Canadian Environmental Assessment Agency

Agence canadienne d'évaluation environnementale

Comprehensive Study Report

Little Bow Reservoir Rehabilitation and Upgrading Project

Canadian Environmental Assessment Agency

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Canada

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Summary

The Alberta Ministry of Transportation (AT), the proponent, proposes to construct new structures and modify existing structures in the Little Bow Reservoir, and in the connecting canal to the Travers Reservoir (TLBR Connecting Canal). The Little Bow Reservoir is located in southern Alberta, approximately 50 km southeast of the Town of Vulcan, and is one of three major reservoirs in the Carseland-Bow River Headworks (CBRH) System that includes both the McGregor and Travers reservoirs and over 65 km of irrigation canals. The Project is the final phase in an upgrading and rehabilitation program for the CBRH System.

The objectives of the Little Bow Reservoir Rehabilitation and Upgrading project (the Project) are to ensure that the rehabilitated works meet the requirements of the Canadian Dam Association (CDA) Dam Safety Guidelines for the handling of extreme flooding, and to provide a reliable water supply for users of the Bow River Irrigation District (BRID).

Primary physical undertakings of the Project include: raising and extending of the Little Bow Reservoir Dam by approximately 3.35 m in height and 2.5 km in length; constructing the new Little Bow Reservoir irrigation outlet structure and abandoning of the existing structure at the main dam; constructing Enhancement Dyke 1; enlarging and upgrading the downstream section of TLBR Connecting Canal; removing the Travers Reservoir irrigation outlet structure; constructing a roadway and culvert crossing on the TLBR Connecting Canal; demolishing and removing the existing Little Bow Reservoir Provincial Recreation Area (PRA) and constructing a new PRA; reclaiming disturbed areas; and installing cattle deterrents.

A provincial environmental assessment of the project under Alberta's *Environmental Protection and Enhancement Act* was not required as the Project is an Exempted Activity as specified in the *Alberta Environmental Assessment (Mandatory and Exempted Activities) Regulation*.

The *Canadian Environmental Assessment Act* (the Act) applies to federal regulatory authorities when they contemplate certain actions or decisions that would enable a project to proceed in whole or in part. An environmental assessment is required under the Act due to actions that may be undertaken by the Fisheries and Oceans Canada (DFO) and Transport Canada (TC) to increase full supply limit (FSL) of the Little Bow Reservoir and subsequently increase its surface area by more than 35% of current operations. DFO and TC may issue permits, authorizations or approvals in relation to the project pursuant to the *Fisheries Act* and *Navigable Waters Protection Act* respectively.

Moreover, pursuant to paragraph 8 of the *Comprehensive Study List Regulations*, this project is subject to a comprehensive study environmental assessment under the Act:

"…an expansion of a dam or dyke results in an increase in the surface area of a reservoir of more than 35%."

The Canadian Environmental Assessment Agency (the Agency) conducted the comprehensive study in collaboration with the Federal Review Team, which consists of representatives from Environment Canada, Health Canada, Natural Resources Canada, Fisheries and Oceans Canada and Transport Canada.

The Agency assessed the effects of the project using information provided by the proponent

in its Environmental Impact Statement, complementary reports, information request response documents, opinions from federal experts, and comments received from Aboriginal groups and the public during the consultation phase.

During the environmental assessment, Aboriginal communities expressed concerns about issues such as water quantity and quality, wildlife and species at risk, traditional plants, and land access. The proponent has committed to implementing mitigation measures in order to reduce the effects that the project could have on the environment. These measures will also address concerns raised by Aboriginal communities and the public. For example, the proponent will apply best management practices to control erosion and sedimentation, revegetate using a native grass seed mix as soon as it is practical after disturbance, conduct a fish salvage operation during dewatering of any isolated areas to ensure that stranded fish are returned to the reservoir, and avoid disturbing migratory birds and their habitat during nesting season.

A follow-up program is required under the Act to verify the accuracy of the environmental assessment and to determine the effectiveness of the proposed mitigation measures. The follow-up program will focus on critical phases of the project, including winter drawdown of the reservoir during the construction phase; building and removal of cofferdams; any in-water work; and installation of fish and terrestrial habitat replacement and enhancement features. It will also include review of water quality construction monitoring reports and fish habitat compensation.

Given the implementation of the proposed mitigation measures and follow-up program, the Agency concludes that the project is not likely to cause significant adverse environmental effects.

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List of Acronyms, Abbreviations and Symbols

%	Percent
<	Less than
>	Greater than
~	Approximately
AANDC	Aboriginal Affairs and Northern Development Canada
ACCS	Alberta Culture and Community Services
ACIMS	Alberta Conservation Information Management System
AENV	Alberta Environment (Now AESRD)
AESCC	Alberta Endangered Species Conservation Committee
AESRD	Alberta Environment and Sustainable Resource Development
AEW	Alberta Environment and Water (Formerly Alberta Environment (AENV), now AESRD)
AMEC	AMEC Earth and Environmental Ltd.
ASRD	Alberta Sustainable Resource Development
AT	Alberta Ministry of Transportation
AQI	Air Quality Index
BMP	Best Management Practice
BRID	Bow River Irrigation District
CAESA	Canada-Alberta Environmentally Sustainable Agriculture Agreement
CBRH	Carseland-Bow River Headworks
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CEA	Cumulative Effects Assessment
cm	Centimetres
CO_2	Carbon Dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSR	Comprehensive Study Report
dam^3	Cubic decametre = 1,000 cubic metres
dBA	Decibels
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EC	Environment Canada
EIS	Environmental Impact Statement
El.	Elevation
ESC	Erosion and Sediment Control

List of Acronyms, Abbreviations and Symbols (cont'd)

FAN	Federation of Alberta Naturalists
FHCP	Fish Habitat Compensation Plan
FSL	Full Supply Level
GHG	Greenhouse Gas
GOA	Government of Alberta
ha	Hectare
HCF	Heritage Community Foundation
HRA	*Historical Resources Act*
HRO	Historical Resources Overview
Hwy	Provincial Highway
IBA	Important Bird Areas
IO	In-stream Objectives
km	Kilometres
km^2	Square Kilometres
LSA	Local Study Area
m	Metre
mm	Millimetre
m^3/s	Cubic Metres per Second
NRCan	Natural Resources Canada
PM	Particulate Matter
PMF	Probable Maximum Flood
PRA	Provincial Recreation Area
RSA	Regional Study Area
SARA	*Species at Risk Act*
TC	Transport Canada
TCPL	TransCanada Pipelines Limited
TDS	Total Dissolved Solids
the Act	*Canadian Environmental Assessment Act*
the Agency	Canadian Environmental Assessment Agency
the Project	Little Bow Reservoir Rehabilitation and Upgrading Project
TLBR	Travers Reservoir and Little Bow Reservoir
UTM	Universal Transverse Mercator
VEC	Valued Ecosystem Component
WSC	Water Survey of Canada

1. Introduction

1.1 Project Overview

The Alberta Ministry of Transportation (AT) the project proponent, is serving as the agent for Alberta Environment and Sustainable Development (AESRD), the owner and operator of the Carseland-Bow River Headworks (CBRH) System. AT proposes to rehabilitate and upgrade the Little Bow Reservoir and associated infrastructure in southern Alberta, approximately 50 km southeast of the town of Vulcan. The Little Bow Reservoir is one of three major reservoirs, the other two being McGregor and Travers reservoirs, which include more than 65 km of irrigation canals and together make up the CBRH. The Little Bow Reservoir Rehabilitation and Upgrading project (the Project) will ensure that the Travers Reservoir and Little Bow Reservoir are capable of passing the probable maximum flood (PMF) as recommended in the Canadian Dam Association (CDA) Dam Safety Guidelines (CDA, 2007), and are capable of providing a reliable supply of water to users of the CBRH and further downstream to the recreationally and agriculturally important Bow River Irrigation District (BRID) canal system. The projected cost of the Project is $20 million.

1.2 Environmental Assessment Process

The *Canadian Environmental Assessment Act* (the Act)[1] applies to federal authorities when they contemplate certain actions or decisions in relation to a project that would enable the Project to proceed in whole or in part.

An environmental assessment is required under the Act due to actions that may be undertaken by the DFO and TC. DFO and TC may issue permits, authorizations or approvals in relation to the project pursuant to the *Fisheries Act* and *Navigable Waters Protection Act* respectively.

The project is subject to a comprehensive study environmental assessment under the Act as it is listed in Part III, section 8 of the *Comprehensive Study List Regulations*. This section of the Regulations reads as follows:

"…an expansion of a dam or dyke that would result in an increase in the surface area of a reservoir of more than 35%."

The Project did not require a provincial environmental assessment under Alberta's *Environmental Protection and Enhancement Act* as the Project is an Exempted Activity, as specified in the Alberta *Environmental Assessment (Mandatory and Exempted Activities) Regulation*.

1.3 Purpose of the Comprehensive Study Report

The purpose of this report is to present the results of the process carried out by the Canadian Environmental Assessment Agency (the Agency) to determine whether the Project is likely to cause significant adverse environmental effects.

[1] The *Canadian Environmental Assessment Act*, 2012 (CEAA 2012) came into force on July 6, 2012, replacing the *Canadian Environmental Assessment Act* S.C. 1992, c. 37. Section 125 of CEAA 2012 sets out transition measures for comprehensive studies, such as the Little Bow Reservoir Rehabilitation and Upgrading Project, which were commenced under the former Act. For this project, all references to federal environmental assessment legislation reflect the requirements and regulations of the *Canadian Environmental Assessment Act* S.C. 1992, c. 37.

Figure 1.1: Project Site Plan

Courtesy of Alberta Transportation, 2012

Figure 1.2: Project Location

Courtesy of Alberta Transportation, 2012

The Agency prepared this comprehensive study report in collaboration with the Federal Review Team composed of representatives from Environment Canada (EC), Fisheries and Oceans Canada (DFO), Health Canada (HC), Natural Resources Canada (NRCan), and Transport Canada (TC). The conclusions of this report are based on the results of the review of the proponent's Environmental Impact Statement (EIS) and associated documentation and on an assessment of the Project's environmental effects.

The federal Minister of the Environment will take into consideration this report and comments received from the public and Aboriginal groups in making an environmental assessment decision. Before announcing the environmental assessment decision, the Minister may request additional information or require public concerns to be addressed further. Following the announcement of the environmental assessment decision, the Minister will refer the Project back to Fisheries and Oceans Canada and Transport Canada, the responsible authorities for the Project, for appropriate action under section 37 of the Act.

2. Project Information

2.1 Purpose and Need for the Project

AT is undertaking the CBRH Rehabilitation Project as a phased upgrading and rehabilitation program for the CBRH system which includes 65 km of main canal, 6 km of connecting canal, the dams associated with the McGregor, Travers, and Little Bow Reservoirs, and numerous associated water control and conveyance structures.

Rehabilitation and upgrading of the CBRH system was divided into separate projects with the rehabilitation of the CBRH main canal, McGregor Dam and structures, and portions of the Travers Reservoir facilities being completed between 2001 and 2011. This Project is the last component of the CBRH system to be upgraded and is located at its downstream end where it joins with the BRID canal system.

Rehabilitation and upgrading are needed to ensure that the Travers Reservoir and Little Bow Reservoir are capable of passing the probable maximum flood (PMF), as recommended in the CDA Dam Safety Guidelines (CDA, 2007). During normal operation, flows are released from Travers Reservoir into the Little Bow Reservoir and subsequently into the BRID canal system where the water is then distributed for agricultural irrigation purposes. The Project will ensure CBRH continues to be capable of providing a reliable supply of water to users of the both the CBRH and downstream in the recreationally and agriculturally important BRID canal system.

2.2 Project Description

2.2.1 Location

The Little Bow Reservoir is located in southern Alberta approximately 50 km southeast of the town of Vulcan. The area encompassed by the Project includes portions of Sections 16, 17, 18, 20, 21, 22, 27, 28, 29, 30, 32 and 33-14-20-West of the Fourth Meridian (Figure 1.1).

2.2.2 Components and associated activities

The Project involves the construction of new structures and the modification of existing structures in the Little Bow Reservoir and Travers Reservoir to the Travers to Little Bow Reservoir (TLBR) Connecting Canal (Figure 1.2). The rehabilitation associated with the Project that is being considered in the comprehensive study is summarized in Appendix 1.

Currently the Travers Reservoir and Little Bow Reservoir are operated at different full supply levels (FSLs) with the Travers Reservoir at elevation (El.) 856.18 m and the Little Bow Reservoir at El. 852.83 m. As part of the

Project, the hydraulic control structures will be removed, the TLBR Connecting Canal will be enlarged, and the two reservoirs will be operated at a common FSL of El. 856.18 m. The Little Bow Reservoir will then operate in tandem with the Travers Reservoir changing the current Little Bow Reservoir operating regime from a stable balancing reservoir to a fluctuating storage reservoir with a winter operating level of at least El. 854.05 m. This raises the Little Bow Reservoir operating level by 3.35 m and increases the reservoir surface area from 6.16 km^2 to 8.86 km^2. This change in operations will provide spillway capacity that exceeds the probable maximum flood event level.

2.2.3 Schedule

According to the proponent's schedule (Table 2.2) construction is expected to start May 2013 and end by April 2016.

Table 2.2: Schedule

Component	Schedule
Little Bow Reservoir moves from a stable balancing reservoir to a fluctuating storage reservoir	May 2013
Little Bow Reservoir Dam	July 2013 to April 2015
Little Bow Reservoir Outlet Structure	April 2014 to January 2015
Enhancement Dyke 1	October 2014 to December 2014
Travers Little Bow Connecting Canal	October 2014 to April 2016
Little Bow Reservoir Provincial Recreational Area (includes abandonment and construction)	October 2013 to September 2014

3. Scope of Assessment

The scope of the environmental assessment is an exercise by which the Agency establishes the framework and limits of its analysis on the Project. It is determined by the scope of the Project and the factors that will be assessed for the Project.

3.1 Scope of the Project

For the purposes of this federal environmental assessment, the scope of the Project includes all components and activities identified in Appendix 2.

3.2 Factors to be Considered

Pursuant to subsections 16(1) and 16(2) of the Act, the Agency has taken into consideration the following factors:

- the purpose of the Project
- alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means
- the environmental effects of the Project, including the environmental effects of malfunctions or accidents, and any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out;
- the capacity of renewable resources that are likely to be significantly affected by the Project to meet the needs of the present and those of the future
- the significance of the environmental effects
- comments from the public that are received in accordance with the Act and the Regulations;
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project
- the need for, and the requirements of, any follow-up program in respect of the Project

Under subsection 16(1)(e) of the Act, the Agency also required the assessment of the need for the Project, an evaluation of alternatives to the

Table 3.2: Environmental Components, Spatial Boundaries, and VECs Examined during the Environmental Assessment

Environmental Components	Spatial Boundaries	VECs
Geophysical	• The Little Bow Reservoir, the lands that will be inundated with increased FSL, and the anticipated construction footprint	• Soil Quantity • Soil Quality
Hydrology	• The LSA includes the proposed area of inundation at the reservoir boundary at the operating FSL of El. 856.18 m • The RSA includes the CBRH diversion from the Bow River, the CBRH system, the reach of the Bow River downstream of the diversion, and the Little Bow River downstream of Travers Reservoir	• Bow River discharge downstream of BCRH diversion • Little Bow River discharge downstream of Travers Reservoir • Little Bow Reservoir and Travers Reservoir water levels
Surface Water Quality	• The LSA includes the proposed new FSL boundary and the Little Bow Reservoir outlet, and the waters immediately downstream and immediately upstream of the Little Bow Reservoir (i.e., the BRID canals, Travers Reservoir, and Little Bow River) • The RSA includes the entire CBRH system	• Little Bow Reservoir • Downstream BRID canals • Travers Reservoir • Little Bow River
Hydrogeology and Groundwater Quality	• The LSA is located in Township 14, Range 20, W4M and includes the Little Bow Reservoir and adjacent areas where baseline groundwater conditions could be impacted. This study included assessment of the Little Bow River valley area south of Little Bow Reservoir and the canal, where groundwater from a spring is currently used for domestic purposes and where seepage areas have been identified on the valley slopes • The RSA encompasses a much broader area including the McGregor and Travers Reservoirs	• Groundwater quantity • Groundwater quality
Aquatic Environment	• The LSA includes the lower half of the Travers Reservoir, the TLBR Connecting Canal, the Little Bow Reservoir and the BRID irrigation canal immediately downstream of the Little Bow Reservoir • The RSA includes the entire CBRH system, including the Little Bow Reservoir, the Travers Reservoir, and the McGregor Reservoir, as well as the Bow River at the CBRH intake and all connecting canals	• Northern Pike (*Esox lucius*) • Lake Whitefish (*Coregonus clupeaformis*) • Walleye (*Sander vitreus*) • Spottail Shiner (*Notropis husonius*) • Benthic invertebrate density and community structure • Vegetation communities in the littoral and riparian areas
Vegetation	• The LSA includes the proposed construction footprint and area of inundation at the new operating FSL of 856.18 m, (15.66 km^2) • The RSA was 94.62 km^2 and is coextensive with the boundary of Township 14, Range 20, W4M	• Riparian vegetation • Wetland ecosystems • Aquatic vegetation • Grasslands • Shrubs and trees • Rare/uncommon plant species • Rare ecological communities including the western wheatgrass-low sedge and low sedge-western wheatgrass communities

Table 3.2: Environmental Components, Spatial Boundaries, and VECs Examined during the Environmental Assessment (cont'd)

Environmental Components	Spatial Boundaries	VECs
Wildlife and Wildlife Habitat	• The LSA includes the proposed construction footprint, the TLBR Connecting Canal, and the 2.7 km^2 to be inundated at the new FSL boundary, for a total area of 15.66 km^2 • The 94.62 km^2 RSA is coextensive with the boundary of Township 14, Range 20, W4M	• Colonial nesting waterbirds • Waterfowl • Federal Species at Risk ○ Ferruginous Hawk (*Buteo regalis*) ○ Long-Billed Curlew (*Numenius americanus*) ○ Burrowing Owl (*Athene cunicularia*) ○ Common Nighthawk (*Chordeiles minor*) ○ Loggerhead Shrike (*Lanius ludovicianus*) ○ Sprague's Pipit (*Anthus spragueii*) ○ McCown's Longspur (*Calcarius mccownii*) • Chestnut-collared Longspur (*Calcarius ornatus*)
Climate and Air Quality	• The LSA refers to the area in which local effects on climate and air quality could occur as a result of the proposed Project • The RSA includes the potential zones of influence of the Project that stretch to a radius of 65 km for climate and 130 km for air quality	• Climate • Air Quality
Noise	• The LSA includes the footprint of active construction and the area of proposed inundation. • The RSA includes a buffer with a radius of 3 km extending beyond the boundaries of the LSA	• Noise
Heritage and Archaeological Resources	• The LSA includes all terrain that will be inundated by the Little Bow Reservoir at the proposed FSL of El. 856.18 m, as well as all lands that may be impacted during the construction of all the structures	• Historical Resources ○ Sites ○ Structures • Objects of historical, archaeological, paleontological or cultural significance
Navigable Waters	• The LSA includes the entire wetted area of the reservoir at El. 856.18 m, including TLBR Connecting Canal	• Navigability
Socio-economic (Current use of lands and resources for traditional and Recreational purposes)	• The LSA includes the Project footprint and area immediately surrounding the Project, including the Little Bow Reservoir at the new operating FSL boundary, the outlet canal, and the construction footprint • The RSA for commercial and domestic land and resource use is coextensive with the boundary of Township 14, Range 20, W4M • The RSA for recreation includes recreation facilities and activities along the CBRH system including the LSA, McGregor Reservoir, and Travers Reservoir and the important birding areas immediately surrounding the reservoirs • The RSA for human health includes the area irrigated by water from the Little Bow Reservoir through the BRID system	• Physical and cultural heritage • Current use of lands and resources (for recreational or commercial purposes or traditional use by Aboriginal groups) • Health and socio-economic conditions with specific attention to the potential entry of contaminants into the food chain.

Project, and an examination of the benefits of the environmental assessment to Canadians.

An environmental effect, as defined in the Act, means any change that the Project may cause in the environment; any effect of any such change on health and socio-economic conditions, the current use of lands and resources for traditional purposes by aboriginal persons, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; or any change to the Project that may be caused by the environment. This definition includes indirect economic and social changes that are caused by biophysical modifications of the environment. It does not include the direct economic and social effects of the Project. For example, the Agency may examine the economic effects of a decline in commercial fishing success that is related to a loss of fish habitat, but it will not examine economic effects related to the construction of a road.

3.3 Scope of the Factors Considered and the Spatial Boundaries

In determining significant environmental effects, the environmental assessment focuses on aspects of the natural and human environment that have particular value or importance and are likely to be impacted by the Project. The Local Study Area (LSA) is the portion of the environment that may be directly affected by the Project. The Regional Study Area (RSA) is the portion of the environment surrounding the Project that may be indirectly affected by the Project. The environmental components and associated spatial boundaries used in the analyses are presented in Appendix 3.

3.4 Temporal Boundaries

The temporal scale of the assessment encompassed existing conditions, construction, reservoir operation (including maintenance and/or modifications) and decommissioning.

Temporal boundaries used in assessing the potential effects of the Project were defined as:

- *baseline*: The characteristics of the physical, biological and social environment as documented during the Project studies. This reflects the conditions in the study areas before the Project development
- *construction*: Pending regulatory approvals, construction of works above the level of the existing Little Bow Reservoir will begin in the summer of 2013. Construction of the works within the Little Bow Reservoir will begin in the winter of 2014 once reservoir levels have been drawn down. Construction is estimated to take three full years
- *reservoir operation and maintenance*: operation and maintenance will be ongoing throughout the life of the reservoir, which is anticipated to be more than 50 years; and
- *decommissioning*: Decommissioning of temporary facilities no longer needed after construction will occur during, and immediately after, the construction phase Decommissioning of major Project components is not planned within the foreseeable future and the life-span of major Project components, as noted above, is estimated to be more than 50 years. As such, an assessment based on the legislative requirements at the time of decommissioning will be undertaken prior to the decommissioning of major Project components

3.5 Determination of Valued Ecosystem Components (VECs)

VECs were determined by AT with input from the Federal Review Team. An opportunity to comment was provided to First Nations, Métis and the public. Table 3.2 lists the environmental components and their associated VECs.

4. Project Alternatives

Based on paragraph 16(1)(3) of the Act, the Agency required that the proponent

assess alternatives to the Project as part of a comprehensive study. Alternatives to the Project are functionally different ways to meet the Project's need and purpose. As well, in accordance with paragraph 16(2)(b) of the Act, the comprehensive study process included consideration of the alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means. The evaluation of both of these factors is presented in the following sections, based on evaluations conducted by the proponent.

4.1 Alternatives to the Project

The proponent has indicated that alternatives to the proposed project are constrained by the location of the pre-existing reservoir structures and by the Project's purpose, which is to upgrade the infrastructure to meet the CDA Dam Safety Guidelines. As such, opportunities to compare the Project alternatives are limited. As presented, there are three project alternatives:

- proceed with the Project in the near-term, as planned
- delay the Project or
- abandon the Project

The environmental effects associated with the first two alternatives would be essentially the same, with the exception of the timeframes. The proponent has indicated that abandoning the rehabilitation project would eliminate the anticipated environmental effects associated with construction and the change in the reservoir operating regime. This is not feasible because as the existing system does not meet the requirements of the CDA Dam Safety Guidelines and would pose an unacceptable risk to public safety during long-term operation. Delaying the Project would also pose a safety risk to the public.

Therefore, in considering all of the above, the proponent has advised that proceeding with the Project in the near-term, as planned, is the preferred alternative and is the only technically and economically feasible alternative that fulfills the Project's purpose.

4.2 Alternative Means of Carrying out the Project

Although alternative locations for some facilities were considered, as the Project primarily involves rehabilitation or upgrading of existing structures and embankments the locations of which are fixed. As a result, AT determined that the Project as proposed was the only technically and economically feasible way that the preferred alternative could be implemented.

4.3 Agency's Assessment

The Agency is satisfied that the proponent has adequately considered alternatives to the Project and alternative means of carrying out the Project. The selected alternative provides the most appropriate solution to meet the purpose of the reservoir rehabilitation and upgrading, within the constraints of existing structures and embankments.

5. Consultations

The Agency and the proponent conducted public and Aboriginal consultation activities to improve the quality of the environmental assessment.

5.1 Public Consultations

5.1.1 Agency consultations

The Act provides for three official opportunities for the public to participate in the comprehensive study. The first consultation took place from July 19th to August 20th, 2010, seeking comments

on the Project description and the conduct of the comprehensive study environmental assessment.

The second consultation took place from November 2nd to December 2nd, 2010, seeking comments on the draft project-specific guidelines and scoping document.

In the third consultation opportunity, the Agency will invite the public to comment on the content, conclusions and recommendations of this comprehensive study report. The Agency will present the comments received to the Minister of the Environment to assist in the environmental assessment decision.

The notices announcing the consultation periods were published on the Registry Internet site (www.ceaa-acee.gc.ca/050/index-eng.cfm; File Number: 09-03-49421) and in locals newspapers: Le Franco, Lethbridge Herald, Sun Times, and the Prairie Post as well as the Aboriginal newspaper, Alberta Sweetgrass.

To support the participation of interested individuals, not-for-profit organizations and Aboriginal groups in federal environmental assessments, the, Agency may provide funding through the Participant Funding Program. For this comprehensive study, there was a single applicant, the Métis Nation of Alberta—Region 3 who received $4,000 from the program.

5.1.2 Participation activities conducted by the proponent

AT's primary communication was to ensure that interested parties had the information they required to make informed decisions about the Project and to facilitate information exchange between interested parties and AT.

A public information session hosted by representatives from AT, Alberta Environment (AENV), and Klohn Crippen Berger Ltd. was held on May 28, 2009 at the Southern Alberta Bible Camp to explain the proposed project to the public and to seek feedback on the proponent's assessment of the environmental effects. The public information session was advertised through applicable local Municipal Districts, Towns, Villages, Little Bow Resort, and the BRID websites, printed on displays and in the Vulcan Advocate and Vauxhall Advance newspapers during the two weeks preceding the session. The public information Session was attended by twenty-seven members of the public, twelve exit surveys were received representing nineteen people, and nine requests for further information were received and responded to by the proponent.

The proponent has committed to conducting additional public consultation if there are changes to any of the features of the Project as a result of EIS recommendations or regulatory review.

5.2 Aboriginal Consultation

The Crown has a duty to consult Aboriginal groups and, if appropriate, to accommodate them when its conduct is likely to have an adverse impact on their established or potential Aboriginal or treaty rights. Aboriginal consultation is also commonly practiced with a view to good governance and to develop appropriate policies and find informed solutions.

In addition to these general practices and obligations, the Act requires that federal environmental assessments take into consideration, among other things, the impact of any change that a project may cause in the environment, and the impact of that change on the current use of lands and resources for traditional purposes by Aboriginal persons.

5.2.1 Consultations conducted by the Federal Government

To meet the Crown's duty to consult, the Agency conducted focused consultations

with Aboriginal people in proximity to the Project area, in addition to the public consultation process.

During the first public consultation phase, the Blood Tribe, Métis Nation of Alberta—Region 3, Piikani (Peigan) Nation, and Siksika Nation received a document summarizing the Project and outlining the steps in the environmental assessment. The consultation period was announced in a local newspaper, the Lethbridge Herald, Sun Times and the Prairie Pose as well as, an Aboriginal newspaper, Alberta Sweetgrass, and on the Agency Internet site. During this phase, none of the Aboriginal groups submitted any comments on the Project. As indicated, the Métis Nation of Alberta—Region 3 applied and received participant funding under the Participant Funding Program administered by the Agency.

In the second public consultation opportunity, the Blood Tribe, Métis Nation of Alberta—Region 3, Piikani (Peigan) Nation, and Siksika Nation received the draft project-specific guidelines and scoping document directly from the Agency. In addition, the consultation period was announced in a local newspaper, the Lethbridge Herald, Sun Times and the Prairie Post as well as the Aboriginal newspaper, Alberta Sweetgrass, and on the Agency Internet site. None of the Aboriginal groups submitted any comments on the draft project-specific guidelines and scoping document.

Following the second public consultation opportunity, the Agency met with the Blood Tribe, Piikani (Peigan) Nation, and Siksika Nation individually. The Aboriginal groups received the EIS directly from the Agency at these meetings. Métis Nation of Alberta—Region 3 was unable to meet with the Agency but was provided with a copy of the EIS directly from the Agency. Aboriginal groups were invited to submit comments on the EIS to the Agency; however, no comments were received.

The Blood Tribe, Métis Nation of Alberta—Region 3, Piikani (Peigan) Nation, Siksika Nation, Tsuu T'ina Nation and Stoney (Nakoda) First Nation were provided with the draft Comprehensive Study Report for their review and comment over a period of four weeks ending November 13, 2012. During the drafting of the CSR, it came to the Agency's attention that the Project may fall within the asserted traditional territory of the Tsuu T'ina Nation and Stoney (Nakoda) First Nation. Consequently, the Agency invited the Tsuu T'ina Nation and Stoney (Nakoda) First Nation to comment on the Draft Comprehensive Study Report (CSR). None of the Aboriginal groups submitted comments on the draft Comprehensive Study Report.

During the final public consultation phase, the Agency will invite Aboriginal groups to comment on the content, conclusions and recommendations of the final Comprehensive Study Report. The Agency will present the comments to the Minister of the Environment to assist in the environmental assessment decision.

In addition to the identified public and Aboriginal consultation opportunities the Agency contacted Aboriginal groups on several occasions to clarify issues, solicit comments and feedback, and exchange information through phone calls, email, letters, and meetings.

If the environmental assessment decision is to allow the Project to proceed, departments with regulatory responsibilities may consult further with the Aboriginal groups on the authorizations to be issued for the implementation of the project. This consultation may occur if there are outstanding Aboriginal issues related to departmental mandates that can be most appropriately addressed in the regulatory phase.

5.2.2 Consultation activities conducted by the proponent

The proponent's communication objective was to ensure that the First Nations and Métis had

the information they required to make informed decisions about the Project and to facilitate opportunities for the exchange of information between the First Nations, Métis and AT. First Nations identified by AT as having a potential interest in the Project are the Blood Tribe, Piikani Nation, Siksika Nation and Métis Nation of Alberta—Region 3. The proponent provided each of the First Nations and Métis Project Specific Guidelines & Scoping Document, the Project overview presentation (included location, components, need, environmental effects), and historical resource and archaeology studies. Communication also included direct phone and email contact, letters, and face-to-face meetings.

5.3 Issues Raised

The Agency forwarded the concerns and comments received from the public and Aboriginal Groups to both the proponent and the Federal Review Team. The following general subjects were raised by the participants and are addressed further in Section 7 (environmental effects) where mitigation to address the issues, as they relate to the environment, are also presented. A more detailed summary of issues raised can be found in Appendix 6.

5.3.1 Capacity funding

The Blood Tribe, Piikani Nation, Siksika Nation and Métis Nation of Alberta—Region 3 all indicated that capacity funding was required to fulfil AT's request for traditional knowledge and use of the Project area. Of the four groups, the Métis Nation of Alberta—Region 3 was the only group that applied for, and received, $4,000 from the federal Participant Funding Program in the summer of 2010. AT indicated that as a government proponent they would not provide capacity funding to any of the Aboriginal groups, either for review or for site visits.

5.3.2 Water quantity

Métis Nation of Alberta—Region 3 and the Siksika Nation expressed concerns that the Little Bow Reservoir development may impact the ability of their communities to withdraw water from the reservoir, and have concerns about the reduced water levels in the Bow River. The potential impact of the Project on water quantity and the mitigation measures proposed to address these concerns are presented in Section 7.3 on hydrology.

5.3.3 Water quality and aquatic environment

The Siksika Nation noted that water quality in nearby water bodies has declined in recent years, pointing to industry and development as the cause. They were concerned that the water can no longer be used for traditional activities (e.g., swimming and sweat lodges). The Siksika Nation and Métis Nation of Alberta—Region 3 have noted that they are concerned about future activities in the area that may impact abilities to fish downstream of the Project. The potential impact of the Project on water quality and the mitigation measures proposed to address these concerns are presented in Section 7.4. The environmental effects assessment of the aquatic environment is presented in Section 7.6. The potential impacts of the Project on the current use of lands and resources for traditional and recreation purposes and suggested mitigation measures are presented in Section 7.12.

5.3.4 Current and traditional use and knowledge studies

The Blood Tribe and Siksika Nation stated a need for further land use studies in the Project area to identify and verify the historical sites, plants and animals that may be present. The potential impacts of the Project on the current use of lands and resources for traditional and recreation purposes and proposed mitigation measures to address these, and

more general land use concerns, are presented in Section 7.12. The environmental effects assessment of heritage and archaeological resources is presented in Section 7.13.

5.3.5 Wildlife and species at risk
Métis Nation of Alberta—Region 3 has concerns regarding the area of land that will be inundated and how this will affect species at risk (including burrowing owls and ferruginous hawks) and other wildlife species (including red tailed deer, beaver, coyotes, fox, rabbits, antelope and waterfowl). The potential impacts of the Project on wildlife and wildlife habitat and proposed mitigation measures are addressed in Section 7.8.

5.3.6 Traditional plants
The Blood Tribe has concerns over the relocation of traditional plants and feels that they should be the ones to carry out this relocation. The Siksika Nation has noted that it has become very difficult to find their medicinal plants in the Little Bow Reservoir area. The potential impacts of the Project on vegetation and associated mitigation measures are presented in Section 7.7. The environmental effects assessment of current use of lands and resources for traditional and recreation purposes and more general land use concerns are presented in Section 7.12.

6. Profile of the Environment

6.1 Biophysical Context

6.1.1 Landscape
The landscape of southern Alberta is the result of North America's last glaciation, which ended approximately 7,000 years ago. The landforms present in the LSA and RSA are primarily hummocky terrain resulting from the disintegration of the Wisconsinan advances of the Laurentide ice, and from the erosion of the resulting tills.

The Little Bow Reservoir experiences frequent thunderstorms during the summer months as a result of rapid upward movement of warm, moist air, causing convective storms. The area experiences the effects of Chinook winds during the winter, but to a lesser extent than areas further west. These winter weather events are characterized by a rapid rise in temperature accompanied by dry winds. In general, the reservoir is subject to frequent high wind velocities, predominantly from the west, due to the open landscape and long fetch.

6.1.2 Geophysical
Surface soil salinity, based on the observed presence of species of salt tolerant grasses, has been observed on localized parcels of land and has been identified as being associated with either irrigation canal seepage salinity or slough ring salinity in dry land.

High winds and large resulting wave action are a relatively common occurrence in this area of southern Alberta, commonly resulting in shoreline erosion. The reservoir shoreline is characterized by areas of frequent instability, including areas of ongoing erosion of varying severity and areas that have become stabilized at lower elevations through beaching or armouring of the slope toe, however upper elevations continue to be eroded by large waves. Mass-wasting sometimes occurs during heavy rainfall events such as summer thunderstorms.

6.1.3 Hydrology
The Bow River originates at Bow Lake in the Rocky Mountains and flows southeast through the mountains, foothills, and prairies to its confluence with the Oldman River which at that point together form the South Saskatchewan River. The Bow River is primarily a snowmelt stream that is considered to be relatively natural upstream of the Town of Banff; downstream of Banff most of the flows are highly altered. The Bow River is the most regulated river in

Alberta, with eleven hydroelectric facilities and three major irrigation districts within its watershed.

The headwaters of the Little Bow River originate near the Town of High River. The river flows south to Twin Valley Reservoir and south and east from Twin Valley Reservoir to Travers Reservoir. From Travers Reservoir the river flows south and east to the Oldman River, near the Town of Picture Butte. The natural catchment area draining to the Little Bow River is rolling upland dominated by pasture and irrigated cropland. The land generally drains from northwest to southeast, away from the Rocky Mountain Foothills.

The Little Bow, McGregor, and Travers Reservoirs together with more than 65 km of irrigation canals make up the Carseland-Bow River Headworks (CBRH) system. The CBRH system (see Figure 1.2) is a major multi-purpose water delivery system that diverts, impounds, and releases water from the Bow River for water management (e.g., water supply for irrigated agriculture, municipalities, domestic users, and livestock operations, flow regulation, water conservation, industrial users, and recreational users). Reservoir levels and releases from the Combined TLBR are affected by upstream river diversions and downstream water demands, respectively. The CBRH system diverts water to 85,000 ha of agricultural land in the BRID and 2,000 ha for the Siksika Nation. Diversions from the Highwood River to the Little Bow River via the Little Bow Canal started in the late 1890s. The canal was rehabilitated in 2004 as part of the Twin Valley Dam and Reservoir project. Rehabilitation of the CBRH main canal was completed in 2008.

The McGregor Reservoir is approximately 33 km long with the north end of the reservoir located approximately 100 km southeast of Calgary near the Village of Milo. The reservoir is contained by two earthfill dams (the North and South McGregor dams). The dams and associated structures were originally constructed in 1910, significantly upgraded in the 1950's, and rehabilitated from 2004 to 2008. Water is released through the South Dam to the connecting canal to Travers Reservoir. Travers Reservoir is created by a 44 m high dam on the Little Bow River. The dam and associated structures were originally constructed in the early 1950s and are currently being rehabilitated.

6.1.4 Surface water hydrology

The Little Bow Reservoir receives water at its southwest corner from Travers Reservoir, and is thus, despite its name, made up of water almost entirely from the Bow River. The reservoir's volume is replaced approximately 16 times per year, with all inflows and outflows generally occurring from April to October. The reservoir discharges water at its northeast corner via a dammed outlet that directs water into the BRID main canal. The BRID main canal leaves Little Bow Reservoir and carries water in an easterly direction to provide irrigation water to the most of the BRID. The Lomond Lateral Irrigation Canal is a small canal that branches off from the main canal approximately 350 m downstream from the Little Bow Reservoir outlet and carries water in a northeast direction past the Village of Lomond.

The water in Little Bow Reservoir is clear, however high winds can cause wave erosion of exposed sandy banks, particularly along the east side of the reservoir south of the existing PRA. The water is well-mixed during the summer because of its exposure to prevailing westerly winds, and there is very little vertical stratification of water quality parameters (including temperature) throughout the water column during the open water season.

The Travers Reservoir is considerably deeper than Little Bow Reservoir and is contained within generally higher landforms, such that

more thermal stratification occurs than in Little Bow Reservoir, although wind-generated wave action still often mixes the water column. Almost all of the maximum concentrations of nutrients occur during major precipitation events, when storm water runoff carries cattle manure and crop fertilizers to the river.

6.1.5 Hydrogeology and groundwater quality

Although the Little Bow Reservoir catchment is within the Oldman River drainage basin, most of the reservoir inflow is water from the Bow River basin diverted into the CBRH system. Groundwater resources are currently being used for domestic, stock, irrigation and municipal purposes. In general, the majority of wells produce water from aquifers that are less than 100 m deep. Given the relatively flat topography of the plain areas, local shallow groundwater flow will be controlled by the water level in the Little Bow Reservoir. The Little Bow Reservoir has porous soil that produces little natural runoff, and is in an area with some of the lowest precipitation rates and highest evaporation rates in Canada.

The water chemistry of Little Bow Reservoir is very similar to Travers Reservoir; chloride ionic ratios are low in all groundwater and surface water samples. Deeper groundwater chemistry reflects long residence times in aquifers. Some shallow groundwater samples have relatively high Total Dissolved Solid (TDS) concentrations. Generally, sodium and potassium cations and sulphate increase with depth and calcium and magnesium are relatively reduced with depth.

The only domestic groundwater resource use in the area is the L&J Murray Ranches Ltd. spring, which is a permanent spring situated on private property. The spring, situated within the Little Bow River valley approximately 1 km south of and approximately 30 m lower in elevation than, the TLBR Connecting Canal, has been used as a domestic water supply since sometime prior to 1928.

6.1.6 Aquatic environment

Emergent vegetation around the perimeter of Little Bow Reservoir and some of the islands consists primarily of cattail, with much smaller amounts of bulrush, horsetail and sedge. In general, there is sparse emergent vegetation coverage only in shallow bays or on shorelines that are protected from the prevailing wind and resulting wave action.

The Little Bow Reservoir littoral zone (<2 m deep) is about 30% of the total surface area, and supports extensive submergent weed beds. The submergent vegetation species observed in Little Bow Reservoir include: pondweed, white water crowfoot, northern watermilfoil, chara, coontail, ditch-grass, bladderwort, water starwort and occasional yellow pond lily.

Benthic invertebrate samples from the Little Bow Reservoir showed considerably greater densities of invertebrates than Travers Reservoir, a higher diversity index, and slightly greater variety of taxa.

Although no official fisheries management objectives have been approved for Little Bow Reservoir, the reservoir is managed to maintain northern pike, walleye, and lake whitefish populations. Northern pike and walleye represent the two primary recreational targets, while lake whitefish is the primary commercial winter fishery species. Other species that may be present include spottail shiner, yellow perch, burbot, longnose sucker, white sucker, shorthead redhorse, rainbow trout, and brown trout. Little Bow Reservoir appears to provide suitable habitat for all age classes. Little Bow Reservoir winter dissolved oxygen concentrations under the ice are sufficient for fish survival, as no winter kills have been documented. Catch data suggests a potentially greater density of lake whitefish and walleye in Travers Reservoir than in Little Bow Reservoir and more perch and spottail shiners in Little Bow Reservoir. Northern pike catch

rates were similar for Little Bow Reservoir and Travers Reservoir.

All fish sampled had mercury concentrations over the Canadian Council of Ministers of the Environment (CCME) guidelines (1999) for mercury in fish for consumption by birds and mammals. In general, the older age classes of species typically showed higher mercury content as mercury accumulates over time when small quantities are ingested continually. ESRD has applied the Health Canada Recommended Fish Consumption Limits to fish species in Alberta water bodies and set consumption limits accordingly. Current consumption limits for Little Bow Reservoir and surrounding water bodies and tributaries can be found at: http://www.mywildalberta.com/Fishing/SafetyProcedures/FishConsumptionAdvisory.aspx. At the time of writing, consumption limits for Northern Pike apply within the Little Bow Reservoir.

6.1.7 Vegetation

The Project occurs within the Mixedgrass Natural Subregion of southwestern Alberta. It is broadly characterized as a band of intensely cultivated prairie over coarse and/or medium textured wind or water-laid sediments and glacial till. The Mixedgrass Natural Subregion accounts for 2.9% of the area of Alberta. The Mixedgrass Prairie experienced heavy livestock grazing during the early twentieth century, and at present, only 31% of the original 4.6 million acres of native prairie remain. Both terrestrial and aquatic vegetation types are present in the Project area including riparian vegetation, wetlands, emergent and submergent aquatic vegetation, grasslands, and shrubs and trees.

6.1.8 Wildlife and terrestrial habitat

The Mixedgrass Subregion contains important habitat for prairie wildlife species that can use moderately to heavily grazed prairie. The Little Bow Reservoir PRA has been identified as an Important Bird Area (IBA) of Canada. This site provides habitat to approximately 118 species of birds, including approximately 1,050 (1% of Canada's population) of non-breeding American white pelicans in the summer months.

6.2 Human Context

6.2.1 General overview

The closest communities to the LSA are the Vulcan County communities of the village of Lomond (population 175) and the hamlet of Enchant (population 205), each located approximately 20 km from the LSA. The communities of Vauxhall in the Municipal District of Taber and Picture Butte in the County of Lethbridge are the closest communities with a population of over 1,000. The Little Bow Reservoir drainage basin has no major population centres and no cottages.

The landscape of the South Saskatchewan Region, including the RSA, has been significantly affected by agricultural development, both through grazing and other agricultural related activities including development of irrigation infrastructure. These activities have been ongoing since the early 1900's with the Little Bow Reservoir being completed in 1920. There are no private land holdings or residences within the LSA. Several sections of land in the RSA are privately owned.

The Little Bow Reservoir provides a good environment for recreational activities but is also exposed to strong winds and contains aquatic plant growth, concentrated on the west side of the reservoir, which may deter some forms of recreation. The Little Bow Reservoir PRA also provides access to some sandy beach shoreline areas adjacent to the Little Bow Reservoir. Activities available to Little Bow Reservoir PRA and Little Bow Reservoir users include beach use, birding, camping, canoeing, kayaking, fishing, ice

fishing, power boating, sailing, swimming, water skiing, windsurfing, hiking, other water activities, and wildlife viewing.

The PRAs and provincial park in the Project area are managed by the MIM Management Group, based in Champion, Alberta. The PRA provides basic camping facilities and access to beach areas and the Little Bow Reservoir. The Little Bow Reservoir and the areas around Travers and McGregor reservoirs are part of an Important Bird Area (IBA).

Little Bow Reservoir is currently used by recreational power boaters and non-motorized recreational craft (canoes, kayaks, wind-surfers, and kite-boards). The open exposure and long fetch of the reservoir frequently results in rough open water conditions, limiting most recreational opportunities on windy days. However, these windy conditions can also provide excellent opportunities for some specific sports such as wind-surfing and kite-boarding.

The lands adjacent to, and immediately surrounding, the LSA are owned by the Alberta Provincial Government and leased for grazing. The proponent has indicated the same family has held the lease for three generations. Pastureland in the LSA has good to fair capacity but is limited by ability to provide irrigation. Non-irrigable lands include gravel operations immediately south of the TLBR Connecting Canal, and steeply sloping land on the banks of the Little Bow River. Some primarily agricultural commercial property is also located in the RSA. The Little Bow Reservoir is located within the vicinity of oil, gas, and coal deposits, of which oil and gas are currently extracted.

6.2.2 Aboriginal context

Archaeological studies suggest that Blackfoot Confederacy members (which include the Blood Tribe, Siksika Nation and Piikani Nation) have lived in southern Alberta for at least 12,000 years. Historically, the First Nations led a nomadic lifestyle based on bison hunting and gathering in an area from the Red Deer River in Alberta to the Yellowstone River in Montana. Following the signing of Treaty 7, Blackfoot Confederacy member nations transitioned to an agricultural based lifestyle centered on their reserves.

Siksika Nation, Piikani Nation, and Blood Tribe customs, traditions, spirituality, and lifestyle reflect their intimate relationship with their territory and its resources. This territory includes lands on and surrounding the Little Bow Reservoir where Siksika, Blood, and Piikani tribes followed bison herds. Bison hunting was an important component of the Blackfoot 'seasonal round'—a seasonal movement of people across a land base to use available resources. River valleys were often used as wintering areas as they provided shelter, the surrounding trees provided fuel, and game usually wintered nearby.

The Blood tribe

The Blood, or Kainai, Tribe has a registered population of 11,274, two reserves known as Blood 148 (1,342.9 km^2) and Blood 148A (19.7 km^2), and seven communities in Southern Alberta, with the main community being Standoff. As of June 2011, about 69% of Blood First Nation members were living on one of the two Blood Tribe reserves.

The Piikani First Nation

The Piikani Nation is the largest of the Blackfoot Confederacy nations. The Piikani traditional territory extended from Rocky Mountain House, Alberta to Heart Butte, Montana. Today, the Piikani Nation has two reserves known as Peigan Timber Limit "B" (29.8 km^2) and Piikani (427.0 km^2) with a registered population of 3,578 members, approximately 66% of which live on reserve at Piikani. The administrative centre of Piikani Nation is situated in Brocket.

The Siksika Nation
The Siksika traditional territory includes the northern and eastern lands of the Blackfoot Confederacy territory (i.e., the land between Saskatchewan to the east, Alberta to the West, the Saskatchewan River in Alberta to the North, and Missouri River in Montana to the South). Today the Siksika are centred south of the Town of Gleichen and have 6,718 registered members, approximately 55% of which live on the 710.9 km^2 Siksika 146 Reserve.

Tsuu T'ina
The Tsuu T'ina First Nation, signatory to Treaty 7, is located 13 km southeast of Calgary where they hold 277 km^2 ha of reserve land. The registered population of the Tsuu T'ina First Nation is 1,992. The Project lies within the asserted traditional territory of the Tsuu T'ina First Nation which encompasses a large section of south central Alberta; extending from southern most Alberta, northwest along the Rocky Mountain range to north of Willmore Wilderness Park, east to Edmonton then south east to the Alberta/USA border.

Stoney Nakoda First Nation
The Stoney Nakoda First Nation, signatory to Treaty 7, is recognized by AANDC as being comprised of the Wesley First Nation, the Chiniki First Nation, and the Bearspaw First Nation. The combined registered population of the three First Nations is 5,146. The Stoney Nakoda First Nation holds more than 480 km^2 of reserve land located west of Rocky Mountain House (Big Horn Reserve), southwest of Calgary (Eden Valley Reserve), and northwest of Calgary (Stoney Reserves 142-143-144 and 142B). The Project lies within the traditional territory, as identified by the Stoney Nakoda First Nation during the Joint Review Panel process for the Enbridge Northern Gateway Project.

Métis
The Métis, a culturally distinct group of Aboriginal peoples who emerged from mixed Aboriginal and European ancestry are one of three Aboriginal groups recognized in Canada. The Métis of Southern Alberta Region 3 are considered by the Métis Nation of Alberta to be the Métis people who have traditionally occupied the area now known as 'Region 3'. This is the area in which the Project is located.

Traditionally, the Métis lived a semi-nomadic lifestyle centred on seasonal activities including bison hunting, pemmican making, berry and vegetable gathering and trapping. The Métis were known to have semi-permanent bison hunting camps near Fort Macleod and Fort Calgary. As the bison population declined in the 1870s, many Métis relocated and settled in order to survive.

7. Environmental Effects Assessment

7.1 Approach

In this section, the Agency provides a summary to help readers understand the steps in its analysis process. Readers who would like to have more detailed information can consult the series of documents relating to the environmental assessment of the Project available on the Canadian Environmental Assessment Registry.

The Agency, in collaboration with the Federal Review Team, identified and assessed potential adverse environmental impacts of the Project on the basis of:

- the proponent's impact assessment, including the proponent's responses to the questions and comments from the Federal Review Team
- additional studies submitted by the proponent such as survey results, fish and mercury level studies
- the information obtained during public consultations

- the expert opinions obtained from the federal government departments.

The method used to assess the significance of the effects considers six criteria, which are defined as:

- direction: the long-term trend of the effect (i.e., positive, neutral, negative)
- magnitude: the amount of change in a measurable parameter or variable relative to baseline conditions (i.e., negligible, low, moderate, high)
- geographical extent: the area within which an effect occurs (i.e., local, regional, provincial/ trans-boundary)
- duration: the period of time required for a resource component to return to its baseline condition, or for the effect to be no longer measured or otherwise perceived (short-term, medium-term, long-term, far future)
- frequency: the number of times during a project or a specific project phase that an effect might occur (i.e., one time, sporadic, regular, and continuous)
- reversibility: a rating of the permanence of the effect (i.e., reversible short-term, reversible long-term, irreversible)

Based on the nature and extent of the effect, a conclusion was made as to whether the effect would have a negligible, low, moderate, high or unknown impact on the VEC.

- negligible: The Project effect is not expected to have a measurable or detectable impact on the population or resource
- low: the Project effect is expected to result in subtle environmental changes that are likely measurable or detectable but would not constitute or result in a population level effect;
- moderate: the Project effect is expected to result in a measurable change in the population or resource that would be of potential ecological significance
- high: the Project effect is expected to result in a measurable change in the population or resource that would be of significance to ecosystem structure and function
- unknown: the impact cannot be determined due to inadequate baseline information or uncertainty about the nature and extent of the Project effect

Following the determination of level of impact, the determination of significance was done by considering thresholds beyond which impacts would be considered significant. These thresholds reflect the limits of an acceptable state for each ecosystem component based on resource management objectives, applicable environmental standards, and guidelines. Where standards were not available, professional judgement based on experience and scientific literature was used to determine thresholds specific to each VEC. The level of confidence and likelihood that the impact would occur were also considered in their determination. After taking into account identified mitigation measures intended to reduce the incidence of potential adverse environmental effects the evaluation of significance was carried out for each residual effect.

A summary of VECs and significant effects is presented in Appendix 3. A summary of residual effects for all VECs is presented in Appendix 4. A summary of all proposed mitigation is presented in Appendix 5.

7.2 Geophysical

The proponent used previously existing data sources (reports, maps, etc.) to review assess the geophysical environment including soil quantity and quality in the LSA and RSA and the Alberta Soil Quality Guidelines for Unrestricted Land Use (AENV, 2001) to assess the soil for both topsoil and subsoil as good, fair, poor, or unsuitable. Mapping indicated that all of the test soil sample sites, with the exception of one site located

outside the LSA but within the RSA, are rated as good and have low reported values with respect to measured salinity.

The proponent has noted that the processes of wave erosion and sediment transport within the reservoir have not resulted in a state of shoreline equilibrium within the reservoir, but rather a continuous process of shoreline erosion occurring at a relatively consistent rate.

7.2.1 Potential environmental effects

Construction

Potential impacts to soil during construction are primarily related to handling of topsoil and the use, maintenance, and storage of heavy equipment. Topsoil will be stripped from all areas to be disturbed or developed and will be stockpiled for use during reclamation. Heavy equipment will be required for clearing and grubbing, topsoil stripping, material transport, and building structures.

The potential impacts that may occur including: soil compaction, topsoil loss, erosion, reduction of organic content of soils, and the introduction of pollutants are all of low magnitude, of short duration and restricted geographically.

Operation

The primary impacts to soil that may occur during reservoir operation include wind or wave erosion at the sediment/water interface and deposition of sediment into the reservoir through wind or runoff erosion in near shore areas. Wind erosion potential for the RSA is rated as moderate to severe. Minor increases in sediment deposition into the Little Bow Reservoir as a result of the Project are expected. Increased shoreline exposure and fluctuating water levels are expected to result in a minor increase in sediment deposition due to wave erosion during Project operation. Fluctuating water levels will result in cyclical submersion and exposure of an area of approximately 2.13 km^2 that will be subject to wind erosion. Exposure of a larger area of shoreline to the effect of wave erosion and wave action at lower elevations may lead to undercutting and destabilization of steep sloping shorelines. Decreased slope stabilization poses a risk to PRA users. Surface water erosion is not anticipated to increase significantly as a result of the Project.

7.2.2 Mitigation measures

To minimize the potential effect of the Project on the geophysical environment Erosion and Sediment Control (ESC) measures will be implemented prior to work and maintained during the work phase until the site has been stabilized. The ESC measures will be inspected regularly. The Erosion and Sediment Control Manual (Alberta Transportation, 2011) and standard AT construction practices will be followed for all project phases. Wind and wave erosion will be mitigated by installing riprap armouring in the steeply sloped shoreline areas in the vicinity of the new PRA. See Appendix 5 for details.

Monitoring will include both general construction and reservoir turbidity monitoring conducted by AT during the first two years of operation and biannually thereafter as a component of the Follow-up Program (see Section 8 and Appendix 7) to determine the extent and severity of erosion along the new shoreline at FSL and within the reservoir drawdown zone. These biannual surveys will visually assess changes in shoreline stability and erosion potential, which will be photographed, mapped and compared to the baseline condition. Areas of particular erosion concern, such as those predicted in the EIS, will be noted and the need for additional mitigation will be evaluated on a case by case basis. The proponent will work with

federal authorities to identify thresholds at which monitoring results will trigger adaptive management. Over the long term, monitoring of the reservoir shoreline will be conducted by ESRD on a biannual basis (once every two years) to detect areas of potential erosion concern or slope instability, in accordance with established infrastructure management procedures.

7.2.3 Residual environmental effects
Implementation of the proposed mitigation measures will result in a negligible potential for residual effects on soils as a result of Project construction activities. During operation, increased aquatic sedimentation resulting from increased wind and wave erosion will not be fully mitigated and will result in a residual effect that is local in extent, continuous, extending far into the future, and irreversible. Wind and wave erosion is a naturally occurring process that results from the existing LSA soil conditions, but the Project will likely cause an increase in the magnitude of this effect over the long term. The residual effects of the Project on soil quantity and quality are likely to be limited in magnitude and geographic extent.

7.2.4 Government, public and Aboriginal comments and proponent's response
Fisheries and Oceans Canada and Environment Canada had requested that the proponent provide more detail with respect to the potential increase in erosion as a result of the Project including an explanation of the extent of the increase in erosion due to increased water levels and a fluctuating reservoir and details on whether any monitoring will be conducted within the reservoir to determine the extent and severity of erosion. The proponent provided further information on rates of shoreline erosion, their methodology for calculation, and proposed mitigation and monitoring to address the potential impact. Fisheries and Oceans Canada and Environment Canada also sought clarification on the requirements of the Contractor to conduct turbidity monitoring and the methodology to be used for such monitoring, this information was provided by the proponent. Fisheries and Oceans Canada and Environment Canada concluded that a satisfactory amount of information was gathered for assessing the effects.

7.2.5 The Agency's conclusions regarding residual environmental effects
Taking into account the implementation of the proposed mitigation, as well as the Follow-Up Program, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on soil quantity or soil quality.

7.3 Hydrology

Simulation modelling assisted the proponent in identifying and developing an understanding of potential issues including: water supply versus water demand, instream objectives, reservoir operation, and competing stakeholder objectives (i.e., irrigation, fisheries and recreation). Instream objectives (IO) are the amount and quality of water in an aquatic ecosystem necessary for the protection of a natural water body or its aquatic environment; protection of tourism, recreational, transportation or waste assimilation uses of water; and management of fish and/or wildlife.

The Bow River basin and South Saskatchewan sub-basin have been reserved to limit future licenses for water-taking to protect the aquatic environment and improve the water supply to existing licensees.

7.3.1 Potential environmental effects
There are no proposed changes to the existing licensed allocations for the proposed Combined TLBR; however, the size and timing of diversions from the Bow River for the existing allocations may change.

Construction

The proponent did not identify any anticipated impacts to hydrology as a result of construction activities.

Operation

Impacts to hydrology with respect to Bow River discharge may include a slightly greater diversion in spring (April to mid-May) from the Bow River downstream of the CBRH diversion at Carseland. In the late summer and fall, (mid-August to mid-October) less water will be diverted from the Bow River as a result of increased storage within the Combined TLBR, thereby lessening the impact of CBRH system diversions on Bow River temperatures. Over the long term, there may be slight changes to the number of weeks when the weekly Bow River discharge downstream of the CBRH diversion is above and/or below the IO.

Impacts to the Little Bow River Discharge include an increase in the FSL of Little Bow Reservoir relative to the existing operating level (15.87 km^2 over the entire reservoir). In addition, annual fluctuations of the Little Bow Reservoir will occur as a result of irrigation demands. The effect of this change on current use of lands and resources for traditional and recreational purposes is discussed in Section 7.12. Negligible changes in flow at the Little Bow River discharge downstream of Travers Reservoir are expected.

High evaporation water loss from Little Bow Reservoir is expected as a result of an increase in surface area. This is estimated to be 0.225% of the water volume allocated for CBRH System withdrawal.

7.3.2 Mitigation measures

Based on the water licenses allocated for the CBRH system, no mitigation is required with respect to reduced Bow River discharge downstream of the CBRH system diversion. AT notes that Alberta Environment's Operating Strategy 2010 will account for any fluctuations in the system, limiting and/or temporarily restricting diversions as necessary.

The potential for increased withdrawals from the Bow River in the spring, as identified in the Water Resource Management Model results, can be mitigated in accordance with AENV's Operating Strategy 2010. In the late summer-early fall, river diversions are expected to be less which could result in a slight increase in the number of weeks when the IO is met over the long term. A Combined TLBR results in a net benefit as Bow River discharges downstream of the CBRH diversion are greater in the late summer-early fall, when water temperatures are higher, than they would be under baseline conditions.

The Project will result in increased evaporation losses from Little Bow Reservoir due to the increase in the flooded area. This loss cannot be mitigated.

Monitoring

Current monitoring of Bow River discharge, CBRH diversion discharge, and Little Bow River discharge upstream and downstream of the Travers Reservoir will continue as in the past, as per existing licensing requirements. Current water level monitoring of the McGregor Reservoir will also continue, and the water level monitoring previously conducted for the Travers Reservoir will now be carried out on the Combined TLBR. This monitoring will be conducted by AESRD in liaison with WSC.

7.3.3 Residual environmental effects

There are no impacts to hydrology anticipated as a result of Project construction activities. The potential for increased withdrawals from the Bow River in the spring can be mitigated in accordance with AENV's Operating Strategy 2010. A Combined TLBR results in a net benefit as Bow River discharges downstream of the CBRH diversion are greater in the late summer-early fall when water temperatures are higher,

than they would be under baseline conditions. This positive residual effect is expected to be negligible in magnitude, regional, and sporadic. During operation, increased evaporation resulting from an increase in flooded area will not be mitigated and will result in a residual effect that is regional in extent, is regular in frequency, and will extend far into the future and be irreversible during operation. Evaporation is a naturally occurring process in any reservoir or basin of water, but the Project will likely cause an increase, although negligible, in the magnitude of this effect over the long-term. This increase is equal to approximately 0.225% of the total water allocation for the CBRH System and does not represent a significant increase in withdrawal from the Bow River.

7.3.4 Government, public and Aboriginal comments and proponent's response

In response to a request from Fisheries and Oceans Canada the proponent provided detailed calculations and analysis of evaporation loss in the Little Bow Reservoir. Fisheries and Oceans Canada subsequently concluded that a satisfactory amount of information was gathered for assessing the effects.

The Métis Nation of Alberta—Region 3 and the Siksika Nation expressed concerns that the development may impact the ability of their communities to access water resources (i.e., water withdrawals from the reservoir), and had concerns about the reduced water levels in the Bow River. In particular the Siksika Nation sought reassurance that the Project would not impact current and future use of the water supply licenses allocated to the Siksika Nation. The proponent responded that, based on the water licenses allocated for the CBRH system, no mitigation is required with respect to reduced Bow River discharge downstream of the CBRH system diversion as these licenses are not subject to IO. However, as per AENV's Operating Strategy 2010, AESRD has made a commitment to limit diversions to 34 m^3/s (maximum design discharge of 51 m^3/s) if different instream flow conditions are not met. The proponent also confirmed with the province that should the Siksika Nation wish to use their existing water license, the water will be made available to them. However, to date they have not exercised their right to this water.

7.3.5 The Agency's conclusions regarding residual environmental effects

Taking into account implementation of the proposed mitigation, as well as the Follow-Up Program, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on the hydrology, specifically the Bow River discharge downstream of the CBRH diversion, the Little Bow Reservoir discharge downstream of Travers Reservoir, or the Little Bow Reservoir and Travers Reservoir water levels.

7.4 Surface Water Quality

The analysis of impacts to surface water quality was wide-ranging in order to incorporate and assess concerns with respect to the health and survival of organisms living in (e.g., fish and aquatic organisms) or otherwise exposed to (e.g., agricultural crops and livestock), the reservoir water.

The Little Bow Reservoir has high dissolved oxygen content. Levels of total organic carbon, nitrogen, and phosphorous are generally low, and the trophic status of Little Bow Reservoir is on the border between oligotrophic (i.e., cold, low nutrient levels) and mesotrophic (i.e., moderate nutrient levels). Chlorophyll a concentrations during the open-water season in the Little Bow Reservoir are generally similar to those in Travers Reservoir and are low compared to natural lakes in the area. Alkalinity, conductivity, and TDS are all generally low. The dominant ions are bicarbonate, sulphate, and calcium. The pH has been in the range of 8.0 to 9.0.

Travers Reservoir is between oligotrophic and mesotrophic, due mainly to nutrient-rich runoff from agricultural fields that potentially contains fertilizers and/or cattle manure. Water releases from Travers Reservoir have consistently low concentrations of all water quality parameters and have not exceeded of published guidelines. Irrigation return flows only affected water quality in the mainstem river during low flow years, when total nitrogen, total phosphorous, and dissolved phosphorous were increased due to nitrogen and phosphorous forms in the irrigation return water.

7.4.1 Potential environmental effects

Construction and operation

Surface water quality in the Little Bow Reservoir could potentially be impacted during construction and operation as a result of erosion and sedimentation from direct disturbance of the bed and shoreline, or indirectly as a result of surface flow or wave action. Decreased dissolved oxygen concentrations and release of methane, CO_2, and other by-products as vegetation decays during reservoir drawdown in winter are expected for three consecutive years of construction. There will be an increased nutrient and organic carbon loading within the reservoir. Both nutrients and dissolved oxygen may be transported throughout the reservoir with re-suspended sediment during heavy wave action and mixing.

Increased methylation of mercury is expected as a result of decomposition of vegetation in the newly flooded area. The assimilation of methylmercury by aquatic life will result in an increase in fish mercury level. Mobilization of metals (aside from mercury) will likely occur as a result of decomposition of vegetation in the newly flooded area. An improvement to regional water quality under the new combined operating regime as a result of smaller river diversions from mid-August to mid-October is expected. During the same period temperatures in the Bow River are expected to increase.

7.4.2 Mitigation measures

The primary potential impact to aquatic life is the reduction of dissolved oxygen concentrations as oxygen is sequestered during the decomposition process; however the period in which the decomposition process will occur within the wetted perimeter of the reservoir has been timed to coincide with the operational irrigation season where open water conditions exist and the reservoir is well mixed. Oxygen concentrations are expected to be high throughout the water column at this point; reducing the impact on aquatic life decreased dissolved oxygen concentrations. Supplemental aeration (i.e., adding additional oxygen to the water) may be required to maintain dissolved oxygen concentrations in the drawn down reservoir if low dissolved oxygen levels are measured, to ensure the survival of fish and other aquatic life during the winter (see Section 7.6.1). As such, the anticipated impact on water quality as a result of decomposition of flooded terrestrial vegetation is negligible. See Appendix 5 for details of mitigation.

As Little Bow Reservoir experiences a rapid water exchange rate, it is expected that any increased nutrient loading within the inundation zone would be offset through distribution within the reservoir and flushing out of the reservoir (i.e. adding new water to the reservoir). No algal blooms or significant increases in aquatic vegetation growth are expected in the Little Bow Reservoir or in the BRID canal system downstream, due to the nutrient inputs. Nutrient input may actually help vegetation to establish in the drawdown zone.

Fish tissue samples in both Little Bow River and Travers Reservoir currently show mercury levels exceeding the CCME criterion for wildlife that eat fish and approaching the Health Canada criterion for fish eaten by humans. Environmental effects and mitigation measures with respect to methylation of mercury in the aquatic environment are further discussed in Section 7.6 and Section 7.12.

Given that there have been no trends of high metal content, other than mercury, noted in sediment, water, or fish tissue samples collected in the existing reservoir, the increased sediment water interface is not expected to increase metals leaching sufficiently to result in an impact.

For further mitigation with respect to erosion and sediment control see Section 7.2.

Monitoring

Monitoring of turbidity levels will occur during any construction activities within the wetted perimeter of the reservoir. Construction monitoring will be required to ensure that erosion and sedimentation are controlled within the construction footprint and that potential impacts to surface water quality are mitigated.

Monitoring of dissolved oxygen concentrations will be conducted through the ice during the three years when the Little Bow Reservoir is drawn down for construction during the winter. Supplemental aeration may be required to maintain dissolved oxygen concentrations in the drawn down reservoir if low dissolved oxygen levels are measured, to ensure the survival of fish and other aquatic life during the winter.

The Government of Alberta is responsible for monitoring mercury content in fish in Alberta water bodies and setting consumption limits. Ongoing regional sampling programs are employed throughout southern Alberta to determine fish consumption advisory requirements. Monitoring of methylation of mercury and fish mercury levels is further discussed in Section 7.6.

7.4.3 Residual effects

Two potential residual effects are and increase in aquatic sedimentation resulting from increased wind and wave erosion and a potential net positive regional impact to water quality related to changes in CBRH system withdrawal rates and timing under the new combined operating regime.

The residual effects with respect to increased sedimentation are assessed in detail in Section 7.2.

7.4.4 Government, public and Aboriginal comments and proponent's response

Fisheries and Oceans Canada and Environment Canada requested more information with respect to turbidity monitoring (as described in Section 7.2). Environment Canada sought more information on a water quality worst-case scenario. The proponent has committed to a further discussion of the effects associated with ongoing sediment loadings, along with options for improving mitigation, through the Follow-up Program presented in Section 8 and Appendix 7. Fisheries and Oceans Canada and Environment Canada were satisfied with this response.

The Siksika Nation has expressed concerns with respect to water quality and the aquatic environment. Specifically, they are concerned that the water may become unsuitable for traditional activities, that swimming holes will no longer be used due to water quality issues, and that the ability to fish downstream of the Project will be impacted. The proponent has indicated that the proposed mitigation measures, monitoring, and follow-up will sufficiently address these concerns to the extent that they relate to the Project. Mitigation measures related to current use of lands and resources for traditional and recreational purposes are explored further in Section 7.12.

7.4.5 The Agency's conclusions regarding residual environmental effects

Taking into account implementation of the proposed mitigation, as well as the Follow-Up Program, the Agency concludes that the Project is not likely to cause significant adverse

environmental effects on the surface water quality, specifically in the Little Bow Reservoir, downstream BRID canals, Travers Reservoir, and Little Bow River.

7.5 Hydrogeology and Groundwater Quality

Clay till dominates the surficial geology and changes in the Little Bow Reservoir operating level are likely to be dissipated over a limited distance by relatively steep groundwater gradients. Groundwater contours interpreted from available data show that groundwater flow in bedrock shale is toward the Little Bow River. Similarly, groundwater contours in surficial aquifers is generally away from Little Bow Reservoir and Travers Reservoir towards the Little Bow River valley. Based on the available data and the interpreted groundwater contours, there is no significant vertical gradient between bedrock and surficial aquifers, and hydraulic connection between the TLBR Connecting Canal and springs on the Little Bow River valley slopes south of the canal cannot be substantiated.

7.5.1 Potential environmental effects

The upland plains portion of the LSA has relatively flat topography and the shallow hydrogeology is dominated by low permeability clay tills. From the information available, there are no buried channel aquifers that connect or daylight within the area of inundation in Little Bow Reservoir at its new FSL of El. 856.18 m. Consequently, groundwater impacts to the north, west and east of Little Bow Reservoir are expected to be limited to areas close to the reservoir and the TLBR Connecting Canal.

The increase in the Little Bow Reservoir FSL will increase local groundwater recharge within the LSA. Increased recharge will result in local increases in groundwater elevations that will be dissipated as groundwater flows radially from Little Bow Reservoir. The potential impact of locally elevated groundwater levels include increased seepage from ground surfaces such as valley sides, low lying areas, and ephemeral watercourses as well as local changes in groundwater elevations south of the Little Bow Reservoir in the Little Bow River valley where groundwater discharge has historically occurred naturally as spring flow, seepage, and likely as base flow to the Little Bow River. Inflow water quality to Little Bow Reservoir will not change and no impact to local groundwater quality is expected as a result of the Project.

7.5.2 Mitigation measures

As part of canal widening in the upstream portion of the TLBR Connecting Canal, sand and gravel exposures in the base and sides of the canal were lined with a clay liner to mitigate future seepage losses. Additional seepage mitigation is not required as the impacts to groundwater quantity resulting from the Project are expected to be minor. Mitigation measures may be required in the future if impacts on groundwater levels, spring flow or seepage are detected through monitoring.

Increasing the FSL in the Little Bow Reservoir and the TLBR Connecting Canal may result in higher groundwater levels in areas immediately adjacent to these structures. In areas where clay till dominates the surficial geology, increased groundwater levels are expected to be dissipated over relatively short distances away from the FSL contour and the residual groundwater level effects will be limited to areas close to Little Bow Reservoir and the TLBR Connecting Canal. Minor increases in seepage rates will likely occur in current seepage areas and new seepage areas may develop down gradient of the FSL.

The proponent has specified that contractors will ensure ground water levels in wells located on adjacent lands are not changed due to their activities and that the groundwater quality in adjacent landowner wells is not diminished due to their activities. See Appendix 5 for details.

Monitoring

A groundwater monitoring program will be conducted to monitor changes in groundwater levels in response to the Project, for the confirmation of conclusions regarding residual groundwater effects.

7.5.3 Residual environmental effects
The residual effect of increased seepage rates is expected to be local in extent, will fluctuate regularly with increased head pressure as the reservoir is filled, and will continue for the entire operational existence of the Project. The residual effects of the Project on hydrogeology and groundwater are likely to be limited in magnitude and geographic extent.

7.5.4 Government, public and Aboriginal comments and proponent's response
NRCan asked the proponent about time series groundwater level data and potential climate trends for surficial water and groundwater flow. The proponent provided the raw data for groundwater levels and explained that as long as the reservoir is operated and maintained at proposed operating levels, climatic influences on local groundwater levels are expected to be insignificant. NRCan concluded that a satisfactory amount of information was gathered for assessing the effects.

7.5.5 The Agency's conclusions regarding residual environmental effects
Taking into account implementation of the proposed mitigation, as well as the Follow-Up Program, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on groundwater quantity or quality.

7.6 Aquatic Environment

The LSA for the aquatic environment assessment included the lower half of Travers Reservoir, the TLBR Connecting Canal, Little Bow Reservoir and the BRID irrigation canal immediately downstream of the Little Bow Reservoir. The RSA included the entire CBRH system, including Little Bow Reservoir, Travers Reservoir, and McGregor Reservoir, as well as the Bow River at the CBRH intake and all connecting canals (Figure 1.2).

7.6.1 Potential environmental effects
The aquatic environment impact assessment focused on identifying the effects of construction and operation of the Project, including the impact of fluctuating water levels on the new littoral zone, the effects on fish and their life stages (spawning, rearing, feeding, etc.), the effects on fish habitat, and the effects on aquatic invertebrates.

Construction

In general physical works associated with raising and extending the Little Bow Reservoir Dam are expected to have limited impacts on the aquatic environment as the majority of the material used to build the structure will be installed on dry land to the north and west of the wetted perimeter of the reservoir. Potential impacts resulting from construction of the Little Bow Reservoir Dam may include; a minimal impact on fish habitat from additional riprap material that will be installed along the dam face both above and below the FSL as needed to ensure long-term erosion protection and dam safety; some disturbance to the substrates in the existing shallows from heavy equipment used to place riprap along the upstream face of the dam; wave erosion of newly flooded borrow areas that may lead to increased suspension and transport of sediment; temporary loss of fish habitat from the construction of two cofferdams comprised of clay till within the Little Bow Reservoir during construction of the new outlet structure and removal of the existing outlet structure; and erosion or sediment deposition into the reservoir from dewatering of the cofferdam isolated work areas. Raising and extending the Little Bow Reservoir Dam will also result in the displacement of 37,500 m^2 of fish habitat during the construction of Enhancement Dyke 1.

The potential impacts resulting from construction of the TLBR Connecting Canal may include: the temporary loss of aquatic habitat; increased sediment deposition and suspension; and fish stranding during construction and removal of cofferdams within the canal. The construction of the TLBR Connecting Canal will result in the permanent loss of 5,500 m^2 of fish habitat from the footprint of the earthfill embankments and the culvert structure.

There will be some positive effects associated with the construction of the TLBR Connecting Canal, including the creation of approximately 41,800 m^2 of new aquatic habitat in the medium- to long-term as a result of increasing the width of the TLBR Connecting Canal and an increase in fish habitat (~ 6,250 m^2) from the removal of both the inlet and outlet structures. Another positive feature is that future reservoir operation will create seasonal fish passage, from approximately October 7 to April 15, and will include unimpeded passage during spawning periods.

Operation

The potential impacts resulting from reservoir operation during construction of the Little Bow Reservoir may include: potential impacts to water quality if the grey water pumped from the isolated work areas is released into the reservoir; the complete loss of preferred spawning habitat during construction drawdown, reduction in populations of spring spawners, such as northern pike, if water levels are not raised to normal operating levels by early spring to inundate the spawning habitat typically used by these species; and decreased dissolved oxygen concentrations and release of methane, CO_2, and other by-products as vegetation decays during reservoir drawdown in winter for three consecutive years of construction. In addition, fish may be stranded within any of seven ponded areas of concern as the water levels recede during initiation of construction. Stranded fish would potentially perish during the winter, as these areas would be shallow and would either freeze to the bottom or be too shallow to sustain sufficient dissolved oxygen through the winter.

The potential impacts resulting from future operations of the reservoir and the TLBR Connecting Canal are extensive and may include: a seasonal increase in the total area of fish habitat by 2.765 km^2 in the Little Bow Reservoir and TLBR Connecting Canal as a result of an increase in FSL, complete loss of all existing emergent cattail, bulrush, and sedge around the perimeter of the Little Bow Reservoir (~12,284 m^2 total) due to inundation, and an increase in reservoir productivity as initial increase in the flooded terrestrial vegetation decays and surficial substrates begin to erode.

Seasonally fluctuating water levels in the littoral zone are expected to be less productive for plant and animal life than is the existing stable water levels in Little Bow Reservoir. These seasonal fluctuations in the Combined TLBR will also result in seasonally variable moisture availability and create uncertainty in the establishment of new emergent vegetation along the perimeter of Little Bow Reservoir at the new FSL.

The reservoir may experience a reduction in fish populations due to an expected loss of emergent vegetation. This will result in a loss of spawning and early rearing habitat for northern pike, and rearing habitat for other juvenile fish, including lake whitefish, and suckers. Die-off of well-developed submergent aquatic vegetation in the Little Bow Reservoir due to decreased light penetration from the increased FSL is expected. Limited establishment of submergent vegetation within the seasonal drawdown zone resulting from annual desiccation is expected. A stable zone supporting submergent vegetation

will eventually become established between the seasonal low water level and the limit of light penetration at FSL.

A reduction in benthic community abundance will occur in both the drawdown and littoral zones due to fluctuations in surface elevation during reservoir operation. The condition of lake whitefish is expected to decrease as a result of reduction in benthic invertebrates.

Elevated mercury levels are expected in the biota from newly flooded soils that are currently in the riparian area around Little Bow Reservoir. Increased methylation of mercury in the environment and the bioaccumulation of mercury in fish will occur as a result of elevating reservoir levels. Increased mercury levels in predatory fish such as northern pike and walleye are expected while mercury concentrations in the insectivorous lake whitefish are expected to increase by a lower factor.

7.6.2 Mitigation measures

The proponent has indicated that a range of impact avoidance and mitigation measures will be employed to protect fish and fish habitat in Little Bow Reservoir, Travers Reservoir and the connecting canal, such that most of the potential adverse effects of the Project on the aquatic environment will be minimized. The proponent will follow the Alberta Transportation Fish Habitat Manual: Guidelines and Procedures for Watercourse Crossings in Alberta (AT, 2009) for instream works, as well as any appropriate measures contained in the Alberta Transportation Erosion and Sediment Control Manual (AT, 2011) for terrestrial aspects of the project. See Appendix 5 for details. Any impacts to fish habitat that cannot be mitigated through the proceeding measures will be mitigated through fish habitat compensation measures, as described in the Follow-up Program (see Section 8 and Appendix 7).

Of note, the drawdown process will be monitored to identify areas of potential concern with respect to fish stranding during all three years that construction drawdown occurs. A fish rescue operation will be conducted in any areas where fish may become stranded during drawdown of the reservoir. Fish will be returned to the reservoir. All areas that may potentially result in fish stranding within the annual drawdown zone will be modified to allow for either positive drainage or complete isolation from the reservoir. This may require the excavation of channels or construction of berms and will be completed prior to the initial raising of the Little Bow Reservoir to the new FSL.

Possible supplemental aeration, to maintain dissolved oxygen concentrations in the drawn down reservoir, will be used if low dissolved oxygen levels are measured, to ensure the survival of fish and other aquatic life during the winter. Supplemental aeration would be done by installing an aerator on the ice, which can quickly increase the oxygen levels in the water.

AT will enter into an agreement with the commercial fishery license holders to suspend the harvest of lake whitefish during the three years of construction drawdown. This will ensure that 13,600 kg of lake whitefish (the annual commercial quota) is not harvested from the Little Bow Reservoir each year.

In accordance with DFO's policy on fish habitat management, a fish habitat compensation plan (FHCP) will be implemented to mitigate fish habitat losses due to construction and operation of the project. A conceptual FHCP has been prepared by the proponent; a detailed FHCP will be prepared for DFO as part of the application for authorization of the Project.

The mitigation measures identified in Section 7.2 to prevent impacts from construction activities near water bodies will be applied to prevent sediment-laden water in construction areas from entering the Little Bow Reservoir and the TLBR Connecting Canal.

Implementation of mitigation measures for mercury in fish as they relate to human health that are presented in Section 7.12

Monitoring

A monitoring plan will be developed by the proponent in consultation with federal agencies to validate the assessment of residual impacts on the aquatic environment. Areas for monitoring will likely include:

- fish stranding monitoring during construction and early future operation
- spring spawning water levels and habitat availability
- benthic invertebrate populations
- aquatic and riparian vegetation
- planktonic productivity
- turbidity
- compensation
- dissolved oxygen concentrations through the ice during drawdown
- turbidity levels
- mercury concentrations in water and fish tissue
- chlorophyll to monitor shoreline erosion

Monitoring during the second year of reservoir operation will be conducted to validate the assessment of residual impacts to aquatic life. The need for further monitoring will be determined based on the results of this summary report. If deemed necessary, the monitoring program will be repeated in the fifth year following construction. Monitoring will also serve to validate the recommendations of the FHCP and to determine whether the proposed compensation was constructed as planned and is providing functional habitat. If any part of the compensation works does not function as planned, adaptive management will be applied to ensure that the compensation measures are remediated and begin to function properly.

7.6.3 Residual environmental effects

Despite the application of mitigation measures, it is likely that some sedimentation will occur during installation and/or removal of cofferdams, including those upstream and downstream of the Travers Reservoir outlet structure. The impact is expected to be low in magnitude, local in extent, short-term, and reversible.

Construction drawdown may result in a low magnitude impact to lake whitefish due to reduced spawning habitat suitability. This could result in a short-term shift in lake whitefish population structure towards older, mature fish with a higher proportion of the total biomass comprised of fewer fish. However, this moderate residual effect is tempered by the effects of natural mortality and harvest, and the fact that lake whitefish are a long-lived species (reproductively mature fish aged in range from 3 to 17 years). Suspending the commercial lake whitefish harvest during the construction drawdown period will also reduce the negative draw on the whitefish population, minimizing the negative effect from reduced recruitment. The overall level of impact on the whitefish population is expected to be local and reversible in the short-term, low in magnitude and the effect will not be significant.

The three years of poor lake whitefish recruitment during construction drawdown could result in a negative effect on piscivorous species that feed on juvenile lake whitefish, including walleye, burbot, and juvenile northern pike. A reduced number of juvenile whitefish would limit the food source available for other fish, forcing them to rely on other sources of forage, such as spottail shiner, juveniles of other species, and the young of their own species. This could result in a reduction in the productivity of these three species over the period of construction, but the effect is expected to be buffered by the availability of other food sources. The residual effect is expected to be a minor decrease in productivity which will be of short-term duration and is not considered to be significant.

Despite proposed mitigation measures, it is likely that some fish will remain stranded and die, or be eaten by predators during reservoir drawdown. Likewise, some of the fish salvaged

may not survive being captured and transported. Relative to the total population of fish within the Little Bow Reservoir, this represents a low impact that is local and is reversible over the short-term. The level of impact is negligible and the effect is not significant.

The provision for fish passage from Little Bow Reservoir into Travers Reservoir during future reservoir operation will result in a positive effect on fish populations. Upstream passage had previously been impossible as a result of a drop at the irrigation outlet structure at the outlet of Travers Reservoir. This change is expected to have a low to negligible enhancing effect on habitat availability for all species in Little Bow Reservoir, as suitable habitat is currently available.

It is anticipated that there will be a residual impact on northern pike reproductive effort as a result of a short-term decrease in spawning habitat suitability during construction and in the first few years of operation. The effect is expected to be of low magnitude and reversible in the short-term.

The residual effect of submergent vegetation loss and change in community structure is likely to have a measurable impact of ecological significance, and a moderate magnitude impact on rearing habitat. This impact will be local and likely be irreversible; however rearing habitat will be available in the long-term elsewhere in the reservoir

A moderate reduction in abundance and species diversity of benthic invertebrates is expected to have an adverse impact on food chain input and productivity. This effect will be of low magnitude, local, long-term, and irreversible. Based on the assessment of potential changes in benthic invertebrate biomass and community structure a minor reduction in total biomass of benthic invertebrates within Little Bow Reservoir and a shift in the population of invertebrates within the drawdown zone is expected. Assuming a shift in the benthic invertebrate population of the Little Bow Reservoir drawdown zone does occur, the dominant species would be expected to include chironomids and copepods.

A minor shift in invertebrate species assemblage and biomass towards a more planktonic dominated food source could result in a minor decrease in the growth rate of lake whitefish in Little Bow Reservoir. This effect is expected to be of low potential magnitude and is not expected to have a significant effect on the total biomass of the lake whitefish population.

The potential minor increase in spottail shiner food availability and decrease in lake whitefish growth rate would be expected to have a negligible effect on the populations of northern pike and walleye. The potential changes are not anticipated to be large enough to have an appreciable effect on either species, as food availability is not expected to be limiting.

Salvage of fish stranded during the first year of operational drawdown may be required, and a small portion of these fish are likely to perish. This impact will be local, occur once, and will be reversible in the short-term.

Increases in mercury are expected to peak within 5 years to 10 year of Little Bow Reservoir expansion, after which they will gradually decrease back to baseline levels within 15 to 30 years. All predicted peak mercury concentrations are within ranges typically observed in southern Alberta which typically exceed CCME water quality guidelines. Increased mercury levels are predicted to have a short- to medium-term impact on fish populations and will be monitored during the follow-up process.

7.6.4 Government, public and Aboriginal comments and proponent's response

Fisheries and Oceans Canada asked the proponent for more specific details on

submergent vegetation, riparian vegetation, compensation and emergent vegetation. They also requested that the proponent provide an estimate of potential growth and survival effects from expected or potential changes in benthic invertebrate populations on all life stages of VEC species.

Environment Canada asked the proponent about water quality in relation to pre-construction water sampling of mercury, contaminants guidelines, and worst-case scenario for mercury concentrations through construction and the medium-term operating life of the facility.

Following the proponent's responses, both Environment Canada and Fisheries and Oceans Canada concluded that a satisfactory amount of information was gathered for assessing the effects of the project on the aquatic environment.

7.6.5 The Agency's conclusions regarding residual environmental effects

Taking into account the implementation of the proposed mitigation measures, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on the aquatic environment including northern pike, lake whitefish, walleye, spottail shiner, benthic invertebrates and vegetation communities in the littoral and riparian areas.

7.7 Vegetation

The LSA includes the proposed construction footprint and area of inundation at the new operating FSL of 856.18 m. The RSA (94.62 km^2) was used to assess the effects of the Project on the general vegetation community.

The LSA and RSA contain a variety of habitats, such as shoreline, wetlands, aquatic, grasslands, shrub and tree lands, and disturbed agricultural land.

Rare plant species are defined for the purposes of the EIS to include those species listed:

- by the Alberta Conservation Information Management System (ACIMS) on the tracking list for rare vascular and non-vascular plant species
- within Alberta as At Risk or May Be at Risk
- within Alberta as Species at Risk by the Alberta Endangered Species Conservation Committee
- as Threatened or Endangered under the *Alberta Wildlife Act*
- as Special Concern, Threatened, or Endangered under the *Species at Risk Act* (SARA)

Vegetation surveys completed in 2007 and 2010 identified four rare plant species (Common beggarticks, Salt-marsh sand spurry, Prairie wedge grass, American water-horehound) and nine uncommon plant species (Low milk vetch, Berlandier's goosefoot, Louisiana broomgrape, Plains cottonwood, Veined dock, Peach-leaved willow, Common tickseed, Pale blue-eyed grass, Bushy cinquefoil) within the LSA. Several of these species are on the AESRD provincial tracking or the ACIMS watch list.

The rare ecological vegetation communities (western wheatgrass–low sedge and low sedge–western wheatgrass), occur in seven locations within the LSA.

7.7.1 Potential environmental effects

Vegetation within the LSA may be impacted by construction activities include direct impact and loss within the footprint of the structures including the dam, dykes, canal, and new PRA, temporary disturbance in laydown areas, access roads, and work pads adjacent to the structures, temporary disturbance during installation of an overhead three phase power line, as well as modification of some existing pipeline infrastructure, and introduction and spread of non-native vegetation species.

Reservoir operation effects will occur as a result of raising the Little Bow Reservoir water level to the new FSL and the new reservoir operating regime. The potential effects of the Project on vegetation VECs as a result of future reservoir operation include the loss of vegetation ecosystems. The terrestrial riparian vegetation community may experience changes in community structure. Some species that currently exist such as sedge and rush may be unsuccessful at reestablishment. Loss of wetland ecosystems, emergent aquatic vegetation (100% in LSA and RSA) and changes in submergent aquatic vegetation community structure and abundance are also expected. It is estimated that a total of 2.9 km^2 of wetland (0.028 km^2), emergent aquatic (0.031 km^2), grassland (2.772 km^2), and shrub and tree (0.038 km^2) vegetation communities (including rare or uncommon plants and ecological communities) will be lost as a result of the Project.

Four rare and nine uncommon plant species will be impacted by raising the Little Bow Reservoir to the new FSL. All rare and uncommon plants identified within the footprint of the expanded reservoir will be lost however, these species likely occur within the RSA and none are listed as threatened or endangered. In addition, it is anticipated that a small portion of the western wheatgrass–low sedge and low sedge–western wheatgrass plant communities, which occur within the LSA, will be lost as a result of flooding.

7.7.2 Mitigation measures

Wetland habitat will be lost as a result of the Project and compensation must be provided for all wetland complexes that will be affected, which are identified as Class II or greater according to the Stewart and Kantrud system of classification (1971) and as per the Federal Policy on Wetland Conservation. The total loss of wetland habitat for which compensation is required is equal to 0.028 km^2.

Wetland compensation will involve one of the following: reconstructing the compromised wetland area at another location onsite; restoring off-site wetlands which have previously been degraded; enhancement of existing wetlands; or paying compensation to an accredited/recognized wetland conservation and restoration organization. A compensation plan outlining the proposed measures for achieving compensation will be submitted to ESRD, which will review the proposal to ensure that the requirements of the *Alberta Water Act* are met. Consequently, the Project is expected to result in no net loss of wetland vegetation, function, or habitat value.

Reclamation measures for grasslands will include re-establishment of northern and western wheatgrass within the LSA following completion of construction activities. However, EC recommends the amount of western wheatgrass in the seed mix be kept minimal—10 to 15 percent. Efforts should be made to establish other species such as needle and thread, green needle, june, or blue gramma grasses. Should the proponent be unable to complete sod salvage, salvaged topsoil from the areas that will be inundated with water should be spread over the area. In addition, the LSA has been fenced, which will exclude local cattle and contribute to an improvement of the existing grassland areas.

The increased variability of soil moisture conditions as a result of proposed reservoir fluctuations will result in a larger area for riparian and emergent aquatic vegetation to establish in the upper portion of the reservoir drawdown zone. The most suitable conditions for establishment of emergent and riparian vegetation within the future drawdown zone include low gradient, protected bays.

Trees may be planted within the new PRA to replace the mature trees that will be removed however, if the mature trees that were removed

were not native to the area or ecozone, they should not be replanted as this will disrupt ecozone integrity. The only native trees in the ecozone are cottonwoods that occur along the river valley bottom in the flood zone, not on the open prairie shorelines of lakes. The proponent should discuss the planting of trees and shrubs with appropriate federal authorities. Planting of sandbar willow will be carried out as per the conceptual FHCP.

Transplanting rare plant and rare ecological communities from within the zone of inundation will be attempted to offset the potential effect on the regional populations of these species. Suitable areas for transplanting will be determined based on species growing requirements. As the precise species preferences are not typically well known and parameters such as moisture content will have to be predicted based on the future reservoir operating regime, it is expected that the success rate for transplanting may be low. However, even moderate successful establishment will help to reduce the short-term impact and could result in a complete offset of the anticipated loss over the long-term as individual plants propagate and establish populations. Live cuttings or potted saplings of identified VECs, including peach leaf willow and plains cottonwood will also be planted above the new FSL of Little Bow Reservoir in and around the new PRA.

In addition, a revegetation plan promoting a native mixed grass community in disturbed areas of the LSA would help to promote re-establishment of rare and uncommon plant species by limiting competition with invasive species. Likewise, re-establishment of a healthy riparian zone would improve the likelihood of hydrophilic rare or uncommon species becoming re-established within the LSA.

All disturbed areas above the new FSL will be revegetated as soon as practical after disturbance using native grass seed mix to inhibit invasive species introduction and spread. Noxious and restricted weeds will be controlled as per the requirements of the *Alberta Weed Control Act*.

Monitoring

Post-construction monitoring will be conducted to ensure that all mitigation, weed control, and revegetation of disturbed areas have been implemented. Regular weed control will be completed until successful revegetation has been achieved. The inspection will follow the procedures and requirements of the Erosion and Sediment Control Manual (AT, 2011).

Monitoring of transplanted rare plants will be conducted to determine their success rate. A survey will be conducted in July of the first two years of operation to assess survival; the results will be reported and the need for further monitoring or mitigation assessed after two years.

7.7.3 Residual environmental effects

Residual effects on Little Bow Reservoir vegetation include: an increase of approximately 0.157 km^2 of riparian vegetation, changes in riparian vegetation community structure, the loss of approximately 0.031 km^2 of emergent aquatic vegetation, changes in submergent aquatic vegetation community structure and abundance, the loss of approximately 2.772 km^2 of modified grasslands, and the loss of 13 rare or uncommon plant populations within the inundation zone.

The increase in riparian habitat available for establishing water-loving species is expected to result in a low magnitude increase in riparian vegetation abundance. This effect will be local in extent and it is expected that riparian species will begin establishing in the short-term and the transition to riparian species dominance will occur over the medium-term. The overall level

of impact is expected to be low and the existing riparian habitat was not a critical or limited resource. A change in riparian vegetation community structure is expected to occur as a result of fluctuating water levels creating a moisture regime that is different from the soil conditions in the existing riparian area. This effect is expected to be of low magnitude, local, a single occurrence and will be irreversible during future reservoir operation.

The loss of emergent aquatic vegetation is expected to be moderate in magnitude within the LSA as although some emergent vegetation will likely re-establish, the existing species are not likely to recover to the current productive capacity for the duration of the Project. However, the emergent vegetation within the LSA was heavily dominated by cattail with low species diversity and all species recorded are common aquatic plants. Within the RSA, all species are expected to occur in other permanent water bodies such as wetlands, despite the absence of comparable reservoir habitat.

As discussed in Section 7.6, a low magnitude reduction in submergent vegetation abundance is expected as well as a shift in species composition as a result of fluctuating water levels.

Loss of modified grassland vegetation is expected to be high in magnitude within the LSA, will occur once, and will be permanent for the duration of the Project. With respect to the RSA, the loss is of low magnitude as it represents a small percentage of the regional grassland vegetation area (4.7%). Likewise, grassland habitat of equivalent quality and species composition will continue to exist within the vicinity of the new FSL.

Despite transplanting of rare plants, a one-time moderate magnitude of local impact that is reversible in the short-term is expected. The overall level of impact is expected to be low as these species may re-establish populations in the vicinity of the reservoir and additional populations may exist outside of the footprint of inundation or within the RSA. The species have not been rated as endangered or threatened under provincial or federal legislation.

7.7.4 Government, public and Aboriginal comments and proponent's response

Fisheries and Oceans Canada questioned the proponent extensively on the effects of the Project on riparian vegetation, as described above in Section 7.6. Following the proponent's response with respect to re-establishment of emergent, submergent, grassland and tree and shrub vegetation, Fisheries and Oceans Canada and Environment Canada concluded that a satisfactory amount of information was gathered for assessing the effects.

The Blood Tribe has concerns over the relocation of traditional plants and believes that they should be the ones to carry out this relocation. The Siksika Nation noted that it has become very difficult to find their medicinal plants in the Little Bow Reservoir area and more generally in the southern part of the province of Alberta. The proponent is encouraged to continue discussions on reclamation with Aboriginal groups and include groups in the planning and relocation of traditional plants within the Little Bow Reservoir.

7.7.5 The Agency's conclusions regarding residual environmental effects

Taking into account implementation of the proposed mitigation measures and the Follow-up Program, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on the vegetation components of the Project including riparian vegetation, wetlands, emergent and submergent aquatic vegetation, grasslands, and shrubs and trees and rare or uncommon plant species and rare ecological communities.

7.8 Wildlife and Terrestrial Habitat

Historically, colonial nesting waterbirds inhabiting the Little Bow Reservoir have included double-crested cormorants, American white pelicans, ring-billed gulls, and California gulls. Currently, a colony of double-crested cormorants is located on an island in the northern portion of the Little Bow Reservoir.

There were eleven waterfowl species along with common loons, red-necked grebes, and American coots reported during waterfowl surveys. Nine species of waterfowl were observed in the 2011 Wildlife Surveys. Ducks and geese can begin breeding as early as March, though the peak of the breeding season occurs in May.

For this assessment, wildlife 'species at risk' are defined as being listed as endangered, threatened, or of special concern by COSEWIC, SARA, or AESCC and have been documented within the LSA. There were twelve species (all birds) that may be found in the LSA that met this criterion. They include the Ferruginous Hawk, Piping Plover, Long-billed Curlew, Burrowing Owl, Short-eared Owl, Common Nighthawk, Loggerhead Shrike, Sprague's Pipit, Barn Swallow, McCown's Longspur, Chestnut-Collared Longspur, and Bobolink.

Of these twelve species at risk, evidence of 5 species were observed during surveying: ferruginous hawk (2008); long-billed curlews (2009, 2011); common nighthawks (2008, 2009, 2011); Sprague's pipits (2008, 2009, 2011); and the chestnut-collared longspurs (2008, 2009, 2011). Suitable habitat was also found for each of these species, including high quality habitat for burrowing owls, though none were observed.

7.8.1 Potential environmental effects

Construction may potentially affect wildlife within the LSA through the direct loss of habitat such as wetlands, emergent vegetation, grasslands, shrubs, trees, islands and nesting structures for cliff swallows (i.e., Little Bow Reservoir and Travers Reservoir outlet structures) during clearing, during site preparation, and because of an increased FSL and a newly fluctuating operating regime. Ferruginous hawk nesting sites may be lost due to the removal of mature trees. An indirect loss of habitat close to intensive activity (traffic and large machinery, etc.) and impedance of wildlife movement by physical barriers and disruptions is expected. A decrease in abundance and reproductive success of songbirds in adjacent habitats may occur. There may also be direct mortality of wildlife as a result of clearing and grubbing during the nesting or natal period or during the initial raising of the reservoir, which is particularly a risk for nesting birds. Increased vehicle traffic associated with construction, may also result in direct mortality by increasing the number of animals involved in vehicle-wildlife collisions.

Reservoir Operation may potentially affect wildlife within the LSA through the loss of 2.36 km^2 of vegetation communities providing habitat for various wildlife species and the potential submergence of early nests built below the FSL.

7.8.2 Mitigation measures

The following mitigation measures, primarily to ensure compliance with the *Migratory Birds Convention Act*, will be implemented during construction. Clearing and grubbing of wildlife habitat will be completed outside of the breeding season (April 15 to July 31) for breeding birds protected under the *Migratory Bird Convention Act* and the *Alberta Wildlife Act*. If Sprague's Pipits are nesting in this area, restricted activity dates of May 1 to August 31 will be followed. If, despite mitigation, a Sprague pipit nest is found, it cannot be destroyed or moved and the proponent must wait until the young have fledged. In such a case the proponent could contact Environment

Canada Wildlife Enforcement to discuss the matter. If limited clearing must take place during the nesting season, EC recommends that it be undertaken by qualified avian biologists or avian naturalists that have expertise in identifying indicated nests as well as in identifying behaviour indicative of nesting (i.e. aggressive or defensive behaviour, carrying of nesting material, food or faecal sacs). Surveys should be undertaken within seven days of clearing, with the results submitted to EC for review. The removal of structures, such as the Little Bow Reservoir and Travers Reservoir outlet structures where birds may be nesting will be completed outside of the breeding season for those species. The initial filling of the reservoir will be delayed until July 15 to avoid flooding of Sprague's pipit nests, but not left until later as predictive models suggest a later flooding initiation date would not allow for full levels by the end of the irrigation season

The following mitigation measures are recommended by EC as a means to assist compliance with the *Migratory Bird Convention Act* and the *Alberta Wildlife Act*. The proponent will complete any grass mowing in the area to be inundated outside of both the Sprague's pipits nesting period of May 1st to August 31st as well as the breeding season for migratory birds of April 15th to July 31st. Therefore, the proponent needs to mow the area before April 15th. If there are any trees to be removed that have shown evidence of ferruginous hawk activity within the last two years, they should be replaced with nesting platforms. Implementation of lowered speed limits (less than 60 km/hour) within the active construction area and along new roads will reduce the likelihood of wildlife/vehicle collisions. In addition, installation of metallic streamers may deter birds from nesting along the shoreline.

During reservoir operations, mitigation includes reclaiming disturbed grassland habitat using a grass seed mix containing native species, replanting trees and shrubs within the riparian area of the new PRA, and controlling cattle grazing within the LSA through maintenance of fences, to improve the quality of grassland, wetland, and riparian habitat.

7.8.3 Residual environmental effects

Mitigation measures will reduce or eliminate most project effects on wildlife during construction. However, some minor effects due to disturbances associated with construction activities will remain after the application of the mitigation strategies. The avoidance of suitable habitat by wildlife due to disturbance is expected to be low in magnitude, local, short-term, and sporadic. The residual effects of disturbance are expected to be negligible.

The few mature trees present within the PRA will be removed during the construction phase. While suitable nesting habitat for ferruginous hawks will be lost, no nests will be destroyed during the construction phase. White the proponent has committed to planting new trees in the proposed PRA based on EC's understanding of the ecozone; the only native trees should be cottonwoods and should only occur along the river valley bottom in the flood zone, not on the open prairie shorelines of lakes. EC notes that if the mature trees that were removed were not native to the area or ecozone then they should not be replanted as this will disrupt the ecozone integrity. The continuous presence of transmission towers in the area will provide nesting opportunities for the hawks throughout the operation phase of the Project; however, nests on transmission towers pose a safety hazard (fire, mortality of birds) and are not considered ideal habitat. The proponent may replace ferruginous hawk nests that have been active within the last two years with suitable habitat in the form of nesting platforms, thereby reducing the potential for birds to nest on transmission lines. Thus, the Project is expected

to have a negligible effect on ferruginous hawks, with the effects being local, a single occurrence and reversible in the short-term.

Once the Little Bow Reservoir water level is raised to the new FSL, after the breeding period, the islands currently used by colonial nesting birds will be submerged. However, new islands will become available in the vicinity of the existing cormorant colony and will provide isolation from land predators at all operating levels. At the new FSL, the existing 23 islands with an area of 0.059 km^2 will be replaced by an estimated 59 new islands with an area of 0.397 km^2. No mortalities are expected due to flooding. Although no colonies of pelicans or gulls were observed, the establishment of colonies may also occur as these species were observed within the LSA. A net gain of nesting habitat coupled with no increases in mortality indicates that the Project will have a net positive effect on colonial nesting waterbirds. This effect may be regional, as additional habitat may result in increased numbers of birds residing at Little Bow Reservoir during the breeding season. The loss of 23 islands will occur once and will be permanent for the duration of the lifespan of the Project.

The reduction of upland nesting habitat is considered to be minor as equivalent grassland habitat will continue to be available adjacent to the new FSL. Despite the absence of comparable emergent aquatic vegetation within the RSA, wetland habitat is readily available and will provide comparable habitat value for waterfowl. The negative effect of habitat loss is therefore considered to be local, of low magnitude and minor when regional habitat availability is considered.

Approximately 2.32 km^2 of grassland habitat will be inundated at the new FSL; however, not all grassland habitats adjacent to the reservoir at baseline is suitable for species at risk such as burrowing owls, long-billed curlews, Sprague's pipits and longspurs. No habitat has been defined as critical and suitable grassland habitat exists elsewhere in the RSA. As such, accounting for the entire area of inundation as a loss of habitat is considered to be an overestimation. The effect of habitat loss to grassland species is considered negative, will occur once, and will extend into the far future, lasting the life-span of the Project. While a high proportion of grassland habitat within the LSA will be inundated with water, the geographic extent and magnitude of the reduction in habitat availability are considered to be low, as the loss is equivalent to 5.0% of the grassland habitat available within the RSA. The potential mortality of breeding grassland birds will be limited by raising the water level to the new FSL outside of breeding season.

Monitoring

Revegetation of disturbed grassland, shrubs and trees will be monitored. A survey will be conducted in the second year, of operation to assess the presence of and habitat use by wildlife. This will include conducting breeding bird surveys, observing of colonial nesting waterbirds presence, and generally observing wildlife. The need for further monitoring or mitigation will be assessed after the second year. If deemed necessary, the survey will be repeated in the fifth year of operation.

7.8.4 Government, public and Aboriginal comments and proponent's response

Environment Canada sought clarification from the proponent on how it intended to avoid destruction to any migratory bird eggs and/or active nests and adhere to each of the species at risk setbacks and timing restrictions for burrowing owl, ferruginous hawk and Sprague's pipit. The proponent provided further explanation of the set-backs and strategies it intended to use to avoid impacts to migratory birds and species at risk. Environment Canada also noted that with the new PRA will result

in the destruction of native prairie and may affect species at risk. The proponent provided its rationale on site selection, specifically noting factors used to minimize impacts to species at risk and native prairie. Following the proponent's responses, EC concluded that a satisfactory amount of information was gathered for assessing the effects.

7.8.5 The Agency's conclusions regarding residual environmental effects

Taking into account implementation of the proposed mitigation measures and the Follow-up Program, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on wildlife and wildlife habitat, including colonial nesting waterbirds, waterfowl, and federal species at risk.

7.9 Climate and Air Quality

The climate of the region is defined as the Grassland ecoclimatic province. It has cold winters and short hot summers with July usually being the warmest month. The region has the lowest mean annual precipitation (410 mm) of the three ecoclimatic provinces, with a summer-high typically occurring in the month of June. The temperature regimes and precipitation patterns make the Grassland Natural Region the warmest and driest region in Alberta. Wind (or airflow) patterns are usually northerly in winter and westerly (or south-westerly) during other seasons of the year. Air quality within the RSA has been categorized as 'good', or as having an air quality index (AQI) between 0-25.

7.9.1 Potential environmental effects

The change in surface area of the Little Bow Reservoir is not sufficient to have a substantial effect on the local climate. A minor moderating effect on temperature within the micro-climate immediately east of Little Bow Reservoir may occur, resulting in slightly lower surface air temperatures in the summer and slightly warmer temperatures in the winter. There are no aspects of the Project that could affect wind or precipitation patterns; therefore, no changes are anticipated.

Man-made sources of Greenhouse Gas (GHG) emissions for the Project will include: construction activities using mobile heavy-duty diesel- and gasoline-powered equipment; motor vehicle emissions generated by vehicles arriving and leaving the Project site; and onsite fuel combustion for other Project-related activities, such as space and water heating and fireplaces and/or stoves. In addition, the production of methane will occur as a result of inundating and resulting decay of the upland vegetation due to the planned increase in water levels of the reservoir. Approximately 494 tonnes CO_2 equivalents and 1,462 tonnes CO_2 equivalents respectively will be emitted for the clearing of vegetation and the subsequent flooding of the upland area of Little Bow Reservoir, during construction and operation.

The Project will not be a major emitter of ozone, nitrogen dioxide, carbon monoxide, sulphur dioxide, or total reduced sulphur compounds. Potential impacts of the Project as a result of construction activities, soil transfer or excavation and from vehicle/equipment traffic on access roads, strong wind conditions, and reservoir drawdown may include an increase in emitted particulate matter (PM), in the form of dust and an increase in vehicle-related emissions of combustion gases, as well as emissions from construction equipment.

7.9.2 Mitigation measures

No mitigation action is required with respect to the Project's potential effect on the temperature of the surrounding micro-climate.

CO_2 emissions are minor (0.000008%) in comparison with the total provincial GHG emission of 244 million tonnes of CO_2 equivalents. In addition, the upland vegetation that will be inundated at the new FSL will be in dormancy during flooding. Therefore, clearing

of the vegetation prior to flooding is not considered necessary.

Where required, site-specific measures such as water spraying to damp down disturbed areas with high dust concentrations or erecting silt fencing or other structures will be erected to block wind in areas of active excavation will be employed.

Monitoring

Dust levels will be visually monitored on site during construction to assess the need for additional measures to prevent topsoil loss and to protect workers.

7.9.3 Residual environmental effects
Although the Project may result in a minor moderation of the surface air temperature of the micro-climate associated with the Little Bow Reservoir due to the increase in surface area of the reservoir, the effect is expected to be negligible as it affects only the microclimate and not the regional climate.

With the mitigation measures in place, strong wind conditions at the site are not expected to carry construction dust to areas of concern like human residences. A low magnitude, irreversible increase in dust created as a result of wind erosion in the exposed drawdown zone is expected, and will continue for as long as the proposed operating regime is in place.

7.9.4 Government, public and Aboriginal comments and proponent's response
Neither the public or Aboriginal groups expressed any concerns regarding AT's mitigation or approach to the climate and air quality components of the Project.

7.9.5 The Agency's conclusions regarding residual environmental effects
Taking into account implementation of the proposed mitigation measures, the Agency concludes that the Project is not expected to result in a significant contribution to climate change or cause significant adverse environmental effects on air quality.

7.10 Noise

The LSA for noise associated with the Project is confined to the footprint of active construction and the area of proposed inundation. The RSA is the area in which regional impacts to sound quality may potentially occur, which includes a 3 km buffer extending beyond the boundaries of the LSA. The average baseline day-night sound levels for the Little Bow Reservoir were found to be 47.6 dBA which is, according to Health Canada guidelines, comparable to noise levels found in quiet rural areas with an average population density of 28 people per km^2.

7.10.1 Potential environmental effects
Chronic noise, such as that associated with traffic and large machinery, can affect the abundance and reproductive success of songbirds in adjacent habitats. The noise impact will be greatest in locations that are closest to the source (the construction site) and will then gradually taper off with increasing distance from the source. The Project will result in minimally increased noise levels during construction by about 1 dBA above current levels. No increase in noise levels is expected during future operation.

7.10.2 Mitigation measures and residual environmental effects
A change of less than 3 dBA is barely perceptible to the human ear (Health Canada, 2011). For short-term construction, where an increase of 1 dB is predicted, a comparison of construction noise levels on human receptors at receptors 1,800 m, 3,275 m and 5,250 m from the source indicates that mitigation measures at the source are not required. Calculations to quantify long-term construction noise exposure were not considered necessary because of the attenuation of the construction noise levels

to 10 dBA below baseline levels at 3,275 m and 5,250 m from the source.

Based on the impact assessment, the Project is not expected to affect ambient noise levels at the identified receptors, for both humans and songbirds, and no further mitigation was deemed necessary by the proponent.

7.10.3 Government, public and Aboriginal comments and proponent's response

Neither the public nor Aboriginal groups expressed any concerns regarding AT's mitigation or approach to the noise components of the Project.

7.10.4 The Agency's conclusions regarding residual environmental effects

In considering that there are no residual noise impacts, the Agency concludes that the Project-related noise is not likely to cause significant adverse environmental effects.

7.11 Navigable Waters

Navigability was selected as a VEC as changes within a water body may impact the public right to navigation legislated under the *Navigable Waters Protection Act*. Impacts to navigation were examined within the LSA which included the entire wetted area of the Little Bow Reservoir at current and future operating levels.

Boaters currently access the reservoir at the public boat launch located in the PRA on the east side of the reservoir. At times when the PRA was closed and the boat launch was inaccessible, sport fisherman launched their boats along the northwest shore of the reservoir at other beach areas accessible by four-wheel drive vehicles.

There is no anticipated commercial navigation on the reservoir. The commercial fishery that operates at Little Bow Reservoir is a winter fishery. The only instance in which navigation for commercial fishing could occur would be in a year where there was no ice on the reservoir and an open-water fishery was sanctioned by AESRD.

There are several existing impediments to navigability in Little Bow Reservoir that reduce the overall potential for watercraft use. There are significant areas of shallow water near shore, including large bays too shallow to navigate with an outboard engine, particularly along the west and north margins of the reservoir. There are also numerous submerged islands, bars, and points in the reservoir. These features present a potential hazard to navigation and as a result, signage has been posted at the public boat launch warning users to exercise caution. The presence of dense submergent aquatic vegetation also impedes travel. Passage between Little Bow Reservoir and Travers Reservoir is not possible because of the presence of the control structure at the outlet of Travers Reservoir.

7.11.1 Potential environmental effects

Construction

During reservoir operation during construction access to the public boat launch will be restricted and launching at most locations along the shore will be difficult after the reservoir is drawn-down as the previously wetted shoreline would primarily consist of mud, clays, etc.

Operation

Once the Little Bow Reservoir is operational, the cofferdam may have an impact on navigation in the open water season.

During operation, passage between the reservoirs via the TLBR Connecting Canal will continue to be unfeasible as a submerged culvert will be installed at the outlet of Travers Reservoir. Navigation within the vicinity of the culvert structure could present a hazard to public safety.

During future reservoir operation and maintenance fluctuation in reservoir levels will mean inconsistent presence of hazards as they will sometimes be exposed and sometimes be submerged. Unplanned drawdowns for maintenance activities that occur during the summer could impact navigation.

7.11.2 Mitigation measures
The recommended means for mitigating impacts to navigation is to post signage at the public boat launch in the new PRA that identifies the location of potential hazards. The sign will be easy to interpret and clearly communicate that hazards may be present at various water levels, necessitating user caution at all times, which is similar to the existing navigational conditions. The sign should have a large air photo overlaid with markings to show the location of the hazards relative to the boat launch, with a legend explaining all markings. In addition, the UTM or latitude and longitude coordinates for specific hazards can be provided below the map so that recreational users who are interested can program the information into their navigational equipment. Additional signage will be posted for construction activities and potential short-term impediments or hazards.

To minimize navigational hazards all areas are to be armoured with riprap such as the dam slope and cofferdams, and areas prone to erosion will be at a constant grade consistent with the specified design or natural shoreline contour. The armouring will not project into the reservoir and, therefore, will not represent a hazard to navigation. Buildings and other structures within the portion of the existing PRA to be flooded will be removed and all mature trees and shrubs within the same area will be cleared and the roots removed, prior to inundation. The new Little Bow Reservoir PRA structure will be constructed in the dry, prior to raising the reservoir level to the new FSL and will be clearly visible at reservoir operation levels. Access to the entire TLBR Connecting Canal will be eliminated by installing safety booms across the inlet to Little Bow Reservoir and the outlet at Travers Reservoir.

7.11.3 Residual environmental effects
The only identified navigational impact that cannot be mitigated is the presence of irregular contours in the profile of the reservoir bottom, which may create hazards as the reservoir level fluctuates. These contours cannot be graded and marking of individual hazards would be impractical. The anticipated incidence of hazards will be similar to the existing navigational conditions in the reservoir, necessitating boater caution. This impact is expected to be low in magnitude, local in extent, and regular in frequency.

7.11.4 Government, public and Aboriginal comments and proponent's response
The public and, Aboriginal groups did not express any concerns regarding AT's mitigation or approach to navigation.

7.11.5 The Agency's conclusions regarding residual environmental effects
Taking into account the implementation of the proposed mitigation measures and the Follow-up Program, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on the navigability of the Little Bow Reservoir.

7.12 Current Use of Lands for Traditional and Recreation Purposes

This section contains an assessment of the effect of any change the Project may cause in the environment including impacts to health and socio-economic conditions, physical and cultural heritage, current use of lands and resources for recreational or commercial purposes or traditional use by Aboriginal groups. The effect of any change the Project may cause in the environment on any structure, site or thing that is of historical,

archaeological, paleontological or architectural significance is assessed in Section 7.13.

The LSA encompasses the Project footprint and area immediately surrounding the Project, including the Little Bow Reservoir at the new operating FSL boundary, the outlet canal, and the construction footprint. No residences are located within the LSA.

The RSA likely includes historic traditional use areas of surrounding Aboriginal groups, though specific uses have not been identified as part of the Project studies. The RSA is encompassed within the historic Blackfoot traditional territory and within an area of importance for traditional uses, use areas, and traditional knowledge for Blackfoot First Nation Peoples. It is also within the traditional territory of the Nakoda (Stoney) First Nation and the Tsuu T'ina First Nation, and likely within the traditional use area for Métis Nation—Region 3 members. More specifically this means that the RSA *may* include areas where hunting, fishing and trapping as well as the gathering of berries and medicinal plants may be carried out.

Fishing for recreational purposes occurs on the Little Bow Reservoir within the LSA. It is likely that a portion of the fish caught is consumed. While unconfirmed, examination of the limited information on traditional use activities within the RSA suggested the possible subsistence use of fisheries resources in the reservoir by either First Nations or Métis groups is also occurring.

Aboriginal peoples may hunt, trap, and/or fish within the RSA for domestic purposes on all unoccupied Crown land. Geographically, the Project is not within, or close to, any Province of Alberta Registered Fur Management Areas, nor is trapping permitted in the Little Bow Reservoir PRSA or any of the PRA or provincial parks in the RSA (GOA, 2011g). With the exception of bison hunting, treaty First Nations may hunt for food throughout Alberta year round for food related purposes where they have a right of access for hunting (GOA, 2009). Hunting white-tailed deer and mule deer is allowed on surrounding private and/or agricultural public lands provided the hunter receives permission from the landowner or leaseholder. Hunting or the discharging of firearms is not permitted in the LSA or RSA PRAs or the provincial park in the RSA (GOA, 2011h). There is no specific information on whether the Blackfoot First Nations, Métis or other Aboriginal groups currently use the RSA or LSA as a hunting area.

Gathering of plants for traditional purposes by Aboriginal people may occur within the LSA and/or RSA, as plant resources gathered for domestic uses by Blackfoot First Nations people for traditional use, such as yarrow and scarlett mallow, have been identified in these areas; however, no gathering activities were identified during the Project studies. No Aboriginal traditional use of LSA and RSA lands for commercial purposes were identified during the Project studies.

The Little Bow Reservoir has been fished commercially in winter for whitefish, northern pike, and walleye since 1948 (Beak, 1983). The value of the commercial fishery in Little Bow Reservoir, Travers Reservoir and McGregor Reservoir is vulnerable to changes in spawning and rearing habitat availability that are associated with water level fluctuations (Beak, 1983). In the 1970s, commercial catches decreased as a result of drawdown in all three reservoirs (Beak, 1983). The Little Bow Reservoir fishery was closed in 1982 for several years to allow for population recovery after over-harvesting throughout the late 1970s (Beak, 1983).

7.12.1 Potential environmental effects

The proponent has indicated that preliminary Project-related discussions with representatives

of local First Nations and Métis groups suggested that traditional use activities were conducted in the LSA and surrounding area in the past. However, as the three First Nations and Métis contacted by the proponent did not participate fully in the Project studies due to lack of capacity funding, the information presented by the proponent was taken primarily from secondary sources (e.g., publicly available reports, Aboriginal websites, AANDC, Statistics Canada, and government databases). The proponent acknowledges that, as a result, the information presented may not be wholly representative of First Nations and Métis interests.

The Agency in turn made an effort to acquire traditional land use information by directly engaging with the Blackfoot First Nations and Métis Nation—Region 3, however little project-specific information has been provided to date. As a cautious approach given the minimal traditional land use information, the mitigation measures presented below broadly address the potential impacts of the Project on possible traditional uses within the LSA and RSA.

Construction

The effect of construction on recreation facilities and activities will be a temporary loss of recreation-related infrastructure in the LSA due to the two–year closure of the Little Bow Reservoir PRA during construction. A reduction in recreational activities and opportunities, such as bird watching, boating, and sport fishing in the LSA and, possibly, the RSA due to construction activities, including lowering of the Little Bow Reservoir will also occur.

No acquisition of properties and/or residences in the RSA is required for the Project and construction activities are not expected to generate impacts to domestic land use. Temporary road closures during the construction period could result in inconvenience for local residents, but the effect is expected to be minor and short-term.

Construction activities are not expected to affect potential resource uses for traditional purposes such as gathering, hunting, and trapping in the LSA or RSA. The potential impacts to the ten historical resource sites which were identified within the LSA are assessed under Heritage and Archaeological Resources (Section 7.13).

During construction, fishing on Little Bow Reservoir may be affected by the proposed drawdown during construction as well as by limited access to fishing sites. Drawdown to El. 849 m and potential activation of an aeration system will likely force fish to occupy different areas of the reservoir and the typical netting locations may not produce as well as usual. Alternatively, drawdown could result in concentration of fish in specific areas, resulting in an above average catch rate in those areas.

The proposed structures and construction activities are not expected to affect human health.

Operation

A new PRA was included as a Project component and a larger recreation area with infrastructure and facilities similar to those at the current PRA (e.g., boat ramp, fire pits, toilets, water pump, and picnic tables) will be developed on higher ground near the southeast perimeter of the Little Bow Reservoir. As such, the Project will result in an improvement in recreation facilities during operation. Existing beach areas and boat launches will be affected by the new FSL but these activities will be available at new locations on the Little Bow Reservoir during operations.

Traditional land use in the LSA may be impacted during operation, as resource use areas below the new FSL of El. 856.18 m will be inaccessible due to inundation. Though this could potentially result in changes to traditional use areas and plant gathering areas of both the

First Nations and Métis groups, no specific gathering areas in the inundation zone have been identified.

Oil and gas facilities and activities in the LSA and RSA are not expected to be impacted during operation, as most existing oil and gas facilities are situated above the new FSL. Where oil and gas facilities are located below the elevation of the PMF, and therefore susceptible to short-term impacts during major flood events, advance notice has been given to respective companies so the appropriate mitigation measures could be arranged.

Changes to the retail fish guideline exceedances and consumption limit advisories are expected to be transient in nature and will reflect the timeline of mercury increases in the fish, i.e., peak increases within 5 to 10 years, followed by gradual reversal to baseline levels within 15 to 30 years. Increased mercury concentration in fish may result in a higher proportion of some fish populations exceeding Health Canada's guidelines for consumption and consumption advisories for some sport and/or subsistence fish species may be required.

The navigable waters assessment contained in Section 7.11 identified irregular contours of the Little Bow Reservoir bottom at fluctuating water levels as a residual effect of reservoir operation. Due to the irregular nature of contours in the reservoir substrate profile, caution must be exercised by boat users on the Little Bow Reservoir to avoid impacts to human health. Failure to exercise caution may result in such human health effects as accidental drowning and/or death.

7.12.2 Mitigation measures

No mitigation strategies are proposed for the temporary loss of the Little Bow Reservoir PRA and infrastructure during project construction. A new PRA will be available during operation and will result in an improvement in recreation facilities in the LSA. Mitigation for decreased access due to construction road closures in the LSA is not planned. Birding opportunities will continue to be available in the RSA. No mitigation is proposed for the loss of access to the boat launch in the Little Bow Reservoir PRA during construction. Boaters choosing to access the Little Bow Reservoir during construction via unofficial boat launch locations will not be prohibited from doing so, but this activity will be undertaken at the users' risk. During operations, a boat launch will be available at the new Little Bow Reservoir PRA. No mitigation is recommended for reduced access for sport fishing.

The loss of plants potentially gathered by Aboriginal people is local in extent, will occur once, and is permanent. Given the limited geographic extent of this loss and the presence of these plants elsewhere in the RSA, no mitigation is planned to specifically address this loss.

Given the extent to which hunting and trapping is already limited in the RSA and LSA as a result of the presence of privately owned land, extensive agricultural development, and occupied Crown land (PRA, PRSA, and provincial parks), the Project is unlikely to have an impact on any hunting and trapping activities potentially undertaken by Aboriginal people.

No mitigation is recommended for potential effects on potential subsistence or commercial fish catches during construction drawdown as the impacts of drawdown on fish catches are expected to be short-term in duration and local in extent.

The TransCanada Pipelines Limited (TCPL) pipeline near the proposed Little Bow Reservoir outlet structure will be relocated by the pipeline owner to coincide with the realignment of the outlet channel. A protective concrete slab will be installed where a new roadway is proposed across a TCPL pipeline at the west end of

the Little Bow Reservoir Dam. Additional protective measures such as concrete slabs were not required for ConocoPhillips pipeline crossings. Potential impacts to oil and gas in the LSA and/or RSA during construction and operation have been mitigated through advance notice to respective stakeholders. Pipeline companies have been advised of this risk so that protective measures such as protective berms can be incorporated, if deemed necessary.

The potential human health effect of boating hazards, due to irregular contours, will be mitigated through strategies detailed under Section 7.11.

The Government of Alberta monitors all recreational fishing areas for mercury levels. If retail fish species and sport fish species that are caught recreationally are found to have elevated mercury levels, the Government of Alberta will modify the consumption limits for Little Bow Reservoir and surrounding water bodies and tributaries. Fish consumption advisories can be found at: http://www.mywildalberta.com/Fishing/SafetyProcedures/FishConsumptionAdvisory.aspx. Consumption advisories may be required until mercury levels gradually reverse to baseline in the next 15 to 30 years. To avoid exceeding mercury consumption advisory levels, people concerned about exposure to mercury may choose to primarily consume lake whitefish (an insectivorous species).

Monitoring

Project-specific monitoring of mercury in fish will be conducted by Alberta Environment and Sustainable Resource Development (AESRD) and will start in year 2 after expanded operation and continue until mercury levels peak and begin to decline. After the initial operation phase sampling, subsequent sampling will be conducted at least once every three years, in year five and year eight of operation. If values are close to, or exceed the Health Canada guideline, the sampling, frequency may be increased. After mercury levels stabilize or begin to decline, the monitoring frequency will be reduced. After mercury levels decline, monitoring would revert to general provincial monitoring as directed by Alberta Health. A consistent sampling method and analytical protocol will be employed at all times to ensure that the data is comparable.

7.12.3 Residual environmental effects

Residual effects include improvements in PRA facilities, change in fish catch rates during construction drawdown, changes in fish consumption rates, including which species are being consumed, increases in mercury levels in fish over the next 5 to 10 years, and irregular contours affecting boater safety. All residual effects are local in extent, of limited magnitude, and are reversible in the long-term.

7.12.4 Government, public and Aboriginal comments and proponent's response

Health Canada requested further information from the proponent on Country Foods, with a focus on types, quantities, and frequency of consumption of fish consumed by First Nations and Métis groups and their exposure risk to mercury. The proponent has indicated that although there is no evidence to suggest that subsistence use of the fisheries resources in the reservoir is occurring, measures such as consumption advisories will help mitigate the potential impact if there is in fact subsistence fishing by Aboriginal people occurring. Health Canada concluded that the proponent's response was satisfactory.

Environment Canada asked the proponent about the calculation of baseline mercury levels in the water and fish. The proponent clarified its methods and sampling results. Environment Canada concluded that the proponent's response was satisfactory.

7.12.5 The Agency's conclusions regarding residual environmental effects

Although limited information was provided by the proponent or the Aboriginal groups, on First Nations and Métis current and traditional land use, given the implementation of the proposed mitigation measures that encompass potential current and traditional land use within the vicinity of the Project, as well as the Follow-Up Program, the Agency concludes that the Project is not likely to cause significant adverse environmental effects with respect to health and socio-economic conditions, physical and cultural heritage, current use of lands and resources for recreational or commercial purposes or traditional use by Aboriginal groups.

7.13 Heritage and Archaeological Resources

The LSA for the historical resources assessment includes all terrain that will be inundated by the Little Bow Reservoir at the proposed FSL of El. 856.18 m, as well as all lands that may be impacted during construction of the infrastructure. The assessment looks at physical and cultural heritage, as well as any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

7.13.1 Potential environmental effects

Seven historical resource sites identified within the LSA will be impacted by the Project. Two sites as a result of the construction of the Little Bow Reservoir Dam and the new PRA, one as a result of construction of an enhancement dyke and four sites will be impacted by raising the FSL of the Little Bow Reservoir.

Additional studies were conducted at the four sites that will be inundated by raising the Little Bow Reservoir to determine their cultural significance. The proponent identified three sites as containing surface stone features (i.e., tipi rings and/or stone cairns), that are dated to the Pre-contact period. In addition, one was a Historic period site, and through further research was proven to be the former residence of a dam operator, who likely lived at the site during the 1950s.

7.13.2 Mitigation measures

The successful documentation of all modern and pre-contact surface features and pre-contact artefact assemblages was completed and clearance documentation issued by Alberta Culture and Community Services (ACCS) under the Alberta *Historical Resources Act* (HRA) has been received or is anticipated for all of these identified historical resource sites.

Final removal, where possible, of the remaining historical features at the six sites within the footprint of disturbance will occur prior to inundation.

Under Alberta law, the proponent and its contractors are required to report the discovery of any additional historical resources (archaeological, paleontological, or Aboriginal traditional use sites) that may be encountered during construction activities. This caveat is considered by the Government of Alberta (GOA) to provide an appropriate level of self-monitoring in the rare cases that significant historical resources were to have previously eluded identification during the Historical Resources Impact Assessment process.

Monitoring

Specific requirements for monitoring either during or post-construction are not listed as a condition of the HRA Clearance (refer to ACCS Project File 4825-09-002). Therefore, monitoring of the construction activities, or of residual effects of the construction, will not be undertaken as regards historical resources.

7.13.3 Residual environmental effects

Although there will be a final removal and/or inundation of remaining historical features at the six sites within the footprint of disturbance, such an eventuality is a routine consequence of construction in all cases where HRA Clearance is granted. Thus, the residual effect of construction on these historical sites is considered to be neutral.

An increased understanding of past human occupation of the Little Bow region of Alberta; represents a positive effect of the project. It is unlikely that a comprehensive study of historical resources on the spatial scale that was ultimately achieved would otherwise have been undertaken in this region.

7.13.4 Government, public and Aboriginal comments and proponent's response

The public and Aboriginal groups did not express any concerns regarding AT's mitigation or approach to heritage and archaeological resources with respect to the Project.

7.13.5 The Agency's conclusions regarding residual environmental effects

Taking into account implementation of the proposed mitigation measures, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on any physical or cultural heritage or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

7.14 Effects of the Environment on the Project

This section addresses potential effects the environment may have on the Project. The proponent examined these effects and proposed mitigation measures for the Project construction and operation phases.

7.14.1 Potential effects

Under the Act, and as part of the evaluation of effects, an EA must consider the potential effects the environment may have on the Project. The Agency considers the following environmental conditions as the most likely to impact the Project: flooding, drought, and climatic variability.

In 2002, NRCan determined that the most likely impacts to water resources as a result of climate change on the Prairies were changes in annual stream flow with large summer declines, increased likelihood of drought and aridity, and changes in irrigation demand and water availability.

As the Project lies in a seismically monitored, but inactive area of Alberta, the proponent did not provide an effect assessment related to earthquakes.

7.14.2 Mitigation measures

In the case of flooding, excess flows entering McGregor Reservoir can be either stored or routed to the north of McGregor Reservoir via its auxiliary spillway rather than south into Travers Reservoir to minimize downstream impacts. Following completion of the proposed upgrades to the reservoir and associated structures, Little Bow Reservoir and Travers Reservoir will operate in tandem at a common FSL of El. 856.18 m. During the operational phase, negative impacts from flooding are unlikely as the reservoir and associated infrastructure have been designed to accommodate the PMF by routing flood waters from Little Bow Reservoir through the auxiliary spillway back into the Little Bow River. The risk of extreme floods, greater than the 1:1000 year flood, within the CBRH System during the construction phase is very low; however should one occur it could result in drastic impacts to the Project and downstream areas. Emergency manual activation of the auxiliary spillway would be required in this event to prevent overtopping of the Little Bow Reservoir Dam.

A primary objective of the Travers and Little Bow Reservoir components rehabilitation is to provide protection for extreme floods. Until the Little Bow Reservoir Dam has been raised to its new level, the potential consequences of an extreme flood include dam failure and extreme environmental, financial and social losses and impacts. Although the probability of such an event is considered to be very low, the potential adverse consequences are considered to be extreme. This is an inherent risk that will exist until such time as the planned work is completed.

7.14.3 Residual environmental effects
A severe flood could cause significant impacts to the construction works as well as the irrigation infrastructure and downstream communities. However, this risk is a constant threat under the present operating conditions and the proposed Project will provide sufficient flood control capacity to mitigate this risk in the future. As potential impacts are confined to the short-term period of construction, there are no anticipated residual effects as a result of the Project.

7.14.4 Government, public and Aboriginal comments and proponent's response
There were no comments with respect to AT's mitigation or approach to the environmental effects of the environment on the Project components.

7.14.5 The Agency's conclusions regarding residual environmental effects
Taking into account implementation of the mitigation measures proposed by the proponent, the Agency concludes that environmental conditions are not likely to adversely affect the Project.

7.15 Effects of Possible Accidents or Malfunctions

The environmental effects caused by accidents or malfunctions are among the factors to be examined pursuant to the Act. Accidents and malfunctions can occur at any time during Project construction and operations, with the actual environmental effects being dependent on the specific nature of the accident, malfunction, or unplanned event (e.g., amount of deleterious material released, scope of cofferdam failure).

7.15.1 Potential effects

Construction

The proponent identified the spill or release of deleterious substances as the main risk of accident or malfunctions. The use of heavy machinery, motorized equipment, and light-duty vehicles during construction and to a lesser degree during operations presents an inherent risk of spills or releases of gasoline, diesel fuel, hydraulic fluids, lubricants, coolant, and other deleterious substances. These substances can be released as a result of equipment being in poor repair, mechanical failure, damage sustained during operation, poor fuelling practices, or inadequate means of containment during storage.

Additional accidents and malfunctions include failure of cofferdams installed to allow isolation of work areas within the reservoir, which could lead to hazards to the safety of workers and impacts to downstream areas if a large scale failure occurred at the outlet structures.

Future Operation

During future operation, a 'sunny day' dam failure may occur, whereby a dam breach occurs under normal or typical operating conditions not associated with a storm or flooding. This is an existing risk at the site as there are a number of dams on the Little Bow system. There is a very low potential for the Little Bow Reservoir Dam or associated structures, or any other dam or structure in the CBRH to fail under normal operating conditions. There is negligible potential for flooding to cause catastrophic

failure of the Little Bow Reservoir Dam after it is rehabilitated. Activation of the auxiliary spillway during a major flood could result in significant erosion within the south channel and in the Little Bow River valley. However, activation of the auxiliary spillway would only occur in the event of a 1:1000 year flood or greater; therefore, the risk of this occurring is considered to be very low.

7.15.2 Mitigation measures

The potential for a spill or release to occur during construction can largely be mitigated through best management practices, such as frequent inspection of machinery for leaks, easy access to spill response kits and the appropriate usage, storage and disposal of waste and hazardous materials. Therefore, the potential for a spill or release to occur is low. If a spill were to occur, the potential for a deleterious substance to enter the Little Bow Reservoir is also considered to be low. The majority of the proposed works will occur above the existing Little Bow Reservoir operating level, and any work required within the Little Bow Reservoir will be isolated by a cofferdam and the construction area will be dewatered. A Spill Prevention and Response Plan (including provision for refuelling and servicing of vehicles) will address the means to prevent and/or deal with accidental discharges and any emergency situations that may arise. See Appendix 5 for details.

The risk of contact with an underground utility during construction is typically controlled by conducting line locates for underground utility lines as well as by general hazard assessment procedures during work planning. Although utility owners in the Project area have been contacted during the previous investigation, design and construction phases, provisions are included for reconfirming all utility locations prior to any new work. The potential for an incident to occur is therefore considered to be low.

As the cofferdams are engineered structures designed to withstand anticipated reservoir levels and waves, there is low potential for a failure to occur. In addition, regular inspections will be carried out to allow for early identification of any potential maintenance requirements. The proponent's Emergency Measures Plan will include provisions to deal with any unexpected failure or malfunction of a temporary containment system.

In the case of extreme flooding during operation, emergency manual activation of the auxiliary spillway would be initiated to prevent overtopping of the Little Bow Reservoir dam. Completion of the Project will also mitigate the possibility of an extreme flood as the existing Emergency Response Plan will be updated to include a procedure for manual activation of the auxiliary spillway to prevent overtopping of the Little Bow Reservoir dam during construction.

7.15.3 Residual Environmental Effects

No residual effects have been identified with respect to accidents and malfunctions.

7.15.4 Government, public and Aboriginal comments and proponent's response

The Agency requested further information from the proponent with respect to the potential environmental effects of any accident, malfunction, or unplanned event and the spill contingency plans for the various components of the site. The proponent supplied information concerning potential accidents and malfunctions as well as emergency response plan. As a result, the Agency concluded that a satisfactory amount of information was gathered for assessing the effects.

7.15.5 The Agency's conclusions regarding residual environmental effects

Taking into account the implementation of the proposed mitigation measures, the Agency considers that the Project is not likely to cause significant adverse environmental effects through accidents and malfunctions.

7.16 Cumulative Environmental Effects

7.16.1 Approach

Cumulative environmental effects are defined as the effects on the environment that are likely to result from a project when a residual effect combines with the effects of other projects or human activities that have been or will be carried out. This assessment of cumulative effects is based on the *Canadian Environmental Assessment Agency's Operational Policy Statement* on cumulative effects (Canadian Environmental Assessment Agency, 2007), the *Cumulative Effects Assessment Practitioners Guide* (Canadian Environmental Assessment Agency, 1999) and the proponent's analyses.

7.16.2 Scoping

The scope of this Cumulative Effects Assessment (CEA) was to examine the predicted residual effects arising from the Project that were identified in direct assessments (e.g., fisheries, vegetation), that could interact with the residual effects from other projects or activities both past, present and reasonably foreseeable. Residual effects are defined as Project impacts that will potentially exist following implementation of mitigation.

After residual effects were considered, potential cumulative impacts in relation to the Project and any other projects and activities that could potentially contribute to cumulative effects were identified. Where it was determined that the potential residual effects of the Project would not act in a cumulative manner with similar effects from past, present or likely future projects and activities, it was determined that there would be no cumulative effects.

The RSA used for assessing cumulative environmental effects includes the largest defined resource component RSA to ensure that all projects and/or activities that potentially have effects that could combine with those activities from the Project are included. The temporal scope for assessing the cumulative environmental effects of the Project was defined as the period of time during which a residual impact caused by a project related activity would act in combination with effects from other existing and foreseeable future project activities, plus the period required for any cumulative impacts to become undetectable and for the resource to return to current background levels. The Project baseline reflects existing projects and the future temporal limit is set to the lifetime of the Project, with specific temporal boundaries relative to specific ecosystem or social components being considered.

Other regional projects or activities were identified and reviewed to determine their potential temporal or spatial overlap with the Project. All potential Little Bow Reservoir residual effects are summarized in Appendix 4. Projects which met the temporal and spatial criteria identified above were evaluated to determine any cumulative interactions with the residual effects of the Project in the areas identified (see Table 7.16.1).

7.16.3 Potential cumulative effects

Residual effects on VECs of concerns that have the potential to interact with effects of other projects and/or activities were considered within the analysis of cumulative effects. Cumulative effects were assessed in cases where the Project-specific residual impact is expected to have a measurable or demonstrable effect and is reasonably expected to occur; and the Project-specific residual impact is likely to act in a cumulative manner with the effects of other existing or future projects and activities. Following this methodology, three projects or activities occurring within the vicinity of the Project were identified as having the potential to contribute to cumulative effects: the Blackspring Ridge Wind Project, oil and gas wells, and agricultural activities.

Table 7.16.1: Potential Effects of Past, Existing or Reasonably Foreseeable Projects with the Potential to Interact Cumulatively with the Project

Project or Activity	Project Description	Potential Effects/Residual Effects	Potential for Cumulative Effects
Existing Projects/Activities (including potential future changes to existing activities)			
Agriculture	• Grazing lease, crop land and ranching in the Little Bow Reservoir RSA as well as in the surrounding area. • As most of the land in the RSA is currently agricultural land, future agricultural use would be similar to that currently occurring but possibly in a different mix barring changes to land use designations.	• Future changes to agricultural activities in the Little Bow Reservoir RSA or surrounding area are not known but would be expected to follow land-use and other guidelines. • Continued displacement of native grassland prairie within the RSA with non-native agricultural and noxious-weed species. • Loss of potential habitat for burrowing owls and other ground dwelling species. • Additional irrigation requirements will result in more nutrient-rich return water to Little Bow River. This is not expected to be significant.	• Potential cumulative loss of grassland vegetation. • Potential cumulative loss of wildlife habitat. • Depending on agricultural practices, could act cumulatively with wind erosion and creation of dust.
Oil and gas activity	• Oil and gas wells in the Little Bow Reservoir LSA and RSA as well as in the surrounding area.	• Development of new gas or oil wells could affect vegetation and wildlife resources depending on the location of the wells and the clearing required. • Potential for additional wildlife habitat loss due to installation of new wells within the RSA.	• Potential cumulative loss of grassland, vegetation, shrubs, and trees. • Potential cumulative loss of wildlife habitat.
CBRH System Overall	• Existing McGregor and Travers Reservoir and associated irrigation infrastructure in the Little Bow Reservoir RSA and surrounding area. • Diverts water to 85,000 ha of agricultural land in the BRID and 2,000 ha for the Siksika Nation. The source of water for the water licenses supplied by the CBRH system is the Bow River.	• It is possible that future maintenance activities may result in different effects depending on the nature of the maintenance required. Should major maintenance be required, applicable permitting and regulatory requirements would have to be met and residual effects from the Project would be assessed.	• Cumulative effects are not anticipated as activities would not act cumulatively with identified residual effects.
Commercial Fishing	• Small commercial lake whitefish fishery on Little Bow Reservoir.	• Reduction in the number of lake whitefish in the Little Bow Reservoir.	• Cumulative effects are not anticipated as the Project is not expected to affect lake whitefish populations.

Table 7.16.1: Potential Effects of Past, Existing or Reasonably Foreseeable Projects with the Potential to Interact Cumulatively with the Project (cont'd)

Project or Activity	Project Description	Potential Effects/Residual Effects	Potential for Cumulative Effects
BRID (Water Use in the Bow River Basin)	• All unallocated water in the Bow, Oldman, and South Saskatchewan sub-basins is reserved and further licenses in these sub-basins are limited to outstanding applicants, First Nations, IO, and for future storage development provided the development is to protect the aquatic environment or to improve water supply to existing licensees.	• None identified	• No cumulative effects as basin is closed to further water allocations and unallocated water must be used for specified uses.
Established Recreation Sites (Little Bow Reservoir PRA and Travers and McGregor PRAs)	• Existing Provincial Park and PRAs on McGregor Reservoir and Travers Reservoir provide access to reservoirs for recreation.	• Existing effects are expected to continue and were captured in the baseline and assessed in the EA.	• Cumulative effects are not anticipated as activities would not act cumulatively with identified residual effects.
Roadways	• Existing roadways in the Little Bow Reservoir LSA and RSA and in the surrounding area.	• Existing effects are expected to continue and were captured in the baseline and assessed in the EA.	• Cumulative effects are not anticipated as activities would not act cumulatively with identified residual effects.
First Nations Traditional Use	• Potential hunting, gathering and other activities in the RSA and surrounding area.	• Specific activities currently being undertaken in the RSA have not been identified. However, any environmental effects associated with ongoing activities are reflected in the Project baseline.	• Cumulative effects are not anticipated as activities would not act cumulatively with identified residual effects.
Recreation/ Tourism	• General recreation and tourism activities outside the Park and PRAs including activities similar to those undertaken in the Park and PRAs as well as others such as hunting.	• Existing effects are expected to continue and were captured in the baseline and assessed in the EA.	• Cumulative effects are not anticipated as activities would not act cumulatively with identified residual effects.

Table 7.16.1: Potential Effects of Past, Existing or Reasonably Foreseeable Projects with the Potential to Interact Cumulatively with the Project (cont'd)

Project or Activity	Project Description	Potential Effects/Residual Effects	Potential for Cumulative Effects
Future Projects/Activities			
Blackspring Ridge Wind Project	• Proposed wind energy project to be developed immediately west of the Project in Township 14, Range 21 and 22, and Township 13, Range 21, 22, and 23.	• Potential residual effects include increased mortality of bird and bat populations as a result of wind turbine interaction within the RSA, including Sprague's Pipits which were observed within the Blackspring Ridge Wind Project study area. • A minor loss of prairie grassland habitat would be required for the construction of 27 towers (~25 m^2/tower). This represents a total loss of approximately 675 m^2 of grassland.	• Potential cumulative loss of grassland habitat.
Siksika Water License	• Siksika irrigation expansion of 43,172 dam^3 that receives water from the CBRH system. • Siksika expansion is subject to current IO on the Bow River.	• Siksika expansion has been considered in modelling scenarios for the Combined TLBR. In addition, the models assume a 20% increase in irrigation demand within the Bow River basin.	• Cumulative effects not expected as potential effects have been captured in the assessment of the Project.

Cumulative impacts to grasslands may occur as a result of the combined influences of the new Little Bow Reservoir operating regime and continued agricultural activity in the RSA. The loss of approximately 2.77 km^2 of modified grasslands as a result of the increased FSL in combination with continued agricultural activity in the RSA has the potential to further reduce the grassland community biodiversity through overgrazing, spread of adjacent crop species, and introduction or proliferation of noxious or invasive species.

Further loss or degradation of grassland vegetation could contribute to a cumulative effect on wildlife within the RSA. Continued agricultural activity could result in degradation of grassland vegetation as described above.

Clearing for the Blackspring Ridge Wind Project and any future oil and gas development will be minimal. Therefore, the residual cumulative effect on grasslands is not considered to be significant. Likewise, the cumulative effect of grassland vegetation loss on wildlife habitat availability is not considered significant.

The Project is expected to cause an increase in soil loss through wind and wave erosion as a result of an increase in shoreline length and annual fluctuation in water levels. Cultivated land is expected to have a much higher incidence of wind erosion than the grazing pasture adjacent to project. Because of the arid nature of soils in the RSA, it is expected that both soil loss as a result of the Project and wind erosion of the exposed drawdown zone during future reservoir operation will contribute cumulatively to wind erosion and increased dust occurring in cultivated land.

7.16.4 Mitigation measures

The effects of wind erosion can be minimized through practices such as building shelterbelts. Soil loss within the adjacent cultivated land is expected to be reduced through the regular application of irrigation water and zero tillage practices. The magnitude of this cumulative effect of wind erosion is expected to be low. Likewise, the creation of dust from cultivated fields is expected to have a low impact.

To mitigate the impact on grassland vegetation, the Project area has been excluded from the existing grazing lease and has been fenced to control local cattle from accessing the reservoir. This is expected to improve the existing grassland areas by limiting degradation through grazing and loss of species diversity. All grassland areas disturbed by construction will be revegetated with a native seed mix and monitoring of the success of revegetation conducted. No additional monitoring is recommended.

7.16.5 Residual environmental effects

The majority of the existing grassland vegetation within the RSA has been grazed for many decades and further reduction in habitat value is not anticipated as a result of ongoing land use. Likewise, the land suitable for cultivation has already been broken and it is not expected that the remaining grassland vegetation will be cleared for cultivation. The residual cumulative effects on vegetation and wildlife are not expected to be significant.

The residual cumulative effects on the geophysical environment as a result of wind and wave erosion and the creation of dust from fields are not expected to be significant.

7.16.6 Government, public and Aboriginal comments and proponent's response

Fisheries and Oceans Canada requested further information on how the existing works on Travers Reservoir and other infrastructure in the CBRH could impact the Project and contribute to cumulative effects of the Project. The proponent clarified that the baseline environmental conditions assessed reflect the current conditions on the landscape, and thus account for accumulated residual environmental effects of past and existing projects and activities in proximity to the Project, such as the existing works on the Travers Reservoir and other infrastructure. Following the proponent's response, Fisheries and Oceans Canada concluded that a satisfactory amount of information was gathered for assessing the cumulative effects of the Project.

The Agency requested that the proponent provide additional detail on the rationale and methodology used to determine that a project or sector would not act cumulatively with the identified residual effects of the Project and that an identified residual effect of the three project/sectors would have limited or no interaction with an identified residual effect of the Project. Following the proponent's explanation of its cumulative effects methodology, the Agency concluded that a satisfactory amount of information was gathered for assessing the cumulative effects of the Project.

7.16.7 The Agency's conclusions regarding cumulative environmental effects

Taking into account implementation of the mitigation measures, the Agency concludes that the Project is unlikely to cause significant adverse cumulative environmental effects on grassland vegetation, grassland habitat available for wildlife, soil erosion or dust introduced into the air.

7.17 Effects on the Capacity of Renewable and Non-Renewable Resources

The Act under section 16(2)(d) states that comprehensive study reports must "address the

capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and the future."

Renewable resources

Water within the reservoir is a renewable resource which is managed for irrigation and domestic purposes. This water constitutes a portion of a large network of canals and storage reservoirs designed to transport water to areas where it can be used for agricultural irrigation, drinking water, household water, and watering live-stock. This resource is critical for the end-users as there are few other options for procuring water in these areas, hence the necessity for the upgrades of the infrastructure required to transport this water. This water resource is carefully managed through the allocation of water licenses to ensure that the capacity of the system is not overdrawn. The proposed Project has been designed to facilitate the continued management of this water resource and the proposed upgrades will ensure a sufficient storage capacity for future water use and protect against flooding. The regional requirements for water usage have been established in the Approved Water Management Plan for the South Saskatchewan River Basin, which describes water allocation limits, conservation objectives, and management objectives for the future (AENV, 2006).

The prairie grassland surrounding Little Bow Reservoir is pasture land which has been used for grazing cattle for many years. This land base has historically provided a nutritional component of the annual energy budget of the herd maintained by the adjacent landowner. Cattle are rotated throughout the pasture land, consuming regenerating grassland vegetation in cycles. The area of pasture that will be inundated has already been fenced off and excluded from the landowner's grazing lease. The grazing capacity of this resource (roughly 238 ha) will be lost as a result of reservoir expansion; however, this impact is considered to be minor relative to the total area available for grazing in the vicinity of the Project.

As the Project is not predicted to have any significant adverse residual effects on renewable resources, the Agency concludes that the Project's impacts on the capacity of the renewable resources will not be significant.

8. Follow-Up Program under the *Canadian Environmental Assessment Act*

The purpose of a follow-up program is to verify the accuracy of the environmental assessment of a project and to determine the effectiveness of any measures taken to mitigate the adverse environmental effects of the Project. The results of a follow-up program will also support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects or to modify existing measures.

Fisheries and Oceans Canada and Transport Canada will be responsible for the Follow-up Program and, with the support of the relevant federal and provincial authorities, will ensure that the proponent designs and implements a detailed program.

Appendix 7 outlines the requirements and objectives of the Follow-up Program pertaining grassland vegetation, terrestrial wildlife, groundwater, water quality, and fish habitat (compensation structures and free passage of fish) among other things. The program will take into account the conditions of the federal and provincial authorizations and approvals required for the implementation of the Project, as well as changes in environmental conditions and the observation of environmental effects that may arise while the Project is being carried out. The proponent will undertake adaptive management

practices with respect to adverse environmental effects that are identified through monitoring.

As part of the Follow-up Program, the proponent must produce reports describing the results, their interpretation and any necessary corrective measures. The proponent will submit the reports to Fisheries and Oceans Canada and Transport Canada as well as to the relevant monitoring committees. The results of the follow-up program will be made publicly available on the Canadian Environmental Assessment Registry.

9. Benefits to Canadians

The comprehensive study process gave the Canadian public and Aboriginal groups opportunities to participate in improving the Project during the design phase thus helping reduce the environmental effects of its construction and operation. As a result, the design, construction and operation of the Project are not based solely on technical or economic criteria, but also incorporate environmental criteria that promote a balanced approach in keeping with the principles of sustainable development.

The Project will ensure that the Travers Reservoir and Little Bow Reservoir are capable of passing the PMF as recommended in the CDA Dam Safety Guidelines (CDA, 2007), and are capable of providing a reliable supply of water to users of the CBRH and further downstream in the recreationally and agriculturally important BRID canal system.

An increased understanding regarding of past human occupation of the Little Bow region of Alberta represents a clear and significant positive effect of the Project. It is unlikely that a comprehensive study of historical resources, on the spatial scale that was ultimately achieved, would otherwise have been undertaken in this region.

During this evaluation, modifications were made in response to comments received from Fisheries and Oceans Canada and Transport Canada to ensure that stream crossings were designed so as to reduce fish habitat loss and disturbance and maintain navigability where necessary.

10. Conclusion and Recommendation of the Agency

To reach a conclusion on the environmental effects of the Project, the Agency took the following elements into account in its analysis:

- the documentation submitted by the proponent
- the analysis and findings of this comprehensive study report
- the opinions and comments of the public, federal and provincial expert departments, and Aboriginal groups
- the proponent's obligations and mitigation measures, as documented in Appendix 5, Table of Commitments
- requirements to be described in the *Fisheries Act* authorizations and their associated habitat compensation plans to mitigate potentially negative impacts to fish and fish habitat
- requirements to be described in the *Navigable Waters Protection Act* approval
- requirements of the follow-up program to be implemented by the proponent

In the event that the responsible authorities take the course of action described in paragraph 37(1) (a) of the Act, they will ensure that mitigation measures are implemented in accordance with subsection 37(2.1) and (2.2) of the Act.

No significant adverse biological, health, or heritage effects are predicted to result from the Project. The environmental effects of the Project have been determined using assessment methods and analytical tools that reflect current best practices. The EIS concludes that the Project can be constructed and operated without significant adverse environmental effects, including the consideration of cumulative effects and accidents and malfunctions.

Taking into account implementation of the mitigation proposed, including commitments made by the proponent in this report and the fulfillment of regulatory requirements, the Agency concludes that the Project is not likely to cause significant adverse environmental effects.

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Appendix 1: Summary of Project Components and Associated Activities

Area	Component	Existing Facility	New Facility/Activity
Little Bow Reservoir	• Little Bow Reservoir Dam	• Dam crest El. 857.25 m • 14 m high • 1,200 m long, relatively steep slopes 1.85-2.75H:1V • Riprap in poor condition	• Dam crest El. 860.5 m • Raise by 3.25 m and lengthen to 3,300 m • Flatten slopes to 3-3.5H:1V • New riprap • Widen on downstream side with internal drains
	• Little Bow Reservoir Outlet Structure	• Design capacity is 76.5 m^3/s • Comprised of an inlet at El. 846 m, 7 cell conduit, and basin section • Structure to be partially demolished and remainder grouted and abandoned in place	• Design capacity is 87.8 m^3/s • Comprised of an inlet at El. 848 m, gatewell structure, 5 cell conduit, and stilling basin section • Slide gates 1.83 m wide by 2.44 m high • Offset 90 m east of existing outlet
	• Enhancement Dyke 1	• No existing enhancement dyke	• Dyke crest El. 860 m • Upstream slope varies 5-15H:1V with no slope protection • Downstream slope 3H:1V
Travers Little Bow Reservoir Connecting Canal	• Canal Enlargement (Downstream Portion)	• 24.4 m wide • 2H:1V side slope • Unprotected slopes • Invert at El. 849.8 m	• 50 m wide • 2.5-3H:1V side slope • Partial clay liner with gravel armour • Invert at El. 849 m
	• Inlet and Outlet Structures	• Travers outlet structure consisting of 7 box shaped concrete conduits with 2.438 m square radial gates • Little Bow Reservoir inlet structure consisting of concrete chute with overflow weir at El. 850.95 m	• Both existing structures to be removed and no new structures constructed
	• Culvert and Roadway Crossing	• No existing culvert crossing • Roadway currently located on Travers outlet structure	• Combined culvert and roadway crossing • Four 3 m wide by 3.5 m high conduits • Invert of culvert at El. 848.8 m
Little Bow PRA	• Little Bow Reservoir PRA	• Camping areas, toilets, picnic tables, boat launch, and beach	• Camping areas, picnic tables, toilets, breakwater and boat launch at new PRA location

Appendix 1: Summary of Project Components and Associated Activities (cont'd)

Area	Component	Existing Facility	New Facility/Activity
Miscellaneous	• Utilities	• Remove single phase power • Abandon sections of phone line • Protect existing oil and gas facilities	• Construct new three phase power • Install new phone lines • Relocate sections of pipelines
	• Roadways	• Abandon sections of roadway	• Construct new sections of roadway
	• Topsoil Stockpiles	• Two existing topsoil stockpiles	• Two additional topsoil stockpiles

Appendix 2: Scope of the Project by Component and Associated Activity

Area	Component	Phase	Activity
Little Bow Reservoir	• Little Bow Reservoir	• Construction	• Change in reservoir operation including full supply levels
	• Little Bow Reservoir Dam	• Construction, operation, and maintenance	• The rehabilitation of the Little Bow Reservoir dam and its associated works or activities related to the raising of the main dam, the extension of the dam, the placement of riprap and drainage materials, and the installation of geo-technical and structure instrumentation
	• Little Bow Reservoir Outlet Structure	• Construction, operation and maintenance	• New irrigation outlet in the Little Bow Reservoir and its associated works or activities
	• Enhancement Dyke 1	• Construction, operation and maintenance	• Enhancement dyke at the south end of the Little Bow Reservoir
Travers Little Bow Reservoir Connecting Canal	• Canal Enlargement (Downstream Portion)	• Modification, operation, and maintenance	• Enlargement of the remaining 1.8 km of connecting canal from 25 m to 50 m and any associated works or activities
	• Inlet and Outlet Structures	• Decommissioning • Decommissioning	• Removal of existing control structures in the TLBR Connecting Canal and its associated works or activities • Little Bow Reservoir inlet chute and Travers Reservoir outlet control structure in the connecting canal, and its associated works
Travers Little Bow Reservoir Connecting Canal	• Culvert and Roadway Crossing	• Construction, operation and maintenance of the	• Culvert crossing and its associated works or activities in the TLBR Connecting Canal
Little Bow PRA	• Little Bow Reservoir PRA	• Decommissioning • Construction, operation, and maintenance	• Demolition and removal of the existing recreation facilities in the Little Bow Reservoir Provincial Recreation Area and any associated works or activities • New Provincial Recreation Area and its associated works and activities

Appendix 2: Scope of the Project by Component and Associated Activity (cont'd)

Area	Component	Phase	Activity
Carseland-Bow River Headworks (CBRH) System	• Reservoir Systems—Water Withdrawal	• Operations and maintenance	• Change to the annual operations, and associated maintenance activities, of the CBRH system post construction with particular focus on operations within the Little Bow Reservoir and any changes to timing or rate of water withdrawal from the Bow River to the CBRH system required for the purpose of filling and maintaining the Little Bow Reservoir to its new expanded capacity
Miscellaneous	• Roadways	• Construction • Construction and maintenance	• The reconstruction of the existing gravel road north of the Little Bow Reservoir dam • Concrete protective slabs for the existing roads crossing pipelines
	• Disturbed Areas	• Reclamation	• Reclamation of disturbed areas including re-distribution of topsoil and re-seeding with vegetation native to the area
	• Fencing and Gates	• Construction and maintenance	• Installation of remaining sections of fencing and gates around the reservoir boundary including maintenance of the fencing and gates throughout its operation

Appendix 3: Vecs, Significance Thresholds, and Spatial Boundaries for the Project

VEC	Significance Thresholds	Spatial Boundaries	
		Local	Regional
Geophysical			
Soil Quality	• Contamination exceeding Alberta Tier 1 or CCME guidelines • Permanent damage to soil structure in an area greater than 5% of LSA	The LSA includes the Little Bow Reservoir, the lands that will be inundated once the reservoir is at the new FSL (El. 856.18 m), and the anticipated construction footprint	Surficial and bedrock stratigraphy is discussed over a broader RSA including a significant portion of southern Alberta
Soil Quantity	• Increased loss of soil will be greater than 5% of LSA soil		
Hydrology			
Bow River discharge downstream of CBRH diversion	• Frequency of IO not being met increases by greater than 1%	The LSA includes the proposed area of inundation at the reservoir boundary of the operating FSL at El. 856.18 m	The RSA includes the CBRH diversion from the Bow River, the CBRH system, the reach of the Bow River downstream of the diversion, and the Little Bow River downstream of Travers Reservoir
Little Bow River discharge downstream of Travers Reservoir	• Reduction in Little Bow River discharge downstream of Travers Dam exceeding conditions of the Water License		
Little Bow Reservoir and Travers Reservoir water levels	• Change significantly affects other VECs, as evaluated within the EIS		
Surface Water Quality			
Little Bow Reservoir	• Change in parameter concentration that causes an exceedance of regulatory guidelines	The LSA includes the proposed new FSL boundary and the Little Bow Reservoir outlet, and the waters immediately downstream and immediately upstream of the Little Bow Reservoir (i.e., the BRID canals, Travers Reservoir, and Little Bow River)	The RSA includes the entire CBRH system
Downstream BRID canals			
Travers Reservoir			
Little Bow River			
Hydrogeology			
Groundwater Quantity	• Increased seepage to surface affects adjacent landowner through changes in soil structure or land use capability	The LSA includes the proposed new FSL (El. 856.18 m) of the Little Bow Reservoir and adjacent areas where baseline groundwater conditions could be impacted	For information purposes, regional hydrogeology is discussed over a broader RSA
Groundwater Quality	• Change in parameter concentration that causes an exceedance of regulatory guidelines		

Appendix 3: Vecs, Significance Thresholds, and Spatial Boundaries for the Project (cont'd)

VEC	Significance Thresholds	Spatial Boundaries	
		Local	Regional
Aquatic Environment			
Northern pike	• Change in population numbers or biomass greater than 20% • Change results in contravention of protected species legislation • Residual effect after mitigation contravenes legislation • Change in tissue mercury concentration that causes an exceedance of regulatory guidelines	The LSA includes the lower half of Travers Reservoir, the TLBR Connecting Canal, Little Bow Reservoir, and the BRID irrigation canal immediately downstream of the Little Bow Reservoir	The RSA includes the entire CBRH system, including Little Bow Reservoir, Travers Reservoir, and McGregor Reservoir, as well as the Bow River at the CBRH intake and all connecting canals
Lake whitefish			
Walleye			
Spottail shiner			
Benthic invertebrate density and community structure	• Change in biomass greater than 20%		
Vegetation communities in the littoral and riparian areas	• Change in areal extent greater than 20%		
Vegetation			
Wetland ecosystems	• Change in areal extent within RSA greater than 20% • Change results in contravention of protected species legislation • Residual effect after mitigation contravenes legislation	The LSA includes the proposed construction footprint and area of inundation at the new operating FSL of 856.18 m	The RSA is coextensive with the boundary of Township 14, Range 20, W4M
Aquatic vegetation	• Change in areal extent greater than 20%		
Riparian vegetation	• Change in areal extent within RSA greater than 20%		
Grasslands			
Shrubs and trees			
Rare/uncommon plant species (see Table 11.1 of the EIS for a complete listing of rare/uncommon plant species identified as VECs)	• Change results in contravention of protected species legislation • Change results in re-classification of provincial or global listing • Change results in local extirpation of rare ecological community	The LSA includes the proposed construction footprint and area of inundation at the new operating FSL of 856.18 m	The RSA is coextensive with the boundary of Township 14, Range 20, W4M
Rare ecological communities including the western wheatgrass-low sedge and low sedge-western wheatgrass communities			

Appendix 3: Vecs, Significance Thresholds, and Spatial Boundaries for the Project (cont'd)

VEC	Significance Thresholds	Spatial Boundaries	
		Local	Regional
Wildlife			
Colonial nesting waterbirds	• Published thresholds for population viability are not available • A permanent 20% decrease in island habitat surface area was considered to be significant	The LSA includes the proposed construction footprint, the TLBR Connecting Canal, and the area to be inundated at the new FSL boundary	The RSA is coextensive with the boundary of Township 14, Range 20, W4M
Waterfowl	• Published thresholds for population viability are not available • Only a select number of species of waterfowl and diver (e.g., red-necked grebes) use emergent vegetation for nesting. The majority of species nest in upland areas (e.g., mallards), or in tree cavities (e.g., buffleheads) • For the species that use emergent vegetation for nesting, a permanent 20% decrease in emergent vegetation was considered significant		
Federal Species at Risk			
Ferruginous hawk	• Use of a numerical threshold to determine the significance of Project effects on ferruginous hawks was considered to be inappropriate. The sparse spatial distribution of nesting ferruginous hawks in the region exists at a scale that is not comparable to the localized effects of the Project • The permanent destruction or disturbance of a ferruginous hawk nest was considered significant		
Burrowing owl	• The use of a numerical threshold to determine the significance of Project effects on burrowing owls was considered to be inappropriate. The sparse spatial distribution of nesting burrowing owls in the region exists at a scale that is not comparable to the localized effects of the Project • The permanent loss of an active or historical burrowing owl burrow was considered significant		

Appendix 3: Vecs, Significance Thresholds, and Spatial Boundaries for the Project (cont'd)

VEC	Significance Thresholds	Spatial Boundaries	
		Local	Regional
Long-billed curlew	• Published thresholds for population viability are not available • A 10% reduction of nesting habitat for grassland species within the RSA was considered to be a potential threat to regional population sustainability for Species at Risk and would be considered significant		
Sprague's pipit			
Chestnut-collared longspur			
McCown's longspur			
Loggerhead shrike			
Common nighthawk			
Climate and Air Quality			
Climate	• Change in total provincial GHG emissions greater than 0.1% • Change in local or regional mean surface air temperature greater than 1°C	The LSA includes the proposed construction footprint, the TLBR Connecting Canal, and the area to be inundated at the new FSL boundary	The RSA includes a radius of 65 km
Air Quality	• Change in parameter concentration that causes an exceedance of regulatory guidelines		The RSA includes a radius of 130 km
Noise			
Noise	• Increase in noise level at a Receptor is greater than 5 dBA above ambient level	The LSA includes the footprint of active construction and the area of inundation	The RSA includes a buffer with a radius of 3 km extending beyond the boundaries of the LSA
Heritage and Archaeological Resources			
Historical Resources	• Residual effect after mitigation contravenes legislation	The LSA includes the proposed construction footprint, the TLBR Connecting Canal, and the area to be inundated at the new FSL boundary	An RSA is not defined for the historical resources assessment in accordance with HRA Clearance requirements
Navigation			
Navigability	• Residual effect after mitigation contravenes legislation	The LSA was defined as the entire wetted area of the reservoir at El. 856.18 m, including the TLBR Connecting Canal	As there are no impacts to navigation anticipated within the region outside of the LSA, an RSA was not defined

Appendix 3: Vecs, Significance Thresholds, and Spatial Boundaries for the Project (cont'd)

VEC	Significance Thresholds	Spatial Boundaries	
		Local	Regional
Current Use of Lands and Resources			
Recreational land and resource use	• A potential effect was identified if there was a change from the baseline condition (e.g., if any activities, businesses, or properties were affected) • Professional judgement considering baseline information, the nature of the Project/VEC interaction, and ability to mitigate the effect were considered in the effects assessment and residual effects discussion	The LSA encompasses the project footprint and area immediately surrounding the Project, including the Little Bow Reservoir at the new operating FSL boundary, the outlet canal, and the construction footprint	The RSA is coextensive with the generalized IBA boundary for Site #AB016
Domestic land use			The RSA is coextensive with the boundary of Township 14, Range 20, W4M
Domestic resource use			
Commercial land use			
Commercial resource use			
Human health, specifically including the potential entry of contaminants into the food chain	• Health Canada's methylmercury guidelines		The human health RSA includes the portion of the BRID irrigated by water from the Little Bow Reservoir

Appendix 4: Summary of Identified Potential Residual Effects of the Project

Resource Component	Phase	Activity	Residual Effect Description
Geophysical Environment	Operation	• Reservoir operation at the new FSL and at fluctuating water levels	• Soil loss through wind and wave erosion
Hydrology	Operation	• Changes to diversion of water from Bow River	• Net reduction of diversion in late summer/early fall during periods when Bow River flows are typically low
		• Increased surface area at FSL El. 856.18 m	• Increased evaporation from Little Bow Reservoir
Hydrogeology/ Groundwater Quality	Operation	• Reservoir operation at FSL El. 856.18 m	• Increased groundwater quantity and seepage as a result of increased head pressure
Surface Water Hydrology	Construction/ Operation	• Reservoir operation at FSL El. 856.18 m	• Increased aquatic sedimentation resulting from increased wind and wave erosion • Net positive regional impact to water quality related to changes in CBRH system withdrawal rates and timing under the new combined operating regime
Aquatic Environment	Operation	• Operation during construction drawdown	• Temporary reduced suitability of whitefish spawning habitat in drawdown zone • Reduced access to spawning substrate for northern pike • Stranding of fish during construction drawdown • Reduced benthic invertebrate abundance and species diversity
		• Reservoir operation at the new FSL and at fluctuating water levels	• Loss of northern pike spawning substrate (emergent vegetation) • Loss of rearing habitat (emergent vegetation) • Loss of rearing habitat (submergent vegetation) • Reduced benthic invertebrate abundance and species diversity • Decrease in health of piscivorous species that feed on juvenile lake whitefish • Shift in population structure toward older lake whitefish • Decrease in lake whitefish growth rate • Stranding of fish during operational drawdown • Provision of fish passage between Little Bow and Travers Reservoirs • Increase in fish mercury levels, higher levels expected in predatory fish

Appendix 4: Summary of Identified Potential Residual Effects of the Project (cont'd)

Resource Component	Phase	Activity	Residual Effect Description
Vegetation	Operation	• Reservoir operation at the new FSL and at fluctuating water levels	• Net increase in terrestrial riparian vegetation
		• Annual fluctuation in water levels	• Changes in riparian vegetation community structure • Changes in submergent aquatic vegetation community structure and abundance
		• Reservoir operation at the new FSL and at fluctuating water levels	• Loss of emergent aquatic vegetation • Loss of grassland vegetation • Loss of locally rare/uncommon plant populations
Wildlife and Terrestrial Habitat	Construction	• Clearing and grubbing of vegetation to prepare the footprint of the structures	• Direct loss of shrubs and trees (ferruginous hawk nesting habitat)
		• Construction activity in laydown areas, access roads, and work pads	• Indirect loss of habitat through disturbance and avoidance
	Operation	• Reservoir operation at the new FSL and at fluctuating water levels	• Net increase in colonial nesting waterbird habitat • Loss of waterfowl nesting habitat in grassland, emergent aquatic, and wetland vegetation • Loss of grassland nesting habitat for burrowing owl, long-billed curlew, Sprague's pipit, and longspurs
Climate and Air Quality	Operation	• Increased surface area at FSL El. 856.18 m	• Minor moderation of surface air temperature within the microclimate east of the LSA
		• Annual fluctuation in water levels	• Introduction of dust to the air as a result of wind erosion in drawdown zone
Navigable Waters	Operation	• Annual fluctuation in water levels	• Changing navigational hazards due to submerged topography
Current Use of Lands and Resources for Traditional and Recreational purposes	Operation	• Construction of new PRA	• Improvement of PRA facilities
		• Operation during construction drawdown	• Change in fish catch rates for commercial fishing during construction drawdown
		• Fluctuating water levels	• Navigational hazards affecting health
		• Reservoir operation at the new FSL	• Increases in mercury levels in fish over the next 5 to 10 years
Effects of the Environment on the Project	Construction	• Operation during construction drawdown	• A severe flood could cause significant impacts to the construction works as well as the irrigation infrastructure and downstream communities

Appendix 5: Summary of Proposed Mitigation Measures

No.	Commitment	Project Phase | Timing	Party Responsible
1	The proponent will implement Erosion and Sediment (ESC) Control measures found in the Erosion and Sediment Control Manual (Alberta Transportation, 2011) prior to work and maintained during the work phase until the site has been stabilized. The ESC measures will be inspected regularly.	All project phases	AT
2	The proponent will follow Standard AT construction practices which include: topsoil will be salvage and stockpiling for re-use under non-frozen and non-saturated soil conditions.	All project phases	AT
3	The proponent will install the cofferdams and Enhancement Dyke 1, as well as armouring of these structures and the Little Bow Reservoir Dam face, during the periods when the reservoir is drawn down to El. 849 m.	All project phases	AT
4	The proponent will install riprap armouring in the steeply sloped shoreline areas in the vicinity of the new PRA.	All project phases	AT
5	An evaluation of the need for armouring along the slope adjacent to the south loop of campsites during development of the PRA (Area 2) will be completed.	All project phases	AT
6	Should the steeply sloped island (Area 3) adjacent to Borrow Area B be included in borrow excavations; the proponent will ensure it is re-graded to a more natural gradient, resilient to wind and wave erosion.	All project phases	AT
7	The proponent will ensure ground water levels in wells located on adjacent lands are not changed due to their activities and that the groundwater quality in adjacent landowner wells is not changed due to their activities.	All project phases	AT DFO
8	The proponent will apply fish habitat compensation measures to mitigate any impacts to fish habitat that cannot be mitigated through other identified measures.	All project phases	AT DFO
9	The proponent will follow the Alberta Transportation “Fish Habitat Manual: Guidelines and Procedures for Watercourse Crossings in Alberta (AT, 2009) for instream works, as well as any appropriate measures contained within the Alberta Transportation Erosion and Sediment Control Manual (AT, 2011) for terrestrial aspects of the project.	All project phases	AT
10	The proponent will ensure grey water pumped from the isolated work areas within Little Bow Reservoir will be directed into a silt curtain contained area within the reservoir to settle on bottom in an area with sand/silt substrates and no aquatic vegetation. If the grey water from the isolated area is both high in volume and suspended sediments, it will be pumped inland for release into a constructed sediment trap or basin well away from the reservoir to infiltrate to ground.	Construction	AT DFO
11	The proponent will ensure borrow areas are graded and compacted to minimize the potential for erosion once construction of the Little Bow Reservoir Dam is completed and no further borrow fill is required.	All project phases	AT
12	The proponent will ensure access within the reservoir for installation of riprap material on the dam face is controlled and confined to a minimum area of the reservoir bottom to limit disturbance of fish habitat.	Construction	AT DFO

Appendix 5: Summary of Proposed Mitigation Measures (cont'd)

No.	Commitment	Project Phase | Timing	Party Responsible
13	The proponent will ensure tracked or rubber-tired equipment, is operated directly on the frozen bottom substrates, rather than constructing work pads with fill material.	Construction	AT
14	The proponent will ensure installation of and removal of the cofferdams upstream of the Travers outlet. Turbidity monitoring will be carried out as per AT specifications and a silt curtain will be installed to prevent suspended sediment from being distributed into the water body.	Construction	*AT*
15	The proponent will conduct a fish rescue operation in any areas where fish may become stranded during drawdown of the reservoir fish will be returned to the reservoir.	All project phases	AT DFO
16	The existing cattails, rushes and sedges will be left in place by the proponent prior to inundation to provide seed stock for any such plants that may take root after the FSL is raised; likewise for any sandbar willow found in the existing riparian zone.	Construction	AT
17	The proponent will develop and grade borrow areas after use to ensure positive drainage during periods of drawdown and to avoid entrapment and stranding of fish.	Construction	AT DFO
18	The proponent will monitor the drawdown process to identify areas of potential concern with respect to fish stranding during all three years that construction drawdown occurs.	Construction	AT DFO
19	AT will enter into an agreement with the commercial fishery license holders to suspend the harvest of lake whitefish during the three years of construction drawdown.	Construction	AT
20	If required, the proponent will initiate supplemental aeration to maintain dissolved oxygen concentrations in the drawn down reservoir if low dissolved oxygen levels are measured to ensure the survival of fish and other aquatic life during the winter.	Construction	AT DFO
21	The proponent will modify all areas that may potentially result in fish stranding within the annual drawdown zone to allow for either positive drainage or complete isolation from the reservoir.	Operation	AT DFO
22	The proponent will monitor drawdown during the first year of operation during drawdown to the winter El. of 854.06 m to identify additional areas where stranding of fish may occur.	Operation	AT DFO
23	The proponent will provide wetland habitat compensation for all wetland complexes that will be affected which are identified as Class II or greater according to the Stewart and Kantrud system of classification (1971) and as per the Federal Policy on Wetland Conservation.	All project phases	AT
24	The proponent will include reclamation measures for grasslands such as the re-establishment of northern and western wheatgrass within the LSA following completion of construction activities (EC recommends the amount of western wheatgrass in the seed mix be kept minimal, 10 to 15 percent).		AT EC
25	The proponent will continue to maintain fences and control cattle grazing to improve existing grassland areas.	All project phases	AT

Appendix 5: Summary of Proposed Mitigation Measures (cont'd)

No.	Commitment	Project Phase | Timing	Party Responsible
26	Planting of sandbar willow will be carried out as per the conceptual FHCP.	Operation	AT DFO EC
27	The proponent will attempt transplantation of rare plant and rare ecological communities from within the zone of inundation in order to offset the potential effect on the regional populations of these species.	Construction	AT EC
28	Monitoring of transplanted rare plants will be conducted to determine the success rate of mitigation.		AT
29	The proponent will revegetate all disturbed areas above the new FSL after disturbance using native grass seed mix to inhibit invasive species introduction and spread.	All project phases	AT EC
30	Noxious and restricted weeds will be controlled by the proponent as per the requirements of the *Alberta Weed Control Act*.	All project phases	AT
31	The proponent will complete regular weed control until successful revegetation has been achieved. The inspection of weed control will follow the procedures and requirements of the Erosion and Sediment Control Manual (AT, 2011).	All project phases	AT
32	The proponent will conduct post-construction monitoring to ensure that all mitigation, weed control, and revegetation of disturbed areas have been implemented.	Operations	AT
33	Clearing and grubbing of wildlife habitat will be completed outside of the breeding season (April 15th to July 31st) for breeding birds protected under the *Migratory Bird Convention Act and the Alberta Wildlife Act.*	Construction	AT EC
34	If Sprague's Pipits are nesting in this area, restricted activity dates of May 1st to August 31st will be followed.	Construction	AT EC
35	If limited clearing must take place during the nesting season, it will be undertaken by qualified avian biologists or avian naturalists that have expertise in identifying indicated nests as well as in identifying behaviour indicative of nesting (i.e. aggressive or defensive behaviour, carrying of nesting material, food or faecal sacs). Surveys should be undertaken within seven days of clearing, with the results submitted to EC for review.	Construction	AT EC
36	Removal of structures such as the Little Bow Reservoir and Travers Reservoir outlet structures where birds may be nesting will be completed outside of the breeding season for those species.	Construction	AT EC
37	The initial filling of the reservoir will be delayed until July 15 to avoid inundation to avoid flooding of Sprague's pipit nests.	Construction	AT EC
38	The proponent will complete any grass mowing in the area to be inundated outside of both the Sprague's pipits nesting period of May 1st to August 31st as well as the breeding season for migratory birds of April 15th to July 31st. Therefore, the proponent needs to mow the area before April 15th.	Construction	AT EC

Appendix 5: Summary of Proposed Mitigation Measures (cont'd)

No.	Commitment	Project Phase | Timing	Party Responsible
39	The proponent's revegetation plan should include the replacement of trees where ferruginous hawk nests have been active within the last two years with nesting platforms.	Construction	AT EC
40	The proponent will set speed limits (less than 60 km/hour) within the active construction area and along new roads to reduce the likelihood of wildlife/vehicle collisions.	Construction	AT EC
41	The proponent should install metallic streamers to deter birds from nesting along the shoreline.	Construction	AT EC
42	Trees and shrubs will be replanted within the riparian area of the new PRA. The Proponent should discuss the planting of trees and shrubs with appropriate federal authorities.	Construction	AT EC
43	The proponent will monitor revegetation of disturbed grassland, shrubs and trees. A survey will be conducted in the second year following the commencement of operation to assess the presence and habitat use of wildlife. This will include conducting breeding bird surveys, observation of colonial nesting waterbird presence, and general observation of wildlife. The need for further monitoring or mitigation will be assessed following the second year. If deemed necessary, the survey will be repeated in the fifth year of operation.	Operations	AT EC
44	The proponent will employ water spraying to tamp down disturbed areas with high dust concentrations.	All project phases	AT
45	The proponent will erect silt fencing or other structures to block wind in areas of active excavation.	Construction	AT
46	Dust levels will be visually monitored on site during construction in order to assess the need for additional measures to prevent topsoil loss and protect workers.	Construction	AT
47	Signage will be posted at the public boat launch in the new PRA that identifies the location of potential hazards. The sign will be easy to interpret and clearly communicate that hazards may be present at various water levels, necessitating user caution at all times, similar to the existing navigational conditions. The sign should have a large air photo overlaid with markings to show the location of the hazards relative to the boat launch, with a legend explaining all markings. In addition, the UTM or lat/long coordinates for specific hazards can be provided below the map for recreational users that are interested in programming the information into their navigational equipment.	Operation	AT TC
48	Additional signage will be posted for construction activities and potential short-term impediments or hazards.	Operation	AT TC
49	The proponent will ensure all areas to be armoured with riprap such as the dam slope, cofferdams, and areas prone to erosion will be at a constant grade consistent with the specified design or natural shoreline contour. The armouring will not project into the reservoir and, therefore, will not represent a hazard to navigation.	All project phases	AT TC

Appendix 5: Summary of Proposed Mitigation Measures (cont'd)

No.	Commitment	Project Phase | Timing	Party Responsible
50	The proponent will ensure that buildings and other structures within the portion of the existing PRA to be flooded will be removed and all mature trees and shrubs in the same area will be cleared and the roots removed, prior to inundation.	Construction	AT TC
51	The proponent will construct the new Little Bow Reservoir PRA structure in the dry, prior to raising the reservoir level to the new FSL.	Construction	AT
52	Access to the entire TLBR Connecting Canal will be eliminated by installing safety booms across the inlet to Little Bow Reservoir and the outlet at Travers Reservoir.	Operation	AT TC
53	Should consumption advisories for some sport/subsistence fish species that are caught be required the Government of Alberta will modify the consumption limits for Little Bow Reservoir and surrounding water bodies and tributaries and inform anglers of these changes.	Operation	AT GOA
54	The proponent will report the discovery of any additional historical resources (archaeological, paleontological, or Aboriginal traditional use sites) that may be encountered during construction activities.	All project phases	AT GOA
55	The proponent will prepare and adhere to a Spill Prevention and Response Plan (including provision for refuelling and servicing of vehicles).	All project phases	AT
56	The proponent will prepare and adhere to an Emergency Measures Plan. The plan will include provisions to deal with any unexpected failure or malfunction of a temporary containment system and a procedure for manual activation of the auxiliary spillway to prevent overtopping of the Little Bow Reservoir dam during construction.	All project phases	AT
57	The follow-up program, which includes monitoring, will be carried out (see Appendix 7).	Operations	AT DFO TC EC NRCan

Appendix 6: Summary of Concerns Raised by Aboriginal Groups with Respect to the EA

Comment ID#	Group	Subject	Comment	
1	Piikani Nation	• Heritage and Archaeological Resources	• Concerned about a Tipi Ring that was previously moved on the Little Bow Basin.	
2	Piikani Nation	• Surface Water Quality • Current Use of Lands and Resources	• Concerned about loss of historically used Little Bow [River] water for ceremonies.	
3	Siksika Nation	• Surface Water Quality • Current Use of Lands and Resources	• Concerned they can longer use the water from the [Little Bow] river in their sweat lodges.	
4	Siksika Nation	• Surface Water Quality • Current Use of Lands and Resources	• Concerned that the children can no longer play in the [Little Bow] river water, some experience skin irritation and peeling after having been in the water. • Unknown cause, concerned it could be related to the Strathmore treatment plant and its effluent.	
5	Siksika Nation	• Surface Water Quality • Current Use of Lands and Resources	• Concerned traditional swimming holes [Little Bow River] no longer exist due to reduced water levels/water quality.	
6	Siksika Nation	• Surface Water Quality • Current Use of Lands and Resources	• Concerned with fish deaths in Little Bow River.	

	Summary of Proponent Response	Agency Response
	• The proponent confirmed that the Little Bow Basin was not synonymous to the Little Bow Reservoir.	• Agency confirmed that the 'Little Bow Project' (2004) created what is now known as the Twin Valley Dam and Reservoir, approximately 50 km upstream on the Little Bow River from the project currently under assessment. • A joint Natural Resources Conservation Board (NRCB) and CEAA Panel examined this as the 'Highwood Storage and Diversion Project' between 1998 and 2002.
	• The potential impacts to surface water quality within the Little Bow Reservoir were assessed in the EIS, Section 8.	• Upstream impacts to the Little Bow River are outside the scope of this environmental assessment; however this issue was forwarded to DFO. • Sections 7.4 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to surface water quality. • The Agency is satisfied that the proponent has considered this issue within the EIS and, taking into account the identified mitigation measures, concludes that there will be no significant adverse environmental effect associated with this activity.
	• The potential impacts to surface water quality within the Little Bow Reservoir were assessed in the EIS, Section 8.	• Upstream impacts to the Little Bow River are outside the scope of this environmental assessment. • Sections 7.4 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to surface water quality. • The Agency is satisfied that the proponent has considered this issue within the EIS and, taking into account the identified mitigation measures, concludes that there will be no significant adverse environmental effect associated with this activity.
	• The area of the Little Bow River near the Strathmore treatment plan is not within the scope of the environmental assessment and is in fact upstream of the proposed project. • The potential impacts to surface water quality within the Little Bow Reservoir were assessed in the EIS, Section 8. Impacts to the Little Bow Provincial Recreation Area were assessed in Section 17.	• Although this issue was not within the scope of the environmental assessment, the Agency notes that the proponent's assessment does include an analysis of the swimming area located at the Little Bow Reservoir Provincial Park however. • Sections 7.4 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to surface water quality. • Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to recreational use of lands.
	• The potential impacts to surface water quality within the Little Bow Reservoir were assessed in the EIS, Section 8. Impacts to the Little Bow Provincial Recreation Area were assessed in Section 17.	• Although this issue was not within the scope of the environmental assessment, the Agency notes that the proponent's assessment does include an analysis of the swimming area located at the Little Bow Reservoir Provincial Park however. • Sections 7.4 and Appendices 3, 4, 5, and 7 outlines the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to surface water quality. • Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to recreational use of lands.
	• The potential impacts to surface water quality within the Little Bow Reservoir were assessed in the EIS, Section 8.	• Upstream impacts to the Little Bow River are outside the scope of this environmental assessment; however DFO was notified of this issue. DFO provided Siksika First Nation with their spill response number should any additional dead fish in this or any other water body be observed.

Appendix 6: Summary of Concerns Raised by Aboriginal Groups with Respect to the EA (cont'd)

Comment ID#	Group	Subject	Comment	
7	Metis Nation of Alberta—Region 3	• Wildlife and Wildlife Habitat	• Concerned about the area of land that will be inundated and how this will affect species at risk (including burrowing owls and ferruginous hawks) and other wildlife species (including red tailed deer, beaver, coyotes, fox, rabbits, antelope and waterfowl.	
8	Blood Tribe	• Current Use of Lands and Resources	• Concerned about the relocation of traditional plants and indicated that it is the Blood First Nations people that should carry out that relocation as a form of mitigation.	
9	Siksika Nation	• Current Use of Lands and Resources	• Concerned that is has become very difficult to find their medicinal plants in the Little Bow Reservoir area.	
10	Siksika Nation	• Current Use of Lands and Resources	• Concerned that during periods of drought possibly exaggerated by the rehabilitation of the Little Bow Reservoir that they will lose their license for irrigation water under the “First in time, First in Right” Provincial policy.	
11	Piikani Nation	• Current Use of Lands for Traditional Purposes	• Concerned that Project is a surrender of the tribe's territory and that it is an erosion of land rights.	

	Summary of Proponent Response	Agency Response
	• The potential impacts to wildlife and wildlife habitat were assessed in Section 12 if the EIS and associated Supplemental Information Requests.	• Sections 7.8 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to wildlife and wildlife habitat.
	• The potential impacts to vegetation within the Little Bow Reservoir were assessed in the Section 11 of the EIS and associated Supplemental Information Requests. • Impacts to the current use of lands and resources were assessed in Section 17 of the EIS.	• Sections 7.7 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to vegetation. • Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to current use of lands and resources. • The Agency is satisfied that the proponent has considered this issue within the EIS and, taking into account the identified mitigation measures, concludes that there will be no significant adverse environmental effect associated with this activity.
	• The potential impacts to vegetation within the Little Bow Reservoir were assessed in the EIS, Section 11. Impacts to the current use of lands and resources were assessed in Section 17.	• Sections 7.7 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to vegetation. • Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to current use of lands and resources. • The Agency is satisfied that the proponent has considered this issue within the EIS and, taking into account the identified mitigation measures, concludes that there will be no significant adverse environmental effect associated with this activity.
	• The proponent has indicated that, based on the water licenses allocated for the CBRH system, no mitigation is required with respect to reduced Bow River discharge downstream of the CBRH system diversion. • The proponent also confirmed with the province that should the Siksika First Nation wish to use their existing water license, the water will be made available to them however, to date they have not exercised their right to this water.	• Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to current use of lands and resources for traditional purposes. • The Agency is satisfied that the proponent has considered this issue within the EIS and, taking into account the identified mitigation measures, concludes that there will be no significant adverse environmental effect associated with this activity.
	• The potential impacts to current and traditional land use were assessed in the EIS, Section 17.	• The environmental assessment process is not, in itself, a rights determination process. • However, with respect to current use and lands and resources Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to the current use of lands and resources for traditional purposes. • The Agency is satisfied that the proponent has considered this issue, to the extent possible based on information provided by the Aboriginal groups, within the EIS. Taking into account the identified mitigation measures, the Agency concludes that there will be no significant adverse environmental effect associated with this activity.

Appendix 6: Summary of Concerns Raised by Aboriginal Groups with Respect to the EA (cont'd)

Comment ID#	Group	Subject	Comment	
12	Siksika Nation	• Current Use of Lands and Resources for Traditional Purposes	• Concerned about the raising of water levels in the Little Bow Reservoir.	
13	• Piikani Nation • Siksika, Nation • Metis Nation—Region 3	• Current Use and Lands and Resources for Traditional Purposes	• Concerned that site visit were not conducted.	
14	Metis Nation—Region 3	• Current Use of Lands and Resources for traditional purposes	• Concerned with harvesting in the area of Little Bow Reservoir.	
15	Metis Nation—Region 3	• EA	• Concerned with lack of funding for EA review.	
16	• Piikani Nation • Siksika Nation • Blood Tribe	• EA	• Concerned with lack of funding for EA review, traditional use collection, and site visits.	
17	Siksika Nation	• EA	Concerned with lack of proper consultation.	

	Summary of Proponent Response	Agency Response
	• The details of increase in water levels are presented the Executive Summary of the EIS. The potential Impacts to current use of lands and resources were assessed in the EIS, Section 17.	• Sections 7.6 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to the aquatic environment and include details on the impacts to the inundation zone. • Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to the current use of lands and resources. • The Agency is satisfied that the proponent has considered this issue, to the extent possible based on information provided by the Aboriginal groups, within the EIS. Taking into account the identified mitigation measures, the Agency concludes that there will be no significant adverse environmental effect associated with this activity.
	• The proponent has indicated that a Historical Resources Impact Assessment (HRIA) was conducted for the project. • The proponent was not prepared to provide funding to Aboriginal groups for the Little Bow Reservoir Rehabilitation Project.	• Participant Funding was made available in 2010, but the only application received was from Metis Nation—Region 3 who received $4,000. No applications were received from these groups within the application period. • Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to the current use of lands and resources. • The Agency is satisfied that the proponent has considered this issue, to the extent possible based on information provided by the Aboriginal groups, within the EIS. Taking into account the identified mitigation measures, the Agency concludes that there will be no significant adverse environmental effect associated with this activity.
	• The potential impacts to current use of lands and resources within were assessed in the EIS, Section 17.	• Sections 7.12 and Appendices 3, 4, 5, and 7 outline the potential effects, mitigation measures, environmental effects analysis, commitments and follow-up measures related to the current use of lands and resources. • The Agency is satisfied that the proponent has considered this issue, to the extent possible based on information provided by the Aboriginal groups, within the EIS. Taking into account the identified mitigation measures, the Agency concludes that there will be no significant adverse environmental effect associated with this activity.
	• The proponent was not prepared to provide funding to Aboriginal groups for the Little Bow Reservoir Rehabilitation Project.	• Metis Nation—Region 3 received up to $4,000 in Participant Funding from the Agency in 2010.
	• The proponent was not prepared to provide funding to Aboriginal groups for the Little Bow Reservoir Rehabilitation Project, however was willing to conduct site visits if the groups were prepared to attend. • Metis First Nation—Region 3 attended such a site visit.	• Participant Funding was made available in 2010, but the only application received was from Metis Nation—Region 3 who received $4,000. Participant funding is available to be used by groups for such activities as site visits. • No applications were received from these groups within the application period.
	• The proponent indicated on numerous occasions that it was willing to consult and/or provide a site visit, however was not prepared to provide funding to Aboriginal groups for the Little Bow Reservoir Rehabilitation Project.	• The Agency met, in person, with Siksika Nation in February 2012 and attempted to arrange a site visit and/or meetings on numerous other occasions. Siksika Nation was provided with all relevant environmental assessment documentation and an opportunity to comment on this draft Comprehensive Study Report. • Participant Funding was made available in 2010. No application was received from Siksika Nation.

Appendix 7: Focus of the Follow-Up Program

Element	Objectives and Requirements	Frequency and Duration*	Responsible Department
Revegetation of disturbed areas	• Monitoring to ensure the revegetation of disturbed areas and survival of plantings	• Post-construction	DFO
	• Implement corrective measures depending on the results of the follow-up	• Based on 2nd year results, determination will be made for further mitigation and/or monitoring	DFO
Weed control and rare plant replacement	• Invasive plant control	• Applied until successful revegetation has been completed	EC
	• Monitoring of transplanted rare plants to determine success rate of mitigation	• Conducted in July for the first 2 years of operation to assess survival	EC
	• Implement corrective measures depending on the results of the follow-up • Thresholds at which corrective measures are required should be implemented should be established in conjunction with the relevant federal department(s)	• Based on 2nd year results, determination will be made for further mitigation and/or monitoring	EC
Terrestrial wildlife	• Survey to assess the presence and habitat use of wildlife, including breeding bird surveys, observation of colonial nesting waterbird presence	• To be conducted in the 2nd year following operation commencement.	EC
	• Implement corrective measures depending on the results of the follow-up	• Based on results, determination will be made for further mitigation and/or monitoring to be carried out in 5th year following construction	EC
	• Thresholds at which corrective measures are required should be implemented should be established in conjunction with the relevant federal department(s)		EC
Fish habitat (compensation works)	• Confirm the integrity and effectiveness of the compensation works outlined in the Fish Habitat Compensation Plan (FHCP)	• As specified in the Fish Habitat Compensation Plan	DFO
	• Implement corrective measures depending on the results of the follow-up		DFO
	• Thresholds at which corrective measures are required should be implemented should be established in conjunction with the relevant federal department(s)		DFO
Surface water quality	• Reservoir turbidity monitoring	• Daily to weekly during construction (depending on activities)	DFO
	• Monitor to determine the extent and severity of erosion along the new shoreline at FSL and within the reservoir drawdown zone	• During first 2 years of operation	DFO
	• Monitor dissolved oxygen concentrations in drawn down reservoir during winter construction & mitigate as necessary to ensure aquatic life survival	• During the 3 years when the Little Bow Reservoir is drawn down for construction during the winter	DFO

Appendix 7: Focus of the Follow-Up Program (cont'd)

Element	Objectives and Requirements	Frequency and Duration*	Responsible Department
Groundwater	• Monitor for changes in groundwater levels in response to Project to confirm conclusions on residual groundwater effects	• To be determined in discussion with proponent	NRCan
Aquatic life (including fish)	• Monitoring will be conducted to validate the implementation of mitigation measures to minimize impacts to aquatic habitat	• During construction phase	DFO
	• Monitoring to validate the assessment of residual impacts to aquatic habitat	• During 2nd year of operations. Based on results, determination will be made to repeat monitoring in 5th year following construction	DFO
	• Monitor draw down process to ensure avoidance of fish stranding	• During the 3 years construction drawdown occurs and during first year of operation when winter drawdown to 854.06m El. occurs	DFO
Mercury monitoring	• Monitoring of mercury concentrations in the water and in fish tissue	• Periodically during construction and annually during operation	EC
	• Implement corrective measures depending on the results of the follow-up		EC
	• Thresholds at which corrective measures are required should be implemented should be established in conjunction with the relevant federal department(s)		EC
Navigation Safety	• Provide bathymetric signage of the Little Bow Reservoir at launch facilities	• During construction and for the life of the project	TC
	• Indicate locations on map of potential submerged islands/hazards		TC
	• Indicate locations on map showing non-navigable areas (Travers Reservoir Dam-Little Bow Reservoir connecting Canal)		TC
	• A floating safety boom and signage shall be placed and maintained at the entrance to and outlet of the Travers Reservoir Dam-Little Bow Reservoir connecting canal during all open water periods as per specifications outlined in the Canadian Dam Association guidelines		TC

*Depending on the results, the proponent may extend the duration