

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE  
ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table of Contents**

**3.0 EIA SUMMARY .....3.1**

**LIST OF TABLES**

Table 3-1 Summary of Environmental Effects Assessment.....3.3

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE  
ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

## **3.0 EIA SUMMARY**

Volumes 3A and 3B provide a detailed evaluation of the VCs selected for the Project, including the potential environmental effects, mitigation measures, and the potential for residual effects on each of the VCs. The purpose of this summary table is to provide a summary of the information presented in Volumes 3A and 3B.

With the implementation of the proposed commitments and mitigation measures (summarized in Volume 4, Appendix C), adverse residual environmental effects of Project-related construction and operation are predicted to be not significant for all VCs.

Information regarding definitions and terminology shown in Table 3-1 is available in Volumes 3A and 3B.

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
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VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE  
ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

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Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Air Quality and Climate	-	✓	✓	<p>The following potential project effects are assessed for Air Quality and Climate:</p> <ul style="list-style-type: none"> <li>change in ambient air quality</li> <li>change in ambient light</li> <li>changes in greenhouse gases</li> <li>change in carbon sequestration capacity</li> </ul>	<ul style="list-style-type: none"> <li>One-way traffic flows on Highway 22 and Springbank Road that would result in line-ups and extended idling periods would be limited.</li> <li>Project construction vehicles would meet current emission control standards.</li> <li>Engines and exhaust systems would be properly maintained.</li> <li>Construction vehicle idling times would be reduced in order to reduce fuel costs.</li> <li>Cold starts would be limited to reduce emissions.</li> <li>Chemical dust suppressants would be applied to haul roads as an alternative option to watering, on an as-needed basis.</li> <li>In the event trackout and carryout occurs, road cleaning would be conducted.</li> <li>Loading bucket distances would be kept close to the empty truck to reduce drop height and dust emissions.</li> <li>Exposed surfaces would be revegetated promptly following construction to prevent wind erosion.</li> <li>Surfaces of temporary soil and overburden stockpiles would be stabilized during extended periods between usage.</li> </ul>	<p>The direction for change in air quality, ambient light and greenhouse gases during construction is rated adverse (A) because the Project results in a predicted increase of ambient concentrations and dustfall, light trespass and glare, and greenhouse gas emissions compared to the Base Case.</p> <p>The magnitude for change in air quality during construction is rated moderate to high (M/H) because the Project results in predicted ambient concentrations that are greater than 50% of the ambient criteria (M) or greater than the ambient criteria (H) for different substances of interest. The magnitude for change in ambient light during construction is rated low (L) because the Project results in predicted light trespass and glare that is detectable but is limited through design mitigation. The magnitude for change in greenhouse gases during construction is rated low (L) because the Project results in a relatively small change of GHG emissions compared to provincial and national totals.</p> <p>The geographic extent for change in air quality, ambient light and greenhouse gases during construction is limited to the LAA because the areas where the Project results in predicted ambient concentrations and dustfall, light trespass and glare, and estimated greenhouse gas emissions greater than the Base Case is limited to the extent of the LAA.</p>	AN/	N/L/ M/H	LAA/ PDA	ST	IR/R/ C	R	D	<p>The overall residual effect for air quality is not significant.</p> <p>With the proposed mitigation, an increase in Project-related light emissions (light trespass and glare) such that the guidelines for a rural environment are exceeded is not likely. Based on this light assessment, Base Case sky glow levels in and surrounding the Project site are currently typical of an urban environment, being close to metropolitan areas, and they are not anticipated to increase due to the Project. Therefore, residual effects would be not significant.</p> <p>The Project releases represent a small contribution to Alberta and national GHG emissions (0.03% and 0.01%, respectively). The residual environmental effects of the Project, in relation with CEA Agency guidance on GHG emissions would be not significant.</p>

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

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		Construction and Dry Operation	Flood and Post-Flood Operations											
Air Quality and Climate (cont'd)					<ul style="list-style-type: none"> <li>Lights would be positioned so that the luminaires can be pointed downward with no more than a 10° tilt from the horizontal, so that only the working area is illuminated.</li> <li>As much as is possible, lighting would be located such that unavoidable light spill off the working area is not directed toward receptors outside the PDA.</li> <li>Lighting would be located so that the lights are not directed toward oncoming traffic on nearby roads on or off site because of the objectionable nuisance and safety hazard this may present.</li> <li>Lights would be designed to avoid excessive use of the mobile flood lighting units and reduce potential effects by turning off lighting when they are not required; this would also conserve fuel.</li> <li>A primary mitigation for wind erosion in the reservoir would be the re-establishment of vegetation cover (e.g., native grasses) after reservoir draining. Should wind erosion occur and natural revegetation prove to be ineffective, a tackifier would be applied where required.</li> </ul>	<p>The duration for change in air quality, ambient light and greenhouse gases during construction is short-term (ST) because the predicted increase in ambient concentrations and dustfall, light trespass and glare, and greenhouse gas emissions due to the Project is restricted to the duration of the construction phase (36 months).</p> <p>The frequency for change in air quality during construction is rated irregular event (IR) because the predicted ambient concentrations at a given location are variable in time depending on the current meteorological conditions, although emissions could be continuous. The frequency for change in ambient light during construction is rated regular event (R) because the predicted increase in light trespass and glare occurs regularly at nighttime. The frequency for change in greenhouse gases during construction is rated continuous (C) because GHG emissions occur continuously during the construction phase.</p> <p>The reversibility for change in air quality, ambient light and greenhouse gases during construction is rated reversible (R) because the predicted increase in ambient concentrations and dustfall, light trespass and glare, and greenhouse gas emissions due to the Project would return to Base Case conditions after the end of the construction phase.</p>								<p>A change in fugitive dust (i.e., PM<sub>2.5</sub>) near the PDA boundary is rated as not significant since fugitive dust emissions are only expected to occur within the reservoir if the prescribed mitigations (e.g. re-vegetation and possible application of a tackifier) are not effective.</p> <p>A change in odour occurrences following flood events is rated as not significant since the duration of the submerged vegetation is not considered sufficient to generate unpleasant odours. Because no sewage would be washed into the reservoir, there is negligible potential for sewage type odours to occur.</p> <p>A change in carbon sequestration capacity is rated as not significant since there would be ample time between floods for revegetation to occur in the reservoir.</p>

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

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		Construction and Dry Operation	Flood and Post-Flood Operations												
Air Quality and Climate (cont'd)						<p>The LAA where the changes in air quality, ambient light and greenhouse gases are assessed, is rated as disturbed (D) because there are existing emission and light sources within the LAA prior to the project construction.</p> <p>The direction and magnitude for change in air quality, ambient light and greenhouse gases during dry operation are rated neutral (N) and negligible (N), respectively. During the dry operations phase, associated activities will be limited to periodic inspections and routine maintenance and there are no interactions of the Project with air quality, light, or GHG emissions.</p> <p>The direction with respect to odour occurrences is expected to be neutral (N) because odours are not expected from the reservoir during the flood and post-flood operations. The reservoir basin is rated as disturbed (D) with respect to odours because there are existing sources of odours not associated with flood and post-flood operations.</p> <p>The direction with respect to carbon sequestration capacity is expected to be neutral (N) because of minimal disruption of the reservoir surface due to flood and post-flood operations. The reservoir basin is rated as disturbed (D) because agricultural activities (e.g., tillage and grazing) in the LAA can cause changes in carbon sequestration capacity.</p>									

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
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Acoustic Environment	-	✓	-	<p>The following potential project effects are assessed for Acoustic Environment:</p> <ul style="list-style-type: none"> <li>change in existing acoustic environment</li> </ul>	<p>Potential mitigations that would be implemented are:</p> <ul style="list-style-type: none"> <li>reducing or restricting equipment activities for specific areas or during specific time periods</li> </ul> <p>The following list of best management practices would be implemented to further mitigate noise effects:</p> <ul style="list-style-type: none"> <li>residents near to major noise-generating activities would be advised, and it would be determined if additional mitigation is required, depending on proximity to noise sources</li> <li>machinery and factory supplied noise-abatement equipment (e.g., mufflers) would be maintained in good working order</li> <li>a complaint response procedure would be implemented to address noise complaints should they arise</li> </ul>	<p>The unmitigated sound levels at most receptor locations during some phases of construction exceed the noise limits established based on Health Canada's preferred approach for environmental assessments. The acoustic modelling assumed downwind conditions exist 100% of the time and that all normally operated equipment is operating at 100% throughput during their use. These conditions do not occur at all times and, therefore, the model predictions are expected to be conservative.</p>	A/N	H/L	LAA	ST	R/IR	R	D/U	<p>The residual environmental effects assessment shows that out of 45 receptors considered for the assessment, up to 33 have the potential to exceed the Health Canada limits without mitigation. It is feasible, that with the application of mitigation options, the sound levels at many of the identified receptor locations would meet noise thresholds. Upon development of the detailed construction execution plan, mitigation measures would be developed to meet assessment noise thresholds.</p> <p>A significant environmental effect on the acoustic environment would result in an exceedance of applicable local, provincial, federal, or international guideline limits appropriate for the Project. The noise effects at all receptor locations during the flood and post-flood operations are not predicted to exceed Health Canada noise thresholds. The residual effect on the acoustic environment is not significant.</p>

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Hydrogeology	-	✓	✓	<p>The following potential project effects are assessed for Hydrogeology:</p> <ul style="list-style-type: none"> <li>change in groundwater quantity</li> <li>change in groundwater quality</li> </ul>	<ul style="list-style-type: none"> <li>Construction dewatering, if required, would be done locally and according to the terms and conditions of dewatering licences issued by AEP and best management practices. This would be included as part of the ECO Plan (Environmental Construction Operation Plan) prepared by the contractor.</li> <li>Effects on groundwater quantity as a result of construction dewatering would not be entirely mitigated at a local scale, since dewatering deliberately seeks to temporarily lower the groundwater table in the PDA in order to facilitate construction. The amount of time required for construction dewatering can be minimized through diligent construction planning. Groundwater that is collected during dewatering would be returned to the local water shed to mitigate regional-scale effects on groundwater quantity.</li> <li>Groundwater that would seep into the diversion channel (when dry) would remain within the watershed. Regional-scale effects on groundwater quantity can be mitigated by allowing seepage in the dry diversion channel to infiltrate back into the subsurface, or flow back into the Elbow River via surface water drainage pathways.</li> </ul>	<p>Residual effects on groundwater quantity could be expected as a result of construction dewatering. Dewatering creates a lowering in groundwater levels that are greatest near the pumping location, and gradually rise back toward non-pumping groundwater levels with increasing distance away from the pumping location.</p> <p>The Project has the potential to change groundwater quantity through groundwater seepage into the diversion channel when dry. Groundwater that seeps into the diversion channel would infiltrate back into the groundwater system at a downstream location or continue to flow by gravity down the diversion channel and into the off-stream reservoir. There, groundwater seepage would become part of the surface water system, eventually draining through the outlet structure.</p> <p>Based on the preliminary results of the design flood simulations, the potential effects on groundwater quantity related to flood/post-flood Project operations can be characterized as follows:</p> <ul style="list-style-type: none"> <li>Direction is adverse (in areas where net change in groundwater level is negative) to positive (in areas where net change in groundwater level is positive).</li> </ul>	A/N/P	L/M/L-H	LAA	ST/LT /ST-LT	S/C/IR	R/I	D	<p>Due to the limited interaction of the Project with groundwater resources, the residual effects on groundwater quantity and quality during construction and dry operations would be not significant.</p> <p>Due to the limited interaction of the Project with groundwater resources in the flood and post-flood phases, the residual effects on groundwater quantity would be not significant, with a moderate degree of confidence.</p> <p>Due to the limited areas over which groundwater infiltration could occur during the flood and post-flood phases and the short time period and eventual flow paths of for this flood affected water, the residual effects on groundwater quality would be not significant.</p>



SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
 ENVIRONMENTAL IMPACT ASSESSMENT  
 VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)

EIA Summary  
 October 2017

Table 3-1 Summary of Environmental Effects Assessment

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
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Hydrogeology (cont'd)						<ul style="list-style-type: none"> <li>Magnitude is considered to range from low (in areas where net change in groundwater levels is not predicted) to high (in areas near the diversion channel and off-stream reservoir).</li> <li>Geographic extent of the effects are limited to the LAA based on the preliminary design flood simulation.</li> <li>Frequency of the effects in the off-stream reservoir area are irregular, depending upon the flood. Frequency of effects in the diversion channel area, near the inlet structure are continuous because seepage into the channel would continue indefinitely.</li> <li>Duration of the effects and considered to be short term in the off-stream reservoir: groundwater levels would recover to pre-flood levels with one year following the end of the flood. Duration of the effects near the diversion channel are long term because seepage into the channel would continue indefinitely.</li> <li>The effects on groundwater quantity are anticipated to be reversible once the flood has passed and the off-stream reservoir has been emptied. The effects on groundwater quantity near the diversion channel are anticipated to be irreversible because the diversion channel would be in place indefinitely.</li> </ul>								

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Hydrogeology (cont'd)						<ul style="list-style-type: none"> <li>The ecological and socio-economic context is disturbed because the PDA has been substantially previously disturbed by human development.</li> </ul> <p>Based upon the qualitative discussion presented above, the potential effects on groundwater quality related to flood and post-flood operations of the Project can be characterized as follows:</p> <ul style="list-style-type: none"> <li>Direction would be positive or adverse, depending upon the chemical species under consideration.</li> <li>Magnitude would be low to high depending upon the chemical species under consideration.</li> <li>Geographic extent of the effects would be limited to the LAA because potential seepage out of the off-stream reservoir would be directed back toward the Elbow River valley within the LAA.</li> <li>Frequency of the effect would be irregular, depending upon the flood and approximate return period for that flood.</li> </ul>								

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
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Hydrogeology (cont'd)						<ul style="list-style-type: none"> <li>The duration of the effect on groundwater quality would be short term as the preliminary modelling results suggest that groundwater levels would recover to pre-flood levels with one year following the end of the flood, and in turn infiltration of surface water and migration away from the off-stream reservoir would be limited to the same time period.</li> <li>The effects on groundwater quality due to infiltration of surface water and subsequent migration away from the off-stream reservoir would be reversible, because once the reservoir is emptied of its inventory, then no further flood affected water can infiltrate into the subsurface.</li> <li>The ecological and socio-economic context is disturbed because the PDA has been previously disturbed by human development.</li> </ul>								

SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
 ENVIRONMENTAL IMPACT ASSESSMENT  
 VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)

EIA Summary  
 October 2017

Table 3-1 Summary of Environmental Effects Assessment

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Hydrology	-	✓	✓	The following potential project effects are assessed for Hydrology: <ul style="list-style-type: none"> <li>change in hydrological regime beyond the range evident in the historical record</li> <li>change in sediment transport dynamics</li> <li>change in channel morphology</li> </ul>	Potential effects of erosion and sedimentation on watercourses during construction would be avoided or mitigated through: <ul style="list-style-type: none"> <li>isolating instream work areas</li> <li>using sediment and erosion control measures</li> <li>reclaiming bank/riparian areas, including revegetation</li> </ul> All applicable regulatory notifications, permits, and authorizations, if required, would be obtained before the start of any instream construction.	The residual effects on the hydrology of the Elbow River, because of tributary drainage diversion and groundwater intersection, during dry operation can be characterized by the following: <ul style="list-style-type: none"> <li>Direction is neutral because primary flow in the Elbow River and the low-level outlet would not be impeded and intermittent flow from the diverted small tributaries, including any potential groundwater seepage, is unlikely to be measurable at the LAA scale.</li> <li>Magnitude is negligible with little to no variation from existing conditions in the Elbow River and the low-level outlet.</li> <li>Geographic extent of the effects is limited to the PDA area due to scale limiting any transfer of effects into the Elbow River in a measurable way.</li> <li>Frequency of the effect is continuous given the permanent nature of the Project.</li> <li>The duration of the effect is long-term given the permanent nature of the Project.</li> <li>The effects are irreversible, given the permanent nature of the Project.</li> <li>The ecological and socio-economic context is disturbed because the PDA has been previously disturbed by human development.</li> </ul>	N/A	N/H	PDA/LAA	LT/ST - LT	C/IR	I	D/U	Due to the limited nature of Project interactions with hydrology during the construction and dry operation phases, the residual effects on hydrology have been assessed to be not significant.  Changes in sediment transport during construction and dry operations of the Project have been assessed to be not significant.  Determination of significance is not relevant for changes in hydrology during the flood and post-flood phases because the purpose of the Project is to actively modify the hydrology of the Elbow River.

SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
 ENVIRONMENTAL IMPACT ASSESSMENT  
 VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)

EIA Summary  
 October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
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Hydrology (cont'd)						The apparent lack of sediment transport measured in the low-level outlet under existing conditions and the intermittent flow regime suggest that dry operations is unlikely to have any measurable effect on sediment transport. The residual effects on sediment transport in the Elbow River, because of localized hydraulic changes during dry operation, can be characterized by the following: <ul style="list-style-type: none"> <li>• Direction is neutral because primary flow in the Elbow River and the low-level outlet would not be impeded and effective discharge ranges for suspended sediment and bedload are unaltered at the LAA scale.</li> <li>• Magnitude is negligible with little to no variation from existing conditions in the Elbow River and the low-level outlet.</li> <li>• Geographic extent of the effects is limited to the PDA area due to scale limiting any transfer of effects up- or downstream of the Elbow River and the low-level outlet in a measurable way.</li> <li>• Frequency of the effect is continuous, given the permanent nature of the Project.</li> <li>• The duration of the effect is long-term, given the permanent nature of the Project.</li> <li>• The effects are irreversible, given the permanent nature of the Project.</li> </ul>								

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

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		Construction and Dry Operation	Flood and Post-Flood Operations											
Hydrology (cont'd)						The ecological and socio-economic context is disturbed because the PDA has been previously disturbed by human development.								
Surface Water Quality	-	✓	✓	<p>The following potential project effects are assessed for Surface Water Quality:</p> <ul style="list-style-type: none"> <li>change in surface water quality</li> </ul>	<p>Potential effects of erosion and sedimentation during construction can be avoided or mitigated for the Project through:</p> <ul style="list-style-type: none"> <li>scheduling (e.g., avoidance of wet periods), limiting instream and riparian works</li> <li>isolating instream work areas</li> <li>using sediment and erosion control measures</li> <li>reclaiming bank/riparian areas, including revegetation</li> </ul> <p>Herbicides would be applied according to Environmental Code of Practice for Pesticides.</p>	<p>The residual 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. 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.</p> <p>The effect of dry operation on water quality through herbicide application is adverse in direction, low in magnitude, restricted to the LAA, short-term in duration and a regular event in frequency. Given the very low frequency of herbicide detection in the watershed, the effect is reversible through dilution.</p>	A	L/L – H/N-L	PDA/LAA	ST/MT	S/R/IR	R	U/D	<p>The effects of the Project on water quality during construction and dry operations are not significant. Herbicide application during dry operations is not significant.</p> <p>The estimated low and high methylmercury concentrations in all floods are below the CCME Canadian Water Quality Guideline for the Protection of Aquatic Life. The effects of the Project on water quality during flood and post-flood scenarios are assessed as not significant.</p>

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

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		Construction and Dry Operation	Flood and Post-Flood Operations											
Surface Water Quality (cont'd)						During flood operation, the Project is expected to have a reversible, short-term adverse effect on water quality. The magnitude of the effect is anticipated to be from low to high. The high magnitude effect is related to suspended sediment concentrations in the Elbow River at the end water release.  During post-flood cleanup, it is not anticipated that the Project would measurably affect water quality in Elbow River or Glenmore Reservoir.								
Aquatic Ecology	✓ 5(1)(a)(i) 5(1)(a)(ii) 5(2)(a)	✓	✓	The following potential project effects are assessed for Aquatics Ecology: <ul style="list-style-type: none"> <li>change in fish habitat</li> <li>change in movement</li> <li>change in mortality risk</li> </ul>	Key mitigation measures for Aquatics Ecology: <ul style="list-style-type: none"> <li>Works in water would be timed with respect to the restricted activity periods (RAPs) wherever possible. +</li> <li>Washing, refueling, and servicing of machinery and the storage of fuel and other materials would be away from the watercourses in manner to prevent deleterious substances from entering the water.</li> <li>Where instream works are required, non-toxic and biodegradable hydraulic fluids would be used in machinery.</li> </ul>	The residual effect of construction on causing a permanent alteration to fish habitat is adverse in direction, low in magnitude, restricted to the PDA, permanent in duration, and a single event in frequency. Due to the permanence of the project structures in the river, the effect is irreversible.  The residual effect of construction on causing the destruction of fish habitat is adverse in direction, low in magnitude, restricted to the PDA, permanent in duration, and as a single event in frequency. Due to the permanence of the structure in the river, the effect is irreversible.  The residual effect of construction causing death of fish is adverse in direction, low in magnitude, restricted to the PDA, and as an irregular event in frequency. Given the low potential and the small portion of the fish population that could be affected, the effect is reversible.	A/N	L/N	PDA/LAA	P/ST/ LT	S/IR/ C	I/R	U/D	The residual effects on change in habitat, movement, and mortality risk are unlikely to pose a long-term threat to the persistence or viability of a fish species, including SAR, in the RAA.  With the application of mitigation and environmental protection measures, residual effects on aquatic ecology are predicted to be not significant.

SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
 ENVIRONMENTAL IMPACT ASSESSMENT  
 VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)

EIA Summary  
 October 2017

Table 3-1 Summary of Environmental Effects Assessment

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect	
		Construction and Dry Operation	Flood and Post-Flood Operations												
Aquatic Ecology (cont'd)					<ul style="list-style-type: none"> <li>A site-specific Erosion and Sediment Control Plan would be developed and implemented during the various phases of the Project.</li> <li>The location of the in-stream works would be isolated from the flowing water in the water body.</li> <li>Boulders would be added to increase the bed roughness of the channel immediately downstream of the diversion structure, which would increase water depths and reduce velocities.</li> <li>Large woody debris pieces such as rootballs and logs over 50 cm in diameter, would be retained and relocated in the river downstream of the structure.</li> <li>Debris should be cleaned from the structure gates after a flood recedes to allow unimpeded fish passage upstream over the structure.</li> </ul>	<p>The effect of dry operation on aquatic ecology through a destruction of fish habitat is adverse in direction, low in magnitude, extends to the Elbow River through the LAA, permanent in duration, and would occur during spawning migrations at an irregular, but continuous frequency. Due to the permanence of the structure in the river, the effect is irreversible.</p> <p>The residual effects on fish habitat, as a function of bedload movement in Elbow River and low-level outlet during the post-flood phase are of a high magnitude, short-to-long term duration. The release of water from the reservoir through the low-level outlet will temporarily increase localized suspended sediment concentrations and turbidity in the Elbow River. Increased turbidity and the deposition of sediment on substrates could affect the quality of fish habitat in the low-level outlet channel and in Elbow River downstream of the low-level outlet.</p> <p>Upstream movement of fish during post-flood operations would not differ from upstream movement during dry operations.</p> <p>During post-flood operations, stranding in the reservoir is expected to cause mortality of fish that do not swim out of the reservoir during post-flood draining. The diversion structure and reservoir are planned and designed as mitigation measures to limit the effects of floods in the Elbow River</p>									



**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Terrain and Soils	-	✓	✓	<p>The following potential project effects are assessed for Terrain and Soils:</p> <ul style="list-style-type: none"> <li>Change in terrain stability</li> <li>Change in soil quality and quantity</li> </ul>	<p>Standard construction mitigation that lessen residual effects on terrain stability would be:</p> <ul style="list-style-type: none"> <li>A concrete retaining wall would be designed and constructed as part of the diversion structure to stabilize the Elbow River escarpment.</li> <li>Standard mitigation would be practiced include salvage, stockpiling, and final reclamation of soils and landscapes in all disturbed areas.</li> <li>Areas of land associated with project components such as the water intake, water retention, water outflow and roads would use previously salvaged soil materials for erosion control and support for vegetation re-establishment.</li> </ul> <p>Standard post-flood mitigation to be employed to lessen the extent of residual effects on terrain stability due to a substantive shift in the stream flow regime within the low-level outlet channel include:</p> <ul style="list-style-type: none"> <li>conducting slope stability monitoring on the channel to assess if stream bank stabilization is required</li> <li>seeding and revegetating the channel banks with native seed/plants to improve bank stability</li> <li>Use of native or agronomic plant species (grass, legumes) would be used in reclaimed areas to maintain a strong sod-layer that would contribute to erosion prevention.</li> </ul>	<p>After standard construction mitigation, there would be a change in terrain stability along the excavated diversion channel banks, off-stream dam and at the diversion structure. The diversion structure would be constructed through the Elbow River escarpment which would result in stabilization of the slope compared to existing conditions. Overall, the magnitude of the adverse residual effect following construction and dry operations is moderate.</p> <p>The change in agricultural land capability distribution is a decline in the extent of the class 3 soils in the area of the LAA.</p> <p>There are no anticipated effects on soil quality during dry operations.</p>	A	M/L/H	PDA/LAA	LT/MT/ST	IR/S	R/I	U	<p>The effect of the Project on terrain stability following construction and dry operation is assessed as not significant.</p> <p>The change in soil quality and quantity following construction and dry operations is assessed as not significant.</p> <p>Within the reservoir, the change in terrain stability following flood and post-flood operations for all modelled floods is predicted to be not significant. For the low-level outlet channel, the change in terrain stability following flood and post-flood operations for the 1:100 year and design floods is predicted to be significant and with an extent that is not confined to the PDA.</p> <p>Within the reservoir, the change in agricultural land capability is predicted to be not considered significant.</p>

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Vegetation and Wetlands	Vegetation species at risk	✓	✓	<p>The following potential project effects are assessed for Vegetation and Wetlands:</p> <ul style="list-style-type: none"> <li>Change in Landscape Diversity</li> <li>Change in Community Diversity</li> <li>Change in Species Diversity</li> <li>Change in Wetland Functions</li> </ul>	<p>Key mitigation measures for Vegetation and Wetlands are:</p> <ul style="list-style-type: none"> <li>Reseeding native soil areas disturbed by the Project using an Alberta Transportation native custom seed mix.</li> <li>Use a cover crop to assist in weed and erosion control on exposed soils where warranted</li> <li>Monitor topsoil and subsoil piles for weed growth during construction and implement corrective measures (e.g., spraying, mowing, hand-pulling) to avoid growth and establishment of regulated weeds.</li> </ul>	<p>Residual effects on vegetation and wetlands during construction and dry operations will not result in the loss of native upland or wetland plant communities or wetland functions from the LAA. Effects on unidentified plant SOMC could occur, but such effects would likely be limited, and likely habitat for plant SOMC does exist elsewhere in the LAA. Effects to plant communities of management concern are not anticipated.</p> <p>Residual effects on vegetation and wetlands post-flood would not result in the loss of native upland and wetland plant communities, or wetland functions from the LAA. Effects on one rare plant as well as the potential for effects on unidentified plant SOMC could occur. It is likely that habitat for plant SOMC exists elsewhere in the RAA as affected vegetation and wetland land units exist elsewhere in the RAA. Effects on plant communities of management concern are not anticipated, because none were identified within the RAA.</p> <p>A design flood would result in the loss of the only known occurrence of slender cress plant SOMC from the RAA, because slender cress habitat is present in the RAA. It is likely that there are other occurrences of slender cress in the RAA that are currently undocumented.</p>	A	L/M	PDA	LT/MT	S	I/R	D	Residual project effects are predicted to be not significant because the Project will not result in the loss of native upland or wetland cover types, plant SOMC or wetland function in the LAA. Though there will be loss of wetland in the PDA, the loss is predicted to be low and these cover types are common in the LAA. The loss of a slender cress plant during a design flood would be considered significant if no other specimens were present in the RAA.

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Wildlife and Biodiversity	✓ 5(1)(a)(iii)	✓	✓	The following potential project effects are assessed for Wildlife and Biodiversity: <ul style="list-style-type: none"> <li>• Change in Habitat</li> <li>• Change in Movement</li> <li>• Change in Mortality Risk</li> <li>• Change in Biodiversity</li> <li>• Change in Wildlife Health</li> </ul>	Key mitigation measures for Wildlife and Biodiversity include: <ul style="list-style-type: none"> <li>• To maintain ungulate movement within the KWBZ, the floodplain berm would be covered with materials conducive for ungulate movement.</li> <li>• Maintenance activities would be reduced as much as possible in the Key Wildlife and Biodiversity Zone (KWBZ) identified along the Elbow River from December 15 to April 30. This would reduce potential sensory disturbance to wintering ungulates (ESRD 2015a).</li> <li>• The diversion channel would be built with moderate slopes that most large mammals are known to traverse. The side slopes of the diversion channel would be vegetated, which would provide a more conducive material to help facilitate escape from rising flood waters or when swimming across the channel.</li> <li>• If an active nest or den is found, it would be subject to a provincial or federal disturbance setback buffer and site-specific mitigation.</li> <li>• If previously unidentified listed or sensitive wildlife species or their site-specific habitat (e.g., dens, nests) are identified during maintenance operations, they will be reported to the Environmental Inspector(s) or designate.</li> </ul>		A	L to H	PDA/ LAA/ RAA	ST/LT	S/IR/ C	R	D	Residual environmental effects on wildlife and biodiversity during construction and dry operations are predicted to be not significant.  Project residual environmental effects on wildlife and biodiversity during flood and post-flood operations are predicted to be not significant.

SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
 ENVIRONMENTAL IMPACT ASSESSMENT  
 VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)

EIA Summary  
 October 2017

Table 3-1 Summary of Environmental Effects Assessment

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Land Use and Management	✓ 5(2)(a)	✓		The following potential project effects are assessed for Land Use and Management: <ul style="list-style-type: none"> <li>Change in Land Use (including navigation)</li> <li>Change in Parks and Protected Areas</li> </ul>	Key mitigation measures for Land Use and Management are: <ul style="list-style-type: none"> <li>AT would avoid interference with public navigation of the Elbow River through design and best management practices:                             <ul style="list-style-type: none"> <li>As part of construction, a permanent portage would be developed around the in-stream water intake components.</li> <li>Signs directing traffic to detours would be installed during construction of road realignments and modifications.</li> <li>Signs would be installed along the existing Elbow River channel and on the dam.</li> </ul> </li> </ul>	Land use in the PDA would be affected by construction of the Project, including permanent removal of private property and agricultural lands and changes to industrial development infrastructure. Property owners would be compensated for the acquisition of their lands by Alberta Transportation. Other land uses in the PDA including consumptive recreation and livelihood and non-consumptive recreation, would be affected by construction; however, these land uses would be able to continue at or near current levels elsewhere in the LAA during dry operations.  Land users in the LAA may be affected by temporary changes to access and nuisance noise, light, and air emissions during construction. However, these effects are limited to the construction phase or shorter and land users in the LAA are not anticipated to be affected during dry operations.  Our Lady of Peace cairn and monument plaque would not be substantially or irreversibly compromised because of construction or dry operations. Access to this site would be temporarily disrupted and land users may experience nuisance noise, light, and air emissions during construction. However, these effects are short-term and would not affect access to or quality of the unique site during dry operations.	A/N	H/M/L	PDA/LAA	LT/MT/ST	S/C	I/R	R	Change in land use during construction and dry operations and during flood and post-flood operations are predicted to be not significant.

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Land Use and Management (cont'd)						Land ownership in the PDA would not change in the event of a flood; however, recreation would be suspended. Additionally, grazing in the area north of Springbank road would be suspended during 1:100 year and design floods.  Access to areas in the PDA and to the LAA would be affected by 1:100 year and design floods because Springbank Road is anticipated to be flooded by these events. Post-flood operation includes repair of Springbank road and cleanup and repair, as necessary, in the PDA.								
Historical Resources	✓ 5(1)(c)(ii) 5(1)(c)(iv)	✓		The following potential project effects are assessed for Historical Resources: <ul style="list-style-type: none"><li>Loss of or alteration to historical resource site contents or sites context</li></ul>	Key mitigation measures for Historical Resources are: <ul style="list-style-type: none"><li>Alberta Culture and Tourism requirements for the Project area will be followed.</li></ul>	The HRIA field studies required by Alberta Culture and Tourism (ACT) for archaeology and palaeontology have been completed, except for deep testing, which would be completed prior to construction, and HRIA studies for archaeology as required by ACT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Alberta Transportation would implement all mitigation required by ACT and would obtain all required project approvals under the <i>Historical Resources Act</i> . Project effects on historical resources are assessed as being not significant.

SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
 ENVIRONMENTAL IMPACT ASSESSMENT  
 VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)

EIA Summary  
 October 2017

Table 3-1 Summary of Environmental Effects Assessment

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Traditional Land and Resource Use	✓ 5(1)(c)(iii) 5(2)(b)	✓	✓	The following potential project effects are assessed for Traditional Land and Resource Use: <ul style="list-style-type: none"> <li>Change in Availability of Traditional Resources for Current Use</li> <li>Change in Access to Traditional Resources for Current Use</li> <li>Change in Current Use Sites or Areas</li> </ul>	Key mitigation measures for Traditional Land and Resource Use are: <ul style="list-style-type: none"> <li>Alberta Transportation has documented and will continue to document engagement activities with Indigenous groups, as well as any issues, concerns, and recommendations raised by Indigenous communities.</li> <li>Following construction, the area along the Elbow River flood plain would be accessible for some TLRU activities; this would be a conservation zone with public access and opportunities for low impact recreation</li> </ul>	Overall, the residual effects of the Project on the availability of traditional resources for current use are predicted to be low in magnitude. There will be direct and indirect loss of habitat, but the loss is relatively small compared to the size of the RAA. However, the long-term persistence and viability of wildlife and fish species in the RAA are unlikely to be affected, and the Project is not expected to result in loss of vegetation communities in the LAA  Overall, the residual effects of the Project on access to traditional resources, current use sites or locations are anticipated to be low in magnitude. The permanent portage may marginally affect the use of the Elbow River for transportation by forcing users to avoid the in-stream water diversion components. Fencing of infrastructure would restrict access to traditional resources or current use areas in certain areas of the Project. The effects of the Project would extend to the LAA, would be continuous and long-term and irreversible.  Residual effects to current use sites or areas within the area of permanent structures and cultural, spiritual, ceremonial, and ancestral sites as well as archaeological sites located within the areas of temporary physical disturbance would be of high magnitude because these sites would be permanently removed. These effects would be restricted to the PDA, continuous, long term and irreversible.	A	L/M/H	PDA/LAA	ST/LT	C/S/IR	I/R	D	The residual environmental effects from the Project on TLRU are determined to be not significant because they do not result in the long-term loss of availability of traditional use resources in the LAA or RAA. Long term effects on access to lands relied on for traditional use practices or current use sites are anticipated to be limited to areas in the reservoir under deeper sedimentation, and are not expected to critically reduce or eliminate current use in the RAA.

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect	
		Construction and Dry Operation	Flood and Post-Flood Operations												
Traditional Land and Resource Use (cont'd)						Overall, the residual effects of flood and post-flood operation on the availability of traditional resources for current use are predicted to be low in magnitude and short-term in duration. The long-term persistence or viability of wildlife and fish species in the regional assessment area (RAA) are unlikely to be affected, nor would the Project result in loss of vegetation communities or wetland function in the LAA. No measurable effects on downstream water quality are predicted. The adverse effects of the Project would be reversible and extend to the LAA, because anticipated changes in wildlife habitat and movement, as well as fish habitat and mortality, are expected to extend to the LAA. The duration of effects ranges from short-term to long-term: long-term effects include those on alteration of fish habitat and fish mortality. The magnitude of residual effects on the availability of resources is expected to range from low to high; low because the anticipated magnitude of effects on the diversity of plant communities and fish habitat are anticipated to be low, and high because more than 10% of habitat suitable for elk and grizzly bear, which are also representative species, would be affected, and effects of the Project on fish mortality are expected to be high in magnitude.									

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Traditional Land and Resource Use (cont'd)						<p>Overall, the residual effects resulting from flood and post-flood operation of the Project on access to traditional resources, current use sites or locations are anticipated to be low in magnitude. The effects resulting from flood and post-flood operations would be restricted to the PDA, reversible, and short term (except for effects from deeper sedimentation if sediment excavation is not undertaken at current use site locations; in these areas effects would be long term).</p> <p>Overall, the residual effects resulting from flood and post-flood operation of the Project on current use sites or areas are anticipated to be low in magnitude for harvesting areas, and moderate for cultural sites (except for effects from deeper sedimentation; in these areas, effects are anticipated to be of high magnitude). The effects resulting from flood and post-flood operation of the Project would be restricted to the PDA (the reservoir), short term and reversible (except for effects from deeper sedimentation if sediment excavation is not undertaken for cultural sites; in these areas effects would be long term).</p>								



SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
 ENVIRONMENTAL IMPACT ASSESSMENT  
 VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)

EIA Summary  
 October 2017

Table 3-1 Summary of Environmental Effects Assessment

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Public Health	✓ 5(1)(c)(i)	✓	✓	The following potential project effects are assessed for Public Health: <ul style="list-style-type: none"> <li>Change to Human Health</li> </ul>	Key mitigation measures for Public Health are: <ul style="list-style-type: none"> <li>Project construction vehicles would meet current emission control standards.</li> <li>Engines and exhaust systems would be properly maintained.</li> </ul>	Because mitigation measures are effective at reducing exposures, residual effects to public health from inhalation is medium- term for duration, moderate for magnitude, expected to extend to the LAA, and is reversible following construction During flood and post-flood operations for changes in drinking water quality, the surface water quality identifies potential increases in TSS and methylmercury in the water stored in the off-stream dam, which would be released back into the Elbow River when the reservoir is drained. With regards to methylmercury bioaccumulation and biomagnification in fish, the estimated high-estimate concentration of methylmercury when the reservoir is drained is 0.002 µg/L. This is less than the Canadian Council of Ministers of the Environment water quality guideline for the long-term protection of freshwater aquatic life of 0.004 µg/L. There is a low probability that methylmercury in the water drained from the reservoir could substantially change the existing concentrations of mercury in the aquatic ecosystem to the extent that fish consumers would be at risk. Longer reservoir retention time appears to be associated with increased methylmercury concentrations in fish. In contrast, the filling and draining of the reservoir is a short-term source of methylmercury, which would not affect the long-term viability of fish resources.	A	M/L	LAA/ RAA	MT/ ST	C/IR	R	R	The assessment of public health shows that the effects from air quality, water quality and country foods are not significant for the construction and dry operations phases. During flood and post-flood operations, phase the effects on public health is not significant. The conclusion is further supported by the short-term duration that the Project would alter the water quality during the flood phase. The short-term influx of less than 0.002 µg/L of methylmercury into the Elbow River from the drained reservoir would not influence the long-term viability of the drinking water supply.

SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
 ENVIRONMENTAL IMPACT ASSESSMENT  
 VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)

EIA Summary  
 October 2017

Table 3-1 Summary of Environmental Effects Assessment

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Infrastructure and Services	✓ 5(1)(c)(ii)	✓	✓	The following potential project effects are assessed for Infrastructure and Services: <ul style="list-style-type: none"> <li>Change in infrastructure and services</li> <li>Change in accommodation availability</li> <li>Change in transportation infrastructure and services</li> </ul>	Key mitigation measures for Infrastructure and Services are: <ul style="list-style-type: none"> <li>The overall construction staging plan (to be developed as part of the detailed project design) would consider reduction of traffic disruptions</li> <li>The details of day-to-day road construction management would be set out in traffic accommodation strategies that would be developed by the contractor(s) and reviewed and approved by Alberta Transportation.</li> </ul>	During construction, traffic along Springbank Road may be diverted to Range Road 40 and Township Road 250 or a temporary detour to Highway 22 may be constructed. This may create a longer travelling distance for residents of Rocky View County but would not create additional demands on Springbank Road.  The addition of equipment to the local roadways for Project construction may cause traffic disruptions. However, construction would occur beside the existing Highway 22 and is not anticipated to adversely affect traffic. With the capacity of the local road network, the traffic associated with the Project can easily be accommodated.  The residual adverse effects of the Project on transportation infrastructure and services during flood and post-flood operations are predicted to be low in magnitude and to occur as a single event, lasting for the short-term. Effects would be reversed following the completion of post-flood activities.	A	L	RAA/LAA	ST	C/S	R	HC	The Project would not result in: <ul style="list-style-type: none"> <li>an exceedance of available capacity or</li> <li>a substantial decrease in the quality of a service provided,</li> </ul> Therefore, Project residual effects on infrastructure and services are assessed as not significant for all phases.

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

Valued Component (VC) Affected	Area of Federal Jurisdiction	Project Phase		Potential Effects	Proposed Mitigation	Residual Effect	Direction*	Magnitude*	Geographic Extent*	Duration*	Frequency*	Reversibility*	Ecological and Socio-economic Context*	Significance of Residual Adverse Effect
		Construction and Dry Operation	Flood and Post-Flood Operations											
Employment and Economy	-	✓	✓	<p>The following potential project effects are assessed for Employment and Economy:</p> <ul style="list-style-type: none"> <li>• Change in Provincial Economy</li> <li>• Change in Regional Labour Force</li> <li>• Change in Regional Economy</li> </ul>	<p>Project effects on employment and economy are expected to be positive in direction with the addition of direct, indirect, and induced employment income and GDP. As such, no mitigation measures are proposed to address adverse effects. Alberta transportation would adhere to government procurement policies and procedure with respect to labour, and goods and services.</p>	<p>In determining effects of the Project on employment and economy, the assessment considers expected change in labour supply and demand, effects on commercial businesses from project spending (i.e., regional economy), and changes to the provincial economy. The Project would not materially affect labour supply and demand in the LAA during construction or dry operations because the available labour force greatly exceeds the workforce requirements. The Project is expected to have a largely beneficial effect on commercial businesses operating in the LAA because of opportunities associated with project spending. While there is potential for adverse effects due to competition for available labour and cost of labour supply, because of the large available workforce in the LAA, this effect is predicted to be negligible. The Project is predicted to have a beneficial effect on the provincial economy as a result of increased GDP and government revenue associated with construction expenditure.</p>	P/A	N-L	LAA	ST/LT	C/R	R	R	<p>Construction and dry operation of the Project is predicted to have a generally positive effect on employment and economy in the LAA and Alberta.</p> <p>In terms of flood and post-flood operations, the Project would reduce the average annual damages of floods by \$28 million. Over an assumed 100-year operating life, the Project's discounted benefits in terms of flood damage avoidance, exceed its costs; therefore, it would have a net economic benefit.</p>

**SPRINGBANK OFF-STREAM RESERVOIR PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT  
VOLUME 3D: EFFECTS ASSESSMENT (ACCIDENTS AND MALFUNCTIONS, EFFECTS OF THE ENVIRONMENT, AND EIA SUMMARY)**

EIA Summary  
October 2017

**Table 3-1 Summary of Environmental Effects Assessment**

<p><b>*KEY</b>  See individual chapters for detailed definitions</p> <p><b>Project Phase</b>  C: Construction  DO: Dry Operations</p> <p><b>Direction:</b>  P: Positive  A: Adverse  N: Neutral</p> <p><b>Magnitude:</b>  N: Negligible  L: Low  M: Moderate  H: High</p>	<p><b>Geographic Extent:</b>  PDA: Project Development Area  LAA: Local Assessment Area  RAA: Regional Assessment Area</p> <p><b>Duration:</b>  ST: Short-term  LT: Long-term</p> <p>N/A: Not applicable</p>	<p><b>Frequency:</b>  S: Single event  IR: Irregular event  R: Regular event  C: Continuous</p> <p><b>Reversibility:</b>  R: Reversible  I: Irreversible</p> <p><b>Ecological/Socio-Economic Context:</b>  U: Undisturbed  D: Disturbed  R: Resilient  NR: Not Resilient  LC: Low Capacity  MC: Moderate Capacity  HC: High Capacity</p>
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