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Abbreviations

2,4-D	2,4-dichlorophenoxyacetic acid
BRBC	Bow River Basin Council
EIA	environmental impact assessment
EIS	Environmental Impact Statement
ERWP	Elbow River Watershed Partnership
LAA	local assessment area
MCPP	2-methyl-4-chlorophenoxyacetic acid
PDA	project development area
RAA	regional assessment area
the Project	Springbank Off-stream Reservoir Project
ToR	Terms of Reference
TLRU	traditional land and resource use
TUS	traditional use study
VC	valued component

7.0 ASSESSMENT OF POTENTIAL EFFECTS ON SURFACE WATER QUALITY

Surface water quality refers to the chemistry of water in watercourses, which are defined as rivers, creeks and streams, and waterbodies, such as lakes and ponds. Springbank Off-stream Reservoir Project (the Project) construction and dry operations can affect surface water quality in watercourses through introduction of sediment and the use of herbicides to control weeds along the project infrastructure. Changes in water chemistry can affect aquatic life and other ecological and human receptors.

7.1 SCOPE OF THE ASSESSMENT

7.1.1 Regulatory and Policy Setting

The environmental effects assessment for surface water quality has been prepared in accordance with the requirements of the provincial Terms of Reference (TOR) and federal Environmental Impact Statement (EIS) Guidelines for the Project. Concordance tables, demonstrating where TOR requirements and EIS Guidelines have been addressed are provided in Volume 4, Appendix A.

Environmental Quality Guidelines: Environmental quality guidelines "*are science-based recommendations that protect water uses and form a cornerstone of aquatic ecosystem management and protection*" (ESRD 2014). Provincial water quality guidelines are not legally binding, unless they are used to develop "*legally binding effluent limits under the Environmental Protection and Enhancement Act*" (ESRD 2014). Water quality guidelines are developed to protect aquatic ecosystems in large geographic regions. Local lithology and other local conditions can cause exceedances in ambient water quality. In this assessment, water quality guideline exceedances are identified when an applicable and appropriate water quality guideline is available. Applicable general water quality guidelines for the protection of aquatic life are identified from:

- Environmental Quality Guidelines for Alberta Surface Waters (ESRD 2014)
- Canadian Environmental Quality Guidelines (CCME 2016)

In addition to generic water quality guidelines, watershed management water quality objectives developed by the Bow River Basin Council (BRBC) and the Elbow River Watershed Partnership (ERWP) for the upper and central reaches of the Elbow River (BRBC 2012, ERWP 2009) are considered in this assessment. These proposed water quality objectives are not included in the South Saskatchewan Region Surface Water Quality Management Framework (Government of Alberta 2014) and are, therefore, not implemented. However, they are considered relevant for this assessment.

For a discussion on Health Canada drinking water guidelines, see Section 12 Public Health.

7.1.2 Engagement and Key Concerns

Alberta Transportation is committed to building ongoing relationships through effective consultation by addressing the interests, priorities and concerns of those potentially affected by the Project in a timely manner. Engagement was ongoing prior to and throughout the Project planning process. It will continue through permitting and throughout the life of the Project. Stakeholder feedback will be considered when making Project decisions, where possible and appropriate. See Volume 1, Section 6 for more details on the consultation process, including comments received during the development of the EIA. A summary of the key questions/comments received during public engagement to date and directly related to surface water quality are as follows:

- How will reservoir water quality be managed when draining back into the Elbow River?
- How will water quality be affected by water stagnation and sedimentation in the dry reservoir?
- Will water quality downstream in the Elbow River and in the Glenmore Reservoir be affected by the Project operation during and after a flood?

Alberta Transportation's engagement with Indigenous groups began in 2014 with five Indigenous communities. In June 2016, an additional eight Indigenous communities were engaged as outlined in the CEA Agency guidelines. Indigenous engagement has been ongoing prior to and through the Environmental Impact Assessment (EIA) process and will continue until a decision is made by Natural Resources Conservation Board (NRCB). Detailed information regarding the Indigenous Engagement program is presented in Volume 1 Section 7 and Volume 4, Appendix B.

Traditional Land and Resource Use (TLRU) information was gathered through Project-specific traditional use studies (TUS) conducted by potentially affected Indigenous groups and through the results of Alberta Transportation's Indigenous Engagement program. Alberta Transportation had received a Project-specific TUS report from Piikani Nation, as well as a joint interim TUS report from Kainai First Nation and Siksika Nation. In addition to Project-specific sources, publicly-available literature was reviewed for TLRU information relevant to the Project. Secondary source materials reviewed include:

- regulatory TUS conducted by Indigenous groups
- TLRU assessments, supplemental filings, and hearing evidence for other developments
- government reports and databases
- legal proceedings

- historical and ethnographic literature
- relevant internet sources (such as Indigenous community websites and the Indigenous and Northern Affairs Canada website)

TLRU information was considered during the preparation of all aspects of the EIA, including both methodology and analysis, as stipulated by the CEA Agency project guidelines. TLRU information contributed to the understanding of the existing ecological conditions and informed the assessment of potential Project effects. While this information did not directly affect the significance definition it has been incorporated into the analysis of effects on which the significance determination was based. Generally, issues and concerns related to effects of industrial development on water quality, as reported by Indigenous groups through the review of Project-specific and publicly-available TLRU information, include:

- increased sedimentation
- methylmercury
- groundwater-surface water interactions

These issues and concerns, which are summarized below, have been considered in the assessment of potential project effects. More detailed information regarding TLRU in relation to water quality is discussed in the TLRU assessment (see Section 14).

Water is important to Samson Cree Nation and waterbodies have been affected by industrial development. Samson Cree Nation members used to melt snow, collect rain water and drink water from rivers, but no longer do so (EEP 2016).

Samson Cree Nation stated that the quality of water has decreased since the establishment of industrial development and agricultural leases (grazing leases, linear access limitation etc.) (SCN 2015).

The water quality within Samson Cree Nation traditional territory has been adversely affected by pollution and contamination, which has in turn affected Samson Cree Nation's ability to undertake traditional practices. Samson Cree Nation wants all water sources protected (Enbridge 2012).

Samson Cree Nation has witnessed water sources and water ways where there are no wild game tracks because of polluted waters. Samson Cree Nation explained that these animals now have to travel greater distances to get good water (TMP 2014).

Through the Project-specific Indigenous Engagement program, Tsuut'ina Nation expressed concerns that the Project would permanently alter the flow of the Elbow River and result in flooding of portions of Tsuut'ina Nation traditional territory. Tsuut'ina Nation noted the potential for flood water, including any debris or contamination it contains, to spill over the floodplain

berm and on to the Tsuut'ina Nation 145 Reserve. Potential for methylmercury contamination both upstream and downstream. More frequent floods and higher flood volumes than those predicted in the project description may occur as a result of global warming.

Through the Project-specific Indigenous Engagement program, Tsuut'ina Nation noted that the Project will result in increased sedimentation in the Elbow River, especially during construction, but also during operation.

Through the Project-specific Indigenous Engagement program, Tsuut'ina Nation stated that community members rely on the Elbow River for drinking water and noted concern regarding effects of the Project on Tsuut'ina Nation's ability to use the river as a water source. Tsuut'ina Nation depends on the groundwater in the Elbow River Alluvial Aquifer for the reserves' drinking water. Tsuut'ina Nation explained that the project doesn't plan to line the reservoir, so any contaminants would likely seep into the ground water system. "Any potential contamination or change to the flow of the Elbow River is therefore likely to contaminate our aquifer."

In a letter submitted to the Canadian Environmental Assessment Agency regarding the Springbank Off-Stream Reservoir Project, Louis Bull Tribe noted potential for the Project to affect water quality.

Through the Project-specific engagement program, Piikani Nation voiced concern regarding silt build up in the Elbow River as well as the in the off-stream reservoir due to flood cessation. Piikani Nation used the example of the Oldman Dam and the silt shadow that has developed. The Piikani also expressed concern about the impacts to wetlands and upstream and downstream effects on Elbow River.

Through the Project-specific engagement program, Stoney Nakoda Nations voiced concern regarding underground streams that may be impacted by the Project. Stoney Nakoda Nations elaborated, "they used to listen to the bison moving. There are pockets of underground streams, and they listened to the vibrations. The oral history told us about the water table and the flood plain."

Through the Project-specific engagement program, Stoney Nakoda Nations stated that the Project poses many environmental effects including the areas of health of the Stoney Nakoda Nations and the current use of the lands and resources that will impacted by the Project. Stoney Nakoda Nations noted that the waters that flow through the traditional lands have sustained the Stoney Nakoda Nations since time immemorial. Furthermore, "When Treaty 7 was signed, the Stoney Nakoda Nations neither surrendered their Aboriginal title to water within their traditional territory nor surrendered any other interests pursuant to an associated Aboriginal right. The Stoney Nakoda Nations continue to hold these rights. Therefore, the Stoney Nakoda Nations are concerned that the project will impact these rights and traditional use of lands in the Project

area." The Stoney Nakoda Nations expressed concerns about the hydrology of the Project area, particularly relating to Elbow River and groundwater impacts.

The Kainai First Nation expressed concern about impact on wetlands and upstream and downstream effects. The Kainai First Nation also expressed concern about debris and sediment that may be left in the reservoir as a result of a flood. Kainai First Nation expressed concerns that instream work within Elbow River will impact fish and there could be temporary downstream impacts from project construction.

In an email to the Canadian Environmental Assessment Agency, Métis Nation British Columbia noted the potential for the Project to affect Métis land use, and effects on water due to the proximity of the Project to the Alberta and British Columbia border; where a long history of Métis land use is documented in the Kootenay region.

The Siksika Nation expressed concern about impact on wetlands and upstream and downstream effects. The Siksika Nation stated "They [impacts to TLRU] can be expected to include both upstream and downstream impacts during the construction and operation of the control structure. Given that the Elbow River is a major transport corridor for Siksika members and has been for millennia, is expected that the impacts on Siksika traditional use and sites will be substantial."

The Siksika also stated "the seepage area between the reservoir and the Elbow River situated between the intake and discharge channels, that will likely become impacted by water seeping from the reservoir, access channel or discharge channel and by project construction activities, the downstream waters and riparian areas that will be impacted by instream project construction activity ... and, upstream high bank riparian impacts resulting from the rapid rise in upstream flood waters above levels that would otherwise occur when the flood control structure is raised during a floor to divert waters to the reservoir."

The Siksika Nation noted that "During the construction period, there will be substantial instream project work as the control structure and access channels are built. This ...will have obvious instream and riparian impacts on Siksika Traditional Use in areas A [off-stream storage dam], C [downstream Elbow River]and D [upstream high bank riparian impacts] ...."

The Siksika Nation noted that "During a major flood there may be an initial upstream surge of water as the gates are raised on the control structure to divert water to the reservoir. This upstream surge may flood high bank riparian areas that would not otherwise be impacted if the flood were permitted to proceed naturally."

As of January 1, 2018, no project-specific intangible concerns were identified with respect to surface water quality.

7.1.3 Potential Effects, Pathways and Measurable Parameters

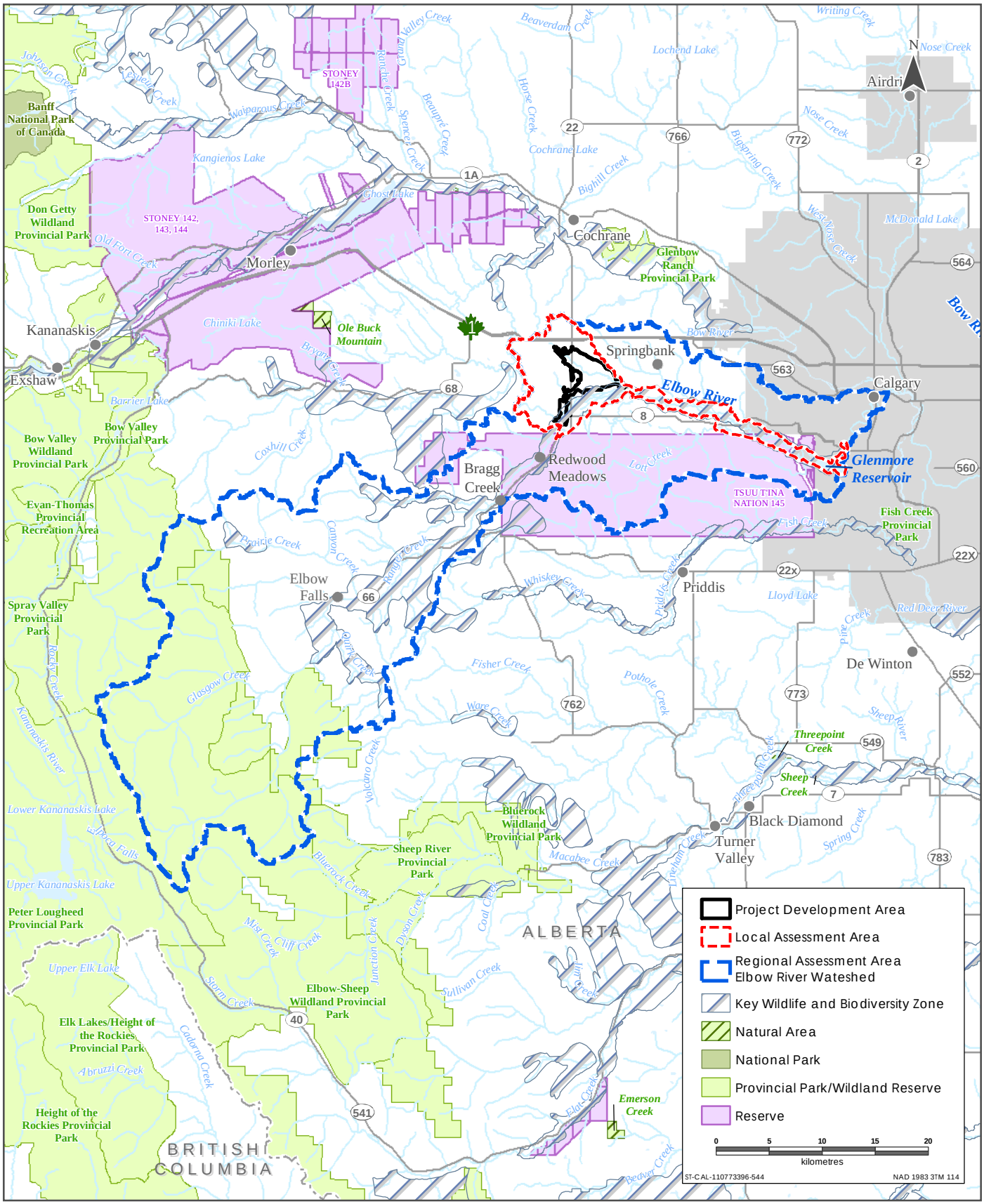
For a summary of potential effects of the Project on surface water quality, see Table 7-1.

Table 7-1 Potential Effects, Pathways and Measurable Parameters for Surface Water Quality

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in surface water quality	• Change in suspended sediment concentrations • Change in substance inputs	• Relevant water quality parameters, such as turbidity, suspended sediment and herbicides in appropriate units, such as mg/L

7.1.4 Spatial Boundaries

Study areas for water quality are the same as for hydrology. The project development area (PDA) is the immediate area of Project activities. The local assessment area (LAA) is the Elbow River from Redwood Meadows to the inlet of Glenmore Reservoir, including the outlet channel (i.e., the unnamed creek that runs through the proposed reservoir), see Figure 7-1. The regional assessment area (RAA) is used to evaluate potential cumulative changes to watercourses resulting from the Project and other development in the watershed; it encompasses the Elbow River watershed from its headwaters to Glenmore Dam.



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - ERBC, Government of Alberta, Stantec Ltd

Surface Water Quality Spatial Boundaries

Stantec

7.1.5 Temporal Boundaries

Project construction would take place over a 36-month period. Assuming regulatory approval by Q4 2018, construction would commence in Q1 2019. By Q4 2020, the Project would be able to accommodate a 1:100 year flood. Construction would be complete by Q1 2022 at which time the Project would be able to accommodate water volumes equal to the 2013 flood. Dry operations of the Project will occur indefinitely (i.e., permanent installation) after construction, with periods of dry operations alternating with flood and post-flood phases.

7.1.6 Residual Effects Characterization

For effects characterization, see Table 7-2.

Table 7-2 Characterization of Residual Effects on Surface Water Quality

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	Positive – a residual effect that changes a measurable parameters in a direction beneficial to surface water quality relative to existing conditions. Adverse – a residual effect that moves measurable parameters in a direction detrimental to surface water quality relative to existing conditions. Neutral – no net change in measurable parameters for surface water quality relative to existing conditions.
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible – no measurable change compared to existing conditions Low – a measurable change but within 10-20% of existing conditions and not causing water quality guideline exceedances Moderate – measurable change but within 20 to 50% of existing conditions and not causing water quality guideline exceedances High – measurable change of higher than 50% change compared to existing conditions and/or causing water quality guideline exceedances
Geographic Extent	The geographic area in which a residual effect occurs	PDA – residual effects are restricted to the PDA LAA – residual effects extend into the LAA RAA – residual effects interact with those of other projects or development in the RAA
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	Single event Multiple irregular event – occurs at no set schedule Multiple regular event – occurs at regular intervals Continuous – occurs continuously

Table 7-2 Characterization of Residual Effects on Surface Water Quality

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	Short-term – residual effect lasts for several days Medium-term – residual effect extends through several months Long-term – residual effect extends through more than one year
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	Reversible – the residual effect is likely to be reversed after activity completion and reclamation Irreversible – the residual effect is unlikely to be reversed
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	Undisturbed – area is relatively undisturbed or not adversely affected by human activity Disturbed – area has been substantially previously disturbed by human development or human development is still present
Timing	Periods of time where residual effects from Project activities could affect the VC	Seasonality – residual effect is greater in one season than another (e.g., spring/summer vs. fall/winter) Time of day – residual effect is greater during daytime or nighttime Regulatory – provincial or federal restricted activity periods or timing windows (e.g., migration, breeding, spawning) related to the VC Not applicable - the residual effect of Project activities will have the same effect on the VC, regardless of timing

7.1.7 Significance Definition

A significant adverse residual effect on water quality is defined as a measurable change in water quality that:

- exceeds an implemented water quality objective or site-specific water quality guideline for the protection of aquatic life or
- contravenes a watershed management target or
- causes acute or chronic toxicity to aquatic life or
- changes the trophic status of a lake or stream

7.2 EXISTING CONDITIONS FOR SURFACE WATER QUALITY

See Volume 4, Appendix K, Surface Water Technical Data Report for a description of spatial and temporal variation in water quality existing conditions as they relate to other parameters, including metals, nutrients, and physical parameters.

7.2.1 Methods

For water quality data sources and data processing methods, see Volume 4, Appendix K, Surface Water Technical Data Report.

7.2.2 Overview

Water quality in the Elbow River upstream of Glenmore Reservoir (referred to as upper Elbow River) is good in relation to aquatic ecosystem and human uses of water from the river (Sosiak and Dixon 2004). However, concentrations of some parameters increased between 1979 and 1997 in the Elbow River upstream of Glenmore Reservoir within the City limits at Highway 8, including dissolved phosphorus, turbidity, and bacteria (Sosiak 1999). These changes were potentially related to runoff from livestock wintering areas and seepage from septic fields (Sosiak 1999). In general, two major sources affecting water quality in the watershed are (Sosiak and Dixon 2004):

- non-point source runoff from agriculture, recreation, and residential development upstream of the City of Calgary. There are no approved wastewater discharges to the Elbow River upstream of Glenmore Reservoir.
- urban runoff from Calgary that is conveyed to the Elbow River and Glenmore Reservoir

Water quality of the river reflects lithology and geochemistry in the watershed, with major sources of nutrients and suspended sediment located within the City of Calgary limits (see Volume 3A, Section 6, Volume 4, Appendix K; Sosiak and Dixon 2004)

For a description of turbidity conditions in the Elbow River and the outlet channel based on continuously collected data since 2015, see Volume 3A, Section 6 (Hydrology).

Pesticide is a general term used for chemical compounds that are used to kill weeds (herbicides), fungi (fungicides), insects (insecticides), and other pests. Excess pesticides and their metabolites and degradation products can wind up in watercourses and waterbodies. In the Elbow River watershed within the RAA, a total of 63 pesticides have been measured at the mainstem sites (Bragg Creek, Highway 22, Twin Bridges and Weaselhead Bridge) during 18 discrete sampling events between 2005 and 2010. All analytical results were below the laboratory detection limit, with the exception of two pesticides: 2,4-D and MCPP (see Volume 4,

Appendix K). No pesticide data were available for Elbow River tributaries or the Glenmore Reservoir.

2,4-D (chemical formula 2,4-dichlorophenoxyacetic acid) is a herbicide used for the control of broadleaf weeds, weedy trees and brush in Canada (Health Canada 2008). According to Health Canada, 2,4-D "*use is permitted on fine turf, forests and woodlots (conifer release and forest site preparation), terrestrial feed and feed crops, and industrial non-food sites (non-cropland)"* (Health Canada 2008). This herbicide has been detected four times in the Elbow River between 2005 and 2010 (see Figure 7-2).

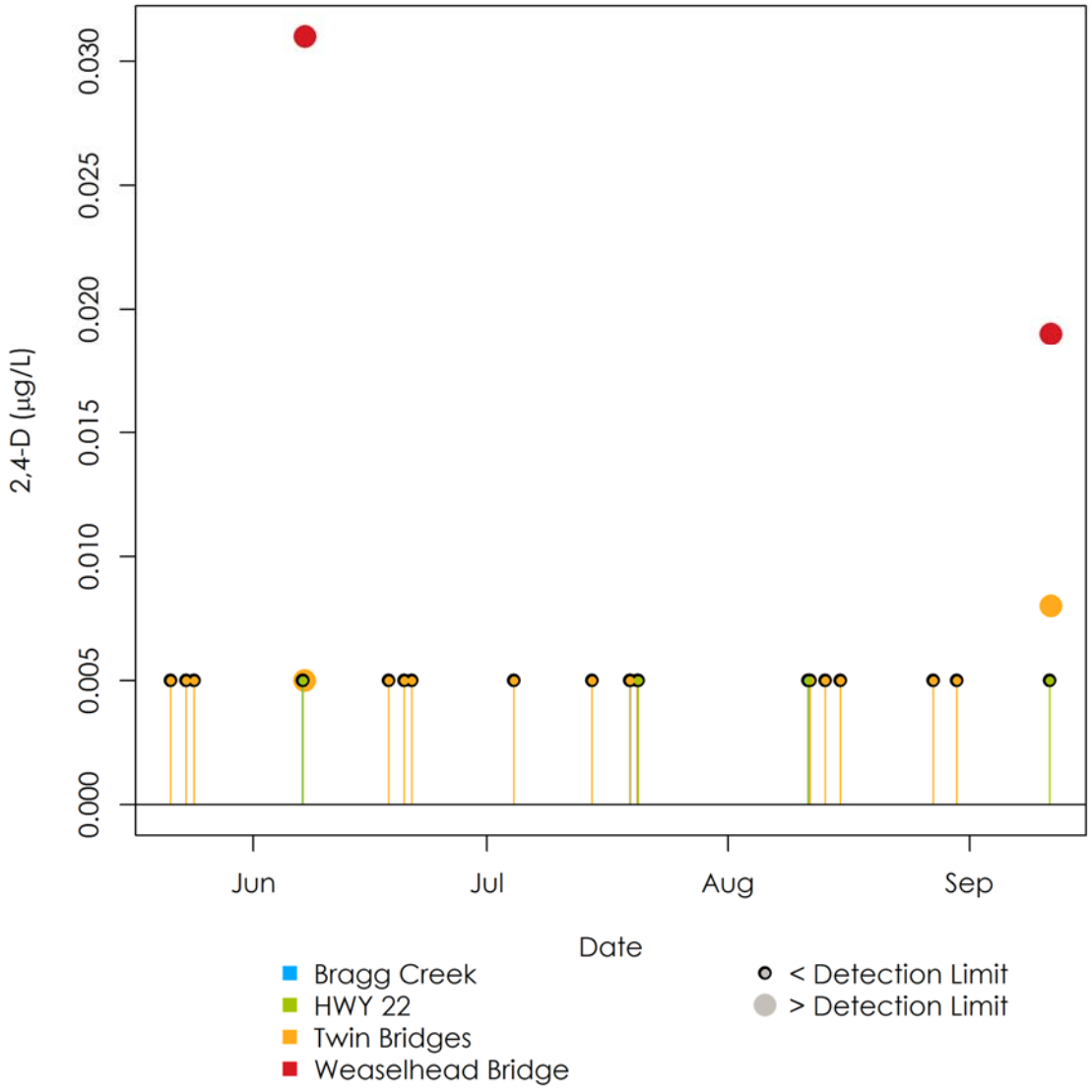


Figure 7-2 2,4-D Concentrations in the Elbow River

MCPP (chemical formula 2-methyl-4-chlorophenoxyacetic acid) is a herbicide is used to control a suite of broadleaf weeds in agricultural and non-cropland applications (CCME 1999). This herbicide has been detected twice in the Elbow River between 2005 and 2010 (see Figure 7-3).

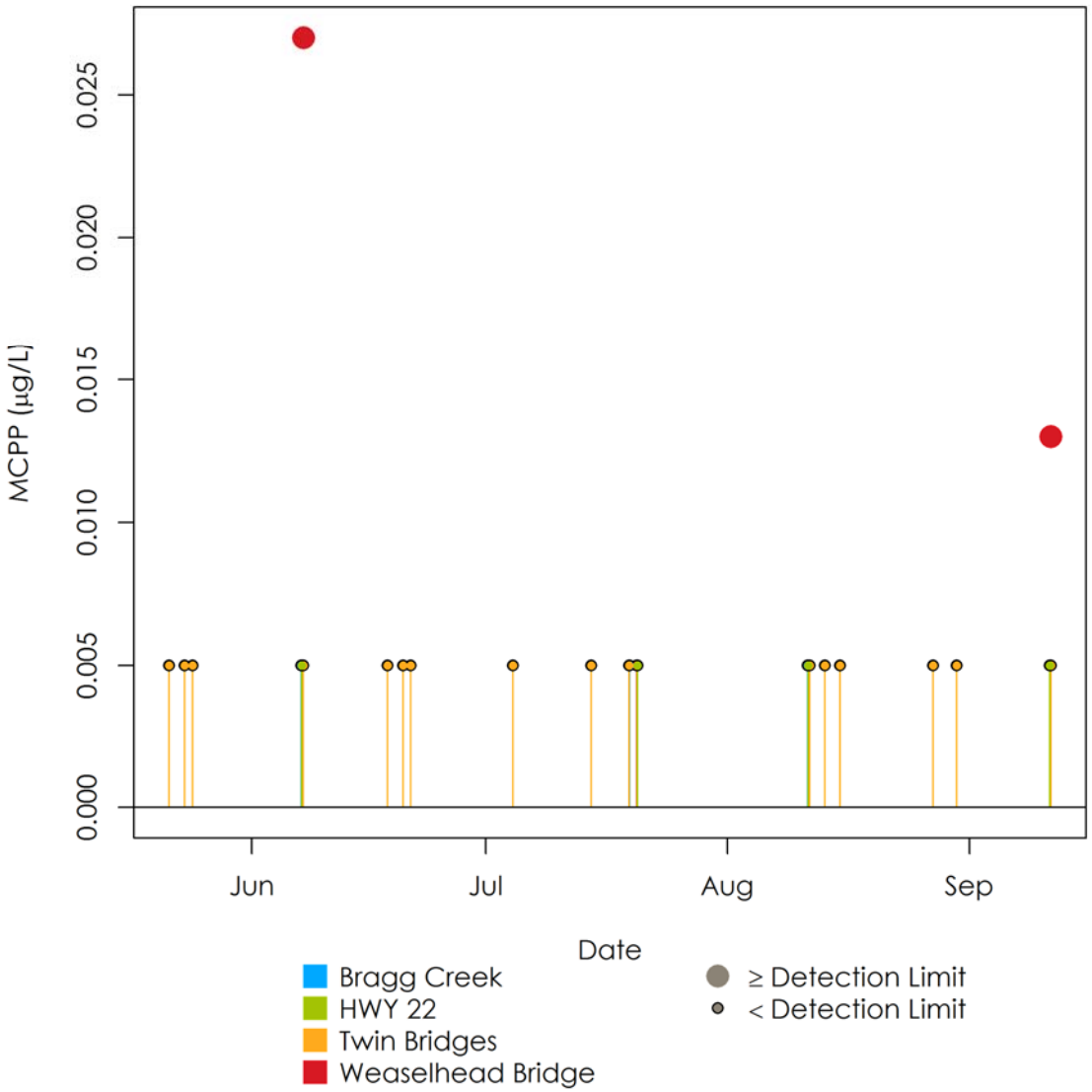


Figure 7-3 MCPP Concentrations in the Elbow River

7.3 PROJECT INTERACTIONS WITH SURFACE WATER QUALITY

Error! Reference source not found. identifies the interactions between the Project and surface water quality during the construction and dry operations phases of the Project. All activities listed in the table have an interaction with surface water quality.

Table 7-3 Project-Environmental Interactions with Surface Water Quality

Project Components and Physical Activities	Environmental Effect Change in Water Quality
Construction	
Clearing	✓
Channel excavation	✓
Water diversion construction	✓
Dam and berm construction	✓
Outlet works construction	✓
Road construction	✓
Bridge construction	✓
Lay down areas	✓
Borrow extraction	✓
Reclamation	✓
Dry Operations	
Maintenance	✓
NOTES: ✓ = Potential interaction – = No interaction	

7.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON SURFACE WATER QUALITY

7.4.1 Analytical Assessment Techniques

Changes in water quality during construction and dry operations are assessed qualitatively. Because fish and fish habitat are the end receptor of project construction and dry operations effects, the qualitative effect assessment relies on the *Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff* (DFO 2010). The potential for the Project construction and dry operations to affect the Glenmore Reservoir as a drinking water supply was also qualitatively assessed.

Characterization of residual effects follows Table 7-2. The effects characterization for water quality and aquatic ecology are the same for construction and dry operations effects.

7.4.2 Change in Water Quality

7.4.2.1 Project Pathways

Change in Water Quality through Water Withdrawals

Water withdrawals for dust suppression and other construction needs can be required and can affect downstream water quality by decreasing assimilative capacity. Volumes for these water withdrawals are not known yet. Given that any water withdrawals during construction will be short term and of relatively small quantity, no effects to downstream assimilative capacity are anticipated, and therefore, this effect pathway is not discussed further.

Change in Suspended Sediment Concentration

For a description of changes in turbidity conditions in the Elbow River and the outlet channel based on continuously collected data since 2015, see Volume 3A, Section 6 (Hydrology).

Land-based construction activities such as riparian vegetation removal or grading may increase erosion potential, resulting in mobilization of sediments to a water body. In addition, instream construction activities and agitation or excavation of the stream bed or banks may cause the release of sediment into a watercourse.

Change in Herbicide Concentration

Vegetation along the Project infrastructure will be maintained and weed growth managed, including the application of herbicides to control weeds. Operational plans for weed management have not been developed yet for the Project. It is possible that herbicides applied on land to control weeds could enter local watercourses.

7.4.2.2 Mitigation

Potential effects of erosion and sedimentation during construction can be avoided or mitigated for the Project through:

- Instream work areas will be isolated from the main river flow by using cofferdams, silt fences and turbidity barriers. TSS will be monitored and measured for conformance with Alberta Transportation's Turbidity and Monitoring specifications.
- Clean granular fill with less than 5% fines passing the 80um sieve size will be used for instream work such as cofferdams, causeways, access ramps, Bailey bridges, river channel diversions. Fine grained soils may be used, provided only clean granular fill is exposed to the river at any time during construction and restoration operations.
- Bank and riparian areas disturbed during construction will be rehabilitated and re-vegetated. Silt fences, turbidity barriers and riprap materials will be used to prevent future bank erosion.

For more information on construction mitigation measures, see Volume 3A, Section 8.4.7 (Aquatic Ecology). Suspended sediment concentrations will be monitored upstream and downstream of instream construction activities. Should an unacceptable increase in suspended sediment concentrations occur, it would be mitigated immediately, or the work halted until mitigation is in place. Additionally, the following Alberta Transportation specifications will be used:

- *Turbidity Barriers and Monitoring Section 02242 of the Civil Works Master Specifications for Construction of Provincial Water Management Projects* (Volume 4, Supporting Documentation, Document 9)
- *Care of Water Section 02240 of the Civil Works Master Specifications for Construction of Provincial Water Management Projects* (Volume 4, Supporting Documentation, Document 12)
- *Soil Erosion Protection Section 02930 of the Civil Works Master Specifications for Construction of Provincial Water Management Projects* (Volume 4, Supporting Documentation, Document 14)

Herbicides would be applied according to Environmental Code of Practice for Pesticides:

- restrict herbicide mixing and loading within 30 m of an open body of water
- identify open bodies of water within the application sites
- mark or flag of open bodies of water that will not be clearly visible to the applicator

The Code of Practice specifies minimum distances that need to be maintained from open bodies of water, depending on the type of herbicide used.

Other substances will be controlled on the construction site through:

- transport of hazardous materials to and from the Project site, storage, use and disposal will be in accordance with regulatory requirements.
- use construction equipment that is mechanically sound with no oil leaks, fuel or fluid leaks. Inspect equipment daily and immediately repair any leaks.
- employ persons qualified to handle construction equipment fuels and lubricants to perform repairs.
- service vehicles to carry fuel spill clean-up materials.
- use of containment berms and impermeable liners around fuel and lubricant storage tanks.
- maintain a minimum 100 m setback between stored fuels and lubricants and rivers, streams and surface water bodies.

7.4.2.3 Project Residual Effects

The effect of construction on water quality through change in suspended sediment concentration, considering construction mitigation measures and construction monitoring, is adverse in direction, low in magnitude, restricted to the PDA, short-term in duration and a single event in frequency. Time of day and seasonal variations were identified and considered for the assessment of suspended sediment concentration during construction. Due to the transient nature of the effect on water quality, the effect is reversible. The effect of the Project construction on downstream water quality in the Elbow River and the Glenmore Reservoir is negligible, given that sediment concentrations will be monitored during construction and the mitigation measures.

The effect of dry operation on water quality through herbicide application, considering the use of the Code of Practice, is adverse in direction, low in magnitude, restricted to the LAA, short-term in duration and a regular event in frequency. Seasonality is considered because of the timing of activities in relation to vegetation growth cycles. Given the very low frequency of herbicide detection in the watershed, the effect is reversible through dilution.

7.4.3 Summary of Project Residual Effects

For a summary of the residual environmental effects on surface water quality during construction and dry operations, see Table 7-4.

Table 7-4 Project Residual Effects on Surface Water Quality during Construction and Dry Operations

Residual Effect	Residual Effects Characterization								
	Project Phase	Timing	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in water quality	C/DO	T/S (for C)/S (for DO)	A	L	PDA/ LAA	ST	S/R	R	U

KEY

See Table 7-2 for detailed definitions

Project Phase
C: Construction
DO: Dry Operation

Timing Consideration
S: Seasonality
T: Time of dayR: Regulatory

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

7.5 DETERMINATION OF SIGNIFICANCE

The effects of the Project on water quality during construction and dry operations, given mitigation measures and monitoring during construction in the PDA, are not significant. Should an increase in suspended sediment concentrations occur, it will be mitigated immediately, or the work halted until mitigation is in place. Herbicide application during dry operations will follow the Code of Practice and the effect on water quality in the LAA is not significant.

7.6 PREDICTION CONFIDENCE

Prediction confidence of construction effects on water quality is high because the effects on water quality from construction involving earthworks and instream work are generally known and the mitigation measures are well established.

Prediction confidence in the effect of herbicide application during dry operations on water quality is moderate. Confidence is moderate because while the application of herbicides to control weeds is a common and required practice in Alberta, the operational quantities for herbicide application for the Project are not available.

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