Trail will disturb surficial deposits of low palaeontological potential. The likelihood of impacts to palaeontological resources is considered low. No further work or monitoring was recommended for the North Trail on the north side of the NSR.

On the south side of the NSR, the South Trail occurs partially on the floodplain and mainly on the valley slopes. The floodplain is underlain by recent fluvial sand of low palaeontological potential. Above the floodplain, on the upper part of the slope, colluvium and surficial silt of low palaeontological potential occur. Construction of the South Trail on the floodplain and upper part of the slope will disturb surficial deposits of low palaeontological potential. Bedrock of the Horseshoe Canyon Formation underlies the lower and middle parts of the valley slope. No fossils were observed at the bedrock exposures during the survey, but five known fossil sites do occur in the vicinity of the Study Area, suggesting the bedrock is regionally fossiliferous. Bedrock occurs at the surface where the South Trail crosses the lower and middle parts of the slope. The bedrock will be disturbed by grading or excavation and the likelihood of impacts to palaeontological resources is considered high. Palaeontological monitoring was recommended for any surface disturbance in LSD 12-10-52-25 W4M.

Alberta Culture agreed and issued Schedule "B" indicating that "Pursuant to Section 37(2) of the *Historic Resources Act*, a HRIA for palaeontological resources and any work resulting from this assessment is to be conducted on behalf of the Proponent by a palaeontologist qualified to hold a "Permit to Excavate Palaeontological Resources (Mitigative)" within the Province of Alberta. The HRIA is to consist of a monitoring program. The monitoring program must include all areas where impact to the Horseshoe Canyon Formation will occur." Appropriate personnel of the Royal Tyrrell Museum of Palaeontology must be contacted in the event that significant palaeontological resources are encountered during the conduct of the monitoring program. It may then be necessary for Alberta Culture to issue further instructions regarding these resources.

6.0 Field Work Results

The following sections summarize the results of the various field programs undertaken as part of this assessment.

6.1 VEGETATION AND RARE PLANT SURVEYS

6.1.1 Vegetation and Wetland Land Units

Within the VSA, 38 site characterization surveys were completed and were used to characterize upland, wetland, and anthropogenic land units in the VSA (see Figure 6.1 and Appendix M). The VSA (Table 6-1) was delineated as:

- 82% Upland (54.8 ha)
- 5% Wetland and Water (3.6 ha)
- 13% Anthropogenic (8.7 ha)

Upland areas within the VSA were predominately aspen poplar woodland alliance (44%) and balsam poplar woodland alliance (31%). The aspen poplar woodland alliance is a deciduous-dominated canopy which is typically mixed with both aspen and balsam poplar. This land unit is generally found in moist rich sites, which were very common along the VSA. In contrast, the canopy of the aspen woodland alliance is composed primarily of aspen, but may have minor components of coniferous species (often white spruce). This land unit was generally found at mesic sites with medium nutrient regime. Other upland land units that were found within the VSA were a mixed deciduous and evergreen woodland alliance, tall shrubland alliance and short shrubland alliance.

There was only one wetland land unit (treed swamp) and one water land unit (open water) observed within the VSA (Table 6-1). The treed swamp land unit comprised 1% (0.4 ha) of the VSA and was observed along the edge of the NSR as a deciduous dominated swamp consisting of balsam poplar, river alder (*Alnus tenuifolia*) and honeysuckle (*Lonicera* spp.). The open water land unit made up 5% of the VSA and was observed where the VSA extended into the NSR (Figure 6.1).

In addition to upland and wetland land units there were also anthropogenic land units within the VSA (Table 6-1). The area of cultivated land (5%) was observed at the northern portion of the VSA (Figure 6.1). Areas classified as green space (7%) were located in several areas within the VSA and were generally associated with parks. There were also small areas classified as residential and transportation, which were associated with houses and roads (Figure 6.1).

Table 6-1 Vegetation and wetland land units within the Vegetation Study Area

Land Unit		Permanent Features					Temporary Features														Total Study Area	
		Footbridge	Footbridge Rip Rap	Trail Footprint	Permanent Disturbance Total		North Abutment Laydown Area	North Abutment Stockpile Area	North Access Road	North Bank Project Footprint	Option 1 Access	Proposed Laydown and Stockpile Area	Option 2 Access	South Abutment Laydown Area	South Abutment Stockpile Area	South Access Road	South Bank Project Footprint	Tree Stumping	Temporary Total		Total Study Area	
Upland		**ha**	**ha**	**ha**	**ha**	**% of Study Area**	**ha**	**ha**	**ha**	**ha**	**ha**	**ha**	**ha**	**ha**	**ha**	**ha**	**ha**	**ha**	**ha**	**% of Study Area**	**ha**	**% of Study Area**
AW	Aspen Woodland Alliance	0	0	0.02	0.02	0.02	0	0	0	0	0	0.01	0	0	0	0	0	0.01	0.02	0.02	**3.45**	**3.9**
AP	Aspen Poplar Woodland Alliance	0.02	0.02	1.89	1.92	2.1	0	0	0	0.06	0.06	0.01	0	0	0	0	0.34	0.22	0.70	0.8	**28.94**	**32.3**
PB	Balsam Poplar Woodland Alliance	0.03	0.06	0.88	0.97	1.1	0	0	0	0	0	0	0.17	0	0	0	0.15	0	0.32	0.4	**17.16**	**19.2**
MX	Mixed Deciduous and Evergreen Woodland Alliance	0	0	0.02	0.02	0.02	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	**1.61**	**1.8**
TSA	Tall Shrubland Alliance	0.02	0.04	0	0.05	0.1	0	0	0	0.04	0	0	0	0	0	0	0	0	0.05	0.1	**1.54**	**1.7**
SS	Short Shrubland Alliance	0.01	0.04	0	0.05	0.1	0	0	0	0.06	0.13	0	0.04	0	0	0	0	0	0.23	0.3	**3.55**	**4.0**
Upland Subtotal		*0.07*	*0.15*	*2.81*	*3.03*	3.4	*0*	*0*	*0*	*0.17*	*0.19*	*0.02*	*0.21*	*0*	*0*	*0*	*0.49*	*0.23*	*1.32*	*1.5*	***56.25***	***62.9***
Wetland and Water																						
TS	Treed Swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.50**	**0.6**
OW	Open Water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.96**	**2.2**
Wetland and Water Subtotal		*0*	*0*	*0*	*0*	0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	***2.46***	***2.7***
Anthropogenic																						
CL	Cultivated Land	0	0	0.29	0.29	0.3	0.83	0.50	0.08	4.52	0.28	0.18	0.82	0	0	0	0	0	7.21	8.1	**21.73**	**24.3**
GS	Green Space	0	0	0.16	0.16	0.2	0	0	0	0	0	0.04	0	0.36	0.84	0.09	1.43	0	2.76	3.1	**6.48**	**7.2**
RR	Residential	0	0	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0	0.02	0.03	**1.43**	**1.6**
TR	Transportation	0	0	0.02	0.02	0.03	0	0	0	0	0	0	0	0	0	0.02	0.12	0	0.14	0.2	**1.15**	**1.3**
Anthropogenic Subtotal		*0*	*0*	*0.48*	*0.48*	0.5	*0.83*	*0.50*	*0.08*	*4.52*	*0.31*	*0.22*	*0.82*	*0.36*	*0.84*	*0.11*	*1.55*	*0*	*10.13*	*11.3*	***30.78***	***34.4***
Total		**0.09**	**0.30**	**3.28**	**3.68**	**4.1**	**0.83**	**0.50**	**0.08**	**4.70**	**0.50**	**0.24**	**1.03**	**0.36**	**0.84**	**0.11**	**2.04**	**0.23**	**11.46**	**12.8**	**89.49**	**100.0**

Note: 1. Values in this table have been rounded for presentation; therefore values may not appear to sum to their respective subtotal and/or total
2. Trail footprints presented above are overestimated due to the presence of existing trail systems that are too narrow to be accurately mapped

Q:\Clients\City_of_Edmonton\Terwillegar_Footbridge\Figures\Figure6_1_VegetationandWetlandSummaryforTerwillegarFootBridge_2014.mxd
2/4/2014 By:alundell

February, 2014
1135-60353

Rare Plant Finding 2013 (*Doellingeria umbellata* var. *pubens*)
Historical ACIMS Rare Plant Record

Survey Location
Spring Rare Plant and Site Characterization
Summer Rare Plant and Site Characterization

Terwillegar Footprint Features
Permanent
Temporary

Water/Wetland
TS - Treed Swamp
OW - Open Water

Upland
AW - Aspen Woodland Alliance
AP - Aspen Poplar Woodland Alliance
PB - Balsam Poplar Woodland Alliance
MX - Mixed Deciduous and Evergreen Woodland Alliance
TSA - Tall Shrubland Alliance
SS - Short Shrubland Alliance

Anthropogenic
CL - Cultivated Land
GS - Green Space
RR - Rural Residential
TR - Transportation

1:11,000
0 200 400 600 800 1,000 Meters
This map is for reference purposes only

Projection: 3TM CM:114 Datum: NAD 83
Imagery obtained from City of Edmonton, Transportation Department, 2012.

Client/Project
CITY OF EDMONTON
TERWILLEGAR PARK FOOTBRIDGE AND TRAILS

Figure No.
6.1

Title
VEGETATION AND WETLAND SUMMARY

Q:\Clients\City_of_Edmonton\Terwillegar_Footbridge\Figures\Fig6_2_SpeciesofManagementConcernLocations.mxd February, 2014

2014 - 01 - 31 alundell 1135-60353

Stantec

Projection: 3TM CM:114° Datum: NAD 83
Imagery obtained from City of Edmonton Transportation, 2012

- Study Area
- Canadian Toad
- Barred Owl
- Least Flycatcher
- Pileated Woodpecker

0 250 500 750 1,000 1,250

1:20,000 Metres

This map is for reference purposes only

Client/Project
CITY OF EDMONTON
TERWILLEGAR PARK FOOTBRIDGE AND TRAILS

Figure No.
6.2

Title
SPECIES OF MANAGEMENT CONCERN LOCATIONS

6.1.2 Rare Plants and Rare Ecological Communities

Although no rare ecological communities were observed within the VSA, one rare vascular plant was observed at six locations throughout the VSA (Table 6-2). Flat-topped white aster (*Doellingeria umbellata* var. *pubens*) was observed under aspen poplar woodland alliance and balsam poplar woodland alliance canopies (Figure 6.1). This aster is a perennial species that stems from creeping rhizomes (Moss 1983). This plant was found under intact stands within the VSA and along existing trails.

Although all locations of historical ACIMS rare plant records (see Section 5.5.1) were surveyed in 2013, no rare plants were observed at those sites in 2013 (See Figure 6.1). A complete list of species observed within the VSA is included within Appendix N.

Table 6-2 Rare plant observations within the Vegetation Study Area

Scientific Name	Common Name	Site Number	Easting	Northing	Zone	Year	Survey Type & Timing
Doellingeria umbellata var. *pubens*	flat-topped white aster	RPLJJ01	326823	5928726	12	2013	Rare Plant Summer
		RPLJJ04	326888	5928536	12	2013	Rare Plant Summer
		RPLJJ05	327133	5928375	12	2013	Rare Plant Summer
		RPLJJ12	328134	5929626	12	2013	Rare Plant Summer
		RSTBJS1303	328100	5929516	12	2013	Rare Plant Spring
		RSTBJS1315	327333	5928894	12	2013	Rare Plant Spring

6.1.3 Old-Growth Forests

Upland land units that were tree dominated were primarily poplar woodland alliance and balsam poplar woodland alliance (Table 6-1); however, aspen woodland alliance and mixed deciduous and evergreen woodland alliance were also present in the VSA. These upland units were observed to be young forests consisting of single strata canopies with trees heights between 13 and 18 m, or mature forests consisting of multiple strata or had tree heights greater than 18 m. The average age of trees that were cored during rare plant surveys was 47 years old. No old-growth forest was observed in the VSA.

6.1.4 Weed Species

Within the VSA seven species listed as *noxious* according to the *Weed Control Act* (Alta. Reg. 19/2010) were identified at several locations (Table 6-3). See Appendix N for weed survey forms for these observations. There were no *prohibited noxious* weeds identified within the VSA.

Table 6-3 Weed species and locations within the Vegetation Study Area

Scientific Name	Common Name	Weed Designation[1]	Site Number	Easting	Northing
Cirsium arvense	creeping thistle	*Noxious*	RPLJJ02	327014	5928761
			RPLJJ03	326707	5928647
			RPLJJ05	327133	5928375
			RPLJJ08	327104	5928760
			RPLJJ09	327869	5930383
			RPLJJ10	327941	5930190
			RPLJJ15	326858	5926845
			RSTBJS1302	328176	5929904
			RSTBJS1309	326545	5928471
			RSTBJS1311	327661	5928770
			RSTBJS1314	327321	5928822
			RSTBJS1316	327046	5928792
			RSTBJS1319	327215	5927661
Convolvulus arvensis	field bindweed	*Noxious*	RPLJJ15	326858	5926845
Linaria vulgaris	common toadflax	*Noxious*	RPLJJ15	326858	5926845
Matricaria perforata	scentless chamomile	*Noxious*	RSTBJS1305	327966	5929024
			RSTBJS1316	327046	5928792
Ranunculus acris	tall buttercup	*Noxious*	RSTBJS1303	328100	5929516
Sonchus arvensis	perennial sow-thistle	*Noxious*	RPLJJ02	327014	5928761
			RPLJJ08	327104	5928760
			RPLJJ09	327869	5930383
			RPLJJ15	326858	5926845
			RSTBJS1314	327321	5928822
			RSTBJS1316	327046	5928792
Tanacetum vulgare	common tansy	*Noxious*	RPLJJ11	327995	5930067
			RSTBJS1302	328176	5929904

NOTE:
[1]Weed Control Regulation (R.S.O.1990. c.W.5)

6.2 WILDLIFE SURVEYS

The following sections summarize the findings of the amphibian and breeding bird surveys. Incidental wildlife species recorded are also discussed.

6.2.1 Amphibian Survey

Two amphibian species consisting of boreal chorus frog and Canadian toad were recorded during the nocturnal amphibian surveys conducted on both sides of the NSR. A wood frog (*Lithobates sylvaticus*) was recorded incidentally during the breeding bird survey on the south side of the NSR.

The Canadian toad is considered a species of management concern and it is listed as *may be at risk* by ESRD (ESRD 2011). It was detected from survey points A2, A4, and A5 during the amphibian survey (Figure 6.2). This species is known to occur within the Study Area as indicated by the FWMIS search result (see Section 5.6.1.1). However, its presence had not been documented since 2005 (see Section 5.6.1.1).

6.2.2 Breeding Bird Survey

A total of 204 individual birds representing 36 species, including incidentals, were recorded during the breeding bird and amphibian survey (Table 6-4) while 117 individual birds representing 25 species were recorded in the fixed-radius point-count survey. On average, 5.85 individual birds and 1.25 species were detected per fixed-radius point-count station.

Table 6-4 Bird species recorded during the breeding bird and amphibian surveys

Family	Scientific Name	Common Name
Anatidae	*Anas Americana*	American wigeon
	Anas platyrhynchos	mallard
	Branta canadensis	Canada goose[1]
Corvidae	*Corvus brachyrhynchos*	American crow
	Corvus corax	common raven
	Pica hudsonia	black-billed magpie
Emberizidae	*Ammodramus leconteii*	LeConte's sparrow
	Melospiza melodia	song sparrow
	Passerculus sandwichensis	savannah sparrow
	Spizella pallida	clay-colored sparrow
	Spizella passerine	chipping sparrow
	Zonotrichia albicollis	white-throated sparrow
Fringillidae	*Spinus tristis*	American goldfinch
Hirundinidae	*Riparia riparia*	bank swallow
Paridae	*Poecile atricapillus*	black-capped chickadee

Family	Scientific Name	Common Name
Parulidae	*Cardellina petechia*	yellow warbler
	Cardellina pusilla	Wilson's warbler
	Setophaga coronata	yellow-rumped warbler
	Setophaga ruticilla	American redstart
Passeridae	*Passer domesticus*	house sparrow[2]
Picidae	*Colaptes auratus*	northern flicker
	Dryocopus pileatus	pileated woodpecker[3]
	Picoides pubescens	downy woodpecker
	Picoides villosus	hairy woodpecker
Scolopacidae	*Actitis macularius*	spotted sandpiper
Sittidae	*Sitta canadensis*	red-breasted nuthatch
	Sitta carolinensis	white-breasted nuthatch
Strigidae	*Aegolius acadicus*	northern saw-whet owl[1]
	Strix varia	barred owl[1,3]
Troglodytidae	*Troglodytes aedon*	house wren
Turdidae	*Catharus guttatus*	hermit thrush[1]
	Turdus migratorius	American robin
Tyrannidae	*Empidonax minimus*	least flycatcher[3]
Vireonidae	*Vireo gilvus*	warbling vireo
	Vireo olivaceus	red-eyed vireo
	Vireo philadelphicus	Philadelphia vireo

NOTES:

[1] Species only detected during the amphibian survey
[2] ESRD 2011 *exotic*
[3] ESRD 2011 *sensitive*

Yellow warbler, bank swallow, black-capped chickadee, red-eyed vireo and least flycatcher were the most common species recorded in the fixed-radius point-count stations, representing between 7.7% and 22.2% of individual birds documented (Table 6-5).

Table 6-5 Most common bird species recorded in the fixed-radius point-count stations

Rank	Common Name	No.	% of Total (117)
1	yellow warbler	26	22.2
2	bank swallow	15	12.8
3	black-capped chickadee	11	9.4
4	red-eyed vireo	10	8.5
5	least flycatcher	9	7.7

Three of the 36 bird species are considered of management concern, consisting of the barred owl, least flycatcher and pileated woodpecker. These species are listed as *sensitive* by ESRD (ESRD 2011) (Table 6-4 and are discussed below. The house sparrow is the only non-native species that was detected during the fixed-radius point-count station survey (Table 6-4).

6.2.2.1 Barred Owl

The barred owl is a large grey-brown owl that can live up to 18 years. This non-migratory species is found in western Mexico, eastern and northwestern United States, British Columbia, Alberta, central Saskatchewan and Manitoba, southern Quebec, Ontario, and the Maritime Provinces (Mazur and James 2000).

Barred owls feed on a wide range of prey, including amphibians, reptiles, birds and small mammals (Mazur and James 2000). Nesting occurs primarily in cavities, but may occur in stick nests built by other species (Mazur and James 2000). In the Boreal Forest Natural Region of Alberta, most nests for this species have been found in balsam poplar and aspen snags (dead trees), averaging 52 cm diameter at breast height (dbh) (Olsen 1999). The species favors large tracts of unfragmented old mixedwood stands near riparian areas or wetlands during the breeding season, which begins in March in Alberta (FAN 2007; Mazur et al. 1998; Takats 1998; Olsen 1999). Home ranges covering 321 ha have been reported in the province during the breeding season. Barred owls typically lay two or three eggs which are incubated for 28 to 33 days. Young usually fledge 42 days after hatching (FAN 2007; Mazur and James 2000).

Barred owls are listed as *Sensitive* by ESRD (ESRD 2011) and as *Special Concern* under the Wildlife Act (ESRD 2012). The species has been designated as a species of management concern due to its reliance on old growth mixedwood stands, and tracts of unfragmented forest; both of which are in decline due to current forest management and resource development practices (FAN 2007). The species was recorded incidentally during the amphibian survey across from A2 (Figure 6.2) and there is suitable habitat to support it in the Study Area.

6.2.2.2 Least Flycatcher

The least flycatcher is a small olive-gray songbird weighing between 8 and 13 grams (g). The species can easily be recognized by its characteristic "chebec" song. Considered a long distance migrant, the least flycatcher overwinters in Mexico and Central America, and breeds in northern United States and Canada (Tarof and Briskie 2008). The species is widespread across Canada and can be found in all provinces and two territories (Yukon and Northwest Territories). Least flycatchers are primarily found in deciduous or mixedwood forests and commonly observed in the vicinity of open areas (e.g. forest clearings), water (e.g. swamps or lakes) and roads. The species builds grass nest cups in trees and starts nesting in May after they return from migration. They feed mostly on flying insects and insects located in the foliage of trees (Tarof and Briskie 2008).

Although reportedly common, populations of this species have declined west of Ontario since the late 1960s. Their decline appears concealed by the fact that the species is still observed on a regular basis. The relative abundance of least flycatcher declined in Alberta between the late 1980s and the beginning of the early 2000s in the Boreal Forest, Parkland and Grassland Natural Regions (FAN 2007). The least flycatcher is listed as *sensitive* in Alberta, a species susceptible of being negatively impacted by human activities but not in an immediate risk of extinction (ESRD 2011). The species was recorded on twelve separate fixed-radius point-count stations (B1, B4, B5, B6, B7, B8, B9, B11, B12, B16, B20, and B21) (Figure 6.2) and there is suitable habitat to support it in the Study Area.

6.2.2.3 Pileated Woodpecker

The pileated woodpecker is the largest woodpecker in Alberta and can weigh between 250 and 350 g. This bird has a mostly black body with white stripes on its neck and a visible red crest present in both sexes. The species does not migrate and occurs year-round in Alberta. It is also found in all other provinces of Canada, except for Newfoundland (Bull and Jackson 2011). Pileated woodpeckers require late successional stage forests for nesting. In Alberta, the species primarily feeds on insects (carpenter ants typically) on snags, logs and dying or diseased trees, and excavates cavities in large trees (>50cm dbh [diameter at breast height]) with signs of decay for nesting in April (Bull and Jackson 2011).

The species is listed as *sensitive* by ESRD (ESRD 2011). Although the species appeared to have increased in the Boreal Forest Natural Region between the two breeding bird atlases, it also declined during the same period in the Foothills and Parkland Natural Regions. The species was listed due to the loss of mature forest habitat in the province required for its nesting (FAN 2007). Pileated woodpecker was detected incidentally at B19 during the breeding bird survey (Figure 6.2). Suitable habitat for this species is available in the Study Area.

6.2.3 Incidentals and Signs of Wildlife Usage

Various wildlife species and signs of wildlife usage were observed during the breeding bird and amphibian survey. A southern red-backed vole (*Myodes gapperi*) and two red squirrels were observed on the north side of the NSR while porcupine browse was observed at two bird survey locations on the south side of the NSR. Several woodpecker cavities were also observed in the latter area indicating that it is used by one or more woodpecker species. This is supported by the four woodpecker species recorded during the breeding bird survey (Table 6-4). Two large mammal species were also recorded incidentally in the Study Area consisting of white-tailed deer and coyote. A total of nine white-tailed deer were observed during the breeding bird and amphibian surveys on the north side of the NSR, including a fawn suggesting that the area is used by the species for reproduction. Coyotes were also heard howling on the north side of the NSR during the amphibian survey.

Four bird species were only detected incidentally during the amphibian survey. These species consist of Canada goose, barred owl, hermit thrush and northern saw-whet owl. An osprey and bald eagle were observed incidentally during the fisheries assessment in August. The osprey was observed flying over the Study Area, while the bald eagle was perched on a snag overlooking the NSR on the north side of the river near the proposed bridge abutment. No bald eagle or osprey nests were observed during the wildlife surveys.

6.3 FISH HABITAT ASSESSMENT

A fish and fish habitat assessment was conducted on the NSR from August 27 to 29, 2013 (see Appendix G for more details of the methods and results of this assessment). In accordance to the findings of the surveys, the channel was predominantly run/riffle habitat (85% and 10%, respectively) interspersed with several small pools (5%). Water depths ranged from 0.4 to 1.9 m within the run habitats, and 0.2 to 0.4 m in the riffle habitats. Substrate consisted of predominantly gravel and sub dominantly with fines, cobble and boulder. Maximum water depth in the pool habitat was >1.0 m. Substrate within the pool habitats consisted of loosely compacted sand, and fines (silt). Pool habitats were > 1 metre with in-stream cover providing suitable habitat for fish.

Bank habitat within the aquatic study area consisted of armored, depositional and erosional habitat types (Figure 2-1, Appendix G). Depositional habitat accumulated predominantly a silt substrate with stable banks; the erosional habitat provides very unstable banks with a mixture of substrate including silt and small gravels. Approximately 45% of the channel was classified as erosional habitat (E1, E4 and E5) while depositional habitat (D1 and D2) accounted for approximately 55% of the aquatic study area (Figure 2-1, Appendix G). The left downstream bank (LDB) was composed of E4 (600 m), E5 (390 m) and D1 (1600 m) habitat and the right downstream bank (RDB) was composed of D1 (1000 m), D2 (300 m) and E1 (1550 m) habitat.

The channel consisted of one main unobstructed channel with two singular islands (S) located upstream and downstream of the proposed footbridge location. Riffle sections were small areas located upstream of the singular islands.

Field water quality measurements indicated that the NSR was well oxygenated in the summer assessment (7.76 mg/L). A pH of 8.6 was within the *Canadian Water Quality Guideline* (CWQG) and *Surface Water Quality Guidelines for use in Alberta* (SWQGA) (AENV 1999; Canadian Council of Ministers of the Environment [CCME] 2011). Conductivity was 365 µs/cm, and water temperature at the time of the survey was 18.7°C. Water clarity was rated as clear with a turbidity value of 4.80 NTU.

During the summer survey, boat electrofishing was conducted for a total of 5,434 seconds and backpack electrofishing for a total of 937 seconds. Spottail shiners were the most abundant species captured in the Project area. Burbot, emerald shiner, longnose dace, longnose sucker, goldeye, mooneye, northern pike, shorthead redhorse, silver redhorse, spottail shiner, walleye, white sucker, and yellow perch (*Perca flavescens*) were also captured or observed during the electrofishing survey. Four minnow traps were set over consecutive days (28 trap-hours) and lake chub, spottail shiner, trout-perch, white sucker, and yellow perch were captured. Backpack electrofishing and beach seining were conducted in selected areas; however, no fish were captured in the sampling effort. Spin-cast angling occurred throughout the Project area over three days with a total effort of 15 hours. Fish captured were goldeye, northern pike, and walleye.

7.0 Potential Impacts, Mitigation Measures, and Residual Impacts

The following sections outline the potential impacts of construction, recommends mitigation measures, and evaluates residual impacts of the project after mitigation measures have been implemented.

7.1 ENVIRONMENTAL COMPONENTS

Stantec has identified 10 environmental components having direct and indirect environmental impact linkages associated with the proposed Project based on the scope of activities, the environmental context, the results of public consultation, and professional judgment. These components include:

- Water Quality of the North Saskatchewan River
- Hydrology
- Fisheries
- Wildlife
- Vegetation
- Aesthetics
- Noise
- Public Safety
- Contractor Safety
- Archaeological and Historical Resources

As described in Section 4.4, specific magnitude definitions are needed for each environmental element. Each of these definitions is assumed to apply to the Study Area as illustrated within Figure 1.1. Definitions are provided in Table 7-1.

Table 7-1 Magnitude definitions

Environmental Element	Definition
Water Quality of the North Saskatchewan River	Low – Minimal decrease in water quality in the North Saskatchewan River during/post-construction, parameters ≤7.5% higher than baseline Moderate – Partial decrease in water quality in the North Saskatchewan River during/post-construction, parameters 7.5% - 10% higher than baseline High – Substantial decrease in water quality in the North Saskatchewan River during/post-construction, parameters ≥10% higher than baseline
Hydrology	Low - Minimal change in the timing and magnitude of stream flow discharge ≤5% of baseline Moderate – Partial change in the timing and magnitude of stream flow discharge ≤25% of baseline High – Total change in the timing and magnitude of stream flow discharge ≥50% of baseline
Fisheries	Low – Minor alterations or enhancements to the aquatic environment in the Study Area. Similar or increased function of productive fish habitat. Minimal disturbance during construction activities in the immediate area Moderate – Moderate alterations to the aquatic environment in the Study Area or outside of the Study Area. Similar or changed function of productive fish habitat. Moderate disturbance during and after construction activities extending to the Study Area High – Major alterations or destruction of the aquatic environment in the Study Area or outside of the Study Area. Decreased or lost functioning of productive fish habitat. High disturbance resulting in a permanent change after completion of construction extending beyond the Study Area
Wildlife	Low – No wildlife species will be eliminated from the Study Area and wildlife movement corridors will not be impacted Moderate – Some species may be eliminated from the Study Area and some movement corridors may be disrupted High – Project will eliminate some species of management concern from the Study Area and major wildlife corridors will be lost
Vegetation	Low – The distribution and abundance of native plant communities, rare plants, or rare ecological communities are not reduced in the Study Area beyond natural variation Moderate – The distribution and abundance of native plant communities, rare plants, or rare ecological communities are reduced, but not lost, in the Study Area High – The distribution and abundance of native plant communities, rare plants, or rare ecological communities are completely removed from the Study Area

Environmental Element	Definition
Aesthetics	Low – Minor loss or alteration to key elements/features/characteristics of view, and/or may not be uncharacteristic of the broader area Moderate – Partial loss or alteration to key elements/features/characteristics of view, and/or may be somewhat uncharacteristic of the broader area High – Total loss or alteration to key elements/features/characteristics of view, and/or totally uncharacteristic of the broader area
Noise	Low – Minor increase in noise during construction Moderate – Partial increase in noise during construction High – Substantial increase in noise during construction
Public Safety	Low – Minor threat to public safety during construction, with risk of injury being low Moderate – Partial threat to public safety during construction, with risk of injury being moderate High – Substantial threat to public safety during construction, with risk of injury being high
Contractor Safety	Low – Minor threat to contractor safety during construction, with risk of injury being low Moderate – Partial threat to contractor safety during construction, with risk of injury being moderate High – Substantial threat to contractor safety during construction, with risk of injury being high

The 10 environmental elements and a summary of the potential residual impacts are outlined in Table 7-2 and characterized in the following sections. Mitigation measures designed to reduce the degree of impacts are discussed. The potential impacts are characterized as described in Section 4.4 (i.e., magnitude, spatial extent, duration, likelihood of occurrence). Where possible, discussions of impacts as a result of the construction components and corresponding mitigation measures have been combined for readability and to reduce redundancy within this report. Only those impacts that have been deemed to be negative are discussed below, as it is assumed that positive impacts are desirable and do not require mitigation.

Table 7-2 Impact characterization summary for environmental elements

Environmental Element	Impact	Residual Impact Characterization			
		Magnitude	Spatial Extent	Duration	Likelihood of Occurrence
Water Quality of the NSR	Vegetation clearing	Low	Project	Short	Low
	Soil exposure	Low	Project	Short	Low
	Deleterious substance	Low	Local	Short	Low
Hydrology	Surface water Runoff	Low	Project	Short	Low
	Erosion potential	Low	Project	Short	Low
	Flow patterns (hydraulics)	Low	Local	Short	Low
Fisheries	Direct habitat alteration	Low	Project	Short	High
	Deleterious substance	Low	Local	Short	Low
	Fish entrapment/ entrainment	Low	Project	Short	Low
Wildlife	Wildlife mortality	Low	Project	Long	Low
	Habitat loss	Low	Project	Long	High
	Barriers to wildlife movement	Moderate	Project	Long	Moderate
Vegetation	Windthrow	Low	Project	Long	Low
	Changes to plant community composition	Moderate	Project	Medium	Medium
	Disturbance to or loss of rare plant populations	Moderate	Project	Medium	Medium
	Disturbance to wet areas	Low	Project	Short	Low
	Introduction and/or spread of weed species	Low	Local	Long	Medium
Aesthetics	Quality of views of the Study Area	Moderate	Local	Long	High
Noise	Disturbance to users of the NSR valley park and trail system and local residents	Moderate	Local	Short	High

Environmental Element	Impact	Residual Impact Characterization			
		Magnitude	**Spatial Extent**	**Duration**	**Likelihood of Occurrence**
Public Safety	Interactions with users of the NSR valley park and trail system	Low	Project	Short	High
	Interactions with surrounding residents	Low	Local	Short	High
	Interaction with users of the NSR	Low	Project	Short	High
	Physical hazards present during construction	Moderate	Project	Short	Moderate
	Increased risk of wildfire during dry periods	Moderate	Project	Short	Low
Contractor Safety	Physical hazards present during construction	Moderate	Project	Short	moderate
	Interactions with wildlife and domestic animals	Low	Project	Short	Low
Archaeological Resources	Discussed within the SoJ and HRIAs (Appendix L)				

7.2 VEGETATION

This section summarizes the direct and indirect impacts on vegetation of the development of the Terwillegar Footbridge and Trails.

Vegetation plays a fundamental role in natural ecosystems. Changes in the distribution and abundance of plant communities and individual species have the potential to alter ecosystem function and the ability of other organisms to use and benefit from these natural landscape features. The vegetated environment includes the physical area where vegetation is found, and includes all plant communities and individual plant species that occur in upland and wetland habitats. The Project will result in ground disturbance that will create changes in native plant communities and individual species, including natural habitats that do or may contain rare plants.

7.2.1 North and South Trails

The potential impacts of the development of the North and South Trails may result in changes to the presence and distribution of plant species and plant communities (e.g., changes in the occurrence of individual plant species or communities resulting from vegetation clearing) and may include:

- Windthrow
- Change in plant community composition
- Disturbance to or loss of rare plant populations
- Disturbance to wet areas
- Introduction and/or spread of weed species

Windthrow

Removal of tree cover during construction of the trails has the potential to compromise forest stands structurally, and may allow for windthrow (blow down of remaining trees along newly exposed edges of the stand) and the introduction of edge effects. The majority of the trails will be established through the mature aspen poplar woodland alliance and balsam poplar woodland alliance. Mature aspen and balsam poplar are susceptible to windthrow due to the high incidence of heart-rot within these trees. As well, trees that develop within a forest stand are not as structurally sound as trees that develop along the forest edge. Therefore, a gap in the forest canopy can result in the blow down of a number of individuals. Additionally, during trail construction, accidental damage to trees may occur as a result of equipment striking trees causing wounds that may increase susceptibility of a wounded tree to infection. Wounding of trees may result in reduced vigor (health) and may increase mortality. Compaction of the soil as a result of trail construction and/or trenching of the soil to facilitate installation of a power line to the Bridge could damage tree root systems. This may also result in reduced vigour and mortality of trees.

Change in Plant Community Composition

Development of the trails has the potential to alter plant community composition resulting from edge effects such as increased light availability, decreased humidity, and increased ease of access for people, wildlife, and introduced plant species. Although the trail alignment follows existing trails; there will be approximately 2.8 ha of native upland communities (land unit) permanently removed as a result of the trails (Table 6-1). This area is approximate and is larger than the actual amount of native upland communities that will be removed because the trail alignment follows an existing trail, which could not be mapped (too narrow), and is an inclusion in the upland land units. During trail construction there will be temporary removal of native upland plant communities (0.2 ha Table 6-1).

Disturbance to or Loss of Rare Plant Populations

One rare vascular plant species was observed at six locations throughout the Study Area (see Section 6.1.2, Table 6-2 and Figure 6.1). Flat-topped white aster (*Doellingeria umbellata* var. *pubens*) is ranked S2 (ATPRb 2013), and has a status of *may be at risk* according to the Alberta General Status of Wild Species rank (ESRD 2010). This vascular species is generally found in moist woodlands and along swamp edges (Kershaw et al. 2001) and has been historically found at numerous sites in and around the Study Area (ATPRb 2013). Flat-topped white aster is a perennial species that stems from creeping rhizomes (Moss 1983), which was observed under aspen poplar woodland alliance and balsam poplar woodland alliance canopies. Two of the six occurrences of flat-topped white aster were along an existing trail. Since flat-topped white aster was found along trail edges, it is apparent this species grows in the microsites that occur along existing trail edges.

Disturbance to Wet Areas

The trail alignment crosses several drainages (see Section 2.1) and is in the vicinity of a treed swamp. Development of the trails has the potential to alter drainage patterns and contribute to soil compaction in these wet areas.

Introduction and/or Spread of Weed Species

Seven *noxious* weed species were observed in the VSA, with 23 occurrences (Table 6-3). As *noxious* weeds are already present in the VSA, the development of the North and South Trails has the potential to increase spread of these species, and could potentially lead to the establishment and spread of other weeds into the area.

7.2.1.1 Mitigation Measures

Development of the North and South Trails will occur along an existing trail network, and will involve widening of these existing trails. The permanent development of the trails will result in a reduction of informal trails, which will ultimately reduce further edge effects.

Mitigation measures that will be employed include:

Windthrow

- Tree removal should take place perpendicular to the prevailing wind direction wherever possible. This allows for consistent wind effect along remaining treed edges and will likely reduce windthrow. If windthrow occurs, suitable native tree species should be planted to compensate for lost trees.
- Care should be taken to ensure construction equipment do not come into contact with trees.

Change in Plant Community Composition

- To reduce edge effects on treed areas remaining after vegetation clearing and to limit changes to plant community composition, trails should not be located too close together. Edge effects may be exacerbated as a result of the additive edge effects of adjacent trails that may permeate further into the treed areas. Additionally, the width of the trail and disturbance area associated with trail construction should be minimized wherever practical, which will further reduce edge effects.
- Areas of temporary vegetation clearing (i.e., laydown areas, access roads) should be reclaimed as soon as they are no longer required, and re-vegetation activities should focus on the re-establishment of native vegetation resembling pre-development plant communities.

Disturbance to or Loss of Rare Plant Populations

The widening of the existing trail has the potential to impact these two rare plant populations; however, mitigation measures will be imposed to reduce or eliminate possible disturbance to this species.

The type of mitigation technique recommended is specific to the rare plant species, associated terrain, project requirements, and construction constraints. Mitigation technique recommendations can be separated into three general categories:

- Avoid habitat or population
- Minimize disturbance
- Implement alternative techniques

Avoidance is the most successful rare plant mitigation technique because the population is left intact, and generally involves relocation of the project footprint. In this case, the alignment of the trail may be modified at the site of the rare plant occurrence, or reduced right of way clearing may also be possible. A snow fence should be erected at the location of the rare plant occurrence to isolate the plant and protect the population from disturbance. Tree clearing and trail construction should occur along the side of the trail only where the rare plant species is not present. Limiting construction activity in the vicinity of rare plant populations adjacent to the trails, and continued monitoring of these populations to assess their condition during and following construction will reduce the potential for loss of these populations. However, if it is not possible to change the trail alignment to avoid the two rare plant populations, alternative rare plant mitigation techniques may be used.

Alternative rare plant mitigation techniques that may be used for some species are: transplanting selected specimens, salvaging of the seed bank, and collection and sowing of seed. These techniques are considered experimental, and success rates have been observed to vary greatly between species. Flat-topped white aster was found throughout the study area, but each occurrence only had a small number of individuals (generally less than 20) present. Since

these methods are experimental, avoidance is recommended for mitigation of flat-topped white aster. Prior to any construction a snow fence will be erected to isolate the rare plant populations. The fence will be erected along the edge of the existing trail for a distance of 10 m (5 m on either side of the population) as well as along the sides back towards the edge of existing vegetation clearing.

Vascular Species Transplant

Transplant of vascular species is a two-step approach:

- Revisit the location where the rare vascular occurrence was identified in rare plant surveys. Sampling. This involves collecting individuals of the species, ensuring that the root mass is fully included.
- Locate recipient transplant sites. Ideally, recipient transplant sites will be located in an area:
  - Protected from future development
  - Known to support the rare species
  - Microhabitat similar to the donor site

Transplanted individuals should be watered (ideally with collected rainwater) at the time of planting. A bamboo stake should be placed near transplanted individuals to distinguish them from others in the area (if the site is already known to support the rare species).

Vascular Seed Bank Collection and Planting

Seed bank collection is generally completed in conjunction with topsoil stripping. The upper 5 cm of surface material is stripped off the footprint and stored separately from top soil. Upon reclamation, the seed bank is placed on top of reclamation materials. Depending on post-development plans, nutrient additions may be required. This mitigation technique is likely not appropriate for the project and plant species, because the disturbance is in the form of a trail that is a permanent feature.

Seed Collection

The collection, storage and preparation, (propagation) and planting of vascular seeds is a three- to four-step phased approach. The phased approach includes:

- Seed Collection: Collect 10 to 20 seeds of target plant species when mature (likely August) from up to 25 individuals, if possible. Sample the population randomly, collecting from healthy plants throughout the population to avoid biased collection by location and phenotype.
- Seed storage
- Preparation (breaking external or internal dormancy) and propagation
- Planting: Location of a planting (or out-planting if propagation has occurred) that ideally will be located in an area:
  - Protected from future development

- Known to support the rare species
- Similar to the donor site
- Once a recipient site has been identified, seeds will be sown to the appropriate depth and density and individual seedlings will be out-planted.

Monitoring Protocols to Assess Mitigation Success

Long-term monitoring should be done for all mitigation other than to confirm avoidance. Monitoring should ideally be done for at least five years with monitoring occurring in alternate years (i.e., Year 1, 3 and 5). Ultimately, alternative mitigation success is based on reproductive success. Monitoring should confirm the health, vigor and reproductive status of mitigated vascular plants. For areas that have been seeded, or where new individuals have been established, identification and counting of new individuals will be required. A vigor assessment should be completed following Alberta Environmental Protection standards (1994) and include a scale from 0 to 4 with 0 = dead; 1 = poor; 2 = average; 3 = good, and 4 = excellent.

Disturbance to Wet Areas

- Standard erosion and sedimentation (including dust) control best BMPs should be employed during construction and operation of the trails.
- Construction activities should be limited in wet areas (e.g., drainages, wetlands, etc.) whenever possible, to reduce soil compaction, erosion and sedimentation, and the potential introduction or spread of weeds.

Introduction and/or Spread of Weeds

- Construction machinery should be cleaned prior to entering and leaving the Project footprint to reduce the potential establishment or spread of weed species in native communities.
- Mechanical weed control should be employed to control continued establishment and spread of weed populations during construction and re-vegetation of temporary features. Herbicides will not be used as a method to control weeds in the Project footprint.

7.2.1.2 Residual Impacts

After mitigation, the potential residual impacts to vegetation resulting from the development of the north and south trails are expected to be nominal and are not expected to result in residual impacts. Potential impacts such as windthrow, changes to community composition, disturbance to wet areas, and the establishment and spread of weeds are expected to be managed by employing the mitigation measures described above.

Windthrow

Windthrow is expected to be low in magnitude, limited to the extent of the Project, long in duration and has a low likelihood of occurrence.

Change in Plant Community Composition

Development of the north and south trails will result in the removal of approximately 3.1 ha of native upland vegetation (see Table 6-1). After reclamation of temporary features (construction laydown, access roads, etc.), approximately 2.8 ha of native vegetation will have been permanently removed from the VSA as a result of trail development. None of the land units that will be disturbed by the Project are uncommon along the NSR, and none will be completely removed from the VSA. Re-vegetation of temporary areas will be undertaken with native species selected to return these areas resembling pre-disturbance plant communities.

Change in plant community composition is expected to be moderate in magnitude, limited to the extent of the Project, medium in duration and has a moderate likelihood of occurrence.

Disturbance to or Loss of Rare Plant Populations

Residual impacts are expected to be limited to impacts to rare plant populations along the north and south trails. Limiting construction activity in the vicinity of rare plant populations adjacent to the trails, and continued monitoring of these populations to assess their condition during and following construction will reduce the potential for loss of these populations. Also the occurrence of flat-topped white aster in four other locations along the existing trails suggests this species is not sensitive to edge effects associated with linear openings, and the development of the trails is not likely to prevent these populations from persisting in the VSA.

Disturbance to or loss of rare plant populations is expected to be moderate in magnitude, limited to the extent of the Project, medium in duration, and moderate in likelihood of occurrence.

7.2.2 Footbridge

This sub-section summarizes the direct and indirect impacts of the development of the Terwillegar Footbridge as well as mitigation measures.

7.2.2.1 Potential Impacts and Mitigation Measures

The potential impacts of the development of the Footbridge may result in changes to the presence and distribution of vegetation species and communities in the same manner as the development of the North and South Trails (see Section 7.2.1). Potential impacts include:

- Windthrow
- Change in plant community composition

- Introduction and/or spread of weeds

For the ease of reading and to reduce redundancy, the mechanisms of these impacts and mitigation measures proposed to address these impacts are described in Section 7.2.1 and are not repeated here.

Development of the Footbridge will result in the removal of approximately 1.3 ha of native upland vegetation (see Table 6-1). Although there were several rare plant species observed historically nearby that have the potential to inhabit the footbridge footprint, no rare plant populations were observed within the footprint during rare plant surveys. As such, there is not anticipated to be any impact to rare plant populations as a result of the development of the Footbridge. After reclamation of temporary features (i.e., laydown areas, access roads, etc.), approximately 0.2 ha of native vegetation will have been permanently removed from the VSA as a result of development of the Footbridge. None of the land units that will be disturbed by the Project are uncommon along the NSR, and none will be completely removed from the VSA. Re-vegetation of temporary areas will be undertaken with native species selected to return these areas resembling pre-disturbance plant communities.

Potential impacts such as windthrow, changes to community composition, and the establishment and spread of weeds are expected to be managed by employing mitigation measures described in Section 7.2.1. No residual impacts are expected as a result of development of the Footbridge.

7.3 WILDLIFE

The following sections discuss impacts to wildlife within and surrounding the Study Area as a result of the Project.

7.3.1 North and South Trails

Potential impacts of the development of the North and South Trails on habitat availability and wildlife pertain to:

- Wildlife mortality
- Habitat loss
- Barriers to wildlife movement

<u>Wildlife Mortality</u>

The Project has the potential to cause wildlife mortality. Removal of vegetation during the breeding season could disturb active nests and other less mobile wildlife, resulting in direct mortality. Noise and other disturbances caused by clearing activities and active construction could cause disturbance-sensitive birds and wildlife adjacent to these activities to abandon active nests and/or young resulting in indirect mortality. Noise has been shown to negatively

influence the behavior of wildlife, sometimes leading to higher energy expenditure and impacting wildlife health (Francis and Barber 2013).

Improper disposal of food waste during and after construction could also lead to problem wildlife being attracted to food waste, which may result in habituation of wildlife. These individuals may be at increased risk of direct mortality from construction activities.

Habitat Loss

The North and South Trails are expected to remove and/or alter permanently 3.92% (3.51 ha) and temporarily 12.8% (11.45 ha) of the Study Area (see Section 7.2). Permanent direct habitat loss and alteration will be limited to the clearing of vegetation along the 3 m wide trails. These areas will no longer be available to species to fulfill their lifecycle requirements. However, much of the proposed trail alignment occurs along existing informal trails of variable width. Tree and shrub clearing is expected to be minimal along these portions of the trail.

Wildlife habitat can also be indirectly lost due to disturbance caused by human activities. Sensory disturbance such as the presence of construction personnel and noise during construction has the potential to decrease the use of wildlife habitat in the zone of influence around the Project footprint. Noise has been shown to reduce passerine bird density and pairing success of ovenbirds in the vicinity of compressor stations (Habib et al. 2007; Bayne et al. 2008). However, construction noise is expected to be sporadic relative to the continuous noise associated with compressor stations.

The impact of noise on amphibians is not well documented with respect to indirect habitat loss, but some studies suggest that noise has low impacts on amphibians (Herrera-Montes and Aide 2011). For instance, traffic noise induced vocalization modifications in some anuran species but did not affect mate attraction (Cunnington and Fahrig 2010, 2013).

Noise has also been shown to affect some mammal species more than others. Ungulates such as caribou (*Rangifer tarandus caribou*) have been shown to be sensitive to noise (Dyer et al. 2001), while other ungulates such as deer and moose appear to be more tolerant to this type of disturbance (Clevenger and Waltho 2000; Laurian et al. 2012). Noise during construction may cause some avoidance of adjacent habitats by mammals and result in increased movements that may cause higher energy expenditure and indirect habitat loss (Bradshaw et al. 1998).

Abundance or diversity of wildlife species does not appear to be influenced by the presence of on-leash or off-leash dogs (Forrest and St. Clair 2006; Reed and Merenlender 2011) but may influence their behavior in urban parks (Lenth et al. 2008).

Disturbance by human and dogs in the Study Area during operation of the trails has the potential to cause indirect habitat loss for shorebirds on the nearby sandbar. Some studies found that shorebirds habituated to human presence on beaches but that domestic dogs were

the greatest source of disturbance to nesting shorebirds (Lafferty 2001; Lord et al. 2001; Morse et al. 2006; Beaudains and Lloyd 2007). Nonetheless, Beaudains and Lloyd (2007) concluded that overall reproductive fitness was not affected by recreational use of the area suggesting that human and dog disturbance have only immediate and short-term impacts.

Habitat degradation may also arise from unintentional spillage of fuel, lubricant, anti-freeze, or other contaminants during construction or operation.

Habitat fragmentation occurs when large tracts of continuous habitat are reduced to smaller, more isolated habitat patches. Smaller habitat patches typically sustain fewer species and/or individuals, and isolation decreases the arrival of new species and/or individuals. Fragmentation of habitat has been shown to negatively affect amphibians, mammals, and birds (Andren 1994; Cushman 2006). Edge habitat also increases with habitat fragmentation and typically mostly influences birds.

Barriers to Wildlife Movement

Landscape permeability and habitat connectivity are important factors allowing individuals of a species to exchange genes, disperse, or migrate and ultimately persist across the landscape (Fahrig and Merriam 1985; Heinen and Merriam 1990).

The North and South Trail footprint, recreational activities, and construction disturbance occurring in the Study Area have the potential to result in barriers to the movement of wildlife. Responses to disturbance are species-specific, such that some species are highly sensitive to disturbance and will avoid areas of even minor anthropogenic activity; while other species can tolerate a variety of activities associated with urban/suburban development in close proximity. As such, construction as well as the presence of humans and their dogs on the trails may acts as barriers to wildlife movements for some species. The presence of construction personnel and noise are likely to deter wildlife from crossing the trails during construction.

The barrier impact has the potential to be greater on small mammal and amphibians due to their limited dispersal abilities. For instance, amphibians typically require good connectivity between their seasonal habitats and the presence of barriers such as roads have been shown to disrupt their movement (e.g. Gravel et al. 2012), sometimes reducing gene flow (Holderegger and Di Giulio 2010). However, trails are more permeable than roads and are not expected to pose a barrier to wildlife movement (Stantec Consulting Ltd 2010). The presence of trails was found to be beneficial in some instances. The maintenance practice of removing branches and logs from walking trails was also shown to be beneficial to terrestrial salamanders by creating additional microhabitats (Davis 2007).

The barrier impact should be limited for medium-sized and large mammals, songbirds and raptors. For instance, red squirrels (*Sciurus vulgaris*), mule deer and coyote were shown to be more tolerant to human disturbance than other species (George and Crooks 2006; Lowney

2011). Songbirds appear to be disturbed by human presence on trails but (Miller et al. 2001) but their nest survival remained similar (Smith-Castro and Rodewald 2009). The presence of trails along a riparian corridor did not have a barrier impact for red-tailed hawks (*Buteo jamaicensis*) and bald eagles but both species avoided perching near the trails. Nonetheless, a bald eagle was observed incidentally perching on the Oleskiw lands near the future bridge location, an osprey was observed incidentally flying over the NSR south of the Study Area, and two nocturnal raptors (barred owl and northern saw-whet owl) were detected in the Study Area during the amphibian survey. This would suggest that raptors in the Study Area have some habituation to human presence.

Bald eagles typically nest in mature or old-growth forest near waterbodies. They are also known to nest within 100 m of human development. Home range sizes can be highly variable but in Saskatchewan are no smaller than 700 ha and in Oregon the average home range size is over 2,000 ha (Environmental Protection Agency 2014). No nests of bald eagles were observed during any field surveys, including breeding bird surveys, amphibian surveys and two fisheries assessments.

Osprey nest on artificial platforms and natural nest sites, for example large trees, cliffs, power poles, and specially designed nesting platforms. This species can commute between 10 and 20 km to foraging sites (Poole et al. 2002).

ESC measures expected to be used during construction (e.g., silt fences) may also act as barriers to species unable to move around or over them. Impacts should affect mostly small mammals and amphibians due to their low dispersal abilities. Some medium-sized mammals such as common porcupines or white-tailed jack rabbits may also be negatively affected. Birds and larger animals such as ungulates are not likely to be impacted negatively by silt fences as they can easily traverse around fenced areas.

City of Edmonton Wildlife Passage Design Guidelines (Stantec Consulting Ltd. 2010) indicate that trails do not pose a barrier to wildlife passage. Therefore, specific design elements of bridges and culverts for wildlife passage across the trail are not anticipated. The pedestrian bridges recommended for the ephemeral stream crossings, or culverts, if necessary in the north and south portions of the Study Area are unlikely to act as barriers to wildlife movement. Small mammals and amphibians should be able to easily traverse under the clear span bridge or over the trail, while medium and large mammals will go around the bridge and cross the trail. Culverts designed with natural substrate similar to the natural channel, including the watercourse and dry passage areas, are likely to support movement of amphibians and small mammals and pose minimal risk of becoming a barrier to movement (Stantec Consulting Ltd. 2010).

7.3.1.1 Mitigation Measures

The following mitigations have been developed for the North and South Trails and are expected to reduce impacts of the Project on wildlife:

Mortality

- Vegetation clearing will be completed outside the migratory bird nesting window. If this window cannot be avoided, qualified biologists should conduct nest sweeps to identify active nests and nest setbacks should be applied if nests are found.
- Signage prohibiting dogs on sandbars and off-leash dogs outside of the designated Terwilligar Park Off-leash Area should be installed in appropriate locations along the trail to notify users of restrictions; signage will follow the guidelines outlined in the City of Edmonton's River Valley Wayfinding program
- Construction personnel should not feed or harass wildlife.
- Waste products should be stored in secure containers and transported to appropriate facilities during construction.
- Wildlife-resistant garbage bins should be installed along trails.
- If nesting birds or other wildlife are observed on the active construction site, construction activity should be stopped and the appropriate wildlife authorities contacted immediately.

Habitat Loss

- Project footprint should be minimized.
- Previously disturbed areas should be used where ever possible.
- Temporarily impacted construction areas should be reclaimed and re-vegetated with native species.
- Construction activities associated with the trails should be restricted to specific hours as per the City of Edmonton's Community Standards Bylaw (City of Edmonton 2013).
- Signage prohibiting dogs on sandbars and off-leash dogs on all trails outside of the designated Terwilligar Park Off-leash Area should be installed in appropriate locations along the trail to notify users of restrictions.
- Bylaw officers should patrol the north portion of the Study Area to enforce the exclusion of dogs on sandbars and the on-leash policy.
- An environmental emergency spill response and contingency plan should be developed and implemented.
- Spills should be reported to the 24-Hour Alberta Environmental Hotline at 1-800-222-6514 and other applicable agencies.
- Chemicals should be stored in environmentally safe containers.
- In the event of a spill, the spill should be contained, monitored, and cleaned up.

Barriers to Wildlife Movement

- Project footprint should be minimized.

- Construction activities associated with the Project should be restricted to specific hours as per the City of Edmonton's Community Standards Bylaw.
- Openings at regular intervals should be created in silt fences where ever possible and when ESC measures are not compromised.
- A pedestrian bridge should be used for the ephemeral stream crossings , if possible. Should a culvert be installed instead of a pedestrian bridge, a box culvert or arch pipe are recommended.

7.3.1.2 Residual Impacts

Wildlife Mortality

Increased risk of wildlife mortality is expected to occur at a low magnitude, to the spatial extent of the project, over a long duration, and has a low likelihood of occurrence. Wildlife mortality is not expected during or after construction. Furthermore, the presence of construction personnel and noise are likely to deter wildlife from approaching construction areas.

Habitat Loss

Habitat loss is expected to occur at a low magnitude, to the spatial extent of the project, over a long duration, and has a high likelihood of occurrence. The areas permanently cleared of vegetation will no longer be available to wildlife species. However, the permanent Project footprint is small (<5% of the Study Area), and the habitat types lost are common along the NSR (See Section 7.2). Species abundance and diversity, including species of management concern, are not anticipated to be adversely affected by the North and South Trail.

Impacts due to fragmentation are anticipated to be low, trails are narrow (3 m) allowing for wildlife species to move freely across the disturbed area. In addition, a majority of bird species detected during the breeding bird survey are already adapted to forest edges except for a few adapted forest interior species (i.e., American redstart, barred owl, hairy woodpecker, pileated woodpecker, and red-eyed vireo). Observations of American redstarts, barred owls, and pileated woodpeckers were all in the Terwillegar Park area. The only observations of red-eyed vireos were in the Oleskiw lands, where there were found throughout the forest.

Noise due to construction activities will be limited to specific hours as per the City of Edmonton's Community Standards Bylaw (City of Edmonton 2013) and will only occur for the duration of construction.

The possibility that people and dog access the sandbar in the north portion of the Study Area exists. Appropriate signage prohibiting dogs on sandbars and Bylaw enforcement should reduce the likelihood of this happening. Furthermore, the trail comes near the sandbar for a short distance and is not directly adjacent to the NSR edge (approximately 20 m away), which should discourage most people from accessing the sandbar because of the dense vegetation

along the bank. No viewpoints have been designed near the sandbar. The forest and water channel between the North Trail and the sandbar should act as a visual and noise buffer reducing the disturbance of human and dog use of the trail to shorebirds nesting on the sandbar. The forested portion of the north trail is home to a wildlife population that is made up, primarily, of edge-tolerant and disturbance tolerant wildlife species, such that indirect habitat loss from the trail or human use of the trail is expected to be low. The trail follows an area of existing disturbance and is not expected to contribute substantially to the overall fragmentation of the forested area.

Barriers to Wildlife Movement

Barriers to wildlife movement are expected to occur at a moderate magnitude, to the spatial extent of the project, over a long duration, and have a moderate likelihood of occurrence. Given that there are existing informal trails currently in use, especially in the south portion of the Study Area, wildlife in the area are habituated to some level of human and dog disturbance in the Study Area.

The physical barrier represented by the Project permanent footprint is small (<5% of the Study Area) and should have a limited impact on wildlife. The barrier impact caused by construction activities may cause avoidance of the Study Area by some species, but only for the duration of construction.

The overlap between trail users and wildlife usage of the Study Area may be limited. Peak user time of the Study Area should be mostly confined to daytime and early evening whereas several wildlife species occurring in the Study Area are mostly active at dusk, dawn, or during the night. For instance, the peak activity window of songbirds occurs around sunrise and sunset, ungulates are typically more active at dusk and dawn, and small mammals and nocturnal raptors are more active at night. These separated activity windows should reduce the barrier effect on wildlife caused by human and dog disturbance.

Literature also suggests that formal trails appear to have less negative consequences to wildlife than informal trails. Colorado State Parks (1998) identified controlled access to environmentally sensitive or socially valued areas to reduce the overall impact of multiple informal trails through a highly desired area. Multiple informal trails can have overall greater impact on wildlife than a single trail where access to wildlife habitat is controlled and predictable. The predictability of human activity (where it occurs and when it occurs) may improve the ability of wildlife to adapt and habituate to human use of an area (Colorado State Park 1998). For instance, off-trail encounters with ungulates and birds were shown to result in increased energy expenditure by the animals (Neumann et al. 2010, Miller et al. 2001). Thus, implementing formal trails may reduce the effect of barriers to wildlife movement caused by the current informal trails, especially in Terwillegar Park.

The informal trails associated with this use can affect wildlife habitat, especially when the spur trail ends at sensitive habitat types.

7.3.2 Footbridge

Potential impacts of the Footbridge on wildlife include:

- Wildlife mortality
- Direct and indirect habitat loss
- Barriers to wildlife movement

Wildlife Mortality

Wildlife mortality may be impacted by the construction and operation of the Footbridge. As with the trails (see Section 7.3.1), removal of vegetation and ground disturbance during the breeding season may result in mortality for slow-moving wildlife that are not able to avoid machinery, including some small mammals and amphibians. Ground disturbances, including excavation, filling, placement of rip rap, etc. in the winter may disrupt overwintering Canadian toads.

Canadian toads were detected at a number of amphibian survey points in 2013 (see Figure 6.2), and are likely breeding in the NSR valley. Canadian toads breed in a variety of water bodies and wetlands from mid-May to August, but spend most of the year in terrestrial habitat. Hibernation typically begins in mid-September in Alberta (Kuyt 1991), typically in well-established hibernacula in sandy soils (Kuyt 1991; Hamilton et al. 1998). Hibernacula can be several hundred metres to a kilometre from breeding areas (Kuyt 1991). During hibernation, Canadian toads are vulnerable to ground disturbance activities and are not able to avoid construction equipment.

Lighting on the bridge may also impact mortality for birds during spring and fall migration. Birds that migrate at night can be attracted to sources of artificial light, especially during conditions of poor visibility, including fog, rain, etc. (Poot et al. 2008; Longcore and Rich 2004; Evans Ogden 1996). When birds are attracted to lighted structures, mortality can subsequently occur from collision with the structure, increased susceptibility to predation if birds aggregate around the light, and exhaustion from reluctance to leave the lit area (Evans Ogden 1996). Resident birds may habituate to existing sources of light and the risk of mortality is reduced.

Information on bat mortality related to night lighting is scarce. However, night lighting can impact daily emergence from daytime roosts, thereby limiting potential foraging opportunities (Swift 1980). Some bats may also be attracted to night lighting while foraging on insects drawn to light (Longcore and Rich 2004). Risk of predation near lights may increase, as with birds (Longcore and Rich 2004). No information could be found on bat collisions with infrastructure due to night lighting.

Direct and Indirect Habitat Loss

The project footprint will have both direct and indirect impacts to wildlife habitat. Direct impacts to wildlife habitat will include the loss of habitat associated with the temporary and permanent footprint of the bridge, including laydown areas, stockpile areas, construction access, bridge abutments and permanent ESC measures (i.e., rip rap). Direct loss of habitat will peak during construction and will be reduced to the permanent project footprint during Project operation. Direct impacts to wildlife habitat from the bridge are expected to be similar to those outlined for the trails.

The extent of the Footbridge footprint during construction, including the permanent footprint (0.23 ha), and all laydown areas, stockpile areas, and access roads is 11.44 ha. Of this total area 11.22 ha will be re-vegetated or reclaimed following completion of Footbridge construction in November 2016.

Of the temporary workspace that is directly impacted by the Project footprint, 10.13 ha (90%) is in previously disturbed areas. On the north side of the NSR all of the stockpile and laydown areas are located in the agricultural field. Fields of this type typically provide low quality wildlife habitat due to the uniform vegetation structure and increased visibility and associated risk of predation.

The permanent footprint of the Footbridge includes the bridge structure and the permanent rip rap installed as ESC measures. The Footbridge structure and permanent rip rap represents approximately 0.07 ha and 0.15 ha of wildlife habitat, respectively. This is currently made up of tall and short shrubland alliance communities and aspen and balsam poplar woodland alliance communities in the riparian zone of the NSR. Riparian habitats are typically some of the most biologically diverse habitats and are home to a variety of wildlife species including moose, deer, and a multitude of songbirds, amphibians, and small mammals.

Indirect impacts to wildlife habitat are also expected to peak during project construction, and may include the effect of noise, light, and activity during construction of the bridge. These activities may deter wildlife from using areas adjacent to the Project footprint. Responses to anthropogenic activities, including construction, are species specific and the zone of influence will vary by species. See Section 7.3.1 for a discussion on the impacts of construction activity and noise on indirect habitat loss.

During operation of the Footbridge indirect impacts to wildlife habitat are expected to be confined to areas immediately adjacent to the permanent project footprint. While the infrastructure itself will have minimal indirect impacts on wildlife, use of the Footbridge by pedestrians, cyclists, etc. may deter wildlife from adjacent areas. These impacts are expected to be similar to those associated with the trails as discussed in Section 7.3.1.

Barriers to Wildlife Movement

Many species of wildlife, including moose, deer, and coyote utilize riparian areas as movement corridors and the NSR valley is an important movement corridor within the City of Edmonton (Stantec Consulting Ltd. 2010; Leblanc et al. 2006). The valley is also home to a large portion of the native vegetation in the City, making it an important wildlife reserve system for the region and providing important seasonal and annual dispersal corridors for a variety of wildlife. Moose, deer, shorebirds, bald eagle, coyote, red fox, a multitude of songbirds, and small mammals use the NSR valley.

Construction of the Footbridge will impact the ability of wildlife to move through the NSR valley. Anthropogenic activity associated with construction may deter wildlife from crossing the Footbridge construction zone, or may force them to move upland to go around the construction zone. Because construction will be confined to primarily within daylight hours as per the City of Edmonton Community Standards Bylaw, wildlife may alter their diurnal patterns to cross or go around the construction zone during dawn, dusk, or night. Some wildlife species that are less mobile (e.g., small mammals, amphibians) may be completely deterred from crossing during construction.

Lighting of the Footbridge may pose a barrier to bats. While some bats are attracted to light due to the foraging opportunities afforded by the insects that congregate there, many bats avoid artificial light sources. Bats forage in and around water bodies, including the NSR, and may be deterred from crossing the Footbridge due to the bank of lights running across the NSR along the bridge deck.

7.3.2.1 Mitigation Measures

Best management practices (BMPs) and project specific mitigation measures below will be employed to mitigate impacts of the bridge on wildlife habitat and wildlife movement. Relevant mitigation measures discussed for the trails will be applied to the Footbridge construction and operations wherever applicable.

Footbridge design mitigations are identified below and divided into the primary impact they are designed to mitigate for.

Mortality

- Vegetation clearing will be completed outside of the primary breeding bird season wherever practical; where clearing is required during the breeding bird season a qualified wildlife biologist will conduct a pre-construction nest search.
- Excavation and filling for the bridge abutments and power lines will occur outside of the hibernation period for Canadian toads, wherever practical.

- Lighting for the bridge will conform to safety standards required by Transport Canada and the City of Edmonton and will be down lit, wherever possible, to minimize glare and ambient light that may attract or distract migrating birds and bats.
- Waste products should be stored in secure containers and transported to appropriate facilities during construction.
- Wildlife-resistant garbage bins should be installed near the bridge.

Direct and Indirect Habitat Loss

- The stressed ribbon style of bridge facilitates a small footprint for the bridge abutments, resulting in minimal direct habitat loss for wildlife.
- Temporary workspaces, including laydown and stockpile areas, and access roads are situated in areas of low quality wildlife habitat (i.e. hayfield).
- Areas of temporary vegetation clearing (i.e., laydown areas, access roads) should be reclaimed as soon as they are no longer required, and re-vegetation activities should focus on the re-establishment of native vegetation resembling pre-development communities.

Barriers to Wildlife Movement

- Rip rap will be installed to avoid sharp, vertical side walls and remain passable by wildlife.
- Natural substrate and vegetation should be retained/reclaimed wherever possible along the riparian areas to facilitate wildlife movement via a Wildlife Passage under the Footbridge, following the guidelines set out in the City of Edmonton's Wildlife Passage Engineering Design Guidelines (Stantec Consulting Ltd. 2010).
- Lighting for the bridge will conform to safety standards required by Transport Canada and the City of Edmonton and will be down lit wherever possible to minimize glare and ambient light that may attract or distract migrating birds and bats.

7.3.2.2 Residual Impacts

Mitigative measures identified above are designed to reduce Project impacts to wildlife mortality, habitat, and movement.

Wildlife Mortality

With the above mitigation measures in place, the impact of the Footbridge on wildlife is expected to be of low magnitude, at the project extent, with the peak impact occurring over a short duration. Should excavation activities occur during Canadian toad hibernation periods it is possible that some mortality may occur. Identifying hibernacula and trans-locating toads is extremely difficult once hibernation has initiated. The likelihood of occurrence of mortality to toads during excavation is expected to be low given the small scale of excavation within the Project footprint.

Indirect and Direct Habitat Loss

A total of 1.23 ha of suitable wildlife habitat is expected to be directly impacted due to the construction of the Footbridge. The remainder of the impacted habitat is agricultural field or tame grass, which typically provides very low suitability wildlife habitat. Habitat types impacted by the project are common in the Study Area and throughout the NSR valley in the City of Edmonton. Loss of these habitats is not expected to result in loss of wildlife biodiversity in the Study Area.

Indirect impacts to wildlife habitat are expected to peak during construction, when anthropogenic disturbance is greatest. During operation of the Footbridge, indirect impacts to wildlife are expected to be contained to the effect of trail users (e.g., pedestrians and cyclists).

Overall, the Footbridge is expected to have a low magnitude impact on direct and indirect wildlife habitat loss. The spatial extent of the impact will be local, with the peak impact occurring in the short duration during construction. There is a high likelihood of the impact occurring.

Barriers to Wildlife Movement

Construction activity will deter wildlife from passing through the bridge footprint (including abutment, pier and rip rap construction areas). It is expected that wildlife moving through the area will either modify their route by going up and over the construction zone and/or modify their diurnal cycle to pass through the area during times of low activity (i.e., dawn, dusk, night). On the south side of the NSR sufficient vegetation cover is available around the construction zone to accommodate secure wildlife passage. On the north side, wildlife may be re-routed at least partially into the hayfield to cross the construction zone. Wildlife species with limited mobility (i.e. small mammals and amphibians) are not likely to cross the construction zone and connectivity will be lost for these species during construction. Canadian toads' primary lifecycle movement is from breeding ponds and rivers in the summer to upland areas in the fall/winter. These movements are not expected to be impacted by bridge construction.

During operation of the bridge, few or no barriers to wildlife movement are expected. Most wildlife will continue to traverse around the bridge. Reclamation of natural substrate and vegetation wherever possible under the bridge deck and between the rip rap will facilitate movement of small mammals and amphibians. A designated Wildlife Passage will be constructed under the north abutment to facilitate wildlife movement, following the guidelines identified in the City of Edmonton's Wildlife Passage Engineering Design Guidelines (Stantec Consulting Ltd. 2010). The wildlife passage is 7.4 m wide and approximately 10 m high. The side wall up to the bridge abutment is gently sloping (see Appendix D Drawing TPFB-PD-SO2). The wildlife passage and sidewall will consist of natural substrate and will be vegetated with native vegetation. Tree compensation from clearing activities will be used to revegetate the approaches to the Wildlife Passage for improved cover for wildlife. Appendix C Drawing TPFB-DD-TA-RP-02 includes details of seed mix and reclamation of the north abutment. As per the

WPEDG, the total length of natural vegetation will be greater than 10 m (see Section 4.5.15 of WPEDG; Stantec Consulting Ltd. 2010). The size of the Wildlife Passage will be sufficient to facilitate movement of ungulates and other large and medium-bodied animals. Low-lying vegetation, such as grasses, forbs and low shrubs will be incorporated into the reclamation plan to facilitate movement of smaller animals under the bridge (Stantec Consulting Ltd. 2010).

Lighting of the Footbridge will be designed so as to minimize spill and ambient light to minimize impacts to bats and birds.

With these mitigation measures in place it is expected that the overall impact of the project on wildlife movement will be of moderate magnitude, with barriers to movement for some species during construction. The wildlife corridor along the NSR valley will not be eliminated; however, during construction some wildlife may be deterred from crossing the construction zone, resulting in a disruption to wildlife movement. The spatial extent of the impact is expected to be local, and the duration will be short term. The likelihood of occurrence of this impact is high.

7.4 FISHERIES

The following sections discuss impacts to fisheries within and surrounding the Study Area as a result of the Project. The North and South Trails are anticipated to have a negligible impact on the fisheries and therefore in-stream works will be the primary discussion on the potential impacts to fisheries.

7.4.1 Temporary Bridge Construction Access Roads

Potential impacts of the development of the temporary bridge construction and access roads on fish and fish habitat include:

- Vegetation clearing
- Deleterious substances (suspended sediments)
- Fish Mortality (suspended sediments)
- Temporary loss of fish habitat

Clearing vegetation at the temporary access road is not expected to cause any impacts to fish habitat because the portion of the river bank within the Study Area is relatively steep, contains little vegetation, and vegetation that is present does not currently provide shade or cover for fish. This will increase soil exposure, resulting in the possibility of erosion occurring during or following a storm event, particularly on the south side of the NSR where erosional banks are evident. This may result in deleterious substances entering the NSR, which would impact fish and fish habitat.

Mitigation Measures

A QAES should be retained to conduct regular sediment monitoring of in-stream activities to ensure that adverse impacts are avoided or minimized.

As discussed in Section 7.5.1, the CCME guidelines outlines monitoring water quality of suspended sediments during construction.

ESC measures will be required during all phases of construction for the temporary bridge access on the north and south sides of the NSR. This will reduce soil displacement with the use of silt fences and other selected ESC control measures.

If any ESC or containment measures fail and sediment laden runoff water enters the NSR, the proper authorities ESRD will be notified immediately of a release. In addition, provincial and municipal authorities will be notified as necessary. The general contractor will be required to determine where the deficiencies in ESC measures occurred and to repair these deficiencies immediately. All disturbed areas will be re-vegetated as part of the ESC measures and final reclamation plan.

Residual Impacts

Residual impacts of the access roads fish and fish habitat will have a low magnitude with a low likelihood of occurrence after all mitigation measures are in place. During construction, a QAES consultation and implementation of ESC measures will reduce the potential impact for the introduction of deleterious substances. The spatial extent of the impact is expected to be within the project and the duration will be short term.

7.4.2 Footbridge

The following sections outline potential impacts to fisheries as a result of the construction and operation of the proposed footbridge.

7.4.2.1 Temporary Bridges

Potential impacts of the temporary bridges on fish and fish habitat include:

- Direct habitat alteration during construction of the temporary bridge pilings
- Deleterious substances (suspended sediments)
- Fish Mortality (suspended sediments)
- Temporary loss of fish habitat

The temporary bridge structures are anticipated to directly alter fish habitat within the area of the temporary bridge pilings. This could introduce deleterious substances during installation construction activities.

An increase in suspended sediment in the NSR due to erosion and sediment release from the Project footprint can directly or indirectly affect fish populations. Fine sediments have a long-term effect on fish habitat when they settle out on the substrate, filling in interstitial spaces and smothering spawning beds (Grant et al. 1986). The infill of the channel bed reduces the capacity of the waterway to accept greater flows, thus increasing susceptibility to flooding. High gradient streams are less susceptible to sedimentation because of their high capacity to flush introduced sediment. Fine sediments can increase fish mortality by causing inflammation of the gill membranes or by adhering to mucous on the gill and providing a substrate for bacterial gill infections (Lynch et al. 1977).

Sedimentation and turbidity can indirectly affect fish by reducing primary productivity, destroying the habitat of fish food organisms, increasing the drift rate of benthic organisms (Lynch et al. 1977), and reducing the abundance of benthic organisms (Culp and Davies 1983).

Mitigation Measures

This type of construction is considered mitigation by reducing the overall in-stream footprint. The extent of the berms is reduced from the shoreline to a location in-stream, temporarily affecting a smaller area of fish and fish habitat.

As discussed in Section 3.1.1, personnel are required to notify and report if serious harm to fish and/or a deleterious substance deposit occurs in the water body (DFO 2013a).

A QAES should be retained to conduct regular sediment monitoring of in-stream activities to ensure that adverse impacts are avoided or minimized.

Machinery required to perform work should be serviced and maintained within a designated staging/laydown area at least 100 m away from the stream bank, to prevent the leaking of fuels, lubricants, and hydraulic fluids. All maintenance work and refueling should be performed within the staging/laydown area. Every precaution will be taken to avoid/contain spills during maintenance and refueling of this equipment.

ESC measures will be required during all phases of construction for the temporary bridge access on the north and south sides of the NSR. The use of silt fences and other selected ESC control measures will reduce potential for soil displacement.

If any ESC or containment measures fail and sediment laden runoff water enters the NSR, the proper authorities at ESRD will be notified immediately. In addition, provincial and municipal authorities will be notified as necessary. The general contractor will be required to determine where the deficiencies in ESC measures occurred and to repair these deficiencies immediately.

Residual Impacts

If the described mitigation measures are implemented, the impact of the temporary bridges on fisheries is expected to be of low magnitude, at the project extent, with the peak impact

occurring over a short duration. The likelihood of occurrence is expected to be low given the small scale of excavation within the project footprint.

7.4.2.2 Berms, Footbridge Piers, Bank Stabilization

Potential impacts of the berms and footbridge piers on fish and fish habitat include:

- Direct habitat alteration through channel modifications during construction of berms, footbridge piers and bank stabilization
- Deleterious substances (suspended sediments) levels increased during installation of the berms, footbridge piers and bank stabilization activities
- Stream flow disruption within the channel during construction
- Fish entrapment in the isolated berm and Aqua Dam area
- Fish entrainment on water pumps
- Fish mortality (sediments, entrapment, entrainment)

Addition of anthropogenic barriers to fish movement (berms) adversely affects fish populations by restricting habitat availability. Increases in suspended sediment levels may harm fish directly through physiological changes in blood chemistry, physical damage, decreased feeding efficiency, loss of spawning habitat, smothering of incubating eggs, and reduction in benthic invertebrates, which are a food source for fish, through sedimentation on substrates (Newcombe and Jensen 1996).

Stream flow disruption can impede the ability of fish to move or migrate within the channel to feed, escape predation, reproduce, or to reach suitable habitat for sustaining survival. Fish entrapment and entrainment could occur during isolation of the berms.

Spring floods and high volumes of flows may cause damage to the berms. Scour pools and sediment deposits could form in areas immediately in front and behind each berm.

The permanent footbridge pier structures have the potential to introduce concrete materials to the NSR and may impact water quality, causing impacts to fish health.

Mitigation Measures

As discussed in Section 3.1.1, discussions with ESRD are required if the contractor determines construction activities will occur within the RAP. In addition, personnel are required duty to notify and report if serious harm to fish and/or a deleterious substance deposit occurs in the water body (DFO 2013a).

Placement of Class 2 rock rip rap will temporarily affect in-stream fish habitat upstream. A silt curtain or other approved alternative will be used to isolate the area during construction of the berm. During this time, the berm structural maintenance must be monitored throughout the in-stream placement and construction. Ice break up and spring floods could impact berm

structural integrity and introduce deleterious substances into the NSR. Failing to remove the berms as per the design schedule will result in a significant impact to fish and fish habitat.

Mitigation requirements for stream flow disruption will be minimal as the berms will be confined to selected portions of the channel in two locations. This will permit the river channel to remain unobstructed, minimizing the potential for creating a velocity and structural barrier to fish passage.

ESC measures must be installed to prevent sediments from entering the NSR and must be monitored for deficiencies. If required, repairs should be made in a timely fashion to reduce sediments entering the NSR. If any ESC or containment measures fail and sediment laden runoff water enters the NSR, the proper authorities at ESRD will be notified immediately. In addition, provincial and municipal authorities will be notified as necessary.

All equipment should be operated from outside of the NSR in a manner that minimizes disturbance to the bank of the NSR. Machinery required to perform this work should be serviced and maintained within a designated staging/laydown area at least 100 m away from the stream bank, to prevent the leaking of fuels, lubricants, and hydraulic fluids. All maintenance work and refueling should be performed within the staging/laydown area. Every precaution will be taken to avoid/contain spills during maintenance and refueling of this equipment. Should equipment be required within the river (i.e., for rip rap installation along the NSR banks), the oil within the equipment should be changed to a biodegradable oil.

Following installation of the berms and silt curtain, fish salvage within the isolated area should be completed by a QAES prior to starting construction activities for the concrete pier footings. A QAES should also be retained to conduct regular sediment monitoring of in-stream activities to ensure that adverse impacts are avoided or minimized. Water pumps used for dewatering must be fitted with intake screens in order to protect fish from being taken into pumps and harmed (DFO 1995). Water flow must be maintained around the berms.

An Aqua Dam has been recommended before bank stabilization activities occur. Placement will be parallel to the shoreline of the NSR to allow water to be pumped out of the area on each side of the NSR (TPFB-PD-S02A, Appendix D). Rip rap is to be keyed into the bank 1 m below the river bed surface. A QAES should also be retained to conduct regular sediment monitoring of in-stream activities to ensure that adverse impacts are avoided or minimized. Water pumps used for dewatering must be fitted with intake screens in order to protect fish from being taken into pumps and harmed (DFO 1995). Water flow will be maintained around the bank stabilization activities. This will reduce the impact of deleterious substances to an area restricted within the Aqua Dam.

<u>Residual Impacts</u>

After the completion of the Terwillegar Park Footbridge, including the implementation of mitigation measures, there will potentially be harmful alterations to in-stream areas of the NSR as

described in Section 3.1.1. DFO has developed the Fisheries Productivity Investment Policy (DFO 2013b) to provide guidance to proponents for developing effective measures to offset serious harm to fish. The temporary affects total 5,639.1.3 m^2 of fish habitat that will be temporarily altered by the berms. The alterations will result in the temporary loss of fish habitat for approximately one year. The structures will be removed after completion of the construction of the two pier structures.

The permanent effects total 88 m^2 of fish habitat removed as a result of the construction of two in-stream bridge piers. To ensure that the offset measures match the potential loss in productive habitat, the habitat will be offset at a 2:1 ratio, resulting in the need to offset for 176 m^2 of fish habitat.

A number of offsetting measures are proposed to counterbalance the unavoidable alterations to fish habitat in the NSR. These measures will be discussed with DFO, ESRD and Transport Canada and can include localized improvements to habitats with erosional issues located upstream and downstream from the bridge abutments.

The placement of boulder clusters along the rock rip rap in areas with fine substrate and homogenous habitat would provide habitat diversity and overall potentially improve habitat functionality. The rock could provide effective cover in the interstitial spaces, a beneficial substrate for aquatic invertebrates, algae growth, and velocity cover. However, placement of this rock may impede navigation.

Habitat enhancement in tributaries to the NSR is another offsetting technique that could be provided in Wedgewood Creek located upstream of the Fort Edmonton footbridge on the left downstream bank. This could provide an enhancement of spawning habitat in the mouth of the tributary or access to those habitats. As stated in the policy "In situations where offsets are realized away from the project site, a robust rationale is required and should be communicated to potentially affected parties (DFO 2013b)". This will require additional applications and delay the project.

In addition, enhancing the natural river features in erosional habitats with root wad structures along the rip rap could provide fish habitat in forms of cover and velocity refugia. This would provide rearing and feeding habitat for species residing throughout the Project area including habitat creation for northern pike.

Should discussion with DFO, ESRD and Transport Canada result in the choice of providing habitat offsets at an alternate location (i.e., in a tributary stream or other location on the NSR), it is understood that an addendum to this report or additional study may be required to meet the requirements of the City of Edmonton.

During construction, a QAES consultation and implementation of ESC measures will reduce the introduction of deleterious substances from impacts resulting from the berm construction.

Overall, the berms and footbridge piers are expected to have a low magnitude impact with a low likelihood of occurrence. The spatial extent of the impact will be within the project, with the peak impact occurring in the short duration during construction including installation and removal of the berms. Direct habitat alteration likelihood will be high and will occur during construction of the berms and permanent alteration after complete installation of the pier structures.

7.5 WATER QUALITY OF THE NORTH SASKATCHEWAN RIVER

The following sections discuss impacts to water quality within and surrounding the Study Area as a result of the Project. The north and south trails are anticipated to have a negligible impact on water quality and therefore in-stream works associated with the bridge construction will be the primary discussion on the potential impacts to water quality.

7.5.1 Temporary Bridge Construction Access Roads

Potential impacts of the Temporary Bridge construction access roads on water quality values pertain to:

- Vegetation clearing
- Soil exposure
- Deleterious substances (suspended sediments)

Clearing vegetation for construction of the temporary access roads that will access the berms will increase soil exposure, resulting in the possibility of erosion occurring during or following a storm event, particularly on the on the south side of the NSR due to the presence of erosional banks. This may result in an introduction of a deleterious substance into the NSR, which could impact water quality through increased turbidity values.

Mitigation Measures

A QAES should be retained to conduct regular sedimentation monitoring of in-stream activities to ensure that adverse impacts to water quality (turbidity) are avoided or minimized.

Due to the potential for deleterious substance release into the NSR, water quality (i.e., turbidity) should be monitored by a QAES during in-stream works. The QAES may provide recommendations for isolation and guideline values for increases in turbidity according to CCME guidelines (CCME 2011).

The CCME guidelines suggest that total suspended solid (TSS) increases should not exceed 10 mg/L when background suspended solids levels are <100 mg/L. TSS can be monitored during construction throughout the year as part of a suspended sediment release monitoring plan. Appropriate contingency measures for the release of suspended sediments would be outlined in the construction monitoring plan.

All machinery required to perform this work should be serviced and maintained within a designated staging/laydown area at least 100 m away from the stream bank, to prevent the leaking of fuels, lubricants, and hydraulic fluids. All maintenance work and refueling should be performed within the staging/laydown area. Every precaution will be taken to avoid/contain spills.

Machinery should be operated from outside of the water body in a manner that minimizes disturbance to the banks. It should arrive clean and be maintained as to be free from leaks and spills during maintenance and refueling of this equipment.

Due to the on-site presence of fuels, lubricants and hydraulic fluids, the contractor should be required to have a spill containment kit on site at all times.

ESC measures will be required in North and South Abutment Laydown Areas for the start of construction for the temporary bridge access on the north and south sides of the NSR. This will reduce soil displacement through the use of silt fences and/or other selected ESC measures.

If any ESC or containment measures fail and sediment laden runoff water enters the NSR, the proper authorities will be notified immediately so that appropriate actions may be taken to report a release. In addition, provincial and municipal authorities will be notified as necessary (Stantec 2013a). Stantec will work closely with the general contractor to determine where the deficiencies in ESC measures occurred and to repair these deficiencies immediately.

Residual Impacts

With these mitigation measures in place it is expected that the impact of the access roads on water quality will be of a low magnitude with a low likelihood of occurrence. During construction, a QAES consultation and implementation of ESC measures will reduce risk for introduction of deleterious substances from vegetation clearing and soil exposure. The spatial extent of the impact with vegetation clearing and soil exposure is expected to be within the project, and the duration will be short term. Should the introduction of deleterious substances occur, it is expected to be local and of short term duration.

7.5.2 Temporary Bridges

Potential impacts of the temporary bridges on water quality include:

- Deleterious substances (suspended sediments)

Introduction of deleterious substances could occur during site access along the banks and the temporary piling installation in the NSR. Due to the steep slopes along the south bank of the NSR, construction materials may enter the bed and shore of the NSR by falling down the slope from the access road.

Mitigation Measures

Due to the potential for deleterious substance release into the NSR, water quality (i.e., turbidity) should be monitored by a QAES during in-stream works. The QAES may provide recommendations for isolation and guideline values for increases in turbidity according to CCME guidelines.

As discussed in Section 7.5.1, the CCME guidelines outlines monitoring levels of suspended sediments during construction. In the event of a spill, the spill should be contained, monitored and cleaned up. An environmental emergency spill response and contingency plan should be developed and implemented. Spills should be reported to the 24-Hour Alberta Environmental Hotline at 1-800-222-6514 and other agencies.

Due to the on-site presence of fuels, lubricants and hydraulic fluids, the contractor should be required to have a spill containment kit on site at all times.

An erosion and sedimentation control plan should be developed by the contractor to avoid increased suspended solids levels or sedimentation of the NSR during construction and operation of the Project. This plan may include silt fences and straw wattles around the perimeter of the Project footprint and near the access roads to the temporary bridges. ESC measures as discussed within Sections 2.2.7 and 2.2.8 will protect this area, and a silt fence installed along the edge of the water within the NSR will prevent any runoff that that may originate from within this area from entering the NSR.

Residual Impacts

The temporary bridges are expected to have a low magnitude impact and low likelihood of occurrence affecting water quality with the introduction of a deleterious substance. The spatial extent of the impact will be local, with the peak impact occurring in the short duration during construction including installation and removal of the temporary pilings.

7.5.3 Berms, Footbridge Piers, Bank Stabilization

Potential impacts of the berms, footbridge piers and bank stabilization on water quality include:

- Deleterious substances (suspended sediments and toxins)

Introduction of deleterious substances to the NSR could occur during berm installation/ removal, placement of the concrete piers could leech toxins and bank de-stabilization could introduce sediments.

Mitigation Measures

Due to the potential for deleterious substance release into the NSR, water quality (i.e., turbidity) should be monitored by a QAES during in-stream works. The QAES may provide

recommendations for isolation and guideline values for increases in turbidity according to CCME guidelines.

As discussed in Section 7.5.1, the CCME guidelines outlines monitoring levels of suspended sediments during construction.

In the event of a spill, the spill should be contained, monitored and cleaned up. An environmental emergency spill response and contingency plan should be developed and implemented. Spills should be report to the 24-Hour Alberta Environmental Hotline and other agencies.

Prior to berm construction, all angular boulders and rocks will be washed to remove any sediment, dust, or debris that may be introduced to the NSR. In addition, berm maintenance is critical to diverting flow and creating a dry work site.

Cast in place concrete has the potential to leach toxins if exposed to water prior to curing. Cast in place concrete should be allowed to cure for at least 48 hours before contact with fish bearing water. A tarp should be erected to cover the concrete in the event that significant precipitation occurs during initial concrete curing.

As discussed in Section 7.4.2.2, bank stabilization activities will recommend Aqua Dam placement to reduce impact to fish and fish habitat through deleterious substances.

Residual Impacts

The berms, footbridge piers and bank stabilization are expected to have a low magnitude impact and low likelihood of occurrence affecting water quality with the introduction of a deleterious substance. The spatial extent of the impact will be in the project, with the peak impact occurring in the short duration during construction including installation/ removal of the temporary pilings and rip rap placement for bank stabilization.

7.6 HYDROLOGY

The following sections discuss impacts to hydrology within and surrounding the Study Area as a result of the Project.

7.6.1 North and South Trails

Potential impacts of the north and south trails to hydrology include:

- Surface water runoff
- Limited infiltration of surface water flow into asphalt/ gravel compacted surfaces
- Erosion potential

During construction of the trail system, the timing and magnitude of runoff from the surrounding area may change. The addition of paved trails and gravel compacted surfaces will limit infiltration and facilitate a more rapid delivery of runoff to the NSR. As well, the location of runoff contributions in this area to the NSR may become more visible i.e. runnels, small channels, or an increase in erosional features. These areas include two ephemeral drainages, one located on the left bank and one located on the right bank of the NSR. Construction of bridges over the ephemeral drainages may result in localized increases in sedimentation/erosion due to concentration of runoff. However, considering the mean total daily discharge of the NSR is > 18 million m^3 per day (Environment Canada 2013), the potential impact to water quantity of the NSR is considered negligible. Conversely, alterations to the surrounding area will introduce the potential for sediment contributions or sediment introduction through changing runoff patterns due to construction and potential concentration of runoff from impervious surfaces.

Mitigation Measures

To mitigate the potential impacts to hydrology within the NSR, effective erosion and sedimentation control (ESC) measures should be installed prior to construction in cleared areas. Silt fences are designed to reduce water velocity and create areas to contain and settle sediment laden waters before then enter the NSR. This is intended to prevent large changes to flow patterns around the base trail system and scouring banks below the bridge abutments. Sediment control measures should be inspected and repaired regularly and remain operational until complete re-vegetation of disturbed areas is achieved.

Class 2 rock rip rap (Appendix X, TPFB-PD-S02A), placed to provide protection to the bed and banks of the NSR, will be installed on the north and south banks upstream and downstream of the abutment structures. Class 2 rip rap is not likely to adversely disrupt flow patterns.

Residual Impacts

With these mitigation measures in place it is expected that the north and south trails impacts to hydrology will be of a low magnitude and low likelihood of occurrence. Surface water flow, runoff and erosion potential will be a short duration with the spatial extent confined to within the project boundaries.

7.6.2 Footbridge

Potential impacts to hydrology as a result of the construction and operation of the proposed footbridge include:

- Alteration of flow patterns
- Scour pools

Flow patterns within the NSR will be altered in a small section of the river with construction of the temporary bridge access to the berms. Two sets of pilings on the north and south sections of the

river will temporary alter of flow patterns during berm construction. These alterations to flow patterns may result in instances of increased scour and deposition.

Mitigation Measures

The temporary bridges have been designed as a temporary access for berm construction purposes only and will be removed after construction is complete (see Section 2.2.6). However, operation of the temporary bridge pilings will alter the flow patterns in the immediate vicinity of the pilings. This may result in localized scour and deposition. The temporary bridges will be in-stream for one year, thus any change to the long-term hydrologic regime of the NSR should be negligible.

Residual Impacts

The temporary bridges are expected to have a low magnitude impact and low likelihood of occurrence affecting hydrology of the NSR. The spatial extent of the impact will be within the project, with the peak impact occurring in the short duration during construction including installation and removal of the temporary pilings.

7.6.2.1 Berms and Footbridge Piers

Potential impacts of the berms and footbridge piers on hydrology include:

- Alteration of flow patterns
- Floods and high volumes of flow
- Scour pools
- Downstream bank erosion

The current design indicates that the two berm/piers will occupy approximately 50% of the channel width. This coverage will confine flow and change the hydraulics between the structures by increasing flow velocity and depth. These changes may result in increased scour and changes to flow patterns downstream. As the footbridge is located on a meander bend, changes to the current flow patterns may result in the potential for increased shear stress on the true right bank, downstream of the footbridge thereby increasing bank erosion.

Spring floods and high volumes of flow may cause damage to the berms and the reduced conveyance may result in changes in upstream water levels. Scour pools and sediment deposits could form in areas immediately in front and behind each berm. Failing to remove the berms as per the design schedule will result in alteration of flow patterns due to flow constriction and subsequent increased water velocity. This could also reduce flows to selected areas around the north and south banks of the NSR.

Mitigation Measures

Installation of the berms is to occur outside of the RAP during Aug 1- Sept 15 with low flows during the summer and fall season. During design and construction, the two berms in the river will provide approximately 50% of the total flow of the NSR (TPFB-PD-S03) with approximately 30% of this flow between the two berms/piers. This reduction in conveyance will likely disrupt flow patterns in the short term.

Erosion and sediment control measures will be implemented to reduce downstream sediment transportation. Recommendations include placement of silt curtains around each berm structure during installation and removal. Continuous berm maintenance and monitoring structural integrity is critical to diverting flow and creating a dry work site.

Residual Impacts

The berms are anticipated to have a moderate likelihood of resulting in a local impact of moderate magnitude on the hydrology of the NSR. The permanent footbridge pier structures are anticipated to have a low to moderate likelihood of resulting in a local impact of low to moderate magnitude on the hydrology within the NSR if the proposed mitigation measures are implemented. Hydraulic modeling would need to be undertaken to validate these residual impacts.

7.7 AESTHETICS

The following sections discuss impacts to aesthetics within the Study Area as a result of the Project.

7.7.1 North and South Trails

The development of the North and South Trails may result in direct aesthetic impacts including:

- The quality of views of the Study Area

During construction, the quality of views of the Study Area will be reduced by the presence of construction vehicles, workers, materials, and equipment. The use of silt fences and/or other types of ESC measures may also reduce the quality of viewpoints. Areas of bare soil, erosion, or slumping have the potential to reduce the quality of views in the Study Area, as will the final placement and appearance of retaining walls and rip rap. Immediately after construction of the trails, the quality of views along the trails will be reduced by the presence of remaining coarse woody debris and exposed soil while vegetation is being re-established. The presence of rip rap along the NSR bank below the Footbridge abutments will also have a negative impact on the aesthetics of the Study Area.

7.7.1.1 Mitigation Measures

Mitigation measures that will be employed to address potential impacts on aesthetics include:

- The extent of vegetation clearing and construction of temporary access and laydown areas should be minimized to the greatest extent possible.
- Areas of bare soil, including any soil stockpiles, should be seeded with an appropriate seed mix to reduce erosion and prevent the establishment and spread of weeds.
- Retaining walls and rip rap materials should be designed and placed to blend with the existing surroundings to the greatest extent possible.
- Re-vegetation should incorporate native plant species and should be focused on creating species assemblages that resemble pre-development plant communities.

7.7.1.2 Residual Impacts

After mitigation, the potential impacts to aesthetics resulting from the development of the North and South Trails are expected to be limited to the quality of views along trails and temporary work areas until re-established vegetation has regenerated and blends in with natural vegetation, as well as to the portions of the NSR bank that will be protected with rip rap. In areas where existing trails will be widened, there may be a permanent impact to the aesthetic qualities of the Study Area in comparison to pre-development conditions due to the addition of asphalt and the creation of larger gaps in forested areas. In addition, the presence of the rip rap will likely have a permanent impact on the aesthetics of the Study Area.

Reduced quality of viewpoints along trails and associated temporary work areas is expected to be moderate in magnitude, limited to the extent of the Project, of medium duration, and high in likelihood of occurrence.

7.7.2 Footbridge

Construction of the Footbridge may result in direct aesthetic impacts in the same manner as the development of the North and South Trails. Potential impacts include:

- The quality of views of the Study Area

The mechanisms of these impacts and mitigation measures are discussed in Section 7.7.1. In addition to the impacts discussed in Section 7.7.1, activities associated with the construction of the Footbridge may impact the quality of views of residences overlooking the NSR valley due to the presence of the berms and construction equipment. The presence of the completed Footbridge may impact the quality of views overlooking the NSR valley because the Footbridge is not part of the natural characteristics of the NSR valley. As such, it may be seen as an intrusion and interference with the quality of views.

7.7.2.1 Mitigation Measures

In addition to the mitigation measure discussed in Section 7.71, the following mitigation measures are recommended respect to the Footbridge:

- The Footbridge has been designed as a stressed ribbon, which provides a low profile than alternative bridge designs and has a better fit with the characteristics of the surrounding area. During the consultation process, the stressed ribbon was the design preferred by members of the public.
- Lighting on the Footbridge will be designed to minimize light pollution, which will reduce the intrusiveness of the Footbridge during the night.

7.7.2.2 Residual Impacts

After mitigation, the potential impacts to aesthetics resulting from the development of the Footbridge are expected to be limited to the quality of views of the Study Area as a whole due to the presence and style of the Footbridge. The Footbridge has been designed as a low profile structure, and to minimize light pollution to provide the least amount of visual intrusion in the NSR valley. This design provides a unique bridge style to the Edmonton area, and the lighting satisfies the City of Edmonton's Crime Prevention Through Environmental Design guidelines (City of Edmonton 2014a, internet site). Reduced quality of views of the Study Area associated with the Footbridge are expected to be moderate in magnitude, limited to a local spatial extent, be of a long duration, and have a high likelihood of occurrence.

7.8 NOISE

This section discusses impacts to noise levels within and surrounding the Study Area as a result of the Project. This section does not consider noise impacts on wildlife because this is discussed in Section 7.3.

7.8.1 Project

The potential noise impacts of the development of the North and South Trails and the Footbridge include:

- Disturbance to users of the NSR valley park and trail system within and adjacent to the Study Area
- Disturbance to local residents

The operation of construction equipment and an increase in local construction traffic travelling to and from the Project during allowable days and hours may cause an increase in noise levels within and adjacent to the Study Area. This may impact users of the NSR valley park system, as well as local resident adjacent to the Study Area and along the route that construction traffic

will travel. With respect to the Footbridge, the impact to noise levels may be greater than for all other components of the Project because sound travels farther over water than over land.

7.8.1.1 Mitigation Measures

Mitigation measures that will be employed to address impacts associated with noise include:

- All work should be limited to normal working hours in accordance with City of Edmonton Community Standards Bylaw.
- All reasonable efforts should be made to minimize noise disturbance at all times.

7.8.1.2 Residual Impacts

After mitigation, the potential impacts to noise levels resulting from the development of the North and South Trails and the Footbridge are expected to be limited to disturbance to users of the NSR valley and local residents. The impact of noise is expected to be moderate in magnitude, limited to the local area, short in duration, and have a high likelihood of occurring.

7.9 PUBLIC SAFETY

The following sections discuss impacts to public safety within the Study Area as a result of the Project.

7.9.1 North and South Trails

The potential impacts of the development of the North and South Trails associated with public safety include:

- Interactions with users of the NSR valley park and trail system
- Interactions with users of the Edmonton Country Club and Golf Course
- Interactions with surrounding residents
- Physical hazards present during construction
- Increased risk of wildfire during dry periods

<u>Interactions with Users of the River Valley Park and Trail System</u>

The Project has the potential to have negative interactions between the construction activities and the users of the area. Heavy equipment along the established informal trail system could result in a conflict between trail users and construction activities. Improper delineation and segregation of the construction activities from public access could result in the public encountering hazardous situations and areas. The presence of construction materials and equipment in the laydown areas for the project has the potential for negative interactions if the laydown areas are not properly secured to prevent access by the public.

Interactions with Users of the Edmonton Country Club

The Project has the potential to have negative interactions between the construction activities and the users of the country club. Construction traffic movement through the country club to access the north work area could result in a conflict between golfers and country club workers, and construction activities. Improper delineation and segregation of the construction traffic from country club users could result in the public encountering hazardous situations.

Interactions with Surrounding Residents

The access to the construction area and the laydown areas for the Project may result in an increase in local traffic through residential areas as workers travel to and from the work sites and materials are delivered. The increased traffic increases the potential for a negative interaction with pedestrians and cyclists in the area.

Physical Hazards Present

The construction of the trails has the potential to cause physical hazards in the construction area. The construction of the trail system, involving vegetation clearing, surface alterations, and machinery/equipment movement, presents the opportunity for physical hazards to be present within the constructions area. Additional opportunities for temporary hazards to be present in surrounding areas could be in the form of slope instabilities, flying debris during vegetation clearing, and respiratory hazards in the form of dust and particulates.

Increased Risk of Wildfire

The construction activities conducted in areas of heavy vegetation during dry periods may increase the risk of wildfire for the area. There is an increased possibility of dry vegetation being ignited by construction equipment and personnel moving through the area during times of drought through the summer months.

7.9.1.1 Mitigation Measures

Recommended mitigation measures that may be employed by the contractor to address potential impacts on public safety include:

- A comprehensive hazard assessment of each aspect of the trail construction activities should be conducted to ensure all hazards are identified and controlled. A comprehensive health and safety plan outlining the hazards and appropriate controls should be created to ensure consistency within the construction program and to ensure the safe operation of construction-related activities.
- The construction area and storage areas should be segregated from the public through the use of physical barriers, whenever possible.
- The construction traffic route through the golf course should be managed along sections where interactions with pedestrians, golf carts and construction traffic are unavoidable to

include designated pedestrian crossings and traffic control measures where mixed traffic is present.

- Information outlining the extent of the work area and timing of construction activities in the form of notices and signage should be provided to the public regularly.
- Access to the construction areas through residential neighborhoods should be minimized whenever possible and traffic should be minimized with deliveries scheduled for off peak hours, whenever possible.
- Access to construction areas along informal trail systems should be closed and monitored to maintain control of the work area.
- Signage at points of access to the work area should outline personal protective equipment (PPE) requirements for access to the construction area, including access points from informal trail systems, whenever possible.
- Construction activities during times of elevated fire hazard ratings should be minimized, and all vehicles should be equipped with basic firefighting equipment.

7.9.1.2 Residual Impacts

After mitigation, the potential impacts to public safety resulting from the construction of the North and South Trails are expected to be limited to interactions with users of the river valley trail system, and local residents. The impact on public safety is expected to be low in magnitude, limited to the extent of the Project, short in duration, and high in likelihood of occurrence.

7.9.2 Footbridge

The potential impacts of the development of the Footbridge associated with public safety include:

- Interactions with users of the NSR valley park and trail system
- Interactions with users of the Edmonton Country Club and Golf Course
- Interaction with users of the NSR
- Physical hazards present during construction

<u>Interactions with Users of the NSR Valley Park and Trail System</u>

The Project has the potential to have negative interactions between the construction activities and the users of the area. Heavy equipment movement and operation within the park and trail system could result in conflicts between the users and construction activities. Improper delineation and segregation of the construction activities from public access could result in the public encountering hazardous situations and areas. The presence of construction materials and equipment in the laydown areas for the project has the potential for a negative interaction with the park and trail system if the laydown areas are not properly secured to prevent access of the public.

Interactions with Users of the Edmonton Country Club and Golf Course

The Project has the potential to have negative interactions between the construction activities and the users of the golf course. Construction traffic movement through the golf course to access the north work area could result in a conflict between golfers and golf course workers, and construction activities. Improper delineation and segregation of the construction traffic from golf course users could result in the public encountering hazardous situations.

Interaction with Users of the NSR

The Project has the potential to have negative interactions between the construction activities and the users of the NSR. Construction activities to install the temporary bridges and the permanent structure within the river could result in a conflict between NSR users and the construction activities. Improper delineation and segregation of the construction activities from public access could result in the public encountering hazardous situations and areas on the NSR. The change in the NSR navigational area through the introduction of berms to the area has the potential for a negative interaction with users if the area is not properly identified.

Physical Hazards Present During Bridge Construction

The construction of the Footbridge has the potential to result in physical hazards in the area of the NSR valley park and trail system, and the NSR. The construction of the Footbridge, involving excavation, electrical trenching, drilling, pile driving, and construction material placement, presents the opportunity for physical hazards to be present within both the aquatic and terrestrial constructions areas. Hazards are expected to occur in the area of access, and above and within the river system during all phases of construction.

7.9.2.1 Mitigation Measures

Recommended mitigation measures that may be employed by the contractor to address potential impacts on public safety include:

- A comprehensive hazard assessment of each aspect of the bridge construction activities should be conducted to ensure all hazards are identified and controlled. A comprehensive health and safety plan outlining the hazards and controls should be created to ensure consistency within the construction program and to ensure the safe operation of construction-related activities.
- The construction area and storage areas should be segregated from the public through the use of physical barriers, whenever possible.
- The construction traffic route through the golf course should be managed along sections where interactions with pedestrians, golf carts and construction traffic are unavoidable to include designated pedestrian crossings and traffic control measures where mixed traffic is present.

- Information outlining the extent of work area for both the terrestrial and aquatic components of the construction and timing in the form of notices and signage should be provided to the public regularly.
- Access to construction areas from both the north and south, including along informal trail systems, should be closed and monitored to maintain control of the work area.
- Access to construction areas along the NSR should be restricted and monitored to maintain control of the work area both on and above the NSR.
- Signage at points of access to the work area should outline PPE requirements for access to the construction area, including access points from informal trail systems, whenever possible.
- Ensure appropriate safety and warning lights, markers, etc. are used and maintained during construction and operation of various works in accordance with the *Navigation Protection Act*.

7.9.2.2 Residual Impacts

Following mitigation, the potential impacts to public safety resulting from the construction of the Footbridge are expected to be limited to interactions with users of the NSR valley park and trail system, and NSR. The impact on public safety is expected to be low in magnitude, limited to the extent of the Project, short in duration, and high in likelihood of occurrence.

7.10 CONTRACTOR SAFETY

The following sections discuss impacts to contractor safety within the Study Area as a result of the Project.

7.10.1 North and South Trails

The potential impacts of the development of the North and South Trails associated with contractor safety include:

- Physical hazards present during construction
- Interactions with wildlife and domestic animals
- Increased risk of wildfire during dry periods

<u>Physical Hazards Present During Construction</u>

The construction of the trail system, involving vegetation clearing, surface alterations, and heavy machinery movement, presents the opportunity for physical hazards to be present within the areas associated with the construction activities. Additional physical hazards may be present in the areas surrounding the construction activities in the form of slope instabilities, and naturally occurring hazards.

Interactions with Wildlife and Domestic Animals

The Project has the potential to have negative interactions between the construction activities and wildlife and domestic animals within the NSR valley park area.

7.10.1.1 Mitigation Measures

Recommended mitigation measures that may be employed by the contractor to address potential impacts on contractor safety include:

- A comprehensive hazard assessment of each aspect of the trail construction activities should be conducted to ensure all hazards are identified and controlled. A comprehensive health and safety plan outlining the hazards and controls should be created to ensure consistency within the trail construction component of the project and to ensure the safe operation of construction-related activities.
- PPE appropriate to the task and hazards identified should be worn by all construction workers and anyone accessing the construction site.
- Activities located across slopes should be monitored and designed to engineered specifications to maintain slope stability.
- Signage prohibiting dogs in areas of construction should be installed in appropriate locations along the trail to notify users of restrictions.
- Construction personnel should not feed or harass wildlife.
- Waste products should be stored in secure containers and transported to appropriate facilities during construction.
- Wildlife-resistant garbage bins should be installed along trails.
- Construction activities during times of elevated fire hazard ratings should be minimized, and all vehicles should be equipped with basic firefighting equipment.

7.10.1.2 Residual Impacts

After mitigation, the potential impacts to contractor safety resulting from the construction of the North and South Trails are expected to be limited to the physical hazards encountered on the project, and the interaction with wildlife and domestic animals.

The impact on contractor safety is expected to be moderate in magnitude for the physical hazards encountered, limited to the extent of the Project, short in duration, and moderate in likelihood of occurrence. The impact on contractor safety is expected to be low in magnitude for the interaction of wildlife and domestic animals, limited to the extent of the Project, short in duration, and moderate in likelihood of occurrence.

7.10.2 Footbridge

The potential impacts of the development of the footbridge associated with contractor safety include:

- Physical hazards present during construction

The construction of the trail system, involving vegetation clearing, surface alterations, and heavy machinery movement, presents the opportunity for physical hazards to be present within the areas associated with the construction activities. Additional physical hazards may be present in the areas surrounding the construction activities in the form of slope instabilities, wildlife, and domestic animals.

7.10.2.1 Mitigation Measures

Recommended mitigation measures that may be employed by the contractor to address potential impacts on contractor safety include:

- A comprehensive hazard assessment of each aspect of the footbridge construction activities should be conducted to ensure all hazards are identified and controlled. A comprehensive health and safety plan outlining the hazards and controls should be created to ensure consistency within the footbridge construction component of the project and to ensure the safe operation of construction-related activities.
- Personal protective equipment appropriate to the task and hazards identified should be worn.
- Signage prohibiting dogs in areas of construction should be installed in appropriate locations along the trail to notify users of restrictions.
- Construction personnel should not feed or harass wildlife.

7.10.2.2 Residual Impacts

After mitigation, the potential impacts to contractor safety resulting from the construction of the Footbridge are expected to be limited to physical hazards encountered on the project. The impact on contractor safety is expected to be moderate in magnitude, limited to the extent of the Project, short in duration, and moderate in likelihood of occurrence.

7.11 ARCHAEOLOGY AND HISTORICAL RESOURCES

Three assessments were completed for historical resources within the Study Area (see Section 5.9 and Appendix L). These assessments were completed as standalone studies, and were not included within the scope of this environmental impact assessment. These studies concluded that there is a possibility of impacting historical resources that are known to be present within the Study Area through excavation and other surface activities, including soil piling, capping, etc. They also present proposed mitigation measures to address these potential impacts, including, but not limited to:

- Use photographic documentation, and recording and collection of surface specimens for sites with low interpretive value.
- Employ controlled excavation for site with high interpretive potential.
- Avoid known historical resources where ever possible. The location of the north abutment of the Footbridge has been changed as a result of implementation of this mitigation measure.

See Appendix L for additional details of the assessment of impacts.

8.0 Public Consultation

The public consultation process for the proposed footbridge and trails has been extensive and is ongoing. To date, public comments regarding the construction of Terwillegar Park Footbridge and Recreational Trail were received through a stakeholder meeting held on September 11, 2013 at the Riverbend United Church, 14907 45 Avenue NW, and through an open house held on September 21, 2013 at the Alfred H. Savage Center, River Valley Whitemud, Edmonton. Public consultation was facilitated by staff members from the City of Edmonton and by Stantec design and engineering teams. Attending the stakeholder meeting on September 11, 2013 were groups identified by the City of Edmonton's Community Recreation Coordinator and included area community leagues, a disability committee, and mountain bike clubs; 14 participants attended. The open house was attended by the general public, who were invited through advertisements in print media, roadside signs, a direct mail campaign (reaching over 26,000 households), and online through community league websites and the City of Edmonton's website; 211 people attended the open house. 81 comment forms were collected at the open house, 70 comment forms were received online, and one by fax. Additional public engagement is scheduled to occur starting spring 2014 prior to commencement of construction. See Appendix P for a report summarizing the public consultation process and results.

Comments received through public consultation process show that local area residents are generally supportive of the Project. Comments received in support of the development highlight the unique design and aesthetic appeal of the footbridge and note that increased connectivity within the NSR valley park system, including improved accessibility by families with small children and disabled and elderly citizens is desirable. Comments were received regarding the development plan, use, and enjoyment of Terwillegar Park and the design of the Footbridge and development of the North and South Trails.

Concerns regarding the development plan focused on the routing of and proposed surface material to be used to construct the North and South Trails. It was expressed that paving of the North Trail would be costly, would not fit with the natural appeal of the area, and that paving of trails in the floodplain does not make fiscal sense.

Participants expressed concern that physical activities related to the construction of the Footbridge and North and South Trails would disrupt the 'natural' appeal of the park and that the development of the North and South Trails could impact the use and enjoyment of undeveloped trails currently used by recreationalists (primarily those involved in mountain biking). Residents near Oleskiw Access Road off Woodward Crescent expressed concerns regarding increased construction traffic and members of the Edmonton Country Club expressed concern regarding the proposed access route on the north side of the NSR to the Footbridge.

9.0 Summary

It is recommended that all mitigation measures detailed within Section 7.0 of this report be implemented. These mitigation measures should be considered throughout the life of the project and are summarized as follows:

9.1 EROSION AND SEDIMENTATION CONTROL MITIGATION MEASURES

- An ESC plan should be developed and implemented by the contractor for all phases of the project. ESC measures should be inspected and repaired regularly and remain operation until complete re-vegetation of disturbed areas is achieved.
- If any ESC or containment measures fail and sediment laden runoff water enters the NSR, the proper authorities will be notified immediately so that appropriate actions may be taken to report a release.
- Construction activities should be limited in wet areas whenever possible, to reduce soil compaction, erosion and sedimentation, and the potential introduction or spread of weeds.
- A QAES should be retained to conduct regular sediment monitoring of in-stream activities to ensure that adverse impacts are avoided or minimized.
- An Aqua Dam should be installed before bank stabilization activities occur. Water pumps used for dewatering must be fitted with intake screens in order to protect fish from being taken into pumps and harmed (DFO 1995). Water flow should be maintained around the bank stabilization activities to reduce the impact of deleterious substances to an area restricted within the Aqua Dam.
- All rip rap used for the project should be cleaned to remove any sediment, dust, or debris and reduce the potential spread of weed species.
- A silt curtain or other approved alternative should be used for in-stream isolation during construction of the berms.
- ESC recommendations for specific phases of the project can be found in Appendix E.

9.2 VEGETATION MITIGATION MEASURES

- The extent of vegetation clearing and construction of temporary access and laydown areas should be minimized to the greatest extent possible. These areas should be reclaimed as soon as they are no longer required, and re-vegetation activities should focus on the re-establishment of native vegetation resembling pre-development communities.
- Tree removal should take place perpendicular to the prevailing wind direction wherever possible. This allows for consistent wind effect along remaining treed edges and will likely reduce windthrow. If windthrow occurs, suitable native tree species should be planted to compensate for lost trees.
- Rare plant populations situated adjacent to the trails and associated laydown areas should be flagged and fenced off, and construction activities adjacent to these areas should be limited, whenever practical.

- Areas of bare soil, including any soil stockpiles, should be seeded with an appropriate seed mix to reduce erosion and prevent the establishment and spread of weed species.
- Altering the alignment of vegetation clearing and trail development should be considered to avoid rare plant populations within the alignment. When avoidance of a rare plant population is not possible, a rare plant mitigation strategy should be developed in consultation with the Urban Ecology Unit.
- Mechanical weed control should be employed to control continued establishment and spread of weed populations during construction and re-vegetation of temporary features. Herbicides should not be used as a method to control weeds in the Project footprint.

9.3 WILDLIFE MITIGATION MEASURES

- Vegetation clearing should be completed outside of the primary breeding bird season wherever practical; where clearing is required during the breeding bird season a qualified wildlife biologist will conduct a pre-construction nest search.
- Excavation and filling for the bridge abutments should occur outside of the hibernation period for Canadian toads, wherever practical.
- Openings at regular intervals should be created in silt fences where ever possible and when ESC measures are not compromised.
- Construction personnel should not feed or harass wildlife.
- Avoid using silt fencing reinforced with plastic or metal wherever possible, as amphibians and reptiles can become entangled in the mesh (California Coastal Commission 2012).
- All silt fencing fraying or with holes should be replaced immediately to avoid entanglement by wildlife (California Coastal Committee 2012).
- Silt fencing should be removed as soon as is practically feasible to minimize barriers to wildlife movement; however, silt fencing or other barriers should remain around open excavations to exclude wildlife from excavation areas.

9.4 HEALTH AND SAFETY MITIGATION MEASURES

- A comprehensive hazard assessment of all construction activities should be conducted to ensure all hazards are identified and controlled. A comprehensive health and safety plan outlining the hazards and controls should be created to ensure that all construction work is conducted in a safe manner.
- Signage at points of access to the work area should outline personal protective equipment requirements for access to the construction area, including access points from informal trail systems, whenever possible.
- Personal protective equipment appropriate to the task and hazards identified should be worn.
- Access to construction areas should be restricted and monitored to maintain control of the work area.
- Information outlining the extent of work area and timing in the form of notices and signage should be provided to the public regularly.

- The construction traffic route through the golf course should be managed along sections where interactions with pedestrians, golf carts and construction traffic are unavoidable to include designated pedestrian crossings and traffic control measures where mixed traffic is present.
- Ensure appropriate safety and warning signs, lights, markers, etc. are used and maintained during construction to notify users of restrictions and are in compliance with federal, provincial and municipal requirements (e.g. Transport Canada).
- Activities located across slopes should be monitored and designed to engineered specifications to maintain slope stability.
- Construction activities during times of elevated fire hazard ratings should be minimized, and all vehicles should be equipped with basic firefighting equipment.
- All work should be limited to normal working hours in accordance with City of Edmonton Community Standards Bylaw.
- Rip rap should be placed in a manner to blend in with the existing surroundings to the greatest extent possible.

9.5 POLLUTION MITIGATION MEASURES

- An environmental emergency spill response and contingency plan should be developed and implemented.
- The contractor should have a spill containment kit on site at all times. In the event of a spill, the spill should be contained, monitored and cleaned up. Spills should be reported to the 24-Hour Alberta Environmental Hotline at 1-800-222-6514 and other agencies.
- Waste products should be stored in secure containers and transported to appropriate facilities during construction.
- All machinery should be maintained and fueled within a designated staging/laydown area at least 100 m away from the stream bank.
- Construction machinery should be cleaned prior to entering and leaving the Project footprint to remove any sediment, dust, or debris and reduce the potential spread of weed species.
- Cast in place concrete should be allowed to cure for at least 48 hours before contact with fish bearing water. A tarp should be erected to cover the concrete in the event that significant precipitation occurs during initial concrete curing.
- Lighting on the Footbridge should be designed to minimize light pollution, which will reduce the intrusiveness of the Footbridge during the night.
- All reasonable efforts should be made to minimize noise disturbance at all times.

10.0 Limitations and Qualifications

In conducting the investigation and rendering our conclusions, Stantec gives the benefit of its best judgment based on its experience and in accordance with generally accepted professional standards for this type of investigation. This report was submitted with the best information to date and on the information provided. The conclusions made within this report are a professional opinion, not a certification of the Study Area's environmental condition, and no other warranty, expressed or implied, is made. This report has been prepared for the exclusive use of the City of Edmonton for the purposes of assessing the current state of the Study Area. Any use which any third party makes of this report, or any reliance on or decisions to be made on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any other third party as a result of decisions made or actions based on this report. Our conclusions are limited by the following:

- All vegetation, wildlife, and fisheries surveys were completed during the dates specified and conditions may vary outside those times.
- Field surveys to verify the presence of species listed within ACIMS and/or FWMIS databases were conducted for the Study Area on the dates specified and presence or absence of said species outside of the survey dates cannot be verified.
- Some of the information contained within this report was provided by agencies and organizations external to Stantec. While Stantec cannot guarantee the information provided by external parties, this information has been assumed to be correct.
- The information contained within this report is based on the design available at the time of report preparation. Design drawings will continue to be modified and added as the detailed design process continues, but are intended to not depart significantly from the information presented in this report. Should significant changes to the drawings be made in the future, an amendment to this report may be required.
- The investigation was limited to those parameters specifically outlined in this report.
- The contractor will be responsible for determining the ultimate construction schedule and means of construction for the Project; however, should significant changes to construction timing and/or methodology from that presented within this report be proposed or required, it is the responsibility of the contractor to confirm with all applicable regulatory agencies or bodies that this is acceptable. It is also the responsibility of the contractor to obtain all applicable amendments to approvals and/or permits that may have previously been obtained based on the information presented within this report.

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5. Please provide any additional comments about the Terwillegar Park Footbridge concept:

_____

_____

_____

6. Please provide any additional comments about the West End Trails concept:

_____

_____

_____

ABOUT THE EVENT

Your responses to the following questions will assist us in planning future meetings.

7. Using the following scale from 1 to 5 where 1 means Strongly Disagree and 5 means Strongly Agree. Please circle the appropriate number to indicate the extent to which you agree with each of the following statements:

	Strongly Disagree				*Strongly Agree*
• *The information presented at the event was useful and informative.*	*1*	*2*	*3*	*4*	*5*
• *The information was easy to understand.*	*1*	*2*	*3*	*4*	*5*
• *The project representatives were helpful, friendly and available to talk to me.*	*1*	*2*	*3*	*4*	*5*
• *I was able to find satisfactory answers to my questions.*	*1*	*2*	*3*	*4*	*5*
• *I have a better understanding of the project because of my attendance.*	*1*	*2*	*3*	*4*	*5*
• *Participating in this session was a good use of my time.*	*1*	*2*	*3*	*4*	*5*
• *The venue location was appropriate.*	*1*	*2*	*3*	*4*	*5*

8. Which aspects of the meeting did you find most valuable? (Please check all that apply)

☐ *Interaction with representatives* ☐ *Display boards*
☐ *Handouts* ☐ *Other (Please specify):* _____

9. How did you hear about this meeting? (Please check all that apply)

☐ *Road side signs* ☐ *Word of mouth* ☐ *Newspaper advertisement*
☐ *Flyer in mailbox* ☐ *Email* ☐ *Community league website*
☐ *City of Edmonton website* ☐ *Social Media* ☐ *Other (Please specify):* _____

Thank you!

Please leave your comment form at the welcome desk or fax to (780)425-6646 by midnight Saturday, October 5.

For more information visit Edmonton.ca/RiverValleyProjects