SR1 Project: Submission

On behalf of the impacted communities of Bragg Creek and West Bragg Creek, Redwood Meadows and Springbank, Alberta.

Elbow River Sustainability Alliance

3/17/20

Submission

SECTION 1: GENERAL (NRCB QUESTIONS 1-204, IAAC (CEAA) QUESTIONS IR1-05, IR3-01, IR3-45)

NRCB: https://www.nrcb.ca/download_document/2/83/9208/20190614-at-sir-to-nrcb-re-sir1-response-sec-2-nrcb

IAAC (CEAA):

- https://www.nrcb.ca/download_document/2/83/9090/20190614-at-eia-to-nrcb-re-IAAC (CEAA)-ir-response-package-1
- https://www.nrcb.ca/download_document/2/83/9114/20190614-at-eia-to-nrcb-re-IAAC (CEAA)-ir-response-package-3

OUTSTANDING QUESTIONS & CONCERNS FROM THE WESTERN COMMUNITIES:

Before commenting on the specific responses by Alberta Transportation to IAAC (CEAA) and NRCB, we bring to your attention several general information gaps that have not been resolved by the Proponent.

TSUUT'INA TECHNICAL QUESTIONS

Re: https://www.nrcb.ca/download_document/2/83/9452/20180620-tsuutina-corr-to-nrcb-re-technical-review-of-revised-eia)

These technical questions have not been answered by Alberta Transportation.

- Will Alberta Transportation answer Tsuut'ina's questions?
- Will IAAC (CEAA) and NRCB require answers to these questions before ruling?

BUDGET APPROVAL

The Proponent has not identified to us through which Alberta Government approval process is SR1 proceeding (i.e. Water Act Approvals)?

We asked the regulators to direct the Proponent to explain under what authority has land been acquired and under what budget, given SR1 is not an approved provincial project. In response, the Proponent did not explain how land has been acquired and under what budget SR1 expenditures are being made. Our understanding is that the Government cannot acquire land for a project that has not been approved.

We request a detailed history of changes in scope and cost to the SR1 project, along with the type of change, date, and title of who authorized the change. The project has changed materially and the history of these changes deserves scrutiny.

APPROACH TO FLOOD MITIGATION

MYOPIC VIEW: FLOOD MANAGEMENT VS WATER MANAGEMENT

The 2014 Bow River Basin Council (BRBC) Flood Mitigation discussion paper Provincial Policy, as follows:

It appears that somewhere along the path of evaluating flood mitigation options on the Elbow River, many of these considerations and objectives were lost. SR1 does not provide safe, secure drinking water; healthy aquatic ecosystems or reliable, quality water supplies for a sustainable economy. Given these are Provincial Priorities, what is the justification for SR1 to be so directly in opposition to these objectives?

POLICY CONTEXT

Provincial

Water for Life: Alberta's Strategy for Sustainability

All three of the Strategy's desired outcomes are impacted by flooding:

- Safe, secure drinking water;
- Healthy aquatic ecosystems; and
- Reliable, quality water supplies for a sustainable economy.

The report also discusses key considerations for flood mitigation:

Working collaboratively with its members, the BRBC has identified four additional key considerations in classifying, assessing and implementing strategies for long-term flood mitigation actions:

1. Watershed integrity,
2. Multipurpose watershed management,
3. Project justification and prioritization (including cost-benefit analysis and risk mapping), and
4. Future resilience.

With regard to watershed integrity, we point out the Off-Highway Vehicle Use in the McLean Creek area is still occurring, logging in the McLean Creek Area is still ongoing and no wetland preservation projects in the headwaters have been proposed.   It appears that the Proponent is relying on SR1 to be the replacement for good management of the headwaters.

> ## Watershed Integrity
>
> Watershed protection is paramount, particularly in the headwaters region. This entails considering a host of land-use practices, including (but not limited to) wetland preservation, forestry practices, intensive recreation (e.g., off-highway vehicle use) and other headwaters activities.

Additionally, the BRBC report goes on to state that, for Watershed Management: "From a public safety perspective the most reliable and cost-effective risk-reduction strategy is to move people out of flood-prone areas." In reality, what is occurring is large-scale development in the City of Calgary on the floodplain. Rather than minimizing development in Calgary in the floodplain, it appears that SR1 is being used as an insurance policy for the City of Calgary's many developers. [1]

Regarding diversions, the BRBC states: "Diversions may reduce risk in some areas, but increase it in others (risk transfer). Large-scale detention facilities reduce risk of a "design event," but this benefit is reduced if the design event is exceeded (over-topped). Furthermore, a new significant risk is created by the possibility of structural failure. While the probability of this may be very low, it is not zero, and the consequences would be extreme."

We are confounded by the contravention of SR1 of many of the BRBC's philosophies and strategies for water management.

[1] https://dailyhive.com/calgary/1818-1st-street-east-calgary-the-hat-elbow-river.

PROJECT PRECEDENTS

The Springbank Community Association in July 2019 asked the Proponent:

- Has anything like SR1, close to the mountains, affected by snowmelt and rain, been done in Canada? Other places in the world?
- If there are precedents, provide examples (locations, date of construction, size) and comment on their similarities / differences. Do not include diversions, as the only purpose of this project is temporary storage of flood waters in the reservoir.
- If this project is new to Canada and to this type of area composition, please comment on the level of confidence that the project will work as planned.

On December 23, 2019, in response to these questions, the Proponent stated that there are two similar projects: the Winnipeg Diversion and the Miami Conservancy Dry Dams in Ohio. As the Proponent did not comment on the similarities/ differences of these projects from SR1, we have the following observations:

Winnipeg Diversion (1962, 2010):

- Prairie flooding (from snowfall and river ice)[2], not a mountainous region and, in fact is "extremely flat"[3]
- Not associated with significant debris such as 70' long evergreens and gravel;
- As a result of freeze/thaw conditions[4][5]

Ohio Miami-Conservancy-District Dry Dams (approx. 1918-1922)[6]

- These are over 100 years old
- These **are effectively On-stream "reservoirs**" that do not require a large-scale diversion such as the one required for SR1
- **Used to some degree nearly every year**
- Floods occur when ground freezes and then rain accumulates; not much snow in this region (flood risk begins around Christmas and runs through the spring)
- Not a mountainous region; farmland is the main surrounding lands
- **Little, if any, pre or post flood debris**
- **No silt issues** resulting from flood, so land goes back to normal once it dries out
- Most of the dry dam lands are **used for parks & recreation and it is mowed a couple of times a year**[7]
- Built long before any concerns about climate change & water security

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[2] https://www.cpc.ncep.noaa.gov/products/assessments/assess_97/rriver.html
[3] https://all-geo.org/highlyallochthonous/2011/04/why-does-the-red-river-of-the-north-have-so-many-floods/
[4] https://all-geo.org/highlyallochthonous/2011/04/why-does-the-red-river-of-the-north-have-so-many-floods/
[5] https://www.gov.mb.ca/mit/floodinfo/floodproofing/reports/pdf/2013_red_river_floodway_operation_report.pdf
[6] https://www.asce.org/project/miami-conservancy-district/
[7] Conversation between Karin Hunter and Ben Casper, Operations Supervisor on December 5, 2019

Based on the above differences to SR1, we suggest these two are not valid comparisons. Based on our research we have been unable to find close comparisons anywhere in the world. Due to the lack of precedents and the abundant amount of speculation used by the Proponent on both operations and outcomes, the SR1 project is an experiment of high consequence, and should be reviewed as such by the regulators.

MULTIDISCIPLINARY REVIEW OF SR1

We expect that with a project of this consequence and magnitude, and given the incredibly massive scope escalation, the Proponent should perform a complete multidisciplinary review of SR1.

For instance, the paper by Brown et al[8] demonstrates the need for broad-scale reviews of dams. "To meet the simultaneous demands of water, energy, and environmental protection well into the future, a broader view of dams is needed. We thus propose a new tool for evaluating the relative costs and benefits of dam construction based on multi-objective planning techniques. The Integrative Dam Assessment Modeling (IDAM) tool is designed to integrate biophysical, socio-economic and geopolitical perspectives into a single cost/benefit analysis of dam construction. Each of 27 different impacts of dam construction is evaluated by objectively and subjectively by a team of decision-makers. By providing a visual representation of the various costs and benefits associated with tow or more dams, the IDAM tool allows decision-makers to evaluate alternatives and to articulate priorities associated with a dam project, making the decision process about dams more informed and more transparent."

SR1 is far beyond the small, simple and inexpensive project envisioned in 2014. It is the time for reflection on this project against the principles of the Bow River Basic Council. As the Proponent is unwilling to consider the broader social, economic, bio-physical, and tourism implications of SR1, we ask the regulators to direct the Proponent to conduct an updated project assessment, such as the "Integrative Dam Assessment Modeling (IDAM)" tool.

[8] Modeling the costs and benefits of dam construction from a multidisciplinary perspective (2008), doi: 10.1016/j.jenvman.2008.07.025 (http://rivers.bee.oregonstate.edu/sites/default/files/brown_tullos_tilt_magee_wolf_2008.pdf)

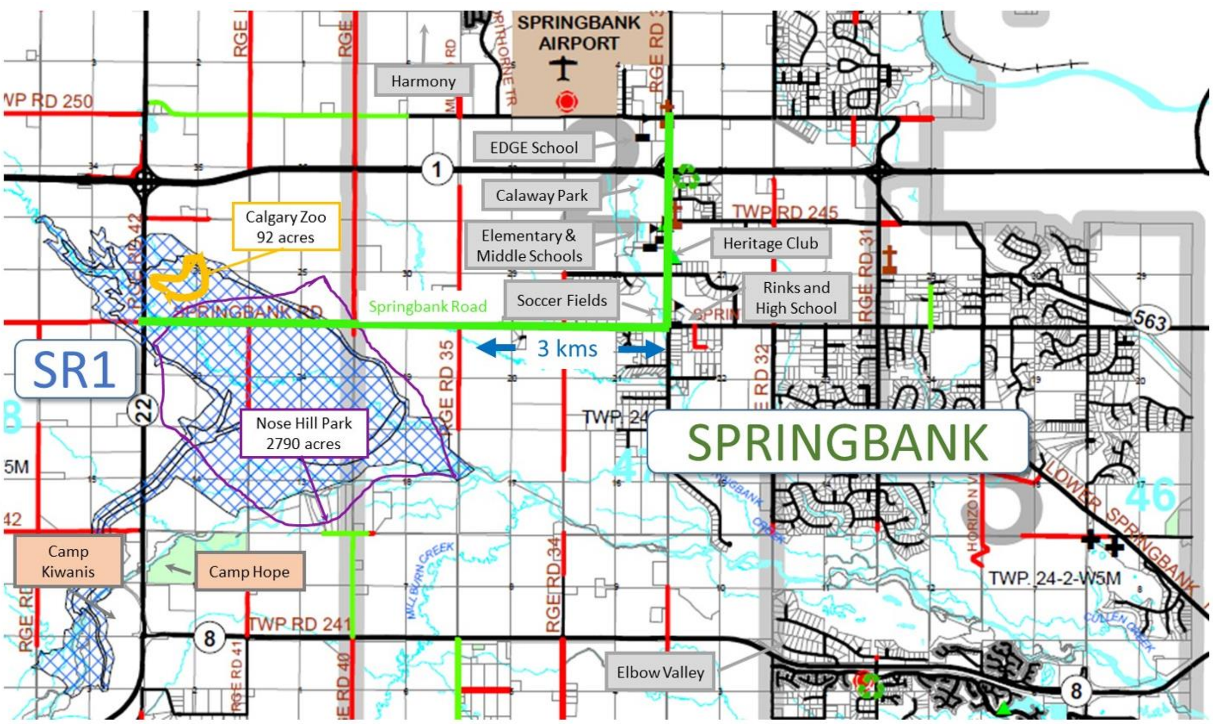
COMMUNITY IMPACTS: WESTERN COMMUNITIES

We ask the regulators to review our community impact videos and presentations in Appendix D.

From inception, this project has been exclusively about protecting the City of Calgary from flood. This narrow scope has prohibited a comprehensive discussion and analysis of the impacts on the local communities surrounding SR1.

In 2014, the Project Summary submitted to the NRCB identified no unique social or environmental consequences. [9] Today, we know there are serious health and environmental consequences in the local area as a direct result of this project. Only in January of 2020 has the Proponent met with impacted Western Communities to hear any concerns. The Project footprint is massive and it is situated just west of the main road in Springbank, home to three schools, the soccer park, community recreation centre and senior's centre.

As the Proponent did not provide maps with sufficient road names and landmarks, we created our own, below:



We ask the regulators to consider that this project has lasting impacts that extend far beyond the City of Calgary's borders that have been dismissed by the Proponent.

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[9] https://www.nrcb.ca/download_document/2/83/8566/20140711-at-eia-to-nrcb-project-summary-table

We are greatly concerned about the level of uncertainty with regard to outcomes (bio-physical, environmental, social, health, economic). We do not believe that adequate baseline research has been conducted, which will forever impair impact analysis.

Further, the Proponent relies on much speculation regarding impacts. A paper exploring the EIA process by Tullos et al research states that “One important component of EIA through time has been the uncertainties related to impact projections, which may either serve an important role in the design and assessment process (De Jonghe, 1992) for dams, or limit the utility of the EIA to influence project outcomes (Sadler et al., 2000). Uncertainty in predicting the significance and extent of environmental impacts arise from insufficient and/or inaccurate baseline information, unexpected changes in project plans, oversimplification in monitoring and modeling efforts (Glasson et al., 2005), and a failure to accurately assess causality (Perdicou´ lis and Glasson, 2006). Failure to address these uncertainties is due in part to limitations on time and resources for scientific study, which Boxer (1988) reported would result in underestimation of negative impacts of a project.”[10]

COMPARISON OF SR1 TO “DO NOTHING” OR “UNMITIGATED FLOODING”

We discussing outcomes, the Proponent often compares SR1 with a “do nothing” or “unmitigated” approach. This is a false comparison. The “do nothing” alternative has never truly been an option, as every report on SR1 has included alternatives (originally, several, including Priddis and Glenmore Tunnel, and then MC1 exclusively). We contend that the Proponent should have to make fair comparisons on economy, environment, health, aquatics, terrestrial, etc. to the MC1 alternative, at a minimum. We believe that by comparing SR1 to unmitigated flooding, the Proponent is introducing pro-SR1 bias.

Examples of how this impacts the EIA:

- The Proponent states that SR1 is better for sediment control for the Glenmore Reservoir than an unmitigated approach. We would likely see that MC1 manages silt as effectively as SR1 compared to no mitigation. (NRCB Question 304)
- The Proponent states that SR1 has a positive effect on fish eggs and fry versus unmitigated flooding. How does this compare to MC1? (NRCB Question 348)
- The Proponent states that SR1 it will generally have positive effects on drinking water quality [in the Elbow River during a flood] (compared to conditions without the project) (NRCB Question 314). Again, MC1 would also have positive effects on drinking water.

In summary, comparisons to “do nothing” are not acceptable and should be dismissed from the Proponent’s EIA. In fact, we contend that the regulators cannot fairly judge SR1 under this approach and the EIA should be submitted with the updated comparisons to alternative means.

[10] http://rivers.bee.oregonstate.edu/sites/default/files/tullos_2008.pdf

In fact, we would argue that SR1 has negative water quality outcomes compared to MC1. SR1 waters will be warm and low oxygen, while MC1 water would not. Additionally, in its ability to assist with fire suppression in the Kananaskis region, MC1 could have a materially positive benefit on water quality, which would suffer greatly from wildfire.

Wildfire in the Kananaskis region jeopardizes Calgary's drinking water

Wildfires in the Elbow River watershed could also impact the potable drinking water of over 500,000 Albertans.

"A large fire could have a profound effect on raw water quality (especially in the small Elbow River watershed) and the effect could last for years."

Champion Lakes/McLean Creek Wildfire May 27-31 2018, 16 kms South-West of Bragg Creek

City of Calgary Water Supply Infrastructure - Climate Change Vulnerability Risk Assessment, Prepared by Associated Engineering Ltd. for the City of Calgary - May 2011)

LOCAL ASSESSMENT AREA (LAA): IMPLICATIONS

We have concerns that the LAA is too small to account for all the impacts of SR1. We view that the LAA should be expanded to consider negative impacts on health of people and animals, impact on traffic, lost opportunity for tourism, and significant impact on wildlife (refer to Appendix E).

We would like the Proponent to justify the chosen LAA given that we know now that many impacts extend beyond the LAA.

We request the Proponent discuss consequences of SR1 beyond the LAA for impacts to wildlife, air, water, terrestrial and safety.

TRAFFIC: TOWNSHIP ROAD 250 INTERSECTION:

This intersection is not included in the LAA, therefore impacts of additional traffic on this road does not appear to be adequately considered by the Proponent. What are the Proponent's plans to deal with high traffic volume at Township Road 250 and Hwy 22 when SR1 is in-use? This is an alternate traffic route through Springbank, and this intersection is already extremely dangerous. Where will all the school buses SAFELY travel to get from the Springbank schools to and from Highway 22 during/after a flood?

In response to our question on this topic, the Proponent states: "As part of the SR1 project, the intersection of Highway 22 at Twp 250 will be upgraded to a Type IVa intersection with a southbound left turn lane."[11]

The cost for this road upgrade is contained in the Alberta Government's plans for Highway 22 Upgrades, not the SR1 project. The timelines for that project are uncertain (could be decades), meanwhile the SR1 traffic impacts will be imminent. We request that road upgrades for Township Road 250 and Highway 22 be included in the SR1 cost model.

We request the Proponent provide the history of accidents within 1 km north and south of Hwy 1 on Hwy 22.

We request that the Proponent conduct a traffic count at Hwy 22 and Township Road 250 and then predict traffic during the diversion when SR1 is in use. We believe there are higher risks of accidents at and near this intersection, which has not been taken into account by the Proponent.

Are there plans for a temporary Highway 22 while the large bridge is built and while Highway 22 is being raised?

Has the Alberta Trucking Association been consulted and is it satisfied with the construction plans so that the construction plans are functional for their trucking needs?

11 http://www.transportation.alberta.ca/projects/assets/Area_7_Calgary_Area/Hwy_22_twinning_from_Hwy_8_to_Cochrane/Executive%20Summary.pdf

WILDLIFE MOVEMENT

The relatively small LAA is concerning for wildlife. We expect that the diversion channel and SR1 footprint may push wildlife to the TransCanada Highway. The TransCanada Highway is currently outside the LAA. There is obviously a significant elk herd roaming in the project area as shown in the pictures taken in December 2019. This abundance of wildlife pictured in the Appendix raises the question of the credibility of information presented by the Proponent and Stantec. They stated in their material that SR1 is low to moderate suitability for elk. Yet we know, and the ranchers regularly see regularly the large elk herds roaming the area all times of the year. The same portrayal happens with grizzly bears and bears. The under-reporting of wildlife is problematic and we question the validity of the wildlife studies.

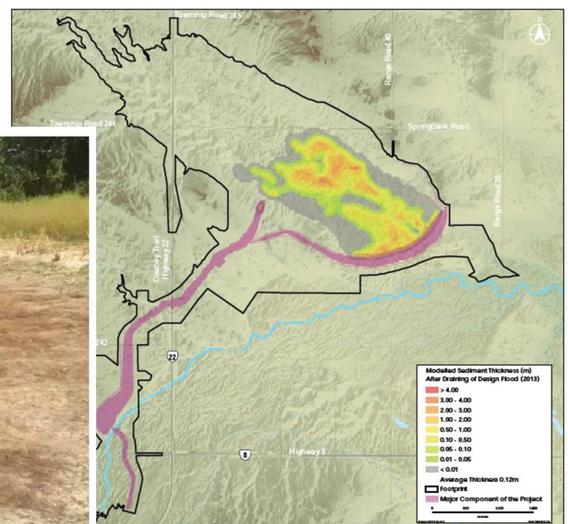
ENVIRONMENTAL IMPACTS

Dust, mosquitos will travel far outside the LAA. Where is the analysis of these important topics?

In response to the Springbank Community Association[12], the Proponent states that insect effects are out of scope. We are unsure of how this is not a consideration in the EIA and are disappointed with that conclusion, knowing that the SR1 reservoir is a closed-system that will hold water for 1-3 months, thus at risk of increased insect activity. We ask the regulators to consider insect-related risks when reviewing the SR1 project. If our community members or animals become sick from mosquito-borne illness, those risks should very-much be in-scope. There are social and economic costs involved with people becoming sick. If there are any increased risks to these types of illness in our community, we deserve to know and have those risks addressed.

What we know now: Post-flood mud & silt create health concerns

Modelled Sediment Thickness (m) After Draining of Design Flood (2013)



A drained pond near the Alberta Birds of Prey Centre, which staff believe was the source of a West Nile Virus outbreak which killed 15 of the centre's birds in the Summer of 2018. The centre is located in the municipality of Coaldale, Alta., and town has launched and investigation into the source of the outbreak. CALGARY

Death of 15 rescued birds prompts investigation into source of West Nile Virus in southern Alberta

RYAN RUMBOLT Updated: December 22, 2018

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12 https://www.nrcb.ca/download_document/2/83/9749/20191203-at-corr-to-springbankcomassoc-re-responses-to-20190726-questions

PHYSICAL PROJECT INFRASTRUCTURE: IMPACT ON THE LANDSCAPE

We request that the Proponent provide our communities with renderings (or equivalent) of all elements of the project infrastructure. The current video on the project website is insufficient. This project is so massive and complex that we have a hard time visualizing its impacts on our communities in all project states, below.

In our view, this project has four ongoing states:

1. Post-construction, pre-flood use
2. Flood (wet operations)
3. Post Flood Operations (pre-cleanup and cleanup)
4. Dry operations (post construction, post-flood)

We have seen the technical documents and cross-sections. However, we request more information about the visual and biophysical aspects of this project on our communities for each of those four states of the project.

We request visuals of berms, diversion channel, bridges, debris deflector, outlet channels, spillways, etc., as pictured by commuters, cyclists and people using the river.

Examples (not exhaustive):

- We know that the floodplain berm is 8 stories, but how will this look from Springbank Road and Hwy 22?
- How will the floodplain look under a flood scenario from this same perspective?
- How will the post-flood landscape look, given the large amount of silt deposited in the reservoir?

PHYSICAL PROJECT INFRASTRUCTURE: FUNCTION AND IMPLICATIONS

DIVERSION CHANNEL

What is the width of the diversion channel? We request that information be provided about the current specifications in meters and feet for height and width due to impact on safety of people and animals.

What are the expected contents of the deep diversion channel such as dead animals and fish after a flood? Such as when it remains unused for years?

Will any silt reside in the channel & how will it be managed? Will it be flushed out post-flood or removed using heavy equipment? If so, will flushing of this channel be an independent event from the original diversion of the river? Given the lessening amount of water in the Elbow River will there be enough power to divert water into the diversion channel to conduct these tasks without threatening the water flow needed by the City of Calgary?

We request information about how the multitude of animals (Reference Appendix E for pictures of some of the animals) are expected to traverse this diversion channel which runs a significant distance north/south? Based on information at the Open Houses we were told that there will not be a fence close along the length of the channel. Instead the fence will be father back. We were also advised that it would only be a 3-strand high fence, with barb wire along the top wire. As shown in Appendix E, the elk could easily jump a 3-strand barb wire fence, including the young calves in the herds. Also, deer and moose easily jump a barb wire fence, and other animals shown in the pictures find ways to get through fencing. It is noted that on the north corner of the Highway 22 bridge is an ancient pathway of deer, elk, moose to cross back and forth. It is such a major animal thoroughfare that there is a sign on Highway 22 to alert motorists to watch for animals crossing.

This plan suggests that animals and people are at risk from attempting to cross the diversion channel. When it is dry, how will they get out if they fall in since it is so deep? This is an unsafe situation for animals and children/adults since there are no Alberta Transportation employees monitoring the area, usually only when there is a flood.

RESERVOIR

The Proponent has not explained what will be left in the reservoir land after the temporary reservoir is drained? Based on this lack of information, we are left to guess what this will look like:

- Standing water left in the reservoir in pools?
- Dead fish, including bull trout, and animals?
- We expect massive piles of silt. Alberta Transportation states that silt could be as deep as 4m and weigh 2.3 million tons.
- Springbank Road muddied, the dirt base of the highway weakened and unsafe to use, especially to have school buses again drive on it, or perhaps the highway may be entirely washed out?

On this basis, we request information be provided to address these concerns.

SPRINGBANK ROAD:

QUESTION 116: ROAD ELEVATIONS

The Proponent states: “An overpass will not be constructed at the intersection of Highway 22 and Springbank Road. Rather, the at-grade intersection of Highway 22 and Springbank Road (Township Road 244) will be raised approximately 5 m for an approximate 500 m stretch to maintain traffic operations during a design flood along Highway 22 and up to a 1:50 year flood along Springbank Road. For floods larger than a 1:50 year flood, Springbank Road will be at least partially submerged, and traffic will be detoured to Highway 22 by means of Range Road 40 and Township Road 250. Culverts in the raised road embankment are sized at 3.67 m to facilitate filling and draining of the reservoir during a flood.”

- Will both Springbank Road and Highway 22 be raised 5 meters for 500 meters? Is this referring to 250 meters on Highway 22 north and south of Highway 22? Is this referring to 500 meters east of Highway 22 for Springbank Road? The Proponent needs to clarify this as it is unclear in their response.

QUESTION 121: HIGHWAY 22 AND SPRINGBANK ROAD AS DAM STRUCTURES (ALSO QUESTION 478)

HIGHWAY 22:

- Will culverts along Highway 22 be large enough for silt-removal equipment to pass through? If not, how will silt and debris be removed from the culverts to ensure drainage in flood events?
- If silt and debris cannot be removed effectively from the culverts during or post-flood, Highway 22 can be expected to function as a dam.

SPRINGBANK ROAD:

The Proponent states: “During operation of the reservoir for the design flood, the roadway embankment would temporarily maintain a hydraulic height exceeding 2.5 m and store more than 30,000 m3, which meets the Province of Alberta’s definition of a dam.”

- Has the cost for upgrades to Springbank Road been updated to reflect classification as a dam? If so, the Proponent needs to clearly articulate the cost. If not, what is the incremental cost?
- It doesn’t appear that the Proponent has included changes in culverts in Springbank from the existing structure. The Proponent needs to clarify what size of culverts are used in Springbank Road today and what is planned culvert size for SR1, if different?
- During floods when Springbank Road is inundated, it is likely that silt will accumulate along Springbank Road and in culverts, therefore:
  - Will culverts along Springbank Road be large enough for silt-removal equipment to pass through? If not, how will silt and debris be removed from the culverts to ensure drainage in flood events?
  - It is highly likely, in our view, that silt will accumulate in culverts during reservoir use and thus, water will not be able to pass effectively through culverts during

draining. The result is that Springbank Road will act as a dam and should be classified as such.
    - What is the cost of classifying Springbank Road as a dam? The Proponent should include this cost in its benefit/cost analysis.
    - Will wave action during reservoir filling and use impact the integrity of Springbank Road?
- How will the Proponent measure and address silt and/or debris accumulation in culverts under Highway 22 and Springbank Road during reservoir use?
- The Proponent should provide the cost for rebuilding Springbank road if it is flooded. Also, the Proponent should get an independent opinion on that cost and the impact of flood water hitting Springbank Road (and effects by waves, etc.) on the road integrity.

QUESTION 122:

Clearly the SR1 road changes will result in higher costs for the eventual twinning of Highway 22. Although the Proponent declines to provide expected costs for this, it is obvious that twinning Highway 22 in its current form will be less costly than twinning Highway 22 with elevated roads and new bridges. This is a cost that will result directly from SR1 and would not occur should another option such as MC1 be chosen.

In Response to the community association questions[13], the Proponent states that it has no plans to upgrade the intersection at Township Road 250 and Highway 22 intersection as part of the SR1 project. They further state that the intersection will be upgraded as part of the twinning of Highway 22[14], which they then go on to say in their answer to Question 122, that this upgrade could be decades away. Given the uncertain timelines with the road twinning, we ask the Regulator to direct the Proponent to include upgrades to the Township Road 250/Highway 22 intersection in the SR1 cost model. This intersection is dangerous and given it is the detour route for traffic, it is incumbent on the Proponent to address this risk.

[13] https://www.nrcb.ca/download_document/2/83/9749/20191203-at-corr-to-springbankcomassoc-re-responses-to-20190726-questions

[14] http://www.transportation.alberta.ca/projects/assets/Area_7_Calgary_Area/Hwy_22_twinning_from_Hwy_8_to_Cochrane/Executive%20Summary.pdf

TESTING OF SR1 INFRASTRUCTURE

Although the Proponent states that the infrastructure will be tested without simulating a flood, we wonder if this is realistic. Further, one would assume that SR1 infrastructure would be used as soon as river levels are high, perhaps before the 160m/s3 target as a "test run" to ensure that processes and systems are functioning well before a larger event?

We ask: Why is the Proponent not planning for a testing process, as this project seems to be the first of its kind in the world?

Questions we request answered about testing include:

- How much of the reservoir will be used for the test(s)?
- How much will the dirt foundation of Springbank Road be impacted and safe in the future for our children in school buses for example?
- What is the latest prediction by Alberta Transportation about how long will water be held in the reservoir before it is released back to the Elbow River?
- Will water temperature be monitored at various points in the reservoir during testing?
- Will mosquito populations be monitored?
- Will downstream water quality be monitored?
- Will groundwater quality be monitored? Where will it be monitored? Who is responsible in the event that residents' wells become contaminated because of the springs running throughout the area that supply their wells? Who will pay for damages, including the predicted possibility that the aquifer will cause basements to be flooded as far away as Redwood Meadows?
- How will the impact of the temporary storage of water on aquatic life be measured?
- How will air quality be monitored following a test? How will dust be tracked & measured?
- Who is responsible for cleaning up the dead animals and fish? Where is that in the budget?
- How frequently will the testing be done on an ongoing basis and what will that testing consist of?
- What notifications will be given for testing to area residents, businesses, schools, and what plans are in place for emergency escape routes such as alternative routes for school buses and other regular traffic in the area?

CONFLICT OF INTEREST

Stantec performed the EIA and is now working as the primary source of responses to IAAC (CEAA) and NRCB. Our understanding is that they will also be the construction firm for SR1. We see this as an inherent conflict of interest. We are not convinced that Stantec can do both roles objectively.

IMPACT OF LOGGING IN MC1 AREA ON THE EFFECTIVENESS OF SR1

We request answers about what impacts the increased logging in the McLean Creek area will have on the SR1 project and on the flood risk to Bragg Creek and Redwood Meadows?

Based on the visuals below, between 2015 and 2019, there has been a substantial increase in logging in the MC1 area and one can reasonably assume that deforestation negatively impacts water retention in the mountains and consequently, the impacts the quantity and velocity of water flowing into the Elbow river.

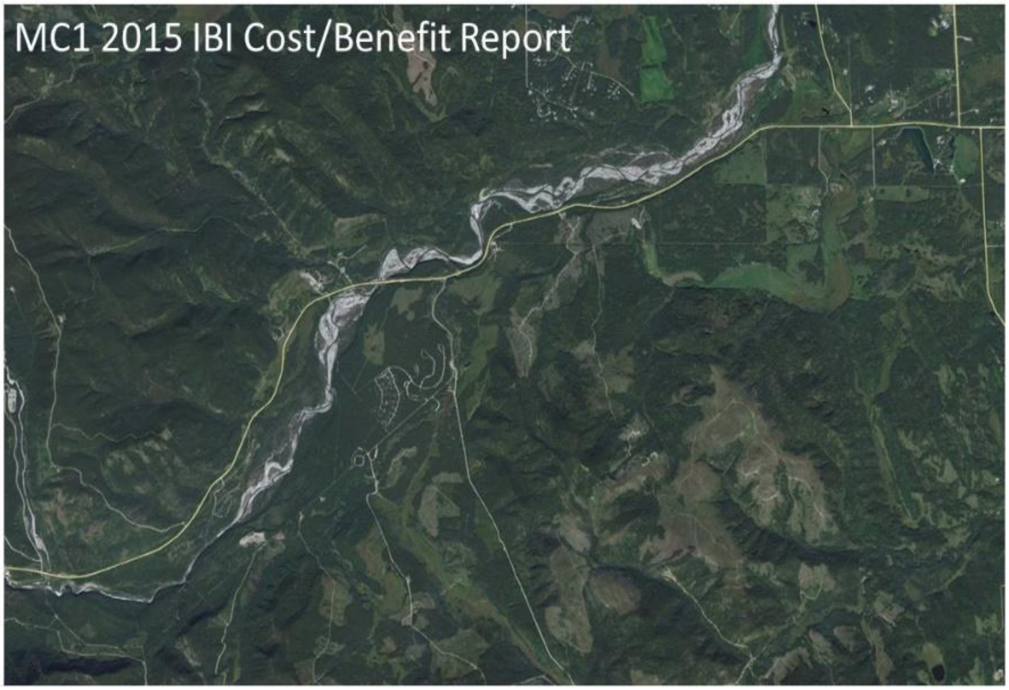
Intact forests are a helpful flood mitigation tool. The Alberta Wilderness Association states:

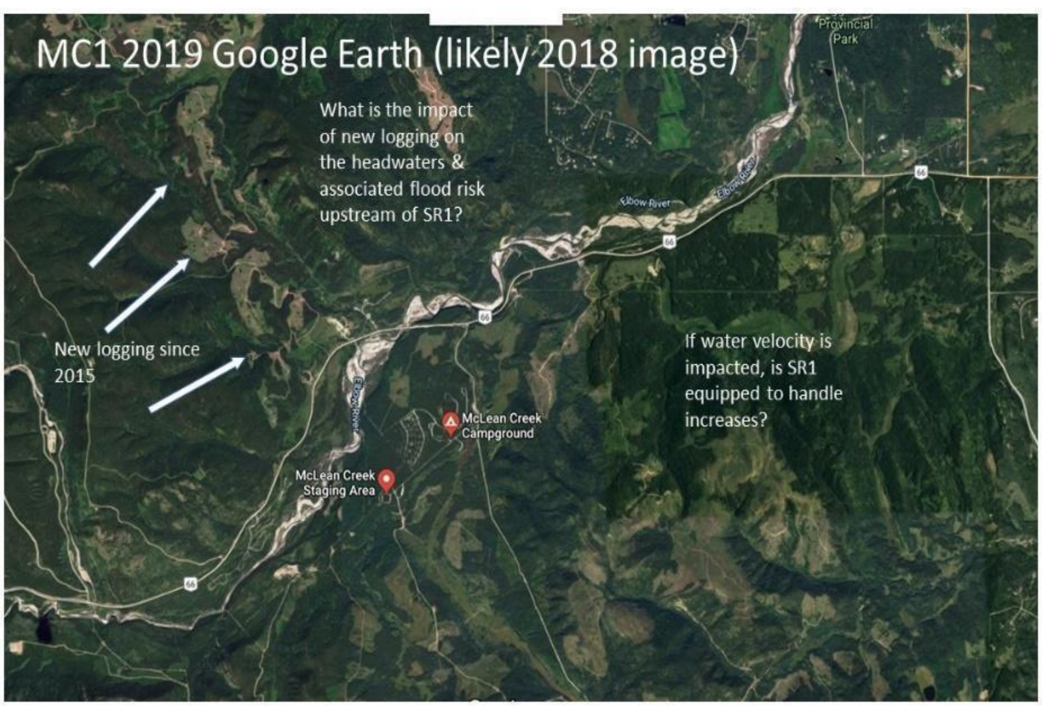
"American Water Works Association has found that every 10 percent increase in forest cover in a watershed – up to 60 percent forest cover – results in a 20 percent decrease in water treatment costs. Forests also contribute to flood prevention by holding water in place. When we destroy our forests, we are destroying one of the key features that helps the landscape retain and slowly release the water it receives."[15]

Further, what, if any, assessments of the new logging in the MC1 area on wildlife have been assessed? In the Deltares report, MC1 was assumed to be more important for wildlife than SR1. Logging, deforestation, and noise/people from All Terrain Vehicles (ATV's) on the south side of the river have already negatively impacted the wildlife in the potential MC1 area, especially from the ATV's.

Have wildlife counts been updated since the original reports were completed? Our residents know that the ATV trails are increasingly busy since it's a very popular area for Calgarians to recreate.

[15] https://albertawilderness.ca/issues/wildwater/headwaters/


MC1 2015 IBI Cost/Benefit Report


MC1 2019 Google Earth (likely 2018 image)
Provincial Park
What is the impact of new logging on the headwaters & associated flood risk upstream of SR1?
Elbow River
66
New logging since 2015
If water velocity is impacted, is SR1 equipped to handle increases?
McLean Creek Campground
McLean Creek Staging Area

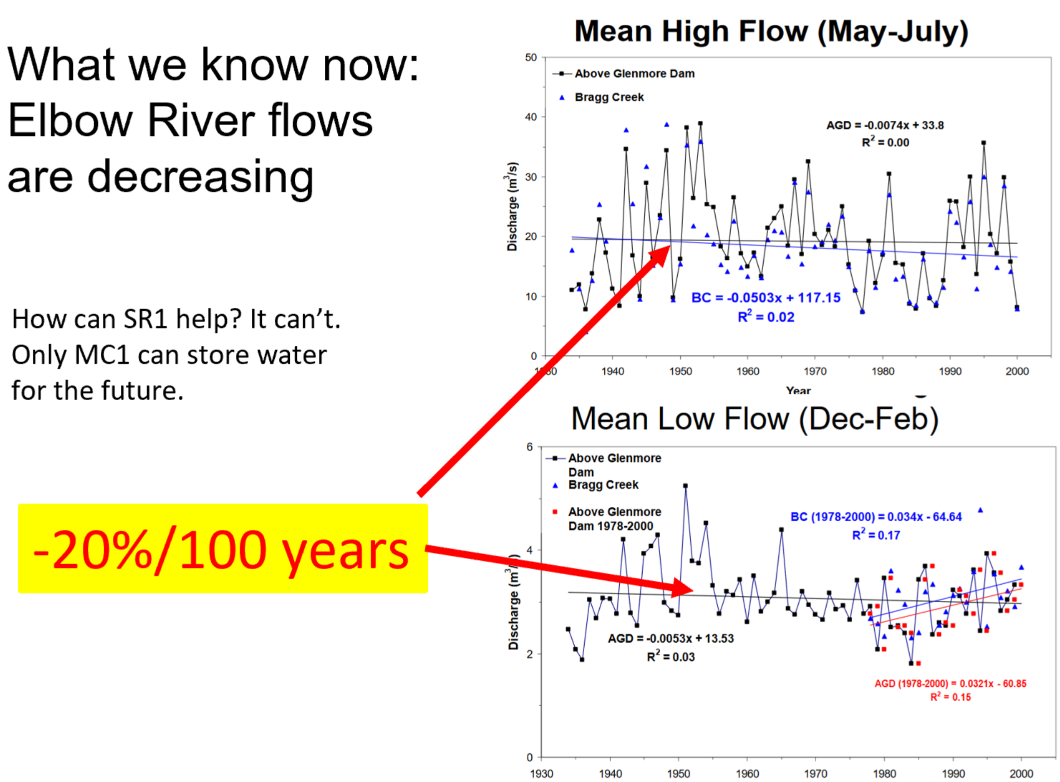
SR1 DECISION: PROCESS FLAWS

The Proponent needs to articulate the original decision criteria from 2014. We ask for written documentation that was used to support the original NRCB Project Summary submission in 2014. What decision criteria was used and what source documents exist?

We see the 2014 WaterSmart Historical Detention site report, which DID NOT include SR1. In fact, this document states "WaterSMART recommends further investigation into the Priddis Diversion concept. Based on review of the 1986 Elbow River Floodplain Management Study and the potential to divert 345 m3 /s, this diversion makes it an ideal choice as it bypasses both Bragg Creek and the City of Calgary. Furthermore, after a brief review of the topography surrounding the Priddis Valley, further storage on this diversion is practical, making it cost effective."

When and how was SR1 introduced as an option and on what basis? How then, considering the context of both flood and drought discussed in the WaterSmart report, did SR1 rise to the top?

It appears that SR1 was originally capable of water storage. How did the project go from one that could store water to one that could not? Again, where is the decision documentation of this?



(U of C EnSc502 2012)

Source: *Elbow River Watershed Assessment: What has changed in the past 14 years: Univ of Calgary Env. Sci. 502 Sept 2015.*

Further, is difficult to ascertain:

- When and how the SR1 project was identified, by whom and under what scope of work;
- What decision criteria were used to narrow the range of projects, many dating back decades, to SR1 and McLean Creek;
- Why water storage was not included as criteria for project evaluation considering that many reports, when early reports by WaterSmart, the Bow Basin Council, and AMEC stress the importance of drought management, and, in fact, early designs of both MC1 and SR1 included so-called live storage;
- Who, and on what basis, decided to focus on “flood” over “water management”, which could include water security, drought management, fire suppression and recreation?
- Given that SR1 was publicly announced by the Premier in the fall of 2014: when, and using what set of criteria, was SR1 chosen over McLean Creek prior to this announcement;
- Who made the decision, and on what basis, to omit public consultation and stakeholder consultation during the option analysis all the way through 2014 up to the release of the “infamous” Deltares Report? Affected stakeholders include landowners, the communities of Springbank, Redwood Meadows, Bragg Creek, Rocky View County, and Tsuut’ina Nation.
- What experts were consulted, and what research was used to arrive at various “value-based” judgements in the Deltares Report, including assessments of First Nations opposition, the perceived value of recreation capacity at MC1, speed of implementation, climate change and wildlife impacts, all of which favoured SR1 over MC1 without supporting evidence?

ALTERNATIVE MEANS ANALYSIS (IAAC (CEAA) AR3-45, NRCB QUESTION 165)

OUR VIEW:

The Proponent never intended to fully examine Alternate Means. Appendix C includes a detailed public history of SR1. SR1 has been the only project considered for the Elbow River from 2014 onward. The assessment of McLean Creek appears to be a "box check" undertaking by the Proponent. We request that the Proponent perform an updated option analysis, using current information. The significance of this project for the entire Calgary and Elbow River regions cannot be understated. A project of this magnitude must be chosen in a fair, open process.

Our communities prepared the following high-level assessment. Note that this does not address risk, which should be independently assessed.

	SR1	McLean Creek
Description	**Off-Stream Reservoir**	**Conventional Dam**
Land Designation	Private Land	Crown Land
Estimated Price[1]	\$506+ Million	\$407 Million
Land Required	4000 - 7000 Acres	1200 Acres / 2300 Acres [5]
Capacity	Up to 104 million m^3	93 million m^3 [(7)]
Timing	4 Year construction	4 year construction
Impacted Utility / Gov't Infrastructure	Multiple high pressure pipelines & roads	One pipeline, one road, old ranger station, transmission line
Other Impacted Infrastructure	Numerous homes & businesses, Kamp Kiwanis	Campgrounds & parking
Current Status	Approvals delayed	Not seriously considered
Flood Protection		
Calgary	Yes	Yes
Bragg Creek / Redwood Meadows	No	Yes
Impact on Local Area		
Health (Air, Water Quality, Mental Health)[2]	Harmful	Positive
Social (Tourism, Community)[3]	Harmful	Positive
Economic (Taxes, Businesses, Development Opportunity)[4]	Harmful	Positive
Ancillary Benefits		
Hydroelectricity	None	TBC
Water Storage	None	Yes
Fire Protection	None	Yes
Drought Management	None	Yes
Parks & Recreation	None[6]	Yes

Notes

1: SR1 costs (\$463M from IR45-3) updated to include Bragg Creek berms (\$42M) for a total of \$506M . True infrastructure costs of moving pipelines & elevating Hwy 22, lost economic value of the SR1 land and fair compensation to private landowners; McLean Creek cost model ignoring postive economic outcomes from conventional dam and tourism-related economic benefits.

2: SR1 planners have not adequately addressed water and air quality concerns within the Springbank area

3: SR1 project analysis have omitted tourism and social consequences on local community (i.e. road closures) while at the same time ignoring the lasting social and recreational benefits of other upstream conventional dam projects

4: SR1 cost model disregards the material financial harm to RVC that result from loss of significant amount of private land

5: MC1 land requirements have increased in the 2019 IRs but unable to find justification

6: Existing recreation areas in MC1 areas remain status quo; much damage from 2013 floods remains

7: 2017 MC1 Volume 1: At PMF, auxilliary spillway would be activated

EXPLANATION

In March 2014, a WaterSmart Study (Bow Basin Flood Mitigation and Watershed Management Project) did NOT include SR1 as an alternative for flood mitigation, but rather, a range of other options were identified:

Concept Category	Short Term (Quick Wins by 2014)	Medium Term (2-5 years - by 2018)	Long Term (> 5 years)
Natural Mitigation	• Initiate bio-engineered bank protection where appropriate	• Increase the capacity of the Elbow River through Calgary • Natural channel design through developed areas • Engineered wetlands in Fish Creek • Wetland detention capacity of the whole Bow Basin	• Mitigation through land management and use practices that reduce runoff throughout the Bow Basin
Operational Mitigation	• Operate Glenmore for flood control • Dredging in reservoir and/or river reaches	• Low impact development to manage storm water	
New Infrastructure Mitigation	• Armour river banks in key spots • Divert high flow into suitable low-lying areas	• Diversion from Glenmore to Bow River under 58th Ave. • Priddis Creek area diversion upstream of Bragg Creek to Fish Creek, with detention • Glenmore to Fish Creek diversion (SWCRR or other path), with detention • Multiple historically identified detention sites • Dikes protecting downtown Calgary infrastructure	• Dry dam at Quirk Creek (EQ1) • Dry dam on Canyon Creek (EC1) • Detention on Prairie Creek • Multiple small detentions instead of one • Expand capacity of Glenmore reservoir

SR1 appeared for the first time in June 2014 by Amec Foster Wheeler. In July 2013, The Alberta Government commissioned a "Flood Recovery Task Force"[16]. The Southern Alberta Flood Recovery Task Force hired AMEC to prepare a report in June 2014 [17]. The report included SR1 as an option to management flood on the Elbow River with the assumptions that "For the purpose of this conceptual assessment a live storage containment of 9,000 dam3 has been assumed providing a maximum pond depth of 10 m.". Live storage was included to "dissipate energy" and to be used for recreational/environmental purposes and/or an additional water supply source for the City of Calgary". *We highlight the original concept of SR1, with live storage, to illustrate the magnitude of change for the project, which now will not have permanent live storage and cannot be used for recreation or a water supply source.*

In fact, the recommendation by the Task Force stated "Environmental assessments and preliminary design for both MC1 and SR1 schemes should be progressed until such time as one

[16] https://www.alberta.ca/assets/documents/2013-Flood-Recovery-Framework.pdf
[17] https://open.alberta.ca/dataset/8106746d-34af-4f2a-b104-3ff4cbfc65ab/resource/f0f11687-9f0e-43df-865a-48343e5ece1a/download/2014-cw2174-volume-1-summary-recommendations-report-3-june-2014-final.pdf

becomes the preferred scheme."

Further, the 2014 Task Force report included this statement regarding SR1 and MC1 (page 70)[18]: "Potential exists for multi-use storage at both sites with little impact on project cost. This is in addition to flood storage, and/or can be included as flood storage. **This multi-use storage could be of significant future benefit at little or no upfront/future cost.** The need for and amount of such multi-use storage should be given early consideration as it impacts design and environmental assessments".

Interestingly, somewhere along the way, multi-use storage was omitted for both projects. One of the main sources of frustration expressed by the western communities is the lack of consideration of multi-use storage, which would have tangible benefits to numerous sets of stakeholders, including the City of Calgary and the Province of Alberta.

Further, the report concludes (p71): "Before a preferred site can be selected between MC1 and SR1, the GoA will need to determine the required design standard, the options available for multi-use storage and also will need to resolve land access issues to enable a full programme of geotechnical drilling and environmental surveys to be undertaken at SR1. At this stage, land access issues at SR1 prohibit AMEC from undertaking sufficient work to enable a recommendation on the best scheme to be made." In our view, the land access challenges for SR1 have contributed to the delays.

What we do not know is how, in September 2014, just two months after the Flood Recovery Task Force Report recommended study of both MC1 and SR1, SR1 became the chosen project. In the fall of 2014, Premier Prentice publicly stated the intent of the Alberta Government to proceed with SR1.

In February 2015, based on IBI Benefit/Cost Reports from that month, the Proponent released a "Fact Sheet" stating that SR1 had a higher benefit/cost ratio[19]. Again, note that this statement by the Alberta Government was made without any consultation with western stakeholders. Also note that Deltares report was not released until October 2015, eight months later.

In October 2014, Deltares prepared a report which is one of basis for choosing SR1. This report is generally cited as the cornerstone of the SR1 decision, yet, it appears the Deltares was a relatively high-level report. Deltares did not appear to conduct research or independent consultations, and based their recommendations on existing government reports such as the IBI benefit/cost.

We request information about the Deltares Report:

- How much did the Deltares Report cost?
- What was the stated scope of work (Terms of Reference)?
- Did Deltares conduct its own research or did it exclusively use Alberta Government information?

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[18] https://open.alberta.ca/dataset/8106746d-34af-4f2a-b104-3ff4cbfc65ab/resource/67a47ce1-92df-461c-a17d-89de10adad49/download/2014-volume-4-flood-mitigation-measures-master.pdf

[19] Elbow River Flood Mitigation Project Decisions Fact Sheet

- How did the draft reports differ from the final report issued by Deltares?

Based on history of the project, See Appendix C, it seems that SR1 was chosen before the Deltares Report. The Alternative Means Analysis does not appear to have been performed with the intent of a fair and open process, resulting in a recommendation that seems pre-determined.

Re: https://www.nrcb.ca/download_document/2/83/9114/20190614-at-eia-to-nrcb-re-IAAC (CEAA)-ir-response-package-3
We request that the Proponent detail its consultation process for SR1. What consultations took place, when and with whom and to what end for both SR1 and MC1?

As mentioned previously, we request information about any consultations that took place with the Tsuut'ina Nation on the MC1 project

It appears that the 2017 Hemmera Report refers to positive outcomes of McLean Creek and negative outcomes that may be "substantive or non-substantive" depending on the individual indigenous group. This report needs to be followed up and more detail is needed – what were the negative (and positive) outcomes of the MC1 project for First Nations?

We have not seen the scoring system used to choose SR1 over MC1. The story that we have heard about AMEC identifying SR1 is that an AMEC employee was driving on Springbank road and surmised that it would be a good location to store water because the contours were conducive to having the flood waters flow naturally south east to be held by a dirt reservoir wall, and then slowly released back to the Elbow River over a period of about 60-90 days, and that the land was not being used for much. We would like the Proponent to confirm or refute this story by releasing documents on the origin of the SR1 concept.

We request to see the scoring system that compares SR1 and MC1. We have the AMEC benefit/cost reports and the Deltares report but have not seen any comprehensive decision document with desired outcomes, weighting schemes and the like.

We point out that we have been vilified for asking questions and told we are standing in the way of flood mitigation for 1.3 million residents of Calgary. This is untrue. We all support having flood management. The City of Calgary and the Province of Alberta dismissed our ranchers as "greedy landowners." We want answers to all our questions before a decision is made, as to how this project will impact our community and how it contributes to managing the Elbow River over the long run, and how it is of benefit to Albertans, since it clearly has no benefit to those thousands of us upstream of SR1, nor does SR1 solve the new problems of fire and drought. .

Importantly, on the cover letter of the pivotal Deltares report, their consultant states:

> "Without additional information on sediment transport, it is difficult to express a well substantiated preference for either of the two projects from this point of view." AND "This needs to be verified by sediment transport studies."

We request to see information that the Proponent addressed this information deficit that was highlighted by Deltares.

Further, the consultant, based on some unknown source, states:

SR1 is pasture land and its use does not change except during high river discharges.

Was Deltares told about Kamp Kiwanis at the intake? Were they told about the equestrian centre at the intake? Were they told about the magnitude of ranch lands and how the original grasslands withstand all types of weather such that the cattle thrive on these native grasses that once gone, can likely never be replaced by equal nutrition value grasses and hardiness? We request that research be provided showing the scientific considerations regarding the loss of this unique native grasses. We also request the research showing the reference that SR1 is only pasture land?

The Deltares Report concludes:

"Environmental Impact: Based on the reports completed to date, environmental impacts (in terms of impact on endangered species) are less for SR1 than for MC1."

We request documentation about the "reports completed to date" and documentation that shows the analysis supporting the impacts on endangered species that Deltares refers to?

Deltares also states: "Both facilities can be adapted to climate change".

We request seeing the explanation of how SR1 can be adapted to climate change? Without this explanation on record, it is difficult to support this conclusion compared to what MC1 offers.

Regarding timelines, Deltares states:

"**Regulatory risk:** It is expected that the regulatory process would be significantly longer for MC1 than SR1 due to the need for environmental mitigation and First Nations consultation.".

This statement shows the lack of consultation with First Nations, since they have publicly stated they are against SR1. Comments such as the impact on endangered Bull Trout suggests that there was minimal consideration of options for MC1 such as fish ladders that have been successfully proven to work. We request evidence of how Deltares arrived at these conclusions?

Without the forgoing additional evidence and science, it seems that the basis for choosing SR1 over MC1 is mostly based on a file/desk review of existing, old, information. For example, who told Deltares that First Nations opposition would be greater at McLean Creek and on what basis?

NARROW FRAME OF REFERENCE:

OUR VIEW:

SR1's objective is solely for flood mitigation for City of Calgary's Elbow River communities. Thus, opportunities for broader water management outcomes were not considered in 2013/2014. A project of this size/cost needs to consider all elements of water management: drought, flood, recreation, fire mitigation and water security. SR1 only achieves one of those objectives. Interestingly, the 2014 Task Force report highlights the opportunities for multi-use storage at MC1 and SR1 that were never subsequently explored. SR1 constitutes a lost opportunity for all Albertans to invest in legacy water infrastructure that benefits future generations.

The regulatory reviews offer the opportunity to consider the best Interest of Albertans.

EXCLUSION OF WILDFIRE MANAGEMENT:

We contend that, in the **Alternative Option Analysis**, the Proponent did not consider the impact of wildfire in the Bragg Creek & Kananaskis areas. The risk of wildfire is considerable in this region, in fact the area is designated as being at High Risk for fire. The MC1 option could provide much needed improvement to fire response and prevention. Additionally, the potential impact of wildfire on the drinking water supply must be considered when choosing between SR1 and MC1. A 2011 study for the City of Calgary concluded that **"A large fire could have a profound effect on raw water quality (especially in the small Elbow River watershed) and the effect could last for years."**

Wildfire suppression for East Kananaskis, Bragg Creek, Redwood Meadows and the Sheep River area would be supplied by a permanent reservoir at McLean Creek**.** Bragg Creek currently is second in Alberta at risk for wildfire, behind Jasper (both Fort McMurray and Slave Lake used to higher priority, but they have had wildfires). During the Champion Lakes fire May 2018, many of the helicopters had to go to Ghost Lake for water with a return time of 25 minutes. This was a big concern as the fire initially grew rapidly. Fortunately, an afternoon wind direction change helped firefighters gain control of the fire.

Wildfire & water contamination: A large wildfire in the Elbow River headwaters would create a huge cost in water treatment at Glenmore Reservoir as well as increased spring runoff and lower summer river flows. Of particular concern is Dissolved Organic Carbon (DOC) which when combined with chlorine, produces carcinogenic compounds. Municipal water services in Canberra Australia (2003) had to build a new treatment facility, Fort Collins CO (2012) had to draw on a nearby lake, and Fort McMurray now spends more than twice previous costs to treat water and are still unsure of their ability to remove DOCs. A lake at MC-1 would settle ash and particulates helping reduce at least turbidity and some heavy metals precipitates. The City of Calgary Water Services is very concerned of this risk.

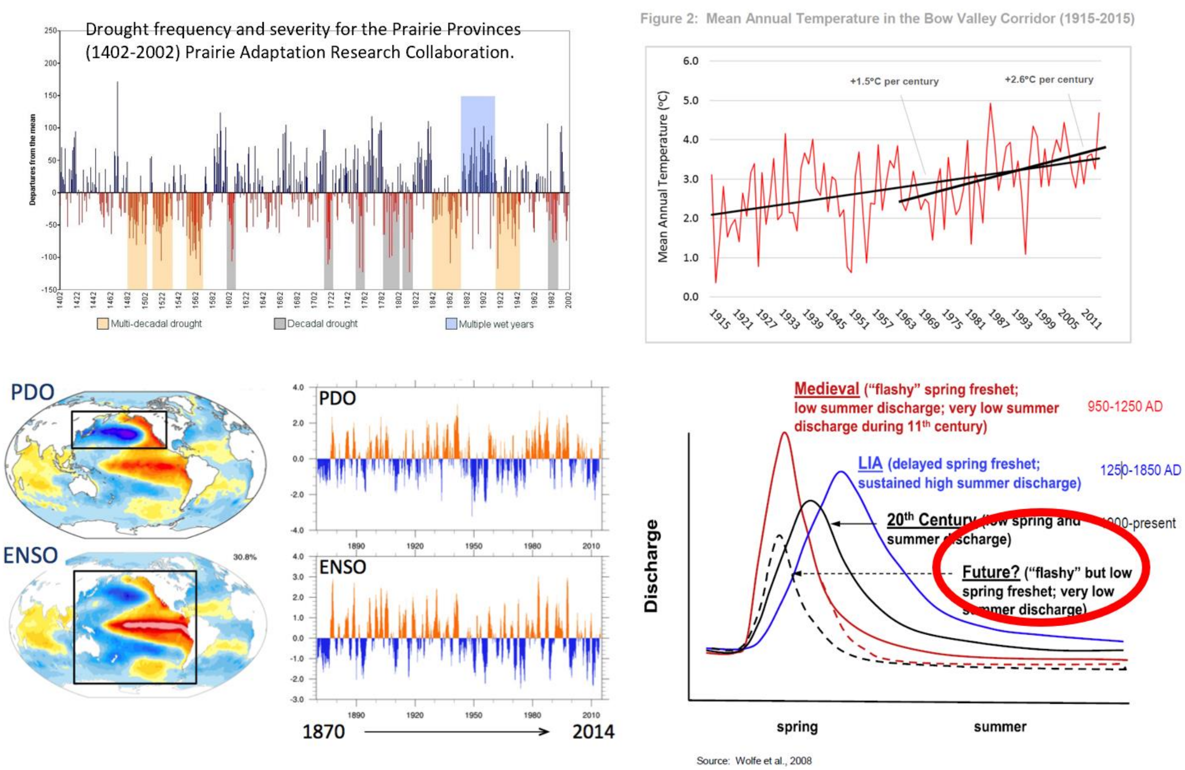
Reference additional information on this topic in **Appendix A about Wildfires, a new consideration.**

EXCLUSION OF WATER SECURITY:

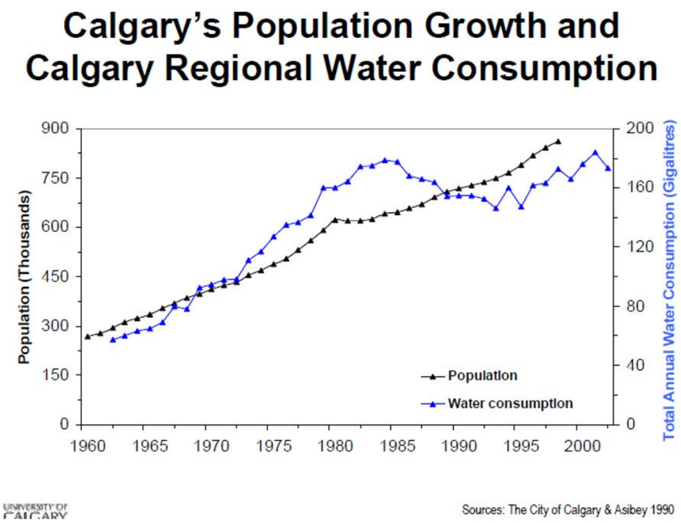
Elbow River water flows are declining in volume since records have been kept (about the last 100 years) and particularly since the 1960’s. At current growth rates and without significant per capita water conservation, Calgary has a high probability of exceeding water supply by about 2034 as was noted in the City of Calgary special meeting May 16, 2019. The Elbow River supplies drinking water to more than 500,000 residents along the watershed and in Calgary. A permanent reservoir at McLean Creek ensures future water supplies for drinking and wildfire suppression.

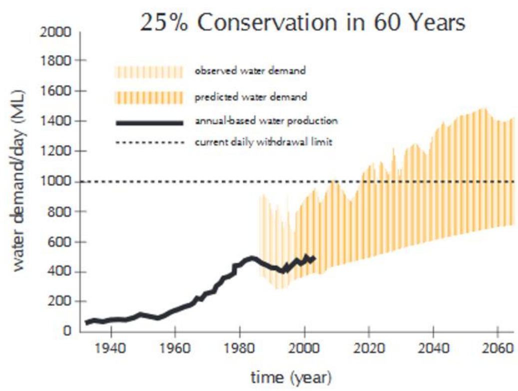
What we know now: Rising temperatures and increasing drought

"It isn't going to be 50 years between droughts. We're going to be moving into a more constant state of dry." Dr. Mary-Ellen Tyler, U of C Drought Adaptation professor.



What we know now: Calgary has a water security problem





The Elbow River supplies approximately 40% of Calgary's water needs. May 14 2019 Calgary City Special Meeting on water security predicts water licenses exceeded 2036.

EXCLUSION OF ADDITIONAL BENEFITS FROM MULTI-USE STORAGE:

We request that the Proponent, as part of the Alternative Means Analysis, conduct a study of the benefits of multi-use storage as originally conceived in the McLean Creek Benefit/Cost Analysis. It appears that the Proponent has excluded benefits from water storage and we are curious if this is because it would make MC1 look better than SR1?

DECISION PROCESS SKIPPED PUBLIC CONSULTATION

See **Appendix C** for a public history of the SR1 project.

OUR VIEW:

SR1 does not have the legitimacy to proceed due to the omission of stakeholder communities during the initial decision-making process. The impacts of the project on local communities, residents and landowners were not considered at the start.

Alberta Transportation has consistently met with representatives from Calgary River Communities Action Group (at least 6 times in public documents) and only once with our communities on November 30, 2018 to listen to alternative concepts such as Tri-Rivers Joint Reservoir. The lack of consultation with affected communities west of Calgary gives the appearance that the process has been biased towards Calgary. Further, the first conversation with landowners was biased since it included representatives from the Alberta Government expropriation team. We note that the expropriation team was there because of the urgency of needing protection from further floods in Calgary. Unfortunately, the Alberta Government neglected to have meetings with us stakeholders to consult with our communities so that we could better understand the plans for this massive project and we could identify ideas to mitigate its impacts. Instead the Alberta Government chose to have open houses in 2016 and 2018 to describe what they had decided and their plans for implementation. We were excluded from input to the decision-making process.

An example of information sharing is shown at a meeting with landowners in 2015 to explain SR1, the Government shared the following slide[20]

[20] https://drive.google.com/open?id=1ArWmZfFC9NtdjdllAE8cdP27DSNPC70A

Note that the GoA admitted to their "lack of communication" and identified the need to "do better."

As an example of the double standard applied to SR1 stakeholder engagements, the Minister of Transportation, the Director and Assistant Director of Springbank Project at Alberta Transportation attended the Calgary River Communities Action Group AGM meeting on September 20, 2019. The Minister of Transportation has attended this meeting on previous occasions as well. We are concerned about the appearance of the government staff, funded by the taxpayers of Alberta, at a members-only meeting of a special interest group of Calgary residents. We have invited the Proponent to our community information sessions for SR1. Only at the Redwood Meadows stakeholder's information in October 2018 session (was the impetus for the November 2018 meeting) did a representative from the Proponent attend to hear what was being said by our group of volunteers.

MATERIAL CHANGES TO SCOPE AND COST

SUMMARY

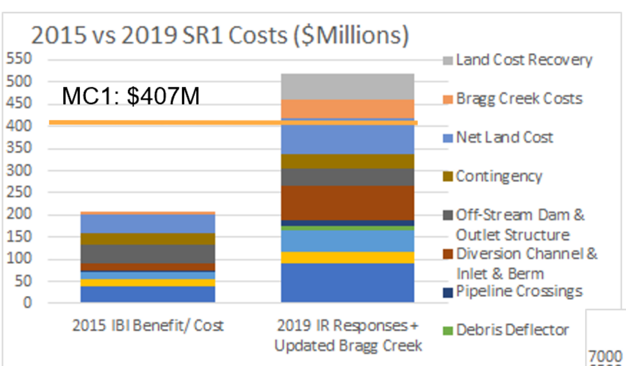
This is a materially different project than the one that was chosen by the Alberta Government in 2014/2015. We request to be informed as to how the regulatory process allows the Proponent to continue to significantly increase the cost, size and structures of the initial project.

Please provide a history of the size and cost escalations for SR1 including date, authority, type of change, cost, etc.

On this basis, we request that the Proponent document a comparison of the initial project scope and cost since the project was selected in 2013/2014 to the current project scope and cost. The document comparison needs to include the broad range of the impact such as: total cost actual land purchases to date, and proposed cost of additional land purchases required, size of reservoir, major project components, transportation costs of Highway 22 upgrades, cost of all bridges, etc. We have begun the estimates in the following few sections and we request that the Alberta government provide a full estimated cost that includes all budgeted items from all aspects such as including bridge costs.

Our summary of the cost and land escalations s below:

SR1 project has changed materially over time

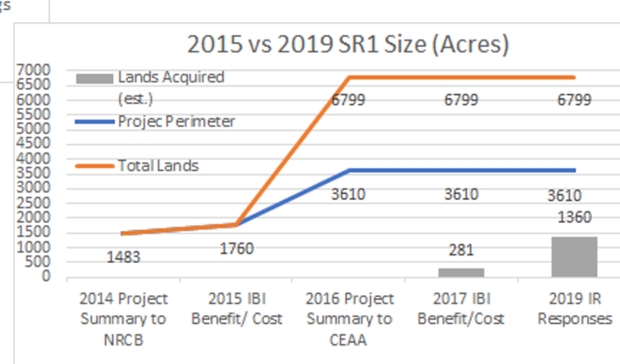


SR1 Costs more than McLean Creek by more $100M

AND...SR1 erodes value from West Rocky View in perpetuity; MC1 creates value!

SR1 land needs have grown from 1400 acres in 2014 to nearly 7000 acres

The project has grown unchecked.



SR1 costs: https://www.nrcb.ca/download_document/2/83/9104/20190614-at-eia-to-nrcb-re-ceaa-ir-response-package-3-appendix-ir45-2
MC1 Costs: sir1-response-appendix-ir6-1

EXPLANATION:

A project summary was submitted to the NRCB in 2014, which included the following:

Projected Construction Start (Month/Year):	08/2016	Projected Operation Start (Month/Year):	10/2017
Life of Project (# years, YYYY - YYYY):	2017-indefinite Permanent installation	Project Location (Legal Land Description) and Municipality:	Project centered on Section 24-Township 24 –Range 4, West of the Fifth Meridian in Rocky View County
Total Project Area (ha):	Approximately 600 ha (full extent to be determined in final design)	Private, Federal, or Provincial Land:	Private (to be purchases by Crown)
Nearest Residence(s) (km):	One residence within flooded area.	Nearest First Nation Reserve(s) (name and km):	Tsuu T'ina Nation 145 (3 kilometres from diversion structure)
Unique Environmental or Social Considerations (Describe or None):	None	Historic Resources Impact Assessment Required (Y/N/Unknown):	Y
Estimated Construction Person-Years of Employment:	50 people for 18 months	Estimated Operation Persons-Years of Employment:	1 person, continuous
Infrastructure Requirements (roads, pipelines, water intake, storage, tankage):	Diversion works(embankment and gates), canal, dam	Project By-Products:	N/A

In 2014, according to the Project Summary:

- The project size was approximately 1400 acres. It is now 6800.
- There was one residence impacted. There are now 20+ residences impacted.
- Tsuut'ina Nation was 3km from the project. Now we know that Tsuut'ina is 395m from the project.
- There were no "unique environmental or social considerations". We know that there are a range of negative social, environmental, health outcomes associated with the project that were not acknowledged.
- In 2014, there was no statement of pipeline impacts from SR1; we know now that numerous pipelines traverse the project footprint and must be moved or otherwise adapted to SR1. What are these costs?
- Construction estimated 50 people for construction for 18 months; now the estimates are 400+ people during construction.

In the original meeting with the landowners in 2015, the following was presented[21]:

Off-Stream vs On-Stream Storage

- **Drought Protection: live storage can be added to either option**
- **On-stream (MC1): $189 Million**
  - Protects Bragg Creek and Calgary
  - Store 58,000 dam³ of water
- **Off-stream (SR1): $193 Million**
  - Protects Calgary
  - Store 57,000 dam³ of water
  - Less physical disturbance to the stream
  - Less construction window restrictions
  - Fish passage on the Elbow River can be implemented

[21] https://drive.google.com/open?id=1ArWmZfFC9NtdjdllAE8cdP27DSNPC70A

SIZE:

In 2014, SR1 was estimated at 1400 acres. In 2015, SR1 was estimated at 1,760 acres. The current project footprint is 3610 acres of land in the project footprint and 6800 of lands that are impacted.

COST:

In 2015, the cost was $193 million (2015 IBI Reports). This is vastly different than the current cost estimate of $477million. Again, the increase illustrates that "live storage" can be added to either option, which has been removed from SR1 subsequently. We request to know the reason for this removal.

The Proponent states that "SR1 land acquisition costs were originally estimated based on the project footprint of the preliminary design, which was approximately 1760 acres. Total land costs were estimated at $40 million." Today, land costs are estimated at $140 million due to an enlarged footprint and also "it has become apparent that willing sales of the land will require much higher compensatory amounts than originally suggested." [22]

SCOPE:

COMPONENTS:

The 2016 Project Description submitted to IAAC (CEAA) states the following:
"The Project consists of the construction and operation of an Off-stream Storage Reservoir, a Diversion Structure located at the Elbow River, a Diversion Channel to transport diverted floodwater into the reservoir, an Off-stream Storage Dam to contain the diverted floodwater, and Outlet Works to return the stored water back to the river following a flood."

There is no mention of another significant "in-river" component thus the project should be resubmitted. The addition of the debris deflector, a core element for project success, is a material change that was not contemplated until late 2017, after the Open Houses.

[22] https://www.nrcb.ca/download_document/2/83/9124/20190614-at-sir-to-nrcb-re-sir1-response-appendix-ir6-1

Item	Estimated Cost ($2017)
Mobilization	$ 360,000
Construction of Debris Deflector	$ 7,370,633
Contingency	$ 1,159,000
Construction Sub-Total	**$ 8,889,633**
Engineering and Environmental Fees	$ 740,000
Project Total	**$ 9,629,633**

A change such as this illustrates the oversimplification of SR1 in its original form.

DIVERSION CHANNEL:

The 2015 IBI reports states the following about the Diversion Channel:
"The diversion channel is designed to convey a peak diversion flow of 300 m3/s from the Elbow River into the off-stream storage reservoir. The channel is designed with a 24 m bottom width, three horizontal to one vertical side slopes and a 3.6 m water depth."

The 2016 project summary doubles the size of the diversion channel from earlier designs. It is now designed for 600m3/s of water (vs 300m3/s) and has a maximum water depth of 6.4 meters (versus 3.6 meters). This increase in height of the channel becomes a significant risk to wildlife when they fall in.
See Appendix E regarding the large elk herd that roams throughout the Springbank area.

HEALTH, SOCIAL AND ENVIRONMENTAL IMPACTS:

In the 2014 NRCB Project Summary, there were "None" identified for these categories. Over the past 6 years significant negative outcomes were identified regarding to the Springbank area, to the environment, and that there are social costs to impacted communities that were never contemplated.

In fact, the Proponent heard so many negative comments in 2016 at the Open Houses and during letters to IAAC (CEAA) that it finally publicly acknowledged outcomes (dust, methylmercury, wildlife, among others) only in 2018 at the second set of Open Houses. Note, throughout this entire process from 2014 to 2018, the message from the Alberta Government was that only a few landowners—about four were impacted. The implication was that there were no other negative outcomes. This continuing inaccurate message to the public was - and continues to be - harmful to this process and to our communities.

FLAWED TRIPLE-BOTTOM LINES ANALYSIS:

Re: https://www.nrcb.ca/download_document/2/83/9124/20190614-at-sir-to-nrcb-re-sir1-response-appendix-ir6-1

Re: Question 23 Volume 4, Supporting Documentation, 1. IBI Report, Section 3.3.1.1, Page 10, and Exhibits 3.5, 3.6 and 3.7

The Proponent states: "The triple bottom line analysis was not used to compare SR1 and the MC1 Option. SR1 was included as an upstream storage option for Elbow River and, as such, the MC1 Option would have yielded the same benefits had it been included.".

OUR VIEW:

To date, the only triple-bottom line analysis completed for SR1 was conducted from the City of Calgary perspective. Had the Proponent considered the triple-bottom line benefits for Albertans we suggest the outcome of the analysis would be different, and far less favorable to SR1. There is a long list of benefits that are unique to MC1 - fire mitigation, drought management, water security and recreation. The Triple-Bottom Line analysis submitted by the Proponent is not valid due to the exclusion of benefits and costs outside the City of Calgary's borders. The negative outcomes of SR1 are borne largely by the Western Communities of Springbank, Redwood Meadows, Tsuut'ina Nation and Bragg Creek.

EXPLANATION:

In Appendix IR6-1 (p7) the Proponent states the following regarding the 2017 analysis (City of Calgary report):

> Each scenario was assessed against a variety of triple-bottom-line criteria, including a BCA. Key points about this study in relation to the BCA for SR1 and MC1 are as follows:
>
> - The scenario that was identified as SR1 (scenario 1) also included the operating agreement between TransAlta and the Government of Alberta for Bow River facilities along with existing and planned barriers and pump stations along the Bow River. Upstream storage (SR1) was the only measure on the Elbow River however, the BCA was for the entire scenario (both the Bow and Elbow Rivers).
> - A high-level estimate of $500 million was used for the Elbow River upstream storage facility.
> - Although the BCA and benefits were reported by scenario, the damages for each scenario could be classified as occurring due to the Bow or Elbow River, allowing for an extraction of benefits on the Elbow River attributed to the upstream storage option.
> - The level of protection and benefits would have been the same if it was assumed to be MC1 upstream on the Elbow River because the scope of the assessment was limited to the City of Calgary.

The last point is critical and highlights one of the main errors with the SR1 and MC1 analysis: "the scope of the assessment was limited to the City of Calgary."

In our view, there has been an intentional exclusion of benefits and costs from the upstream communities along the Elbow River. This continued exclusion of dialogue and input from communities other than the City of Calgary only served to entrench the perspectives of the western communities that MC1 was never really considered, as we strongly believe that the MC1 option offers a long-list of benefits that have been ignored.

Additionally, the Scenario 1 (SR1 + TransAlta Agreements) from the 2017 report includes the full benefits of mitigation on the Bow and Elbow Rivers with only SR1 infrastructure.

We request that the Proponent provide information that separates the benefits and costs of the TransAlta agreements from the SR1 discussion. This is irrelevant to the SR1 decision and only skewed the SR1 decision presented to the City of Calgary to make it look like the most obvious choice based on benefits from the TransAlta agreements. Combining SR1 and TransAlta agreements confused the true impacts of SR1 for the Elbow River.

USE OF VALUE-BASED JUDGEMENTS

The Deltares Report relied heavily on value-based judgments. Value-based judgments, made by consultants, and without input from critical stakeholders such as Tsuut'ina Nation, Redwood Meadows, or Bragg Creek residents, in particular with regard to MC1, have impaired the decision-making process.

We refer to the Rocky View County Report on SR1, which explained why these value-based judgments are problematic[23]. For example, the perceived premium for recreational land over private land; the preference for leaving natural forests over grasslands; the importance of preserving campgrounds versus private homes and businesses.

MC1 RECREATIONAL UTILITY:

The 2014 Task Force Report states that "This study considers the construction of a dam at MC1 downstream of Allen Bill Pond; the pond would be within the impoundment area of this dam. The conceptual dam design includes a permanent pond and this could be an effective replacement for the lost recreation at Allen Bill Pond. If reconstructed, this recreation area will be at risk of flooding in the future."

One of the most important rationale for choosing SR1 over MC1 appears to be the loss of recreation capacity at McLean Creek under MC1. The 2014 Task Force study undermines that rational by stating that new capacity could be created. However, in 2015, the IBI reports chose to ignore potential benefits from multi-use storage and Deltares lamented the loss of recreational lands at MC1.

The Proponent's continued view of the value of the MC1 lands is as follows:

"In addition to the disposition cancellation costs, the study team at IBI Group strongly believes that any analysis of the MC1 project should consider the cost of land. Although no formal purchase of lands would occur, the land is very valuable to Albertans. As a recreational and natural asset, it is utilized by many more residents than equivalent private land is. *Such land is in limited supply in proximity to major population centres. [Emphasis Added]* Therefore, the value of replacement land should be considered even if Alberta Transportation does not ordinarily include such costs in a benefit/cost analysis. As indicated in section 4.2.3 of the August 2017 benefit/cost submission, IBI Group has estimated that the cost of comparable replacement land for the project footprint at $57.75 million. Considering the total land area impacted, including relocation of the highway, the value would increase to $88.6 million."

This statement reflects the ultimate double standard in this project. The consultants place tremendous value on the MC1 lands, far more so than on the SR1 land, on the basis of "recreational utility". May we ask how Kamp Kiwanis, host to thousands of children, 30 min from Calgary and a hospital, on the river and with natural forest, can replace what is lost to SR1 given "such land is in limited supply in proximity to major population centres"? It can't.

[23] https://www.rockyview.ca/Portals/0/Files/Attachments/2018-12-11-Springbank-Dam-Report.pdf

IAAC (CEAA) GENERAL QUESTIONS

IAAC (CEAA) IR1-04: RESERVOIR OPERATIONS

We have significant concerns about AT's responses concerning reservoir operations. There seems to be much uncertainty about the operations of the SR1 structures during and post flood and therefore, reliance of future information. The Proponent makes numerous statements that refer to future decisions by the reservoir operator regarding sediment, water quality, temperatures, etc. of the Elbow and of the reservoir.

IAAC (CEAA) IR3-01 CLIMATE CHANGE

It appears that the SR1 decision relied heavily on the speed at which SR1 could be completed at the expense of other criteria including the ability of the project to mitigate the effects of climate change. We view that this is a critical process flaw and error of judgement on the part of the Proponent.

We are concerned that the focus of climate change has been exclusively on flood. Historically, drought is a more common condition in Alberta. We request information from the Government of Alberta about how SR1 can assist with drought management relative to a project like McLean Creek, which would include a water reservoir (from McLean Creek Cost/Benefit Analysis by IBI, February 2015: "Additional water could be contained above the dead storage El. 1,398.0 m (i.e., multi-use storage) by regulating the permanent outlet gates using pre-programmed automation methods, rather than leaving the gates in the wide open position as considered herein. The potential value and/or need for multiuse storage at this site should be evaluated as part of the future study."

We ask the Proponent, as part of an updated alternative means study, to compare SR1 and MC1 in their ability to address more elements of climate change including drought, fire and water security.

The 2015 Deltares report states: "The province should continue to pursue the multiple layers approach to flood mitigation as outlined in previous work on Room for the River, structural mitigation is only one element. Programs like wetland restoration, floodway regulations and removal of obstructions should continue. Temporary storage of water in detention areas is not a very robust measure because it is only effective up to a certain magnitude of flood. when that magnitude is overcharged its effectiveness is minimal. And, moreover, it is very sensitive to 'sound operation and fast response time'. Where floods up to the size of the June 2013 flood could be managed, anything above the 2013 flood would not be reduced in impact, the awareness of the people in the floodplain will further decline, making them (and society at large) even more vulnerable."

We view that this statement by Deltares has not been acknowledged in the SR1 decision and subsequent actions by the Alberta Government. The Alberta Government has made no efforts towards wetland restorations on the Elbow River and the City of Calgary continues to allow construction of massive infrastructure on the edge of the Elbow River[24]. Obstructions have not been removed from the floodplain, with the exception of the proposed expropriations in Springbank and Bragg Creek. We see this is a double standard, with mass land sterilization in Springbank acting as insurance for the City of Calgary to continue to build along the river.

We ask, in addition to SR1, what other "Room for the River" measures have been implemented or are planned for the Elbow River? The City of Calgary has conducted extensive upgrades for flood, including improvements to the Glenmore Reservoir, the Calgary Zoo area and more, but what has occurred outside the City limits?

NRCB GENERAL (QUESTIONS 1- 113)

NRCB QUESTION 1: UNNAMED CREEK OPTIONS

Re: https://www.nrcb.ca/download_document/2/83/9208/20190614-at-sir-to-nrcb-re-sir1-response-sec-2-nrcb
It appears that the Government has not included the cost of $4.2 million for upgrading the 1.8km unnamed creek channel that is the outlet to SR1. Instead, they propose sediment removal post-flood. We continue to wait on estimates of post-flood recovery for impacted infrastructure and who is responsible for the costs?

The Proponent needs to list what expected activities will take place in or around the unnamed creek. It is not sufficient to say that smaller equipment will be used. What equipment, for what purpose, at what locations, and using what access?

Will any new landowners be affected by these operations in the unnamed creek?

[24] https://calgaryherald.com/news/local-news/tallest-residential-tower-in-the-city-proposed-for-beltline-site-near-elbow-river

NRCB QUESTION 3: MC1 RECREATION CAPACITY POST-CONSTRUCTION

Re: https://www.nrcb.ca/download_document/2/83/9208/20190614-at-sir-to-nrcb-re-sir1-response-sec-2-nrcb
The Proponent refers to a loss in recreation capacity at MC1 as a negative outcome of that option. Here, local knowledge would have helped frame this discussion.

MC1 changes the recreation capacity of the current recreation area. However, there are opportunities with the creation of a permanent pond! The MC1 Report (Vol 1)[25] states:

> Mitigation measures proposed to reduce or eliminate potential effects to Land Use and Management include identifying alternative areas to offset loss of protected areas; retaining or reconstructing access to affected recreation areas; redirecting recreational users to other recreational use areas; creation of a recreation site associated with the permanent pond; communication of construction schedule and road closures; development of a traffic accommodation strategies; compensation for grazing allotment holders and registered fur management area holders; developing and implementing a plan for infrastructure relocation.

We believe that there would be new recreation activities such as water-based activities of camping, hiking, sailing, and canoeing, on and near the reservoir that would result from permanent water storage. Furthermore, it is reasonable to expect economic benefits to Rocky View County and the hamlet of Bragg Creek and ultimately, the Province of Alberta, resulting from increased and sustainable tourism in the MC1 scenario. **All over Alberta, in-stream dams create economic and social value!**

We request consultation about post-MC1 recreation potential as well as an opportunity to speak about our experiences and concerns with the existing MC1 recreation area.

It is the Proponent's contention that MC1 would cause a loss of recreation capacity. We point out that the recreation areas of Elbow Falls and Allen Bill Pond were largely destroyed by the 2013 floods. A decision was made by Rocky View County not to repair Allen Bill Pond again back to having a pond since it would be further destroyed by future floods. The potential for ongoing damages to what is left in this area and the cost of reconstruction have not been considered by the Proponent.

The MC1 report from February 2015 states:[26]

[25] https://www.nrcb.ca/download_document/2/83/8640/20170919-at-eia-to-nrcb-re-mc1-vol-1
[26] https://www.nrcb.ca/download_document/2/83/9072/20171114-at-eia-r-to-nrcb-re-amec-environmental-overview-of-the-conceptual-elbow-river-dam-at-mclean-creek

- River Cove group campground was destroyed during the 2013 flood, and is currently closed to the public. Flood related repairs are currently under way by Alberta Tourism, Parks & Recreation to fully recover the campground and associated access (Storie pers. comm. 2014).
- Station Flats is a hiking, mountain biking and horseback trailhead located on the north side of Highway 66. It has a small gravelled parking lot and vault toilets.
- Allen Bill Pond was also destroyed during the 2013 flood; however, some facilities still remain intact, including vault toilets and several reconstructed trailheads. Prior to the 2013 flood, Allen Bill Pond was stocked with rainbow trout and was a popular destination in Kananaskis. Staff observations from 2012 indicated frequent or occasional congestion and crowding on weekends (GoA 2012). Recreational use patterns have likely changed since the 2013 flood.

Where is a projected cost for rebuilding the River Cove Campground? Where are projected costs for upgrades to roads and other infrastructure that was damaged in 2013, and is at risk from future flood?

We also contend that the area itself is not able to handle the increasing recreational demands of the 300,000, and growing in numbers, of visitors annually. The road into the area often becomes clogged with day-trippers from the Calgary area and the existing road and parking infrastructure is overburdened.

Further, there seems to be a continued bias towards forest over farmland. We point out that the McLean Creek area has a large area of land for both logging and off highway vehicles. These are both destructive to the natural environment and also to wildlife.

We submit the following summary of the impact of poor environmental management in the McLean Creek area, from Heart Waters, by Kevin Van Tighem:

Officially Sanctioned Vandalism

Neither grizzly bears nor elk nor trout nor clean water, however, can thrive amid busy networks of muddy, eroding trails. The last part of my tour with Gord Lehn took us into the McLean Creek watershed, a shameful example of recreational mismanagement.

Dirt bikes, snowmobiles and all-terrain quads began to appear in Alberta's headwaters in the 1970s. Initially, it was hunters, anglers and climbers who used the new OHVs. Most of them simply wanted to drive a bit deeper into the wilds before getting off to walk. It wasn't long, however, before others began to look at the foothills as a playground for machines they saw as powerful toys.

OHV users quickly spread a web of eroding motor trails all through the landscape. Many of those tracks cross streams repeatedly, muddying them with runoff. Worse, many OHV users are not content with improved access that saves them having to use their legs like the rest of us: they like to tear land up. Mud-bogging has turned once-lush wetlands into muddy sumps. Some creeks have become de-facto racetracks. Hillsides are scarred with multiple vertical tracks that funnel rainwater and mud into the streams below after every rainstorm.

Faced with motorized anarchy in the woods, the Alberta government decided to try and regulate use by establishing sacrifice areas. In 1979 the McLean Creek watershed, along with the Ghost-Waiparous farther north, were turned over to the OHV crowd as "Forest Land-Use Zones" (FLUZ).

The idea was to provide a network of authorized woods trails for motorized vehicles. The rest of the landscape would be out of bounds. It didn't work; it had the social effect of legitimizing recreational vandalism. Long weekends in the off-road areas have become famous as three-day drunken mud-fests. It didn't help any that the government put next to no resources into laying out a proper trail network with moderate hill grades, erosion protection, bridged stream crossings and protection for wetlands and riparian areas. Instead, they simply let OHV operators take over abandoned seismic cutlines, cattle trails, open meadows and partly reclaimed oil and gas roads.

Gord Lehn showed me logging haul roads that Spray Lake Sawmills had recontoured and restored only to see irresponsible off-roaders develop new trails there. In one clear-cut, based on Alberta government guidelines, the company had to leave an unlogged buffer along a pre-existing OHV trail. The trail is a deeply eroded gully straight up a hill – a former seismic cutline – that funnels sediment and runoff directly into a once-healthy trout stream. Spray Lake, whose operational guidelines are designed to minimize their impact on the stream, was required to protect an OHV trail that functions as an open wound.

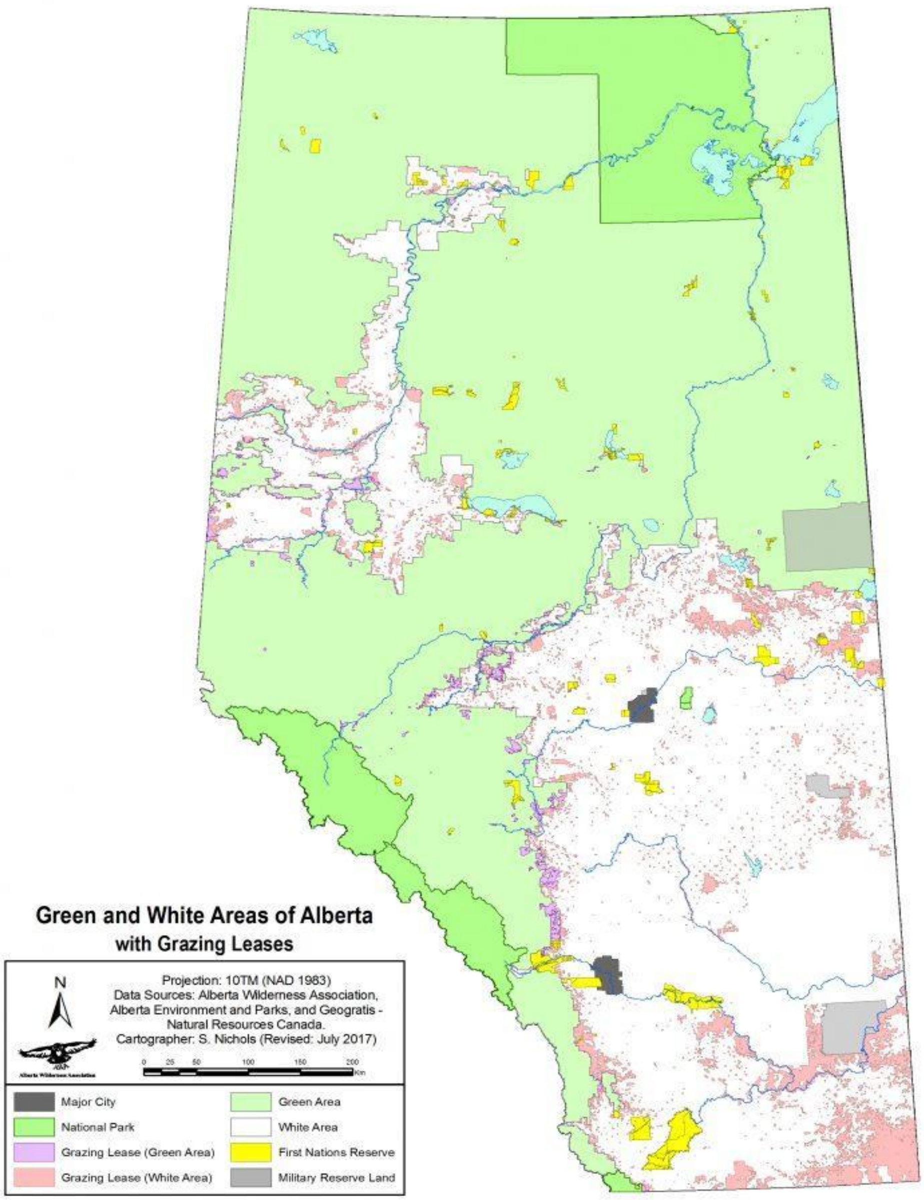
Out-of-control OHV use is a problem all through Alberta's headwater forests. Dr. Dan Andrews did a water quality study of the Waiparous River, a tributary of the Ghost, for Alberta Environment in 2006. He found that the Waiparous, which drains an OHV-riddled FLUZ, receives seven to ten times more sediment loading than the very similar Elbow River because of erosion from vehicle trails.

The Ghost Watershed Alliance Society, a stewardship

The Hamlet of Bragg Creek would have an opportunity for sustainable recreation if the MC1 project were to proceed. As part of MC1, this area could receive must-needed infrastructure improvements to accommodate the growing tourism activity in the area and to diversify the economy. MC1 would be a state-of-the-art eco-tourism destination. **Again, it is important for the Proponent to widen its lens to look beyond flood mitigation for the City of Calgary and instead, to consider the range of benefits possible with an upstream project. The results will be a legacy investment for all Albertans and tourists.**

There has been no information that we have seen that discusses these uses of the MC1 area, which is continually portrayed as a pristine wilderness. Further, SR1 lands are referred to as "pastureland". This does an injustice to the landowners, many of whom have businesses on these lands and also Kamp Kiwanis, which has been largely ignored in terms of understanding SR1 impacts on its unique year-round operations.

In fact, **approximately 60% of Alberta's land is provincial public land and another 10% is federal public land.** Only **28.5% of Alberta is considered "Private Land**". Thus, one could argue that losing 7,000 acres of private land, most of which is in its natural state, largely native grasslands, is a **significant negative outcome of SR1.**[27]



[27] https://albertawilderness.ca/issues/wildlands/public-lands/

NRCB QUESTION 5: CATCHMENT AREA

Re: https://www.nrcb.ca/download_document/2/83/5555/sir-1-july-31-2018
We believe that the narrow frame of reference focused on flood mitigation for the City of Calgary has invalidated this response by Alberta Transportation.

Two points:

1. MC1 is the project that protects MORE communities and homes because it can protect Tsuut'ina Lands, the community of Redwood Meadows and the Hamlet of Bragg Creek. There was minimal consideration (only insofar as the mention they would need additional protection) for these communities in the original decision, which focused on Calgary. The small amount of incremental catchment at SR1 is offset by far by the benefits to protecting more homes, land and communities upstream of SR1.
2. The Proponent states in the following quote that 25% more catchment area results in better flood protection for Calgary. Our experts believe that SR1 has a catchment area of 96% and MC1 has 90-94% by an in-stream dam, such that there is no significant difference in catchment area and also most of the water is generated upstream.

When the spillways are discharging at maximum capacity (inflow design flood) the water behind the dam is termed the "maximum reservoir volume". When passing the PMF, the volume of water behind the MC1 Option dam is 93,000,000 m^3, whereas the volume behind SR1 dam is 77,771,000 m^3. The difference between the two can be attributed to the general arrangement and hydraulic design of the facilities. SR1 has an auxiliary spillway that allows much of the excess flood flow to pass without being diverted to the reservoir. As a result, the SR1 reservoir does not rise as much as the MC1 Option reservoir when passing the PMF.

Given that both offer similar storage capabilities for the 2013 flood, and similar design bases for flood mitigation, the primary reasons that the flood mitigation is better with SR1 are the following:

- SR1 it is located further downstream than the MC1 Option. It is, therefore, in a better position to intercept and manage runoff from the additional 173 km^2 of catchment area that is between SR1 and the MC1 Option. This additional catchment area is a 25% increase over the MC1 Option catchment area, and this additional area allows SR1 to manage flood generating runoff from the major tributaries of MacLean Creek, Harris Creek, Iron Creek, Bragg Creek, and a considerable amount from unnamed creeks, tributaries, and drainages. The MC1 Option would not be able to manage flood runoff generated from this additional catchment area.
- SR1 has been designed to limit releases from the Glenmore Reservoir dam to 160 m^3/s, which is slightly lower than the value of 170 m^3/s adopted in the design of the MC1 Option. The use of 160 m^3/s as the target for SR1 was to coincide with the maximum discharge capacity of Glenmore Reservoir's outlet, which has a capacity of 160 m^3/s.

NRCB QUESTION 5: SOCIAL GOOD CREATED BY THE PROJECT

COMMUNITY IMPACTS: SR1 ONLY CREATES "SOCIAL NEGATIVES"

We ask the regulators to review our Community Impact videos and submissions in **Appendix D and Appendix B. For more discussion, we refer to the negative outcomes outlined in the Springbank Community Association's submission to CEAA in June 2018[28]:**

In 2014, the Project Summary submitted to the NRCB identified no unique social or environmental consequences. [29] Today, we know there are serious health, social, economic and environmental consequences in the local area as a direct result of this project. These impacts have come to light over time, but for some unknown reason, do not seem to merit discussion by the Proponent. The Social Good assessment stopped at the City of Calgary's borders. For some reason, no consideration was/is given to the impacts of the Project on the communities that surround the it.

Our communities are reeling from the SR1 decision. We have been marginalized by three successive provincial governments. From inception, the Project has been exclusively about protecting the City of Calgary from flood. This narrow scope has prohibited a comprehensive discussion and analysis of the impacts of SR1 on both on local communities. According to the Proponent, the social good of the Project refers to benefits that accrue to the City of Calgary. In reality, MC1 would provide equivalent flood protection for the City of Calgary, so these social good outcomes are not unique to SR1.

It is clear to us that SR1 erodes value in many ways, while MC1 creates value by generating a wide variety of ancillary benefits to all communities. **SR1 creates "social negative" outcomes in Springbank, Bragg Creek, Redwood Meadows and for Tsuut'ina Nation. MC1 is the project with legitimate and lasting social good outcomes**.

Social Negative: Bragg Creek and Redwood Meadows residents live under the threat of flood with SR1, but not MC1.
MC1 would control the river level and thus would better address groundwater and overland flood risk. Berms are an incomplete solution, as explained by this presentation by Amec to the City of Calgary[30]. This project is a study in unfairness for flood projection: Calgary residents along the Elbow River were told that berms are inadequate, so upstream mitigation is required; Bragg Creek residents receive immediate funding from the Gov of Alberta for construction of berms, but their calls for upstream mitigation are ignored. It appears that Bragg Creek berms are being designed to a 1:100 standard, but have not been built yet. High River has a 1:200 flood design basis, as is SR1 - so why not the Elbow communities?

[28] https://drive.google.com/open?id=1M075vlAzjk7UZEbPKMw_9o-6cn6o2B80
[29] https://www.nrcb.ca/download_document/2/83/8566/20140711-at-eia-to-nrcb-project-summary-table
[30] https://drive.google.com/open?id=1QLjd-pmUyJC1yvt6cL8UqmMKmY2sqTsN

Social Negative: Bragg Creek and Redwood Meadows live under threat of wildlife that could be addressed, to some extent, by an MC1 reservoir.
With SR1, the lack of consideration of wildfire risk is a point of dismay and surprise, that this important factor was never contemplated in the decision process.

Social Negative: Lack of vision about the future of the Bragg Creek, Redwood and Springbank communities.
The Proponent has not once mentioned the opportunity cost of SR1, which includes foregone economic development in western communities. Bragg Creek is currently planning future growth and would benefit greatly from an MC1 project that would provide certainty about flood risk. Springbank continues to grow and is a gateway to the Rocky Mountains. The new community of Harmony on Springbank's northwest corner illustrate the tremendous economic potential of this region. Harmony is situated on 1300 acres and will be home to 10,000 people (and associated business). The Proponent refers to the proposed Springbank Area Structure Plan as evidence that SR1 lands have only agricultural value. We point out that Harmony was also not included in an area structure plan and was designed outside the area structure plan process within Rocky View County. Further, Springbank, Redwood Meadows and Bragg Creek plan to increase eco-tourism and tourism, in general. SR1 only harms those opportunities over the long-run.

Social Negative: SR1's effect on the landscape of Springbank is permanently negative.
Springbank accounts for some of the most valuable and scenic land in Alberta! The SR1 project is situated at the corner of the tourism corridors of the TransCanada highway and Cowboy Trail (Highway 22). The combination of an 8-story berm, silt, muddy water, all spread over a massive footprint can only be characterized as willfully destructive for future economic development, including tourism and eco-tourism in this vibrant, growing area. Massive depositions of silt are aesthetically displeasing, at a minimum, and this silt will mobilize under various wind conditions, thus negatively impacting potential large parts of our community (and possibly west Calgary!).

Social Negative: Silt accumulation and mobilization is a terrible consequence of the project design.
A design flood will deposit 2.3 million tons of silt in central Springbank. This silt deposit is approximately 3km west of our schools, and homes are nearby. Risks and outcomes of this silt have not been adequately addressed. Again, it doesn't appear that this consequence was recognized by the Proponent until further along in the EIA. Now that we have clarity about this outcome, it should cause serious reconsideration of the entire project.

Social Negative: Road Closures during SR1 use introduce risk and disruption in our communities.
Springbank Road is the main connector between Bragg Creek, Redwood Meadows and Springbank. School busses use this road during the school year. High School students from Redwood Meadows and Bragg Creek attending Springbank Community High School. Traffic will be directed during the closure of Springbank Road to Township Road 250. In addition to the inconvenience this adds to our community, it introduces risk, as the Township Road 250 intersection is notoriously dangerous.

Social Negative: SR1 creates a wealth transfer from Rocky View County to the City of Calgary.
Rocky View County loses property taxes (and future taxes and economic development) on a

massive land footprint. Rocky View County resident taxes will increase in direct proportion to the taxes lost on these lands. Calgary, meanwhile, sees no increased costs from this benefit that accrues exclusively to its residents. Landowners lose their right to develop SR1 lands over time, to the benefit of their families, communities and region. These sacrifices have value, which have not been acknowledged at all by the Proponent.

Social Negative: Kamp Kiwanis is fundamentally changed or must be relocated.
We highlight the following from Volume 1 of the MC1 report[31]. Interestingly, negative outcomes are contemplated for area campers during MC1 construction. We should not need to highlight that both Kamp Kiwanis and Kamp Hope/Gardner will also be negatively impacted by SR1 construction, a fact that seems to be omitted by the Proponent.

> Exceedances of ambient air quality criteria may occur during the Construction phase at the McLean Creek Campground, Easter Seals Camp Horizon, and Paddy's Flat Campground. To reduce exposure to potential air quality effects, the McLean Creek Campground, Easter Seals Camp Horizon, and Paddy's Flat Campground would likely need to be closed during Construction. Gooseberry Campground may also be closed at night during the peak construction period to prevent sleep disturbance to campers.

Meanwhile, impacts to Kamp Kiwanis, which has been operating on the SR1 lands for decades, is not discussed by the Proponent. What will happen to Kamp Kiwanis under SR1 – during construction, in which a cement plant will operate onsite – and after construction, when a large part of their land has been used for the project and they have almost no riverfront left by which to run their popular river programs. This camp is the best Kiwanis camp in Canada and an important part of their camp activities is based on Elbow River frontage to which they will no longer have access. Kamp Kiwanis will be home to a cement plant for SR1 construction. They host thousands of children each summer for camps and during the school year for school students locally and from Calgary. It would be a significant loss to Calgary and area schools to not have easy access to this Kamp if it is forced to relocate. **We request a specific analysis and public report of the negative consequences to Kamp Kiwanis during and post-construction under SR1, including a full cost-accounting of the impacts.**

Social Negative: Heritage landowners are forced to give up their homes, livelihoods and legacy homesteads for a SR1 – to protect homes on the floodplain in Calgary!
The marginalization of landowners impacted by SR1 is appalling. They have been characterized as greedy, rich and selfish. These characterizations are intensely damaging. Mary Robinson's family arrived in the 1880s. She runs a busy riding area and has cattle on the SR1 lands. This land is irreplaceable! It is on a river, close to a major city, surrounded by forest and part of a close-knit community. Brian Copithorne's family arrived on their lands in the reservoir footprint in the 1800s as well. They settled on that land in part because of the natural springs, which provide running water four-seasons a year. Many landowners have left the land in its natural state, largely for cattle grazing. What is the social cost of this mass expropriation of land in one community, from a few families?

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[31] https://www.nrcb.ca/download_document/2/83/8640/20170919-at-eia-to-nrcb-re-mc1-vol-1

We want to be clear on this important point: negative outcomes in western communities were NEVER acknowledged by the Proponent until IAAC (CEAA) began asking questions.

We request that the Proponent describe, in detail, the specific, negative consequences of the SR1 project in the local areas of Springbank, Redwood Meadows and Bragg Creek for inclusion in the "social good" discussion.

MCLEAN CREEK CREATES SOCIAL GOOD

A social good analysis was never conducted for McLean Creek (to our knowledge). **Our communities see the opportunity for tremendous social good with an upstream project like McLean Creek: fire mitigation, drought management, water security, recreation and flood protection for upstream communities.**

We request an updated social good analysis for McLean Creek that includes the benefits of water storage.

The City of Calgary would benefit from water storage capacity at MC1.
While receiving a similar level of flood mitigation under MC1, the City could benefit from water storage at McLean creek that would add security (water quality and quantity) to its drinking water supply from the Elbow River. The Proponent should discuss this water security opportunity cost under SR1.

Better Fire Suppression Capabilities at MC1 would protect Calgary's drinking water from by-products of fire.
See Appendix A for more information on this important consideration.

City of Calgary residents would benefit from an upgraded recreational area at MC1 and a permanent reservoir.
City of Calgary residents would also be the primary users of the upgraded MC1 recreational area. Again, due to the limited scope of analysis, which focussed on flood, the Proponent was unable to conduct a holistic assessment of the benefits of the permanent pond.

Better flood and fire mitigation for Bragg Creek and Redwood Meadows from MC1 cannot be overlooked from a holistic wellness perspective!

The level of anxiety in Bragg Creek and Redwood Meadows from continued risk of flood and fire has a tremendous social cost. In fact, the 2017 Report on MC1[32] states:

Option Benefits

The 2013 flood demonstrated the need for further flood mitigation along the Elbow River to reduce the effect of larger flood events and protect the communities of Bragg Creek, Redwood Meadows, and Calgary. The MC1 Option would provide flood mitigation for Calgary, as well as the communities of Bragg Creek, Redwood Meadows, and the Tsuut'ina Nation IR No. 145.

In addition to property impacts associated with flooding, the adverse health effects associated with flooding events are recognized globally, varying from physical harm in the short-term to delayed mental health problems in the long-term. The health benefits of flood reduction are numerous; implementing flood reduction and flood damage mitigation strategies would reduce adverse health effects associated directly with pre-flooding, flooding, and post-flooding events.

And:

- The MC1 Option would have a positive effect on regional health services as a result of flood reduction, removing health care demands and improving overall public safety associated with emergency preparedness and emergency response during flood conditions. Flood reduction would result in numerous benefits to health and regional health services before, during, and after a flood event. This would be positive in terms of public health and safety.

Redwood Meadows fifteen-year Resident, Dr. Karen Massey, psychotherapist, writes about Redwood Meadows and Bragg Creek experiences during and in the aftermath of the 2013 flood.

The worst part about the flood was being evacuated on the first day of the flood, Thursday, and then having no communication other than through the community Facebook updates. No one knew if the entire town would be lost because the dirt berms were being breached in three places. Fortunately, the town was saved by Tsuut'ina volunteers, town and Calgary volunteers. Although one excavator operator described how he almost lost his life in the darkness of the night, while working on the berm at the edge of the flooding river. He indicated that his flood light had burned out so he didn't realize the river had eroded almost all of the dirt around him.

Every spring since 2013, residents of Bragg Creek and area, and Redwood Meadows have anxiety about whether this is the year for the next calamitous flood? In addition to the worry as the rain comes down, residents who were traumatized during the 2013 flood are hypervigilant about when will a big flood occur again. These chronic emotional stressors are a health risk.

With all the focus on worrying about a flood, unexpectedly, in May, 2018, residents in Bragg Creek and area, and Redwood Meadows were sent an emergency alert on their cell phones on a seemingly normal Sunday afternoon. The alert told residents to prepare to evacuate because a wildfire was out of control in *Champion Lake, or* locally known as the McLean Creek fire. According to the local fire department, a wildfire can travel about 15 km an hour. Redwood was 2 – 3 hours away from the fire, and Bragg Creek was much closer. So once again families packed

[32] https://www.nrcb.ca/download_document/2/83/8640/20170919-at-eia-to-nrcb-re-mc1-vol-1

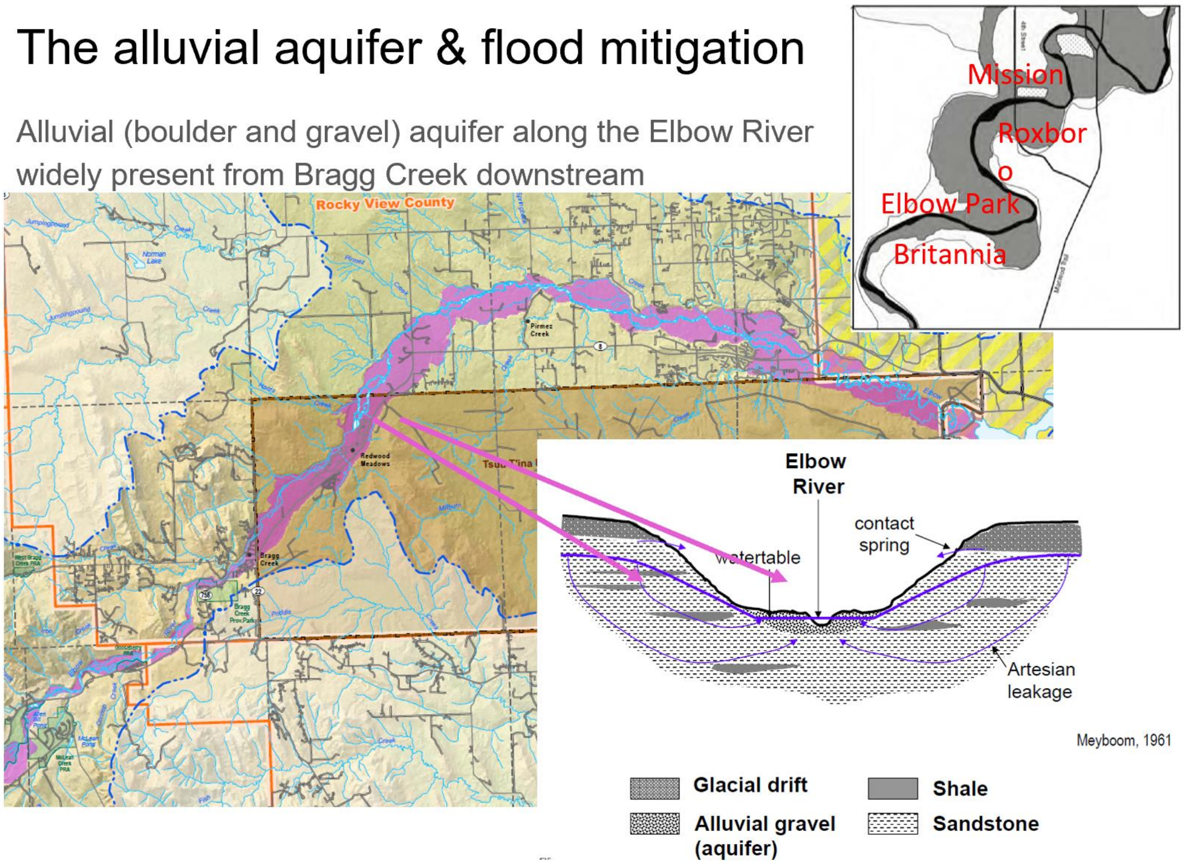
suitcases, took pictures of everything that would be left behind. Residents gassed up their cars, trucks, hooked up their trailers, packed clothing and special items, booked reservations at campgrounds and seriously got ready to evacuate. Fortunately, the wind changed, and no one had to evacuate. Likely this is a precursor for wildfires in the future since each year, as the one-hundred-year-old Bragg Creek forest ages, it becomes a higher fire risk. Now the residents in the area have a DOUBLE reason for being stressed, both in June which is flood time, and from April – October which is fire season. Bragg Creek is considering large-scale growth of the Hamlet, which was not contemplated by the Proponent.

The Fort McMurray disastrous wildfire experience caused millions in lost wages, mental and physical health problems, visits to medical professionals, and there are likely still some traumatic residual mental and emotional problems after the fire. A paper was published in the International Journal of Mental Health and Addictions in October, 2018, by researcher Vincent Agyapong, a psychiatrist at the University of Alberta, who sent questionnaires to residents of Fort McMurray. He found that 6 months after the wildfire:

- about 15% of people were suffering from depression, more than the average Alberta rate of 3.3%;
- about 25% met the criteria for anxiety disorders;
- about 12.8% were suffering from probable PTSD, more than 10 times the normal rate for Alberta;
- these disorders were associated with alcohol and substance abuse and nicotine dependence;
- what kept people resilient and protected them was human contact and support, even as simple as a phone call.

Trauma is a major problem that occurs after a catastrophic event such as a flood and fire. The mental health cost can be enormous due to time off work, visits to medical professionals, deterioration of health due to environmental health risks, and medications. People directly affected by the flood, as well as their families and friends were also at risk of being vicariously traumatized.

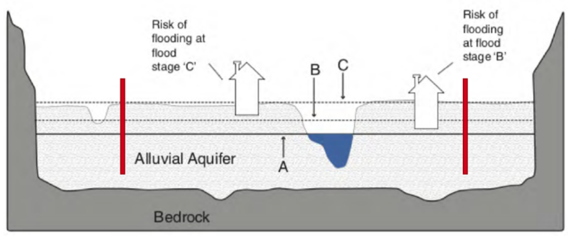
The anxiety of living under threat of fire and flood is an important consideration. This anxiety is not unique to Calgary residents, but is also acutely felt by the upstream communities of Redwood Meadows and Bragg Creek. West Bragg Creek residents were affected in a different way because there is only one exit out of the area. That exit is over a bridge that was closed down due to concerns about its stability at the peak of the flood. This closure stranded people overnight. Parents at work could not get home to their children, but fortunately neighbors helped out the stranded children such as by giving them food and beds overnight. Our communities never want this to happen again.

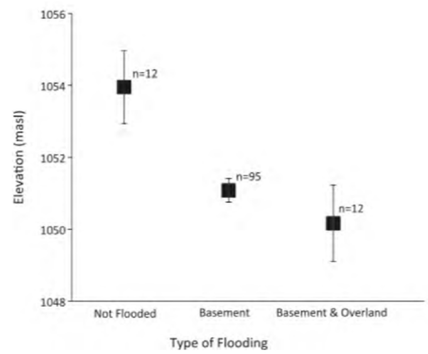


To illustrate the continued risk to upstream communities with SR1 & berms, see this image for a summary of groundwater flooding, due to the many aquifers found in Redwood Meadows in 2013. Aquifers explain why many basements became flooded, and yet their neighbors did not experience flooded basements.

What we know now: Berms will not protect against groundwater flooding! Controlling river height essential.

Basement flooding at Redwood Meadows, June 2013.
Note 60-80cm basement flooding 200-300m from the river…behind the berms!
The alluvial aquifer delivered the water despite berms.





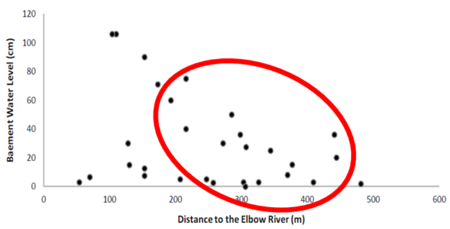


Figure 1. Flood water height above basement floor (cm) with distance of the home to the Elbow River (m).

"Basement flooding, not sewer backup, blamed for damaging homes along Elbow River in 2013." Aboud,Ryan and Osborn, (U of C) Utoday June 19, 2018.

University of Calgary ENSC501: Jabush, Grant and Ryan
Sept 2014

Although the article in **Appendix H is titled "Modeling How Groundwater Pumping will Affect Aquatic Ecosystems- EOS,** is about groundwater pumping, it indirectly speaks to the significant dangers that having tons of flood water stagnant in SR1 for up to about 90 days will likely impact the springs/alluvial aquifers that run throughout Springbank area. There is a reason that Springbank is called *Spring*bank. This article points to the Alberta Government having more scientific investigation to identify the potential damage of SR1 on springs/alluvial aquifers, and perhaps the need for regulatory protection of alluvial aquifers.

We request an updated social good assessment, consisting of all impacts, both positive and negative, in Bragg Creek, Upper/West Bragg Creek, Redwood Meadows, Tsuut'ina Nation and Kamp Kiwanis for both SR1 and MC1. Our communities must have input into this analysis.

NRCB QUESTION 23: TRIPLE-BOTTOM LINE BENEFITS

The NRCB states: “The IBI report includes a “Triple Bottom Line” analysis. a. Explain the rationale for analyzing SR1 but excluding MC1 from the Triple Bottom Line analysis. b. Explain how the triple bottom line analysis of the 12 mitigation scenarios were used to compare SR1 and MC1.”

Our view: scope for Triple Bottom Analysis line should have been the Province of Alberta, not from the perspective of the City of Calgary. We point out that this is a crucial shortcoming of the SR1 project. The triple-bottom line analysis must include all communities impacted by SR1 and the range of outcomes that they experience.

Respectfully, to NRCB, neither of the 2015 IBI Cost/Benefit reports (MC1 or SR1) consider triple bottom-line benefits. Both reports specifically state: “This study was concerned solely with economic efficiency and therefore does not include analysis of the aforementioned non-commensurable criteria.” (as detailed below).

6.5 Triple Bottom Line Considerations

Traditional economic analyses of flood mitigation alternatives have generally assumed a straightforward objective of maximizing the net benefits (total benefits minus total costs) that accrue to a project. Society however, has other goals besides economic efficiency. These goals or objectives are the results of outcomes that society desires and have more recently been described as triple bottom line objectives which include, in addition to economic objectives, considerations of environmental and social impacts. In relation to flood mitigation projects, the following criteria are often considered in the evaluation process:

- Disaster prevention:
  - reduces current losses
  - reduces future losses
  - potential residential loss of life
  - potential non-residential loss of life
- Environmental impact:
  - biophysical impacts
  - social impacts
  - aesthetic impacts
- Implementation:
  - complexity
  - flexibility of integration with other measures
- Incidental benefits:
  - recreation
  - drought mitigation
  - other

This study was concerned solely with economic efficiency and consequently does not include analysis of the aforementioned non-commensurable criteria.

IBI did perform a Triple-Bottom Line Analysis of SR1 in 2017 for the City of Calgary. Regarding this report, triple bottom-line benefits were considered for SR1 as they pertained to the City of Calgary. Thus, the Springbank Off-Stream Reservoir looks great (from the report: river access aesthetics, recreation access, etc.). The Triple-Bottom analysis stops at the City of Calgary's western border; thus, it is incomplete.

We do not accept the 2017 report that discusses triple bottom-line benefits for SR1 due to the significant limitations resulting from the narrow scope, which focused exclusively on flood management for the City of Calgary. Our reasons are as follows:

- Implementation:
    - Subjective Judgment (Timeliness of Implementation – 20 points, the top score, for SR1)
    - Lack of consideration of implementation on Rocky View County
- Social:
    - No inclusion of health outcomes (physical and emotional, negative in SR1)
    - No inclusion of local impacts (negative in SR1)
    - No consideration of bio-physical impacts (negative in SR1 due to road closures and expected
    - No consideration of loss of large amount of private land within one community
- Environmental
    - No consideration of upstream environmental impacts (negative in SR1)
    - Lack of consideration of climate change (drought, fire, flood)
- Economic:
    - No consideration of upstream economic impacts (loss of tourism, impact of future floods on economies of Bragg Creek or Tsuut'ina Nation)
    - No consideration of mass sterilization of land in Springbank which consists of some of the most valuable land in Alberta due to its proximity to Calgary and location on the TransCanada Highway and Cowboy Trail
- General: No Triple Line comparison between SR1 and MC1!
    - We believe that MC1 would score well in climate change, water security, health, recreational, "equitable protection", social and economic.
    - No consideration of degree of consensus on projects – SR1 a contentious, highly controversial project that is opposed by many.

In summary, as a result of this report focusing on an analysis from the City of Calgary's perspective, all the negative outcomes in the local areas surrounding the reservoir (Tsuut'ina Nation, Springbank, Bragg Creek) were ignored**.** **Clearly, the 2017 report is not a holistic triple-bottom line view and should be dismissed.**

Reference the following chart showing the Triple-bottom line criteria applied by Golder for SR1 in 2017. The only item that appears to consider other communities is the "Equitable Protection" Criteria, for which SR1 has a low score.

Please see https://drive.google.com/open?id=1is_xX1NhkE9x_Bol1GR1eAEmSMs6aKqR, exhibits 4.2 and 4.4)

Goal	Criteria	To what extent does the scenario help achive the following objectives, **compared to the baseline existing condition?** (refer to **Exhibit 3.10**)
Social	Complete communities	**Maintains community fabric** *Preserves existing communities, homes and heritage. Maintains opportunities for revitalisation/densification (eg. East Village). Amenities and transportation choices are not negatively impacted.*
	Equitable protection	**Provides equitable protection from flooding** *across communities, the city and does not negatively impact upstream or downstream*
	Vulnerable populations	**Protects vulnerable populations** *Risk-sensitive development, protection of Calgarians who because of age, disability or other circumstances are at greater risk.*
	River aesthetics	**Maintains community and river aesthetics** *River views from private and public property, natural-looking river*
	Recreation access	**Maintains or enhances accessibility and recreation opportunities** *Protects/provides access to the river, riparian areas, natural areas, and parks.*
	Emergency access	**Protects connectivity and ease of access and departure during flooding or other emergencies/disasters** *Does not negatively impact emergency response, reduces residential and non-residential loss of life*
	Risk transparency	**Increased transparency/visibility of risk** *For property owners/prospective buyers regarding flooding risk*
Environmental	Water security	**Protects/provides water supply security** *Promotes efficient, sustainable water management so that the region's water supply meets the current and future needs of a growing city and region of users (municipalities and irrigation districts).*
	Riparian health and ecosystem functions	**Protects riparian health and species habitat and allows natural ecosystem functions** *Protects/enhances riparian areas and health of aquatic and terrestrial species. Lets the floodplan flood, provides room for the river, allows the river to flood*
	Water quality and contamination prevention	**Protects river water quality and prevents contamination of air, land, and water** *Does not have a short or long term detrimental impact on water quality and prevents contamination from spills, stormwater and groundwater flooding, transportation of goods, construction of scenario.*
Implementation	Timeliness of Implementation	**Contributes to orderly implementation of investments.** - *Timeliness and ease of implementation. How quickly can it be implemented and does it complement future measures?*
	Adaptability/Flexibility	**Contributes to flexibility of implementation.** How ***adaptable*** *the solution is - ease of future adaptability and flexibility (can it be raised/improved, can it address climate change issues?)*
	Jurisdictional control	***How easy it is for the City to implement.*** *Jurisdictional ability of The City to implement; financial ability for The City to implement; dependent on other jurisdictions to commit to/implement/fund.*
	Regulatory complexity	**Complexity of regulating land use and development with respect to different structural mitigation measures.** *(City: bylaws; At the Provincial and Federal levels: environmental and land/building regulations, mapping, funding, disaster relief programs)*
Economic	Economic Environment	**Indirect Protection of Calgary's economic engine** *Protects the downtown and business continuity. Protects critical infrastructure and essential services, transportation corridors.*
	Economic Efficiency	*Benefit/Cost Ratio*
	Damages Averted	*Total Benefits*
	Total Cost	*Present Value of deveopment and operating costs*

After applying the criteria to the various flood mitigation projects, the results are as follows (SR1=1):

Goal	Criteria	Objective To what extent does the scenario help achive the following objectives, compared to the baseline existing condition?	Scenario Rating (-6 to +6)												Weight (1-6)	Highest Ranked Scenario by Criteria
			0a	1	1a	2	3	3a	4	4a	5	5a	6	7		
			Non-structural	SR1	SR1 + DT barrier	SR1 + Bow Res	Bow Res + Elbow barriers	3 w/ GW	SR1 + Bow barriers	4 w/ GW	Barriers on Bow+ Elbow	5 w/ GW	Flood-way buyouts	SR1, Bow Res, Select barriers		
Social	Complete communities	**Maintains community fabric** *Preserves existing communities, homes and heritage. Maintains opportunities for revitalisation/densification (eg. East Village). Amenities and transportation choices are not negatively impacted.*	-1	3	4	6	-4	-4	-5	-5	-6	-6	-5	5	2	2
	Equitable protection	**Provides equitable protection from flooding** *across communities, the city and does not negatively impact upstream or downstream*	1	-4	-5	3	-2	-2	2	2	5	5	-3	4	3	5
	Vulnerable populations	**Protects vulnerable populations** *Risk-sensitive development, protection of Calgarians who because of age, disability or other circumstances are at greater risk.*	0	3	4	5	2	2	2	2	1	1	-1	5	1	2
	River aesthetics	**Maintains community and river aesthetics** *River views from private and public property, natural-looking river*	-1	5	1	5	-5	-5	-4	-4	-6	-6	6	4	2	6
	Recreation access	**Maintains or enhances accessibility and recreation opportunities** *Protects/provides access to the river, riparian areas, natural areas, and parks.*	1	5	-1	5	-4	-4	-5	-5	-6	-6	3	4	2	1
	Emergency access	**Protects connectivity and ease of access and departure during flooding or other emergencies/disasters** *Does not negatively impact emergency response, reduces residential and non-residential loss of life*	2	3	2	3	-1	-1	-1	-1	-2	-2	-2	3	1	1
	Risk transparency	**Increased transparency/visibility of risk** *For property owners/prospective buyers regarding flooding risk*	2	1	2	1	3	3	3	3	4	4	1	3	1	5
		TOTAL Community Well-Being score	5	21	1	50	-28	-28	-18	-18	-18	-18	-3	49	12	2
Environmental	Water security	**Protects/provides water supply security** *Promotes efficient, sustainable water management so that the region's water supply meets the current and future needs of a growing city and region of users (municipalities and irrigation districts).*	0	1	1	6	6	6	1	1	0	0	0	6	6	2
	Riparian health and ecosystem functions	**Protects riparian health and species habitat and allows natural ecosystem functions** *Protects/enhances riparian areas and health of aquatic and terrestrial species. Lets the floodplan flood, provides room for the river, allows the river to flood*	1	-1	-1	-1	-4	-4	-4	-4	-6	-6	1	-2	4	0a
	Water quality and contamination prevention	**Protects river water quality and prevents contamination of air, land, and water** *Does not have a short or long term detrimental impact on water quality and prevents contamination from spills, stormwater and groundwater flooding, transportation of goods, construction of scenario.*	-1	-2	-2	0	2	2	-2	-2	0	0	0	0	2	3
		TOTAL Environmental score	2	-2	-2	32	24	24	-14	-14	-24	-24	4	28	12	2
Implementation	Timeliness of Implementation	**Contributes to orderly implementation of investments.** - *Timeliness and ease of implementation. How quickly can it be implemented and does it complement future measures?*	-2	5	4	-3	-5	-5	1	1	-4	-4	-1	-2	4	1
	Adaptability/Flexibility	**Contributes to flexibility of implementation.** How ***adaptable*** *the solution is - ease of future adaptability and flexibility (can it be raised/improved, can it address climate change issues?)*	1	2	2	4	3	3	2	2	-1	-1	3	5	3	7
	Jurisdictional control	***How easy it is for the City to implement.*** *Jurisdictional ability of The City to implement; financial ability for The City to implement; dependent on other jurisdictions to commit to/implement/fund.*	4	0	1	-3	-2	-2	1	1	3	3	2	-2	3	0a
	Regulatory complexity	**Complexity of regulating land use and development with respect to different structural mitigation measures.** *(City: bylaws; At the Provincial and Federal levels: environmental and land/building regulations, mapping, funding, disaster relief programs)*	-3	-2	-2	3	-3	-3	-3	-3	2	2	-1	4	2	7
		TOTAL Implementation score	1	22	21	-3	-23	-23	7	7	-6	-6	9	9	12	1
Economic	Economic Environment	**Indirect Protection of Calgary's economic engine (attracts businesses, business continuity)** *Protects the downtown and business continuity. Protects critical infrastructure and essential services, transportation corridors.*	-1	3	5	5	2	2	2	2	2	2	-1	5	3	1a
	Economic Efficiency	*Benefit/Cost Ratio*	6	5	0	-2	-4	-4	2	0	-1	-2	-6	-3	3	0a
	Damages Averted	*Total Benefits*	-6	3	4	6	3	5	5	7	3	6	-5	6	3	4a
	Total Cost	*Present Value of deveopment and operating costs*	6	5	2	-4	-5	-6	2	1	1	-2	-3	-4	3	0a
		TOTAL Economin score	15	49.19	33.4	13.73	-9.231	-8.53	35.9	29.13	14.69	12.42	-44.1	12.94	12	1
		Total Score	23	90.2	53.4	92.7	-36.2	-35.5	10.9	4.13	-33.3	-35.6	-34.1	98.94		7
		Rank	5	3	4	2	12	10	6	7	8	11	9	1		

In conclusion, a full triple bottom-line analysis has NOT been completed for either SR1 or MC1, nor the remainder of the projects considered. A complete analysis must be done that includes impacts beyond the City of Calgary's borders and should account for impacts across the totality of stakeholders and environments. The specific ranking of SR1, in detail, is as follows:

To highlight serious concerns with the above analysis, we note that SR1 ranked #1 for recreation access, timeliness and emergency access and #2 for river aesthetics. **Please consider that ALL NEGATIVE AESTHETICS are outside the City of Calgary. Please also consider that timeliness accounted for 20 points on the evaluation matrix and we do not foresee SR1 moving ahead any time soon due to the extreme level of opposition which includes First Nations and complexity of approvals, including pipelines. Sadly, the analysis does not include items such as climate change, the environmental impact of losing so much natural grasslands, wetlands and associated ecosystems to the SR1 project, nor consider negative economic, social or health outcomes in the local areas.**

Triple Bottom Line Analysis

GOAL	CRITERIA	SCORE	RANK
SOCIAL	Complete communities	6	4
	Equitable protection	-12	11
	Vulnerable populations	3	4
	River aesthetics	10	2
	Recreation access	10	1
	Emergency access	3	1
	Risk transparency	1	10
ENVIRONMENTAL	Water security	6	5
	Riparian health and ecosystem functions	-4	3
	Water quality and contamination prevention	-4	9
IMPLEMENTATION	Timeliness of Implementation	20	1
	Adaptability/Flexibility	6	6
	Jurisdictional control	0	8
	Regulatory complexity	-4	6
ECONOMIC	Economic Environment	9	4
	Economic Efficiency	15	2
	Damages Averted	10	9
	Total Cost	15	2
	TOTAL SCORE	90	3

NRCB QUESTIONS 30/31: BENEFIT/COST ANALYSIS

SUMMARY:

We would like to point out, that at this point in time, SR1 costs most than MC1. Further, the many tangible economic benefits of MC1 to a broad range of stakeholders (as discussed previously), have been ignored.

Even excluding the tremendous benefits of MC1, the Proponent's most current benefit/cost analysis provides the following conclusion that MC1 has a higher benefit/cost ration than SR1, excluding sunk costs[33]:

2. Disregard the costs to date and compare both projected costs and timelines from 2019 onwards.

   This allows comparison of the two projects from today. Funds spent to date are considered common as both are part of the flood mitigation program undertaken by the Government of Alberta, in an attempt to arrive at the best alternative for flood protection for the City of Calgary and downstream communities. The results are below in **Exhibit 2.4**.

Exhibit 2.4: From 2019 Start – Projected Costs Only

Indicator	SR1	MC1
PV Benefits	$591,610,000	$481,467,000
PV Costs	$432,258,000	$340,832,000
Net Present Value	$159,352,000	$140,635,000
Benefit/Cost Ratio	1.37	1.41

The Proponents benefit/cost analysis has always been deeply skewed in favour of SR1, for the following reasons:

- No consideration of upstream economic impacts (loss of tourism, impact of future floods on economies or infrastructure of Bragg Creek or Tsuut'ina Nation)
  - Highway 66 bridge and recreational areas at Elbow Falls / Allen Bill Pond sustained tremendous damage, and will again in another flood situation similar to 2013
  - Bragg Creek's economy is still recovering from the 2013 floods and no consideration for the continued risk of this community under the SR1 project
- No consideration of mass sterilization of land in Springbank which consists of some of the most valuable land in Alberta due to its proximity to Calgary and location on the TransCanada Highway and Cowboy Trail. The economic potential of this land is significant.
- No consideration of tangible financial benefits from water storage at the McLean Creek site:
  - Fire mitigation (What is the annual benefit from improved fire-management capabilities from a permanent reservoir? One only needs to look to Slave Lake to see the financial consequences of wildfire.)

[33] https://www.nrcb.ca/download_document/2/83/9102/20190614-at-eia-to-nrcb-re-ceaa-ir-response-package-3-appendix-ir45-3

- Water Security (the Elbow River provides drinking water to approximately 500,000 Calgary & area residents)
- Recreation (Improved recreation capacity in the Bragg Creek area under MC1)

PROJECT TIMING

The assumption that SR1 will be constructed years before MC1 is flawed. SR1 construction completion in 2022 is conditional on many assumptions:

- Ability to overcome First Nations opposition. On July 23, 2019, it was published that during a July 11, 2019 Tsuut'ina First Nation's Council that "After discussion we passed a Band Council Resolution formally and finally opposed SR1" stated Chief Lee Crowchild. They were particularly concerned about "SR1's potential impact on groundwater, the accumulation of silt in the dry dam, and the possibility of water backing up onto the First Nations' land when the reservoir is used. Chief Crowchild further stated that "work on SR1 should cease immediately, and the province should begin investigating other flood mitigation options. This is the wrong project for Southern Alberta." **See Appendix C**.
- Ability to quickly expropriate or otherwise acquire the land for SR1.

The Proponent should describe the projects benefit/cost assuming an equivalent start date rather than the current 4-year lag between projects. There is no evidence to support the difference in timelines.

The Proponent assumes a much later start date for MC1 construction. This late start date provides lower present value costs and delays benefits. We are not convinced that the later start date is a reasonable assumption. We believe there will be less opposition for MC1 and no land is required to be purchased. Tsuut'ina has expressed support for MC1.

Additional Comments:

1. SR1 benefit/cost is missing the totality of lost economic opportunity to Rocky View County from taxes from residences, businesses and/or future development any lands on the SR1 footprint.

2. SR1 benefit/cost analysis is missing the flood mitigation upgrades at Bragg Creek ($42m) [34]and Redwood Meadows (which has never been costed and is likely more). The Proponent also needs to consider that the berms at Redwood Meadows have failed in

[34] Bragg Creek Berms were originally $8.9M in the 2015 IBI Report. The latest estimate by Rocky View County is $42 Million (an increase of $9M from the $32.8 Million earmarked for the project in 2015). https://www.cochranetoday.ca/local-news/bragg-creek-flood-mitigation-delayed-2010443
We expect that there will be similar cost escalation on the SR1 capital cost. Councillor Mark Kamachi noted in January 2020 that "Price per metre to construct in 2015 versus 2019 is $4,039 and $5,533, respectively. This does not include the 475 metres of bank armouring noted above." https://highcountrynews.ca/councillor-update-mark-kamachi-jan-2020/

some capacity three times in the past 20 years. Therefore, ongoing capital maintenance, fortification and rebuilding of the berms should be included.

3. SR1 Benefit/Cost Analysis is lacking the full accounting of costs associated with Kamp Kiwanis. We believe that the costs of moving this camp and reconstructing its operations on a new location far exceed the $20k per acre included in the SR1 valuation. As the Kamp will lose a significant amount of its land on which it runs its programs, it is not realistic to assume that Kamp Kiwanis can continue status quo.

4. Where is the cost of Wetland Compensation in SR1, which is included in MC1 for $718,000? SR1 has loss of wetlands also (Exhibit 4.17 below). Has this cost been missed?

MC1 BENEFIT/COST ANALYSIS:

AVERAGE ANNUAL DAMAGE CALCULATION FOR BRAGG CREEK:

In the June 2019 responses, the Proponent states:
"The MC1 alternative is expected to provide additional benefits upstream of the SR1 project, primarily in protection of development in the Bragg Creek and Redwood Meadows area. Previously, no estimate of these benefits was available. IBI Group has since conducted an assessment of flood damages for this area, using consistent Provincial Flood Damage Assessment Tool (PFDAT) methodology and new flood elevation surfaces for the Elbow River between MC1 and SR1. The resulting additional benefit for MC1, over SR1 is $180,000 annually. This is 0.65%of the benefit to the City of Calgary. In terms of the BCA comparison, this amount is not significant."

Our comments on this statement by the Proponent's $180,000 annual damages:

- What is included for homes, roads, bridges, pathways, etc.? Both Highway 22 and Highway 22 sustained significant damage. What was the cost of repairs to this infrastructure, including pathways? If this cost included? If not, why not?
- Are the costs of the damage to the Elbow Falls / Allen Bill Pond recreation areas included? If not, why not?
- Are both groundwater flooding/inundation included and overland flooding in Bragg Creek included? Does the Proponent expect that berms will address groundwater flood risk in Bragg Creek and Redwood Meadows? If so, provide documentation to support this claim.
- Does this include impacts to businesses from interruption and recovery? Some local business owners in Bragg Creek still say that their businesses have not recovered from the 2013 floods. Has this negative long-term economic impact in Bragg Creek been

included in the damage estimate? What is the totality of negative economic impact on Bragg Creek from flood? To our knowledge, there was no analysis of the financial impacts of the 2013 floods on the economy of Bragg Creek, the impact on the Redwood Meadows golf course, etc.

- Bragg Creek businesses were materially and negatively impacted by the 2013 floods. Recovery has been slow and several businesses (Infusion Restaurant was ruined and Joey's only seafood was destroyed and neither business re-established. Bragg Creek Trading Post was massively damaged. The Steak Pit was destroyed in the flood and was planned to be restored prior to the floods.)

- Has the infrastructure damage from RVC been accounted for in the Bragg Creek damage calculation? Reconstruction of various Bragg Creek pathways was required. Further, Bragg Creek bridge connecting the Hamlet and West Bragg Creek was closed during the flood and post-flood due to concerns about integrity (as a result of house impacting the bridge during the flood). Has the Proponent accounted for infrastructure costs such as repairs in Bragg Creek? If not, why not?
- Where is the cost for repairs to Redwood Meadows berms and infrastructure? Is this cost included? If not, why not? If so, please detail these costs. They are an expected cost to be borne under an SR1 scenario in a 2013-level flood so should be included.
- The Proponent's view that the amount is "not significant" is a purely financial perspective. Better flood protection to Bragg Creek, Redwood Meadows and Tsuut'ina is certainly significant for anyone in those communities. The minimization and marginalization of flood impacts upstream is not acceptable. It appears, once again, that the focus on the City of Calgary and the "greater good" is justification to dismiss upstream impacts, which are certainly significant for our communities. For the residents that had to leave their homes and businesses and ultimately restore or rebuild, these impacts are highly important and, to suggest that relative to the City of Calgary, this is "not significant" is offensive. SR1 advantages one community and harms several others while MC1 would have advantaged all the communities between along the Elbow River Watershed.
- What about the physical and mental health benefits of improved flood protection at MC1 for residents of Bragg Creek and Redwood who, with SR1, will continue to live under threat of groundwater flooding – yes, even with berms! GoA has not met with our communities to hear about these challenges that stem from choosing SR1.
- Mental health services were widely used post-2013 flood (Bragg Creek and Redwood Meadows Wellness Committee).
- People in the town reported illnesses due to mold and restoration-related health challenges.

OMISSION OF BENEFITS FROM WATER STORAGE AT MC1

The intentional and continued omission of water storage at the McLean Creek alternative is unacceptable. The benefits to water security, fire protection, drought mitigation, recreation and improved flood mitigation for communities west of Calgary need to be quantified and included in the analysis. We recognize that the original scope was narrowed to focus on flood for the City of Calgary, but where the projects were equal from a flood mitigation standpoint, we expect our government to look to other criteria for water management to help guide policy. The benefit/cost analysis is effectively illegitimate because it has continually ignored the benefits of water storage, which were referenced in the 2014 Task Force Report and also the 2015 McLean Creek Benefit/Cost analysis. The 2015 report contains the following statement on Page 3:

"This conceptual design includes a small permanent pool in the valley bottom extending from river bottom elevation 1,379.0 m to the permanent outlet structure intake invert elevation 1,398.0 m, thereby permanently containing approximately 4,000 dam3 of water as dead storage. This storage is intended to prevent incoming larger bottom sediment from plugging the intake area, and could also replace the previously existing Allen Bill Pond which was destroyed by the 2013 flood. There is no low level outlet to release the dead storage. Additional water could be contained above the dead storage El. 1,398.0 m (i.e., multi-use storage) by regulating the permanent outlet gates using pre-programmed automation methods, rather than leaving the gates in the wide-open position as considered herein. ***The potential value and/or need for multiuse storage at this site should be evaluated as part of the future study. [Emphasis added]."***

To our knowledge, there was no further analysis of the potential for multi-use storage, which has been a critical process flaw since 2015 and one of the main reasons for the continued objections of Springbank, Redwood Meadows, Bragg Creek and Tsuut'ina Nation. Benefits of multi-use storage are as follows:

- Improved fire suppression from a permanent water reservoir at McLean Creek. The Hamlet of Bragg Creek and its greater area are at risk of wildfire. See Appendix A.
- Water security and drought management for the City of Calgary and communities along the Elbow River from a permanent water reservoir at McLean Creek.
- Increased potential tourism capacity resulting from a permanent reservoir and all the ancillary economic benefits to the hamlet of Bragg Creek.

OTHER MC1 COMMENTS:

1. The Highway 66 relocation is listed at $34 million, more than the totality of the SR1 road impacts ($25M), including the elevation of highway 22 between 5 and 10 meters and new bridges for the diversion channel (total $25M). This doesn't make sense given the scope of road changes in SR1. (Exhibit 4.17)

2. Further, facilities relocation costs need to be much more specific – is this the Ranger Stations? Campgrounds? Parking lots? In contrast, there is no cost in SR1 for the relocation of Kamp Kiwanis, which is much more extensive than the Ranger Station and McLean Creek area camping facilities. (Exhibit 4.17)

3. What is the Aquatic Habitat Management Plan in MC1? Is this a fish ladder? (Exhibit 4.17)

Exhibit 4.17: MC1 Cost Opinion

Component	Cost
Mobilization	$12,000,000
Care of Water	$3,000,000
Dam Construction	$188,000,000
Highway 66 Relocation	$34,341,000
Facility Relocation	$22,853,000
Wetland Compensation	$708,000
Aquatic Habitat Management Plan	$10,000,000
Engineering/Environment/Engagement	$54,180,400
Contingencies	$81,270,600
Project Total	**$406,353,000**

We request that the Benefit/Costs analysis of both projects be updated with true costs and opportunities under a more holistic and expanded framework than just flood for the City of Calgary, which was the original frame of reference. The current frame of reference precludes discussions on the management of the Elbow River for the long-term and is the source of the significant opposition to SR1.

SR1 BENEFIT/COST ANALYSIS:

LAND VALUE:

We request a fair market assessment of all the lands, buildings and other infrastructure impacted by SR1. Valuation of the privately held land impacted by SR1 is not a "one-size fits all" situation, despite the Proponent's use of the term "agricultural land".

The benefit/cost analysis is suspect due to the lack of information on SR1 land costs.

Clarification Required: This reporting by the Proponent is rather inadequate. In exhibit 4.3[35], the result is confusing. We recommend the Proponent show the costs for land acquired in a more transparent manner (using a chart table, for instance)? It is difficult to determine how much land has been acquired and yet to be acquired and for what price, both within the project perimeter and outside the project perimeter.

For instance, Exhibit 4.3 states that impacted parcels total 6799 acres. Meanwhile, the Proponent states that the project perimeter is 3610 acres and "The total area of impacted parcels outside of the Project Perimeter is approximately 1537 ha (3,799 ac), as illustrated in Exhibit 4.3. The total area of impacted parcels, excluding those already owned by the Province of Alberta is approximately 2638 ha (6,518 ac)." This math does not work – if the total outside the project perimeter is 3799 and inside is 3610, the total is 7409. What is the correct number? 6799 or 7409?

Exhibit 4.9 includes the 6518 acres yet to be acquired for a total of $108.78 million. Considering the total estimated acquisition price of $140 million for the total 6799, does that mean that as

35 https://iaac-aeic.gc.ca/050/documents/p80123/122352E.pdf

of 2017 there were 281 acres acquired for $31 million, or based on 7409, there were 891 acres acquired for $31 million ($35k/acre)?

Given that $140 out of their $477 total SR1 cost is land, the Proponent should provide a sensitivity analysis to total cost. For instance, if there are escalations in land acquisitions, the impact on the budget for increases is as follows:

	Gross	***Change***	**Net**	***Change***
Land Acquired (acres)	6799		3610	
Land Cost ($)	140,000,000		80,000,000	
Per Acre ($)	20,591		22,161	
5%	147,000,000	*7,000,000*	84,000,000	*4,000,000*
10%	154,000,000	*14,000,000*	88,000,000	*8,000,000*
15%	161,000,000	*21,000,000*	92,000,000	*12,000,000*
20%	168,000,000	*28,000,000*	96,000,000	*16,000,000*
25%	175,000,000	*35,000,000*	100,000,000	*20,000,000*

https://www.nrcb.ca/download_document/2/83/9124/20190614-at-sir-to-nrcb-re-sir1-response-appendix-ir6-1

To date, the Alberta Government has refused to release the cost of land acquisition for the Robinson parcels, citing privacy and ongoing negotiations with other landowners. We believe that the total compensation (cash and non-cash) far exceeds $20,000 per acre.

We request that the Proponent disclose all cash and non-cash compensation to landowners who have sold, including land, infrastructure, tax breaks, and any other item that could be considered compensation. Specifically, if land in lieu has been given, we expect it to be valued at a minimum price of the SR1 lands. Further, the government must provide justification as to whether the historical purchase values (i.e. Robinsons) are representative of expected purchase values for the balance of the land.

The land acquisition amounts need to reflect relocation or accommodation of the impacts on Kamp Kiwanis, which has significant capital assets on its existing site and may not be able to continue operations if SR1 proceeds. This cost MUST be included in the SR1 cost model. We are concerned that the true costs of accommodation for Kamp Kiwanis are elsewhere within the Alberta Government's budget.

We expect full disclosure on the costs of relocating Kamp Kiwanis and a discussion regarding the future of Kamp Kiwanis under SR1. A report should be commissioned and released publicly to understand the impacts of SR1 on this important landmark. The Proponent has not addressed Kamp Kiwanis in any level of acceptable detail and this is a critical element and consequence of SR1.

Regarding land costs, the Proponent States (Vol 4, EIA):

4.1.2.11 Total Costs

The total value of the impacted parcels, excluding the land already owned by Alberta Transportation, is estimated to be $108,780,000 ($16,689/acre). A summary of these costs by category can be found in **Exhibit 4.9,** while a breakdown with the cost for each parcel may be found in **Appendix C**. Including only the 3,610 acre inside the Project Perimeter, the total cost becomes $65,981,000 ($18,277/acre), as displayed in **Exhibit 4.10**.

And further:
"A detailed assessment of individual property owner's specific damages was not possible. Since the original land acquisition estimates, Alberta Transportation has begun negotiations with land owners with the objective of achieving voluntary, willing sellers. *During this process, it has become apparent that willing sales of the land will require much higher compensatory amounts than originally suggested. Accordingly, the current estimate for acquiring all land from affected owners has been revised to $140 million.* The 2017 benefit/cost submission assumed that any residual land acquired outside the project footprint could be resold and the land within leased for compatible uses. Available lands on the periphery of the project may be sold following the construction of the project. Final costs will be known once voluntary land sales or expropriation is complete."

To be clear, there are NO remaining voluntary or willing sellers for SR1. If land is acquired, it will be the "illusion" of willing sellers.

Based on the statement above, we can conclude that the gross land acquisition costs of $140 million (before excess sales $80 million or $22k/acre) are dependent on several factors including future land sales and possible assessments of landowner's specific damages. Considering the magnitude of the private land values in SR1 relative to the entire project cost (approx. 30%), we request that the Proponent should provide a sensitivity analysis for land costs, including cost escalation from the $22k/acre planned as well as for damages associated with business interruption, heritage and cultural considerations and replacement value. What is the cost to move Mary Robinson's equestrian operation? She moves her cattle between her land and McLean Creek each year. What is the cost for her to replace this convenient access? What amount of compensation will replace her family's original log home? Had the government consulted with landowners during the decision process, this inability to acquire land would have been identified as a barrier to completing SR1 in a timely manner.

DAMAGES AND PREMIUMS:

The Proponent states the following[36]:

4.1.2.9.2 Relocation Premiums

When considering costs for the Project Perimeter only, and not the total area of impacted parcels, the notion that certain parcels would have to be divided up was taken into consideration, and expropriation principals were utilized in calculating the associated land costs (see Section 4.1.2.10 below). All the parcels in the project area were examined to determine which parcels had improvements laying inside the Project Perimeter. These parcels had an additional 5% added to the value of their 2017 assessment to account for damages for relocation; the same 3% to account for fair market value; plus another 27% to account for home-for-a-home provisions.[6]

The collective land inside the Project Perimeter area was valued at 98% of the per-acre price of the total value of the impacted area after performing a weighted average calculation, and was then adjusted by 20% for damages similar to those that may be experienced in the expropriation process (such as damages for injurious affection).

And:

Exhibit 4.10: Land and Improvement Costs, including Damages, for Project Perimeter Only

Project Perimeter (3,610 Acres)	Cost
Land Value[8] (@ 98% per-acre value)	$44,793,845
Improvements Inside Perimeter	$12,228,851
Damages (+20% on land portion)	$8,958,769
Total	**$65,981,465**
Price Per Acre	**$18,277**

Notwithstanding the fact that significant adjustments have already been applied to the appraised market values, a further premium of 21% (±$14 million) was added to account for the anticipated contracted negotiating timeframe given the desired construction schedule. This results in a total land acquisition cost for the project perimeter (3,610 acre) of $80 million.

8 The land within the Project Perimeter was adjusted to 98% of the value of the bare land price for all of the impacted parcels by comparing the respective percentages and values of each land type in both areas. This was done to account for the unknown irregularly shaped areas in the Project Perimeter, as well as those that did not constitute a full parcel. This indicates that the total impacted area outside the Project Perimeter was, on average, of slightly higher value than the land inside the Project Perimeter.

Applying the Proponent's own logic, Mary Robinson's house and barn are not in the project perimeter (that she knows of) but yet her life and business on that land will be irreparably damaged. She does not receive a premium on her lands outside the perimeter, according to this calculation? Kamp Kiwanis buildings are not in the project perimeter (to our knowledge) but yet how can they continue their operations given the tremendous negative consequence of SR1? We point to Mary's land and Kamp Kiwanis land as examples that the Proponent's valuation may not be remotely accurate. The Proponent cannot rely on averages and generalities to address these specific situations on the SR1 land.

36 https://www.nrcb.ca/download_document/2/83/8788/20180326-at-eia-to-nrcb-re-vol-4-supporting-documentation

Further, the Proponent does not at all consider likely injurious affection on neighboring parcels outside the SR1 footprint. Certain parcels will lose road access and others will be adjacent to SR1 which will hold up to 4m of silt. Further, the possible injurious affection to all of Springbank and West Calgary, which may be negatively impacted by mobilization of silt.

EXCESS LAND SALES:

In Appendix IR6-1, the Proponent states:

"IBI Group, working with a licensed real estate appraiser, assessed the probable costs of land acquisition for the SR1 project footprint. It was assumed that any additional land acquired outside of the footprint would be re-sold for similar values, resulting in a recovery of those costs."

Firstly, if land sales are contemplated in the financial forecast, they should be identified separately from the avoided flood damages.

Secondly, we contend that the Proponent should assume NO cost recovery from land sales. Cost recovery of $60 million is highly optimistic and would be a "best case scenario", not a likely scenario for the below reasons:

1. There are relatively substantial costs for subdivision in RVC. Additionally, the Proponent should identify whether costs of subdivision for any lands acquired by the Alberta Government are included in the cost/benefit analysis and if they are included in the proposed $60 million resale. If not, the Proponent should estimate the costs of subdivision & servicing for all impacted lands.
2. The $60 million assumes that Rocky View County will approve sub-division applications from the Alberta Government (or their agent). This is a rather bold assumption, considering that RVC is opposed to SR1 and also that the land will be next to the SR1 footprint that has uncertain negative long-term outcomes (dust, silt, mosquitos, etc.).
3. Sub-division applications require access, which may be difficult due to the proximity to the SR1 structures, which will create several non-standard shaped parcels.
4. Subdivision requires servicing of utilities, water and waste-water. There is abundant groundwater in this area and, given the size and depth of the diversion channel and reservoir, it is not reasonable to predict each parcel will be fully serviced.
5. Is it reasonable to assume that there will be a market for this land, which is adjacent to the SR1 project?

In order to have these excess sales grounded in reality, the Proponent should provide the expected land use of the resold/excess land by parcel (with a map).

Thirdly, the Proponent states[37] that, rather than "injurious affection", the lands will generate a higher per-acre value than the original acquisition price because smaller parcels are inherently a

37

Re: https://www.alberta.ca/assets/documents/springbank/SR1_NRCB_AEP_IR1_Sec2_NRCB.pdf Question 25 higher per acre price. This appears to be land speculation on the part of the Alberta Government. One cannot ignore the value of future development and opportunity cost for future uses of SR1 (completely excluded from the SR1 cost/benefit) on one hand and then include the benefits of future development to fit the government's cost model on the other hand. It is either done for both or not at all. If a higher per acre price is assumed for resale, than a higher per acre value should be paid to landowners for foregone opportunity to do the same as the government is proposing to do.

Further, without SR1, landowners and Rocky View County would have the discretion to plan for the future use of these lands: develop, sub-divide, preserve, or otherwise. We know that, over time, some portion of these lands will be tremendously valuable. Rather than recognizing this value in compensation to the landowners, the Alberta Government is proposing to profit on the land acquired through carving it into smaller pieces. We contend that this is the EXACT reason why these lands should not be expropriated. That landowners and RVC should have the opportunity to choose what to do with that land over time and it can generate significant economic utility to all involved.

In summary, it is our strong belief that the Proponent should NOT include the $60 million in proceeds from the land sales of excess land acquired from SR1 due to the uncertainty of subdivision approval.

LEASE REVENUE:

Additionally, the inclusion of lease revenue[38], as detailed in EIA Volume 4: Supporting Documentation, seems optimistic. The Proponent is not clear on the long-term implications of this project on the environment. It would be much more conservative to estimate NO lease revenue from SR1 lands, rather than including a rather large annual sum of $715,000 (the Proponent should correct the error of “per acre” as the figure is per year.

Exhibit 4.12: Lease-back Income Potential Calculation

Project Perimeter Land Category Type	Base Price	Useable Acres in Project Perimeter	Overall Yield	Leaseback Income per Year
Reservoir (A-B and A-C)	$6,500	2,079.62	1%	$135,176
Dam and Outlet (A-A)	$12,000	754.62	1%	$90,555
In-stream and Diversion (REC)	$20,000	407.40	6%	$488,880
			Potential Income Per Year	**$714,610**

Lease revenue – three issues:

1. Basis for revenue per acre assumption:
    - The per-acre, per-year revenue predicted by the Proponent is $220 per acre.

[38] https://www.nrcb.ca/download_document/2/83/8788/20180326-at-eia-to-nrcb-re-vol-4-supporting-documentation

- What is the basis for this lease revenue? Agricultural uses or other? Where are the precedents the Proponent used to arrive at this figure? Supporting documentation must be provided, as this is a material revenue stream that the Proponent is relying on. We are unaware of lease revenue per acre of this magnitude in the region.
- Has the Proponent spoken with existing cattle ranchers / land-owners to see their willingness to lease back this land from the Government? Currently, cooperation between landowners allow for the relatively free movement of cattle in the SR1 area. If the SR1 lands are closed to landowners during certain times, is it reasonable that landowners would even be inclined to lease this land? Perhaps, the landowners are best moving their cattle to another region that would be unaffected by flood operations. In which case, the Proponent must find new lessees, who must then haul cattle (at an expense) into and out of the SR1 footprint. This all seems rather difficult, and thus the projection is unrealistic.

2. Basis for size of land used for lease revenue:
    - Given the total project perimeter is 3610 acres, the Proponent seems to suggest that approximately 3200 acres will be leased? This seems completely unrealistic. 2000 acres within the reservoir? This is effectively the entire reservoir.
    - We don't believe the lease land will be anywhere near 3200 acres described. Are we to believe that the lands in the diversion channel will be used for cattle?
    - The Proponent needs to describe how the leases will be operated each spring? Will cattle be removed each May to make way for possible use of the footprint during the flood? Will the animals be moved back at the end of June? What is the expectation? Will animals be left in the footprint year-round and be moved only when it appears there is flood risk? If so, is it realistic to assume that farmers will move their animals at the whim of the Proponent? What notification will be given? What financial incentives do cattle ranchers have for the additional time and cost of cattle movement within the SR1 reservoir.
3. It appears that there is no negative impact from the accumulation of silt in the footprint on the ability of lease the land.
    - Silt accumulation over time impacts both lease revenue per acre and size of lease footprint. How has the Proponent accounted for this degradation of lease revenue over time?

We recommend that lease revenue be removed from the benefit/cost analysis. The basis for its inclusion is questionable and optimistic.

SR1 CAPITAL COSTS (NCRB QUESTION 10)

LANDSCAPING:

The total cost for landscaping (drill seeding) included in the Proponent's capital cost is $1.2M. Considering the size of this project and massive amount of earthmoving required, only 953 hectares is slated for seeding. We ask for justification of this rather insignificant investment in landscaping.

PIPELINES

For pipelines (NRCB Question 194), we request that the Proponent require cost estimates from pipeline owners within the SR1 footprint. We don't believe that the Gov of Ab is able to arrive at accurate forecasts without involvement from the pipeline owners. Include compensation to pipeline operators for business disruption, if applicable, as a separate line item. Further, the new West Path pipeline is designed to go under the SR1 diversion channel, so where is this additional cost?

Re: https://www.nrcb.ca/download_document/2/83/5555/sir-1-july-31-2018

Our information suggests the pipeline work will be significantly more than the government estimates. We have heard that the Proponent has awarded TCE $1.6 million to begin design of the SR1 pipeline infrastructure. Can the Proponent confirm this design contract for the TCE pipelines? Is the Gov of Ab aware of an estimated cost of $22M for the TCE Pipelines changes, when the current estimate in SR1 is $3M?

We request that the Proponent supply written cost estimates for each pipeline, as provided by the pipeline owners and release the terms of the agreement for each operator. We request that Alberta Transportation explain fully the risks of moving/changing/removing the pipelines and explain how each risk is being addressed. Further, if there are accidents or spills during construction, should explain who is responsible for the cleanup costs. It seems that all risks are borne by the pipeline operators. This is unrealistic.

ROADS

Identify whether any costs related to SR1 may have been included in other projects (i.e. road changes), and if so, identify them and include them in the SR1 cost model. For instance, how much is the additional cost to twin Hwy 22 as a result of the elevated height and new bridge crossings?

Provide a breakdown of roadway changes by road (i.e. RR40 upgrades, Highway 22 Elevation, Highway 22 Bridge Crossings, Springbank Road and Hwy 22 Intersection Elevation, Diversion Channel Crossings on secondary roads). The following table prepared by the Proponent does not appear to be exhaustive.

The Proponent has not included the cost to upgrade Township Road 250 to accommodate the diversion traffic during SR1 use. This intersection is dangerous and the omission of upgrades to this intersection is an oversight by the Proponent. The Proponent states that Township Road 250 upgrades will result when the twinning of Highway 22 is performed. Given the uncertainty of timing for that project, we demand that the Proponent include this cost in the SR1 cost model for the safety of our community members.

It appears that this is different estimates are provided by the Proponent.

Table IR36-1 Costs for Road Modifications

Highway 22 Bridge Crossing	*$5.42 million*
Township Road 242 Bridge Crossing	*$4.21 million*
Grade and Resurface Highway 22 and Springbank Road	*$15.5 million*

In Table IR36-1, the cost for road modification is $25.13 million. In IR45-2, the total for road modifications is $20.72 million (below). The Proponent needs to provide the correct estimations for road modifications.

25	**Roadway Crossings**				
26	Highway 22 Bridge Crossing		See Separate Breakout		$ 4,768,000
27	Township Road 242 Bridge Crossing		See Separate Breakout		$ 3,708,400
28					
29	**Highway 22 and Springbank Road Modifications**				
30	Grade and Resurface Hwy 22 and Springbank Rd.		See Separate Breakout		$ 12,244,340

We cannot find where the Proponent discusses changes to RR40. This is a gravel road that goes under the TransCanada Highway. It is only used for local traffic currently and will be a diversion route during flood events where Springbank Road is at risk of flood. We do not see any costs for this road and it will surely require upgrades.

RVC & PROVINCIAL INFRASTRUCTURE DAMAGE PROJECTIONS:

Provide the cost of the development permit (Rocky View County) and other permits (if any).

It appears that the Proponent needs to add in damages to RVC infrastructure, which is missing from damages calculations under the SR1 scenario and would be avoided under the MC1 scenario. (https://globalnews.ca/news/1338378/10-memorable-images-of-bragg-creek-in-the-2013-flood/

MAINTENANCE CAPITAL

We request that the Proponent detail how they arrived at expected maintenance capital for both SR1 and MC1. Again, for MC1, one would think that existing dams would be a reasonable starting point. For SR1, there is no information available and the Proponent did not provide any details about maintenance capital so we have no information by which to evaluate the projections.

The Proponent should be obligated to provide projections of damages to infrastructure following various flood events, including:

- Costs of restoration to the Elbow Falls recreation area and Paddy's Flats, which were largely destroyed in 2013. SR1 does not protect this area, therefore the costs of restoration should be included in the cost model.
- Costs of the bridge repairs along Highway 66, which was damaged in the 2103 flood. This cost can be risk-adjusted, but without upstream mitigation, this bridge is still at risk of flood damage.
- Costs of Springbank Road reconstruction or repairs (as the road will act as a dam structure within the reservoir). Wave action, water and silt could damage the road.

BRAGG CREEK FLOOD MITIGATION:

Berms will not protect Bragg Creek or Redwood Meadows from groundwater flooding. See this report from U of C: https://drive.google.com/open?id=1MGA1o9aLGXwiO-G5mRmLCGMDTZo8oT5S. Calgary is protected by SR1 but communities upstream of SR1 are not equally protected and will use berms as flood mitigation. McLean Creek would provide equal flood protection for all communities upstream of Calgary as well as the City of Calgary.

We believe the Proponent should include the costs of restoration from groundwater flooding in Bragg Creek and Redwood Meadows in the SR1 cost model.

The Proponent should include the capital costs of both Bragg Creek and Redwood Flood Mitigation projects in the SR1 cost model.

The Alberta Government has not revealed the total cost for Redwood Meadows flood mitigation and associated restoration following the 2013 flood. Redwood Meadows rip-rap and berms were damaged in both the 2005 and 2013 floods.

The Proponent should include future capital costs of Bragg Creek and Redwood Meadows flood mitigation infrastructure. They are costs incurred because of the SR1 decision. The Proponent can refer to the Redwood Meadows repairs following he 2013 flood as a basis for this projection. Given that there has been damage to this infrastructure twice in the last 15 years, it is reasonable to include an allowance for flood infrastructure.

SR1 OPERATING COSTS:

The operating costs have varied widely over the years and it appears that both MC1 is nearly $675k/year and SR1 is estimated at $975k per year.

In the 2017 IBI report to the City of Calgary, operating costs for SR1 were listed at $5 million per year. We are unclear how $5 million has now been reduced to $1 million per year. We assume the $5M includes the TransAlta agreements, but that is just speculation.

Regarding SR1, we fully expect significant operating costs for SR1 during a flood year & the following year – cleanup, replanting, dust mitigation, road repairs, air and water quality monitoring, etc.

We request that Regulators direct the Proponent to detail costs for post-flood cleanup and repairs, which will differ from the “dry operations”.

We request that the Proponent provide an updated projection of annual operating costs of SR1 – both for dry operations and in flood-year operations, including:

- dust suppression (water, tackifiers, vegetation) – this has the potential to be a very significant cost and we request estimates for various scenarios of dust suppression
- repairs and upgrades to Springbank Road - this has the potential to be a very significant cost and we request estimates
- safety management
- emergency response
- silt removal/management - this has the potential to be a very significant cost and we request estimates for various scenarios
- staff
- facilities & structural maintenance
- berm and reservoir maintenance (planting, etc.)
- wildlife management and tracking
- monitoring of fish passages
- spawning areas and fish health
- water quality testing, reporting, etc.
- air quality monitoring, reporting, etc.
- other not mentioned

In the response to IR410, the Proponent provides the following information:

d. During dry operations, there will be an estimated five full-time positions on site, including operators, supervisors, and maintenance staff, which would increase daily traffic volumes by five vehicles on the highway and within the PDA. During a design flood, traffic will be rerouted to Range Road 40 off Springbank Road, but otherwise there will be no disruption in traffic along Highway 22 and Township Road 250. During cleanup during post-flood operations, there would be temporary increase in traffic on roads (see Volume 3B, Section 16.2.2.1).

Considering this is just labour costs (which will add up to approximately $500k per year, including benefits, etc.), we request a detailed breakdown of ALL SR1 operating costs, including the cost estimates of a flood year (wet and post-flood costs) vs a non-flood year under SR1. We ask the Proponent to specifically include the costs of Springbank Road reconstruction following a flood. Alternatively, the Proponent must provide justification, including supporting documentation, of why Springbank Road will not be negatively impacted by floodwaters.

Regarding MC1, we ask that, for reference purposes, the Proponent provide the operating cost of all major non-hydro dams, etc. for reference for operating costs of McLean Creek.

NRCB QUESTION 45: IMPLIED VALUE OF CROWN LAND

Re: https://www.alberta.ca/assets/documents/springbank/SR1_IAAC (CEAA)_IR_Package3_Appendix_IR45-3.pdf

(https://www.nrcb.ca/download_document/2/83/9124/20190614-at-sir-to-nrcb-re-sir1-response-appendix-ir6-1)

The Proponent states:

> In addition to the disposition cancellation costs, the study team at IBI Group strongly believes that any analysis of the MC1 project should consider the cost of land. Although no formal purchase of lands would occur, the land is very valuable to Albertans. As a recreational and natural asset, it is utilized by many more residents than equivalent private land is. Such land is in limited supply in proximity to major population centres. Therefore, the value of replacement land should be considered even if Alberta Transportation does not ordinarily include such costs in a benefit/cost analysis. As indicated in section 4.2.3 of the August 2017 benefit/cost submission, IBI Group has estimated that the cost of comparable replacement land for the project footprint at $57.75 million. Considering the total land area impacted, including relocation of the highway, the value would increase to $88.6 million.

We disagree vehemently that the land costs for the Crown Land at MC1 should be a factor in the decision. This decision appears to be made unilaterally by IBI, contrary to conventional analysis frameworks by Alberta Transportation. This cost of $57.75 million for 2300 acres or $25,000 per acre, which is higher than the $22,000 per acre contemplated in the SR1 cost model as compensation to landowners who actually have homes and businesses on the SR1 land. It is not right to use private properties in the Bragg Creek Area to value MC1 lands. Not all impacted lands are river frontage, as many of the reference points were, and MC1 is still more remote, which should discount the value applied per acre. A property "one block from the school" and the Banded Peak School is up on a hill, far away from the river, is in NO WAY comparable to the MC1 lands. How can you compare land that someone can build a house on and use it to value parkland? This appears to be an effort by the Proponent and its consultants to skew the decision to SR1 away from MC1.

Further, when did the MC1 footprint grow from 1200 acres to 2300? We have been unable to find what accounts for the expanded footprint in MC1. We request further information about this increase in footprint.

In addition, as taxpayers, we are only concerned about how our tax dollars will be spent. There are no tax dollars actually spent on purchasing land that the Alberta Government already owns. This seems to be a hypothetical red herring designed to make it seem that MC1 is more costly than it actually would be. The point is, NO tax dollars will be spent so in reality, MC1 is NO cost.

In summary, it is NOT acceptable to include recreational utility at McLean Creek and ignore the wide range of social, economic, recreational and environmental utilities on the SR1 lands. This is a double standard that appears meant to skew the report to SR1 and away from McLean Creek. **This reference to $57.75 or $88.6 million MC1 cost must be removed. Alternatively, the true cost of the various recreational, social, economic and environmental utilities, utilities on the SR1 lands must be included.**

NRCB QUESTION 61: FLOW DYNAMICS OF UPSTREAM MITIGATION MEASURES

This is also a Tsuut'ina Question. We are interested in the answer, which, to our knowledge has not been provided by the Proponent.

RIVER BANK EROSION

We have many concerns about the de-linking of three projects--the Bragg Creek Berm project is separate from Redwood Meadows projects and separate from SR1, but they all affect the volume and flow of the Elbow River.

One concern is that the result of building berms along Bragg Creek has on the Elbow River. The Elbow River west of SR1 has shifted dramatically over time, and in 2013 there was significant erosion along the bank of the river at Redwood Meadows, Mary Robinson's ranch, and Kamp Kiwanis:

- Redwood Meadows lost over 100 yards of forest during the 2013 flood in places. One place that is easy to measure is where the flood took away hole #7, a 100-yard golf hole and all the forest and trails around it.
- In Bragg Creek the erosion was captured on TV when Dick Koetsier's house floated down the river and he also lost 5 acres of riverfront property. A resident of Bragg Creek Hamlet, Barbara Teghtmeyer, recalls that when pipe was put in above the Hamlet, that one pipe likely contributed to causing the river to shift and meander differently in the subsequent years.
- Mary Robinson's ranch has suffered from catastrophic erosion because of floods. Her ranch is located just above where the intake for SR1 is proposed. She states that she lost as much as 20 acres each time there was a large flood, with the biggest loss being 90 acres in 2013. They have experienced a number of big floods since founding their ranch in 1888.
- Kamp Kiwanis lost a considerable amount of its beach front in the 2013 flood.

USE OF DIRT BERMS: INADEQUATE PROTECTION DURING MAJOR FLOODS LIKE 2005 AND 2013.

Huge portions of the dirt berms and huge rip rap were washed away during the 2005 flood in Redwood Meadows. It is noted that on the Alberta Transportations calculations and chart of big floods, the 2005 flood was not even considered! The 2005 flood caused millions in damage to Redwood Meadows berms and to the Water Intake system. The water intake subsequently underwent major repairs, including digging the intake pipe deep into the bed of the river. This major trench digging was across most of the width of the Elbow River in order to lay the pipe. This digging was done in the fall of 2005. It is interesting to note that in the following several years, after this major trench digging, the river subsequently meandered from the safe north side of the river bank, over to the south side of the river bank, close along the town of Redwood Meadows. Unfortunately, this shift in the river to entirely along it's south bank resulted in the river starting to flood over the dirt berms in Redwood Meadows in three places during the 2013 flood. The entire town was at risk!

When considering SR1, the largest ever intervention into the flow of the river, that it is difficult to predict the long term impact that it will have on the nearby 5 communities of Bragg Creek Hamlet, West Bragg Creek, Redwood Meadows, Tsuut'ina, as well as to the ranchers, Kamp Kiwanis, Kamp Hope, and Calgary, particularly Discovery Ridge which is the first Calgary community below and would be most at risk of SR1 failure. They also rely on dirt berms for flood protection. Amec's presentation to the City of Calgary outlined various risks of dirt berms.[39] How is it that berms are acceptable for Bragg Creek and Redwood Meadows, but not Calgary? This is a double standard.

Only an upstream dam would be able to control and manage river bank erosion and berm risk over the long-term. We believe that upstream berms, such as those proposed at Bragg Creek, will exacerbate risks and that the Proponent has not proven that this risk is mitigated.

NRCB QUESTION 88 WATER QUALITY EFFECTS – NOT SIGNIFICANT

We do not have the expertise to critique this response. Again, we predict that this project will have adverse impacts on the natural water systems, including under-studied downstream impacts to the aquifer.

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[39] https://drive.google.com/open?id=1QLjd-pmUyJC1yvt6cL8UqmMKmY2sqTsN

NRCB QUESTION 96: FLOW DYNAMICS OF UPSTREAM MITIGATION MEASURES

The Proponent states there are no comparable water diversion projects in Alberta. This is one of the concerns we have expressed with SR1: we have no reference point to consider. We have major concerns about the amount of debris in a flood situation (large boulders, houses, vehicles in addition to the modelled “trees”) that may adversely impact the ability of SR1 structures to operate as planned.

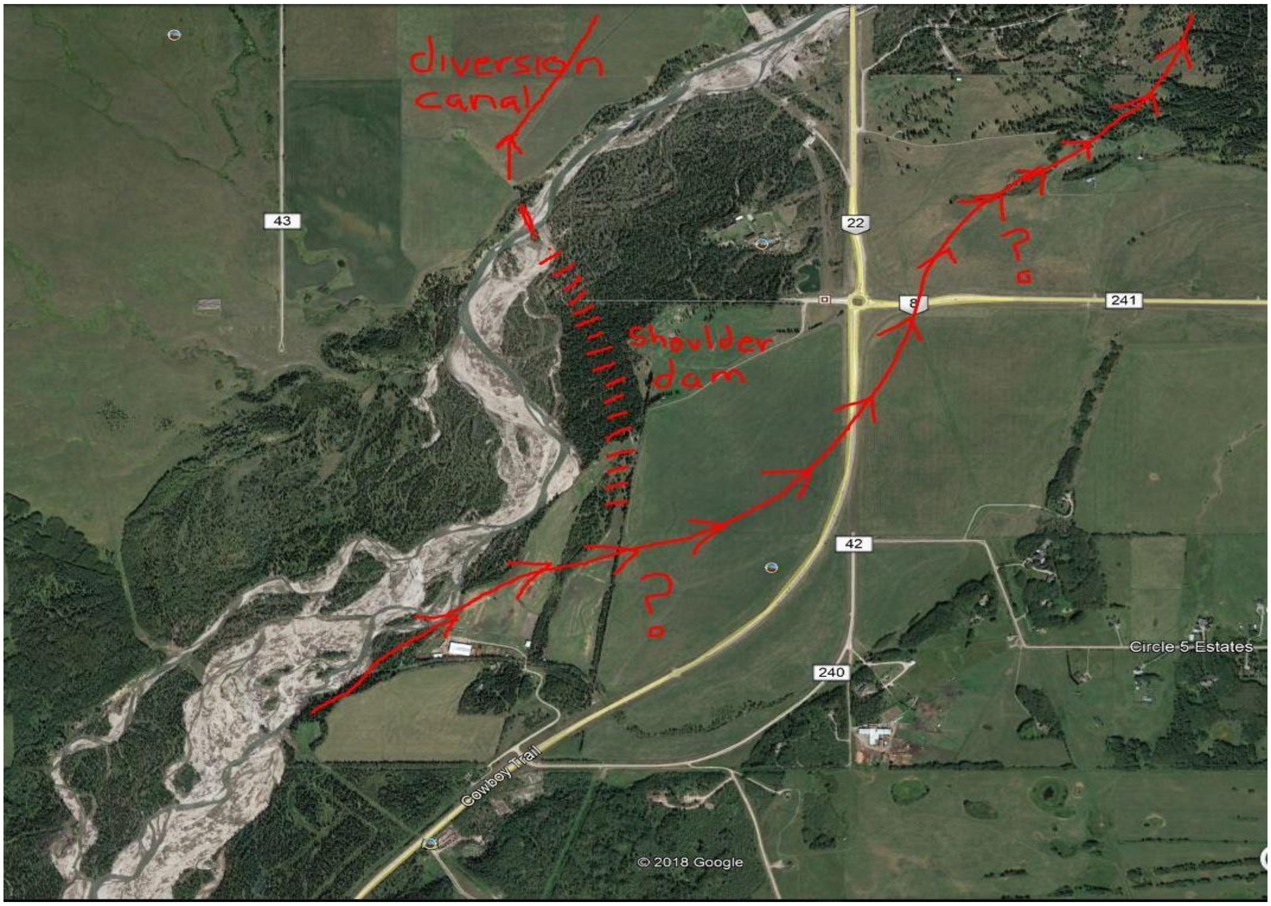
Long-term residents of Bragg Creek and Redwood Meadows observe how the river channel has shifted over time. There was significant movement of the Elbow River in 2013. Is it possible that the river will continue to shift more, resulting in the river circumventing the SR1 structures? In the past the Elbow River used to flow as far east as Highway 22, and it shifted westward to where it currently flows. A dramatic change over time.

We also ask the Proponent to comment on the accuracy of their river flood modelling.

We understand that there are generally two types of software (and mathematics) one is Hydrologic modelling, which is about water quantity (like watersheds or handling runoff in urban streets), and the other is Hydraulic modelling which is about the physics of water flow. Hydraulic modelling is most used in pipeline networks or places like sewage treatment plants to calculate flow rates through pipelines of different sizes (pressure interactions) or pipe and tank systems. It seems WaterCAD/WaterGEMS, InfoWater, and Flow3D are common engineering packages in North America. Stantec appears to use InfoWater as their recent job postings for hydrologists ask for familiarity with that software. Flow3D appears to be a more sophisticated hydrologic/hydraulic modelling package (not used by Stantec as far as we can tell) that offers riverbed scour calculations. A 2011 University of Arizona PhD dissertation by Anu Acharya compares the Flow3D calculated scour around a bridge support verses real scour that was highly dependent on the grain size input and not reliable above 28mm. We assume Flow3D is improved but suspect it is still only reliable under limited conditions (i.e. "normal") and not the velocities and turbulence and sediment load of flood conditions. Our review suggests there are no numerical models yet devised that can reliably do a level of accuracy of hydrology modelling.

Our current belief that any computer simulations of the Elbow River flow under 2013 conditions, other than maybe how high the water gets on the banks (and even that has problems with body surge waves, as occurred at the Bragg Creek bridge, are very suspect in their accuracy. In other words, any hydraulic model is unreliable. We are not sure how Stantec could have numerically modelled high-water conditions using a hydrologic model that simulated 70’ trees by bringing sticks into the debris deflector on the curved north river bank, and Stantec probably was unsure as well, which is why they went to NSERC to build the physical model.

One concern we have is that, given the change in channel meander pattern (sinuosity) documented by Tamminga et al. 2015, and the fact that the whole of the diversion structure lies on the easily scoured alluvial plain north of Redwood, what would happen if the river started to scour to the southeast, as it appears to have almost attempted near Mary Robinson's ranch in 2013? Such a large-scale meander also nearly happened at Bragg Creek at the Trading Post, Barbara Teghtmeyer's place, and again at "the washout" where the river started to erode to the southeast of the bridge. The erosion at the bridge on Highway 22 near the roundabout, was also hit by all the millions of dollars of large rip rap that was washed away at Redwood Meadows. It is noted that this rip rap was then replaced by millions of dollars of more, but much smaller rip rap. Would it be possible that the Elbow River would cut a new channel entirely south of the Diversion (shoulder dam) thereby missing the diversion infrastructure in the most part, as per this image?



Recall that in the "Redwood meander change" in the Tamminga et al paper it was the berm that constrained the river along its southern boundary and there are no such constraints at Mary Robinson's ranch. Ideally it would be useful to have a hydraulic model that could review such a scenario but given the numerical simulation complexity in calculating even a single meander with low bedload and sediment entrainment (Gu et al. 2016) ...but there is not a model.

One thing we do know about rivers like the Elbow...they change with time regardless of what kind of fight we put up over a couple of hundred years.

A highly cited paper by Tammainga, Eaton and Hugenholtz, 2015, Earth Surface Processes and Landforms[40] provides high resolution before- and after- flood images and elevation recording which documents the Elbow River changing channel sinuosity (and amplitude and wavelength) by about 150m laterally as a result of the 2013 flood. Please see their now somewhat famous figure 7. Their recorded area is located along the northern flank of Redwood Meadow, just upstream of the proposed SR-1 diversion infrastructure.

NRCB QUESTION 97: SEDIMENT REMOVALS AND FISH

Although there are silt projections for the reservoir itself, what are expected levels of silt buildup around the diversion structure, in the diversion channel and around the outlet (and other structures, as appropriate)? One would assume there would be estimates available for various flood scenarios? It appears the sediment accumulation could be a significant unknown factor in the operations of SR1.

The Proponent states: "Any diversion of the watercourse from its post-flood position would need to consider fish passage and be executed to comply with any and all required provincial or federal regulatory approvals (e.g., Alberta Code of Practice for Outfall Structures on Waterbodies, Fisheries and Oceans Canada "Measures to Avoid Causing Harm to Fish and Fish Habitat") to perform identified maintenance work." This answer is too vague for us to understand the specific actions that will be undertaken post-flood.

[40] https://drive.google.com/open?id=1iD0Y-t7gAUrftiOa1vRQwz-hNcfpnGmD

NRCB QUESTION 98: BACKWATER AREA

The backwater area includes Mary Robinson's lands and some of Brian Copithorne's along the river. It will be a catchment area for debris and will forever be changed. We are not satisfied with the level of detail provided on the backwater operations and impacts on the land and the river dynamics.

COMMENTS FROM LANDOWNER MARY ROBINSON:

Backflow is always a concern should there be failure of the dam. We think this has been highly underestimated during any of the research. The amount of debris that goes down the river during a massive flood, CANNOT be dealt with by opening some flood gates to let them flow through. The debris is huge, and very large trees --- hundreds of them that would be unmanageable. We believe their research in this category is very flawed and their ability to cope with this problem highly overestimated.

In 2006 after the large flood in 2005, we personally spent over $100,000.00 berming from the SW corner of our property to below the arena (approx. ½ mile). This was a huge financial burden to us for years. They would not let us berm any further north as a small creek is present there with some fish in it. At the end of this berm that we built to the North, during the flood, the river came around the corner of the berm, flowed eastwardly. We subsequently lost 20 acres to the river right there at that time. As you are aware, once the river cuts in – it is considered riverbed and becomes Government-owned and you no longer have title to it. Understandably, we found this very frustrating as their goal of **saving fish** ---actually -- the absolute opposite occurred as those fish did not stay in the river but became stranded on land or small pools that dried later up and the fish all died. If they had allowed us to continue the berming downstream we would not have lost this precious land, the fish would have stayed in the river flow and much less damage overall would have occurred. There was no compensation for this lost property and this large financial loss due to their decision.

Over the years of flooding, where our land joins Redwood Meadows, the river used to be in its channel of approximately 100' wide and against the bank to the west but it has constantly moved eastwardly and the riverbed width is probably close to a ½ mile width due to successive floods – all just debris and scoured alluvial plane--- absolute eyesore. Apparently, the elevation of the land in this area has a huge drop to the east so the water flow is always strongly eastwardly. The intake (or any structure they build), we think there is a high risk of the river getting around it to the east upstream and then the structure would be counterproductive and actually "hold the water" to the east and it wouldn't be able to get back into the main stream of the river. Redwood dirt berms would not be adequate to hold backflow resulting in Redwood Meadows starting to flood due to backwater from the SR1 intake.

NRCB QUESTIONS 99-100: FISH

In 2015, AMEC and AEP conducted their own study[41] of the Elbow as part of their dismissing of MC1 as a viable alternative – see link below. They claim to have found multiple bull trout redds close to the MC1 location. The material is in pages 39-44. They include a map showing redd locations.

In doing the SR1 study we don't believe the Proponent accessed any outside experts or specific problems, and did not consult with Indigenous or other people. They relied on internal resources to do the study.

In arriving at the decision to choose SR1, the Proponent states the following about fish at MC1:

River Uses

Paddling activities—including kayaking, canoeing and whitewater rafting—are popular activities in Elbow River. Experienced whitewater paddlers access the river between Elbow Falls and Elbow River Boat Launch PRA. The MC1 Option would result in inundation of reaches upstream of the dam but would not extend to the Elbow River Boat Launch PRA. No changes to upstream whitewater paddling or rafting between Elbow Falls and Elbow River Boat Launch would be expected due to the MC1 Option.

Commercial and recreational paddlers and rafters currently access the river at the Allen Bill parking area, just upstream of the proposed location for the MC1 Option. Paddling and rafting trips typically occur in May and June, depending on water levels. The permanent pond would obstruct navigation down the river; therefore, as a result of the MC1 Option, commercial and recreational paddlers and rafters would need to relocate to an access point downstream of the dam. During normal operations, inflows would be passed through the MC1 Option diversion tunnels. During a flood event, excess water, over the set flow threshold (i.e., 212 m^3/s), would be retained in the reservoir.

Recreational fishing for native and introduced trout and mountain whitefish is identified as a popular activity in Elbow River and its tributaries. Construction of the MC1 Option would eliminate or alter fish habitat in reaches upstream and downstream of the MC1 Option dam, as well as within multiple tributaries in the area due to placement of dam components, changes to channel morphology due to the permanent pond and realignment of watercourses. The alteration and destruction of fish habitat due to the construction of the MC1 Option would result in a substantive decline in productivity levels for bull trout, which is a species of conservation concern (Hemmera 2017). Other adverse residual effects on fish and fish habitat, including effects on migration and changes to the fish assemblage were considered to be negligible. However, changes to fish and fish habitat would permanently and adversely affect the quality of the recreational fishing experience in affected habitats upstream and downstream in the Elbow River and affected tributaries over the long term.

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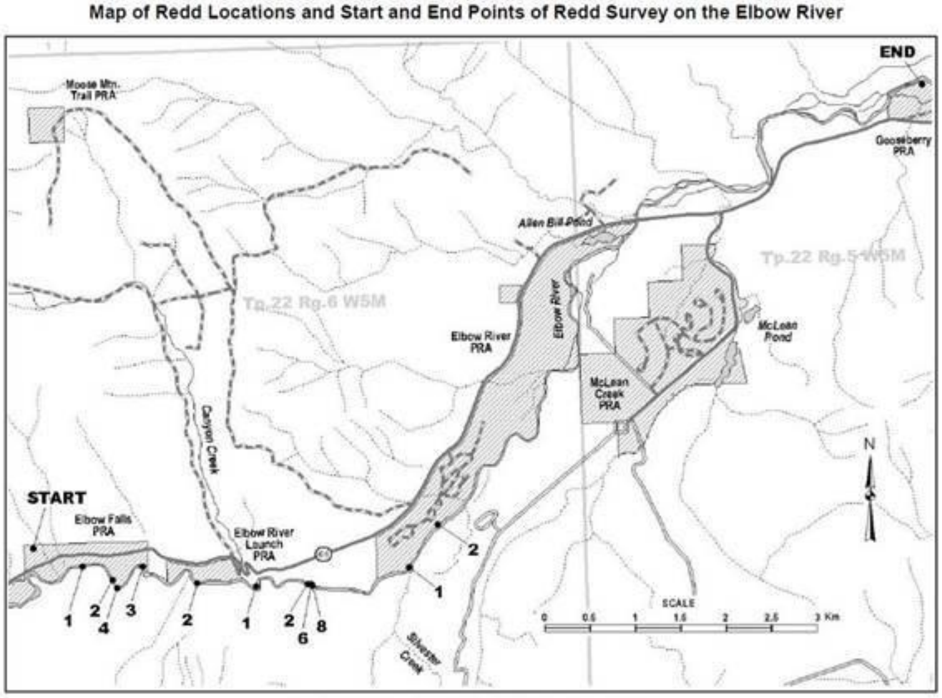
[41] https://open.alberta.ca/publications/cw2174

OUR VIEW:

The above statement does not match any of the information we have been following on the Elbow River for 30 years. We have many reports but the most pertinent Elbow studies are by Faulter, 2000; the GoA Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017, 2013; Fluvial Bull Trout Redd Surveys on the Elbow, Sheep and Highwood Rivers, Alberta Popowich and Eisler 2008; GoA Status of the Bull Trout in Alberta Update 2009, and Seasonal Movement Patterns and habitat selection of bull trout (Salvelinus confluentus) in fluvial environments, Popwich and Paul 2006. The most pertinent information is the location of Bull Trout redds (gravel breeding places) in the Elbow River (Popowich and Eisler 2008) and the second map is the telemetry of tagged Bull Trout to track their movements over the year.

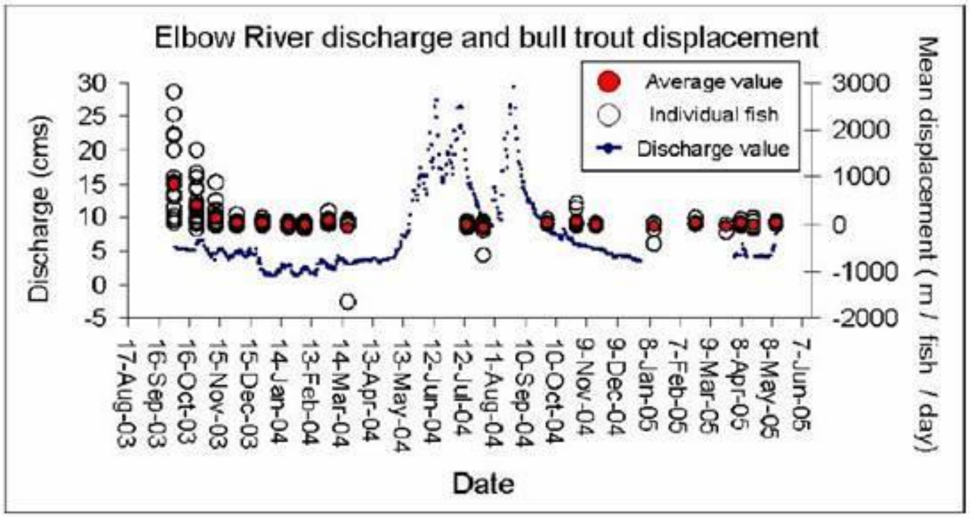
We would hope that a dam at MC1 does include a fish ladder to assist movement of fish, particularly Bull and Mountain Whitefish, from the Lower Elbow to the Upper Elbow, invigorating the genetic pools. Again, in my view, a lake environment is likely to promote large Bull Trout and Whitefish (they shouldn't introduce Lake Trout as they did at Spray Lakes) and enhance the recreational fishery. We don't know who wrote the paragraph above, but we suspect they were not fishermen/women and if they were, they never fished the Elbow.

Map 1
Map of Redd Locations and Start and End Points of Redd Survey on the Elbow River



Fluvial Bull Trout Redds in the Elbow River, 2008.

Figure 24. Mean bull trout displacement values compared to a discharge profile of the Elbow River. Positive displacement values indicate downstream movement; negative values indicate upstream movement.



These data, the most recent for the Elbow, show that there are NO breeding areas in the McLean site and the Bulls in the Elbow tend to stay close to their "home" pools. The river at the MC1 location is always a fast, shallow running stretch with few pools or side sloughs to offer suitable habitat for breeding or holding Bulls (or Cutthroats for that matter). It was made even worse in the 2013 flood as what few pools were present were filled with cobbles. The best Bull habitat on the Elbow is found in the large pools near Canyon Creek (which are closed to fishing) and close to Bragg Creek.

We predict that a dam at MC1 would dramatically enhance the Bull Trout population, but not that of the Cutthroat. (There are not many Cutts in the reservoir section with no good holding pools, but there are good pools near Paddy's Flat.) Lacustrine holding areas that lakes provide promote growth of very large Bull females that spawn prolifically. This is the case in lower Kananaskis Lake where Bulls run up Smith Dorrien Creek (Status of the Bull Trout, Alberta Wildlife Status Report No. 39). Lakes also enhance the populations of Mountain Whitefish as has occurred in Spray Lakes.

We also have reports on the tributaries of the Elbow, especially Silvester Creek, but also McLean, Prairie, Quirk and Canyon creeks. Silvester, Prairie and Canyon creeks are extremely important as they have genetically pure Westslope Cutthroat Trout populations (others along the Elbow have hybridized with stocked Rainbow trout). These will not be affected by a dam at MC1.

A reservoir at McLean Creek should be "bottom release," maintaining pure, cold nutrient-rich flows for the aquatic ecosystem downstream[42] and the human and wildlife populations that rely on the Elbow for drinking water (including more than 500,000 people in Calgary). This dam, as

[42] https://new.tu.org/conservation/conservation-opportunities/dams

you point out, should include a fish ladder to allow movement of spawning Bull and Cutthroat trout, as well as Mountain Whitefish, from the stretches near Bragg Creek and Gooseberry to the spawning redds in the canyon pools downstream of Elbow Falls. We would add that hydro power at a McLean Creek reservoir is not an ecologically desirable facet (except perhaps lower capacity in-stream hydrokinetic turbines) because hydro use creates water level fluctuations that largely incapacitate downstream aquatic ecosystems as has occurred along the Kananaskis River and middle Bow River.

Essentially all instream reservoirs have a lifespan due to eventual siltation (although this lifetime can be expanded by periodic lowering of the reservoir level to at least partially flush out sediment deposits, as dams along the Colorado River have done). The lifetime of a McLean Creek reservoir can be estimated by looking at sedimentation in comparable structures at Barrier Lake and the Glenmore Reservoir. The Glenmore Reservoir was constructed in 1932 and lost 10 percent of its capacity in 40 years (i.e., ~400 yr life). Barrier Lake Dam was constructed in 1947 and appears to have increased it delta area about 20 percent in the last 72 years, yielding a life estimate of 360 years. Dredging has been contemplated for the Glenmore Reservoir but is not considered at this time as increasing the capacity, which is near completion, is more cost-effective.

An off-stream flood mitigation reservoir at Springbank would periodically flood the Elbow River downstream at discharge (or a required 1/5yr testing diversion), destroying the cold water ecosystem with June or July sun-warmed, algae-bearing water. These waters will significantly increase water treatment costs for the Glenmore treatment plant and likely lower the water quality (particularly taste) for the more than 500,000 people drinking that water. A flood event at Springbank would coat the inundated ~3000 acres of grassland with silt up to 4m thick, destroying the habitat for the Sibbald elk herd, deer, voles and mice and the grizzlies, wolves, cougar, coyotes, badgers, weasels and owls and raptors that rely on this prey. As seen at Redwood Meadows it takes years for the grasses and shrubs to regenerate. The landscape at McLean is already largely devoid of wildlife (except wild horses) because of the consistent OHV traffic there.

So in considering all these effects, we believe at cold water, bottom-release dam with a fish ladder at McLean Creek can actually enhance the aquatic ecosystem downstream within the Elbow River watershed assuring wildlife and human residents of cold, pure water in times of drought and relief in times of flood. The Springbank Off-Stream reservoir may only be partially effective at flood mitigation and will destroy the downstream aquatic ecosystem following that flood.

NRCB QUESTION 100: SUSPENDED SEDIMENT AND FISH

Re: https://www.nrcb.ca/download_document/2/83/9208/20190614-at-sir-to-nrcb-re-sir1-response-sec-2-nrcb IR100-1

We are confused as to why the suspended sediment level of 81 is used to summarize impact on fish. Firstly, there isn't a prediction of the sediment level within the SR1 reservoir. We believe this is an important factor to consider. Secondly, the Proponent regularly refers to the 1:10 flood year and doesn't contemplate the impact of design flood on the fish in the reservoir and leaving the reservoir. If they can be so dismissive of the likelihood of the design flood (or, in their words "the unlikely design flood", why are we building this project in the first place?). This appears to be an attempt to minimize the negative outcomes of SR1.

In the IR-100 Response, the Proponent addresses sediment impacts on fish for the 1:10 year flood "because the 1:100 year and design floods are rare and would likely cause higher level effects on fish populations in Elbow River without the Project compared to with the Project."

This is an incomplete response by the Proponent. Although a 1:100-year flood is theoretically less likely doesn't mean that the impacts shouldn't be evaluated. There will be large-scale floods (2005 and 2013 illustrate that point, and these are within 10 years of each other). So, we must understand the effects on fish due to sediment. In fact, there were two large floods in recent years: 2005 and 2013. It is not reasonable to focus on consequences and implications of the 1:10 year flood. We are also unconvinced that the Proponents assertion that 1:100-year floods are rare. Climate change may impact both severity and frequency of flood, so use of the term "rare" is pure conjecture on the part of the Proponent.

The Proponent goes on to state:

"*Without the Project* [emphasis added], these higher effects due to increased river velocities, habitat alteration, and overland flooding of agricultural and urban environments can result in decreases in trout populations (Jowett and Richardson 1989) and water quality (Talbot et al. 2018)."

Again, SR1 is being compared to this false alternative of "do nothing." The comparison should be made to MC1, the true alternative in this process – not "do nothing" or "without the Project" as the Proponent states.

What is the impact on fish with MC1 and flood?! Is MC1 better for fish than SR1, given all that we know about sediment levels in the SR1 reservoir, at the inlet and downstream?

"Without the Project" is a misleading and unacceptable comparison.

NRCB QUESTIONS 101-103 AND IAAC (CEAA) QUESTION IR1-05: FISH MORTALITY

Re: https://www.nrcb.ca/download_document/2/83/5555/sir-1-july-31-2018

MC1 COMPARISON:

Interestingly, SR1 was chosen, in part, because it was expected to be better for fish than McLean Creek. The 2017 Hemmera Report[43][44] for MC1 states:

"However, the potential residual effect on fish mortality and productivity is considered substantive for bull trout, as mortality from fish passing through the diversion tunnels <u>during construction</u> [emphasis added] would likely be unavoidable. Any mortality to bull trout would have population level effects due to the small size of the Upper Elbow River population."

As discussed above, we dispute the Bull Trout statements provided by the Proponent. However:

If any mortality to bull trout would have population-level effects, how is it possible that likely mortality of fish in the SR1 reservoir – by the Proponent's own account – is acceptable? To be clear, the Hemmera Report states that mortality <u>during construction</u> of MC1 is likely to be unavoidable, while stating that:

"Some new wintering habitat may result from the creation of the permanent pond, and coarse substrate deposition at the upstream end of the permanent pond may enhance foraging or spawning habitat, representing potential positive effects."

Therefore, based on the Hemmera Report, MC1 would have permanent, positive long-term impacts to fish and short-term negative impacts. Doesn't SR1 have negative outcomes for fish during construction? It certainly has negative outcomes during use.

We believe that the Proponent should predict, within some confidence interval, the number of fish entering and exiting the SR1 reservoir under various flood scenarios. An order of magnitude is necessary to understand the implications of SR1 on the fish.

Further, the rescuing of fish "by hand" is unrealistic, give the expected high sediment and silt deposits. Further, the area of land used by the reservoir is enormous and any "by hand" solutions should be dismissed. We aren't sure that the Proponent understands how large the inundated area will be. There will be no "rescuing by hand."

Is it realistic to assumed that wind will maintain dissolved oxygen levels in the reservoir? If so, wouldn't the wind continue to stir up sediment also?

[43] https://www.nrcb.ca/download_document/2/83/8788/20180326-at-eia-to-nrcb-re-vol-4-supporting-documentation
[44] We are unable to find the entire report and only have access to the Executive Summary

Regarding sediment, Hemmera states:

"The MC1 Option would result in both a decrease in downstream peak flows and a decrease in the sediment supply, which may result in channel degradation, channel narrowing, coarsening of bed material, pattern simplification, and aggradation at tributary junctions downstream of MC1 to the intake of the Glenmore Reservoir."

Firstly, the hypocrisy here is astounding. One of the benefits touted by the Proponent about SR1 is its ability to remove sediment load from the river. This assertion by the Proponent is in direct opposition to the above statement by Hemmera, which states that sediment removal from the river is negative. Which is the truth?

As for sediment load in in-stream dams, we have the following statement:

The sediment depletion phenomenon is a concern at dams at places like the Aswan (Nile River) and the Colorado River dams where the rivers have a high entrained sediment load. Water flowing from these dams has lost its sediment load in the reservoir becoming clear and “unsaturated”. These rivers then become erosive until they pick up sediment downstream and become “saturated” again. We don’t believe this is a measurable concern in the generally clear water rivers such as the Kananaskis (Barrier Lake) or Bow (Ghost Reservoir) where silt and sand entrainment is a spring event and flood loads are primarily cobbles and pebbles. It is true any reservoir in our rivers have inlet deltas that propagate into the reservoir dropping the spring sediment load (we calculated about 400 years for MC-1 based on Barrier and Glenmore). If we consider the wide alluvial plain downstream from McLean Creek (e.g. at Gooseberry), we would submit the coarse sediment supply there is sufficient to limit hydraulic damage for the lifetime of the reservoir. The operator could also periodically flush some of the submerged delta sediment with large releases as they do along the Colorado.

If one operated MC-1 in a way that was environmentally conscious, one would allow large flows in the spring to move some of the fines through, and maintain steady summer flows to wash those same fines off the gravel beds needed by spawning Cutthroat (June spawners) and Bull (fall spawners) trout. What is most critical in operation though, is not to have daily variations in stream flow like those on the hydroelectric rivers. Those variations are devastating to the invertebrates the fish feed on, and hence the fish population itself. Hydro is still a limited possibility at MC-1 with smaller jet turbine type “run-of-the-river” generators that operate on 2-5m3/s.

The latest response by the Proponent (Conformity IR1-05) clearly indicates a wide range of negative outcomes for fish[45]:

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[45] https://www.nrcb.ca/download_document/2/83/9711/20191105-at-sir-to-IAAC (CEAA)-re-annex-1-information-request-round-1-part-1-conformity-review-dated-20190716

Empirical modelling has demonstrated that a correlation exists between suspended sediment concentrations and adverse behavioral and physiological effects on salmonid species (Newcombe and Jensen 1996; Newcombe and MacDonald 1991; Newcombe 2003; Kjelland et al. 2015). This relationship between sediment and effects on fish is commonly qualified through the Severity of Ill Effects (SEV) Index (Newcombe and Jensen 1996), which was developed through modelling the association of TSS levels with categories of physiological and metabolic stress related effects. In general, TSS presents a variety of adverse effects on fish physiology and behavior, and these effects are compounded by the duration of TSS exposure.

Due to the uncertainty in the predicted TSS levels discussed above, predicted severity of ill effect levels would be similarly uncertain. However, the estimated TSS concentrations described in Table 5-2 have the potential to cause sublethal and lethal effects on fish during the release period.

Behavioral, sublethal, or lethal effects on fish that may result from a release from the reservoir may be caused by decreasing light penetration, primary and benthic productivity, and fish swimming and feeding behavior. If the release overlaps with fall-spawning activities (e.g., early spawning of brown trout and mountain whitefish), the estimated concentrations presented in Table 5-2 may also create a physical barrier to incubating eggs by limiting dissolved oxygen concentrations that are available within gravel substrates as a result of sediment that settles along the riverbed. Increased sediment concentrations may also create a physical barrier to fish by reducing gill permeability (Rombough 1987). Reduced respiration rates can result in hypoxic conditions in fish that subsequently lead to premature fry emergence, decreased growth rate and tissue mass, and overall decreased survival rate (Rombough 1987).

What is not considered by the Proponent is the likelihood that fish exposed as the reservoir levels dropped will become prey for eagles and other predatory birds.

We ask: Does this same level of impact on fish exist with an in-stream dam? We contend that the above effects identified by the Proponent will exist EACH TIME the reservoir is used. This is not a one-time occurrence. This is repetitive mortality of fish that is unique to SR1.

We await the fish studies requested by NRCB in SIR 1, Question 342:

68. Supplemental Information Request 1, Question 342, Pages 5.225-5.228

Alberta Transportation states that no quantitative estimates of fish populations (i.e. mark recapture population estimates) were available, and instead used relative abundance. Relative abundance is not effective in detecting changes to fish populations in the absence of baseline data. Population estimates are therefore more appropriate in assessing impacts (changes) to fish populations pre and post dam construction and operation.

Alberta Transportation must undertake population estimates of fish populations both prior and following dam construction and operation. This approach will allow for the detection of differences in fish populations pre and post dam construction/operation to assess whether impacts to fish are as predicted.

a. Provide quantitative population estimates for the fish species found in the Elbow River.

NRCB QUESTION 105: FISH PASSAGE

"Accumulation of large woody or ice may affect the results of the hydraulic model; however, these phenomena are not possible to replicate with certainty."

This seems like an inadequate answer. It is reasonable to expect large woody debris along with boulders, rip rap, etc. Similarly, if the reservoir waters are held until December, ice will form. We believe the experimental nature of this project is problematic because there are so many uncertainties.

NRCB QUESTION 106: TSUUT'INA CONSENT

We believe that the Tsuut'ina must consent to this project. Deltares made a materially incorrect assumption when they predicted that First Nations would prefer SR1 over MC1. On what basis did they make that assumption? Perhaps they did not look at a map of the project to see that Tsuut'ina lands (and their community of Redwood Meadows) were adjacent and NOT protected by SR1? The Tsuut'ina have expressed valid concerns about this project and, to our knowledge, their questions remain unanswered by Alberta Transportation.

NRCB QUESTION 113: PUBLIC ACCESS

During the first open houses, we were advised that there will be a three-strand wire fence with barbed wire on the top strand around the Intake area, but not directly along the diversion channel. As shown in **Appendix E pictures** there are numerous types of wildlife and birds in the SR1 area, including a large herd of elk. If elk, deer, moose, or any other animal jumped the barbed wire fence, which they routinely do, they could easily fall into the deep diversion channel. There appears to be no way out because it is so deep.

The same concept of lack of fencing apples to lack of protection for the public. This is a critical issue since SR1 site is not planned to be monitored on an on-going basis.

PUBLIC ENGAGEMENT AND ABORIGINAL CONSULTATION (NRCB QUESTIONS 127-161)

AT Responses:

NRCB : https://www.nrcb.ca/download_document/2/83/9192/20190614-at-sir-to-nrcb-re-sir1-response-sec-3-general

IAAC (CEAA) : https://www.nrcb.ca/download_document/2/83/9092/20190614-at-eia-to-nrcb-re-IAAC (CEAA)-ir-response-package-2

NRCB QUESTION 141: POST-CONSTRUCTION LAND USE

We take issue with the contention that SR1 increases recreation capacity due to the transition from private to public land. Firstly, there is significant utility on these lands in their existing state, which has been ignored. Secondly, while it is possible that the southern side of the reservoir berm may have some temporary recreational value, the belief that anything in the reservoir can be used for recreation is pure conjecture. With the deposit of silt, metals and contaminants after a flood, who will use this land for recreation? Residents were advised in Redwood Meadows and Bragg Creek not to touch or allow children to play with the soft sand that washed up on the riverbanks because it contained up to 136 toxins.

This argument by the Proponent that recreation utility increases is laughable. If we need to increase recreation utility in Alberta, make more provincial parks. Temporary **SR1 is not a recreational investment. McLean Creek, on the other hand, has realistic and tangible recreation potential that should be considered in the alternative means analysis.**

In the 2016 EIA, the Proponent states the following with regard to SR1:

"The Project affects grazing areas and ranch lands for a small number of Albertans. This will have an impact as these are legacy ranching families with a strong stewardship ethic."

Kamp Kiwanis was not mentioned. Camp Hope was not mentioned. Moose Hill Equestrian Centre was not mentioned. The numerous cattle operations were not mentioned. The Proponent gave great detail about the MC1 recreational impacts and proceeds to make a dismissive statement about the "grazing areas and ranch lands for a small number of Albertans." Thousands of children every year use Kamp Kiwanis. Many families benefit from the equestrian centre on Mary Robinson's land by being taught about horses and by boarding their horses. Thousands of cyclists in increasing numbers every year use this beautiful corridor. The continued marginalization of the local and social impacts of SR1 is not acceptable.

NRCB QUESTION 147: POST-CONSTRUCTION LAND USE

We are concerned that the post-construction land use is not realistic. There are too many variables in SR1 to have one post-construction land use diagram. We do not believe that the Proponent has given adequate consideration to the various states of this project and is dismissive of the change in appearance and function of this project over time. Silt accumulation will be ongoing with each use of the reservoir, so the land use projection of "dry operations" is overly simplistic. We challenge the regulators to press the Proponent about projections over time regarding silt accumulation and post-flood uses, appearances, and outcomes.

The Proponent needs additional land-use diagrams that are "during flood," "post-flood but pre-clean-up" and "post-food, post-clean-up".

POST-FLOOD, PRE-CLEANUP

In the aftermath of a flood, once, drainage has occurred, there will be damp silt that must dry out. What does this look like and what are the uses of this land during the drying phase? Are animals expected to use the footprint during this time (wild / domestic)? We expect the time to dry may be prolonged, but we were unable to find projections of this duration, which would presumably change by flood scenario.

POST-FLOOD, POST-CLEANUP

There will then be a period where the silt will be moved around to manage drainage for future use of the reservoir. Is it during this phase that reseeding will take place? Or, will seeding take place when the silt is wet? A better explanation of this is required (when and how will reseeding take place?). How long is growth over ground cover (based on the seed mix) expected to take? Are animals expected to use the footprint during this time (wild / domestic)? What is the delay before domestic animals are allowed on to graze (to generate the lease revenue that the Proponent projects)? Is it weeks? Months? Years?

The Proponent should be required to provide detailed descriptions of the land excavation and clean-up between flood events. We believe that it could be a constant excavation area similar to a gravel pit (rather, dustier and full of more toxins).

NRCB QUESTION 151: DEBRIS DEFLECTOR

ONGOING CHANGES TO SR1 COMPONENTS

Our communities have many questions about this new component: debris deflector to the project[46]. We are unclear whether this substantive change can be made this late in the process, and what the potential effects are of this deflector on the aquatic environment over time. This is a $10M addition to the project cost.

We would like to see renderings of how this debris deflector is anticipated to look in the river – status quo, during a flood and post-flood. The residents of Redwood Meadows deserve to understand what this large addition to the project looks like and its possible ramifications if it fails.

AT makes the following statement:

> Debris removal activities will occur outside the restricted activity period (RAP) for instream works of May 1 to July 15 and September 16 to April 15 and for the Key Wildlife and Biodiversity Zone (KWBZ) identified along Elbow River in December 15 to April 30, where possible. If debris removal needs to occur during the bird nesting RAP (March 15 – August 31), as a result of safety considerations, a qualified wildlife biologist will conduct nest searches. If an active nest is found, it will be subject to a provincial or federal disturbance setback buffer and site-specific mitigation (see Volume 3A, Section 11, Table 11-10 and Table 11-11). Removal of large debris from the debris deflector will occur through a manual work force, when determined safe to do so.

There are many qualifications in the above statement about debris removal that concern us. It appears that there is a small window between September 1 and September 15 for the instream debris removal to avoid the likely impact on nesting birds. Is this realistic? What are the setbacks required for nesting birds that Alberta Transportation refers to? How significant is this setback?

> During flood operations, large debris may be caught on the debris deflector and prevented from moving downstream in Elbow River. Without replacement of the debris into the river channel, this could result in a decrease in habitat complexity downstream of the diversion structure. The concrete base and debris trapped on the deflector may induce scour pools to form, creating deeper water along the debris deflector that would result in direct and indirect alteration of fish habitat during flood and post-flood operations.

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[46] https://www.nrcb.ca/download_document/2/83/8820/20180514-at-eia-to-nrcb-re-debris-deflector-addendum

FISH ENTRAINMENT

> During flood and post flood operations, the debris deflector may act as velocity refugia for fish in Elbow River and at the inlet of the diversion channel. There is no certainty whether the debris deflector would increase or reduce fish entrainment in the diversion channel. With the diversion channel and reservoir mitigations and monitoring, the potential for mortality of fish entrained in the diversion is not predicted to change with the addition of the debris deflector.

Has this impact on fish been adequately addressed? Is there potential mortality for fish from the debris deflector?

RIVER CHANNEL EVOLUTION

What is the risk of the river "shifting" over time such that the debris deflector is not properly engaged and thus is rendered ineffective or hazardous?

Does the Proponent need to include a cost for upgrades or relocation of the debris deflector that will likely be required over time?

We observe that the decision on the debris deflector was based on the scale model of SR1. We have the following comments based on the high-level review of the model that was included in *Canadian Dam Association Magazine* in summer of 2019[47]:

- In terms of modelling real water characteristics in times of flood, we are not sure what to make of this work. This is supposed to be a hydraulic model which is more sophisticated in that it includes physics considerations such as shear and turbulent rather than linear flow.
- The simpler hydrologic model (basically filling a topographic surface with water and modelling its velocity as it runs downhill) is what Wood used incorrectly to thwart the PGL Environment's submission for the Tsuut'ina's regarding potential destruction on the reserve land. A hydrologic model absolutely cannot answer that question.
- In the case of the "scaled" model presented here, it might be good for modelling how trees clog the diversion screens but we have many doubts about it's scaling accuracy for turbid, sediment laden water. It is a Froude model, a kind of easy mathematical model that doesn't take into account the viscosity of (muddy and sediment laden!!) water and conclusions about shear stress on banks, and frictional forces on the channel bed might be incorrect because of the simplifying input assumption using Froude modelling.
- The very first time a numerical model robust enough to model a flood induced meander was achieved was in 2016 by a series of supercomputers. The inertial and frictional

[47] https://www.cdabulletin-digital.com/cdaq/0319_summer_2019/MobilePagedArticle.action?articleId=1496882#articleId1496882

forces in turbulent flow are extremely complex. When we look at the clear water flows in figures 10 and 11 in this paper, we have doubts about modelling turbid flow.

Furthermore:

- IAAC (CEAA) was concerned that the toe of the dam was subject to lateral erosion downstream of the diversion channel due to channel migration. We suspect this is a valid concern, even though 600m3/s would be removed from the flow by the diversion canal. We question of accuracy of computer simulations for channel migration because of the extremely complex physics involved and the equations used to model these processes (Rayleigh, Froule, etc.). Please see “Modeling Flow Pattern and Evolution of Meandering” Gu et al., Water, 2016[48]. Pages 3-9 of this paper outline the mathematics of their approach which seems to be the first success in modelling river meanders. Even Gu et al’s model has a series of limitations (their section 5.3) regarding grain size entrainment and meander cut-off because of the complexity of modelling this chaotic (nonlinear) natural process. The Hickin and Namson (1975) paper quoted by Stantec in responding to the IAAC (CEAA) concerns about lateral erosion of the dam toe is inadequate for predicting channel meander and erosion. In their paper “Evaluation of four hydrological models for operational flood forecasting in a Canadian Prairie watershed in the *Hydrological Sciences Journal* (June 2018, 63:8, 1133-1149) Unduche et al. give a review of even the relatively simple process of hydrological models (taking a digital elevation model of a watershed and predicting the runoff flow). They state: “Our conclusion is that a single hydrological model could not be considered adequate to simulate the runoff process in the basin accurately. Therefore, it is recommended to use multiple models and implement probabilistic ensemble prediction systems for operational forecasting.” Nonetheless engineering firms do use simplified hydraulic models that use simple equations to calculate bank erosion and deposition and recognize the limitations in those models. Good firms note the model type, input assumptions and uncertainties in their calculations and conclusions.
- For the above reasons, we are skeptical that a physical model like the one built at the National Research Council by Knox et al. in Ottawa even remotely predictably scales the flow effects of sediment-laden, turbulent and erosive flood flows with the complexity Gu et al. We believe the work of Knox et al. for SR-1 was to understand simple linear flows (like where to place the diversion and sluiceway with respect to each other) and removing entrained wood debris. We believe the debris issue is the principle reason this probably expensive effort was done.

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[48] https://drive.google.com/open?id=1c2uBOraY_kZn-5nbXOlaB58u5DlxNe1Q

DEBRIS & DOUBLE STANDARD:

Again, the use of a debris deflector for SR1 highlights the lack of debris management for upstream communities.

The flood debris issue is also a concern to the Bragg Creek area and downstream communities on a couple of points. First, access is provided to the West Bragg Creek area by the Balsam Avenue bridge, which was closed during the 2013 flood. In the event of a 1:100-year flood (design basis for the Hamlet berms), the eastern span of the bridge will be partially submerged and act as a potential debris trap. Figure 10b in the Canadian Dam Association publication about the SR1 article depicts the issues of a debris jam - which could cause the bridge to be damaged or dislodged, constrict the river channel, and/or cause the river to overflow the berms and flood the Hamlet in the catastrophic case. We went around this issue with Rocky View County, AB Transportation and their consultant Amec on several occasions without much traction (AB Transportation was fixed on a 1:100 design standard for the Hamlet - the berms upstream of the bridge were raised a bit). This article appears to be new information to bring forward to the attention of the IAAC (CEAA)/NRCB.

We would like to think that the Proponent is calling on the best expertise in the SR1 design, but this article in the Canadian Dam Association newsletter highlights the uncertainty with the initial 2015 design and cost estimates, which have both increased and changed substantially. We point our that there is a clear advantage of the MC1 site with its upstream location and 1:200-year design protecting all communities along the Elbow, managing both flood and debris.

NRCB QUESTION 160: PIPELINES

Re: https://www.nrcb.ca/download_document/2/83/5555/sir-1-july-31-2018

We don't believe that adequate efforts have been expended on the cost and consequences of pipeline infrastructure impacted in the SR1 project. We know that not all the pipeline owners have been contacted, calling into question the cost estimates provided by the Proponent. Further, it seems that pipeline owners will bear responsibility for leaks, spills, etc. while the pipelines are being moved. Is this realistic, and why would the pipeline owners take on all this risk without compensation?

We do not believe any approvals from NRCB or IAAC (CEAA) can be issued without a more comprehensive understanding of the pipeline implications. The cost, complexity and risk of pipeline infrastructure is inexorably linked to the SR1 project.

NOISE (NRCB QUESTIONS 162-164)

NRCB : https ://www.nrcb.ca/download_document/2/83/9192/20190614-at-sir-to-nrcb-re-sir1-response-sec-3-general

No comments at this time.

SOCIO-ECONOMIC (NRCB QUESTIONS 165-202, IAAC (CEAA) QUESTIONS PACKAGE 2)

IAAC (CEAA) : https ://www.nrcb.ca/download_document/2/83/9092/20190614-at-eia-to-nrcb-re-IAAC (CEAA)-ir-response-package-2

NRCB : https://www.nrcb.ca/download_document/2/83/9192/20190614-at-sir-to-nrcb-re-sir1-response-sec-3-general

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NRCB QUESTION 167: DE-LINKING OF SR1 AND UPSTREAM FLOOD MITIGATION

It seems that all parties are in agreement that, with SR1, Bragg Creek and Redwood Meadows need additional flood protection. Further, in the IR Responses, Alberta Transportation responds that no upstream flood mitigation is needed with MC1. Therefore, why does Alberta Transportation continually remove the costs for Bragg Creek ($33M) and Redwood Flood ($TBD) mitigation projects from the costs of SR1?

We agree with the Tsuut'ina Nation that separating SR1 from upstream projects amounts to "project splitting." With so much riding on the SR1 project – including lives and livelihoods – is it wise to separate SR1 from upstream projects from a science perspective and a financial perspective? They are clearly interconnected.

We have several points on this separation:

- The Bragg Creek Hamlet berms are designed by Alberta Transportation/RVC/Amec for a 1:100- year flood, which is a lower design standard than the 1:200 criteria that is being used for SR1 or MC1. As we understand it, Redwood survived a catastrophic flood event in 2013 only by emergency measures: building up the berms by trucking in fill, shoring up some areas with rocks and sand bags, and using pumps.
- The prevention of overland flooding through the Bragg Creek Hamlet with berms will have an impact on the Elbow channel water flow rates and subsequent orientation on the Tsuut'ina lands upstream of Redwood Meadows.
- Adding to the complexity is that we are not sure how Stantec and Amec are interacting and sharing information. We had posed some questions to Rocky View County (RVC) on the Hamlet bridge/berms and it appeared they were separate, independent projects and processes with little overlap and exchange. We note that the protection of the upstream communities is missing from the recent round of AEP questions.
- It seems unreasonable not to design the Elbow River for a full 1:200-year flood standard. If the Bragg Creek or Redwood berms are overrun, the contaminants and pollution end up in the river and then SR1 and the Calgary water supply. We're not sure what Calgary water filters can do with the SR1 water and silt issues with a host of chemicals mixed in unless they considerably, and at a significant cost, improve their water filtration systems. A good question for the combination of IAAC (CEAA), NRCB, AEP and AB Transportation to consider

From a financial perspective, the Proponent refers to the Bragg Creek project as a “sunk cost” and therefore ignores it in the updated Benefit/Cost Analysis. Neither Bragg Creek nor Redwood Meadows projects have been completed as of today. Therefore, these costs are not yet “sunk”. In fact, Tsuut’ina have held up the Bragg Creek Berm project due to concerns over the impact on the Nation downstream. In the latest Alberta Government budget, some money was announced for Redwood Meadows flood mitigation. We have not been able to get details for this cost, but it should be included in the SR1 cost model.

From a science perspective, we believe that it is likely that upstream mitigation consisting of berms, which will narrow the river, will increase the velocity of floodwaters entering the SR1 infrastructure. We do not believe the Proponent has supplied adequate evidence about this topic. The risk of “being wrong” on this topic is substantial. SR1 has been modelled around a unique set of circumstances based on 2013. By adding upstream mitigation, those circumstances change. There is no doubt about this. The complexity of river modelling during flood is a challenge but we must not risk lives by overlooking this point.

In summary, we contend that SR1 and any upstream project should be linked from an assessment and financial perspective.

NRCB QUESTION 169, 177, 197, 204: CONSTRUCTION TRAFFIC

The Proponent responded: “A peak hour traffic scenario has not been completed at this stage of the Project design” and “The details on the TAS will not be available until construction staging and logistics have been finalized.”

This is not a realistic answer. The Proponent knows the quantity of earth to be moved, along with a preliminary construction timeline. Therefore, they should be able to estimate the number of hauling vehicles used to move earth and construct SR1. We read that over 200,000 truckloads of earth will be moved for this project (before the diversion channel was doubled in size).[49] Is this still the case? We deserve to know this answer in advance of this project proceeding, and this answer should be used for the social good analysis. In addition to our communities, it is likely that the Alberta Trucking Association needs to know the impact of construction traffic on Highway 22 and on the temporary highway that will be built while the f is being constructed on Highway 22.

- How many trucks is that per day?
  - Our math: 200,000 truckloads divided by 600 days is approximately 330 trucks per day.
- What is their expected route?
  - Will they go through Cochrane or the Springbank area? Highway 8?
- How will this traffic interact with our community’s traffic (school busses, tourists, etc.)?

Knowing the significant number of tourists travelling to Bragg Creek during the weekends in particular and during the summer in general, we have concerns over this lack of response from the Proponent.

- Traffic jams along Hwy 22 are common and can last hours during construction problems, so we need a more complete understanding of how construction traffic will interact with the heavy summer tourism traffic.
- There are approximately 350,000 visitors to the Bragg Creek region each year, concentrated on weekends in the summer, during peak construction season.
- Many Bragg Creek and Redwood Meadows residents commute to Calgary for work. What will the impacts on those commuters be?
- Will people’s access to their homes and businesses along Highway 22 or Springbank Road be impacted by delays, detours or otherwise?

Did the Proponent conduct traffic counts along Hwy 22, Highway 8, Springbank Road and at the Township Road 250 intersection to get a baseline for traffic, including the number of school buses affected and what safe options are available? Did they consult with the Alberta Trucking

[49] https://calgaryherald.com/news/local-news/mclean-creek-dam-best-option

Association since Highway 22 is a major long-haul trucking route? What is the expected change and what are alternative routes due to SR1 construction?

It is likely that Calgarians who drive the highways out to recreation areas in Bragg Creek and beyond will be significantly impacted at the roundabout during construction of the SR1 intake and diversion channel. In addition to the roundabout impact, there will likely be a change in the traffic routes that will affect the already overloaded four-way stop in Bragg Creek. This problematic intersection is on the Government's list for improvement eventually.

Springbank Road and Highway 22 are ecotourism corridors and cyclists use these routes year-round. Did the Proponent conduct a study of cyclist traffic? If so, what are the expected impacts to cycling traffic from construction?

- How will construction traffic impact the quantity of cyclists?
- How will construction impact the experience of cyclists?
- How will construction traffic impact the safety of these cyclists?
- Will cycling corridors be closed or disrupted in any way?

We would like to know the following regarding impacts on the tourism industry in the Bragg Creek region:

- Given that construction of the project will take place during the peak tourism season, how will the project impact the number of visitors to the Bragg Creek area during the construction phase (due to delays, road closures)?

- If the Proponent expects tourism to be adversely impacted during the construction of SR1, what are the expected financial impacts to the Hamlet of Bragg Creek and Rocky View County? We know that construction has adversely impacted businesses in Calgary and we believe that the Bragg Creek region will experience similar impacts.

- Has the government contemplated any compensation to area business?

The significant impacts of the SR1 construction on our community cannot be understated. We request to understand the complete construction and traffic plans before the SR1 project is approved.

We want to be very clear on this importance of this topic: The Proponent should have to determine the impacts of construction on the Bragg Creek region and ecotourism between Springbank and Bragg Creek. This area is interconnected and is a popular destination due to its proximity to the City of Calgary. The impacts must be identified, quantified and mitigated to the extent possible. Due to the lack of consultations and opportunities for input from local communities and residents, the Proponent has a large gap in its information.

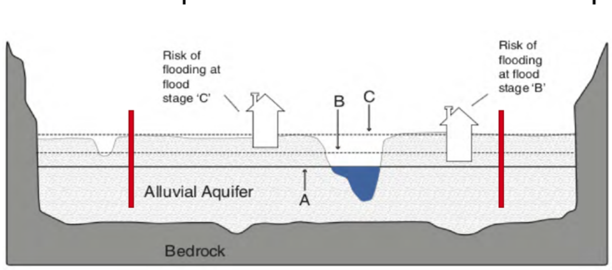
NRCB QUESTION 179 & 180: FLOOD DAMAGE CALCULATIONS

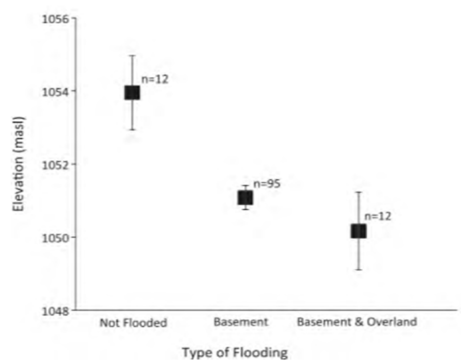
Re: https://www.nrcb.ca/download_document/2/83/9140/20190614-at-sir-to-nrcb-re-sir1-response-appendix-ir23-1

With SR1, how much groundwater flooding is expected to be mitigated vs McLean Creek option? To our knowledge, this has not been explored. It is critical to understand the risk of groundwater flooding in Elbow River Communities under the SR1 and MC1 scenarios. We know that berms will not protect against groundwater flooding. Therefore, there is a financial consequence to using berms and SR1 rather than an in-river structure that would control river height.

What we know now: Berms will not protect against groundwater flooding! Controlling river height essential.

Basement flooding at Redwood Meadows, June 2013.
Note 60-80cm basement flooding 200-300m from the river…behind the berms!
The alluvial aquifer delivered the water despite berms.





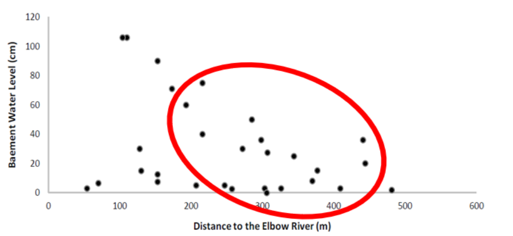


Figure 1. Flood water height above basement floor (cm) with distance of the home to the Elbow River (m).

"Basement flooding, not sewer backup, blamed for damaging homes along Elbow River in 2013." Aboud,Ryan and Osborn, (U of C) Utoday June 19, 2018.

University of Calgary ENSC501: Jabush, Grant and Ryan
Sept 2014

This is the Proponent's answer, which is a little baffling:
https://www.nrcb.ca/download_document/2/83/9192/20190614-at-sir-to-nrcb-re-sir1-response-sec-3-general

Also:

Question 180

<u>Volume 3B, Section 17.2.2.2, Page 17.3</u>

Alberta Transportation states *Flood damage estimates provided in IBI 2017 reflect updated hydrology and hydraulic modelling, which simulated higher averages water levels of both the Bow and Elbow Rivers as compared to previous modelling*.

a. Explain why it is appropriate to use a higher average water level. Explain how much higher than previously are the *higher average water level* damage estimates.

Response 180

a. Additional data related to the 2013 flood has led to changes in the probability/peak flood flow relationship, and hence higher water levels for the flood probabilities. The higher water levels are the result of the modelling, not the input.

   The discussion of higher water levels than previously estimated is provided in Appendix IR23-1 (provided in the response to IR23), Section 2.2. In that appendix, it is explained that more current hydraulic modelling has resulted in predicted water levels that are on average 0.27 m higher for Bow River and 0.38 m higher for Elbow River than water levels predicted by the 2012 modelling, upon which the previous (2015) damages were based and upon which the assessment is based. The impact of this and other factors resulted in an essential doubling of the average annual damage from $84 million to $168 million, with the largest impact (62%) attributable to the increase in peak flood flow.

Alluvial Plain Aquifer. Along the middle and lower reaches of the Elbow River watershed, the river has created a widespread (1-2km wide) apron of highly permeable cobble and gravel deposit called an alluvial aquifer, covered by a thin layer of soil. The aquifer is a result of sinuous movement of the channel across the valley over about 12,000 years. The aquifer is charged with groundwater in elevated water levels of flood events and fills basements with water in the Calgary communities of Elbow Park, Rideau, and Roxboro (Abboud et el 2018), and upstream residences at Redwood Meadows (ENSC501) and Bragg Creek. The only way to mitigate groundwater flooding is to keep the river level low or construct concrete-cored berms anchored into bedrock.

Based on the University of Calgary data compiled following the 2013 floods, we contend that there is still high risk for groundwater flooding as the river levels will be high when the diversion is in use. Further, what ability does SR1 have to mitigate groundwater and aquifer flooding upstream if the reservoir is at capacity?

Given the detailed information on the aquifer, which will become charged in a flood event, there is currently no capability for the proposed Bragg Creek berms and Redwood Meadows' existing berms to protect against aquifer flooding of basements and homes.

The Proponent and the City of Calgary have elected to conduct small-scale groundwater flow modelling, not a comprehensive 3D groundwater model – hydrogeoshere). The drawbacks mentioned include "very rough estimates of groundwater levels and areas of groundwater flooding." (Golder, 2016). We believe when the investment is climbing to over half a billion dollars, a more complete analysis of groundwater is critical. Redwood Meadows and Bragg Creek residents who reside on the aquifer deserve to know the groundwater flood risk with SR1 and berms. Further, we believe it is important to understand the continued flood risk in Calgary from groundwater flooding. Will SR1 alleviate 100 percent of groundwater flooding? If not, groundwater flood projections under various scenarios should be provided.

As an aside, the reports used in this project continue to focus on Calgary and have omitted data regarding upstream communities. All the maps in the Golder report stop at the City's borders. This points to the ongoing myopic approach to the SR1 project, which is problematic.

TRANSPORTATION (NRCB QUESTIONS 203, 204)

No comments at this time.

SECTION 2: AIR (NRCB QUESTIONS 205-210)

AT Responses: https://www.nrcb.ca/natural-resource-projects/natural-resource-projects-listing/83/springbank-off-stream-reservoir-project/documents/9188/20190614-at-sir-to-nrcb-re-sir1-response-sec-4-air

EMISSIONS MANAGEMENT (NRCB QUESTIONS 205, 206)

AIR QUALITY

Proponent assumes most of the fine material was washed away in 2013 – this is not realistic for a permanent project. There is no plan to decommission SR1. Is the Proponent referring to a near-term flood? In 100 years, will there be fine silt? In 50 years? 10 years? This is a ridiculous statement by the Proponent.

Air emissions for the post-flood scenario were determined for the 1:100 year flood as well as the design flood (2013 flood). Alberta Transportation states in Section 3.2.4.1 *The 2013 flood removed an appreciable portion of fine sediment (e.g., clay and fine silt) from the upstream Elbow River drainage basin. The remaining surficial materials in the stream bed and on the banks of the Elbow River and its tributaries that may be prone to mobilization during a future flood would comprise mostly larger material (e.g., sand). Hence, most of the sediment deposited in the reservoir during future floods would be dominated by sand, not fine silt. The sand is less prone to result in fugitive dust during dry windy meteorological conditions.* However, during the time between floods natural geomorphological processes will re-create fines such as clay and fine silt in the drainage basin system.

a. **How would the addition of fines into the basin from natural processes impact the assumptions made in Section 3.2.4.1 and the resultant emission rates used in the modelling?**

Response 205

a. The potential increase of fines in the upstream Elbow River drainage basin due to natural geomorphological processes over a long regeneration period is estimated to be approximately 7%. The magnitude of fines increase was determined based on comparison of surface and subsurface sediment samples taken at an average depth of approximately 0.3 m along Elbow River and bore hole data collected at depths between 1.8 and 4.0 m from the Elbow River floodplain near the diversion structure. This conclusion is derived from the following logic:

    1. The surface and sub-surface sediment data showed that Elbow River is dominated by gravel-sized material (2 mm to 64 mm) and coarse silt/sand (0.063 mm to 2 mm) as described in Volume 3B, Section 6 and Volume 4, Appendix J, Hydrology TDR. For the subsurface grain size distribution (GSD), coarse silt/sand accounts for 13% and fines account for 3% of the GSD.

    2. The GSD of the bore hole data showed that sand-sized fractions account for 17% to 36% of the GSD. Fines accounted for less than 10% and are silt-sized (Volume 3B, Section 6 and Volume 4, Appendix J, Hydrology TDR).

CHEMICAL DUST SUPPRESSION

It appears that the Proponent focusses on construction-related dust. Most of our community concerns stem from post-flood silt dust and erosion.

Further, the Proponent's plan to develop a plan "in the future" is not acceptable. Plans should be in place before project approval as this is a crucial concern. If there is dust, it will likely impact a broad range of Rocky View, Tsuut'ina Nation and possibly Redwood Meadows residents. We have not seen maps that would explain how the dust travels once airborne. Residents in Springbank and west Calgary who live east of the reservoir ask questions such as:

- How far will dust or silt travel under various wind conditions? Springbank is notoriously windy.
- We note that Springbank Airport weather data was not used, so is the proxy accurate for wind?
- Will there be visible dust following reservoir use?
- Will my child, who has asthma, be at increased risk following reservoir use?
- Will there be risk for our animals?
- Will there be negative impacts to our crops?
- Will elderly people be adversely impacted by mobilization of silt or dust?

a. **How will it be determined that PM concentrations would be exceeding the AAQO, thus requiring dust suppressant?**

b. **Describe the implementation plan for this mitigation measure.**

Response 206

a. During construction, adaptive management techniques will be used to help control the generation of airborne dust (see Volume 3, Attachment 3A, Section 3.4.4.1 and Volume 3C, Section 2.2); the management techniques will include ambient air monitoring in conjunction with dust emission mitigation. Ambient air monitoring will be combined with review of weather data (from an onsite meteorological station) to assess the need for more rigorous dust mitigation. Monitoring will include the installation and operation of an anemometer to measure wind speed and wind direction, and an environmental beta attenuation monitor (EBAM) to measure ambient particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) and total suspended particles (TSP) concentrations. Monitoring will be continuous over 24 hours and extend throughout the construction period.

   If the monitoring program indicates that the ground-level $PM_{2.5}$ and TSP concentrations are greater than Alberta ambient air quality objectives (AEP 2019), additional mitigation to reduce dust emissions will be implemented. This mitigation could include increased watering of access roads, the spraying of surfactants, or the suspension of construction activity at the site.

b. An Environmental Construction Operations Plan (ECO Plan) will be developed by the selected construction contractor using Alberta Transportation's ECO Plan framework (Volume 4, Supporting Documentation, Document 4). The ECO Plan will identify the mitigation measures for the potential environmental effects of construction, including the ambient air monitoring program and adaptive management techniques to control the generation of airborne dust. The ECO Plan will follow the requirements outlined in Alberta Transportation's *Civil Works Master Specifications for Construction of Provincial Water Management Projects* (Volume 4, Supporting Documentation, Document 10).

DISPERSION MODELLING (NRCB QUESTIONS 207, 208)

NRCB QUESTION 207: DISPERSION MODELLING

We are not sure – this is a huge concern within the community, and we don't have the technical expertise to assess the quality of the Proponent's response or the associated evidence. We request that a technical specialist be hired to review these comments and complete a scientific assessment.

Alberta Transportation discusses the chemical transformation model options applied in the dispersion modelling in Section 3C.3.5. The RIVAD/ARM3 chemical scheme was selected, consistent with the Alberta Air Quality Model Guideline, for the chemical transformation processes including NO to NO_2 conversion. However, section 3C.3.6 states that the ozone limiting method (OLM) was applied for NO to NO_2 conversion.

a. Confirm the NO to NO_2 conversion method used in the dispersion modelling.

b. Confirm that the modelled NO results were used in OLM not the NO_2 results based on the RIVAD/ARM3 transformation.

c. Provide updated NO_2 results if necessary.

Response 207

a. The RIVAD/ARM3 chemical scheme in the CALPUFF dispersion model was used to model the chemical transformation of nitrogen oxide (NO_X) and sulfur dioxide (SO_2) to nitrates (NO^{3-}) and sulphates (SO_4^{2-}) that contribute to the formation of secondary particulate matter.

   The RIVAD/ARM3 chemical scheme was not used to convert nitrogen monoxide (NO) to nitrogen dioxide (NO_2) concentrations. NO_X was modelled as an inert substance in addition to its components NO and NO_2, with no chemical transformation applied. The dispersion model predictions of NO_X concentrations were converted at the post-processing stage to NO_2 concentrations using the ozone limiting method (OLM), as recommended in AEP 2013.

b. The modelled NO_X concentrations were converted at the post-processing stage to NO_2 concentrations using OLM.

c. No update to NO_2 concentration results is necessary.

NRCB QUESTION 208: HOURLY WEATHER DATA

At the very least, the Proponent should discuss how the Springbank Airport data from May 2014 to current day differs from the data set used for the meteorological model. Are there statistically significant differences in meteorological data (temperature, wind, pressure, etc.) that should be discussed and if so, what conclusions can be drawn about the meteorological modelling?

Alberta Transportation states *there are no surface stations with concurrent hourly data for the 2002-2006 period within the model domain*. However, Section 3B.3, Page 3B.11 discusses meteorological measurements at the nearby Environment and Climate Change Canada Springbank Airport climate station (for 1981-2010), located within the local assessment area.

a. Provide justification for not using the hourly data from the Springbank Airport climate station as supplement inputs into CALMET.

Response 208

a. The statement, "there are no surface stations with concurrent hourly data for the 2002-2006 period within the model domain" pertains to the modelling protocols that compensate for the absence of a complete set of hourly data. The Springbank Airport station observations record covered only 18 hours per day (from 4 am to 10 pm) up to April 2014. This results in 10,950 missing hours (5 years x 365 days x 6 missing hours per day) of observations from the Springbank Airport (starting April 2014, the station began recording observations 24 hours per day).

The Alberta Air Quality Model Guideline (AQMG) (AEP 2013) specifies the requirements for the meteorological data to be used as an initial estimate for the CALMET meteorological preprocessor. According to the AQMG, the 5-year MM5 meteorological dataset (2002-2006) distributed by AEP must be used for refined modelling assessment.

When CALMET is run in "observation mode" (i.e., with supplemental surface station data), one of the requirements is that at least one of the surface stations in the study area must have an observation for each hour of the modelled period. However, there are no other surface stations within modelling domain. Therefore, CALMET was run in "no-observation mode" (i.e., with no supplemental surface station data) using the MM5 dataset provided by AEP. This protocol is consistent with the AQMG recommendation of using supplemental data for surface meteorological stations if the meteorological data coincides with the 5-year period provided in the MM5 dataset and the data is at least 90% complete.

AIR QUALITY ASSESSMENT (NRCB QUESTIONS 209, 210)

DRAINING OF THE RESERVOIR (209):

Explain the risks to air quality as the reservoir is drained assuming that, each day, some of the silt will be exposed. Board 18 from the 2018 open houses: "In the event of a design flood the modelling predicts the potential to exceed air quality objectives for up to 4 days following drainage of SR1." If the reservoir is draining over a long period of time, please explain how air quality risks are limited to four days.

Given uneven topography, what is the plan to ensure drainage of the reservoir? How much standing water will be left following a flood event?

This is a critical issue for our community. We appear to be at risk during reservoir draining from silt mobilization. We do not have enough information on this point to share with our community and the Proponent has not communicated at all to us about this risk.

ANOXIC WATER CONDITIONS (210):

Glenmore Reservoir is NOT the correct comparison at all for SR1. Glenmore would be more appropriately compared to the McLean Creek Dam project.

In our view the main difference between the Glenmore Reservoir and SR1 is that there is constant flow through of water in the Glenmore. This flow allows an inflow of cold oxygenated water to sink to the bottom of the reservoir below the warmed and mixed surface layer depth. This oxygenated inflow prevents anoxic conditions in the deeper layers of the reservoir. The thermocline at the base of the surface, wind-mixed layer and the colder deeper layers (either oxic or anoxic) is a function of wave heights, water temperature distribution in the water column, and suspended matter (which affects temperature distribution). Lakes without flow create limnological layers quickly, especially in low wind months, and the deeper layers can become anoxic from bacterial and algal respiration.

Because of the important distinction of water flux through the reservoir, and the temperature distribution and total dissolved oxygen that flow provides, a more appropriate analogue for the Springbank Reservoir would be closed lakes like Eagle Lake, Namaka Lake, Deadhorse Lake or similar closed system lakes in central Alberta. Limnological layers and anoxic conditions are far more likely to develop in these lakes.

Glenmore Reservoir is an open system, with the river flowing through it. Rather, the Proponent should look at using "closed reservoir" comparisons for SR1, such as Eagle Lake (max 5m deep[50]) or even semi-closed like the deeper Travers Reservoir[51] (max 40m deep) on the Little Bow River.

[50] http://albertalakes.ualberta.ca/?page=lake&region=4&lake=123
[51] http://albertalakes.ualberta.ca/?page=lake&region=4&lake=123

The 12km2 Eagle Lake is comparable to most of the SR1 reservoir. Even though the lake is shallow enough to be mixed by surface winds (thus isothermal), dissolved oxygen in the water column is depleted by early July with frequent blue-green algae (cyanobacteria) blooms throughout the summer. The lake is hyper-eutrophic like most shallow prairie lakes (e.g., Frank Lake, Namaka Lake, Mud Lake, etc.). Travers reservoir is not such a good analogue as it gets inflow from the Bow River at Carseland Dam, but, because its depth, would give some indication of stratification of the water column. It becomes stratified from mid July to Early September dissolved oxygen lowering to 4mg/L in the deeper water layers and to 2mg/L by winter. This is in the anoxic range (2 mg/L).

PM 2.5 (210)

The Proponent uses the time a car would be in the PDA to assess PM2.5 and suspended particle risk. This is rather naïve. We have the following questions and statements on this inadequate analysis by the Proponent:

- What about the accumulated impact when these minutes are multiplied by two times a day (and by as many days such as five or more) when school children are bussed past these sites and adults regularly rely on these highways?
- The Proponent needs to consider the significant number of cyclists who use Springbank Road, Hwy 8 and Hwy 22 during the summer season. Has the Proponent conducted a cycling study of these roads to determine impact on this valuable ecotourism traffic?
- As for specific concerns for cyclists, should the Proponent consider that increased respiration is associated with cycling?
- Further, there are homes in the area, including that of Brian Copithorne, that will be on the doorstep of the reservoir. What is the impact of degraded air quality on residents who may experience prolonged exposure to the PM 2.5 particles?
- Additionally, what are the impacts on wildlife, who will not travel through the impacted area at 60 or 80 km/h?
- What are the impacts to homes with open windows? Children playing outside?
- Modelling of PM2.5 and TSPs under various wind scenarios are needed to consider this risk.

Further, most of the air quality statements by the Proponent refer to construction-related air quality and there is little discussion on post-flood air quality. We believe this is a significant oversight by the Proponent. Construction is temporary, but the post-flood conditions (including accumulation of silt each reservoir use) will be ongoing and lasting. We ask the regulators to challenge adequacy of the Proponent's post-construction, post-flood air quality projections.

Alberta Transportation describes in Volume 4, Appendix E, Section 3C.3.2.1, the receptor grid spacing used in the modelling. Specifically that receptors were not included for modelling within the project 'fenceline' or PDA. Volume 3A, Section 3.4.1.1, Page 3.40 states *concentrations and deposition inside the PDA are not compared to the ambient criteria because public access is restricted in this region*. Volume 4, Appendix E, Figure 3C-2, Page 3C.7 indicates that Highway 22 and several other roads dissect the PDA, thus there will be public access through the PDA.

a. **Describe the air quality impacts to the public that access the PDA on Highway 22 or other PDA through roads.**

b. **How does Alberta Transportation plan on managing air quality and dust impacts on the public that access the PDA on Highway 22 or other PDA through roads?**

Response 210

a. Vehicles traveling through the PDA on Highway 22 and Springbank Road will be in the PDA for only a few minutes and exposure of the passengers to particulate matter less than 2.5 micrometers in diameter is short term. In particular, the following describes the presence of the public in the PDA during construction:

   - The current speed limit on Highway 22 is 80 km/h, but this will be reduced to 60 km/h on a segment of Highway 22 along the bridge construction area for raising of Highway 22. Considering the segment of Highway 22 between the intersection with Highway 8 and the bridge construction area (approximately 4 km), the time a vehicle travels along this segment will be 3 minutes (4 km/80 km/h x 60 min/h) when travelling at 80 km/hr. At a speed limit of 60 km/h along the bridge construction area on Highway 22 (approximately 3 km), the time a vehicle travels along this segment would be 3 minutes (3 km/60 km/h x 60 min/h). In total, the travel time along Highway 22 will be approximately 6 minutes.
   - The speed limit on Springbank Road is 80 km/h and, at this speed, the travel time through the PDA is about 4.5 minutes (6 km/80 km/h x 60 min/h).

   The predicted maximum 1-hour $PM_{2.5}$, 24-hour $PM_{2.5}$ and total suspended particles (TSP) concentrations for the Application Case along the sections of Highway 22 and Springbank Road that intersect the PDA are presented in Table IR210-1. The maximum predicted concentrations along the road sections are greater than the Alberta ambient air quality objectives (AAAQO; [AEP 2018]) for 24-hour average $PM_{2.5}$ (30 µg/m³) and TSP (100 µg/m³),

SECTION 3: WATER (NRCB QUESTIONS 211-361, IAAC (CEAA) QUESTIONS TBC)

AT Responses:

IAAC (CEAA) : https ://www.nrcb.ca/download_document/2/83/9114/20190614-at-eia-to-nrcb-re-IAAC (CEAA)-ir-response-package-3

https ://www.nrcb.ca/download_document/2/83/9605/20190716-IAAC (CEAA)-eia-to-at-re-annex-1-information-request-round-1-part-1-conformity-review

NRCB : https ://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water

WATER MANAGEMENT (NRCB QUESTIONS 211-214)

OTHER QUESTIONS:

1. Explain how the Alberta Government will monitor for seepage or loss of water from the SR1 reservoir and what the mitigation strategies are.
2. Quantify the expected evaporation of water from the SR1 reservoir under various flood scenarios and retention lengths. Express this as a percentage of water retained. Compare this to the expected evaporation of the Elbow River as a baseline.
3. What are the expected contents of the water being released out of the reservoir and how will the properties of the SR1 water differ from the Elbow River water that bypasses the SR1 footprint?
4. What will be the water temperature in the SR1 reservoir weekly? The Proponent provides a general answer that is not across time. This should be further broken down into various flood scenarios. The current response by the Proponent is inadequate. One would think that, as the reservoir drains and thus becomes shallower, it would warm up more quickly. This doesn't seem to be represented in the response.
5. What is the risk of contamination of the SR1 waters from septic fields and sewer back-up from Redwood Meadows and Bragg Creek and properties upstream of SR1? Please note that we expect the upstream berms to provide inadequate protection from groundwater flooding due to the width of the alluvial aquifer. Groundwater flooding will inevitably result in flooded septic systems. If you can prove otherwise, please do. What are the measures of contamination from septic systems that would be monitored? The challenges of different flood protection levels along the Elbow are highlighted in this point. In the case of a flood exceeding the 1:100-year design case overflowing the Bragg Creek berms, the resulting contaminants and pollution would be swept downstream to SR1 and Calgary. These pollutants add to the complexity of dealing with the flood aftermath and clean-up, impacting both Elbow water users and nearby Springbank residents.
6. What is the atmospheric pressure of the combined weight of the water and silt and what is the impact on the functions of the Elbow River watershed along the SR1

footprint? Surface flow, groundwater, drainage, etc.? We contend that these impacts are unpredictable and consequences could be far reaching.

NRCB 211:

Explain whether the water in the SR1 footprint is effectively "stagnant" with no fresh water flow from the Elbow River (a closed system). Predict whether any fresh water is expected to enter the reservoir from another source and if so, from which source? Further, if fresh water is somehow entering the reservoir, can reservoir waters be expected to exit the reservoir during retention? What is the net result of this?

HYDROGEOLOGY (NRCB QUESTIONS 215-259)

NRCB : https ://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water

NRCB QUESTIONS 220 & 240: LANDOWNER KNOWLEDGE (WELLS & SPRINGS)

Landowners were not contacted by the Alberta Government, as directed by the NRCB in Question 220, thus this submission is incomplete. ß

We wonder what dataset and modelling software they used of 4,000 well records and how they reached the conclusion that “the effects are not significant.” We suspect AB Transportation resorted to the regional water well information (Éowyn Campbell, a PhD hydrologist at the U of C and one of Cathy Ryan’s students, provided such a map from the GoA database). Unfortunately, this map has some 4,000 wells, mostly TD’d in the Paskapoo bedrock, and water measurements within the Paskapoo are fracture controlled so do not provide information about the overlying glacial sediments and encased unconsolidated sand aquifers within that sediment. That map went from the Big Hill area in Cochrane to the Tsuut’ina, Redwood and Bragg Creek areas. Any conclusion based on the area of SR1 would not be valid if drawn from that database.

Alberta Transportation needs to confirm whether they used the regional water well information and if so, justify its application in this analysis.

Referring to the information pamphlet distributed by the Proponent to the public in 2019[52], the Proponent glosses over the difficult and complex water outcomes of this project. As usual the words in this pamphlet are designed to deal with some of the issues we have raised, but there is no justification or any references to convince us these words have any accuracy. All of our arguments regarding flood mitigation and controlling the river level, providing our children and grandchildren with cold, pure water 40 years from now, heath issues arising from settled sediment and warm water storage (mosquito-borne diseases, algal blooms, cyanobacteria

[52] https://www.alberta.ca/assets/documents/tr-springbank-off-stream-reservoir-update.pdf

growth) and wildlife conservation in Springbank are valid. The Proponent states that "Water quality monitoring in the reservoir will be conducted prior to release of water back to the river for potential contaminants. A surface water monitoring program is being developed." What will this program entail, because we suspect that kind of monitoring can't be done for less than millions of dollars and devastation to the fluvial ecosystem downstream from SR1.

LANDOWNER EXPERIENCE:

Brian Copithorne, who owns land within the SR1 footprint, described Alberta Transportation's request for additional land access as follows:

In spring 2016 Copithorne granted AB Transportation access to his land for an 18-month period which ended in August 2017.

In June 2018, AB Transportation made a request for a second period of access for six weeks.

Negotiations for this access went on through the summer and fall of 2018. Copithorne was initially reluctant to grant a second period of access because AB Transportation and its agents failed to remediate the land after the initial period. AB Transportation told him if he refused to enter into access agreements, it would use provisions of the Expropriation Act to force access without his consent.

In the fall of 2018 AB Transportation revised the period of access from six weeks to 12 months. Copithorne assumed this increased period was to accommodate four-season observations and monitoring of wildlife patterns as well as for owls and other bird habitat. The request indicated the access was for geotechnical testing and monitoring.

In February 2019 AB Transportation revised the period of access a second time from 12 months to 18 months. Copithorne agreed to allow this access and signed the Access Agreement that was prepared by AB Transportation. He was told that his signed Access Agreement was sent to the lawyer for AB Transportation. At that point, he expected AB Transportation to sign the agreement and begin to undertake their studies.

It is likely that AB Transportation requested additional monitoring to respond to information requests issued by IAAC (CEAA), Alberta Environment and Parks and the NRCB. There would be no reason to require access to Copithorne's lands for geotechnical testing except to get the information necessary to provide full and complete responses to these Information Requests.

AB Transportation never signed the Access Agreements, did not access the lands, and seemingly abandoned the request. Copithorne was surprised to see they had filed responses to the Information Requests without having utilized the land access that was provided. The fact that AB Transportation threatened to use the Expropriation Act suggested this access was vitally important for the purpose of being able to properly respond to the Information Requests.

OTHER QUESTIONS:

- Has the Proponent considered the total weight of the silt and the water on the underground water systems in the reservoir footprint? There is a reason that Springbank got its name—it's due to the multitude of springs in that area. Based on the Proponent's responses, it appears they expect 98 percent or so of this sediment will settle in Springbank reservoir (2,300 kilotons).
- Considering the area involved, that will be a significant amount of material to move - and dispose of. Where?
- If it is not regularly removed (perhaps because of cost), the weight of this sediment could depress the area and totally change the planned drainage pattern.
    - A 2019 CBC article states that: "During the 2013 flood, it notes, an estimated 715,000 tonnes of sediment were "delivered in a single day".[53] The Proponent now forecasts 2,300 kilotons of silt in the SR1 reservoir during a design flood event.
- What is the risk that underground springs are negatively impacted, or the groundwater flow is changed, by the weight of the silt and water on the reservoir footprint?

We request a thorough study of the underground water system(s) in the broader area. We know that groundwater is instrumental to our environment, and we must understand how the groundwater model will be impacted by SR1 and also by MC1. [54]

We request that all area wells surrounding the SR1 footprint - in all directions - be tested before any construction begins. We must have a "before" and "after" comparison so that affected landowners can apply for compensation, if there are adverse effects.

- Results must be released publicly for comparison. Testing should take place again, regularly, during and following construction and each time the reservoir is used. Testing should include a complete water quality report along with water pressure. 'Microbial testing' is required but also pressure testing as all the structures and the disturbance of the ground if SR1 is built could most certainly decrease the pressure of wells, depth, quality of water, etc. Wells should be tested for the usual of coliform bacteria, nitrates, pH, sodium, chloride fluoride sulphate, iron, manganese, total dissolved solids, hardness, etc.
- The Proponent should propose mitigation measures if any negative impacts are recorded.

[53] https://newsinteractives.cbc.ca/longform/waiting-for-protection-springbank-mclean-creek-flood-mitigation
[54] https://eos.org/articles/modeling-how-groundwater-pumping-will-affect-aquatic-ecosystems#.Xc-OpLlzXnc.twitter

- Explain whether any compensation is considered for well owners who are negatively impacted. Please confirm what testing of area wells is proposed and the timelines before, during and after construction and also post-flood.

Background for Well-Testing: In the early stages of Stantec doing studies, a lot of the original landowners had their wells tested and GOA paid for it. It was basically because the bore holes and other seismic testing that they did, concerned us as to the effect if would have on our wells. This concern is very real. In the 60's, Shell 'moved' the river over and put a pipeline in the SW corner of our property and did a lot of excavating. One week later one of our cattle wells in our corral went dry. It had run for over a hundred years. This was not coincidental. The corrals were one mile from this site. So again, so strongly confirming the fact that if underground streams and aquifer are disturbed, there is a total change in the flow for miles around.

HYDROLOGY (NRCB QUESTIONS 260-290)

NRCB : [https ://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water](https://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water)

COMMUNITY QUESTIONS:

- We know that when pipeline work was ongoing in the SR1 footprint previously, a local well went dry. Predict the risk to local well operations from construction. How will this risk be mitigated?
- The Stantec modelling, particularly regarding the claim that they could model the behaviour of the river downstream of Bragg Creek such that no damage would occur at Redwood Meadows, is not true. Hydrologic modelling simply fills a surface model with water; it is not capable of calculating erosion or sinuosity of rivers. The first model generating a first order attempt at erosion and sinuosity occurred with a series of super computers in 2016.
- The Proponent should provide sources of water that will be used during construction.

NRCB QUESTION 264: DRAWDOWN RATE

How much will the flow rate of the Elbow River change when SR1 waters are released under various flood scenarios and retention times?

Please clarify if retention times are the estimated times for complete draining of the reservoir (i.e., 60 days until reservoir is empty) or the start of complete draining (draining will begin in 60 days). If the former, please estimate the number of days water will be held without draining in the reservoir, or is this dependent on flood size? If so, explain.

NRCB QUESTION 265: BACKWATER AREA

We do not have a full understanding of this element of the project. More information is required, including the risk of failure.

We are concerned about the impact on nesting birds and windows for cleanup post-flood.

Alberta Transportation states *At that flow, the service spillway gates will be raised to create a backwater upstream of the diversion structure, the diversion inlet gates will be opened, and flood flow will begin to divert into the diversion channel to be retained in the off-stream reservoir*.

a. Describe and show on a figure the area that will be inundated due to the backwater effect in the three flood scenarios (Design flood, 1:100 year flood and 1:10 year flood).

b. For how long will this backwater effect remain for each of the three flood events (Design flood, 1:100 year flood and 1:10 year flood)?

c. What is the impact of backwater on bank erosion, floodplain erosion and sedimentation, hydrology and hydraulics?

d. What is the potential of flooding to any nearby infrastructure or projects due to the back water effect and what are the mitigation measures?

Response 265

BACKGROUND INFORMATION

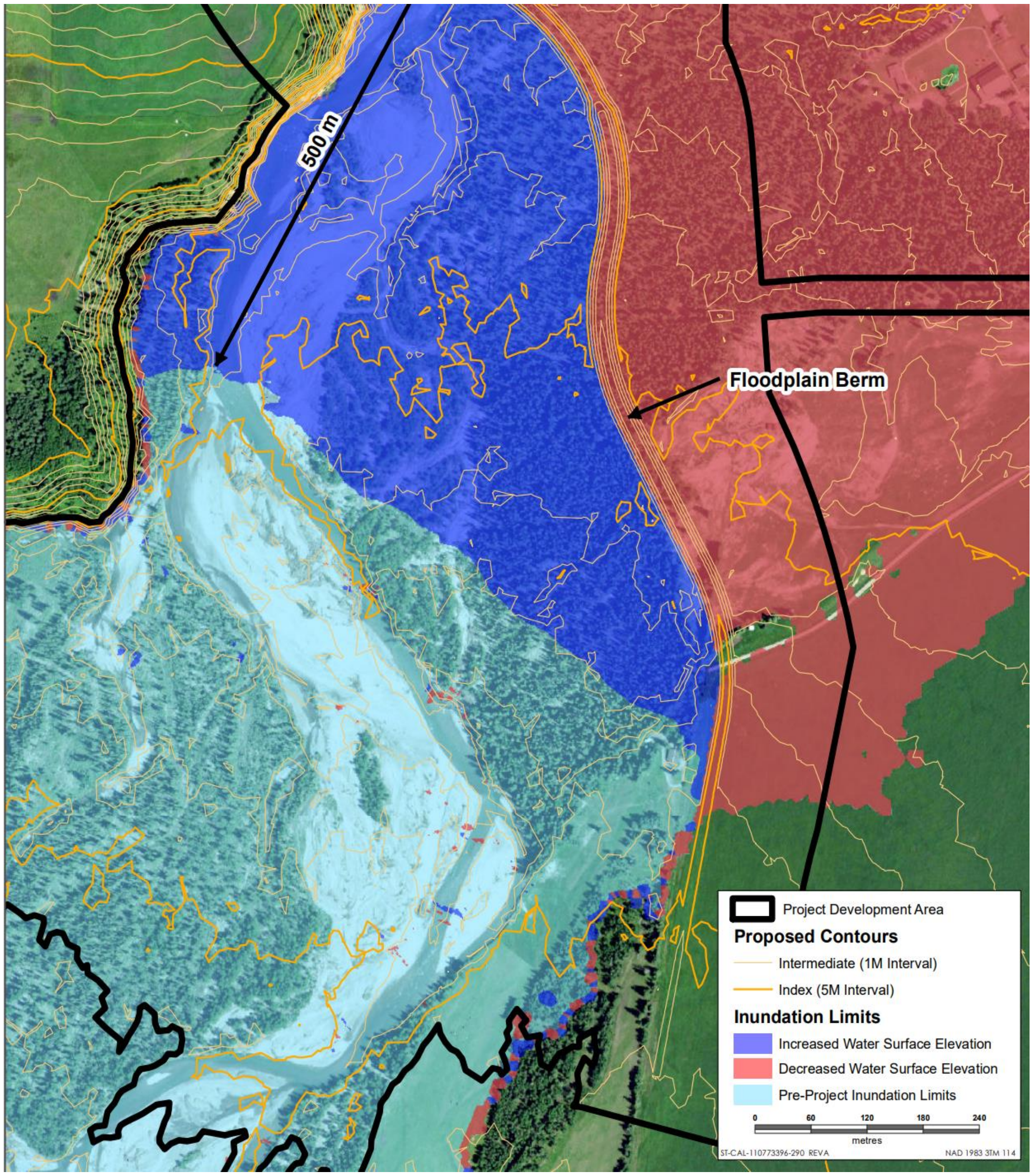
Backwater is defined as the area upstream of the diversion structure, service spillway and floodplain berm where the water surface elevation is raised over pre-Project conditions. To determine the backwater area, 2D hydraulic model results for the pre-Project conditions were compared against the results for the post-Project (flood operations) conditions. The area where the water surface elevation is greater for the post-Project than for the pre-Project conditions is the backwater area.

a. At the peak river flow, the operation of the diversion is not expected to change the backwater area upstream during the three floods. Figure IR265-1, Figure IR265-2, and Figure IR265-3 show the results of 2D hydraulic modelling for existing and Project conditions. The effect of the diversion structure on upstream water surface elevations is limited to within the PDA where the water depth will change 500 m upstream for the 1:100 and design flood and 190 m upstream for the 1:10 year flood.

b. The backwater effect will vary, based on the size and duration of a flood. The total duration of diversion for a design flood is 3.75 days. The total duration of diversion, and the induced backwater effect, for the 1:10 and 1:100 year floods is expected to be shorter in duration because both the peak and volume of flood waters will be less than for a design flood.

c. The backwater will have limited impact on bank erosion and floodplain erosion. It reduces the shear stresses within the impacted area and will reduce risk of erosion within the affected area. Sediment transport simulations indicate that diversion operations will result in sediment deposition within the backwater area. The deposition may result in a local increase in water surface elevations, but impacts will remain within the PDA.

d. Results of the hydraulic modelling indicate that the diversion structure will not increase the risk of flooding to any structures or projects outside the PDA. No mitigation measures are required.



Response 266

a-b. Post-flood cleaning, repair and maintenance activities of the floodplain berm and area upstream of the berm will include the repair of any erosion damage to the berm, as well as the removal of sediment and debris that would affect the operation of the diversion structure. Post-flood repair and maintenance will commence immediately following a flood and will include inspections to identify structural damage to the berm.

NRCB QUESTION 269: MONITORING OF FLOW RATE & RESERVOIR

Considering that many river flow gauges were washed away in 2013, how does the Proponent plan to address the risk of lack of real-time information on flow rates to guide the use of SR1 in a flood event?

NRCB QUESTION 267: REMOVAL OF SEDIMENT

Post-flood sediment removal and reseeding does not seem to adequately address native plant species in the reservoir. Further the use of the tackifier (if required) is concerning as there are many unknowns regarding how it will be applied, its costs and its components. Tackifiers are used to bind mulch products o seeded areas to prevent the much material from being removed by rain and wind. Our concern is the biodegradability of the tackifier and any residual chemicals. It seems like tackifiers must be applied in an area that does not enter surface waters. It is unclear which tackifier products would be considered. The decomposition of tackifier has the potential to deplete oxygen in the down gradient surface waters.

Question 267

Volume 1, Table 3-10, Page 3.37

Alberta Transportation states *partial removal of sediment so that water flow is not blocked* as repair and maintenance activity.

a. **Describe the criteria when sediment deposited in the reservoir will be cleaned to regain full storage capacity of the reservoir.**

b. **Explain the impacts of not removing sediment post-flood from the reservoir and explain the corresponding mitigation measures.**

Response 267

a. The off-stream reservoir is designed for a capacity (full service level elevation) of a 10% volume above that needed to handle the equivalent of the 2013 flood. This excess capacity is designed to account for sediment and debris accumulation over the life of the Project. Post-flood sediment and debris will not be removed from the reservoir. Certain areas may be re-contoured within the reservoir if they interfere with drainage out of the reservoir or the integrity of the dam.

b. Post-flood sediment that remains in place may be either seeded with native plant species or be sprayed with a hydroseed or hydromulch with the addition of a tackifier, if required, in order to reduce the potential of airborne dust while also promoting the re-establishment of vegetation. AEP will have an operation, maintenance and surveillance plan for the Project, which will include post-flood sediment stabilization requirements.

NRCB QUESTION 268: RUN-OFF FROM LOCAL AREA

The Proponent has not included volume projections for runoff from the local inflow basin in its projections because the data was not available. They go on to say that “The expected volumes for each of these floods from the 40 km2 local drainage area are expected to be relatively minor in comparison to the total diverted volume from the 863 km2 Elbow River drainage area and would not affect estimated effects.”

Considering one of the main reasons for choosing SR1 was the additional catchment area relative to SR1, this answer undermines the basis of the decision!

1

a. Local inflow was considered for the total temporary retention capacity of the off-stream reservoir in the following ways:

- Design flood retention was determined by the volume required to mitigate the 2013 design flood, as estimated from the inflow hydrograph to Glenmore Reservoir and provided by the City of Calgary. This volume includes runoff volume upstream of the proposed diversion structure, as well as runoff volume produced from the local inflow basin.
- Freeboard was determined by a runoff volume of 540 dam^3, which is the runoff from a 6-hour, 1:100 year storm. In the calculation, it was estimated from the full service level elevation and included the routing of the probable maximum flood (PMF).

Because all relevant inflows are considered, no changes to total retention capacity of the off-stream reservoir are required.

b. Yes, as noted in the response to a., the retention volume required to mitigate the 2013 design flood is based on the 2013 inflow hydrograph to Glenmore Reservoir. This volume includes runoff from the area between the unnamed creek and Glenmore Reservoir.

No changes to the total retention capacity of the off-stream reservoir are required.

c. The diversion volumes for the three floods (design flood, 1:100 year flood and 1:10 year flood) are based on flow hydrographs of Elbow River that were developed from recorded data or modelled floods. The flood scenarios were not all produced with rainfall-runoff models and, therefore, corresponding inflows from the local inflow basin for the same floods is not available. The expected volumes for each of these floods from the 40 km^2 local drainage area are expected to be relatively minor in comparison to the total diverted volume from the 863 km^2 Elbow River drainage area and would not affect estimated effects.

NRCB QUESTION 269: MEASUREMENTS OF WATER VOLUMES

In the 2013 floods, our understanding is that volume measurement instruments along the Elbow River were unable to record peak flood flow (damaged, washed away). What is the risk to the planned operations of SR1 if there are similar instrumentation failures? What will be the alternate sources of judgment for the SR1 reservoir operations?

Questions by NRCB:

Question 269

Volume 1, Figure A-2, Page A.7

Alberta Transportation states *The need for flood operations will be identified through this advanced communication, and will be informed by forecasted and measured flows on Elbow River at the diversion structure and upstream.*

Alberta Transportation states *Flood operations will begin when flows in the Elbow River exceed 160 m^3/s.*

a. Describe how the flow in the Elbow River will be monitored near the diversion structure to decide when diversion to the proposed reservoir should start. Will there be any permanent continuous flow gauge station near the diversion inlet structure and who will own and operate it?

b. Describe how the flow in Elbow River at the confluence with the outlet channel will be monitored to decide when to start the release of stored water from the reservoir to the outlet channel and eventually to the Elbow River. Will there be any permanent continuous flow gauge station on the Elbow River at the confluence of the outlet channel with the Elbow River and who will own and operate it?

c. Describe how the flow rate through diversion inlet and reservoir outflow will be monitored. Will there be any permanent continuous flow gauge stations at these two locations and who will own and operate them?

d. Describe how the water level of the reservoir will be monitored. Will there be any permanent continuous water level gauging stations in the reservoir and who will own and operate it?

e. All the above mentioned flow data and water level data are important and needs to be recorded for future use such as for flow naturalization, performance evaluation of the reservoir operation and its impact on the environment. Include the monitoring plan for the items mentioned in a, b, c and d in the 'Monitoring' section. Currently no monitoring information is available on these items in the EIA.

Answers from AT:

information:

- flow in the Elbow River upstream at Bragg Creek, at the diversion and downstream at Glenmore Reservoir
- storage volume available within Glenmore Reservoir
- forecasted snow melt and precipitation

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Flow gauging stations are currently operated by Water Survey of Canada on Elbow River at Bragg Creek and at Sarcee Bridge, just upstream of Glenmore Dam.

An additional hydrometric gauge station will be installed immediately upstream of the diversion structure and will provide real time river water elevation measurements (i.e., 15-minute intervals). The water elevation measurements may be used with gate position and pre-determined rating curves to calculate the flow split into the diversion channel and that remaining within the Elbow River. The hydrometric station at the diversion inlet will be owned and operated by AEP.

b. The decision to release water from the reservoir will be based on the following information:

- flow in Elbow River at the diversion structure and downstream at Glenmore Reservoir
- storage volume available within Glenmore Reservoir
- forecasted snow melt and precipitation
- condition of infrastructure downstream of Glenmore Dam

NRCB QUESTION 271: SEEPAGE OF GROUNDWATER INTO THE DIVERSION CHANNEL

Question 271

Volume 3A, Section 5.4.2.3, Page 5.38

Alberta Transportation states *Groundwater that would seep into the diversion channel (when dry) would remain within the watershed, although potentially travelling through a more tortuous route. 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.*

a. Provide information on volumes of ground water that can be expected during non- flood years and flood-years, especially for the design flood, 1:100 year and 1:10 year flood.

Response 271

a. Seepage into the diversion channel (when dry) has been estimated by the numerical groundwater flow model (see the Hydrogeological TDR Update in Appendix IR42-1, Section 5.5). the estimated net seepage into the diversion channel is 0.013 m^3/s or approximately 410,000 m^3/year during non-flood years.

   During flood years, groundwater discharge will be reduced during the period when flood water is partially diverted through the diversion channel. The reduction is a result of the hydraulic head within the channel. Water in the channel will reduce, or potentially reverse,

NRCB QUESTION 272: DIVERSION CHANNEL SEEPAGE & VEGETATION

We do not have the expertise to critique this response.

Question 272

Volume 3A, Section 5.4.2.4, Page 5.39

Alberta Transportation states *The effects due to seepage into the diversion channel would be irreversible because it is expected that the diversion channel would be in place indefinitely and the potential for seepage into the diversion channel would persist indefinitely.*

a. Describe what types of effects are expected due to seepage into the diversion channel during non-flood and flood years and what the mitigation measures are.

Response 272

a. Alberta Transportation is open to discussion regarding appropriate seed mixes based on revegetation objectives and site conditions.

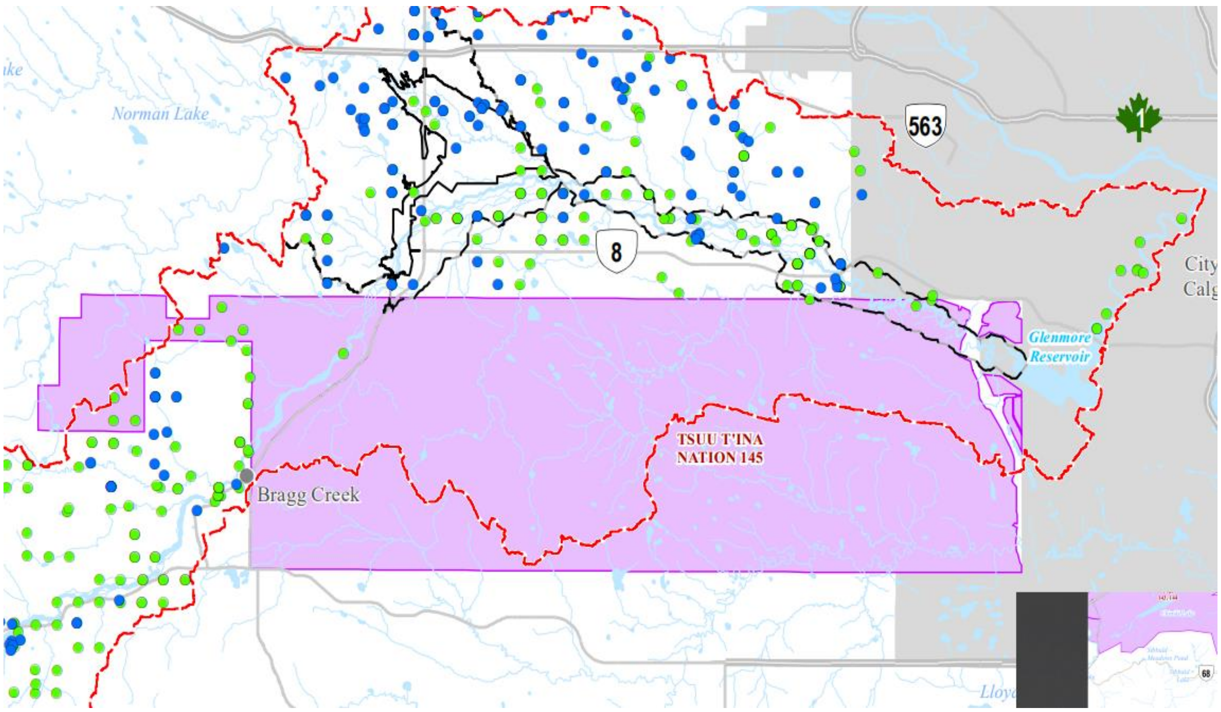
Shorter-lived species may have beneficial effects such as acting as a cover crop to suppress weed establishment until other natural colonizing species can re-establish. Sheep fescue is an excellent weed control species because it has an extensive and dense bunch-type root system. Once a good stand is established, it excludes the invasion of most weeds (Ogle et al. 2010).

Seed mixes will be adjusted while balancing need for vegetative cover, suppressing weed establishment and managing surrounding undisturbed areas. Species used will also be based on availability of required quantities.

Further communication regarding seed mix recommendations can be referred to Mark Svensen at Alberta Transportation by email at Mark.Svenson@gov.ab.ca. Final seed mix details will be provided in the monitoring and revegetation plan, including the reasoning for the inclusion or rejection of recommended species.

NRCB QUESTION 274: WATER LICENSES

The government assumes there will be no impact to water licences in the LAA or RAA, except for the PDA. We are not convinced this is realistic, given local knowledge on groundwater sources from landowners. There will be impacts to water co-operative and water treatment facilities outside the PDA.



Question 274

Volume 3A, Section 6.2.2.6, Page 6.33

a. **Include map showing locations of the water licences in the LAA and RAA (LAA and RAA boundaries as per Figure 6-1 in Volume 3A_S06).**

b. **Provide more detail on each of the licences including the types of licences, source of water, location etc.**

c. **Describe whether these water licences will be affected due to the project and identify the affected licences.**

d. **What will be the mitigation measures be for the affected licences?**

Response 274

Alberta Transportation assumes the question is referring to the information provided Volume 3A, Section 6.2.2.6, page 6.36. Page 6.33 as referenced in this IR does not relate to surface water licences.

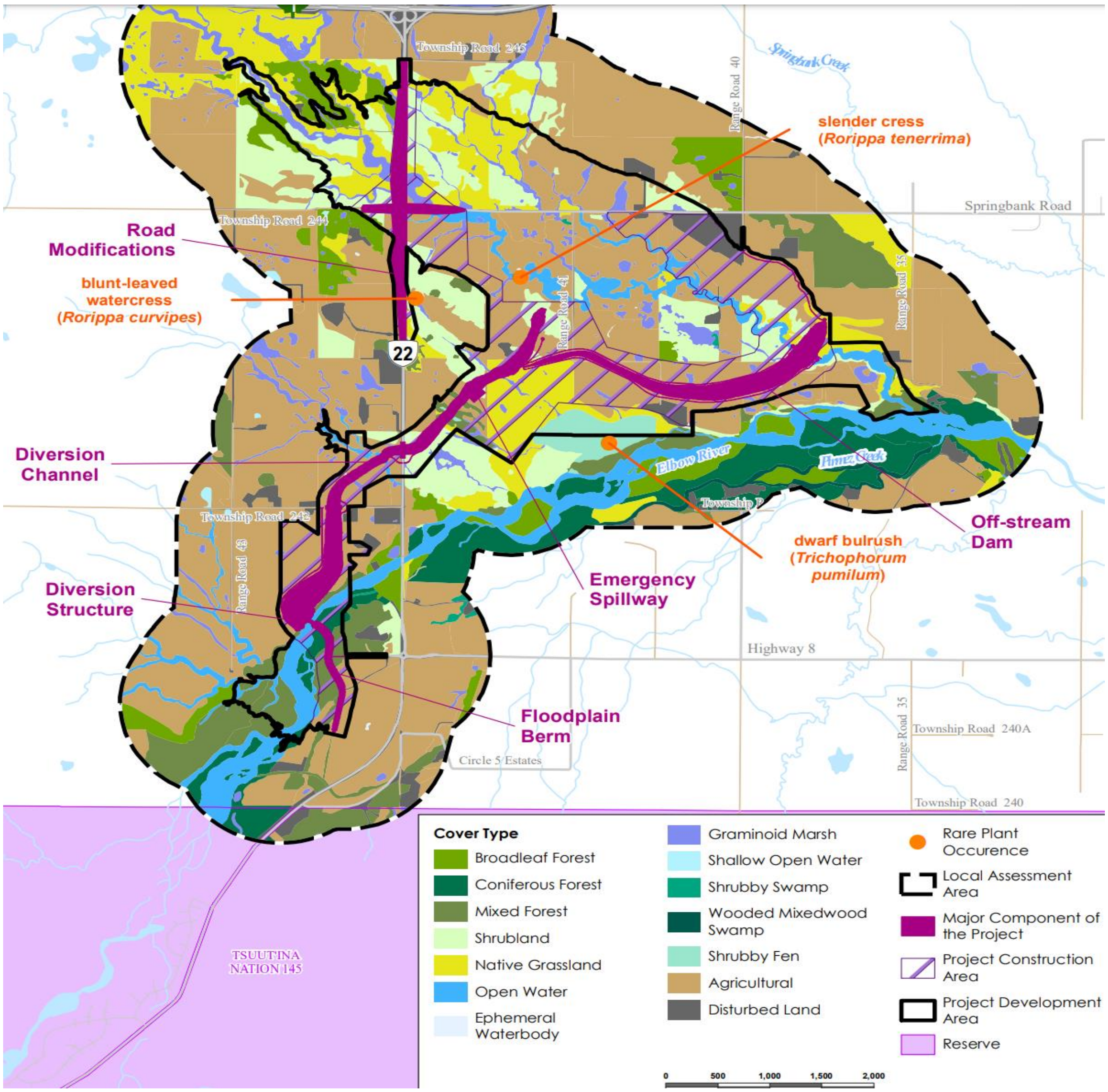
a-b. The location of water withdrawal licences and allocations within the hydrology RAA is provided in Figure IR274-1. The hydrology RAA is the Elbow River watershed. Appendix IR274-1 contains two tables, Table IR274-1 and Table IR274-2 that list all surface water and groundwater licences and allocations within the Elbow River watershed.

c. Of the 591 water withdrawal licences and allocations in the RAA, the Project will have an affect on ten groundwater and six surface water withdrawal licences and allocations located within the PDA. When Alberta Transportation acquires the land within the PDA, they will also assume ownership of these water withdrawal licences.

d. No mitigation measures for the ten affected groundwater withdrawal licences and allocations are proposed because they will form part of the land acquisition for the Project and will be decommissioned to prevent groundwater contamination. The surface water licences and allocations will transfer to the Alberta Transportation.

NRCB QUESTION 274: GROUND AND SURFACE WATER MAPPING

We do not believe that the impacts on the aquifer downstream of the project have been adequately assessed. Water released from SR1 into the Elbow River will charge the aquifer. This has a range of negative outcomes due to the degraded water quality of SR1. We request more research and discussion of this outcome.



NRCB QUESTION 276: IMPACT ON DOWNSTREAM WELLS

"Downstream Licences will not be curtailed". Is this realistic? Under what circumstances would water licenses be impacted? We ask for a better explanation of the "once every 10 years" statement in the Proponent's response. 1:10-year flood does not translate directly to once every ten years. Spring flows in the Elbow River often exceed 160m3/s, so what, exactly is the decision criteria for use?

Response 276

a. The response to IR274, Figure IR274-1, Table IR274-1 and Table IR274-2 displays and lists all water licences and allocations in the hydrology LAA and the hydrology RAA.

b. Any licences allocated to the Project lands will meet water licence requirements from AEP and DFO. The Project will not affect downstream licences for water withdrawals. Diversion of water will only occur when river flows are greater than 160 m^3/s so that flood flows in the river remain at 160 m^3/s; therefore, downstream licences for withdrawals will not be curtailed.

   During the release of water from the off-stream reservoir following a flood, water quality modelling shows an increase in sediment concentrations, at the end of the release period, in Elbow River downstream of the unnamed creek with the river. These changes will be small compared to the concentrations and loads transported during a flood in the absence of the Project. It is anticipated that these suspended sediment concentrations at end of the release of water from the reservoir can be controlled with the outlet gate operation (i.e., reducing flow rate) and, possibly, also with sediment and silt fences. The operation of the reservoir will occur infrequently (once every ten years), so the nature of the change is not anticipated to change the water quality of Elbow River or Glenmore Reservoir.

NRCB QUESTION 276: FUGITIVE DUST FROM FINE SILT

The Proponent does not expect much fine silt to deposit because it was washed away in 2013.

How is this possible when SR1 is a permanent structure? Fine silt will be created on an ongoing basis from logging activity in the headwaters.

This is quite an oversight! In 100 years, will there be no fine silts because of the 2013 flood? Their answer to this question is quite shocking and again highlights the short-term nature of their analysis. Our communities will live with this project in perpetuity and we expect the analysis to reflect the long-term nature of the project.

a. The potential increase of fines in the upstream Elbow River drainage basin, due to natural geomorphological processes that may occur over a long regeneration period, is estimated to be approximately 7%. A 7% increase of fines in the upstream Elbow River drainage basin could result in a maximum of 7% increase of fines in the deposited sediment in the off-stream reservoir. The hydrological model (Volume 3B, Section 6 and Volume 4, Appendix J) estimates an approximate composition of the deposited sediment in the reservoir to have a

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mean value of 72% sand and 22% silt. A 7% increase of silt (fines) in the deposited sediment will result in an increase of the silt fraction from 22% to 29%.

The magnitude of the fines increase is based on comparison of surface and subsurface sediment samples taken along Elbow River and bore hole data from the Elbow River floodplain. The shallow subsurface samples are considered representative of river conditions since the 2013 flood; and the bore hole data are considered representative of river conditions before the 2013 flood. The difference of 7% in the fine fraction between the bore hole data (10% fines) and the shallow subsurface samples (3% fines) is an indication of the washout effect of the 2013 flood.

The natural removal of fine sediment (e.g., clay and fine silt) from the upstream Elbow River drainage basin associated with the 2013 or future floods is estimated to have a small effect on potential fugitive dust emissions for post-flood operations. The particulate emission estimation methods described in the air quality assessment for wind erosion emissions from the post-flood sediment are described in Volume 4, Appendix E, Section 3.1. The emission rate calculation is dependent upon the selected soil classification, as indicated in Figure 3-3 of that Appendix.

NRCB QUESTION 279: FILLING AND DRAINING OF RESERVOIR AND IMPACT ON HYRDROLOGICAL REGIME

This is one of our core concerns, but we do not have the expertise to critique this response.

Volume 3B, Section 6.3, Table 6-3, Page 6.11

In the Table it is indicated that Reservoir filling and draining does not have effect on hydrological regime. However, both of these activities have an effect on hydrological regime as it is changing the hydrograph by lowering the peak and artificially increasing the flow in the low flow season. These changes may or may not happen frequently depending on the magnitude of the flood. However, when the project will be in operation these activities will have direct influence on hydrology and will have an impact over the long term.

Similarly, reservoir filling and draining have impacts on channel morphology as a percentage of sediment is removed from the river and released at a later time at a downstream location, bypassing a reach of the Elbow River. Moreover, channel maintenance will have an effect on channel morphology.

a. Update the table to reflect the above discussion on change in hydrological regime. If this is not possible explain.

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b. Include plots of hydrographs of the Elbow River (at the diversion structure and after the confluence of the outlet channel within the Elbow River) with and without the project in place to show how it changes the hydrograph and flow pattern of the River.

c. Update the table to reflect the above discussion on change in channel morphology. If this is not possible, explain.

d. Include a description of the change in the Elbow River and outlet channel morphology, if possible using the latest surveyed bathymetries.

Answers:

a. Volume 3B, Section 6, Table 6-3 is revised as indicated in Table IR279-1 (strikeout and red indicates the necessary revisions). The Project effects on hydrology are discussed in Section 6.4.2 but was omitted from the Project Interactions table.

b. The hydrographs with and without the Project are shown at the diversion structure in Volume 3B, Section 6, Figure 6-4 (design flood), Figure 6-5 (1:100 year flood) and Figure 6-6 (1:10 year flood). At the velocity of the river water, it will take about one hour to travel from the diversion structure to the confluence of Elbow River with the unnamed creek. The hydrographs shown in Figure 6-4 to Figure 6-6 would illustrate the condition and be shifted to the right by one hour. They look the same.

   The release will take place later in the summer when the flow in Elbow River is about 20 m^3/s. Figure 6-7 shows the release rate from the reservoir for the associated three flood conditions. The modelled release rates (these are not the maximum release rates) are the following: design flood = 20.01 m^3/s, 1:100 year flood =11.31 m^3/s, and 1:10 year flood = 0.27 m^3/s. Adding 20 m^3/s to the release rate hydrographs would represent the flow in Elbow River downstream of the unnamed creek.

   If the hydrographs were combined on one graph, it would be difficult to discern the release of water from the off-stream reservoir on the Elbow River hydrograph, when compared to the flood peaks without the Project.

c. Channel maintenance refers to the channel of the unnamed creek and diversion channel. Channel morphology refers to the river channel. The Project effects on river channel morphology is discussed in Volume 3B, Section 6.4.4 but were omitted from the Project Interactions table. Table IR279-1 shows the revision to the Project interactions table. The table also contains a clarifying edits in red text.

NRCB QUESTION 280: EFFECT ON HYDROLOGY IS NOT APPLICABLE

Evaporation loss <.5%??? Is this negligible? Based on what analysis? What duration of time, temperature and wind conditions, etc.? Is the evaporation in SR1 different than evaporation in a running river?

We are not satisfied with the Proponents responses on this topic.

Question 280

<u>Volume 3B, Section 6.4, Page 6.12</u>

Alberta Transportation states *Assessing the effect of the Project on hydrology under this context is not applicable because the Project is expected to operate whenever hydrological conditions pose a downstream hazard.*

This statement indicates that assessing the effect of a project on hydrology is not applicable which is not correct as one of the objectives of an EIA is to understand the effects of the proposed project regardless if they are positive or negative.

a. Include an assessment of the short term and long term effects of the Project on Hydrology and include all mitigation measures.

Response 280

a. The following statement in Volume 3B, Section 6.4, page 6.12 is not correct: "Assessing the effect of the Project on hydrology under this context is not applicable because the Project is expected to operate whenever hydrological conditions pose a downstream hazard." In fact, the analysis is completed for the design flood, 1:100 year flood, and 1:10 year flood. The following summarizes the relevant content in Volume 3B, Section 6.

   Volume 3B, Section 6, Figure 6-4, Figure 6-5, and Figure 6-6 illustrate that the Project reduces (compared to without the Project) the design flood peak by about 50% (1,150 m^3/s to 550 m^3/s), the 1:100 year flood peak by about 80% (760 m^3/s to 160 m^3/s) and the 1:10 year flood peak by about 20% (200 m^3/s to 160 m^3/s).

   These effects are positive in direction (reduction in ecological and economic damages) and moderate to high in magnitude (as stated in Volume 3A, Table 6-2). Because the effect is positive to reduce flood peaks, no mitigation for effects on hydrology is required.

   Volume 3B, Section 6, Table 6-11 is not correct and should be revised as shown in Table IR280-1.

   The assessment of long-term changes in hydrology is unchanged because there is less than 0.5% water loss from evaporation, which is adverse and negligible.

Table IR280-1 Project Effects on Hydrology during Flood and Post-Flood Operations (revision to Volume 3B, Section 6, Table 6-11)

Effect	Effects Characterization								
	Project Phase	Timing	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Hydrology (long term)	F, PF	N/A	A	N	~~PDA~~ RAA	~~ST~~ LT	IR	I	D
Change in Hydrology (short Term) [this is a new row]	F, PF	N/A	P	H	RAA	ST	IR	I	D
Change in Suspended Sediment Transport	F, PF	N/A	~~A~~ A, P	H	LAA	ST to LT	IR	I	D, U
Change in Channel River Morphology	F, PF	N/A	A	~~H~~ N to M	PDA	LT	IR	I	D

Project Phase
F: Flood Operations
PF: Post-Flood Operations

Timing Consideration
S: Seasonality
T: Time of day
R: 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

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

NRCB QUESTION 282: CHANGES TO THE ELBOW RIVER AS A RESULT OF SR1

This is a fundamental concern for us, but we do not have the expertise to critique this response.

Question 282

Volume 3B, Section 6.4.2, Page 6.19

Provide further information on how the natural flow of the Elbow River is going to be changed due to regulated operations of the Springbank and Glenmore Reservoirs during flood and post flood conditions.

a. Describe the overall changes (timing, magnitude) along the Elbow River (from upstream of the diversion inlet to downstream of Glenmore Reservoir) in terms of flow, water level and velocity in natural and regulated (due to the project) conditions.

b. Provide plots of natural and regulated hydrographs of the Elbow River just after the diversion location, for the three flood scenarios (Design, 1:100 year and 1:10 year floods).

c. Provide plots of natural and regulated hydrographs of the Elbow River just after the confluence of the outlet channel from the dam, for the three flood scenarios (Design, 1:100 year and 1:10 year floods).

d. Provide plots of natural and regulated hydrographs of the Elbow River just after the Glenmore reservoir, for the three flood scenarios (Design, 1:100 year and 1:10 year floods).

NRCB QUESTION 283: RELEASE RATES

We would like to see how they calculate sediment flux and the input data they used. The interesting thing here is the second to the last paragraph, which says it all. It seems they have thought of the effects of a warm water release with high TSS on brown trout and mountain whitefish redds. Other than this paragraph, they have chosen not to explore these outcomes or the eutrophication we have mentioned.

Flood	Elbow River Volume Non-Diversion (dam^3)	Volume Diverted (dam^3)	Elbow River Volume Reduction During Diversion (%)	Diverted Volume / Annual Volume[4] (%)	Diversion Time (days)	Residence Time in Reservoir (days)	Modelled Release Rate (m^3/s)	Release Time (days)	Volume Released[5] (dam^3)	Diverted Volume Remaining In Reservoir (%)
Design[1]	113,985	55,138	48	11.2	3.75	20	20.01	38	54,380	1.4
1:100[2]	58,933	33,014	56	5.4	1.8	43	11.31	39	32,680	1.0
1:10[3]	6,017	790	14	0.2	0.38	43	0.27	30	654	17

NOTES:

[1] Period of diversion: 06/20/2013 04:00 h to 06/23/2013 22:00 h; Residence time: 06/24/2013 to 07/14/2013

[2] Period of diversion: 05/31/2100 05:00 h to 06/02/2100 02:00 h: Residence time: 06/02/2100 to 07/15/2100

[3] Period of diversion: 05/24/2008 15:00 h to 05/24/2008 23:00 h; Residence time: 05/25/2008 to 07/07/2008

[4] Based on actual WSC Record at Sarcee Bridge for Design Flood and 1:10; modelled annual data for 1:100. Calculated annual flow volumes are design flood, 490,136 dam^3 ; 1:100 year flood, 613,411 dam^3; and 1:10 year flood, 380,797 dam^3

[5] Does not include evaporated volume

NRCB QUESTION 283: SUSPENDED SEDIMENT

The Proponent seems to focus much of its analysis on the 10-year flood. We request that the regulators require equal analysis of the Design flood.

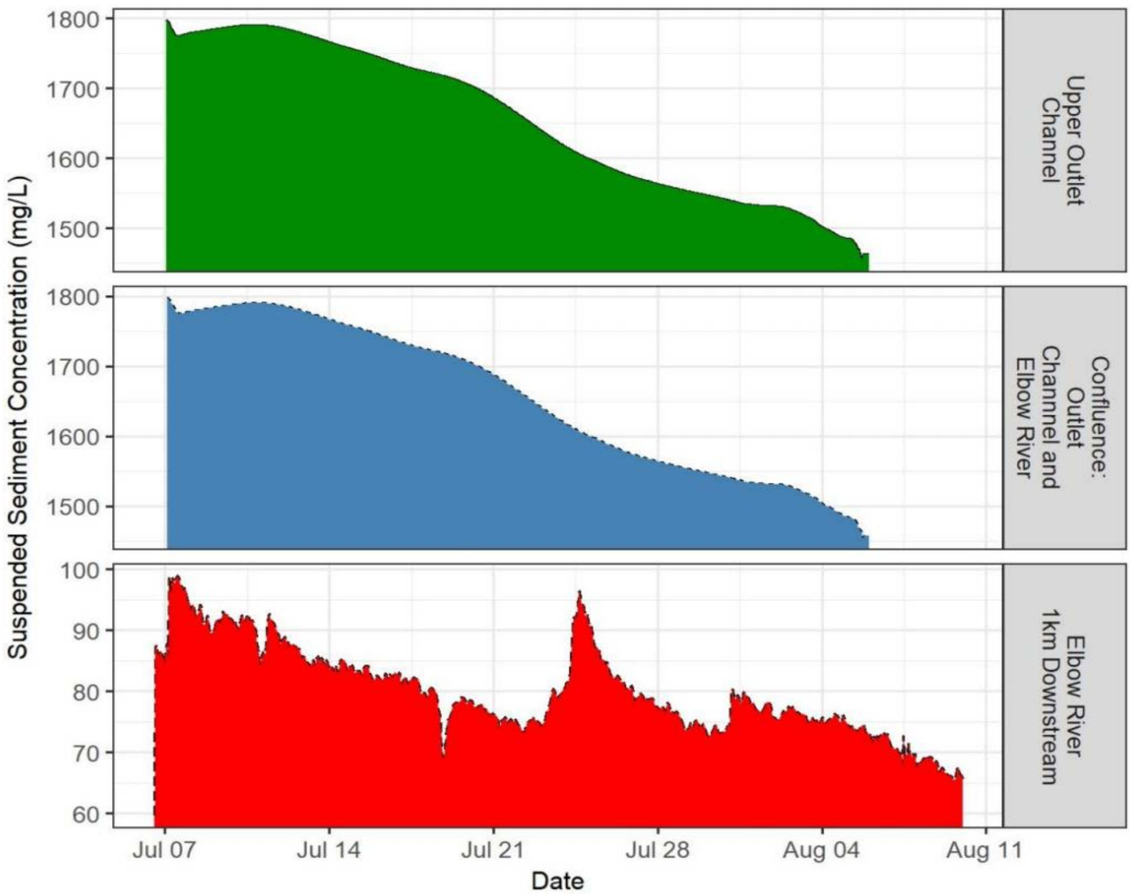

Figure IR286-2 Suspended Sediment Concentrations in Released Water Associated with a 1:10 Year Flood

NRCB QUESTION 287: HYDROLOGY IMPACT BEYOND PDA

We do not have the expertise to critique this response. We are obviously concerned about the general lack of seriousness with which the Proponent addresses risks outside the PDA.

Question 287

Volume 3B, Section 6.4.5, Table 6-11, Page 6.74

a. *Geographic extent* for 'Change in hydrology' is discussed for the PDA. Why is the extent only addressed for the PDA? Hydrology will change in the RAA (RAA boundary as per Figure 6-1 in Volume 3A_S06) as the objective of this project is to lower the peak flow in the downstream reach of the Elbow River. This change will be observed for all flood years having flows more than 160 m³/s.

Response 287

a. The flood protection provided does extend downstream of Glenmore Reservoir; therefore, the geographic extent should be the RAA. Table IR287-1 is a revision (indicated by strikeout and red text and also red text for clarifying edits) to Volume 3B, Section 6, Table 6-11.

Table IR287-1 Project Effects on Hydrology during Flood and Post-Flood Operations

	Effects Characterization								
Effect	Project Phase	Timing	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Hydrology (long term)	F, PF	N/A	A	N	~~PDA~~ RAA	~~ST~~ LT	IR	I	D
Change in Hydrology (short term) [this is a new row]	F, PF	N/A	P	H	RAA	ST	IR	I	D
Change in Suspended Sediment Transport	F, PF	N/A	~~A~~ A,P	H	LAA	ST to LT	IR	I	D, U

NRCB QUESTION 289: SEDIMENT IN SR1 VS GLENMORE RESERVOIR

Glenmore Reservoir would be more appropriately compared to the McLean Creek Dam project and is not a suitable comparison for SR1.

We do not think that the small unnamed creek flowing into SR1 from the Petro Canada area near Hwy 1 will have any effect on oxygenating the waters following a flood event. Does the Proponent have evidence to support this assertion?

We do not know how they calculated the amount of TSS returning to the river. There are equations that allow calculating sediment falling out of still water over time. We suspect their "return to the Elbow River" has something to do with using these Stokes equations with assumed residence time in the reservoir. They are correct in assuming much of the silt and sand particles will settle out and that clay-sized particle sedimentation will be affected by wind waves at the surface.

In a flood event, only 600m/s of the river flow will enter SR1; the rest will continue down to the Glenmore dam. So, it is not as though SR1 is a filter for Glenmore. It will decrease the sediment input, but we contend that the standing water will develop more onerous properties like increased cyanobacteria and coliform properties given the incubation in the warm June/July sun in nutrient-rich (nitrogen, phosphorus, Iron etc.)

The settling of the sediment in SR1 will add to the lifespan of the Glenmore Reservoir without doubt. But we have played out the disruptive scenario this deposit would have on the wildlife in the area. Also, we find this submission in no way alleviates the degradation to the waters following eutrophication, and the low dissolved oxygen and increased coliform populations that are released into the Elbow River. The cold-water riverine ecosystem downstream of the release would be severely impacted and water quality of the Glenmore Reservoir would deteriorate.

The turbid water (high sediment) will have the effect of warming the water and increasing the effect of water layer stratification and anoxia. The water will also be rich in nitrogen phosphorus and iron, all enhancing the growth of bacteria and algae – an effect called eutrophication.

Our conclusion is that SR1 will forever damage the aquatic ecosystem of the Elbow River downstream from the Project. We believe that the water held in SR1 will be elevated in nutrients following a flood (nitrogen, phosphorus, iron and trace metals) and like other large, shallow prairie lakes with no significant flux (e.g. Eagle Lake and Frank Lake) will experience eutrophication with blooms of blue-green algae (cyanobacteria) and other bacteria. This poorly oxygenated water will suffocate fish and invertebrates and at 29m3/s, will quickly wash into Glenmore Reservoir. In our estimation, it will cost at least double the current treatment costs to remove the cyanobacteria (the musty smell cannot be removed) and could cause sickness to those using the reservoir.[55] No one measured nutrients in 2013 but the Red Cross did measure harmful levels of coliforms in the silt which is a good indication of risk.

And then there is no doubt the elevated water levels will move this contaminated water into the aquifer. That is the way aquifers are charged and has been documented at monitoring water wells at Camp Gardner. [56]

The biologist at the Glencoe Golf Course agrees that the release of SR1 water will be a concern for them and require upgrade of their own treatment system. She also agreed that part of the Elbow River would likely lose its cold-water fishes.

[55] . See articles regarding Lake Erie contamination at Cleveland in 2018 and 2019. Matt Head of Stantec feels it will not have sufficient nutrients to achieve eutrophication as Frank Lake and Eagle are surrounded by farms but I feel lawn fertilizer from Redwood, the golf course and old septic fields in Bragg will suffice.

[56]Bryer Manwell's MSc thesis of the aquifer and by Everdingen, Bergeron, and Mellor at Camp Gardner and the Glencoe Golf Course in "Alluvial Aquifers of the Bow and Elbow Rivers, Alberta" (City of Calgary Water Resources, 2009).

Question 289

<u>**Volume 4, Appendix J, Section 2.4.1, Page 2.30**</u>

Alberta Transportation states *The overall model domain includes an approximately 37-km reach of Elbow River from Bragg Creek to Glenmore Reservoir and the entire Glenmore Reservoir.*

a. The EIA does not include any results on the Glenmore Reservoir. Provide the modelling results of the Glenmore Reservoir and describe the impact of the Springbank reservoir flood operation on the Glenmore reservoir in terms of hydrology and sedimentation.

b. Provide a figure of the entire model domain used in HD, ST and MT modelling.

c. Provide the simulation time period (start date, end date) used for the HD, ST and MT modelling in the report.

Response 289

a. The assessment of potential Project effects on hydrology included Glenmore Reservoir, which is in the model domain of the hydrology RAA.

   Overall, the effects of the Project on the Glenmore Reservoir are positive by reducing the volume of water entering the off-stream reservoir during floods and, as a result, reducing sediment loading. The influence of all aspects of water operations on hydrology, due to the combined operations of the Project and the Glenmore Reservoir.

b. Three model domains are used in HD (hydrodynamic), ST (sand transport) and MT (mud transport) modelling:

   - Model Domain (I) for Elbow River between Bragg Creek and Glenmore Reservoir Dam (Figure IR289-1)
   - Model Domain (II) for diversion channel and off-stream reservoir (Figure IR289-2)
   - Model Domain (III) for the unnamed creek channel and Elbow River (Figure IR289-3)

SURFACE WATER QUALITY (NRCB QUESTIONS 291-341)

NRCB : https://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water

NRCB QUESTION 291: WASTE WATER IMPACT

The Proponent claims that it is a positive outcome that most of the particulate matter will settle out into the reservoir. This quite a one-sided view of the impact of the sediment deposition in Springbank.

This is mostly a story with little supporting data, calculation or references to support assertions. We are not sure how they calculated either TSS (total suspended solids) for calculating mud deposition or total nitrogen, phosphorus, to calculate BOD (biological oxygen demand) in the water. They must have had access to TSS data to calculate their mud deposition map. It doesn't appear to us they calculated BOD or Total/fecal coliform or Chlorophyll a (algae content) although measures for all these parameters are available. We suspect a fecal coliform calculation would not be pretty given past numbers at either the Hwy 22 bridge or Twin Bridges stations.

> Particulate matter associated with wastewater that is diverted into the off-stream reservoir will settle out similar to total suspended solids (TSS) as described in Volume 3B, Section 7.4.2. Most of this particulate matter will settle and remain in the off-stream reservoir with only a small portion returning to Elbow River during release of water from the reservoir as follows:
>
> - design flood, 1.8% of sediment and related parameters will return to Elbow River.
> - 1:100 year flood, 11.7% of sediment and related parameters will return to Elbow River.
> - 1:10 year flood, 4.6% of sediment and related parameters will return to Elbow River.
>
> Particulate organic material and dissolved organic carbon associated with wastewater has the potential to affect oxygen levels in the off-stream reservoir. Bacterial activity resulting in biological respiration and chemical oxidation of particulate and dissolved, and organic matter will consume oxygen in water and sediments. (This is discussed in Volume 3B, Section 7.4.3, page 7.24.)
>
> The particulate organic material is predicted to settle in the off-stream reservoir with suspended sediments, thus removing biological oxygen demand in the water column. The amount of organic material accumulating in the off-stream reservoir sediments from the watershed is relatively small and the predicted sediment oxygen demand is predicted to be similar to Glenmore Reservoir. The addition of organic particulate matter from the wastewater is also small and the incremental effect on oxygen demand is predicted to be correspondingly low.
>
> A portion of the organic carbon in the dissolved fraction will be assimilated through biological activity and respiration will consume a portion of the oxygen in the water column. However, effects on oxygen levels in the off-stream reservoir will be reduced by wind turbulence and the shallow reservoir. Furthermore, dissolved oxygen concentrations in the unnamed creek increase due to increased water velocity that causes increased mixing and re-aeration. Any effects on Elbow River water quality will be localized and temporary because of rapid re-aeration in the river.

In summary, the Project mitigates ~~s~~ the impacts of wastewater release and overflow into the Elbow River upstream of the diversion structure during a flood. A portion of wastewater in the river will be diverted into the off-stream reservoir where related particulate matter will settle out similarly to suspended sediment, thus reducing the load on Glenmore Reservoir due to the decreased flood flows in the Elbow River passing downstream of the diversion structure.

NRCB QUESTION 292 & 293: 2D MODEL, MESH-BASED

We do not have the expertise to critique this response.

Volume 4, Appendix J, Section 2.4, Page 2.27

Alberta Transportation states *As a 2D model is mesh based, the mesh network, if based on, for example, LiDAR, better represents large spatial areas […] than surveyed cross-sections.* LiDAR and cross-sections are very often used in conjunction to represent floodplain topography and river channels respectively. The current model did not use cross-sections to better define the thalweg in the river channels.

a. Explain the rationale for not using river cross-sections for the model mesh configuration.

b. To what extent did Alberta Transportation consult with other agencies about any recent bathymetry surveys in the studied area?

c. Discuss any implications of using or not using river cross-sections for the suspended sediment transport to the Elbow River.

Response 292

a-b. River cross-sections for the model mesh configuration were not used because the data that was collected by another consulting company (Golder Associates) for another Government of Alberta project (to complete cross-sections of the Elbow River following the 2013 flood) in the area was not available at the time of the EIA filing. Alberta Transportation contacted the River Forecasting Centre and requested the cross-sections data, but the data was not ready to be released. Alberta Transportation instead obtained light detection and ranging (LiDAR) data by aerial surveillance over Elbow River in the fall of 2015.

c. The LiDAR collected in the fall of 2015 provides a better visual representation of the transects of the floodplain, unlike cross-sections that require greater interpretations of the transect data. The LiDAR and bathymetry provide very good coverage of the river domain used in modelling. The simulations done for hydrodynamics and sediment transport modelling is sufficient for determining Project effects on surface water quality and other VCs.

NRCB QUESTION 294: TSS PREDICTIONS EAST OF BRAGG CREEK

We do not have the expertise to critique this response.

Volume 4, Appendix J, Section 2.4.2, Page 2.32

Alberta Transportation indicated that *the HEC-HMS PMF model was also used to estimate tributary inflows between Bragg Creek and Sarcee Bridge […]*. These tributaries will also contribute suspended sediments.

a. Indicate how the model considers the TSS contribution between Bragg Creek and the downstream boundary condition.

Response 294

a. The HEC-HMS probable maximum flood (PMF) model only predicts flow and does not consider the total suspended solids (TSS) contribution.

For an explanation of how TSS (also referred to as suspended sediment concentrations (SSC)) is modelled, refer to Volume 4, Appendix J, Section 2.2.6, Pages 2.16 to 2.18. In summary, the SSC (or TSS) in the river is a function of the flow because this determines the carrying capacity of the river. Suspended sediment yields are estimated using site-specific SSC-discharge rating curves. The TSS contributions are modelled using the rating curves generated for locations along Elbow River (Bragg Creek, Highway 22, Twin Bridges and Sarcee Bridge). TSS contributions from tributaries between Bragg Creek and the downstream boundary are accounted for in the site-specific rating curves.

NRCB QUESTION 295: DRAW DOWN RATE

The Proponent's answer seems to be that they will figure it out and will change drawdown rates to protect the fish, as appropriate. This doesn't seem like a sufficient answer and leaves much uncertainty regarding the flood-year operations of the Project. Perhaps the regulators could consider requesting a level of confidence on responses such as these. Is the Proponent 95% confident that drawdown will go as planned? 75% confident?

Are there going to be frost and freezing impacts to consider during reservoir operations?

Has the impact of climate change on the Elbow River summer flow rates been assessed to determine how the various drawdown rates and timelines may vary (impacts on rates of release from SR1 water)?

Generally, it seems that SR1 has significant and negative impacts on fish. Is this truly better than an in-stream dam?

As discussed in the response to IR283 and Volume 3B (Section 6.4.1, pages 6.17 and 6.18, and Figure 6-7), the modelled release rate for the design flood is 20 m^3/s. This rate will be sufficient to empty the off-stream reservoir volume in 38 days. Extending the release time (i.e., by decreasing the release rate from the off-) allows operational flexibility to vary the release rates and, therefore, the release of suspended sediments. However, the design of outlet gates does not allow for increasing the maximum release rate out of the reservoir to above 27 m^3/s; that limit prevents the combination of Elbow River flow (20 m^3/s before water is released from the reservoir) and the flow out of the reservoir (maximum design rate being 27 m^3/s) from remobilizing Elbow River sediments (at 47m^3/s, there is a risk of remobilization).

The hydrology assessment used the precautionary principle and considered the maximum rate of release of water from the off-stream reservoir to consider and assess the maximum effect in the river. Reducing the release rate will result in a corresponding reduction in suspended sediment load and peak concentration entering Elbow River. The loading of sediment related constituents on the river will also be similarly reduced. However, there is an ecological limit to reducing the rate of flow from the off-stream reservoir: a release time extending into October would cause an increase in sediment during the last few days of release to occur during biologically sensitive periods for resident fall spawning fish, including brown trout and mountain whitefish. A sediment pulse during October has the potential to affect staging and spawning behavior and impact fish eggs.

On the other hand, if the release of water from the off-stream reservoir is extended into late fall, dissolved nutrients released with water from the reservoir are less likely to be available for biological assimilation. Algae and bacterial activity slows considerably at this time of year as the daily photoperiod shortens and water temperatures decrease. Therefore, dissolved nutrients will not stimulate algae and bacterial growth and changes to trophic structure in the river are not expected.

AEP will manage the release rate in a manner that mitigates detrimental effects to resident fish populations in Elbow River. Operational flexibility provides the off-stream reservoir operator the ability to manage how water is returned to the river while controlling factors such as sediment release. The release rate will be maintained in a manner that results in the off-stream reservoir being empty prior to October to avoid biologically sensitive periods for resident populations of fish in Elbow River.

Figure IR295-1 Off-Stream Reservoir Post-Flood Drawdown Hydrographs from Full Service Volume in the Reservoir

The maximum design water release rate of 27 m^3/s will empty the full-service volume from the off-stream reservoir in approximately 42 days. If the release start date is on June 20, as in Figure IR295-1, the reservoir will be empty approximately August 2. Total suspended sediment and sediment related parameters are predicted to increase in concentration over the last two weeks of reservoir drawdown. The average total suspended solids (TSS) concentration leaving the reservoir will be 2,188 mg/L with a maximum concentration of 17,961 mg/L. Downstream in Elbow River 1.0 km below the confluence with the unnamed creek, the average TSS concentration will be 754 mg/L and reach a maximum concentration of 5,666 mg/L immediately before the reservoir is empty.

When the release rate is decreased to 75% of maximum to 20 m^3/s, the reservoir is predicted to empty over approximately 57 days; the reservoir will be empty by approximately August 17. Suspended sediment concentrations are predicted to increase during the last two weeks of reservoir drawdown but TSS concentrations are predicted to be lower than predicted for

the maximum operational release rate because water movement out of the reservoir will be slower and shear stress lower.

When the release rate is decreased to 25% to 7 m^3/s, the reservoir is predicted to empty over approximately 169 days. If the release start date is on June 20, as in Figure IR295-1, the reservoir will be empty approximately December 7. Suspended sediment concentrations are predicted to increase during the last two weeks of reservoir drawdown but TSS concentrations are predicted to be lower than predicted because water movement out of the reservoir will be slower and shear stress lower.

Water quality parameters associated with TSS will increase in Elbow River in a manner similar to suspended sediments. However, sediment related parameters are bound with sediment particles and will not be available for biological assimilation (Volume 3B. Section 7.4.6, page 7.20-7.23). Only 1.8% of the sediments entering the reservoir (for a design flood) will be released from the reservoir during drawdown (Volume 3B, Section 7.4.6, page 7.23); therefore, the suspended sediment and related parameter loading on Elbow River and Glenmore Reservoir is greatly reduced compared to floods without the Project.

Managing the operational release rates to minimize effects on water quality (i.e., June 20 through December 7) must consider biological sensitive periods in Elbow River. A slower operational release rate will reduce total suspended sediments in the river; however, this may mean TSS is increased during a sensitive period when effects are greater. The period during late summer (i.e., August) is when water temperatures in Elbow River are elevated; the combined effect of sediment and elevated temperatures may affect the ability for resident fish to consume oxygen (Servizi and Martens 1990; Henley et al. 2000). The period of time between October through November is when mountain whitefish and brown trout are spawning and suspended sediments can cause harm to newly spawned eggs.

As discussed in a., AEP will manage the release rate in a manner that mitigates detrimental effects to resident fish populations in Elbow River.

NRCB QUESTION 297: DRAW DOWN RATE

We do not know how they calculated the amount of TSS returning to the river. There are equations that allow calculating sediment falling out of still water over time. We suspect their "return to the Elbow River" has something to do with using these Stokes equations with assumed residence time in the reservoir. They are correct in assuming much of the silt and sand particles will settle out, clay sized particle sedimentation will be affected by wind waves at the surface.

In the response, the Proponent refers to metals. Which metals are they referring to?

For the 1:10 year flood, the following statement is made:

> "In summary, suspended sediment concentrations and suspended sediment yield are reduced by up to 5% during active diversion (compared to no diversion) with approximately 1.3 kt of suspended sediment diverted into the off-stream reservoir."

Stantec

5.140

LBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
ESPONSE TO NRCB AND AEP SUPPLEMENTAL INFORMATION REQUEST 1, JULY 28, 2018

'ater
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The purpose of the Project is not to reduce sedimentation and improve water quality in the Elbow River; rather, the purpose is to control hydrology in Elbow River to reduce the severity of floods. However, controlling hydrology by temporary retention of diverted flood water in the off-stream reservoir will reduce total suspended solids (TSS) in the water (when it is released back into Elbow River) to levels below the TSS concentrations when the flood water was diverted. Measures will be taken to control the rate of water release from the off-stream reservoir by using the outlet structure gates to mitigate re-suspending sediments and manage TSS levels returning to Elbow River. Managing the rate of water release from the off-stream reservoir will reduce sediment resuspension and concentrations of TSS returning to the river during release. This will also reduce concentrations of associated water quality parameters such as nutrients and metals" (Volume 3B, Section 7.4.2, page 7.22 and 7.23).

b. For the release after a 1:10 year flood, the following statement is made in Volume 3B, Section 6.4.3:

> "Release of water from the off-stream reservoir would result in a minor and transient increase in suspended sediment concentrations in the low-level outlet and Elbow River (Table 6-9 and Figure 6-24). No substantial effect on discharge in the Elbow River would occur (Figure 6-24). Peak concentrations modelled at the confluence of the low-level outlet with Elbow River are approximately 1,800 g/m^3 but decline to 99 g/m^3 once in the Elbow River approximately 1.0 km downstream Table 6-9). Historical data suggests that monthly suspended sediment concentrations in August, without 2013 data, average 16 g/m^3 with a maximum of approximately 50 g/m^3, at Highway 22 (Figure 6-1). Release of water from a 1:10 year flood would have a negligible effect on suspended sediment concentrations in Elbow River."

Section 6.4.3 describes the suspended sediment concentrations in water released from the off-stream reservoir for the 1:100 year flood and design flood. Suspended sediment concentrations in Elbow River will be above guidelines and above background conditions near the end of the release period. Without the Project in place, the peak spring TSS in the river will be higher than with the Project in place. The Project reduces the peak and total load of suspended sediment in Elbow River.

NRCB QUESTION 298: WATER TEMPERATURE AND DISSOLVED OXYGEN

The turbid water (high sediment) will have the effect of warming the water and increasing the effect of water layer stratification and anoxia. The water will also be rich in nitrogen, phosphorus and iron, all enhancing the growth of bacteria and algae, an effect called eutrophication.

We do not think that a small unnamed creek flowing into SR1 from the Petro Canada area near Hwy 1 will have any effect on oxygenating the waters following a flood event. What is the basis for this claim?

The Elbow River is constantly being refreshed by mountain water. The reservoir is stagnant, shallow, and sitting in full sun. They are completely dissimilar. Again, where is the consideration of climate change on this response?

SR1 will not have the layering of the deeper Glenmore Reservoir or a constant flow of river water.

a. **Estimate the DO and water temperature in the reservoir and in the Elbow River at the point where the release is completely mixed sing quantitative methods and conservative assumptions.**

Stantec

5.142

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
RESPONSE TO NRCB AND AEP SUPPLEMENTAL INFORMATION REQUEST 1, JULY 28, 2018

Water
May 2019

Response 298

a. Water released from the off-stream reservoir will be aerated as it passes through energy dissipater blocks in the outlet structure and as it flows through the unnamed creek (also referred to as the low-level outlet channel), before it enters Elbow River.

   Water temperatures in Elbow River are expected to increase through the summer months in a manner similar to water temperatures in the reservoir. Therefore, the effects of low dissolved oxygen and increased temperature in the water released to Elbow River are predicted to be of low magnitude, temporary, and localized to the area where the unnamed creek meets Elbow River (Volume 3B, Section 7.4.3, page 7.24).

Water temperatures in Elbow River are expected to increase through the summer months in a manner similar to water temperatures in the reservoir. Therefore, the effects of low dissolved oxygen and increased temperature in the water released to Elbow River are predicted to be of low magnitude, temporary, and localized to the area where the unnamed creek meets Elbow River (Volume 3B, Section 7.4.3, page 7.24).

As stated in the response to IR310:

> "Due to low biochemical oxygen demand (BOD), low sediment oxygen demand (SOD) and the influence of wind mixing and shallow water levels, oxygen concentrations in the off-stream reservoir are not predicted to become anoxic; changes in dissolved oxygen are expected to be smaller than currently observed in Glenmore Reservoir.
>
> "If low oxygen conditions in the off-stream reservoir occur prior to discharge, these levels will be attenuated as water is released to the low-level outlet channel, which has a gradient of greater than 0.8% over the lower 2 km before the confluence with the Elbow River (Volume 4, Appendix J, Section 3.3, Page 3.5). Turbulence generated through this section of the channel will aerate water before it enters the river.
>
> "Median summer dissolved oxygen concentrations in Elbow River were just above and below aquatic life guideline levels (9.5 mg/L CCME 2018) at Highway 22 and Twin Bridges, respectively. Effects in Elbow River from low oxygen are predicted to be localized and temporary because of rapid aeration of water in the river."

Therefore, dissolved oxygen concentrations in the river downstream of the unnamed creek are predicted to be similar to concentrations in the river upstream of the unnamed creek.

As discussed in Volume 3B, Section 7.4.3, page 7.24 and 7.25, water temperature in the reservoir can increase if the air temperature is sufficiently warm. However, the water temperatures in Elbow River are expected to similarly rise during the summer months. Thus, any changes in river water temperatures originating from mixing with reservoir water would be temporary and localized due to rapid mixing.

Because changes to dissolved oxygen in the off-stream reservoir will be ameliorated and temperature in the reservoir and Elbow River will similarly be affected by seasonal conditions, effects on water quality are not predicted.

NRCB QUESTION 298: DISSOLVED OXYGEN

We do not believe adequate work has been done on this topic. That wind mixing is "anticipated to replenish dissolved oxygen" is speculation. Certainly, as the water draws down, the water will pick up sediment.

Their statement in part a, below, that the "results of modelling of the thermal and wind mixing effects on the suspended sediment settling and resuspension would not alter the conclusion of the effects of the Project on surface water quality or other valued components" cannot be substantiated. It is conjecture.

Alberta Transportation identified that *wind mixing in the relatively shallow reservoir is anticipated to replenish dissolved oxygen*.

a. Describe how the thermal and wind mixing effects were considered in the hydrodynamic model for suspended sediment settling and resuspension.

Response 299

a. The hydrodynamic model used in the assessment does not consider thermal and wind mixing effects on suspended sediment settling and resuspension. Thermal and wind mixing will affect the suspended sediment settling and resuspension; however, the short duration of water retention in the off-stream reservoir suggests that it is not likely to have a substantial effect on water quality in Elbow River upon release.

   Water quality modelling, as presented in Volume 3B, Section 7, Section 7.4.2, predicts a short duration increase in suspended sediment concentrations during the last few days of the water release out of the reservoir. This increase can be controlled with the outlet structure gate operation (i.e., reducing flow rate) and, possibly, also with turbidity curtains in the reservoir. The results of modelling of the thermal and wind mixing effects on the suspended sediment settling and resuspension would not alter the conclusion of the effects of the Project on surface water quality or other valued components.

NRCB QUESTION 300: QUANTITY OF SEDIMENT IN RESERVOIR

The Proponent states that 2,389 kilotons of sediment – 2,389,000 tonnes will be deposited in the reservoir during a design flood. We have this image as a reference point from Mary Robinson following the 2013 floods.

If sand and silt remain in SR1, clay will return to the river? How do these finer particles impact spawning sites in the river? If natural flooding occurred, all sand, silt and clay would return to the river, providing a benthic zone that provides habitat for bottom animals and plants. A clay-only benthic zone would negatively impact all aquatic life. This needs to be considered and addressed!

We ask the regulators to direct the Proponent to:

- discuss the aesthetic impacts of this silt, which will be up to 4m deep and spread over hundreds of acres.
- discuss the weight of this silt on the underlying land and water systems.
- discuss the impact of this silt on wildlife that use the reservoir.
- discuss the drying time for silt of various accumulations.
- discuss the impact of this on migratory birds.
- Discuss the timelines for seeding of this silt, following draining and the likelihood of successful reseeding in the fall.

Alberta Transportation states that *For the design flood, 1.8% of suspended sediment load and associated matter in the retained water exists the reservoir, with 98.2% remaining at the bottom of the reservoir after it is drained. For the 1:100 year flood, 11.7% of suspended sediment exits the reservoir*. Significant amounts of sediment could potentially stay at the bottom of the reservoir after a flood and after partial clean-up.

a. Describe the modeling assumptions related to the initial sediment in the reservoir.

b. Discuss the effects of different initial conditions of sediment accumulated at the bottom of the reservoir on the water quality estimations. Assess this effect using the Mike 21 hydrodynamic model calibrated for this Project.

Response 300

a. Sediment remaining in the off-stream reservoir after each flood is as follows in Table IR300-1 (Volume 3B, Section 6, Table 6-6; Volume 3B, Section 7.4.2, page 7.23):

Table IR300-1 Suspended Sediment Mass, and Percent Diverted and Released from the Off-Stream Reservoir (from Table 6-6 in Volume 3B, Section 6)

Flood	Diversion time (days)	Suspended sediment mass diverted into the reservoir (kt)	Suspended sediment mass released out of the reservoir (kt)	Percent suspended sediment remaining in the reservoir (%)	Percent suspended sediment released out of the reservoir (%)	Loss of retention volume in the reservoir due to remaining sediment (%)
Design Flood	3.75	2,389	90	98.2	1.8	1.1
1:100 year flood	1.80	1,268	220	88.3	11.7	0.5
1:10 year flood	0.38	1.3	1.1	95.4	4.6	0.0

NOTE:
kt - kilotonne

The modelling assumes heavier particle-sized sediments (e.g., sand and heavier silts) will deposit in the off-stream reservoir and finer particles (e.g., clay) will remain in suspension and exit the off-stream reservoir during release of water. Vegetation will re-establish and sediments will consolidate and thus create a stable land surface.

There was no sediment sampling in the off-stream reservoir available to define the initial sediment properties in the reservoir. The suspended sediment discussed here are diverted from Elbow River through the diversion inlet. For each of the three floods, the model simulates sediment transport from the existing natural bed conditions assuming no change in off-stream reservoir functionality (see the response to b.) from sediment deposited due to previous floods.

. The mass of sediment diverted from Elbow River that accumulates in the off-stream reservoir during a design flood is estimated to be 1.1%. The volume of sediment remaining after a 1:100 year flood is estimated to be 0.5% and after 1:10 year flood, is estimated to be much less (see Table 6.-6, Volume 3B, Section 6.4.3.1, page 6.28 and discussion on 6.26 and 2.27). Post-flood maintenance in the off-stream reservoir will include moving of sediment within the reservoir so that water flow into and out of the reservoir is maintained and the dam integrity is maintained.

Because accumulated sediments are predicted to have such small volumes, and mitigation to facilitate water movement in the off-stream reservoir will be implemented, initial conditions will essentially remain the same for each new flood. As a result, water quality estimates are expected to be the same and additional modelling has not been undertaken.

NRCB QUESTION 301: SEDIMENT REMOVAL

Basically, they don't plan to remove sediment, just move it around. What does this do to the environment? Our community? What will this look like? See our other questions and concerns regarding this approach by the Proponent.

Question 301

Volume 1, Section 3.6.1, Table 3-10, Page 3.37

Alberta Transportation indicates the plans for sediment removal as *Off-stream reservoir - partial removal of sediment so that water flow is not blocked Low level outlet works - removal of debris and sediment from the outlet components to the degree required to maintain optimal functionality*.

a. If sediment is to stay in the reservoir, how would that change the modeling results for future flooding (i.e. change in initial conditions)?

Response 301

a. See the response to IR300b and, Table IR300-1 for the suspended sediments and settled sediments in the off-stream reservoir for each of the three floods.

NRCB QUESTION 303: CYANOBACTERIA

Their answer: Risk of cyanobacteria is low. We do not have the expertise to critique this response, although we are skeptical of this conclusion. Cyanobacteria thrive in wam water conditions, especially stagnant water.

https://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water

Has the government contacted any water treatment plant operators west of Calgary to discuss the impacts on water treatment due to sedimentation and possible cyanobacteria? If so, which operators, when, and what were the outcomes of any discussions? The operators we have talked with have not been contacted.

Water co-ops are not large, municipal treatment facilities and impacts of degraded water quality on these small providers needs to be explicitly discussed.

Question 303

Volume 4, Appendix A, Concordance Tables, Terms of Reference Section 3.5.2 [E], Page A. 26

In the Terms of Reference for this project, it states *describe the potential and implications for Cyanobacteria/Microcystin in the reservoir to: impact treatment of water from Glenmore Reservoir for drinking water purposes; and to impact recreation of the Springbank Off-Stream Reservoir, Elbow River and Glenmore Reservoir.* The Concordance Table indicates the information is provided in Volume 3B, Sections 7.4.2 and 7.4.4 but the information is not there.

a. Describe the potential for Cyanobacteria blooms to occur within reservoir storage times of over 40 days.

b. If blooms were to occur, describe how this may impact water treatment of water at the Glenmore Reservoir and any other water treatment plants (plants such as Glencoe, Westridge and Calaway) downstream of the Springbank Reservoir outlet and upstream of the Glenmore Reservoir.

c. Describe any recreation impacts in the same reach of the Elbow River.

d. Describe any mitigation measures.

Response 303

a. Cyanobacteria comprise a diverse group of microorganisms with functional traits allowing them to inhabit many habitats. A number of freshwater, planktonic groups are known to affect drinking water and recreational resources. Several environmental factors are involved in the development of these communities in aquatic habitats, including water quality, temperature variation, light attenuation, nutrient levels and nutrient ratios (nitrogen, phosphorus and carbon), water mixing, turbidity levels, and water residence time (Mantzoui et al. 2016; Stroom and Kardinaal 2016; Komarek 2003; Gkelis et al. 2017). The potential for cyanobacteria to bloom in the off-stream reservoir within 84 days (for the 1:100 year flood) is low and the reasons are discussed below.

b. If cyanobacteria were to colonize the off-stream reservoir, it is expected that they would or be in small, localized areas and not in an abundance (see response a). Many cyanobacteral blooms do not result in microcystin because 30-50 percent are non-toxic. Thus, if microcystin is detected, it is predicted to be at low concentrations and dilute throughout the off-stream reservoir. Therefore, it would be released in low concentrations tc Elbow River. This will affect water treatment plants in that they will have to increase their monitoring capacity to detect low microcystin levels during release of water back into Elbo River and adjust their treatment options accordingly. Large municipal water treatment facilities like the Glenmore Reservoir water treatment plant can use an oxidation treatment with chlorine, activated carbon, or ozone. Small water intake operators without treatment may choose to temporarily use an alternative water source until microcystin levels return to normal, instead of treating water

c. Conditions predicted in the off-stream reservoir will not be conducive for cyanobacteria to colonize and produce microcystin and, therefore, is not expected to affect downstream recreational users when retained water is released back into Elbow River.

d. There are no practical mitigation measures available to reduce the predicted low cyanobacteria levels predicted in the off-stream reservoir. Considering current low nutrient levels in Elbow River, the most effective approach to control cyanobacteria and potential microcystin in the off-stream reservoir is through source-water protection and watershed

NRCB QUESTION 304: IMPACT OF SR1 WATERS ON ELBOW RIVER

These suspended sediment levels in the table seem really high, but they use much lower numbers in their answers. Please discuss the rationale for the lower levels in the written responses.

We disagree about the Proponent's statements on phosphorus. Phosphorus may cause algae blooms and decrease oxygen levels. Wetlands naturally serve as a sink for phosphorus (note that wetland habitat is negatively impacted by SR1). Some of the total phosphorus will be dissolved and easily used by algae; only some will be bound to sediment. Note that forest fire release phosphorus bound to soil particles and is a tremendous risk for water in this region.

Total phosphorus is a measure of all forms – organic and inorganic (dissolved or particulate).

Additionally, the Proponent again states "it will generally have positive effects (compared to conditions without the project) ...". We see again, the Proponent using the false comparison of "do nothing", which was never an alternative to the project. The correct comparison is to MC1.

Volume 3B, Section 6.7.2, page 6.76
EIS Summary, Section 6.6.2.2, Page 6.32

Alberta Transportation indicated that *Release of water from the reservoir through the low-level outlet will temporarily increase localized suspended sediment concentrations and yields in the Elbow River*. During flood conditions, river velocity is high and the sediment is flushed downstream. However, the storage time in the Springbank reservoir from start of the flood to end of release can be over two months. Conditions in the Elbow River, post flood would be lower flows, clearer water, and warmer water. The timing of release from the reservoir may potentially coincide with critical conditions for instream dissolved oxygen DO.

a. **Explain whether extra Total Phosphorus (TP) loading under these conditions would result in negative effects within the receiving environment (Elbow River and Glenmore Reservoir) (see: end of discharge from early to late August, Fig 7-10 to 7-12).**

b. **Provide the timing (potential range of dates), duration, and magnitude of suspended sediment and related parameters increase for the three flood cases studied and discuss any variations (early flood or back to back flood) that can influence the effects of the temporary increase in suspended sediment and related parameters.**

c. **Discuss the implications of changing the timing and duration of the release of flood related contaminants (TSS, nutrients, salts, and increase in water temperature)**

Response 304

a. Based on the discussion in Volume 3B, Section 7.4.2, the off-stream reservoir will be a "nutrient sink" (i.e., where nutrients accumulate and are temporarily unavailable for biological uptake). Nutrients, including total phosphorus, are expected to be retained in the off-stream reservoir sediments after water is returned to Elbow River, similar to the behaviour of suspended sediments during release of water back into the river.

   Total phosphorus associated with the sediment and the vegetation in the off-stream reservoir will be an organic form that is not readily available for uptake by algae or macrophytes. Organic carbon and biological respiration in the off-stream reservoir are predicted to be low (Volume 3B, Section 7.4.3). Monitoring of Elbow River and Glenmore Reservoir does not indicate low dissolved oxygen at the concentrations considered anoxic (1-2 mg/L (Nürnberg 2002)). Dissolved oxygen concentrations are predicted to be sufficiently high in the off-stream reservoir that would prevent a chemical release of phosphorus from sediments. As stated in the response to IR90, Elbow River and Glenmore Reservoir are generally considered stated in the response to IR90, Elbow River and Glenmore Reservoir are generally considered oligotrophic and, thus, additional total phosphorus loading is anticipated to be effectively assimilated without changing the trophic structure of either water body.

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LBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
ESPONSE TO NRCB AND AEP SUPPLEMENTAL INFORMATION REQUEST 1, JULY 28, 2018

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As discussed above, the off-stream reservoir will be a sink for nutrients, thereby permanently removing total phosphorus equivalent to that bound in sediments that is diverted to the reservoir. When the Project is active for flood mitigation, it will have generally positive effects (compared to conditions without the Project) on reducing nutrient loads from a flood and will have no effect on the trophic status of the system.

Table IR304-1 Estimated Suspended Sediment Concentrations and Yields in the Elbow River, With and Without Diversion (from Volume 3B, Section 6, Table 6-6)

Flood	Elbow River Peak Suspended Sediment Conc. Non-Diversion (g/m^3)	Diversion Channel Average Suspended Sediment Conc. (g/m^3)	Diversion Channel Peak Suspended Sediment Conc. (g/m^3)	Diversion Time (days)	Elbow River Suspended Sediment Mass Non-Diversion (kt)	Diversion Suspended Sediment Mass (kt)	Elbow River Suspended Sediment Mass Reduction (%)	Suspended Sediment Mass Released into the Low-level Outlet (kt)	Loss of Retention Volume Due to Sediment Remaining In Reservoir[4] (%)
Design[1]	139,682	18,709	89,166	3.75	4,819	2,389	50	90	1.1
1:100 Year[2]	77,649	19,228	74,715	1.80	1,943	1,268	65	220	0.5
1:10 Year[3]	4,818	1,258	2,064	0.38	24	1.3	5	1.1	0.0

NOTES:
[1] Period of diversion: 06/20/2013 04:00 h to 06/23/2013 22:00 h; Residence time: 06/24/2013 to 07/14/2013
[2] Period of diversion: 05/31/2100 05:00 h to 06/02/2100 02:00 h: Residence time: 06/02/2100 to 07/15/2100
[3] Period of diversion: 05/24/2008 15:00 h to 05/24/2008 23:00 h; Residence time: 05/25/2008 to 07/07/2008
[4] Based on full service volume of 77,771 dam^3 and assuming a sediment density of 2,650 kg/m^3

NRCB QUESTION 305: DISSOLVED CONSTITUENTS

The Proponent states that "The main effect on water quality during flood and post flood operations is related to suspended sediment, which comprises organic and inorganic matter that is held in water by turbulence."

We do not have the expertise to critique this response.

Volume 3B, Section 7.4.2, Page 7.20
EIS Summary, Section 6.5.2.2, Page 6.25

Alberta Transportation identified that *The main effect on water quality during flood and post flood operations is related to suspended sediment, which comprises organic and inorganic matter that is held in water by turbulence*. The report also identified parameters that behave similar to Total Suspended Sediments (TSS) including suspended and dissolved constituents.

a. What is the effect on other parameters transported with suspended sediment? What are the water quality constituents of major concern besides TSS?

b. Discuss the implications of any dissolved constituents (e.g. dissolved phosphorus) increasing during the flood conditions.

Response 305

a. The water quality constituents of major concern besides total suspended solids (TSS) include:

- herbicides (Volume 3A, Section 7.4.2)
- temperature and dissolved oxygen (Volume 3B, Section 7.4.3)
- methylmercury (Volume 7.4.4, Section 7.4.4)

The parameters transported with suspended sediment are discussed in Volume 4, Appendix K, Section 3.2.2, Table 3-1. The parameters that have a variation pattern most similar to suspended sediments include phosphorus (total, total dissolved, and dissolved forms), total coliforms, total organic carbon, total hardness, total calcium, total sulphate, total magnesium, and total ammonia. The seasonal pattern for many metal concentrations correspond with suspended sediment levels; however, metals data were not complete enough to assess their variation pattern category. These parameters are predicted to deposit in the off-stream reservoir with a subsequent reduction in downstream loading (i.e., they will be removed and not available to affect water quality; Volume 3B, Section 7.4.2.); thus, other water quality constituents associated with TSS are not considered a concern.

b. Dissolved phosphorus behaves similar to TSS and, therefore, is expected to increase during floods. Dissolved parameters, including the ones that increase in concentration during flooding, will enter the off-stream reservoir and be released during drawdown of water out of the reservoir. Even though dissolved phosphorous acts similarly to TSS with seasonal flows, dissolved nutrients are not expected to settle in the off-stream reservoir. The reservoir is

NRCB QUESTION 306: IMPACT OF MANURE ON WATER QUALITY

This wouldn't be true for the first flood. Spring run-off includes upstream land, much of which is Crown grazing leases.

a. **Discuss any potential effects on increasing nutrient export/loading from cattle manure after release of water from the flooded reservoir to the Elbow River.**

Response 306

a. Since filing of the EIA, Alberta Transportation has created a draft post-construction land use document for the Project (Appendix IR2-1). This document provides the draft principles of future land use for the PDA, which was developed through the engagement process and includes feedback received by First Nations and stakeholders. The principles apply to the land use area (LUA) outlined in yellow in Figure 1 of Appendix IR2-1. The primary use of all lands within the PDA, including the LUA, is for flood mitigation. In light of the primary use, the safety of anyone with access or land users will be an overriding factor. Currently, grazing is not identified as a secondary use within the LUA. The future uses of the LUA will be determined after engagement with Indigenous groups and stakeholders.

As stated in Volume 3B, Section 7.4.3, Table 7.4-1, less than 5% of the flooded area will be north of Springbank Road during a 1:100 year flood and less than 25% during the design flood (this is where the area previously identified in the EIA as Area C is located).

"In most instances when the off-stream reservoir is operated, the flooded area will primarily be over fallow land and be free of livestock waste, or fertilizers that may be associated with agricultural activities" (page 7.25).

Any flood less than a 1:100 year will result in minimal to no animal waste mixing with flood water into the off-stream reservoir; thus, effects from nutrient loading are not anticipated

Organic material from livestock waste carried into the off-stream reservoir during the design flood is predicted to be small and similar to that entering the Elbow River under current conditions (Volume 3B, Section 7.4.3). Subsequent changes in water quality from the export of nutrients into Elbow River from the off-stream reservoir will be similar to that which would occur without the Project.

NRCB QUESTION 307: GROUNDWATER SEEPAGE

We do not have the expertise to critique this response.

Volume 3A, Section 5.2.2.3, Page 5.25 and 5.26

Alberta Transportation states *Groundwater that would seep into the diversion channel (when dry) would remain within the watershed, although potentially travelling through a more tortuous route. 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.* There will be a continuous flow of groundwater into the dry dam since the diversion channel leading to the dry dam will be cut to below the typical groundwater level. Flow may or may not be of significant volume.

In addition, Section 5.2.2. discusses the presence of high sodium, TDS and sulphate concentration in groundwater samples from the unconsolidated deposits.

a. **Discuss the potential for flows to be of significant volume and the resulting potential effect of groundwater on surface water quality discharged to the Elbow River via the dry dam outlet structure.**

b. **Describe any other groundwater-surface water interactions that can lead to changes in the surface water quality.**

Response 307

a. Seepage into the diversion channel (when dry) has been estimated by the numerical groundwater flow model (see the Hydrogeology TDR Update, in the response to IR42, Appendix IR42-1, Section 5.5). Estimates of seepage into the diversion channel (when dry) were obtained by examining flux values at nodes within the diversion channel based on the numerical groundwater simulation results. Based on these flux values, the estimated net seepage into the diversion channel is 0.013 m^3/s. Given the relatively low seepage rate estimate and that groundwater under baseline conditions is already discharging to the unnamed creek, substantial changes to surface water quality are not expected.

b. No other direct effects pathway for groundwater-surface water interactions leading to changes in surface water quality were necessary during dry operations.

NRCB QUESTION 308: WATER QUALITY, TSS AND SEASONALITY

We do not have the expertise to critique this response.

https://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water

Alberta Transportation has provided water quality analysis based on four seasons. The rivers in that region are very dynamic in spring and summer. These are the two seasons where the flood and post-flood operation would have effects on the water quality. Figure 3-2 shows that there is a big variation within each spring and summer season.

a. Evaluate the variability of the different "suspended sediment associated" parameters in a way that can be matched with the scale of the flood and post flood operation (weekly/monthly).

Response 308

a. Descriptions for graph including box and whisker are provided in Figure IR308-1 and in Volume 4, Appendix K, Section 2.2.4.3. Monthly total suspended solids (i.e., total suspended sediment) and suspended sediment associated parameters, as well as temperature and dissolved oxygen, are shown on Figure IR308-2 to Figure IR308-20.

Some parameters are graphed on a logarithmic axis to accentuate monthly variability (e.g., Figure IR308-2: Total Suspended Solids); consequently, these graphs are truncated and some higher outlier concentrations are excluded. These outliers can be viewed in Volume 4, Appendix K, Section 3.2.1 and 3.2.2.

Maximum total suspended solids (TSS) concentrations sampled in the 2005 and 2013 flood years are generally within the upper 50th percentile (i.e., between the median and maximum historical concentration). None of the flood year TSS samples are considered outliers (i.e., extreme values).

Median TSS concentrations were highest in June and the most variable distributions were in the same month. This corresponds with spring freshet; June is also the most common month for flooding. The monthly trend for the maximum flood year TSS concentration is similar to median historical values, with increasing values from March through June and decreasing values through the rest of the summer.

Total organic carbon, nutrients and coliforms appear to show a similar temporal distribution as TSS; however, coliforms did not appear to decrease through the summer.

Metals data from Elbow River were not sufficient to determine if metal concentrations had a similar monthly trend compared to TSS; however, metal concentrations in the Glenmore Reservoir were highest in June. Temperature increased through the spring and summer months while dissolved oxygen concentrations decreased.

NRCB QUESTION 309: RELEASE INTO RIVER

Re: https://www.nrcb.ca/download_document/2/83/5555/sir-1-july-31-2018

We do not have the expertise to critique this response.

The Alberta government's responses on the water quality and monitoring for release appears to be, "We will figure it out." That is not good enough. We deserve a plan to address these water quality issues before the structure is approved!

Volume 3B, Section 7.4.2, Page7.21

Alberta Transportation stated that *It is anticipated that these suspended sediment concentrations during the last few days of the discharge can be controlled with the low-level outlet gate operation (i.e. reducing flow rate) and, possibly, also with sediment and silt fences. Without further mitigation the resulting increase in the Elbow River of suspended sediment concentrations is likely to exceed the Canadian Water Quality Guideline.*

a. What is the level of reduction that the mitigation controls have to accomplish to avoid exceeding the guidelines and the level that would be achieved by proposed controls?

b. What is the uncertainty of meeting those reductions?

Response 309

a. Upon release of retained water from the off-stream reservoir, predicted total suspended solids (TSS) concentrations will range from 1,798 mg/L (1:10 year flood) to 20,692 mg/L (1:100 year flood); however, this is well below the predicted peaks for floods that occur without the Project in place: 4,818 mg/L (1:10 year flood), 77,649 mg/L (1:100 year flood), and 139,682 mg/L (design flood).

Water will be released from the off-stream reservoir after the water flow in Elbow River has subsided; predicted peak and average TSS concentrations at the confluence of the unnamed creek with Elbow River and 1 km downstream (the extent of modelling) of the confluence are presented in Table IR309-1, which is a summary of key information from Volume 3B, Section 6, Table 6-7, Table 6-8 and Table 6-9).

The assessment of Project residual effects on surface water quality is based on the release of water from the reservoir without mitigation measures. The assessment concluded that effects from the predicted sediment concentrations are not significant. Given that significant effects are not predicted, the primary sediment control measure is to control the release rate through the outlet gates; other measures are not necessary.

Table IR309-1 Total Suspended Sediment Concentrations at the End of the Release Period of Water from the Off-Stream Reservoir

Flood	At the Confluence of Elbow River and the Unnamed Creek		Elbow River 1 km Downstream from the Confluence with the Unnamed Creek	
	Peak	Average	Peak	Average
1:10 year flood	1,798 mg/L	1,657 mg/L	99 mg/L	81 mg/L
1:100 year flood	20,692 mg/L	7,285 mg/L	4,704 mg/L	1,576 mg/L
Design flood	17,955 mg/L	2,173 mg/L	5,666 mg/L	754 mg/L

b. There will be uncertainty around the effectiveness of the mitigation due to the variability in site-specific conditions in the off-stream reservoir and in the river at the time of a particular release (e.g., weather, concentrations of TSS in the river, flow rate in the river, deposition pattern of sediments in the reservoir, sediment particle size and erosion locations). These site-specific conditions will also determine when water will be released from the reservoir and back into the river.

   Table IR309-2 lists the applicable guidelines that will be used in controlling the outlet gate to manage suspended sediments in the receiving waters of Elbow River.

Table IR309-2 Water Quality Guidelines for the Protection of Aquatic Life

Parameter	Guideline Value
Suspended Sediments: Clear Flow	• Maximum increase of 25 mg/L form background levels for any short-term exposure (e.g., 24-hour period). • Maximum average increase for of 5 mg/L from background levels for longer term exposure (e.g., inputs lasting between 24 h and 30 d).
Suspended Sediments: High Flow	• Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. • Should not increase more than 10% of background levels when background is greater than 250 mg/L.
SOURCES: GoA 2018; CCME 1999	

NRCB QUESTION 310: WATER QUALITY IN RIVER (DO)

We do not have the expertise to critique this response.

Alberta Transportation states that in the proposed reservoir *Dissolved oxygen can be consumed by retained water because of organic matter decomposition, if the residence time and weather conditions create suitable conditions for decomposition to occur.* In addition Alberta Transportation states that *flows in the Elbow River needed to be less than 20 m3/s before release could occur. This threshold was based on a maximum design release rate of 27 m3/s and the effective discharge for suspended sediment transport of between 35 and 50 m3/s.* Given the potential for lengthy detention in the reservoir that could include summer there is a potential for an anoxic water condition to be created that could promote the release of metals and nutrients from the bottom sediments.

a. Explain how anoxic conditions might affect water quality in the reservoir and further downstream during post flood release into the Elbow River.

Response 310

a. Due to low biochemical oxygen demand (BOD), low sediment oxygen demand (SOD) and the influence of wind mixing and shallow water levels, oxygen concentrations in the off-stream reservoir are not predicted to become anoxic; changes in dissolved oxygen are expected to be smaller than currently observed in Glenmore Reservoir (Volume 3B, Section 7.4.3).

   If low oxygen conditions in the off-stream reservoir occur prior to release of water from the reservoir, these levels will be attenuated as water is released into the unnamed creek, which has a gradient of greater than 0.8 % over the lower 2 km before the confluence with the Elbow River (Volume 4, Appendix J, Section 3.3, Page 3.5). Turbulence—generated by energy dissipater blocks and stream channel roughness through the unnamed creek—is predicted to aerate water as energy is dissipated before it enters the river.

   Median summer dissolved oxygen concentrations in Elbow River are just above and below aquatic life guideline levels (9.5 mg/L, CCME 2018) at Highway 22 and Twin Bridges, respectively. Effects in Elbow River from low oxygen are predicted to be localized and temporary because of rapid aeration of water in the river.

NRCB QUESTION 311: COMPARISON TO SR1

We would like the Proponent to confirm whether, in reality, there are any comparisons to the SR1 reservoir (depth, closed system, level of sediment, temperature, etc.). Is there any shallow lake that would have similar suspended sediment properties?

Alberta Transportation indicated that *The amount of organic material available for decomposition is lower than in many studied wet reservoirs and shallow lakes.*

a. What, specifically, is the amount of organic material used for this comparison?

Response 311

a. The sentence quoted (Volume 3B, Section 7.4.3, page 7.24) in the preamble, "The amount of organic material available for decomposition is lower than in many studied wet reservoirs and shallow lakes" should be revised to read: "The amount of organic material available for decomposition is lower than in two studied wet reservoirs and shallow lakes."

The wet reservoirs and shallow lakes include reported research literature on a prairie chained river-lake system in the Qu'Appelle River watershed, Saskatchewan (i.e., Terry et al. 2017; Akomeah and Lindenschmidt 2017). Specific organic matter levels were not reported in these studies; however, the system has organic inputs not found in Elbow River, including two upstream municipalities with sewage discharges (Moose Jaw and Regina). Based on these inputs and that the shallow lakes in the Qu'Appelle River watershed were reported to be hyper-eutrophic, organic material would be expected to be comparably higher than found in the Elbow River.

As stated, the studies referred to above refer to wet reservoirs, whereas the off-stream reservoir will only hold water temporarily and infrequently (approximately 1:10 year). Therefore, effects of organic material on water quality in the off-stream reservoir are not expected.

NRCB QUESTION 312: MACROPHYTES

We do not have the expertise to critique this response.

Alberta Transportation states *The increase in bed stability and stable flows can result in the growth of aquatic macrophytes, which can improve habitat.*

a. Provide support for your statement that an increase in aquatic macrophytes can improve habitat (in the Elbow River). Or remove if unsupportable in regard to the Elbow River.

Response 312

a. The statement in the preamble is missing the original context provided in Volume 3B, Section 8.2.2.1:

> "Lateral channel migration promotes habitat diversity and can be negatively affected by flow impoundment (Sheilds et al. 2000), as might occur upstream of the diversion structure during diversion. This could affect shallow side-channel and nearshore rearing habitats. The increase in bed stability and stable flows can result in the growth of aquatic macrophytes, which can improve habitat, but can also restrict fish spawning habitat, and fish and invertebrate access to clean substrates."

To further clarify, changes in local hydrology near the diversion structure may constrain lateral channel movement and decrease habitat variability. Altered stream flows and a subsequent reduction in bed scouring during post-flood conditions may allow macrophytes and aquatic vegetation to root in localized low flow and backwater areas. Aquatic vegetation may provide habitat not commonly found in Elbow River; cover and shade are provided around the margins of vegetated patch's where dissolved oxygen (DO) and temperatures are suitable and thus have a positive effect. However, as stated in Section 8.2.2.1, macrophytes and aquatic vegetation can also have negative effects when they alter existing habitat and features important for resident species (i.e., spawning gravels).

High and low flow velocity patterns near the diversion structure will remain similar with upstream and downstream sections of the river. Affected habitat is mostly run habitat with some riffle and pool habitat. Reach 2 has primarily run habitat (85% R3 channel unit with depths between 0.3 and 0.75 m, 12% R2 channel unit with depths between 0.75 and 1.0 m, and a few small shallow pools). Reach 3 has continuous run habitat (45% R2 channel unit, 40% R3 channel unit and 10% riffle channel unit and 5% small shallow pools). The habitat in this reach does not appear to be limiting habitat and is common in the river. Any changes

NRCB QUESTION 314: DOWNSTREAM WATER QUALITY

The Proponent states that the project has a positive impact on the water quality because it would be worse in an unmitigated flood. This is a false comparison. We should compare water quality impacts of SR1 to this to an option like MC1.

We have expressed elsewhere that we are concerned about the impact on the aquifer downstream of SR1. The aquifer will become charged with SR1 water, which has consequences not considered by the Proponent.

Alberta Transportation stated that *The magnitude of the effect is anticipated to be from low to high. The high magnitude effect is related to high suspended sediment concentrations in the Elbow River at the end water release.*

a. Comment on whether this also applies to the parameters that behave in similar fashion to TSS.

b. Comment on the potential implications of the high magnitude effect on downstream water users.

release is predicted to be of high magnitude effect on water quality. However, the effect on water quality is expected also to be reversible and short-term. The Project will result in a high magnitude reduction in sediment loading on Elbow River and Glenmore Reservoir; consequently, there will be a similar reduction in the loading of sediment associated parameters.

The high magnitude effect for sediment is short term and reversible during the "end water release" described in Volume 3B, Section 6.4.3, page 6.25 through page 6.51. The sediment loading associated with this short-term increase will be small because most of the sediment will settle and remain in the off-stream reservoir as follows:

- For the design flood, 98% of sediments will settle and remain in the reservoir and not return to the river; approximately 2% of the sediment will return to the river.
- For the 1:100 year flood, 88% of sediments will settle and remain in the reservoir and not return to the river; approximately 12% of sediment will return to the river.
- For the 1:10 year flood, 95% of sediment will settle and remain in the reservoir and not return to the river; approximately 5% of sediment will return to the river.

Parameters associated with suspended sediments are predicted to have a small, short-term increase in concentration when water is released back into Elbow River (Volume 3B, Section 7.4.2., pages 7.22 to page 7.23). Metals and nutrient loading associated with suspended sediments will increase with TSS; however, based on the small proportion of sediment returning to the river, the loading of these associated parameters is predicted to be equally small. These parameters are attached to sediment, which means they will not be readily bioavailable.

The magnitude of effect from parameters associated with suspended sediment is considered low (Volume 3B, Section 7.4.2., page 7.22 to page 7.23); duration is short and infrequent, limited to a flood periodicity of 1:10 year and reversible.

. The Project will have a substantial benefit, during and after diversion, to the quality of the drinking water supplied to the City of Calgary during a flood by reducing the total suspended solids (TSS) load entering the Glenmore water treatment plant (Volume 3B, Section 15.4.2.3, page 15.20).

There are no effects predicted on downstream water users. During the 2013 flood in Calgary, boil-water advisories were avoided for municipal waters from the Glenmore Reservoir due to earlier investments in water treatment infrastructure. Therefore, a flood similar in magnitude to the 2013 flood in Calgary would have a very low probability of needing mitigation to

NRCB QUESTION 318: LEFT OVER SEDIMENT

We do not have the expertise to critique this response.

Alberta Transportation indicates the plans for sediment removal as *Off-stream reservoir - partial removal of sediment so that water flow is not blocked Low level outlet works - removal of debris and sediment from the outlet components to the degree required to maintain optimal functionality.*

a. How would the remaining sediment be flushed under non-extreme peak flows and affect water quality downstream?

Response 318

a. Post-flood maintenance activities will not include flushing sediment from the off-stream reservoir into Elbow River. Sediment will be left in-place in the off-stream reservoir but moved or recontoured in the reservoir so that the functionality of water flow into and out of the reservoir is maintained and also to maintain the integrity of the off-stream dam.

NRCB QUESTION 320: DUST SUPPRESSION

The Proponent should provide cost estimates for dust suppression services from the third-party provider in the cost/benefit analysis with underlying assumptions under various silt scenarios. It appears there could be constant excavation as silt is moved around within the reservoir.

NRCB QUESTION 321: UNACCEPTABLE LEVELS OF TSS

The level of TSS concentrations expected by the Proponent are shocking. We do not think that consequences of the TSS concentrations in the reservoir have been addressed fully.

Alberta Transportation states that *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.*

a. What would be considered an unacceptable increase in suspended solids?

Response 321

a. Unacceptable increase in suspended solids will be as described in *Clause 1.7- Compliance Criteria of the 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). These criteria are set by GoA (2018), which are based on CCME (2002, 2018), and are listed in Table IR321-1.

Table IR321-1 Suspended Sediment Criteria

Site Conditions (Background TSS)	Exceedance Levels (TSS in Excess of Normal Background Levels)
TSS < 25 mg/L	• A maximum instantaneous increase of 25 mg/L over background levels at any time. • An average increase of >5 mg/L over background levels for more than 24 hours.
TSS 25 mg/L – 250 mg/L	• A maximum instantaneous increase of 25 mg/L from background levels at any time.
TSS > 250 mg/L	• A maximum instantaneous increase of 10% of background levels at any time.

NRCB QUESTION 323: WATER QUALITY TRENDS IN WATERSHED

We do not have the expertise to critique this response.

Alberta Transportation states that *Concentrations of some parameters increased between 1979 and 1997.*

Alberta Transportation also states that *A statistical trend analysis of long-term water quality patterns was not completed because the data available was not appropriate for this type of analysis.*

This trend analysis uses data over 20 years old. The City of Calgary has up to date water quality data.

a. Are there any new water quality trends in this watershed?

b. Are the concentrations increasing at similar rates?

Response 323

a. The statement, "Concentrations of some parameters increased between 1979 and 1997" is based on Sosiak (1999). For clarification, Alberta Transportation has used water quality data sourced from the AEP water quality database and the City of Calgary (the City) water quality database, which includes data up to 2015 (see Volume 4, Appendix K, Section 2.2.1).

Water quality data for the upper Elbow River mainstem and Glenmore Reservoir were not statistically analyzed to identify trends. Determining a statistically reliable long-term trend and characterize variability requires the availability of continuous sampling data. Such data are not available from AEP or City water quality databases. These databases, rather, are characterized by irregular sampling and small sample sizes. Thus, the available data are snapshots of variability and are not suited to determined long term trends. However, a seasonal variation metric (SVM) is calculated for parameters with sufficient site data: monthly water quality data at a sufficient number of sample sites to calculate 20 coefficients of variation used to derive the SVM (Volume 4, Appendix K, Section 3.2, page 3.7).

NRCB QUESTION 326: METHYMERCURY

We do not have the expertise to critique this response. We are concerned about the combination of repeat floods and large deposition of silt has on this risk of exposure in our community.

We would note that, according to a paper by Desiree Tullos[57] "Another water quality concern is that of methylmercury production, a central nervous system toxin (Clarkson, 1987). It is easily absorbed into the tissue of fish that may be consumed by humans, and subsequently result in mercury poisoning at modest consumption rates (USEPA, 2001). Newly-formed reservoirs are known sources of methylmercury to the aquatic food web (Kelly et al., 1997; Duchemin et al., 1995; Bodaly et al., 1997)."

Alberta Transportation indicated that *Methylmercury concentration in diverted water into the reservoir is assumed to be zero because methylmercury concentrations during a flood are not known and existing conditions data indicates that total and dissolved mercury concentrations in the river are low.* A methylmercury concentration equal to zero is an inappropriate assumption.

a. Estimate the median methylmercury background concentration at high flows and recalculate the effects using that concentration.

Response 326

a. Mercury data from Elbow River was collected by the following:

- Samples collected in 2016 at Highway 22 and Elbow River were analyzed for total and dissolved mercury; reported concentrations were below analytical detection limits (Volume 4, Appendix K, Attachment A, Table A-1).
- Total mercury analysis in historical data from AEP was limited to a single value from 1988.

Water data distributions are assumed to be lognormal (Helsel and Hirsch 2002). Depending on how water chemistry data are distributed, the shape and symmetry of the lognormal curve can vary. However, based on how data are distributed above the reported detection limit, the distribution of censured data (i.e., values below the analytical detection limit) can be inferred.

[57] http://rivers.bee.oregonstate.edu/sites/default/files/tullos_2008.pdf

In surface water, methylmercury is generally an order of magnitude lower in concentration than total mercury. Ratios of methylmercury to total mercury reported by Balogh et al. (2005), Dittman et al. (2010), Schuster et al. (2008) and Shanley et al. (2008) ranged between 1% and 15%. Higher ratios are associated with watersheds having a higher proportion of landcover in wetland habitat. Using a conservative methylmercury-to-total mercury ratio of 15%, and median total mercury concentrations estimated as 0.003 µg/L, the estimated methylmercury concentration in the Elbow River is 0.0004 µg/L.

Based on predictions in Volume 3B, Section 7.4.4, page 7.29 regarding methylmercury flux between soil and off-stream reservoir water, and a starting water concentration of 0.0004 µg/L, updated predictions for methylmercury concentrations in the reservoir associated with the three floods are as follows:

- design flood, 0.00068 to 0.0017 µg/L
- 1:100 year flood, 0.0008 to 0.0024 µg/L
- 1:10 year flood, 0.00085 to 0.0024 µg/L

These estimated low and high methylmercury concentrations are conservative and the potential upper limits of these concentration are based on analytical detection limits. The upper limits for the 1:100 year and 1:10 year floods are above the Alberta Environmental Quality guidelines (0.001 µg/L [chronic] and 0.002 µg/L [acute]; GoA 2018); however, these estimated concentrations are below the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guideline for the Protection of Aquatic Life (0.004 µg/L, CCME 2003).

NRCB QUESTION 327: RESIDENCES TIMES IN RESERVOIR

"Depending on the circumstances…such as the flow conditions in the Elbow River". This is a vague response that is not acceptable. Some projections of confidence would be helpful.

The residence times for retained flood water in the off-stream reservoir are presented in in the response to IR 283, Table IR283-1. Flow in Elbow River must be less than 20 m^3/s to accept a maximum release rate from the reservoir of 27 m^3/s and have flows in the river remain below 47 m^3/s. This operational condition will minimize sediment resuspension in Elbow River downstream of the unnamed creek.

The time it takes for Elbow River flow to decrease to 20 m^3/s depends on the shape of the river's hydrograph; the greater the declining slope after the peak, the faster the river returns to a flow of 20 m^3/s. The hydrographs used to model each flood are derived as follows (Volume B, Appendix J, Section 2.4.2, Page 2.31):

- The design flood scenario is derived from the 2013 flood and seasonal flow hydrograph.
- The 1:100 year flood is modelled using the Hydrologic Engineering Center Hydrological Modeling System (HEC-HMS) model and the 1:100 year precipitation and runoff excess as a volumetric time series.
- The 1:10 year flood is based on the 2008 flood and seasonal flow hydrograph.

Figure IR327-1 presents the hydrographs. The 2013 hydrograph used to model the design flood is more "peaky" than the hydrograph used to model 1:100 year flood. In other words, flows in Elbow River return to normal much faster for the design flood than for the 1:100 year flood. Therefore, for a design flood, water can be released back to Elbow River in 20 days rather than the 43 days needed for the 1:100 year and 1:10 year floods.

The actual operational release rates from the off-stream reservoir will vary depending on the circumstances at the time of the diversion and the release, such as the flow conditions in Elbow River. Release rates can be managed to minimize mobilization of sediment in the unnamed creek and remobilization of sediment in Elbow River.

NRCB QUESTION 328: METALS AND NUTRIENTS

Basically, no impact on water quality…what about air once the reservoir is drained?

Alberta Transportation states that *Metals and nutrients that are associated with particles through ion exchange are less available to biota than dissolved forms.*

However, total dissolved phosphorus was very similar to suspended sediment in data patterns. This may mean that the concentration in the reservoir (spring freshet) would be higher than the concentration at lower flows.

a. Discuss the effects on water quality due to dissolved constituents that increase in concentration at high flows.

Response 328

a. Flows in Elbow River have a quick response time; runoff is delivered to the river rapidly where the rising limb of the hydrograph increases rapidly. The initial peak in a flood can happen in a matter of hours (Volume 4, Appendix J, Section 2.4.2, Figure 2-4).

When water is delivered rapidly to the river channel, dissolved constituents increase in concentration with the initial rise in the water flow. However, the supply of available solutes is exhausted and the maximum river solute concentration is reached before the peak in flow rate. As river flow increases, solute concentrations become diluted. Therefore, the discharge–solute concentration relationship on the rising and decreasing limbs of the hydrograph (water flow) are different. This has been shown to hold for watersheds with rapid runoff (e.g., the Elbow River watershed) (House and Warwick 1998; Bowes et al. 2005; Bieroza and Heathwaite 2015).

Nutrient and solute concentrations in Elbow River are expected to increase as water levels increase. Due to the quick response time and nature of the Elbow River hydrograph discussed above, dissolved constituents will quickly be diluted and concentrations will decrease. Nutrient and solute concentrations are expected to be close to their peak during the initial flood stage and solutes are presumed to be diluted at higher flows. The concentration of solutes in the off-stream reservoir will be variable and dependent on dilution in the diverted water.

The operation of the reservoir is not expected to affect dissolved parameters and will reduce or not change the total load of parameters that are associated with suspended solids. No increase in loads are expected and no adverse effect on water quality is expected (Volume 3B, Section 7.4.2., page 7.23).

NRCB QUESTION 328 (CEAA QUESTION IR1-05): RESERVOIR WATER TEMPERATURE

The Proponent predicts reservoir water temperate of 22 degrees Celsius although we wonder whether this reservoir temperature changes with varying water depths, ambient temperatures and other meteorological conditions.

The temperature of 22 is vastly different from the average temperatures of 11-13 degrees seen at Highway 22, the closest point to SR1 reservoir. There is much in the way of uncertainty ("likely adapted to", "suggests") in the Proponents response, which are concerning. The Proponent acknowledges the "uncertainties in terms of measuring the extent of physiological effects on fish." We believe that the effects of the elevated temperature on ALL aquatic life needs to be assessed with more certainty and less speculation.

Water temperature is variable depending on spring/summer conditions and difficult to predict water temperature at discharge. What level of confidence does the Proponent have in these projections?

> The temperature ranges in Elbow River that are estimated to be experienced upon releasing water from the reservoir are within ranges that can be tolerated by salmonid species that are resident to the Elbow River between Bragg Creek and Glenmore Reservoir. Elbow River temperatures generally begin to warm as water moves downstream, with historical temperatures near Highway 22 reaching 11°C to 13°C, with the Glenmore Reservoir

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> temperatures reaching the low 20°C. Fish that reside near the Project are likely adapted to a range of water temperatures that are represented through estimates for Elbow River near Highway 22, rather than temperatures experienced within Glenmore Reservoir. However, the general pattern of increased temperature within Elbow River, as water flows downstream, suggests that fish within the Project area are tolerant of a subtle increase in temperature.

And:

While the estimated temperature ranges upon release from the reservoir are likely within a range of tolerance for fish, some indirect physiological stress may be experienced at the temperatures estimated during a release from the reservoir because of the compounded effects of suspended sediments. The extent to which these effects are compounded is unknown, any reliance on controlled studies to estimate the synergistic effect of sediment and temperature on fish as a result of a release from the reservoir would also present uncertainties in terms of measuring the extent of physiological effects on fish.

NRCB QUESTION 331: METHYLMERCURY ACROSS DIFFERENT SCENARIOS

We do not have the expertise to critique this response. Clearly, methylmercury in the air, water and land is a concern for our community.

a. Explain why the methylmercury concentration is very similar in all three flood scenarios.

Response 331

a. As described in the response to IR326, methylmercury concentrations in the reservoir for the three floods are as follows.

- design flood, 0.00068 μg/L to 0.0017 μg/L
- 1:100 year flood, 0.0008 μg/L to 0.0024 μg/L
- 1:10 year flood, 0.00085 μg/L to 0.0024 μg/L

The ratio of off-stream reservoir volume to surface area is linear for lower magnitude floods, such as the 1:10 year flood and the 1:100 year flood. Thus, the capacity for dilution and flux of methylmercury between soil and water remains constant and is similar for these two flood magnitudes and methylmercury concentrations will be similar.

During the design flood, a larger area of landcover in the reservoir would be inundated (Volume 3B, Section 7.4.4, Figures 7-14, 7-15, and 7-16); however, because the reservoir water release time would be shorter and the residence time for water in the reservoir shorter, the methylmercury flux would also be lower than for the 1:100 and 1:10 year floods:

- design flood, reservoir is inundated for 62 days
- 1:100 year flood, reservoir is inundated for 84 days
- 1:10 year flood, reservoir is inundated for 74 days

Additionally, the data used to predict methylmercury concentrations in the reservoir include very low concentrations (i.e., nanograms/L). Consequently, the differences in the predicted concentrations among the three floods are also small, within rounding error.

NRCB QUESTION 332: IMPACTS ON THE GLENMORE RESERVOIR

The Proponent continues to compare SR1 to the baseline of nothing. The true comparison should be SR1 vs MC1.

By rushing the process, these important comparisons on the environment, fish, water quality and more cannot be fairly made.

The settling of the sediment in SR1 will add to the lifespan of the Glenmore Reservoir without doubt. But we have played out the disruptive scenario this deposit would have on wildlife in the area. Also, we find this submission in no way alleviates the degradation to the waters following eutrophication, and the low dissolved oxygen and increased coliform populations that are released into the Elbow River. The cold-water riverine ecosystem downstream of the release would be severely impacted and water quality of the Glenmore Reservoir would deteriorate.

Elbow River, suspended sediment concentrations are expected increase and cause a short-term peak. **Table 6-7 identifies an average TSS concentration during release of 754 g/m³ at 1 km downstream of the low level outlet confluence with the Elbow River.**

a. Estimate the concentrations in the Elbow River near the Glenmore Reservoir.

b. Identify any potential water quality impacts.

Response 332

a. Volume 3B, Section 6.4.3.2, Table 6-7 shows suspended sediment concentrations (SSC) for the whole release period of the design flood (38 days). Therefore, the average SSC concentration (754 g/m³) at 1 km downstream of the unnamed creek channel confluence with Elbow River shown in Table 6-7 is not the average concentration of SSC at the end of the release period, but the average SSC concentration for the whole release period.

   "During the last few days", which is the period from 9 to 21 Aug 2013 (Volume 3B, Section 6.4.3.2, Figure 6-15), the average SSC is 2,204 g/m³ in Elbow River at 1 km downstream from the low-level outlet channel (unnamed creek) and 2,061 g/m³ at Sarcee Bridge chosen as the site near the Glenmore Reservoir. In Volume 3B, Section 6.4.3.2, page 6.32, it is stated that "…average concentrations show a slight increase of 0.5% between Highway 22 and Twin Bridges versus a 7% decrease between Twin Bridges and Sarcee Bridge." Therefore, a total decrease of 6.5% is used to calculate the average SSC at Sarcee Bridge (2,016 g/m³) using the average SSC (2,204 g/m³) in Elbow River at 1 km downstream from the low-level outlet channel (unnamed creek)

b. Water quality was assessed for potential effects from increased suspended sediments released during the last days that water is released from the off-stream reservoir. Total suspended sediments and TSS associated parameters including nutrients, ions, and metals (Volume 3B, Section 7.4.2, page 7.20) were assessed to determine the potential for changes in water quality. Effects on water quality from the predicted sediment concentrations are "not significant because the change in water quality is not anticipated to cause acute or chronic toxicity to change the trophic status of the Elbow River of Glenmore Reservoir" (Volume 3B, Section 7.5, page 7.34)

NRCB QUESTION 334: REMOVAL OF EXTREME READINGS FROM DATASET

We do not have the expertise to critique this response, although it is concerning to us. Sometimes, extreme values are necessary.

Alberta Transportation states that *In case where a parameter was associated with comparable observations that used more than one method, each observation was compared to the median observation. Observations that differed from the median by more than 50% were removed. The median of the remaining observations was then used as the parameter value.*

a. Explain whether, following this methodology, it is possible that peak concentrations representative of high flows could have been deleted from the dataset.

b. Provide a list of the parameters and samples that followed this method.

Response 334

a. Yes, a number of extreme values from samples collected in May and June were removed from the data set. These were from dates when Elbow River had elevated flows (i.e., 1:2 year flood levels). As stated in response IR336a:

> "values that were removed were considered extreme values and potentially not comparable among all data points due to method consolidation as discussed in Volume 4, Appendix K, Section 2.2.4.1, page 2.16. Where data is evenly distributed, extreme values have the potential to introduce bias in the data distribution (i.e., skewing the data distribution to the right) resulting in elevated median values."

b. Table IR334-1 lists the parameters that had one or more extreme value(s) removed from the dataset.

Table IR334-1 Parameters Sets with Extreme Values Removed

Parameter	Spring	Summer	Fall	Winter
Total suspended sediments	• Highway 22 • Weaselhead Bridge	• Bragg Creek • Highway 22 • Twin Bridges	--	--
Total coliforms	• Glenmore Dam	• Twin Bridges • Glenmore Dam	--	--
Dissolved phosphorus	• Twin Bridges • Glenmore Dam	--	--	• Bragg Creek • Twin Bridges

Table IR334-1 Parameters Sets with Extreme Values Removed

Parameter	Spring	Summer	Fall	Winter
Total phosphorus	• Highway 22 • Twin Bridges	• Bragg Creek • Highway 22 • Weaselhead Bridge	• Highway 22 • Twin Bridges • Sarcee Bridge	• Highway 22 • Twin Bridge
Total Kjeldahl nitrogen	--	• Bragg Creek	--	--

NRCB QUESTION 335: DISSOLVED METALS

If the sediment-bound materials are deposited in SR1, doe these metals get carried in wind-born particulate matter?

Alberta Transportation identified that *Non-essential metals that can be of particular concern because of toxicity include cadmium, chromium, mercury, lead, arsenic and antimony*. The EIA identified that over 70% of the arsenic and chromium have been found to be associated with suspended sediment (Section 3.2, Page 3.2).

a. Assess the potential project impacts on the concentration of these metals downstream of the release.

Response 335

a. Volume 4, Appendix K, Section 3.2 states that "the majority (over 70%) of aluminum, arsenic, barium, chromium, copper, iron, manganese, nickel, zinc, and phosphorus have been found to be associated with suspended sediment particles in major United States (US) rivers (Horowitz 2004)."

Sediment-bound metals will largely be deposited in the off-stream reservoir, which will reduce the load in Elbow River and Glenmore Reservoir. However, suspended sediment concentrations are predicted to increase due to resuspension temporarily during the last few days that water is released from the off-stream reservoir; but, these resuspended sediments (and associated metals bound to them) are comparatively small compared to the overall amount of sediment entering the off-stream reservoir. Most of the suspended sediments that enter the reservoir will remain there (rather than be released to Elbow River). Sediment entering the reservoir as total suspended solids (TSS) will deposit and remain in the reservoir (and the associated sediment bound metals) as follows (Volume 3B, Section 7.4.2, page 7.23):

- design flood, 98.2% of suspended sediment remains at the bottom of the drained reservoir

NRCB QUESTION 337: DO AND NUTRIENTS

Refer to our other comments in this section.

The effect of extra nutrients and changes in concentration may need more resolution on the changes in DO during the retention-release period.

a. Assess how, during a two month period of total flood operation there would be an increasing likelihood of critical DO issues due to a change in the timing of nutrient loading.

Response 337

a. A change in timing to release water from the off-stream reservoir is not predicted to change the results of the water quality assessment or increase the likelihood of a critical dissolved oxygen (DO) issue. The 50th percentile (i.e., median) and 75th percentile dissolved oxygen levels in Elbow River, upstream of Calgary, during July and August, have historically remained above 9.0 mg/L and 8.5 mg/L, respectively, as explained in the response to IR308a. Water temperatures in Elbow River during late summer and fall generally begin to decrease while DO levels increase (Volume 4, Appendix K, Section 3, Figure 3-24 and Figure 3-25).

Nutrients are predicted to deposit in the off-stream reservoir during flood operations and result in limited downstream loading during flows in July and August (Volume 3B, Section 7.4.2, page 7.20-7.23). Nutrient levels in Elbow River during the summer are low. The responses to IR83b demonstrates that median phosphorus concentrations in Elbow River, upstream of Calgary, are at levels indicative of oligotrophic conditions (i.e., below 10 µg/L). Total nitrogen concentrations are low and below 1.0 mg/L (Volume 4, Appendix K, Section 3.2.2.3, Figure 3-27). Any dissolved nutrients released from the off-stream reservoir are predicted to not change water quality and nutrient loading of Elbow River or Glenmore Reservoir (Volume 3B, Section 7.4.2, page 7.23). During the fall, nutrient levels in Elbow River generally remain similar, or decrease, from summer levels (Volume 4, Appendix K, Section 3, Figure 3-5 to Figure 3-8, and Section 3.2.2.3, Figure 3-26 and Figure 3-27), thus increasing the capacity for the river to assimilate dissolved and particulate forms of nutrients.

Particulate forms of nutrients, and those bound to suspended sediments, may temporarily increase in Elbow River during the last few days of release of water from the off-stream reservoir because suspended sediments in the release water increase in concentration. However, particulate bound nutrients are generally not available for uptake and growth in plants or algae downstream of the Project (Volume 3B, Section 7.4.2, page 7.23).

The water released from the off-stream reservoir will contribute to the total flow in Elbow River (but release of water would not occur if the river flow is over 20 m^3/s) below the unnamed creek:

- design flood, release of water contributes 29% to 59% of total flow in Elbow River
- 1:100 year flood, release of water contributes 25% to 34% of total flow in Elbow River
- 1:10 year flood, release of water contributes less than 5% of total flow in Elbow River

The absolute amount of dissolved nutrients in Elbow River downstream of the unnamed creek may increase as a result water released from the off-stream reservoir. But, due to the large volume of water, the dissolved nutrient concentrations contributed by the off-stream reservoir will be diluted. Thus, the reservoir is expected to have no effect on dissolved nutrient concentrations, not contribute to additional plant and algae growth, and not result in changes to DO levels in Elbow River (Volume 3B, Section 7.4.2, page 7.23).

The Alberta long-term guideline (GOA 2018) for DO is a 7-day mean of 6.5 mg/L. During May through the end of June, the guideline is 8.3 mg/L to protect emerging mayflies; however, this guideline will not apply at the time water is released between July and August.

A guideline of 9.5 mg/L (GOA 2018, CCME 1999) is applied for areas and times where larval fish are developing within gravel beds. Rainbow trout and rainbow–cutthroat hybrids are spring-spawning resident fish that build nests, where embryo and juvenile fish remain in gravel during July. During a flood without the Project, most of the spawning habitats, potential redds, and juvenile fish within the river would be disturbed and potentially lost (Warren et al. 2009).

Therefore, a direct critical DO issue due to release of water from the reservoir would not occur. Effects to juvenile fish and aquatic life from changes resulting in release water from the reservoir are not predicted.

NRCB QUESTION 338: LOW LEVEL OUTLET QUALITY

Refer to our other comments in this section. Further, we point out, again, that we have concerns about the aquifer downstream of the SR1 project to become charged with released floodwaters. Some level of investigation on this point is recommended.

Alberta Transportation identified that *Compared to other tributaries, the low-level outlet is associated with low oxygen, high temperature, high conductivity, and high nutrient concentrations.*

a. Discuss any implications of the low-level outlet showing, in general, poorer water quality than other tributaries.

Response 338

a. Poor water quality in the unnamed creek (low-level outlet channel) has no implications for the Project. Stream flows in the creek are low and intermittent throughout the year (Volume 4, Appendix J, Section 3.3.1, page 3.18, Figures 3-10 and 3-11) and appear to largely be driven by precipitation. Groundwater may contribute baseflow in the creek; dilution of electrical conductivity during rainfall events suggests that baseflow in the unnamed creek is, in part, maintained by springs. However, because flows are intermittent, the volume of groundwater contribution is low. The average flow in the creek is approximately 0.03 m^3/s, however, flows were intermittent throughout the year. The peak flow measured was 0.79 m^3/s during a high rain event.

   The average but intermittent flow of 0.03 m^3/s is small compared to the potential amount of water that would be released from the off-stream reservoir. It is approximately 11.0% of the modelled release rate from the reservoir for a 1:10 year flood (0.275 m^3/s) and only 0.15% of the modelled release rate from the reservoir for a design flood (20 m^3/s; Volume 3B, Section 6.4.1, Figure 6-7).

   Flows in the unnamed creek are intermittent and only for a period of several days at a time. The magnitude and timing of potential changes in water quality will not be sufficiently high, or last long enough, to alter water quality in water released from the reservoir or further downstream in the river.

NRCB QUESTION 338: UNNAMED CREEK MONITORING DATA

We do not have the expertise to critique this response.

Alberta Transportation monitored the low-level outlet (TR1 site) during June 2016 to May 2017. Different conclusions were drawn from this data.

a. Discuss if the monitored period represents typical conditions and any implications.

Response 339

a. Flows for the unnamed creek is provided between June 2016 and July 2017 (Volume 4, Appendix J, Section 3.3.1.2, page 3.18 and page 3.19). The date of May 2017 stated in the EIA is not correct. The monitoring period is greater than a year and represents typical conditions in the creek. Generally, flows at the TR1 site (in the unnamed creek) are intermittent in spring and summer while having no flow from fall through winter. Based on site characteristics, conditions do not vary greatly from year to year.

   The mean flow in the unnamed creek is approximately 3×10^{-2} m^3/s with peak flow measured as 0.79 m^3/s after a period of prolonged rainfall (Volume 3B, Appendix J, Section 3.3.1.2, page 3.18). Bankfull flow is approximately 1.0 m^3/s. These natural flows in the unnamed creek are much smaller than the water released from the reservoir (approximately 20 m^3/s for the design flood, 11 m^3/s for the 1:100 year flood, and 4.7 m^3/s for the 1:10 year flood). Years where conditions vary considerably at the unnamed creek (e.g., high annual runoff or drought conditions) have no implication for predictions associated with the Project (Volume 3B, Section 6.4.3 and 6.4.4.). Regardless of how natural conditions change from year to year, these predicted changes remain the same.

NRCB QUESTION 340: LOW LEVEL OUTLET DATA SET

We do not have the expertise to critique this response.

Volume 4, Appendix J, Section 2.3.2, Page 2.20

Alberta Transportation indicated *that a minimum of 10 flow measurements across a range of flows are required to establish a stable stage-discharge relationship*. However, only six measurements were used to establish the rating curve for TR1.

a. Explain why only six flow measurements were used and any implications.

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Response 340

a. Based on the flow regime and intermittent nature of flows in TR1, the unnamed creek, only six flow measurements could be taken. The natural flow in the tributary is intermittent,

   The range of baseline flows, even with uncertainty, is much lower that the predicted flows from the release of water from the reservoir. The uncertainty in the very small baseline flows of TR1 does not have an effect on the prediction of effects on the environment.

NRCB QUESTION 341: TSS RELEASE

Refer to our other comments in this section.

Volume 3B, Section 6.4.3.2, Figure 6-15, Page 6.36
Volume 3B, Section 6.4.3.3, Figure 6-20, Page 6.45

The suspended sediment concentration for these figures does not clearly show the concentration for the initial stage of the discharge.

a. Provide a visual representation of the suspended solids concentration that antecedes the peak at the end of the release.

Response 341

a. The suspended sediment concentrations in Elbow River at the end of the release period from the reservoir are shown in Figure IR341-1 (design flood) and Figure IR341-2 (1:100 year flood). These figures reflect the information in Figure 6.15 and Figure 6-20 (Volume 3B, Section 6.4.3); however, the figures here are presented in logarithm scale to clearly show the lower concentrations during the period prior to the last few days of release of water. The suspended sediment concentrations drop off during the later dates in August at the time when the water release is over.

   The average suspended sediment concentrations in Elbow River (approximately 1 km downstream from the confluence with the unnamed creek) are predicted to be 754 mg/L (associated with the design flood) and 1,576 mg/L (associated with the 1:100 year flood). However, these suspended sediment levels are averages for the complete release period, while the absolute concentrations for this period are much lower and only increase at the end of the release period of water.

AQUATICS (NRCB QUESTIONS 342-361)

NRCB : [https ://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water](https://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water)

General Comments: Given the Proponent's responses about negative outcomes for fish, we ask: is the SR1 project really the best option?

NRCB QUESTION 342: QUANTITATIVE ASSESSMENTS OF FISH POPULATIONS

We agree with the NRCB that fish studies are required. The experimental nature of this project necessitates that we fully understand the potential ramifications to fish. Numerous studies on fish populations in the Elbow River referenced by the Proponent are no longer valid due to the magnitude of changes along the Elbow River that resulted from both the 2005 and 2013 floods.

Further, quantification of potential fish mortality is a "must-have" in order for the regulators to make an informed decision on this project as well as to draw conclusions about the impact of SR1 operations (i.e. entrainment in the reservoir) on fish and fish populations. Counting dead fish after a flood is meaningless unless one knows the relative size of the mortality in relation to the general population.

NRCB QUESTION 343: FISH MIGRATION PATTERNS

We do not have enough information to critique this response. We look forward to fish studies that were requested by the NRCB.

NRCB QUESTION 344: BARRIER OF PHYSICAL STRUCTURE

We do not have enough information to critique this response. However, we point out that only recently has information about negative outcomes to fish come to light. One of the key parameters used to choose SR1 over MC1 was that MC1 was negative for fish. We see very clearly now that SR1 has no positive, and many negative, outcomes for fish in the Elbow River.

Alberta Transportation states on page 8.49 that *During dry operations, the physical structure may be a barrier to upstream fish migration for large fish by creating an area of shallow water over the concrete gates, with depths shallower than 18 cm, that may impede the upstream movement of large fish such as bull trout, brown trout, or mountain whitefish, during late summer spawning migrations.* Subsequent mitigations in sections 8.4.4.2 describe measures to keep velocities from exceeding small fish swim speeds, but depth is only referred to during higher flows (0.75m/s) where depth is described as exceeding 20cm.

a. Describe mitigation measures taken to address low water depth passage restriction to large fish such as Bull trout during low flow periods.

Response 344

a. Fish passage during low water periods will be maintained through several design and mitigation measures. These have been consolidated into Appendix IR91-1 for the response to IR91. These measures are designed to mimic the existing thalweg of the Elbow River channel, including its geometry and intermittent bedrock grade control.

In summary, during low flow conditions, the right gate will be raised in order to increase river flows through the left bay, thus simulating the effect of the existing point bar on the right bank where the diversion structure is located. Hydraulically, this measure has the same depth and velocity characteristics as the existing thalweg, upstream and downstream of the diversion structure and, therefore, will allow passage of large fish such as bull trout. This is described in Appendix IR91-1 (Attachment IR91-1A and Attachment IR91-1B). Because geometry of the flow through the diversion channel and the thalweg are similar, the hydraulic characteristics are similar at flows lower than those evaluated in the Volume 3A, Section 8.

The modelled flow rate of 0.8 m^3/s (0.75 m^3/s) is the 3-day, 10-year minimum daily-mean flow ($3Q10_{min}$) for the biologically sensitive period (BSP) (December 02 – April 01) (Appendix IR91-1, Attachment IR91-1A). The design mitigation provides for 18 cm of water depth during this BSP with this flow rate, which is the lower limit flow condition under which fish can pass the structure without a three-day delay in their migration. This three-day delay condition has an annual exceedance probability of 0.1, which was the basis of the design to maintain fish passage at these potential low flow periods. Elbow River flows have only been lower than this for one day of the record during this BSP (based on daily mean flows for Elbow River at Bragg Creek hydrometric station); excluding winter conditions. When groundfast and interbedded ice create passage barriers, the Elbow River has had flow rates of less than 0.8 m^3/s for less than 0.005% of its entire hydrometric record (1934 – 2015).

NRCB QUESTION 346: REMOVAL OF DEBRIS FROM STRUCTURES

We would like the Proponent to clarify when, exactly, will debris removal take place for the in-river components, considering the small window of opportunity for in-river activities. Further, what equipment will be used and how will it be used? Will there be heavy equipment in the river bed?

Further, we are concerned about the culverts along Highway 22 and Springbank Road becoming clogged with debris. It doesn't appear that new culverts will be added to Springbank Road. How will the existing culverts be cleaned if silt or debris accumulates? If this issue is not addressed, Springbank Road will inhibit water from passing from the north side of the road to the south.

Volume 3A, Section 8.4.4.1, Page 8.58.

Albert Transportation states that *large wood debris that builds up at the structure should be manually moved to downstream of the diversion structure to maintain a natural amount of woody debris in the river channel.*

a. How often will such debris be removed and relocated downstream of the structures?

b. Describe where and how debris will be located downstream of the structure so as to maintain a natural distribution pattern.

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
RESPONSE TO NRCB AND AEP SUPPLEMENTAL INFORMATION REQUEST 1, JULY 28, 2018

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Response 346

a. Debris will be removed from the debris deflector, intake structure and gates prior to spring freshet annually in May or June, to ensure the structure is operating properly when river flow increases and the likelihood of flooding is highest (see Volume 3A, Section 6.2.2.4). Maintenance (see Table IR346-1) to clear large woody debris from the intake structure, debris deflector and gates will happen when conditions are safe to so do in April and again when river flow has receded in the summer.

NRCB QUESTION 348: REMOVAL OF DEBRIS FROM STRUCTURES AND IMPACT ON FISH

We do not have the expertise to critique this response. Over the past 2 years, it has become apparent that outcomes for fish are negative. However, we have an ongoing issue with statements such as "the diversion of water during flood may benefit the survival of fish eggs…". Again, the Proponent compares SR1 to "do nothing" or "unmitigated flooding". How does SR1 compare to MC1, or other alternatives for fish outcomes?

Eggs will be covered with sediment in SR1. This sediment would normally be flushed down the river.

> **Volume 3B, Section 8.2.2.3, Page 8.10**
> **Volume 3B, Section 8.2.2.3, Page 8.12**
>
> **Alberta Transportation states on page 8.10 that *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*. On page 8.12 Alberta Transportation states *the potential change in sediment and turbidity that may result downstream is not anticipated to result in residual effects on aquatic ecology, given the slow rate of draining of the reservoir.***
>
> **a. Discuss the impacts to fish resulting from the slow rate of release of turbid water over an extended period of time. Consider the severity of ill effects (SEV) dose-response curve which indicates elevated negative impacts to fish with increasing duration of high sediment events.**
>
> **b. Discuss the elevated turbidity levels and increased duration and the resulting impact to any spring spawning species potentially using the portion of the Elbow below the outlet structure for spawning during post-flood reservoir draining.**

Suspended sediment concentration in the water from the off-stream reservoir is predicted to increase during the last few days. As discussed in Volume 3B, Section 7.4.2, page 7.22:

> "It is anticipated that these suspended sediment concentrations during the last few days of the discharge can be controlled with the low-level outlet gate operation (i.e., reducing flow rate) and, possibly with physical sediment barriers. Without these mitigation measures, the resulting increase in the Elbow River of suspended sediment concentrations is likely to exceed the Canadian Water Quality Guideline (Canadian Council of Ministers of the Environment"

During a 1:10 year flood, suspended sediment in water released would decrease by approximately 95% between the confluence of the unnamed creek (the low-level outlet channel) with Elbow River and 1 km downstream of the confluence (Volume 3B, Section 6.4.3.4). During a 1:100 year flood, suspended sediments would decrease by 31% over the same distance (Volume 3B, Section 6.4.3.3). Suspended sediment in water from the reservoir would be expected to further decrease with distance downstream in river and, thus, there will be a decreased potential effects on fish from suspended sediment. Fish species within the river experience natural seasonal and prolonged fluctuations in suspended sediment related to river flow and where they are in the river, mostly during episodic floods.

The assessment approach acknowledges CCME (2002) "Canadian Water Quality Guidelines for the Protection of Aquatic Life: Total Particulate Matter", which was derived so as to consider aquatic effects across a suspended sediment gradient; this guideline will inform the reservoir operator how suspended sediments are to be released from the off-stream reservoir.

A discussion of the risk to this species from water release and associated suspended sediment is provided in the response to IR100c. As stated in Volume 3B, Section 8.5.1, page 8.20:

> "Given infrequency of diversion and with the implementation of mitigation measures, the potential change in suspended sediment concentrations downstream is not anticipated to result in residual effects on aquatic ecology. This indicates that the effects on fish habitat are not significant."

Flooding in Calgary typically occurs in June (e.g., 2005 and 2013). Because holding time of water in the off-stream reservoir for 1:10 year and 1:100 year floods is approximately 43 days (Volume 1, Table 3-3, page 3.12), and subsequent release of that water would be approximately 30 and 39 days, respectively, release of water from the reservoir would begin in July or August and continue into August or September if a flood occurred in June. The

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release of flood water from the reservoir during August and September would not coincide with known fish spring spawning timing (see Volume 3A, Section 8, Table 8-5)

Spring spawners such as rainbow trout and white sucker will have completed spawning and fry emerged prior to release of flood water from the reservoir. After emergence, fry move to slower water and areas of cover that are likely to have lower levels of suspended sediment. Adults are more resilient to suspended sediment levels and better able to move to areas of lower suspended sediment. The diversion of water during a flood may benefit survival of fish eggs and fry by reducing the amount of sediment and destructive powers of floods during this critical period of fish life history.

NRCB QUESTION 349: NEW CHANNELS ARE FORMED

We do not have the expertise to critique this response. Overall, it appears that the experimental nature of SR1 requires that the Proponent make guesses about the likely outcomes. Given the scale of this project and potential adverse effects, we ask the regulators to consider whether to approve a project that relies heavily on theories.

Alberta Transportation states that flows over 160 m^3/s *are considered channel forming and would shift bed materials which would maintain overwintering and spawning habitat and shallow side-channel and nearshore rearing habitats*.

a. Provide evidence to support this assertion.

Response 349

a. Bankfull flow was used to determine the threshold for river channel forming flows (i.e., discharge and flow are used interchangeably). Bankfull discharge is the maximum amount of water that can flow through a river or stream channel (i.e., measured as m^3/s) before flows spill out into the river's floodplain. This rate is also highly associated with the flow rate that can suspend and carry the greatest amount of bedload sediments (i.e., termed the effective discharge) and exert the greatest erosional force on the river channel (Wolman and Miller 1960).

   The greater the flow rate, the larger bedload sediment particles (e.g., gravel and cobble size) that can be moved. Therefore, the flows that are at the incipient point of flooding are also associated with the forces that effectively modify the river channel form. Because bankfull discharge can be directly measured in the field, while effective discharge is usually based on indirect measurements and calculations, bankfull flow is often the preferred river flow used to describe channel forming processes. The bankfull flow downstream of the diversion structure ranges from 40 m^3/s to 60 m^3/s.

   Channel forming flows can be assessed by the relative mobility of the bed material to the forces acting on them by flow in the river. Velocity can be used as a measure for determining the erodibility of bed sediment to velocity. Velocity maps were extracted from hydrodynamic model developed for used in the assessment of hydrology and aquatic ecology. Hjulström (1935) developed a curve defining the relationship between erosion and deposition and threshold velocities. The curve is a relationship between flow velocity and grain size and provides domains of a critical erosion velocity curve, transport, and a settling velocity curve.

Figure IR349-1 shows the modelled velocity distribution for the section of the Elbow River provided in the figure at a flow of 50 m^3/s. The velocity range of 1.5 m/s to 2.0 m/s accounts for the higher velocity areas in the model domain. Using the Hjulström curve within this velocity range, sediment sizes of 18 mm to 30 mm would be eroded. The average surface D_{50} (i.e., median sediment particle size, as 50^{th} percentile of sediment particle size) of field-sieved samples in Elbow River was found to range between 32 mm and 42 mm. The surface D_{90} (i.e., 90^{th} percentile sediment particle size) ranged between 57 mm and 82 mm.

Hollingshead (1971) found that the point of incipient motion in Elbow River is around 23 m^3/s. During bankfull flows, it is assumed that bedload transport is occurring over bars and not necessarily for more armoured deposits located in the thalweg of the river channel. Figure IR349-2 shows the modelled velocity distribution for the same reach in the Elbow River at a flow of 160 m^3/s (this is when a partial diversion of flood waters begins). Velocities, and therefore erosive forces, are greater. Selecting a proportionally similar velocity range as was done for Figure IR349-1, the velocity range of 2.5 m/s to 3.0 m/s was selected. Referring to the Hjulström curve and identifying the grain sizes that intersect the critical erosion velocity curve, sediment sizes of 40 mm to 80 mm would be eroded.

This suggests that at flows equal to or greater than 160 m^3/s, velocities are sufficiently high that sediment as large as the D_{90} can be eroded. Mackenzie and Eaton (2017) propose that their experiments support the notion that the stability of a river channel is more dependent on whether the D_{90} is mobile, rather than the D_{50}.

NRCB QUESTION 350: FISH ENTRAINMENT ESTIMATES

The Proponent's answer is not sufficient. "Because of the unique nature of the Project design, and uncertainties regarding fish displacement and entrainment in the diversion structure, modelling would not provide meaningful results because it would have large uncertainties for how fish will be affected by the diversion structure."

We are pleased to see the NRCB's request for fish population studies.

Alberta Transportation states at peak design diversion capacity that *up to approximately 80% of the flow could be going into the diversion canal during a design flood*, potentially resulting in *the entrainment of 80% of the fish that are upstream and near the diversion structure or being swept downstream during flooding*. No further estimates of fish numbers potentially entrained are presented.

a. Discuss the potential to model fish entrainment at varying diversion rates to reduce uncertainty of this significant risk factor.

Response 350

a. The entrainment of 80% of fish near the diversion structure is based on the conservative assumption that there is a linear relationship between diversion rates into the diversion structure and fish being swept into the diversion channel. This linear relationship assumption suggests that varying percentages of diversion rates will result in similar population percentages of fish entrainment (i.e., 80% diversion will result in 80% fish entrainment; alternatively, when 15% of the river is diverted during a smaller flood event, the linear assumption would predict only 15% of the fish being entrained).

Modelling to confirm this assumption must account for numerous factors: site specific habitat and flood streamflow conditions; fish distribution and habitat use; behavior during flooding (such as movement into the flood fringe); use of refuge habitat; and fish moving away from the maximum channel flows (i.e., the thalweg) that will be directed into the diversion structure. Uncertainty in these parameters will add or compound uncertainty in model results.

Because of the unique nature of the Project design, and uncertainties regarding fish displacement and entrainment in the diversion structure, modelling would not provide meaningful results because it would have large uncertainties for how fish will be affected by the diversion structure.

Upon closer review of the prediction regarding the potential for fish to be displaced from the Elbow River and swept into the diversion structure during a flood (Volume 3B, Section 8.2.4, page 8.14), the potential for 80% of fish being displaced is considered conservative and high. It is likely that fish response to rising water levels and flows will reduce the percentage of fish being entrained when flood waters are diverted. Based on literature reviews of fish behavior during flooding, most of the resident fish population upstream of the diversion would find refuge and not be swept downstream and, therefore, would not be at risk of entrainment: larval fish and eggs would still be displaced downstream. However, these life stages would likely have a high mortality rate during the flood itself regardless of the diversion. Fish respond to environmental cues (e.g., rising stream flows and velocities, changes in temperature) that trigger a behavioral response including searching out refuge (e.g., channel margin habitat; floodplain habitats' point bars; concave-bank benches; deflection eddies; and expansion eddies) (Schartz and Harricks 2005; Bolland et al. 2015; Lytle and Poff 2004). Rather than downstream displacement of fish, flooding resulted in upstream dispersal into local refugia habitats (Franssen et al. 2006).

For example, Hog sucker (*Hypentelium nigricans*) in the Current River, Missouri moved into the inundated riparian areas and remain in the same stream reach as prior to flooding (Matheney and Rabeni 1995). Hog sucker are related and belong to the same family of sucker species resident in Elbow River (i.e., Catastomidae). *Galaxias argenteus* is a New Zealand salmoniform gamefish that generally grows to 40 cm and inhabits slow, lowland streams. This fish exhibits an adaptive response by remaining in the same stream habitat or moving upstream during flood events, rather than being displaced downstream (David and Gloss 2002). Large woody debris, boulders and habitat variability provide refugia from high water velocity from bankfull flood stage for coastal cutthroat trout in California (Harvey et al. 1999).

In some river systems, refugia may be limited causing fish to be more susceptible to downstream displacement. Young et al. (2010) estimated that brown trout experienced a 60% to 70% mortality during a flood in a New Zealand river where habitats were dominated by large mobile substrates. The cause of mortality was unclear, but Young et al. (2010) speculate that fish mortality may have been due to physical substrate and bedload movement. Abundance of the endangered diamond darter (*Crystallaria cincotta*) in West Virginia was reduced after a high magnitude 1:200 year flood, but local resident populations were not strongly impacted. The author's conclusion was that this species was able to withstand high stream velocities and downstream displacement (Rizzo et al. 2018).

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Small-sized fish such as minnows, shiners and salmonid fry are at the highest risk of displacement during high water events (George et al. 2015). Weaker swimming capabilities of small-sized fish may make these fish more susceptible to displacement during higher flows, in channelized watercourses (Bolland et al. 2015). Fish larvae (including centrarchids [sunfish *Lepomis* sp.] and largemouth bass [*Micropterus salmoides*]) in an Oklahoma river were displaced by flooding; however, their ability to withstand flooding increased with their size (Harvey 1987).

In summary, adult fish can largely deal with high stream flow events and withstand downstream displacement. However, smaller fish may be susceptible to downstream displacement and being swept into the diversion structure. Even though smaller sized fish, such as salmonid fry in Elbow River, may be susceptible to displacement through the diversion structure during floods, the relationship between fish displaced and percent flow diverted is likely less than 1:1 (i.e., less than 80% fish displaced when 80% of the flow is diverted). Due to the uncertainty in how fish will behave during a flood, a model that can reflect site-specific entrainment conditions during flood events is not available. The development of a new model would not reduce uncertainty in the assessment.

FERENCES

ılland, J.D., A.D. Nunn, M.C. Lucas, and I.G. Cowx. 2015. The Habitat Use of Young-of-the-Year fishes During and After Floods of Varying Timing and Magnitude in a Constrained River. Ecological Engineering. Vol. 75: 435-440.

ıvid , B.O., and G.P. Gloss. 2002. Behavior of stream-Dwelling fish, before, during and after High Discharge events. Transactions of the American Fisheries Society. Vol 131: 762-771

ınssen, N.R., K.B. Gido, C.S. Guy, J.A. Tripe, S.J. Shrank, T.R. Strakosh, K.N. Bertrand, K.M. Franssen, K.L. Pitts, and C.P. Paukert. 2006. Effects of floods on fish assemblages in an intermittent prairie stream. Freshwater Biology, Vol 51: 2072-2086

NRCB QUESTION 351: EFFECTS ON FISH FROM ENTRAINMENT

The Proponent's answer is not sufficient. A fish rescue plan in the high-silt conditions should be dismissed. It appears, once again, that the Proponent is relying on guesses to predict effects on fish. We ask the regulators to consider whether guesses and predictions are acceptable in this instance. We do not believe they are. We must again state that conventional, in-stream dams have predictable outcomes on fish and there are many precedents for these types of project that can ensure best-practices are used.

Fish rescue:

- Minnows and fry will not be rescued.
- Fish will be eaten by eagles, other predatory birds and wildlife in the reservoir as the water levels drop. They will be easy prey prior to rescue operations.

Volume 3B, Section 8.2.5, Table 8-2 Page 8.18
Volume 3B, Section 8.4, Page 8.19

Alberta Transportation states in table 8-2 under residual effects that the magnitude of fish mortality resulting from post-flood stranding is high, and subsequently in section 8.4 that confidence on the effects of fish mortality during post-flood operations is lower than for other effects because of several unpredictable factors related to rate of fish entrainment and escape during draining.

a. Explain how this mortality risk can be classified as not significant given that mitigation relies on locating and rescuing an unknown number of fish by hand with an unspecified work force capacity working in a short time window during which reservoir water quality and capacity will support fish.

Response 351

a. As stated in Volume 3B, Section 8.3, Page 8.19, a residual effect that results in a "significant adverse environmental effect" caused by fish mortality is where:

> "Residual serious harm to fish due to fish mortality occurs when fishery productivity or sustainability is adversely affected and where recovery to baseline levels is uncertain."

The predicted effects on fish will not meet the threshold considered serious harm and, therefore, effects are not significant: "The residual serious harm to fish due to fish mortality from entrainment and stranding in the off-stream reservoir is likely not significant if fish rescues are undertaken to relocate stranded fish" (Volume 3B, Section 8.5, page 8.21).

Fish that become entrained will enter the diversion channel where they may experience bodily harm (Volume 3B, Section 8.2.4, page 8.16) while going through the intake structure (i.e., through physical contact with the structure and debris). Fish that end up in the off-stream reservoir may be at risk of stranding during release of water from the reservoir. However, as discussed in the response to IR350, the fish entrainment rate predicted is conservative and the estimates are precautionary. Actual fish entrainment rates will likely be lower, as stated in the response to IR350:

> "the potential for 80% of fish being displaced is considered conservative and high. It is likely that fish behavior (i.e., fish response to rising water levels and flows) will reduce the percentage of fish being entrained when flood waters are diverted. Based on literature reviews of fish behavior during flooding, most of the resident fish population upstream of the diversion would find refuge and not be swept downstream and therefor would not be at risk of entrainment – larval fish and eggs would still be displaced downstream. However, these life stages would likely have a high mortality rate during the flood event itself regardless of the diversion. Fish respond to environmental cues (e.g., rising stream flows and velocities, changes in temperature) that trigger a behavioral response including searching out refuge (e.g., river channel margin habitat; floodplain habitats' point bars; concave-bank benches; deflection eddies; and expansion eddies) (Schartz and Harricks 2005; Bolland et al. 2015; Lytle and Poff 200]). Rather than downstream displacement of fish, flooding resulted in upstream dispersal into local refugia habitats (Franssen et al. 2006)."

The following is a correction (in red text) to Volume 3B, Section 8.2.4.2, page 8.16 regarding the release of water from the off-stream reservoir:

"The water flows in the canal will be gradually reduced and the reservoir slowly drained to facilitate the movement of fish from the reservoir, back to the Elbow River with the receding water. The outlet will be designed and operated in a manner that allows fish egress out of the reservoir, downstream into the outlet channel. Drainage areas within the reservoir will be

water. The outlet will be designed and operated in a manner that allows fish egress out of the reservoir, downstream into the outlet channel. Drainage areas within the reservoir will be
graded to provide positive drainage and reduce stranding of fish during release of stored flood water from the reservoir").

AEP will develop a fish monitoring program to identify isolated pools and other locations where fish may be stranded as water levels decrease in unnamed creek and reservoir. A draft plan is provided in the response to IR302, Appendix 302-1. The fish rescue plan will include the use of teams of fisheries biologists led by qualified aquatic environmental specialists that will be on hand to capture fish as water levels decrease and safely relocate them to Elbow River. Indigenous groups have offered to participate and assist in the fish rescue efforts.

The overall productivity of the Elbow River fishery is not expected to be adversely affected by fish mortality in the Project components (diversion inlet, off-stream reservoir, and unnamed creek). The fishery is predicted to remain sustainable and any changes to baseline population levels are reversible and will return to existing conditions. Thus, residual effects are not significant.

:FERENCES

ɔlland, J.D., A.D. Nunn, M.C. Lucas, and I.G. Cowx. 2015. The Habitat Use of Young-of-the-Year fishes During and After Floods of Varying Timing and Magnitude in a Constrained River. Ecological Engineering. Vol. 75: 435-440.

anssen, N.R., K.B. Gido, C.S. Guy, J.A. Tripe, S.J. Shrank, T.R. Strakosh, K.N. Bertrand, K.M. Franssen, K.L. Pitts, and C.P. Paukert. 2006. Effects of floods on fish assemblages in an intermittent prairie stream. Freshwater Biology, Vol 51: 2072-2086

'tle, D.A., and N.L. Poff. 2004. Adaptation to Natural Flow Regimes. Trends in Ecology and Evolution. Vol 19(2): 94-100

:hwartz, J.A., and E.E. Herricks. 2005. Fish use of Stage-specific fluvial habitats as refuge patches during a flood in a low gradient Illinois stream. Canadian Journal of Fisheries and Aquatic Sciences. Vol 62: 1540-1552.

NRCB QUESTION 352: WATER QUALITY MODELLING

We do not have the expertise to critique this response. Water quality is a concern of our communities.

d. Will any monitoring of background concentrations of the same various parameters listed above in c be used for the Elbow River near the low level outlet be undertaken so as to determine if release of reservoir water and subsequent mixing would have negative impacts to aquatic ecology? If so, describe the monitoring plan that will be used to monitor background concentrations. If no monitoring will be conducted justify and explain the rationale behind not monitoring any of the listed parameters.

e. Will sampling results be made available to groups other than the City of Calgary (for example fisheries management)? If not why not.

Response 352

a-b. Water quality monitoring will be conducted in the off-stream reservoir prior to release of water. Details of the monitoring plan are provided in the Surface Water Monitoring Plan (see the response to IR302, Appendix IR302-1; in particular, refer to Section 9.3.3 [Turbidity and Suspended Solids] and Section 9.3.7, [Water Quality]).

Table IR352-1 lists the parameters that will be monitored for determining operational procedures. The release period is estimated to be between 30 and 40 days (Volume 3B, Section 6.4.2, Table 6-4, page 6.20).

Table IR352-1 Water Quality Parameter Frequency and Location Monitoring

Monitoring Parameter	Unit	Frequency	Location[1]
Total Suspended Sediments (TSS) and Turbidity	mg/L; NTU	Daily	Res, O-C and u/s
Temperature	°C	Daily	O-C and u/s
Dissolved Oxygen	mg/L; % saturation	Daily	O-C and u/s
Conductivity	µS/cm	Daily	O-C and u/s
pH	-	Daily	O-C and u/s
Discharge (Flows in the channel)	m^3/s	Daily	O-C and u/s
Major ions	mg/L	Weekly	Res, O-C
Total and Dissolved Metals	µg/L	Weekly	Res, O-C
Nutrients	mg/L	Weekly	Res, O-C

Table IR352-1 Water Quality Parameter Frequency and Location Monitoring

Monitoring Parameter	Unit	Frequency	Location[1]
Methyl Mercury	µg/L	Weekly	Res, O-C
Hydrocarbons	mg/L	Weekly	Res, O-C
NOTE: [1] O-C – outlet channel (includes the unnamed creek); u/s – Elbow River upstream of the intake structure and diversion channel; Res – off-stream reservoir.			

c-d. Total suspended sediment (turbidity), dissolved oxygen and temperature levels will be sampled/measured during release back into the river. Results will be compared with background levels in Elbow River upstream from the intake structure at the time samples are taken. If mass balance calculations indicate levels exceed regulatory guidelines at full mixing, then AEP fisheries managers will be notified, and additional downstream monitoring of these parameters will occur.

Guideline threshold levels are provided in Table IR352-2 (from Volume 4, Appendix K, Section 2, Table 2-8).

e. Results will be provided to the City of Calgary and AEP fisheries managers.

NRCB QUESTION 354: FISH STRANDING

Fish rescue plans proposed by the Proponent are not realistic given the large amount of silt and large area. We ask the regulators to dismiss these proposals. From a financial perspective, we do not see costs in the ongoing budget for fish monitoring, rescue, etc.

Additionally, the Proponent continues to refer to "if, then" statements. If fish are stressed, then we will do something. This is quite unacceptable given the likely negative outcomes for fish. Further, the "do something" statements are vague.

Question 354

Volume 3C, Section 2.7.3.3, Page 2.9-2.10

Alberta Transportation describes post flood monitoring during dewatering for stranded fish in isolated pools and their subsequent salvage. In addition to measures described:

a. **Will monitoring be undertaken at the low level outlet to determine if fish in the reservoir are avoiding the outlet current or exhibiting signs of stress from overcrowding or deteriorating water quality? If monitoring is to be undertaken describe the monitoring plan that will be in place. If no monitoring is to be undertaken justify and explain the rationale behind not monitoring fish at the low level outlet for signs of stress from overcrowding or deteriorating water quality.**

b. **Will any monitoring be undertaken in the Elbow River to ascertain whether fish swimming out of the reservoir are exhibiting signs of stress or mortality after returning to the flowing watercourse? If monitoring is to be undertaken describe the monitoring plan that will be in place. If no monitoring is to be undertaken justify and explain the rationale behind not monitoring fish in the Elbow River to determine if fish are exhibiting signs of stress or mortality after returning to the flowing watercourse.**

c. **Confirm there will be a qualified aquatic environment specialist (QAES) responsible for the assessment of fish stranding. Will there be multiple aquatic environment specialists involved considering the size of the reservoir? Provide the rationale behind how the number of aquatic environmental specialists involved in considering the size of the reservoir was selected.**

d. Describe the level of manpower available to perform salvage operation as directed by the QAES.

Response 354

a-c. Post-flood operations will include monitoring fish in the off-stream reservoir during the release of water. The outlet structure will be operated so that allows fish egress from the off-stream reservoir and into the unnamed creek and to the river. Fish monitoring will be necessary to identify shallow areas in the reservoir that become isolated and strand fish as the water levels drop. This monitoring will be done to inform fish rescue activities. Monitoring for fish rescue activities will include the following:

- During release of water from the off-stream reservoir, isolated pools will be identified and the potential for fish to become stranded will be assessed.
- Monitoring in and around the outlet structure will observe if and how fish congregate around the outlet and if conditions permit their movement out of the reservoir. Visual monitoring will also include assessing for potential harm or mortality of fish caused by movement through the outlet.
- Water quality in the off-stream reservoir will be monitored using hand held meters to assess water temperature and dissolved oxygen to inform fish capture and handling methods. If conditions in the reservoir become unfavorable (i.e., low oxygen and elevated temperatures), additional fish rescue crews and equipment will be mobilized.
- When the water has been fully drained, the unnamed creek will also be surveyed to identify isolated pools where fish might be stranded.
- Fish will be handled according to conditions set out in the Fish Research License.
- Monitoring will be undertaken at a frequency that allows for successful fish rescue based on environmental conditions, including ambient air temperature and the rate of the receding water level.
- Shoreline surveys in Elbow River immediately downstream of the unnamed creek confluence with the Elbow River will be completed periodically to assess if potentially translocated fish show signs of stress or mortality. Adjustments in returning fish to Elbow River will be made, as needed, to mitigate stress to fish (e.g., increase acclimation time).

d. The level of manpower will be determined by the size and number of pools where stranding of fish may occur. The off-stream reservoir operator (AEP Operations) will assess and determine the number of personnel required to conduct the fish rescue. Fish rescue activities will be conducted by a qualified company. The company will be vetted for capability to perform all required scale fish rescue and monitoring programs, and for capability to adjust crew sizes as needed. Indigenous groups have offered to participate and provide workers to assist in the fish rescue efforts.

NRCB QUESTION 356: FISH ASSESSMENT EFFECTS

We do not have the expertise to critique this response.

NRCB QUESTION 357: BULL TROUT & REDDS

We look forward to the Proponent conducting fish studies. Guessing and speculating on fish populations is not acceptable for a project of this magnitude and consequence. We must be able to compare before/after to evaluate project outcomes. A rush to approval must not supersede good science, especially considering the magnitude and experimental nature of the

While describing Bull Trout in the desktop review section, Alberta Transportation states *Fisheries surveys indicate that bull trout in the mid-reach of the Elbow spawn in the area upstream of Bragg Creek from Gooseberry Campground up to Elbow Falls.*

a. Map existing critical or sensitive areas used by Bull Trout including migration and spawning routes.

b. Describe and map existing critical or sensitive areas such as spawning, rearing, and overwintering habitats, seasonal habitat use including migration and spawning routes for other fish species.

Response 357

a. There are no listed Schedule 1 species within the aquatic ecology LAA under the *Species at Risk Act* (SARA) and, therefore, there is no critical habitat as defined by SARA. Bull trout are considered *'threatened'* under *Alberta Wildlife Act* and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Redd surveys completed by Applied Aquatic Research in 2002, 2003, 2004, and 2006 (AAR; 2008) were reviewed and referenced in Section 3.1.1 of Volume 4, Appendix M. The redd surveys were completed for three consecutive years, the final year completed was in September of 2006 along a reach of the Elbow River in the aquatic ecology LAA. The reach assessed by Applied Aquatic Research was completed in two sections: Elbow Falls (11U 6559331E, 5637338N) to the downstream (east) end of Paddy's Flat Campground (11U 660811E, 5638200N); and the east end of Paddy's Flat Campground to Gooseberry Campground (11U 666149E, 5643072N). Results of the Applied Aquatic Research redd survey found the area between Elbow Falls and the (east) end of Paddy's Flat Campground consistently and exclusively encompassed spawning areas used by bull trout.

Bull trout are not expected to spawn in the portion of the Elbow River that is in the PDA or downstream of the PDA; however, they may migrate upstream through the PDA to upstream spawning locations and downstream after spawning, but this is not confirmed. Applied Aquatic Research provided maps showing the locations of the survey locations and found bull trout spawning areas consistently within the segment of the Elbow River between Elbow Falls and Paddy's Flat Campground upstream of the PDA (these are provided as Appendix IR357-1).

Project.

b. Figure 357-1 provides the fish and fish habitat reaches assessed within the LAA in 2016 (this figure is a copy of Figure 2-1 in the Aquatic Ecology TDR Volume 4, Appendix M). These reaches were selected based on distances from the proposed diversion structure and to correspond with all 10 benthic invertebrate sampling sites and five sites sampled for sediment quality. The 12 assessed reaches, identified within the Aquatic Ecology TDR (as referenced in Volume 4, Appendix M, Section 3.1.1), were assessed for sensitive fish habitat. Four of these assessed reaches (Reaches 4, 5, 6, and 7) are in the PDA; Reaches 4 and 5 are downstream of the proposed diversion structure and Reaches 6 and 7 are the two nearest assessed river reaches downstream of the unnamed creek.

   No spawning evidence for fish was observed in these reaches. Based on physical parameters such as substrate, cover, and flows, Reaches 4, 5, and 6 could provide good habitat for all life history components of forage fish (fathead minnow, lake chub, longnose dace, pearl dace, spottail shiner, brook stickleback, and trout-perch). Reach 7 could provide moderate to good spawning and overwintering habitat, moderate rearing habitat and good migration habitat for forage fish.

   The fish habitat of these four assessed reaches are discussed in greater detail in Volume 4, Appendix M, Sections 3.1.6 to 3.1.9, pages 3.16 to 3.25. The following provides a summary.

   For coarse fish (longnose sucker, mountain sucker, and white sucker), spawning habitat is rated as moderate in Reach 4 and good in Reaches 5, 6 and 7. Rearing habitat is rated as moderate in Reaches 4 and 7 and good in Reaches 5 and 6. Migration habitat is rated good for all four reaches. Overwintering habitat is rated as moderate in Reach 4, moderate to good in Reach 7 and good in Reaches 5 and 6.

   Three species of sport fish (brown trout, brook trout, and rainbow trout) were captured in Reaches 4 and 5. Historically, sport fish in the area include northern pike, burbot, yellow perch, brook trout, brown trout, bull trout, rainbow trout, westslope cutthroat trout, and mountain whitefish. Fish habitat ratings for sport fish spawning are moderate in Reach 4 and good in Reaches 5 to 7. Rearing is rated as moderate for Reaches 4 and 7 and good for Reaches 5 and 6. Migration habitat is rated good for all four reaches. Overwintering habitat is rated as moderate for Reach 4, moderate to good for Reach 7 and good for Reaches 5 and 6. Brown trout may migrate through the aquatics RAA either to move to upstream

spawning areas or downstream after spawning, rearing or overwintering. Much of Elbow River, from the Elbow River falls to Glenmore Reservoir, could be used for migration during various life history stages. Because brown trout could migrate through any portion of the river that is within the RAA, specific migration mapping is not provided.

NRCB QUESTION 358: REACHES

We do not have the expertise to critique this response.

https://www.nrcb.ca/download_document/2/83/9206/20190614-at-sir-to-nrcb-re-sir1-response-sec-5-water

NRCB QUESTION 358: USE OF ATHABASCA RIVER VS ELBOW

We do not have the expertise to critique this response.

Volume 4, App M Aquatic Ecology, Section 3.1.1, Page 3.5

Alberta Transportation states *Mountain whitefish spawn over gravel and cobble substrates at moderate gradients in the Athabasca River*.

a. Confirm if the watercourse is supposed to be the Athabasca River. If the Athabasca River is incorrect then update the watercourse name so the correct one is referenced.

b. If the Athabasca River is correct then explain why the spawning habitat requirements for a different watercourse in a different part of the province was provided rather than for the Elbow River.

Response 359

a. The Athabasca River is the correct watercourse name.

b. The Sheep River mountain whitefish spawn in substrates of "rock and rubble (5 to 50 cm diameter)" (R.L. & L. Environmental Services Ltd. 1996). The Sheep River mountain whitefish is the closest population in proximity and with habitat characteristics (i.e., within a similar sized watercourse) to Elbow River and, therefore, this information is considered the most relevant representative available outside of Elbow River. Whitefish general habitat requirements are expected to be similar or comparable among watersheds within the Bow River basin.

AMEC (2017) completed habitat surveys on the Elbow River near Bragg Creek and noted that the area was characterized by riffle/run sequences with predominately clean, coarse substrates. These findings are consistent with the reaches assessed for the Project in 2016.

In the Bragg Creek area, large numbers of mountain whitefish were documented (AAR 2008) and broadcast spawners, such as mountain whitefish, prefer to spawn over clean cobble substrate in shallow waters (R.L. and L. 1997; Roberge et al. 2012), which is consistent with the assessed habitat in the Elbow River.

The preferred spawning depths for mountain whitefish are between 0.1 m and 1.0 m (Ford et al. 1995; Langhorne et al. 2001; Roberge et al. 2002). Clipperton et al. (2002) determined a habitat suitability of 1.0 for mountain whitefish in depths of 0.61 m and greater, along with velocities between 0.533 to 1.06 m/s (1.75 to 3.5 feet per second). These findings are consistent with Katopodis and Gervais (2016), who identified velocities for salmonids in Appendix 1 of the J5b series, which suggests that the majority of individuals can successfully migrate upstream between velocities of 0 to 1.6 m/s. Based on these depths and velocities, as well as the abundant run habitat assessed in the river, mountain whitefish could successfully spawn within Elbow River.

SECTION 4: TERRESTRIAL (NRCB QUESTIONS 362-435)

AT Responses : https://www.nrcb.ca/download_document/2/83/9200/20190614-at-sir-to-nrcb-re-sir1-response-sec-6-terrestrial

IAAC (CEAA) : https ://www.nrcb.ca/download_document/2/83/9092/20190614-at-eia-to-nrcb-re-IAAC (CEAA)-ir-response-package-2

COMMUNITY QUESTIONS:

EXPROPRIATION

This appears to be heading toward a large-scale expropriation. If the balance of land is expropriated, how will this compare to historical expropriations in Alberta in terms of size? We note that for SR1, any land expropriate for SR1 effectively erodes value in our community. There is no positive and, in fact, a range of negative outcomes that result from this project.

PERCEPTION THAT CROWN LANDS ARE AT RISK

See our comments regarding NRCB Question 3. One of the primary reasons SR1 was preferred in the Deltares Report was that it left the MC1 area in its natural state. In reality, SR1's natural grasslands are a quickly declining natural environment than habitat in the MC1 area, which Alberta appears to have in spades.

LAND USE, MANAGEMENT AND RECLAMATION

LAND USE AND LAND MANAGEMENT (NRCB QUESTION 362)

No comments at this time.

CONSERVATION AND RECLAMATION (NRCB QUESTIONS 363-373)

https://www.nrcb.ca/download_document/2/83/9200/20190614-at-sir-to-nrcb-re-sir1-response-sec-6-terrestrial

NRCB QUESTION 363: SOIL

See 365 below.

SOIL

NRCB QUESTION 365: SOIL QUALITY AND QUANTITY

“Construction of the Project would result in a significant effect on soil because there will be a change in soil quality and/or quantity resulting in a reduction in agricultural land capability that cannot be offset through mitigation or compensation measures (this occurs in the off-stream reservoir).”

We ask whether the in-stream dam at MC1 has this long list of negative outcomes on soil quality and quantity?

The temporary reservoir will kill the precious, irreplaceable grasslands in the area that cattle and wildlife have grazed on for hundreds of years. This wild grass contains vitamins and minerals upon which cattle and wildlife thrive. Once killed, it will be gone forever.

“In addition, this assessment does not account for the positive effects of the Project associated with preventing flood damage to agricultural land and agricultural capability downstream of the Project site.”

Is there flooding to downstream agricultural land that we are not aware of? Additionally, if there is flooding downstream, would MC1 not also protect against this flooding? False comparison of SR1 to unmitigated flooding is not acceptable.

a. Define agricultural land capability.

b. Explain why the change in land use for the Project was used to conclude that the effect of changes on soil quality and quantity are not significant.

c. Evaluate post-construction land capability independent of the target end land use.

d. Re-evaluate the significance of the effect of change in soil quality or quantity using the Significance Definition provided in Section 9.1.6.

e. Provide detailed rationale to explain how the environmental effect on soil quality and quantity was assessed for significance.

Response 365

a. Agricultural land capability is a quantitative measure of how climate, soil and landscape determine the ability of land to support cereal production. It was measured for the Project by adopting as the standard national "Land suitability rating system for agricultural crops 1. Spring-seeded small grains" (Agronomic Interpretations Working Group1995). The soil data collected in the soils and terrain LAA was compared to that standard.

b. The conclusion of "not significant" for effects on soils and terrain (for change in land use) is not correct. See the response to d. for a discussion regarding effects on soils and terrain, including a correction to the significance conclusion.

c. An evaluation of post-construction land capability independent of the target end land use is provided in Volume 3A, Section 9.4.3.3. The change in land capability class due to construction of the Project is shown in Table 9-14 as a 6.9% reduction in the area of Land Capability Class 3 within the LAA as a result of the construction of permanent project components (i.e., areas where land capability is listed as "not applicable" in the table).

d. The correction to the significance conclusion referred to in a. is the following: using the definition in Volume 3A, Section 9.1.6, construction of the Project would result in a significant effect on soil because there will be a change in soil quality or quantity resulting in a reduction in agricultural land capability that cannot be offset through mitigation or compensation measures (this occurs in the off-stream reservoir).

However, the context for this conclusion is that it is a highly conservative evaluation of potential effects on agricultural capability: there are 30,957 ha of agricultural and pasture land within the RAA (Volume 3C, Section 1.2.6, Table 1-8) and construction of the Project will result in a reduction of 342 ha of agricultural and pasture land (a reduction of 1.1%). While there will be a reduction in the agricultural capability of soils within the PDA (primarily the off-stream reservoir) as a result of Project construction, the Project is not expected to have a significant effect on agriculture in the RAA, overall.

In addition, this assessment does not account for the positive effects of the Project associated with preventing flood damage to agricultural land and agricultural capability downstream of the Project site.

NRCB QUESTION 366-370: TOP SOIL AND SUB-SOIL

We would like the Proponent to explain the value of Native Grasslands and how SR1 changes the amount of native grasslands in the province. Our understanding is that native grasslands are a declining ecosystem. Grasslands are critical for allowing water to infiltrate the ground. According to the Nature Conservancy of Canada, more than 60 species at risk depend on this habitat. True native plant growth can never be recreated. These grasses are hundreds of years old. Native grasslands can have root systems that reach down 10 feet! They are adapted to drought, grazing and fire.

NRCB QUESTION 371: SEED MIX

Following the 2013 floods, Mary Robinson will attest that the silt did not grow anything but weeds. It smothered anything that previously grew there. The silt brought in many weeds—Canada Thistle (worst), Black Henbane (never been on ranch before) Knapweed, dandelions etc. Very hard to get control of some of these.

We contend that none of the grasses in the seed mix will grow well on deposited sand and silt. Will the deposited sediment be amended to provide optimum growing conditions? If so, how and at what cost?

We are concerned about soil impacts resulting from the SR1 project and we believe this topic needs expert and independent assessment. We are uncertain that wetland areas will naturally establish (part c) post-flood operations of the reservoir.

Alberta Transportation states *native upland and wetland vegetation that is disturbed would be reclaimed with Alberta Transportation custom native seed mix….This basic native species reclamation mix can serve as a starting point from which to develop suitable variations*….Examination of the native seed mixture indicates some species proposed although native to Alberta are not necessarily common within the Project Development Area.

a. Has consideration been given to what alternative species may be placed in the seed mixture and which species may be removed? If so, what considerations were made? Why were these considerations not adopted? If no consideration has been given to what alternative species may be placed in the seed mixture and which species may be removed explain why this choice was made.

b. Has the proposed seed mixture been applied in other situations within the Regional Assessment Area? Have follow-up assessments been conducted on these sites to determine the resultant species composition? If so, list the areas and explain which species are the most abundant in each area. Are there any species from the seed mixture which have lower population numbers when compared to other species? For species in the seed mix with limited establishment success has a reason been determined for their poor results?

c. For wetland areas has a seed mixture been formulated yet and if so what mixture is proposed? If a seed mixture has not been formulated yet when will one be formulated and when and how will this information be communicated to AEP.

Response 371

a-b. Alterations will be made to the Alberta Transportation custom native seed mix in consideration of site-specific conditions of vegetation communities and input from Indigenous groups as to species that are culturally important to them. Reclamation details will be discussed in planned meetings with Indigenous groups and the resultant seed mixes will be communicated with AEP.

It is likely that the native seed mix for Zone 6 identified in AIT (2005) will form the basis of native seed mixes (Table IR371-1).

Species Common Name	Species Scientific Name	Seed Mix Percentage by Weight
slender wheat grass	*Agropyron trachycaulum*	30
smooth wildrye	*Elymus glaucus*	20
northern wheat grass	*Agropyron dasystachyum*	10
tickle grass	*Agrostis scabra*	10
fringed brome	*Bromus ciliatus*	10
tufted hairgrass	*Deschampsia cespitosa*	10
Foothills rough fescue	*Festuca campestris*	10

Native seed mixes will likely be targeted to high value native communities in areas of temporary disturbance lacking abundant weeds or aggressive non-native plant species. Suitable variations for revegetation of Project temporary disturbances of native areas will be developed following discussions with Indigenous groups and stakeholders. Variations will support diversification of vegetation communities, traditional use, and wildlife habitat.

c. A seed mix is not proposed for temporarily affected wetland areas because most weeds in Alberta, including species observed during field surveys, are not tolerant of periodic flooding and anoxic soils, and are not likely to increase to unacceptable percentages in wetter wetlands. The seed mix in Table IR371-1 may be applied to wetland edges to provide initial coverage and reduce weed establishment in temporarily wetted areas. Native plants of more seasonally to semi-permanently wetted areas will be left to naturally establish.

NRCB QUESTION 372: MODIFICATION OF SEED MIX

The Proponent uses their "we will figure it out" approach to this question. We cannot accept that this massive area of land is subject to unknown future decisions on seed mix. See our comments to 371.

a. Is the final composition of the agronomic seed mixture finalized or is it open to modification to utilize species with reasonable longevity and low invasive potential? If the mixture is finalized justify and explain why Dahurian wild rye and pubescent wheatgrass were selected when they tend to have a short persistence in Alberta and when it is documented sheep fescue will invade native rough fescue grasslands. If the composition is open to modification how is one to provide input? How will Alberta Transportation communicate what input was accepted or rejected into the final composition and the reasoning behind each acceptance or rejection.

Response 372

a. Alberta Transportation is open to discussion regarding appropriate seed mixes based on revegetation objectives and site conditions. Alterations will be made in consideration of site-specific conditions of vegetation communities and input from Indigenous groups as to species that are culturally important to them.

Shorter-lived species may have beneficial effects such as acting as a cover crop to suppress weed establishment until other natural colonizing species can re-establish. Sheep fescue is an excellent weed control species because it has an extensive and dense bunch-type root system. Once a good stand is established, it excludes the invasion of most weeds (Ogle et al. 2010).

Seed mixes will be adjusted while balancing need for vegetative cover, suppressing weed establishment and managing surrounding undisturbed areas. Species used will also be based on availability of required quantities.

Further communication regarding seed mix recommendations can be referred to Mark Svensen at Alberta Transportation by email at Mark.Svenson@gov.ab.ca. Final seed mix details will be provided in the monitoring and revegetation plan, including the reasoning for the inclusion or rejection of recommended species.

NRCB QUESTION 371: FILL & CONSTRUCTION MATERIALS

We do not have enough expertise to critique the Proponent's response to this question.

NRCB QUESTION 379: PIPELINES

The Proponent lays all the risk and cost at the feet of the pipeline operator for relocating the SR1 pipeline infrastructure. It seems unrealistic for pipelines to accept the costs of moving their pipelines for no other reason than SR1. Given the difficult economic circumstances of the energy industry, this is a bold assumption.

We request that the Proponent provide quotes and terms from the pipeline owners/ operators before this project is approved. The pipeline infrastructure is too important in this project for the Proponent to say it is someone else's responsibility. We do not expect pipeline operators to accept all the risk of pipeline rupture and/or contamination of the SR1 reservoir.

We request the Proponent to reveal the actual costs being incurred by the Proponent and by pipeline operators of moving the numerous pipelines in the SR1 footprint.

We request the Proponent disclose information regarding its communications with pipeline operators.

Alberta Transportation states that *Oil and gas pipelines operated by four companies…are in the PDA*. Alberta Transportation also states that the pipelines will be re-located or retrofitted.

a. **Describe field screening methods and laboratory analytical testing that will be conducted to ensure that the soil remaining in the footprint of the retrofitted and/or re-located pipelines does not contain any potential contaminants of concern, including but not limited to salinity, anions and cations, nutrient parameters, petroleum hydrocarbons, and metals.**

b. **Describe mitigation measures that will be undertaken if soil remaining in the footprint of the retrofitted and/or re-located pipelines is found to contain potential contaminants of concern.**

Response 379

a. The relocation or retrofitting of the pipelines within the PDA is the responsibility of the pipeline operators. The operator will be responsible for obtaining all regulatory approvals and following regulatory requirements in relation to any soil testing or remediation post-relocation/retrofitting. Federally regulated pipelines would apply for applications to the National Energy Board (NEB) under the *National Energy Board Act* and provincially regulated pipelines would apply for applications to the Alberta Energy Regulator (AER) under the *Pipeline Act*. TransCanada Pipelines Ltd. currently operates two federally regulated pipelines in the PDA, Plains Midstream Canada operates three provincially regulated pipelines (including one abandoned pipeline) in the PDA, and both Caledonian Midstream Corporation and Pembina each operate a provincially regulated pipeline in the PDA. Additional information on pipelines in the PDA is provided in the response to SIR 533.

b. Mitigation of identified contaminants within the PDA of the retrofitted and/or re-located pipelines is the responsibility of the pipeline operators and is part of the pipeline's environmental protection plan (EPP). The EPP follows guidelines set by the regulatory agency of the pipeline (the NEB for federally regulated pipelines and the AER for provincially regulated pipelines) and is specific to the material carried within the line (e.g., low vapour pressure vs. high vapour pressure products). Any contamination identified associated with NEB-regulated pipelines will be reported to the NEB and remediated in accordance with the NEB (2019) and GoA (2019) will be followed for AER-regulated pipelines. Contaminants could be mitigated either through removal of contaminated soil or insitu treatment, but the specific methods would depend on a number of factors, including the nature of the contaminants found, areas of the contamination found during testing, and the decision of the operator. Any contaminated material that is disposed of will be disposed according Provincial waste-management directives, such as Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry.

NRCB QUESTION 380: TRANSMISSION LINES

We do not have enough expertise to critique the Proponent's response to this question.

NRCB QUESTION 381: EROSION AND SEDIMENT CONTROL

Seed spray seems likely in SR1, but this may be cost prohibitive. The Proponent should predict the cost of seed spray vs other erosion control options.

NRCB QUESTION 382 & 283: SEDIMENT POST-FLOOD

The Proponent states that sediment will be left in the reservoir but may be moved around somewhat to accommodate drainage. What are the predictions of silt-mobilization as a result of this reconstruction of silt within the reservoir? What machines will be used, how will they be used and for what duration?

Alberta Transportation uses different terms to describe fates of post-flood sediments in different Volumes and Sections. For example, Volume 1 states *removal* and *partial removal of sediment… to the extent necessary to maintain functionality* of the Project components. Volume 3B Section 9.1 states *reservoir sediment cleanup is expected to be minimal*. Volume 4, Appendix D indicates that *The reservoir has been designed so that it can function as required with up to 10% of its capacity lost (i.e. filled with sediment). It is, therefore, not necessary to remove post-flood deposits that do not reach this level….*

a. Clarify discrepancies in sediment fate terminology throughout the applicable Volumes. For example, correct or explain partial removal, removal, versus minimal cleanup.

b. Clarify the fate (i.e. disposal, retention, removal, cleanup) of post-flood sediment as it relates to different component and stages of the Project.

c. Clarify the conditions where sediment removal or cleanup would be necessary.

d. Describe the sediment removal or cleanup procedures including any sampling and analysis for potential contaminants of concern.

e. Describe the pre-determined depth of sediment that would require removal in order to maintain functionality of the Project components.

f. Explain why sediment removal is not anticipated for areas that may accumulate sediment depths ranging between 1.0 m and greater than 4.0 m as described in Volume 3B Section 9.2.3.2.

a-c. Post-flood sediment in the off-stream reservoir will be retained, although it may be moved within the reservoir if it interferes with drainage to the low-level outlet or functioning of the reservoir or associated components. Sediment will be moved away from other Project components:

- diversion channel to the extent necessary to maintain the flow of water into the reservoir during diversion and maintain channel capacity
- dam embankment at the inner toe of the dam to the degree required to maintain functionality of the access road and the dam drainage ditch
- low-level outlet works to the degree required to maintain optimal functionality

Removal of sediment from the reservoir to another off-site location is not planned.

d. Sediment grading within the reservoir will be conducted with the use of earth-moving equipment to move the sediment away from areas where it affects the functionality of the Project components or blocks drainage. Testing would not be necessary because sediment will remain onsite.

e. There is no pre-determined depth of sediment that would require moving or regrading of sediment to maintain functionality of Project components in order for water to continue to flow. Therefore, depth of removal would depend on the location of sediment deposition. The need to regrade sediment within the reservoir to maintain functionality will be determined after the reservoir is drained during post-flood operations.

f. Sediment depths ranging between 1.0 m and greater that 4.0 m are not planned to be moved or regraded unless drainage into the reservoir or out of the reservoir through the low-level outlet is interfered with. The reservoir has been designed to include capacity of a 10% volume increase above that needed to handle the equivalent of the 2013 flood. This excess capacity will be able to accommodate potential sediment and debris accumulation.

NRCB QUESTION 384: POTENTIAL SOIL CONTAMINATION

We do not have adequate expertise to critique the response to this question. It is a concern that has not been given adequate attention by the Proponent.

NRCB QUESTION 385: RECLAIMED SOIL DETAIL

We do not have adequate expertise to critique the response to this question.

NRCB QUESTION 387: SOIL ANOXIA

We do not have adequate expertise to critique the response to this question. It is a concern that has not been given adequate attention by the Proponent. During the anoxic phase of soil during and following reservoir use, how will reseeding be expected to occur? The Proponent has not answered the NRCB's questions.

The structure of the soil will be impacted by the total sand/silt deposited. The weight of this material will impact the porosity of the soil and its ability to hold water and air. None of the Proponent's responses address how sediment left behind in the reservoir affects the soil.

Alberta Transportation states that *Submergence and saturation would lead to soil anoxia in all soils subject to flooding. Related effects include increased solubility of anions such as phosphorus, reduction of manganese and iron, denitrification, and conversion of organic carbon to methane…However, because of the relatively short period of potential anoxia, soil oxygen levels in topsoil horizons would be maintained in the aerobic range soon after reservoir drainage, typically within one or two months of reservoir drainage. Soil anoxia is not discussed further.*

Stantec

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
RESPONSE TO NRCB AND AEP SUPPLEMENTAL INFORMATION REQUEST 1, JULY 28, 2018

Terrestrial
May 2019

a. Given that the soil would be saturated over intervals ranging between 5 and 67 days, provide further rationale why soil anoxia is not a potential effect during flood or post-flood operations.

b. Describe the typical length of time of submergence and saturation that would result in soil anoxia.

c. Discuss the potential effects of soil anoxia on deeper soil profiles following each flood intensity.

d. Describe the likelihood and duration of soil anoxia occurring with each flood intensity.

e. Discuss potential soil contamination as an effect of soil anoxia.

f. Describe mitigation measures for soil anoxia with each flood intensity.

g. Describe the potential residual impacts of the Project following implementation of mitigation measures for soil anoxia in the reservoir.

a. Soil anoxia is an effect of the Project during the flood and post-flood operations. Soil anoxia is a reversible condition; removal of water in the soil profile to a level that allows about 10% air content by volume (water content 90% of pore volume) is generally associated with the return of aerobic soil conditions. Some soils in the terrain and soils LAA (e.g., Pothole Creek soil series), regularly experience saturation and anoxia; in the reservoir, the Project will extend the duration of anoxia in these soils above background levels. Vegetation in these areas will tolerate anoxic soil. Areas of Chernozemic soil (in the reservoir), however, have not regularly been subjected to the anoxic conditions, which will be introduced by the Project. These areas will likely be more strongly affected by flood operations. In particular, vegetation associated with Chernozemic soils will not tolerate anoxia. However, aeration is expected to be restored in topsoil and upper subsoil of the reservoir within one to two months after reservoir drainage and the effects of soil anoxia will then cease.

b. Anaerobic soil conditions are likely to arise within one to two days of soil saturation, while the reservoir is filling. Lower available organic carbon in lower horizons may reduce the speed at which anoxia develops at greater depths relative to topsoil horizons that have higher organic carbon and microorganism populations. Anaerobic conditions will persist until water content returns to approximately 90% of pore volume, one to two months after reservoir drainage. The lengths of time associated with anaerobic soil conditions in different soil units are noted in Volume 4, Appendix G, Attachment 9A, Section 9A.2.5, Table 9A-3.

NRCB QUESTION 388: CONTENTS OF SILT

We do not have adequate expertise to critique the response to this question. Clearly this is a huge issue with wide ranging impacts. Can the Proponent point to an example anywhere in the world were massive silt deposits of similar chemistry are left exposed to the elements? What is the effect of the weight of this sediment on the ground? What is the likelihood anything but weeds can grow?

Alberta Transportation states that *The sediment is expected to be primarily calcium-carbonate in mineralogy…The primary effect of calcite on soil is through its effect on soil pH*. Other potential chemical changes to soil from post-flood sediment have not been discussed.

a. Describe changes in soil quality from sediment that may contain other potential contaminants of concern, including but not limited to anthropogenic sources.

b. Describe mitigation measures to address potentially contaminated sediment that may impact soil quality through changes in soil chemistry.

c. Describe residual impacts of the Project on all chemical soil properties following implementation of mitigation measures for post-flood sediment.

Response 388

a. Additional characteristics of sediment expected to accumulate in the off-stream reservoir during floods were inferred from data provided in Volume 4, Appendix K, Surface Water Quality Technical Data Report, Attachment A, Table A-3, which lists data for sediment samples from various locations on the Elbow River. Table A-4 shows results of soils sampled in the reservoir for the same parameters. For sample locations, see Volume 4, Appendix K, Section 2, Figure 2-2.

Methods of analysis are presented in Appendix K, Section 2, Table 2-6. Results are compared in Table IR388-1. Sediment deposition is presented only for the design flood. In summary, after a design flood, five new soil types are expected in the reservoir, as described in Volume 3B, Section 9, Table 9-5. These soils (DEP1, DEP2, DEP3, DEP4 and DEP5) are defined for the various thicknesses of flood sediment that will be deposited. These thicknesses will vary from 0.2 m to 1.0 m for the DEP1, DEP2 and DEP3 and exceed 1.0 m in thickness for the DEP4 and DEP5 units. Texture for all is expected to be coarse. Overall, soil types DEP1 to DEP5 will be most closely related to the TBR (Twin Bridges) soil series found in the Elbow River floodplain. Metal concentrations in new soil types will be similar to the concentrations observed in existing soils (refer to Table IR388-1). The new soil types will initially differ from existing soils (except for the TBR soil series) in the following ways:

- They will have lower nutrient availability, due to high carbon/nitrogen ratio, lower organic carbon content, lower nitrogen concentration, and lower available phosphorus.

NRCB QUESTION 389: CALCIUM CARBONATE & SEDIMENT

We are concerned that, once again, the Proponent is not focussed on long-term impacts of the SR1 project. We don't understand the why time periods would be too-short for acidification? If the silt is permanent, there is much time for this process. There are clearly long-term implications, including on soil chemistry, that must be clearly documented. We ask the Regulators to press for robust explanations of long-term implications of the silt accumulation.

Alberta Transportation states that *There is no planned mitigation of higher calcium carbonate content in soil and higher pH. Time periods are likely too short to allow any measurable removal of free carbonates through leaching*. However, in the previous paragraph, Alberta Transportation states *This sediment is not expected to be removed*, which appears to be a contradiction.

a. Explain how time periods are too short for leaching to occur if sediment is not going to be removed.

b. If sediment removal is not conducted, describe soil chemistry residual impacts of leaving sediment in place.

a. Flooding will result in sediment deposition in the reservoir, although at spatially-variable thicknesses. The sediment will be retained after reservoir and soil dewatering; it will not be removed, regardless of thickness. Sediment will be moved or regraded if it interferes with drainage to the low-level outlet or functioning of the reservoir or associated components (see IR382).

The retained sediment will have a high calcium carbonate content and a pH of approximately 8. Leaching is a physical-chemical process where chemical products of acid-base neutralization interact with downward moving soil water, resulting in chemical change in the soil profile (acidification). Base cations are transported downward in the soil profile and may accumulate in deeper soil horizons. Soil acidification rates are expected to be too slow for leaching to remove appreciable amounts of base cations relative to the return periods of sediment deposition; calcium carbonate content will remain high and soil pH will tend to remain in the range of pH 8 over the long term, as explained in the response to IR391a.

NRCB QUESTION 390: REMOVAL OF SEDIMENT

The Proponent states that "…deposited sediment will lead to higher risk of wind erosion". Where is the mapping of how far this sediment will travel by air and under varying wind scenarios? We must very clearly understand this, as it is one of our most pressing community concerns.

c-d. The physical properties of the deposited sediment will lead to higher risk of wind erosion. Mitigation for wind erosion is discussed in Volume 4, Appendix G, Attachment 9A, Section 9A.3. Mitigation includes revegetation with native grasses and the use of tackifiers (sprayable erosion control product that bonds with the soil surface and creates a porous and absorbent erosion resistant blanket that can last for up to 12 months).

e-f. The residual effects of flooding on soil quality and quantity, including areas of newly deposited sediments, are presented in Volume 3B, Section 9.2.3.3 and consider the physical properties of sediment as they relate to land capability. Physical properties of sediment, including depth, texture, organic carbon content, structure, consistence, and density are integrated into measures of land capability for all new soil types (DEP1, DEP2, DEP3, DEP4, DEP5) (see Volume 3B, Section 9.2.3.3, Table 9-5 and Table 9-6). Effect on soil quality and quantity are expected to be high magnitude and irreversible because of the change in land capability associated with the introduction of new soil series with different physical properties. Specifically, there will a decrease in equilibrium land capability from existing conditions to post-flood conditions.

NRCB QUESTION 390: SOIL PH

We do not have the expertise to critique the response to this question.

Alberta Transportation states in Section 9.2.3.3 that *Flooding is expected to increase soil pH permanently* which contradicts Section 9.2.3.2 that states *pH can be expected to remain constant for the time periods considered*.

a. Correct or explain this contradiction.

Response 391

BACKGROUND INFORMATION

When the off-stream reservoir is operational, floods of larger magnitude will introduce sediment that is dominantly of calcite mineralogy ($CaCO_3$). $CaCO_3$ is a solid phase species that will buffer soil pH (Bohn et al. 1985), even at a small percentage of the soil volume.

The vertical pH distribution in the existing glacial-age Chernozemic-Gleysolic soils within the off-stream reservoir (Volume 1, Figure 3-7) reflects a long period of development (thousands of years). These soils are currently in the slightly acidic to slightly alkaline range. For topsoil horizons, $pH_{(CaCl2)}$ ranged from 5.68 (Volume 4, Appendix G, Attachment C, Table C3) to 7.47 (Volume 4, Appendix G, Attachment C, Table C8). For the same soils, subsoil horizons ranged in pH from 6.57 (Volume 4, Appendix G, Attachment C, Table C1) to 7.62 (Volume 4, Appendix G, Attachment C, Table C8).

The new depositional soil units that will be introduced by flooding—DEP1, DEP2, DEP3, DEP4 and DEP5 (see the response to IR388 for further detail)—are defined for various thicknesses of introduced sediment. The pH of these depositional soil units is expected to be near pH 8 and will remain that way for hundreds to thousands of years as they develop vertical pH distribution similar to soils in the existing conditions.

a. In response to the question, the cited statements are both correct and are consistent, but they are made in differing contexts.

   The context for the statement in Volume 3B, Section 9.2.3.3 is that flooding will introduce calcite into the soil system, which will result in an increase in pH, compared to existing conditions.

The context for the statement in Volume 3B, Section 9.2.3.2 is that mitigation measures for elevated pH are unnecessary because a stable pH around 8 (characteristic of the new soils) is not expected to be detrimental to vegetation establishment and function. The statement that "pH can be expected to remain constant for the time periods considered" refers to the fact that natural leaching processes would mitigate high pH, but it will take a long time.

NRCB QUESTION 393: SODICITY AND SALINITY

See our other comments in this section.

Again, we are concerned that the Proponent continues to provide “if, then” type responses. For example, if the salinity is a problem, then we will do something about it” in the future. This type of response leaves our community with tremendous uncertainty about the consequences of various interventions over the long run. It appears that the Proponent is quite unable to predict outcomes with any certainty and thus must rely on conditional statements about the future. Clearly, these types of responses are unique to SR1 rather than a conventional in-stream dam structure, for which many precedents exit.

Will there, or won’t there be increased salinity and sodicity? The Proponent’s response is absurd. Surely, this is within reason to predict, with some level of confidence?

What would cause natural desalinization? Given the silt depth, is this likely? More information is required.

We ask that with regard to the various erosion-control measures, that the Proponent detail the cost of each measure, per acre, that would be required during an application.

Alberta Transportation states *An upward shift of the water table could lead to an areal expansion of soils affected by upward movement of sodium or other soluble salts. In turn, this could lead to increased sodicity and salinity in flooded soils.*

a. Describe mitigation measures to address sodicity in flooded soils.

b. Identify and describe the potential residual impacts of the Project following implementation of mitigation measures for soil sodicity and salinity in flooded soils.

Response 392

a. While the potential for increased salinity or sodicity in flooded soils was identified in Volume 3B, Section 9.2.3.3, the residual effects related to soil quality resulting from changes in salinity and sodicity are expected to be negligible over the long term (as described in b.)

Mitigation measures would only be necessary in areas where vegetation establishment is poor due to high salinity or sodicity. The primary approach to mitigating poor vegetation establishment would involve the selection of plant species most suited for the chemical conditions in the off-stream reservoir, both in the first few years post-flood and over the longer term (decades). To understand possible changes in soil chemistry (salinity, sodicity) in the off-stream reservoir resulting from flooded soils, visual (i.e., presence of salt crusts) and laboratory testing will be considered during revegetation planning.

If increased salinity reduces vegetation growth and reestablishment, it could indirectly contribute to heightened erosion risk (resulting in dust) and may require expanded use of tackifier and hydroseeding or hydromulching. During the immediate post-flood period—and where required afterward—surface tackifiers may be used to hold soil in place from wind erosion until desalinization and vegetation regrowth has occurred to a sufficient degree.

NRCB QUESTION 393: SOIL QUANTITY AND QUALITY

See our other comments in this section.

Regarding the Proponent's response to Part d: We request an explanation of the positive effects from avoided flooding in downstream agricultural lands…where, exactly, and what are the positive effects? Honestly, if the Proponent was so concerned about agricultural lands, they wouldn't ruin 3800+ acres of prime agricultural land!

Interestingly, the Proponent's own report[58] on MC1 states "The MC1 Option would result in both a decrease in downstream peak flows and a decrease in the sediment supply, which may result in channel degradation, channel narrowing, coarsening of bed material, pattern simplification, and aggradation at tributary junctions downstream of MC1 to the intake of the Glenmore Reservoir." One of the Proponent's repeated arguments in support of SR1 has been that most of the silt will deposit in the SR1 reservoir, thereby reducing silt load in the Elbow River. Both of these statements cannot be true. We ask the Proponent to explain why the reduction in silt in the Elbow River is negative for MC1 but positive for SR1.

We would like to add that the sediment depletion phenomenon is a concern at dams at places like the Aswan (Nile River) and the Colorado River dams where the rivers have a high entrained sediment load and water flowing from dams has lost its sediment load in the reservoir becoming clear and "unsaturated". These rivers then become erosive until they pick up sediment downstream and become "saturated" again. We don't believe this is a measurable concern in the generally clear water rivers such as the Kananaskis (Barrier Lake) or Bow (Ghost Reservoir) where silt and sand entrainment is a spring event and flood loads are primarily cobbles and pebbles. It is true any reservoir in our rivers have inlet deltas that propagate into the reservoir dropping this spring sediment load (we calculated about 400 years for MC-1 based on Barrier and Glenmore). If we consider the wide alluvial plain downstream from McLean Creek (e.g. at Gooseberry) we would submit the coarse sediment supply there is sufficient to limit hydraulic damage for the lifetime of the reservoir. The operator could also periodically flush some of the submerged delta sediment with large releases as they do along the Colorado.

If one operated MC-1 in a way that was environmentally conscious, one would allow large flows in the spring to move some of the fines through, and maintain steady summer flows to wash those same fines off the gravel beds needed by spawning Cutthroat (June spawners) and Bull (fall spawners) trout. What is most critical in operation though, is not to have daily variations in stream flow like those on the hydroelectric rivers. Those variations are devastating to the invertebrates the fish feed on, and hence the fish population itself. Hydro is still a limited possibility at MC-1 with smaller jet turbine type "run-of-the-river" generators that operate on 2-5m3/s.

[58] https://www.nrcb.ca/download_document/2/83/8788/20180326-at-eia-to-nrcb-re-vol-4-supporting-documentation

Alberta Transportation states that *The predicted effects on soil quality and quantity are adverse, of high magnitude and irreversible effect with a long-term duration. Flooding would saturate the soils within the reservoir, leading to chemical change that in some cases is not reversible. Flooding would also bury baseline soil profiles beneath coarse textured sediment resulting in a loss of agricultural capability and an increase in wind erosion risk unless fully mitigated. Despite these changes to soil quality and quantity the change in land use away from agricultural means that these changes are not significant.*

Since land capabilities are a measure of the land's potential to support a particular land use, consideration of future land uses should not be used to conclude that a reduction in land capability is not significant.

a. Provide further rationale and explain why the changes to soil quality and quantity as a result of flooding are assessed as not significant.

b. Explain why the change in land use for the Project was used to conclude that the effect of changes on soil quality and quantity from flooding are not significant.

c. Evaluate post-flood land capability independent of the target end land use, with consideration of the various sediment depths that will remain in all Project components.

d. Re-evaluate the significance of the effect of change in soil quality or quantity from flooding using the Significance Definition provided in Section 9.3.

e. Provide detailed rationale to explain the determination of significance of the environmental effect of flooding on soil quality and quantity.

c. An evaluation of post-flood land capability independent of the target end land use is provided in Volume 3B, Section 9.2.3.3, Tables 9-5 and 9-6, and Figures 9-3 and 9-5. As shown in Table 9-6, flooding and sediment deposition results in an initial reduction in the area of Land Capability Class 2 within the terrain and soils LAA of approximately 570 ha, relative to

existing conditions. Following release of water from the reservoir, soil moisture conditions will equilibrate and the initial reduction in Land Capability Class 2 will recover somewhat, resulting in a net reduction of 240 ha, compared to an initial reduction of 570 ha.

d. The correction to the significance conclusion is based on using the definition in Volume 3B, Section 9.3, whereby operation of the Project would result in a significant effect on soil because there will be a change in soil quality or quantity resulting in a reduction in agricultural land capability that cannot be offset through mitigation or compensation measures (this occurs in the off-stream reservoir).

However, the context for this conclusion is that it is a highly conservative evaluation of potential effects to agricultural capability. There are 30,957 ha of agricultural and pasture land within the RAA (Volume 3C, Section 1.2.6, Table 1-8), and construction of the Project will result in a reduction of 342 ha of agricultural and pasture land (a reduction of 1.1%). Even with the additional reduction of 570 ha of Land Capability Class 2 soils resulting from flooding, the Project is expected to have a not significant effect on agriculture in the RAA, overall.

In addition, this assessment does not account for the positive effects associated with the offsetting of potential flood damage to agricultural land and reduced agricultural capability

NRCB QUESTION 393: AGRO-CLIMATE COMPARISON

We would like the Proponent to discuss how this data is used in the SR1 modelling and to discuss the limitations of using Lacombe as the comparator.

Alberta Transportation obtained agro-climatic monitoring data from the monitoring station at Lacombe, Alberta to *represent typical soil moisture patterns for the Project site because of similar soil and climate conditions*. Lacombe, Alberta is located within the Central Parkland Natural Subregion, whereas the PDA is located within the Foothills Parkland Natural Subregion.

a. **Provide rationale and justification for the selection of the data from the Lacombe agro-climatic monitoring station rather than a monitoring station located within the same subregion as the PDA.**

Response 395

a. Soil classification in the province of Alberta incorporates ecological considerations (Bock et al. 2006) and soil correlation areas are delineated to account for ecoregion qualities.

   There are no soil moisture data available from agro-climatic monitoring stations located in the Foothills Parkland.

   The Lacombe site was used to provide an estimate of long-term record of soil moisture content variation because the soils and climatic properties best matched those found in the terrain and soils LAA.

   The closest alternative site that has a long-term record of soil moisture variation is located at Olds, Alberta. It too is located within the Central Parkland, but it is closer to the LAA. Both sites had similar period of record. Lacombe had a soil moisture content record from 2008 to 2016. The Olds site had a soil content record from 2005 to 2015. Both sites have sufficient data to serve as an indicator of long-term trends in moisture variation.

   The following comparisons apply to the Lacombe site versus the Olds site with respect to the LAA and the off-stream reservoir:

   - The Lacombe site soil textural property is "moderately fine" to "fine", which is similar to 77% of the LAA (Appendix G, Terrain and Soil Technical Data Report, Table 3-16). By contrast, the Olds site has a soil textural property of "moderately fine".

NRCB QUESTION 396: TACKIFIER

The Proponent discusses the "Use of organic tackifier..." to keep the dust down. What does that do to other soil processes and how well will that suppress pathogen-carrying dust-devils?

Response 396

a. The exact product to be used as the tackifier or sprayable erosion control has not been confirmed for the Project. ProMatrix™ is one example of many comparable erosion control products that could possess the characteristics and provide the required functionality outlined in Volume 4, Appendix G, Attachment 9A, Section 9A-3. This erosion control product consists of 77% processed wood fibers, 18% wetting agents, 2.5% biodegradable fibers derived from plant sugars, and 2.5% proprietary mineral activator (see Appendix IR396-1).

b. The use of a product such as ProMatrix™ or a similar erosion control product would be safe for the environment and human health. The material safety data sheets (MSDS) for ProMatrix™ (#CON069) indicates that the toxicological properties of the wood fibre elements of the product are limited to its potential to create wood dust. The proprietary binding agent is based on guar gum. The product's MSDS notes that the US Federal *Insecticide, Fungicide and Rodenticide Act* considers guar gum to be a "minimal risk inert substance" that poses no risk to humans or to the environment.

c-d. The ingredients in the tackifier or comparable sprayable erosion control products that may be used will not contain potential contaminants of concern and no residual impacts will result from their uses.

NRCB QUESTION 399: SOIL COMPACTION

We believe that a soil/grasslands expert is required to address soil-related consequences of SR1. We have the cumulative experience of pioneer ranching families to attest to the importance and value of the old grasslands. We think this issue is under-studied.

We note that soil compaction discussions refer to the weight of the water. Forget maintenance vehicle traffic - what about the tremendous weight of the silt that will accumulate each use of the reservoir?! What is the impact of the combined weight of water and silt during reservoir use, but also the impact of permanent and increasing silt deposits on the soil?! In our view, much of the land covered in silt will be a “dead zone” post-flood.

Alberta Transportation states that *Much of the LAA is rated moderate to high for compaction risk for topsoil (1,565 ha, or 83%) and Soil series rated for subsoil compaction risk closely follow those rated for topsoil compaction risk*. However, potential effects of soil compaction have not been evaluated for the different Project phases.

a. Evaluate and discuss potential soil compaction effects during construction and dry operations.

b. Evaluate and discuss potential soil compaction effects during flood and post-flood operations, including, but not limited to, the added weight of flood water within the reservoir.

c. Describe mitigation measures at each Project phase to address the moderate to high compaction risk for topsoil and subsoil.

d. Describe the potential residual impacts of each Project phase related to moderate to high compaction risk for topsoil and subsoil, following implementation of the mitigation measures.

a. The potential effects of soil compaction during construction is an increase in bulk density, which can result in a reduction in land capability. Construction activities have the potential to cause compaction, especially in the areas of the PDA that have finer soil textures. As mitigation, areas subject to construction activities will have both topsoil and subsoil salvaged and stockpiled prior to work taking place. Therefore, the topsoil and subsoil materials to be used for reclamation will not have been subjected to compaction. Soils below the depth of the salvaged soils will be loosened by deep ripping prior to topsoil and subsoil replacement.

   During dry operations, potential soil compaction would most likely be caused by maintenance vehicle traffic, however, vehicle traffic will be restricted to the designated access and maintenance roads within the PDA, which will limit the amount of potentially affected soil.

b. During a flood, the effect of the added weight of water could compact the soil. However, the density of water is such that, on a mass per unit area basis, the load will be much lower than loads imposed by heavy equipment. For example, a Caterpillar 140M grader typically will cause a load from each tire of about 20,000 kg/m^2. For comparison, a 10 m deep water column in the reservoir would impose a force of 10,000 kg/m^2. In addition, relative to the existing soils in the off-stream reservoir, the coarse-grained sediment deposited in the reservoir during a flood will have a low compaction risk similar to the Twin Bridges (TBR) soil series, similar to the soils currently on the Elbow River floodplain (Volume 4, Appendix G, Table 3-29 and Table 3-30).

   During post-flood operations, the use of maintenance equipment to remove sediment or move sediment within the reservoir will occur if the sediment depositions impact the functionality of the reservoir operations or present a risk to dam integrity. Maintenance equipment will use designated access and maintenance roads.

c. Mitigation for soil compaction during construction and dry operations is as explained in the response to a. Should compaction be evident as a result of construction activities, mitigation will include ripping to loosen the subsurface to an approximate depth of 500 mm prior to placement of the topsoil and subsoil.

   Mitigation for post-flood operations may include the use of low ground-pressure equipment and avoiding traffic during wet soil conditions, as long as safely possible, when soils are at higher risk of compaction.

d. No residual impacts will occur as a result compaction mitigation for any Project phase.

VEGETATION (NRCB QUESTIONS 401-407)

GENERAL QUESTIONS

LOSS OF ECOSYSTEM THAT WOULD OTHERWISE EXIST AT SR1

Has the Proponent adequately considered the impact of the loss of the large area of native grasses and wetlands on the entire ecosystem that depends on it? We think that SR1 should be considered a “net loss” or “ongoing biological” loss. How much virgin prairie grass is left in Alberta?

The Proponent should contrast the loss of the SR1 land footprint to the loss of land at the MC1 site. SR1 is four times larger. MC1 is in a river valley with cliffs. We don’t think the comparison has been thorough enough from a biology standpoint.

IMPACT ON POLLINATING INSECTS

Many wildflowers will likely be blooming when the reservoir is expected to be used, and will be inundated, and that will adversely affect pollinating insects, which will affect the food source of many other life forms. As a result, this will be an ongoing biological sink.

REGENERATION OF GRASSES AND FORBS POST-FLOOD

Of considerable concern is the regeneration time of grasses and forbs following either a flood event or the required 1/5yr reservoir test floods (varying projections by the Proponent on use). We assume this repeated flooding will "reset" any recovery of plants. Unless the land post-flood is covered with new, healthy topsoil (not just left-over silt) that includes organic material and other biological organisms, the result will be just "dirt" not "soil" and vegetation will struggle to grow.

In the environmental assessment submissions to IAAC (CEAA), the government agent (Stantec) referenced (although the reference year and title were incorrect) a study in northern China barbon grass regeneration times for silt-coated (less than 4cm) flooded plains. Our issue with this analogue is that the semi desert environment of northern China is not analogous to parkland at Springbank and the grasses studied are not similar to the fescue and introduced timothy and brome at Springbank. Silt-coated floodplain at Bragg Creek and Redwood Meadows have taken six years since 2013 to recover, and that recovery is still in the primary succession stages in many areas.

Thus, the Department of Transportation's claims that the land will easily recover after each flood event are based on flawed assumptions and little or no local analogue studies.

Table IR300-1 Suspended Sediment Mass, and Percent Diverted and Released from the Off-Stream Reservoir (from Table 6-6 in Volume 3B, Section 6)

Flood	Diversion time (days)	Suspended sediment mass diverted into the reservoir (kt)	Suspended sediment mass released out of the reservoir (kt)	Percent suspended sediment remaining in the reservoir (%)	Percent suspended sediment released out of the reservoir (%)	Loss of retention volume in the reservoir due to remaining sediment (%)
Design Flood	3.75	2,389	90	98.2	1.8	1.1
1:100 year flood	1.80	1,268	220	88.3	11.7	0.5
1:10 year flood	0.38	1.3	1.1	95.4	4.6	0.0

NOTE:
kt - kilotonne

NRCB QUESTION 402: WATERSHED & IMPACTS ON PLANTS FROM SR1

We do not have the expertise to critique this response, but SR1 appears to have significant and negative outcomes for plants that require further study. Much speculation in this response by the Proponent ("suspected", "likely", "assumed", "potentially", "unclear").

Groundwater flows often redirect when land is altered by construction.

How will climate change impact the groundwater recharge?

a. Given the diversion channel will intersect several small tributaries to the Elbow River and the flow from the tributaries upstream of the diversion channel will be re-directed into the diversion channel to the low level outlet will the reduced flow of water through the small tributaries downstream of the diversion channel cause indirect detrimental effects on the shrublands and shrubby fen lying south of the diversion channel and off-stream dam? Justify and explain how a conclusion was reached.

b. Is the size of the remaining watershed lying south of the diversion channel sufficient to sustain the water table at levels capable of maintaining the shrublands, shrubby fen, and the rare plant species, dwarf bulrush (Trichophorum pumilum) in the area south of the diversion channel and dam? Justify and explain how a conclusion was reached.

c. Have any indirect impacts to the shrublands and shrubby fen south of the diversion channel been accounted for within Table 10-12 on pages 10.46, 10.47, 10.48, and 10.49? Justify and explain how a conclusion was reached.

Response 402

a. From Volume 3A, Section 6.5.2, "Permanent diversion of five small tributaries intersected by the diversion channel and the dam would affect the input of flow from these tributaries into the Elbow River." However, the flow estimates from the five intersected tributaries are extremely low (0.36 L/s to 5.99 L/s), likely intermittent, and are already affected by roads, cultivation, and dugouts (See Volume 3A, Section 6.5.2, Table 6-11). While the measured flov from the five intersected tributaries is considered low, the intercepted flows from these tributaries will likely reduce surface water flow into the identified shrublands and shrubby fen (Volume 3A, Section 10, Figure 10-3).

   It is unclear how groundwater connectivity with the Elbow River and upslope groundwater sources influence water table levels in these habitats. The water table in shrubby fens is typically within 10 cm of the ground surface (ESRD 2015). Water table modelling indicates th water table in the area of the shrublands and shrubby fen is below the bottom elevation of the diversion channel and the diversion channel would not be able to completely intercept groundwater flows. Reduced surface water inputs into these vegetation communities may alter species composition but are unlikely to result in loss of these communities because groundwater inputs will be maintained.

b. The remaining contributing drainage basin of the shrublands and shrubby fen lying south of the diversion channel and off-stream dam is expected to be sufficient to maintain the current vegetation communities and the rare plant dwarf bulrush (*Trichophorum pumilum*). As stated in a., although a portion of surface flow north of the diversion channel and off-stream dam will be re-directed, groundwater in these areas is not expected to be completely intercepted. There is uncertainty regarding groundwater connectivity with the Elbow River in this area, but given the low topographic position of the shrublands and shrubby fen area, groundwater inputs from the river are likely.

   It can be assumed, however, that lower water inputs could potentially drive changes in species composition. Dwarf bulrush has commonly been found in saline or calcareous fens and seepage areas (Kershaw et al. 2001; Dite et al. 2013; NatureServe 2018; Flora of North America n.d.). This species is expected to persist in the shrubby fen area following construction because groundwater flow will be maintained, which is an important component for calcareous fens (ESRD 2015).

c. Indirect effects to shrublands and the shrubby fen are not addressed in Table 10-12, which only lists direct effects through disturbance and reclamation during construction and dry operations.

   Indirect effects could occur due to re-direction of surface water in the five tributaries intersected by the diversion channel. The contribution of these tributaries to the shrubland and shrubby fen area water balance is uncertain, but groundwater is suspected to be an important component given the low topographic position of the shrublands and shrubby fen area and low flow estimates of the five, likely intermittent, tributaries. Species composition may be altered, but the shrublands and shrubby fen are expected to persist following construction because groundwater flow will be maintained. Inclusion of potential indirect effects to shrublands and the shrubby fen potentially affected by interception of the five tributaries would not affect the conclusion found for residual effects, as stated in Volume 3A, Section 10.9.

WILDLIFE (NRCB QUESTIONS 408-435)

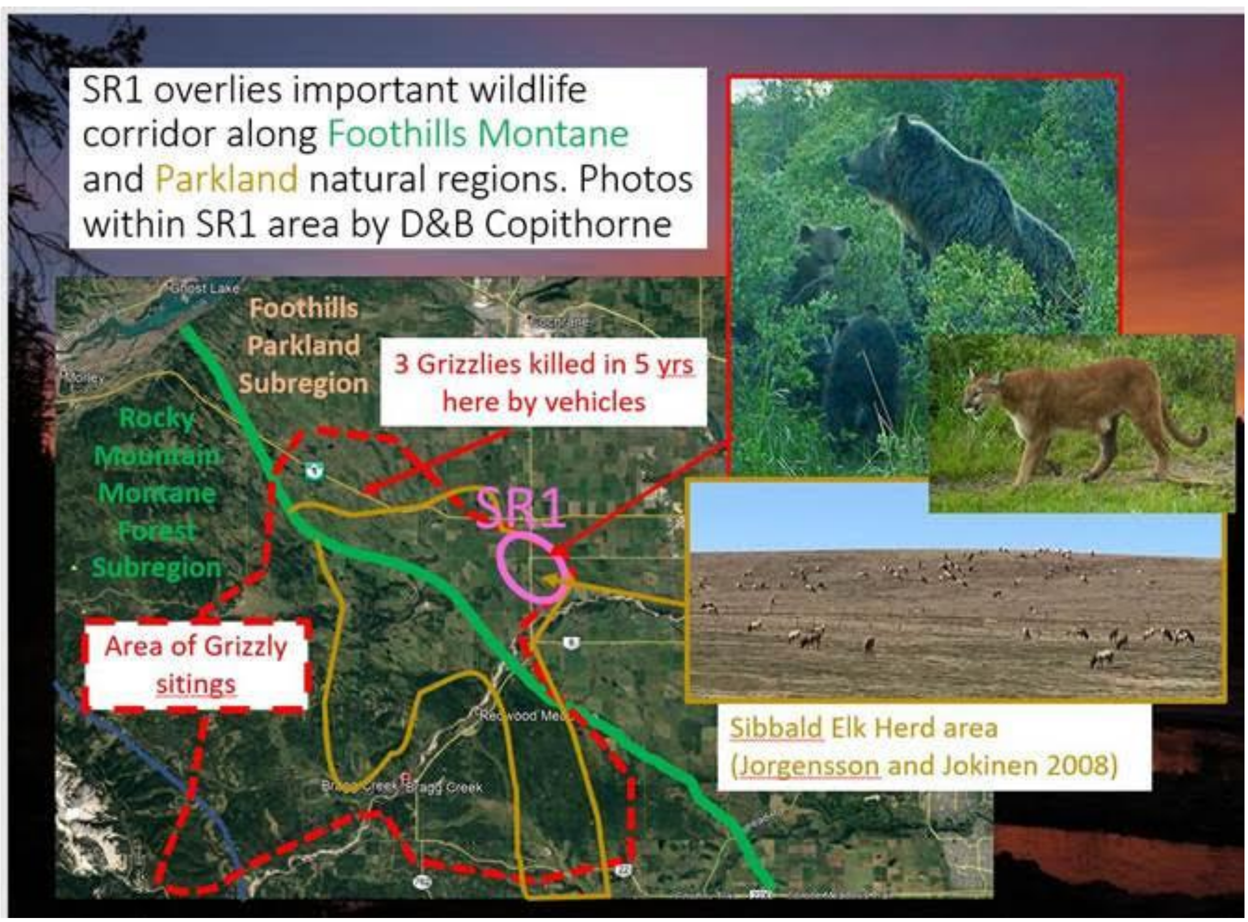
A.T. Responses: https://www.nrcb.ca/download_document/2/83/9200/20190614-at-sir-to-nrcb-re-sir1-response-sec-6-terrestrial

NRCB: https://www.nrcb.ca/download_document/2/83/9605/20190716-IAAC (CEAA)-eia-to-at-re-annex-1-information-request-round-1-part-1-conformity-review

GENERAL QUESTIONS

The ecosystems along the boundary of Foothills Parklands of Springbank and the Montane Forest Subregion immediately west of the SR1 have a high wildlife density and occupy a north-south migration corridor from the Elbow watershed to the Jumpingpound and Bow watershed. There have been no annual adequate population counts or yearly monitoring projects to document this but anecdotal accounts, especially vehicle/wildlife collisions on 22 at the Paintball fields near Mary Robinsons, along 22 between the Elbow River and Upper Springbank Road, and along Hwy 1 near Jumpingpound Creek support this assertion. In precolonial times the highest density of grizzly bears was on the prairie and in the foothills predating on bison and elk and this area seems to be a vestige of that ecosystem. We need better science from the Proponent to quantify the impact SR1 will have on this rich ecological “edge”.

Image below from Dave Klepacki, PhD.



COMPARISON OF ALTERNATIVES – IN-STREAM DAM DOCUMENTED IMPACTS ON WILDLIFE

The Proponent should comment on the construction of a permanent reservoir at MC1 and the impact on wildlife on an ongoing basis vs the periodic use of SR1.

The Proponent has repeatedly espoused the negative the impact of MC1 on wildlife, but when there are so many in-stream dams in our province, is there validity to this? In fact, the Alberta Government is in the process of choosing a new in-stream dam on the Bow River! Does the construction of a wet-dam have negative long-term consequences that are based in fact? Are there studies that show whether current in-stream dams in the province are positive or negative or neutral contributors to the local ecosystem? Considering one of the main reasons that SR1 was chosen was for "environmental reasons," we deserve facts on this important topic, not assumptions from the Proponent.

Further, Alberta Environment and Parks is considering three major dams on the Bow River. If dams have such negative impacts, why are they the expected flood mitigation infrastructure on the Bow River? Surely there are mitigation measures in place to protect wildlife during construction and operation of an in-stream dam. We contend that the government has not provided evidence that the MC1 option is negative for wildlife, including fish. In fact, we believe that fish can perhaps even benefit from an in-stream dam.

Contrast MC1 with the periodic use of the SR1 reservoir. With SR1, there is no wildlife adaptation to the use of the footprint because the use of the reservoir infrastructure is unpredictable. Let's be clear that most of the SR1 lands would not flood in a high-water scenario of the Elbow River.

SR1 WILDLIFE MORTALITY: NET NEW IMPACTS VS OTHER ALTERNATIVES

The Proponent states that wildlife mortality during a flood event is normal and therefore mortality from wildlife in SR1 is not a big deal because mortality along the riverbanks is the alternative. This is a false comparison. Firstly, to say that SR1 saves wildlife along the river is conjecture on the part of the Proponent. Have they studied the impacts of various flood volumes on Elbow River wildlife? Considering the volume of water diverted to SR1 will be up to 650m3/s, is there no mortality along the Elbow River, which still might have flow rates above 160m3/s? The Proponent's assertion that SR1 will save wildlife along the Elbow River is not backed up by facts. Secondly, SR1 is a very big deal for the wildlife that live there. They would be safe from flood without the project.

Again, the Proponent makes a false comparison of SR1 to "do nothing." The true comparison is to MC1.

The result of the project is NEW and INCREMENTAL mortality of animals and plants that would not otherwise have been impacted. This is the only project that creates ongoing, periodic mortality, migration and habitat loss.

MORTALITY PREDICTIONS

What is the expected number of fish and other aquatic animals, by species, in the reservoir at various flood scenarios? Identify each species and its sensitivity to water temperature and changes in water quality. Please do not limit this to fish. Identify expected species mortality. [Note: This question appears to be asked by the NRCB re: fish, but will there be other species - beavers, otters, mollusks, etc.?]

The Proponent, in general, has not explained the overall impact of flooding of SR1 lands on wildlife. It focusses on construction and dry operations although we fully expect the bulk of negative outcomes to be due to the flooding of SR1 lands.

WILDLIFE HEALTH

Will there be other risks to animals passing through the reservoir or diversion channel (e.g., being stranded in silt or having difficulty crossing the diversion channel) during, before and after use of the reservoir? Explain.

What, if any, risks to ungulates, carnivores, birds and other animals may exist from drinking from the SR1 reservoir during a flood event and post-flood? How will this risk be mitigated?

NRCB QUESTION 408: TRAFFIC AND WILDLIFE

Have traffic studies been performed for Hwy 22, Springbank Road, and Township Road 250 (where the re-routed traffic will go?). If so, please make results available. Have estimates of re-routed traffic been made? How much will traffic increase on Township Road 250 versus the baseline? See our comment on IR 409 below.

NRCB QUESTION 409: TRAFFIC AND WILDLIFE

We believe the wildlife assessment area is too small. Animals will be significantly impacted by the construction of SR1 and will move along the river or through fields well beyond the Proponent's assessment area. Anecdotally, our communities have experienced more bear sightings since the ring road construction on Highway 8, on the border of Springbank. Have wildlife surveys and tracking been conducted on the ring road project, which is moving a massive amount of material, as is expected for SR1 construction? Perhaps the Proponent can look to wildlife behaviour for ring road construction as a model for possible wildlife behaviour in SR1 (particularly with regard to large mammals). Both projects are near the Elbow River and both require a large amount of earth moving.

https://www.nrcb.ca/download_document/2/83/5555/sir-1-july-31-2018

For a project of this magnitude, are there specific wildlife studies that must be conducted prior to approval? For instance, what studies would the Proponent of an oil sands tailings pond be required to conduct? We don't see that SR1 is much different from this, considering the government is now referring to it as a settlement pond.

To our knowledge, no systematic wildlife counts have been done in the area, including on privately held lands, (although we recall a short-term count was done with infrared cameras) to record movements of moose, elk, deer, grizzly (at risk), cougar, wolf, badger (sensitive species) through the area. Richardson's ground squirrels, a keystone prey species in this ecozone for smaller predators like badgers, coyotes, foxes, weasels, and raptor and owl species, are still decimated relative to their pre-2013 populations. Flooding at SR-1 will further decimate this important species.

At SR1 threatened grizzly bears have been sighted in the proposed reservoir area, which is frequently visited by the approximately 200 head of the Sibbald elk herd (Appendix E) Environmental assessment at MC1 has found only one moose present. The lack of wildlife at MC1 is likely due to steady year-round off-highway vehicle (OHV) use at the McLean Creek OHV lands.

Long-term residents in the area note the movements of large mammals vary seasonally and that the SR1 footprint lies along a well-travelled north-south migration corridor at the boundary of foothills parkland and open prairie.

From renowned nature enthusiast Gus Yaki (founding member of Nature Conservancy of Canada): “This will cause a net loss of flora and fauna. By mid-summer, when most floods are likely to occur, many birds and mammals will be nesting or rearing young. While some of the adult individuals may be able to flee the rising floodwaters, nests or nestling birds, and juvenile mammals will all likely perish.”

In reading the first document [Project Summary 2016], produced by Stantec, we were shocked that there was no actual fieldwork done - just a roadside reconnaissance (5.1.1). Instead they relied upon reports to Alberta Conservation Information Management System (ACIMS). Since this is (was) all private land, unless a pipeline or other project called for an ACIMS study, none would have been conducted or submitted. A negative result does not mean that any endangered species do not occur there.

The overall quality of the report can be judged by the false statement under Palaeontology, (5.1.9.2). ".... unnamed site along the Elbow River in Fish Creek Provincial Park." (FCPP). The Elbow River does not go near FCPP!”

We don’t believe that enough study has been done on the animals that live in the SR1 footprint. We request a full study of all the insects, reptiles, birds and mammals that live there. If this project goes ahead, we must have a baseline count so that we understand the changes!

NRCB QUESTION 409: UNGULATE MOVEMENT

Where are the ungulates expected to move during SR1 construction? How can the Government of Alberta predict this movement? Will the ungulates ever return to the SR1 footprint post-flood?

Further, the Proponent seems to suggest that because they can't quantify the impacts because of lack of information on the elk (such as radio collars or the AEP data, which considered a larger range) that it will likely all be okay in the end. This is not acceptable to us. Don't they know how many times collared elk have entered the SR1 footprint?

Again, the utter lack of consultation with local people has informed poor quality outcomes on this matter. Local landowners and Tsuut'ina could have explained how the elk have been using this land. See Appendix E.

We must all recognize that this project is unprecedented. Qualitative assessments should not be sufficient.

However, winter track surveys were conducted to quantify baseline elk movements and a herd of elk was recorded in the area. AEP also has information on elk winter range distribution and movements as well as population densities in the project area.

a. Explain why these data were not used to quantify the effects of changes in wildlife movement or abundance due to the project.

Response 409

a. The AEP range distribution and population densities cannot be used as measurable parameters to assess potential Project effects on wildlife movement.

Although elk population counts are available for larger administrative areas such as wildlife management units (WMU), these counts would not represent the abundance of elk within the spatial boundaries used for the assessment nor could these counts (or densities) reliably quantify potential changes in movement due to the Project.

However, the Wildlife Technical Data Report (Volume 4, Appendix H, Attachment A, Section 11A.2.4) does provide the most recent ungulate winter survey results available for WMU 212 and WMU 312; the data are used to provide a regional overview of the estimated number of elk and winter range distribution relative to the spatial boundaries.

Change in movement is assessed qualitatively primarily because quantifying elk daily or seasonal movement patterns typically requires a modelling approach that uses movement data usually generated from radio-collars. It is Alberta Transportation's understanding that these data are not available for the areas within the wildlife LAA. Without these data and a measurable parameter to assess potential effects of the Project on wildlife movement (e.g., km of known migration or movement route), a quantitative approach is not possible. A qualitative assessment is a standard approach used to assess change in wildlife movement and are in alignment with accepted environmental assessment methods in Alberta.

NRCB QUESTION 411: ROAD MODIFICATIONS

The elevation of Highway 22 by 5 to 10 metres is very concerning from a wildlife standpoint as well as a safety perspective, given the high winds in this area. Currently, Hwy 22 is at-grade and there is good visibility for drivers heading north/south and east/west on Springbank Road near Highway 22. How will drivers see animals before they crest the edge of the road? It is reasonable to expect increased collisions because drivers will not see animals until it is too late.

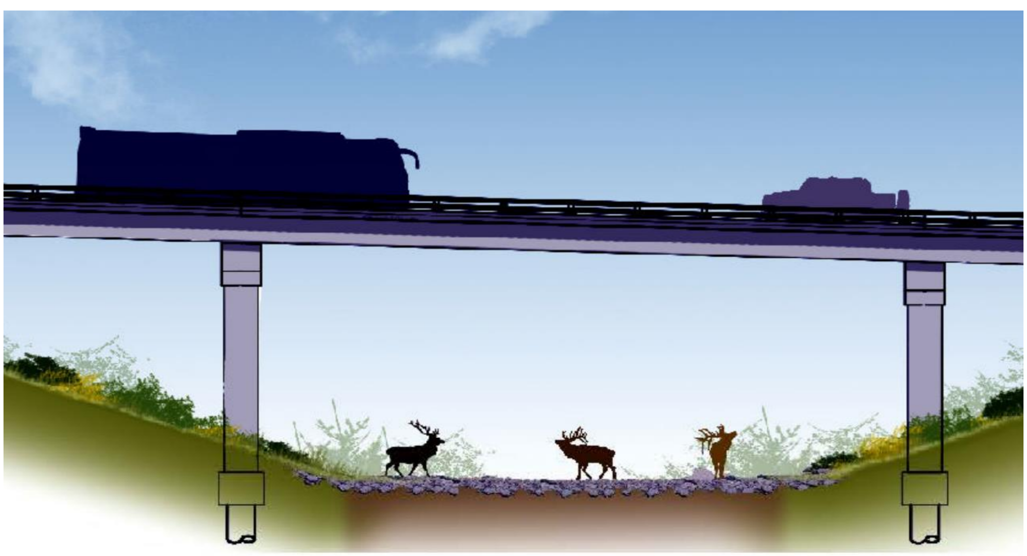
Also, the Proponent's first paragraph in the response below states that elk and deer tend to use overpasses more than underpasses. Are any overpasses planned? How will the use of underpasses actually work, given the Proponents information? If animals will go over the road, aren't increased collisions likely? Combined with the elevated roadway, is this not increased risk for wildlife and commuters?

Further, the Proponent states that there is "some grizzly bear use" in the upper areas but that this is more common along the Elbow River. What do "some" and "more common" mean? These terms are not helpful when trying to assess the impacts.

Additionally, the Proponent's philosophy seems to be "if it isn't working, we will figure it out." This is not okay. Raising a busy road and wildlife corridor 5 to 10 metres cannot be undone.

Regarding winds, does the Proponent have a history of wind speeds at this juncture between Springbank Road and the TransCanada Highway along Highway 22?

Again, the use of the wildlife Local Assessment Area (LAA) is too small. Highway 1 and Township Road 250 should be included.



"The intersection of Highway 22 and Springbank Road is proposed to be raised an average of 5 m, with the highest point being 10 m at the creek north of Springbank Road. The proposed side slope of 33% gradient is within the range (17-45%) of terrain that

Stantec

6.123

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
RESPONSE TO NRCB AND AEP SUPPLEMENTAL INFORMATION REQUEST 1, JULY 28, 2018

Terrestrial
May 2019

elk can move in (McCorquodale 2003; Frair et al. 2005; Mao et al. 2005). These slopes will be vegetated along the sides, which will be beneficial to wildlife movement. Although deer and elk tend to use wildlife overpasses more than wildlife underpasses (Clevenger et al. 2009), the placement of a 3.67 m diameter culvert at the bottom of the raised intersection could function as a passageway for smaller ungulates and wildlife to pass under the road onto the other side".

Potential effects of the proposed upgrades to Highway 22 on grizzly bear are discussed on page 11.60, as follows:

"Although data from government radio-collared grizzly bears have indicated there is some grizzly bear use of upland habitats that occur west of the wildlife LAA, data from field surveys suggest grizzly bear movement is more common along the Elbow River valley where bears travel between mountain and foothill habitats. Therefore, the diversion structure and floodplain berm are more likely to affect grizzly bear movement than the diversion channel and off-stream dam". Therefore, should grizzly bear be crossing Hwy 22 at the location of the upgrades during dry operations, those upgrades and associated design features are not anticipated to impede movement."

NRCB QUESTION 412: SR1 STRUCTURES AND WILDLIFE

We do not have the expertise to critique the response to this question. We would state that the Proponent continues to use its "if it is a problem, then we will do something" approach to Wildlife which is concerning to our community. Again, we point to the need to have thorough baseline numbers of wildlife in the area so that a before/after analysis can be conducted with some validity.

Question 412

Volume 3A, Section 11.4.3, Page 11.56

Alberta Transportation stated that *the diversion channel, floodplain berm, off-stream-dam and associated fencing around the PDA might create hindrances to wildlife movement.*

a. Provide a more specific assessment of how these project structures may impact wildlife movement, including ungulates and grizzly bears.

Response 412

a. An assessment of how Project structures may affect wildlife movement—including ungulates (elk) and grizzly bear—is provided in Volume 3A, Section 11.4.3.3 (see pages 11.58 to 11.61). A summary of the conclusions is in Volume 3A, Section 11.7.2 (page 11.88).

NRCB QUESTION 429: NESTING & HABITAT CLEARING

Would the Proponent comment on the impact on wildlife of SR1 vs MC1 for habitat clearing? Is it foreseeable that, in addition to construction, habitat clearing will occur each spring in the SR1 footprint to ensure that nests are not within the reservoir?

If there will be annual habitat clearing or other measures to deter nesting in SR1, has the Proponent accounted for this annual expense? Further, if regular habitat clearing or deterrents are used, the Proponent should comment on the impact on wildlife of losing more than 3,000 acres of valuable habitat.

For MC1, we assume there would be a one-time habitat clearing for construction. Would there be any ongoing habitat clearing?

NRCB QUESTION 435: GRIZZLY BEAR MOVEMENT

Anecdotally, we have seen an increase in bear activity in the Springbank area due to ring-road construction. What expected movement can we expect from bears due to the scale of the SR1 construction, which is much more land-intensive than the MC1 option?

Landowners describe ongoing grizzly use of SR1 lands (as evidenced by photos in Appendix E).

We are pleased to see regulators ask meaningful questions about grizzly bear movement in the SR1 footprint:

96. Supplemental Information Request 1, Question 415, Page 6.134
Volume 3A, Section 11.2.2.4, Page 11.28

Alberta Transportation states *the frequency of grizzly bear use is expected to be low based on the information presented in Volume 3A, Section 11.2.2.4, page 11.28, which indicates the wildlife LAA provides relatively low suitability habitat*.

a. Explain how a major riparian watercourse movement corridor and KWBZ with native prairie uplands and abundant big game populations can be considered low suitability habitat for grizzly bear considering this habitat is known to support numerous adult and young grizzly bears and is adjacent to the draft recovery plan's identified support zone.

IAAC (CEAA) QUESTION IR1-07: MIGRATORY BIRDS

Explain the ongoing risk to migratory birds each time the reservoir is used. What is expected mortality, by species, during flood events of various sizes? Can the Proponent comment on the species of birds impacted in SR1 that are different from birds that nest along the Elbow River? We deserve to understand the species impacted by SR1 that are unique to the SR1 lands.

It appears that the Proponent has not conducted a detailed study of the wildlife in the SR1 footprint due to land access restrictions. How can this project go forward, given its substantial footprint and impact, without accurate data?

IAAC (CEAA) QUESTION IR1-09: SPECIES AT RISK

Has an inventory of amphibian species within the LAA been completed? What about insects? The Proponent should comment on whether the species that currently reside in SR1 are the same or different from species that would be impacted in a flood of the Elbow River. Are there species or factors that are unique to SR1?

We believe that all wildlife and plants in the SR1 area should be counted and documented over time so that we can compare before and after SR1. This is critical in order to evaluate the implications of the project in the event a similar project is proposed elsewhere.

The Proponent has likely underestimated the post-flood studies that will need to be conducted on plants and wildlife. We hope that, if IAAC (CEAA) and NRCB approve this project, they require transparent reporting on the impacts of the project relative to the lands in their current state.

The Proponent states the following in IR421:

"Volume 3B, Section 10.2.2.3 design flood, "Therefore, it is anticipated that there would be high mortality of species in every stratum (tree, shrub, etc.) comprising upland plant communities. Species that are lost would be replaced, in time, by species within the seedbank, surviving propagules or that can seed-in from surrounding areas…There may be some exceptions, and mortality could occur in the tree or shrub strata; therefore, it is predicted that seasonal shrubby swamp may recover as graminoid dominated marsh following flooding." "Therefore, sediment deposition between 10 cm and 100 cm would likely result in mortality of species in the herb and short shrub strata, but species in the tall shrub and tree strata would likely survive. Loss of species in the short shrub and herb strata would eventually be replaced through recruitment from surrounding areas." "The design flood would cover 40.8 ha in the reservoir in greater than 100 cm of sediment, which would likely cause mortality of species in the tall shrub and tree strata."

We point out that "tall shrub and tree strata" will die under flood conditions in SR1. Their root systems will die from lack of oxygen. They need to breathe. Once again, how does the weight of silt impact plant species?

NRCB QUESTION 413: WILDLIFE FENCING

The Proponent states that fencing that is built for "wildlife to jump over or crawl under." Grizzlies and 250kg elk will do that? Where is the supporting documentation for these assertions?

As a mitigation measure, Alberta Transportation stated that *Where fencing is proposed to restrict livestock access to project structures (e.g. diversion channels), wildlife friendly fencing will be installed to allow ungulate passage.*

a. Define what a wildlife friendly fence is, and what specifications and design features it has.

b. Detail spatially where all project fencing both wildlife friendly and non wildlife friendly will occur.

Response 413

a. A wildlife-friendly fence is typically a 4-strand wire fence designed to allow wildlife passage by having the top wire low enough for ungulates (e.g., deer, elk) to jump over (e.g., no higher than 100 cm above ground), and the bottom wire high enough for other animals (e.g., bear) to crawl under (e.g., at least 45 cm above ground) (GoA 2011; Paige 2012; Visscher et al. 2016).

One design feature requires the top and bottom wire to be smooth and not barbed to reduce potential injury. Elk can tangle their back legs if the top wires are closer together; therefore, it is recommended that the top two wires are no less than 30 cm apart (Paige 2012). Design considerations may be modified based on sites with high or continuous livestock use (e.g., change in minimum and maximum strand heights) (Paige 2012,) if required.

NRCB QUESTION 414: QUALITATIVE ASSESSMENT OF IMPACT ON WILDLIFE

We believe that the Proponent's use of qualitative assessments is problematic. The SR1 project has not been done before anywhere that could provide example or learnings. This continues to be an untested design for flood mitigation that relies on large amounts of "faith" that things will work out. We request that the regulators require quantitative wildlife studies that will provide the basis for a "before and after" comparison of the impacts of SR1. This project has grown so substantially over time that it is now a massive project and land footprint and its impacts are uncertain. How can the long-term impacts be assessed without quantitative measurements?

a. **Justify the use of these qualitative measure to adequately portray the true impact of the project on wildlife. Explain how the sampling design and EIA monitoring methods enables adequate statistical power to detect and estimate impacts with confidence.**

b. **Describe and assess the potential impacts of the Project due to improved access or altered access.**

Response 414

a. The potential Project effects on wildlife movement and mortality risk are assessed qualitatively using baseline data, scientific literature, professional judgement and past project experience. Although qualitative, this approach is sufficient to assess wildlife movement and mortality risk, which do not have quantifiable measurable parameters applicable to this assessment. Qualitative assessments are a standard approach used to assess potential Project effects on wildlife movement and mortality risk and are in alignment with accepted environmental assessment methods in Alberta.

NRCB QUESTION 415: ELK MAPPING

The Proponent should use other information to determine the movement of elk in the SR1 area. Landowners' knowledge of elk movement doesn't appear to have been used. The lack of access to data from collars should NOT be a barrier to mapping the elk as the landowners have farmed this land for generations and know where and when the elk move such as below the Robinson's hill. See Appendix E for pictures of part of the large elk herd.

a. Species accounts were prepared to support the habitat suitability models developed for key indicator species, including elk (see Volume 4, Appendix H, Attachment 11A, Section 11A.2.4). The species accounts describes the ecology and key habitat requirements (i.e., forage and cover) of elk as well as rating assumptions and adjustments applied to habitat ratings to account for anthropogenic disturbances such as roads.

   Mapping seasonal key habitat requirements (i.e., forage and cover) is an accepted and standard habitat suitability modelling approach used in environmental assessments. Elk movement was not mapped, primarily because the type of data typically required to identify or differentiate between daily foraging movements and seasonal travel routes in the wildlife LAA are not available (i.e., GPS collar data). Furthermore, habitats used for movement might not be directly related to foraging and cover habitats identified using available ecosite attributes mapping.

NRCB QUESTION 418: WILDLIFE DEN DESTRUCTION

Again, the Proponent has not consulted with landowners to see if the "theory" of where grizzlies make their dens is the reality in the thousands of acres of SR1. The Proponent needs to be reminded that the Robinson land and Kamp Kiwanis have "mature conifers" and spring feeding sites. Further, grizzlies are known to follow the Sibbald Elk herd.

a. A nuisance animal is broadly defined as an animal that has potential to damage property such as crops (e.g., elk) or threaten human safety (e.g., bear). During construction or dry operations, the encounter or incident would be immediately reported to the environmental inspector (designated by the contractor as the person responsible for implementing environmental mitigation measures), Alberta Transportation and AEP for further action.

b. As stated in Volume 3A, Section 11.1.4, Table 11-3, change in mortality risk, which includes risk of wildlife-human conflicts (e.g., removal of nuisance animals) is assessed qualitatively. Quantifying future human-wildlife conflicts would require a risk modelling approach using known numbers of human-wildlife conflicts and associated variables (e.g., habitat characteristics, anthropogenic features; see Northrup et al. 2012). The data necessary to develop a conflict-risk model that predicts the probability of human-wildlife conflicts at an appropriate scale is not available for the wildlife LAA. Furthermore, as indicated in response to IR408a, the ENFOR data are not used in this assessment because the majority of records do not provide spatial locations of human-wildlife encounters (e.g., animal–vehicle collisions, complaints) and can only be extracted using broad geographic areas (e.g., wildlife management units), which extend beyond the wildlife LAA and RAA.

   Mitigation measures will be implemented to reduce potential wildlife-human conflicts and mortality risk such as using wildlife-proof containers and completing wildlife awareness training (see Volume 3A, Section 11.4.4.2), which are best management practices to reduce potential human-wildlife conflicts (AEP 2011; Jorgenson 2016; AEP 2018).

c. Grizzly bears typically select den sites that are in dry, high-elevation areas with steep slopes (approximately 30% to 80%) in mature conifer stands or caves near abundant spring feeding sites. They avoid wetlands and areas with high road density and other disturbances (Vroom et al. 1980; Ciarniello et al. 2005; ESRD and ACA 2010; Libal et al. 2012; Pigeon et al. 2014; Pigeon et al. 2016). In Alberta, grizzly bears prefer to den in habitats located in the Rocky Mountains or in the boreal forest (ESRD and ACA 2010). The wildlife LAA does not provide suitable denning habitat for grizzly bears because it is in a relatively more disturbed area and lower elevation compared to the Core Grizzly Bear Zone west of the Project. In addition, there were no wildlife dens identified during the wildlife baseline field surveys; therefore, there are no potential Project effects to grizzly bear dens.

NRCB QUESTION 419: DENS OF OTHER ANIMALS

Has the Proponent counted the number of dens on the SR1 footprint that belong to foxes, coyotes, badgers, weasels, and other mammals? If not, we request a study of the SR1 land for dens. The Proponent needs to estimate the mortality associated with these dens, given the reservoir will be used during the season when animals have their young with them.

What is the Proponent's plan to mitigate loss of dens during SR1 use?

NRCB QUESTION 420: LOSS AND ALTERATION OF HABITATS

The Proponent states that "Because of the variability in the geometries and composition of deposits, a site-specific erosion and control plan will need to be prepared following drawdown as part of post-flood operation." This is another example of the Proponent's "we will figure it out" mentality to SR1. There are just so many unknowns with this project.

Additionally, the lack of inclusion of any information from private lands is shocking. Most of the SR1 land is in private hands. Extrapolating from the small amount of government-owned land to make broad conclusions about wildlife seems immoral and egregious.

We view the habitat loss of SR1 lands as permanent. Redwood Meadows residents are just starting to see growth where sediment was deposited – six years post-flood! If the silt is left, the SR1 would seem to be a wasteland. Further, whatever animals make their home in SR1 post-flood are at risk of another diversion and repeat of the habitat loss. It seems naïve for the Proponent to assume that the "modified grassland ecosite" will be at all comparable and that impacts are "not significant" relative to the current natural state of most SR1 lands. This is naïve and arrogant.

Once again, the Proponent focuses on construction-related and "during flood" wildlife impacts. What about post-flood impacts due to the result of silt accumulation? Moving around the sediment post-flood does not allow for habitat reclamation. Again, how will the silt be prepared to ensure seeding is successful? Although, the Proponent doesn't state this explicitly, it appears that reseeding will be required after each flood. Soil preparation or improvements are not mentioned (and their cost).

The Proponent needs to explain modified grassland in more detail. What is the protein value of this "modified grassland ecosites" versus native grasslands? What is the ability of modified grasslands to withstand fire and drought versus native grasslands? In reality, there looks like the Proponent does not intend for wildlife to return to this area.

Also, where is the cost for the wetland compensation for SR1? We see this cost in MC1 but not in SR1.

Alberta Transportation stated that *During construction, the project would result in the direct and indirect loss and alteration of…habitat*.

a. For both elk and grizzly bear habitats:

  i. Did the assessment of habitat loss include loss due to the use of the emergency and auxiliary spillways? Does this affect habitat below these spillways? Explain.

  ii. Explain how the impact of sedimentation and flood debris removal on wildlife habitat was considered in the assessment. Describe what a sediment control plan will contain as per Volume 3A Section 10.3.1 Page 10.39.

  iii. Explain how this habitat will be reclaimed and describe an assessment of the habitat value of the reclaimed habitat relative to the pre-disturbance habitat.

  iv. Was non native habitat type on private land to be purchased assessed for the potential to offset impacts to the LAA?

Response 420

a. i. As stated in Volume 3A, Section 11.4.2.3, the Project would result in the direct and indirect loss of elk and grizzly bear feeding habitat during construction. In Volume 3B, Section 11.3.2, the assessment of habitat loss did not include loss due to the use (i.e., when in operation, flood waters will spill over below these structures) of the emergency and auxiliary spillways. Habitat below these spillways during floods will be temporarily inaccessible for elk and grizzly bear as water flows overland towards the Elbow River. Volume 1, Section 3.2.3 states, for the emergency spillway, "(it) is designed to operate during a probable maximum flood when the diversion inlet gates jam in the open position and cannot be closed, and when the capacity of the reservoir is exhausted" and in Volume 1, Section 3.2.1.5, "the spillway crest will activate when incoming flow from the Elbow River exceeds 1,720 m^3/s (approximately a 1:500 year flood). The auxiliary spillway may also activate for smaller floods if the conveyance capacity is reduced by debris and sediment at the diversion inlet and service spillway and operations of the gates are not adjusted."

After flood waters recede, overflow on these structures will cease and habitat below these spillways will become accessible again (i.e., no habitat loss) for elk and grizzly bear. Based on the purpose of their design, the probability of use of these structures is low and only used for floods.

ii. The potential Project effects on wildlife habitat due to moving of sediment and flood debris within the PDA are assessed in Volume 3B, Section 11.3.2.2, Page 11.9 and Section 11.3.2.3, Page 11.17, by considering effects on vegetation and wildlife sensory disturbance during post-flood maintenance activities. Details on cleanup (i.e., post-flood operations) could affect elk and grizzly bear habitat are in Volume 3B, Section 11.3.2.3, page 11.20 to page 11.22. Sediment will be moved within the reservoir if it interferes with water flow into the reservoir, or drainage to the low-level outlet, or functioning of the reservoir or associated components.

Because of the variability in the geometries and composition of deposits, a site-specific erosion and control plan will need to be prepared following drawdown as part of post-flood operation. Alberta Transportation (2011) is intended for use in the design, construction and maintenance of erosion and sediment control measures for terrestrial highway infrastructure and would be applicable to work in the PDA, except for instream work. Further details are provided in response to IR381, including erosion and sediment control best management practices. Mitigation measures as part of post-flood operation may include the use of tackifier or sprayable erosion control products as well as the use of a cover crop seed mixture to assist in weed and erosion control on exposed soils, where warranted. Further details regarding tackifier or sprayable erosion control products is provided in response to IR396.

iii. Areas of habitat disturbed during construction in the PDA will be reclaimed using only Certified No.1 seed, unless Certified No. 1 seed is not available for selected reclamation species (i.e., native species). Ecosites cleared of vegetation and reclaimed with native seed mix would reestablish to a modified grassland ecosite due to disturbance during construction (see Volume 3A, Section 11.4.2.3, Table 11-12). The habitat value of the modified grassland ecosite (i.e., reclaimed habitat) relative to the pre-disturbance habitat will depend on the pre-disturbance habitat type. For example, the habitat value of the modified grassland ecosite will be similar to pre-disturbed grassland habitat for elk and grizzly bear. Habitat value of the modified grassland ecosite may be lower relative to pre-disturbed forest habitat for elk and grizzly bear because of lack of cover and/or other forage foods. Modified grassland ecosites are considered in the habitat suitability models for key indicator species in Volume 3A, Section 11.4.2.3, Table 11-12.

Private lands that contain non-native habitat types were not assessed for potential to directly offset impacts to the wildlife LAA as part of any future acquirement agreements.

Following construction, crop and hayland in areas of the PDA would be left fallow. These lands are not considered for reclamation to offset permanent loss of native habitat by Project components. However, crop and hayland are expected to become tame pasture over time, which provides suitable wildlife habitat for grassland-dependent species (see Volume 3A, Section 11.4.2.3, Page 11.46). As such, vegetation succession in these areas is expected to reduce the potential effects of the Project on wildlife habitat during dry operations.

NRCB QUESTION 421: HABITAT LOSS

The Proponent clearly documents habitat loss through SR1. There is much obfuscation and contradiction in this answer, which basically states that species with high mortality will be replaced with species from the replacement seed mix and animals that live in trees and shrubs will be replaced by animals that live in grassland. This appears to us to be lost habitat. Post-flood sedimentation will prevent the "recovery" of native grassland.

What does the Proponent mean by "species composition and productivity may be altered"…but "no reduction in native grassland area is expected following flooding.". These statements are contradictory.

The Proponent states that wetlands lost in SR1 will be replaced (elsewhere, presumably?). What is the cost of these replacement wetlands, **and is this cost included in the SR1 budget?** It does not appear so. Is compensation considered an equal trade for lost wetlands?

Native Fescue Grassland: -8.9 ha

Tree and Shrub Cover: -132.2 ha plus an additional -99.3ha post-flood

Wetlands: -15.3ha and an additional -11.7 post-flood (which will be compensated – we need information on what this compensation looks like.)

Plus, the Proponent describes 40 ha of land covered in silt <100cm and does not describe how many hectares up to 100cm (although RVC report mentions up to 600 acres[59]).

The Proponent should be required to explain the full process of reclamation and associated costs. Reseeding alone will not be successful. The sedimentation will create hard-pack. In their response, the Proponent states that the "overall area of native grassland will increase by 90.6 ha during dry operations." On what basis did they arrive at this projection?

Also, they state "no tree and shrub loss are expected from post-flood sedimentation." On what basis do they make this assertion? We see this statement as optimistic given the weight and composition of the silt combined with prolonged water storage.

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Wetland area will be reduced by 15.3 ha following construction (Volume 3A, Section 10.4.3, Table 10-12) and potentially 11.7 ha from post-flood sedimentation greater than 10 cm deep following flooding (Volume 3B, Section 10.2.4, Table 10-12). However, wetland area lost in the PDA will be compensated and no net loss will occur.

Habitat availability (i.e., quantity and quality) will change as a result of alteration and loss of vegetation. However, changes are expected to be both positive and adverse depending on species-specific habitat preferences. For example, changes that result in the creation of grassland where shrubby or treed habitats previously occurred (i.e., after reclamation) will provide more habitat for grassland dependent species while, at the same time, reduce habitat for species that are associated with shrubby or treed habitats. Examples from the vegetation and wetands assessment are:

> Volume 3B, Section 10.2.2.1 1:10 year flood, "…it is predicted that the shrub layers in mesic/rich e3 shrubland and subhygric/rich f3 shrubland would change to modified grassland e (mesic/rich) and modified grassland f (subhygric/rich), respectively."
>
> Volume 3B, Section 10.2.2.2 1:100 year flood, "Land units with shrub and tree strata that are inundated for prolonged periods are expected to become modified grassland ecosites with similar soil moisture and nutrient regimes."
>
> Volume 3B, Section 10.2.2.3 design flood, "Therefore, it is anticipated that there would be high mortality of species in every stratum (tree, shrub, etc.) comprising upland plant communities. Species that are lost would be replaced, in time, by species within the seedbank, surviving propagules or that can seed-in from surrounding areas…There may be some exceptions, and mortality could occur in the tree or shrub strata; therefore, it is predicted that seasonal shrubby swamp may recover as graminoid dominated marsh following flooding."
>
> "Therefore, sediment deposition between 10 cm and 100 cm would likely result in mortality of species in the herb and short shrub strata, but species in the tall shrub and tree strata would likely survive. Loss of species in the short shrub and herb strata would eventually be replaced through recruitment from surrounding areas."

NRCB QUESTION 422: SEDIMENTATION AND PLANT SUFFOCATION

Clearly the silt will result in plant mortality and therefore mortality of insects and other animals that live there. Has the Proponent mapped the flowering plants that would be impacted by SR1 floodwaters and silt and determined the impacts on pollinators?

The Proponent refers to hay crops in Winnipeg. On what basis is that a fair comparison to these floodwaters? Is the silt deposit in the Winnipeg floodwaters comparable to SR1? In Winnipeg, do floodwaters sit stagnant for the same duration as is expected in SR1? Do the Winnipeg floodwaters have the high sediment composition of SR1 floodwaters?

The Proponent states that, regarding ungulate movement, sedimentation can be “both beneficial or detrimental based on deposition patterns”. Can the Proponent clarify under what circumstances sedimentation would be beneficial to elk? We can only imagine that elk, who currently have access to food and shelter on the SR1 lands, would no longer have the same degree of food or shelter. Further, will the SR1 silt deposition impede elk movement in any way? If so, in what ways?

In part b of their response, the Proponent states that delays of re-establishment of vegetation communities for 10 years of longer can result from greater sedimentation and longer immersion periods. In prior responses, the Proponent makes no mention of delayed re-establishment. How, when the reservoir will be used every several years (we cannot find a consistent projection), will vegetation ever re-establish? How does prolonged re-establishment affect the land-use of the SR1 footprint? How will delayed re-establishment impact the economic model (lease revenues)? How will delayed re-establishment impact the use of tackifiers? How will in impact the ease and duration of silt mobilization by wind?

Will nutrient depletion occur from repeated use of the reservoir? How will this impact re-establishmen of vegetation? Although the Proponent references Winnipeg, we again contend that Winnipeg floods are nothing like SR1 but are curious if soil they refer to in part b was assessed pre-flood and post-flood?

How much are post-flood monitoring and maintenance expected to cost?

Clearly, the Proponent does not have adequate answers for this question.

Alberta Transportation states that sediment deposition may bury and suffocate plants and that depths were modelled.

a. **Discuss whether spatial sedimentation patterns may effect weed establishment and reclamation of native habitat.**

b. **Discuss whether the effects of sedimentation and removal will effect ungulate habitat.**

Response 422

a. Sedimentation patterns will affect weed establishment and reclamation of native habitat. Areas of complete burial and full existing plant loss (i.e., 10 cm and greater) will likely take the longest to revegetate and be at the greatest risk of weed establishment. This will limit revegetation from existing sources and greater assisted recovery measures (e.g., seeding) may be required. Weeds may also establish in areas with 3 cm to 10 cm of sediment; however, reviewed literature indicates most upland and wetland plant species will persist and only small changes in species diversity and abundance are expected (Volume 3B, Section 10.2.2). Post-flood monitoring, as part of the vegetation and wetland monitoring and revegetation plan (see a draft version in the response to IR407, Appendix 407-1), will identify areas of high deposition and monitor for weeds. Monitoring results will inform any mitigation actions for vegetation re-establishment, erosion and weed control.

b. Sedimentation will have both positive and adverse effects on ungulate habitat. Positive effects related to increases in nutrients would occur where sedimentation is less and water immersion of vegetation is for shorter periods. For example, flooding experience in Manitoba has noted that native hay flooded under water for up to 60 days is beneficial for a productive native hay crop (MIT 2015). As stated in Volume 3A, Section 10.2.2, adverse effects would be related to greater sedimentation depths and longer immersion periods,

which can delay re-establishment of vegetation communities for 10 years or longer. This delay may affect forage and cover availability for ungulates (Volume 3A, Section 11.3.2.3, page 11.20 and page 11.21).

Ungulate movement may also be affected in high sedimentation areas by changing topography and cover availability. This could be both beneficial or detrimental based on deposition patterns. Exposed areas could be utilized less frequently than areas with higher cover or low-lying topographical relief.

NRCB QUESTION 423: DOWNSTREAM HABITAT AND FLOOD

The Proponent uses past flood frequency as a predictor of future floods. Given climate change and the impact on the duration, severity and frequency of extreme climate events, this assumption is not realistic. For example, statistics show that in the USA hurricanes are more powerful and carry more water than ever before. This is attributed to climate change.

It is suggested that the Proponent visit Redwood Meadows, now going on seven years post-flood. Considerable weeds have taken over the forest, particularly dandelions. The beautiful and hard-to-grow Indian Paintbrush has almost disappeared since these flowers require a special combination of soil and sand. Weeds and dead brush litter the forest.

a. Explain whether downstream wildlife habitat will still receive periodic floods adequate to maintain habitat function and health.

Response 423

a. Although water will be partially diverted when flows exceed 160 m^3/s, water will continue to flow in Elbow River at a maximum flow rate of 160 m^3/s. Periodic floods will continue to occur, even with partial diversion.

For greater context, the following provides additional information.

Volume 3A, Section 6, Table 6-7, Page 6.29 indicates there have been 12 floods greater than 160 m^3/s since 1934. The recurrence interval for this size of flood is between 5 and 10 years (Volume 3A, Section 6, Table 6-6, Page 6.28). Flood mitigation would modify downstream flows and associated sediment transport (Volume 3B, Section 6.4, Page 6.12). As stated in Volume 3B, Section 6.4, pages 6.12-6.13 for the effects related to these flood operations:

> Temporary Delays: "Given that the Project may have operated approximately 12 times for the period 1934 to 2016, changes to the hydrological regime are unlikely to modify the long term median flow values in a meaningful way, given that the Elbow River is a low-flow system."

> Subsequent Release: "The net effect on the hydrological regime of the Elbow River watershed is not considered measurable because overall water volumes, less evaporation, are maintained. However, the potential for a substantial increase in flow magnitude in the low-level outlet would change the sediment transport regime and as a result, channel morphology."

Retention of water in the off-stream reservoir during diverted floods will reduce peak flows but will not reduce the occurrence of floods.

This might reduce the rate and magnitude of change to downstream habitats (e.g., scour or change in stream bank morphology), but changes to the hydrological regime due to diversion are unlikely to modify the long-term median flow values in a meaningful way (Volume 3B, Section 6.7, Pages 6.76).

Long-term changes in habitat conditions, such as scouring, plant cover, woody debris, supporting habitat functions (e.g., food sources, shelter), and health in downstream habitat are therefore also not expected to change in a meaningful way.

In conclusion, wildlife habitat downstream of the Project will continue to receive periodic floods adequate to maintain habitat function and health.

NRCB QUESTION 424: SEASONAL SURVEYS

We would like to request that these surveys be required for project approval. Again, we reiterate the importance of having good data for before/after comparisons of SR1.

What is the ongoing cost of surveys each year?

Volume 3A, Section 11.4.4.2, Page 11.62

Alberta Transportation states that *Seasonally appropriate surveys will be undertaken to identify key habitat and habitat features (e.g. wetlands, nests) of SOMC before undertaking construction*.

a. Provide examples of proposed seasonally appropriate wildlife surveys.

Response 424

a. As stated in Volume 3A, Section 11.4.2.2, pre-construction surveys will be conducted at the appropriate time of year to confirm presence of species of management concern (SOMC) at identified wildlife features (i.e., raptor stick nests, wetlands) that may require mitigation. Examples of pre-construction surveys designed to protect wildlife features are:

- bird nest searches conducted between February 15 to August 31 to identify active raptor stick or migratory bird nests, targeting raptor SOMC such as barred owl, northern goshawk, osprey, and bald eagle, and migratory bird SOMC such as olive-sided flycatcher, barn swallow, bank swallow, long-billed curlew, sora, alder flycatcher, and least flycatcher

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
RESPONSE TO NRCB AND AEP SUPPLEMENTAL INFORMATION REQUEST 1, JULY 28, 2018

Terrestrial
May 2019

- nocturnal or diurnal amphibian surveys conducted mid-April to mid-June and designed to confirm presence of SOMC amphibian breeding wetlands

- mammal den and mineral lick searches conducted in early spring to identify active dens and ungulate mineral licks in the wildlife LAA

NRCB QUESTION 427: MITIGATION MEASURES

How will the Proponent mitigate dens in nests in the SR1 reservoir or diversion channel in the spring of each year? How will the Proponent mitigate wildlife loss from use of SR1?

Based on the Proponent's responses in this section, it appears that the Project has a significant effected on wildlife habitat!

- If an active nest or den is found, it will be subject to a recommended setback buffer and site-specific mitigation measures developed in consultation with regulators (see Table 11-10 and Table 11-11 for setback buffers specific to SOMC with potential to occur in the PDA).
- All construction traffic will adhere to safety, road closure regulations, and other access measures and guidelines for the construction area and associated access roads.
- Wildlife or livestock will not be harassed or fed. Waste will be stored in wildlife-proof containers and wildlife awareness training will be provided to staff on site to reduce human-wildlife conflict (e.g., bears, see Jorgenson 2016).
- Personnel will not be permitted to have dogs at the construction site. Firearms are not permitted in Project vehicles or on the construction footprint, or at associated project facilities. Incidents with wildlife will be reported to an Alberta Transportation representative.
- Sightings of species of interest will be reported to the environmental inspector(s) or designate. Protection measures might be implemented, and the sighting will be recorded.
- If previously unidentified listed or sensitive wildlife species or their site-specific habitat (e.g., dens, nests are identified during construction), then the occurrence will be reported to the environmental inspector(s) or designate.
- Unanticipated wildlife issues encountered during construction will be discussed and resolved by the environmental inspector(s) or designate, wildlife resource specialist(s), and the responsible regulatory agencies, if necessary.
- Unauthorized vehicles will be prevented from access from public roads by using gates."

Given these mitigation measures, the Project will have no significant effects on wildlife habitat, movement, and mortality risk, and will not threaten the long-term persistence or viability of wildlife in the wildlife RAA. Based on this, no further mitigation for biodiversity is required.

NRCB QUESTION 428: REMOTE CAMERAS & DIVERSION CHANNEL

Given their answer, it appears that the Proponent does not really know if the diversion channel will be a barrier to wildlife. Remote camera monitoring does not seem sufficient to assess the impacts of the diversion channel on wildlife movement.

The newer plan for the diversion channel is almost double the depth of the original channel. It will be a danger to all animals who have well-established paths in this area. It is well known that long-standing paths in the area continue to be followed by subsequent offspring for untold years. For example, one dangerous path for the animals is a path that elk and deer follow at Highway 22 bridge near the roundabout at Hwy 8. In fact, there is a sign on the north side of the bridge warning drivers to beware of animals crossing. This path also crosses where the diversion channel will be. So, yes, there will be a significant impact on the animals that live in the area who follow the walking paths of their ancestors.

In a prior response, the Proponent stated the elk are less likely to use underpasses. We do not see that that knowledge has informed their designs for the diversion channel.

Ultimately, if a remote camera does not detect any elk, because they do not use the underpass, will the conclusion be that wildlife we not negatively impacted? Or, will the conclusion be that the project is a barrier to elk, but it is too late to address it?

It seems likely that adverse impacts to wildlife are inevitable, but the reporting of this impact will be insufficient because it relies on placement of cameras, which will be a guess, relative to a baseline qualitative assessment of wildlife, which is a guess. It doesn't appear to us that the Proponent takes impacts on wildlife seriously, and generally, the view is that the project is too important to be impacted by minor details such as wildlife and their habitat.

What is the ongoing cost for this expansive monitoring program?

Alberta Transportation stated that *A remote camera program will be designed, in consultation with Alberta Environment and parks, to identify whether the diversion channel acts a barrier to wildlife movement…*

a. **Discuss how the remote camera monitoring program proposed will adequately enable confident conclusions on residual impacts to wildlife.**

Response 428

a. Remote cameras are a common tool used to determine potential effects of human development on wildlife as well as to evaluate the effectiveness of mitigation measures (McCollister and van Manen 2010; Barrueto et al. 2014; Burton et al. 2015; Andis et al. 2017; Caravaggi et al. 2017). The purpose of the remote camera monitoring program (as part of the draft wildlife mitigation and monitoring plan; see Appendix IR425-1) is to verify predictions related to residual effects of the Project on wildlife movement in the wildlife LAA, particularly for ungulates such as deer and elk.

   With mitigation, the diversion channel and other Project components would allow for wildlife, especially elk, to cross such structures or be deflected to crossable sections (see Volume 3A, Section 11.4.3.3, page 11.59). The remote camera monitoring program will provide data to estimate occupancy or relative abundance (e.g., number of detections per 100 trap-nights) for species of management concern (SOMC) such as deer, elk or grizzly bear, as well as determine the effectiveness of mitigation applied to sections of the diversion channel (e.g., vegetated areas) by providing estimates of crossing success rates by wildlife. The ability of the remote camera monitoring program to provide robust conclusions will be a function of clearly stated monitoring objective(s) and study design.

As stated in Volume 3C, Section 2.10.3, the remote camera program will be designed to identify whether Project components (e.g., diversion channel, floodplain berm) act as a barrier to wildlife movement, focusing on large mammals such as deer and elk. A conceptual design would include the installation of six remote cameras along the Elbow River in the same locations as used in pre-construction baseline surveys; this will allow comparisons of change in relative abundance or movement during the construction phase. Three of these remote cameras will be placed upstream and three downstream of the diversion structure and will monitor wildlife movement in the Key Wildlife and Biodiversity Zone (KWBZ) for a minimum of one year during the estimated 3-year construction period.

During dry operations, 14 remote cameras will be deployed in the wildlife LAA and monitor wildlife movement for at least one year post-construction. The six remote cameras along the Elbow River will remain at the same locations as during construction. Four remote cameras will be deployed soon after completion of construction and placed at the same locations as pre-construction baseline surveys near Highway 22 (near the raised portion of the highway at the north end of the wildlife LAA). An additional four remote cameras will be installed along wildlife friendly fencing at the edge of the diversion channel at crossable sections where there is vegetation. Remote cameras at the diversion channel will be spaced approximately 1 km apart.

A wildlife biologist will visit the cameras every four months during construction and the first year of dry operations of dry operations to change out memory cards and batteries and check on the overall status of equipment (e.g., positioning, weather related malfunctions, animal or human tampering of equipment).

The details of the remote camera monitoring program will be developed in consultation with regulators and Indigenous groups. A more detailed description of the remote camera monitoring program is provided in the draft wildlife mitigation and monitoring plan (see the response to IR425, Appendix IR425-1).

NRCB QUESTION 429: NESTING BIRDS

The Proponent only really considers the impact on nesting birds during construction. Construction is only one small phase in the life cycle of this project – the main impact on nesting birds will be during SR1 flood operations. Can the Proponent speak to the impact on nesting birds during a flood event? What are the mitigation measures?

Does the Proponent consider the impact of nesting females during construction? Noise, dust and movement of vehicles could cause females to leave the nest.

a. Discuss the effectiveness of bird surveys during the breeding season to identify active nests in the PDA. Will project bird surveys prevent the harm of protected species and do they align with Environment Canada's current 2018 recommendations as it relates to large scale habitat clearing? Explain why or why not?

Response 429

a. If construction activities are unable to avoid the primary nesting period (i.e., breeding season) of migratory birds in the PDA, a qualified wildlife biologist will conduct pre-construction bird nest surveys to manage the risk of harm to nesting migratory birds. Bird nest surveys are conducted to reduce the risk of harm to migratory birds, including species at risk. In open, less complex habitats, nests are more likely to be found compared to forested areas (ECCC 2018). In the PDA, nests will be relatively easy to locate because the habitat is mostly crop, tame pasture, and grassland, which will enhance the effectiveness of the surveys.

Techniques for nest surveys include non-intrusive passive point count or transect surveys in appropriate habitat and low intensity nest searches that involve walking transects through an entire area to be cleared/disturbed. When a nest is found, the species and location is recorded, and a species-specific setback buffer is placed around the nest. Nesting can be determined through the discovery of an actual nest, or through behavioural evidence (e.g., defensive calling and displays, carrying nest material, food, or fecal sacs) and professional judgement. Monitoring of the nest is not conducted because this causes a disturbance to the nest and increases predation risk. Instead, a conservative estimate of fledging date is provided for the nest and a biologist is required to confirm that young birds have fledged, prior to removing the buffer. This survey protocol and recommended bird mitigation align with ECCC (2018) recommendations.

NRCB QUESTION 430: INDICATOR SPECIES

Overall, we do not have the expertise to critique the response to this question.

Generally, the Proponent does not discuss impacts on any species from the flood event. Rather, the Proponent continues to focus on the impacts of construction and dry operations. What about flood and post-flood operations?

For example:

Species	Conservation Status		Potential Habitat Use and Percentages in the LAA at Existing Conditions	Frequency of Occurrence[c]	Potential Project Effect(s)[d]	Key Recommendations/ Mitigation Measures Volume 3A	Project Residual Effects[e]	
	AWA[a]	AEP[b]					Construction	Dry Operations
Black bear (*Ursus americana*)	-	*Secure*	Coniferous, mixed and broadleaf forests, shrubland, grassland, wet meadows, wetlands and riparian areas. Coniferous, mixed and broadleaf forests is 5% (245 ha), 6.1% (296 ha), and 5.2% (252 ha) respectively. Shrublands, grasslands and wetlands are 8.4% (408.5 ha), 8.8% (425 ha) and 6.4% (312 ha) respectively. Overall, low to moderate suitability habitat.	Six FWMIS records in the RAA. Observed in the LAA during 2016 remote camera survey (three detections). Low to moderate potential to occur in the LAA.	**Change in Habitat** Direct habitat loss or alteration, including residences, from vegetation clearing during construction (224 ha – all habitat types combined). Indirect loss or reduced habitat effectiveness from sensory disturbance during construction and dry operations. **Change in Movement** Construction and dry operations could result in alteration of movement patterns (daily or seasonal) because of Project structures and sensory disturbance. **Change in Mortality Risk** Ground disturbance and vegetation clearing can result in increased mortality risk due to destruction of potential den sites, vehicle collisions, and increased bear-human conflicts.	Section 11.4.2.2 Section 11.4.3.2 Section 11.4.4.2	**Change in Habitat** T: Seasonality/Regulatory Dir: Adverse M: Moderate G: LAA Dur: Short term F: Single event R: Reversible E: Disturbed **Change in Movement** T: Seasonality/Regulatory Dir: Adverse M: Low G: LAA Dur: Short term F: Continuous R: Reversible E: Disturbed **Change in Mortality Risk** T: Seasonality/Regulatory Dir: Adverse M: Low G: RAA Dur: Short term F: Irregular event R: Reversible E: Disturbed	**Change in Habitat** T: N/A Dir: Adverse M: Moderate G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed **Change in Movement** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Continuous R: Irreversible E: Disturbed **Change in Mortality Risk** T: N/A Dir: Adverse M: Low G: LAA Dur: Long term F: Irregular event R: Reversible E: Disturbed

https://www.nrcb.ca/download_document/2/83/9200/20190614-at-sir-to-nrcb-re-sir1-response-sec-6-terrestrial

a. **Explain why only 5 indicator species were selected and include the rationale why other species were not included.**

b. **Page 11.37 indicates that only 3 of the five indicator species (elk, flycatcher, and grizzly bear) were reportedly detected during monitoring. Explain how it is useful and/or the limitations of having 2 indicator species that were not detected in the monitoring?**

Response 430

a. Kennedy and Ross (1992) emphasized the importance of focusing environmental assessments during the scoping phase to address the key issues. Therefore, as stated in Volume 3A, Section 11.1.2, page 11.4 "several wildlife species of management concern (SOMC) were used to focus the assessment. SOMC represent birds, mammals, and amphibians that depend on a variety of habitat types (e.g., grassland, forests, wetlands)".

   Furthermore, it is a standard environmental assessment approach to further focus wildlife assessments by choosing indicator species. As such, six wildlife species (i.e., olive-sided flycatcher, Sprague's pipit, sora, northern leopard frog, elk, and grizzly bear) were chosen as indicators to assess potential Project effects on wildlife.

   Wildlife key indicators included SOMC that are either legislatively protected (i.e., species at risk) or important for traditional and economic use. It is important to emphasize that although six wildlife species are chosen as indicators, other wildlife species were addressed using a habitat-based approach to assess potential Project effects on SOMC. All 19 species at risk with the potential to occur in the wildlife RAA are assessed (Volume 3A, Attachment A). In addition, 36 wildlife species of cultural importance to Indigenous groups are also discussed in Table IR430-1.

Overall, assessing all 86 wildlife SOMC (see Volume 4, Appendix H, Table 3-12) individually would result in an overly repetitive and redundant assessment because there are multiple species that share similar habitat associations. This approach would not provide a better wildlife assessment or change the conclusions of the wildlife assessment.

Olive-sided flycatcher, sora, and Sprague's pipit are chosen as key wildlife indicators because the pathways for potential Project effects on migratory birds would be similar for a broader group of species represented under the *Migratory Birds Convention Act* (MBCA) that are dependent on forest, wetland or grassland habitat types.

Similarly, elk and grizzly bear are considered representative of wildlife species used for traditional purposes because these species depend on a variety of seasonal habitat types that would include other wildlife species of traditional importance such as mule deer, white-tailed deer, coyote and weasel that also depend on similar habitat types (e.g., grassland, shrubland, forest).

Northern leopard frog is chosen because it is a wetland dependent species sensitive to changes in proximity of habitat types required for breeding, foraging and overwintering.

Of the six key indicator species, Sprague's pipit and northern leopard frog were not detected during baseline surveys. These two species are listed as *threatened* and *special concern* under Schedule 1 of the *Species at Risk Act*, respectively, and are expected to be relatively rare, based on the abundance of low suitability habitat identified within the wildlife LAA (see Volume 3A, Section 11.2.2.4, Table 11-8). However, non-detection of Sprague's pipit or northern leopard frog does not equate to absence of the species in the wildlife LAA. Although these species were not detected, habitat suitability models developed wildlife assessment represent suitable grassland and wetland habitat for these species, which provides a valuable and standard approach to assessing potential Project effects on wildlife. The non-detection of Sprague's' pipit or northern leopard frog does not affect the mapped distributions of high, moderate, and low suitability habitat in the LAA (i.e., the suitability maps provide a valid and reasonable assessment of potential Project effects on these species).

NRCB QUESTION 431: WILDLIFE ABUNDANCE

It is our view that the Proponent has always been dismissive, without evidence, of the wildlife in the SR1 area. We See Appendix E. Again, in order to fully evaluate the long-term implications of SR1 on wildlife, we request quantitative wildlife studies prior to project approval. We must be able to assess, quantitatively, the impacts of SR1. The lack of precedents for this type of project necessitate that additional research and data for measurement purposes be collected. It is not acceptable to generalize outcomes of this project, the likes of which have not been done before.

a. Define the term *wildlife abundance*.

b. Discuss the confidence of these surveys in establishing the abundance of wildlife. Will it enable detection of any changes in populations post construction to inform the residual impacts?

c. Explain why quantitative methodologies was not used to estimate residual effects on wildlife abundance.

Response 431

a. Wildlife abundance refers to the representation of a wildlife species in a particular habitat type. To clarify, the wildlife field surveys conducted in the wildlife LAA provide estimates of relative abundance (i.e., an index of abundance) and not absolute abundance (see Volume 4, Appendix H).

b. The breeding bird, amphibian, rail, raptor nest and winter tracking surveys were conducted following provincial protocols (ESRD 2013), most of which require repeat visits to increase species detection. These wildlife surveys included a remote camera survey, which resulted in 3,207 camera-days of survey effort (see Volume 4, Appendix H, Section 3.6). These data are adequate to provide baseline estimates of relative abundance in the wildlife LAA. Overall, prediction confidence is moderate based, on the quality and quantity of baseline data (see Volume 3A, Section 11.6).

   Any comparison of baseline and post-construction relative abundance data will be limited to species identified in the wildlife mitigation and monitoring plan (WMMP), which will be developed in consultation with provincial and federal regulators. Any limitations of the study design to detect potential changes in relative abundance or other metric(s) will be discussed in the plan. A draft WMMP is provided in the response to IR425, Appendix IR425-1.

NRCB QUESTION 432: LOSS OF NATIVE HABITAT

We do not have the expertise to critique the response to this question. It appears that the Proponent is opting for reclamation for the SR1 area, rather than restoration. We are unsure of the long-term implications of this choice. Reclamation does not expect the ecosystem to return to a natural landscape.

a. Explain how the Alberta Transportation arrived at the conclusion that the 20% of native upland and shrub habitat types would not have any measurable impacts to species that depend on these habitats while considering the fact that many of these habitats are difficult or impossible to restore.

b. Define reclamation and restoration. How do these two forms of mitigation differ and why one or the other will be chosen for disturbed areas.

a. Volume 3A, Section 11.4.5.3 specifically addresses Project residual effects on biodiversity, which acknowledges potential Project effects on wildlife species dependent on upland communities including bird species richness. As stated in Volume 3A, Section 11.4.5.3, "Shrubland and grassland would be reduced by up to 20.8% and 21.1% in the local wildlife LAA, respectively during construction (see Table 11-12). Reclamation of disturbed native upland and shrub habitat types will be reclaimed using an Alberta Transportation native custom seed mix (see Volume 3A, Section 10.3.1, Table 3-10). Reclamation would result in an additional 91 ha of grassland habitat in the LAA during dry operations, a 21% increase from existing conditions."

As stated in Volume 3A, Section 11.4.5.3 and Volume 4, Appendix H, Section 3.1.1, shrubland and grassland communities have relatively lower bird species richness and relative abundance compared to other habitat types in the vegetation LAA. Overall, the conclusion that species richness is unlikely to measurably change is based on 1) the abundance of native upland and shrub habitat types remaining in the vegetation LAA and RAA and 2) proposed reclamation, which will reduce the effects of habitat loss.

b. Restoration is the process of assisting the recovery of ecosystems that have been degraded, damaged or lost (Society for Ecological Restoration 2004). Restoration typically aims to recover stable and adaptable natural or semi-natural ecosystems that are the same or similar to the natural system prior to disturbance (Burton 1991; McDonald et al. 2016).

Reclamation is the process of stabilizing sites, controlling pollution, improving visual conditions and facilitating future land use (Burton 1991). Reclamation, aims to create conditions supporting similar land uses to those of pre-disturbance (ESRD 2013).

Conditions and functions do not need to be identical to pre-disturbance.

Because of the potential for future disturbance from floods, reclamation is favoured over restoration over much of the PDA (in the reservoir); however, restoration will likely be targeted to high value native communities in areas of temporary disturbance lacking abundant weeds or aggressive non-native plant species. Restoration is typically the costlier approach and success is dependent on site conditions. Conditions such as abundant weeds, excess nutrients, and alterations in surrounding lands can limit success. The following areas will be topsoiled and seeded at the end of construction:

- the south (non-river) side of the floodplain berm
- the upper side walls of the diversion channel

- the dam embankment
- contractor laydown areas

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- borrow source 1
- spoil areas
- side slopes and backslopes of new roads
- areas disturbed by utility construction
- temporary construction access roads that have been decommissioned
- the decommissioned portion of Highway 22
- the temporary channel used to create in-the-dry construction conditions
- all other areas disturbed by construction that are not required for operation and maintenance

NRCB QUESTION 433: INSTREAM INFRASTRUCTURE

We do not have the expertise to critique the response to this question. We request that the Proponent be forced to compare SR1 infrastructure against the in-stream infrastructure at MC1 site.

Volume 3B, Section 11.3.3, Page 11.22

a. How will the in stream Elbow River dam infrastructure affect aquatic wildlife movement (for example: waterfowl, aquatic wildlife etc.)?

Response 433

a. During dry operations, the diversion inlet gates will be closed, but the crest gates in the service spillway located in the Elbow River channel adjacent to the diversion inlet will be open to allow for movement of aquatic wildlife. The service spillway bays are designed so that fish passage is maintained with minimal adjustments to the functioning of the service spillway (see the response to IR91). This also allows for movement of waterfowl or semi-aquatic mammals (e.g., muskrat, beaver, mink) to pass through the structure.

During flood operations, the crest gates in the service spillway are positioned to build backwater at the diversion structure to help drive floodwaters into the diversion inlet. The movement of aquatic wildlife in Elbow River would be temporarily blocked until diversion of flood waters cease.

NRCB QUESTION 435: GRIZZLY BEARS

See Appendix E for images of grizzlies on the SR1 lands. Based on conversations with landowners, it appears to us that the Proponent has made a concerted effort to minimize the grizzly reporting on the SR1 footprint. Grizzlies bear impacts were one reason SR1 was chosen over MC1, which was considered more favorable for grizzlies. The MC1 area has heavy off-highway vehicle use and extensive logging. Meanwhile, the SR1 footprint is home to the Sibbald Elk herd. We have been unable to find justification for this conclusion that MC1 has more grizzlies and ask for evidence to support that assertion by the Proponent.

Question 435

Volume 3A, Section 11.2.2.4, Page 11.28

EBA 2010 reference in Volume 3A as well as project monitoring confirmed grizzly bear movement east west in the project and local area.

a. Why were impacts to this movement and risk not further assessed or discussed? Explain rationale and included detail on grizzly movements in the Elbow river valley.

Response 435

a. The Project residual effects on grizzly bear movement (including east-west movement) are discussed in Volume 3A, Section 11.4.3.3, page 11.60. A summary of the conclusions can be found in Volume 3A, Section 11.7.2, page 11.88.

SECTION 5: HEALTH (NRCB QUESTIONS 438-448)

AT Responses: https://www.nrcb.ca/download_document/2/83/9196/20190614-at-sir-to-nrcb-re-sir1-response-sec-7-health

GENERAL QUESTIONS

Who were the authors of the health studies and what are their accreditations and experience?

We contend that there is a natural filtration system (Cathy Ryan study) that exists along the Elbow River Watershed. There is a risk to this natural system which may adversely impact drinking water quality and quantity for residents using the Elbow River (including water co-ops, wells and larger-scale treatment facilities). We ask for a comprehensive assessment of the water systems that will be impacted by SR1.

MC1 COMPARISONS

Our communities believe the health risks from MC1 to be significantly lower than from SR1. The Proponent is requested to comment on the human health risks that would result from the McLean Creek option relative to SR1. The Proponent should consider dust and mosquitoes along with stress and impact on people regarding the transportation highway building projects.

POST-FLOOD HUMAN HEALTH IMPACTS

The Proponent discusses construction health effects, but there is little focus on positive health effects and opportunities to reduce stress through tourism that will occur if MC1 reservoir is used as a tourist destination.

SR1 does not protect upstream communities in times of flood nor the more recent threat of wildfires. Currently many residents in Bragg Creek and Redwood Meadows have increased stress during the months of April – October, the wildfire season. This area is at high risk of wildfires because the forest is old and aging. The whole area was put on evacuation notice May 2018, which retraumatized many residents who lived through the 2013 flood, it was the same fear of losing all their homes, belongings, and families being endangered. MC1 offers a reservoir for quicker access to water for water bombers and firefighters and it is therefore more reassuring to local residents. Trauma leads to lost time at work, and other mental and physical health problems and costs.

In addition to worries about floods and fires, residents in the area are stressed and concerned about the continuing catastrophic erosion of the Elbow River banks. This erosion and changing direction of the river from the safe north bank to the unsafe south bank is a significant concern because there is a diminishing buffer of the forest between the river and Redwood Meadows.

In addition, residents in both towns are now aware of the impact of the alluvial aquiver which can flood their basements again, and berms will not be able to protect them because this type of water goes under the berms. Significant personal and insurance costs occurred in the prior three floods from basement flooding. Insurance costs continue to rise significantly because of this being a flood plain and it is noted that the governments approved building on the plains. It is likely that continued financial support would be required once again in the case of a future flood because SR1 provides no capacity to manage the Elbow River.

RISKS OF STANDING WATER

What are the human health risks related to the standing water in the SR1 reservoir between the heat of the summer in June to Sept?

As the climate changes, mosquito populations may become vectors to carry more diseases not typically associated with northern climates.

RISKS OF BY-PRODUCTS OF STANDING WATER

Will the Proponent be responsible to eliminate odours or other by-products from stagnant floodwater that will exist in the standing water and likely beyond the project footprint?

STANDING WATER & MOSQUITOES

The Proponent has not discussed or addressed the potential for increased mosquito activity in the SR1 reservoir.

Is there expected to be increased mosquito activity on the SR1 footprint, relative to its current uses, once the reservoir there is standing water? If so, what does the Proponent's research show will be the increase, include in the response their assumptions and various scenarios of flood. Provide information on how far mosquitoes can travel within the local area and predict any impacts within the local area. Advise if there is any expected increase in West Nile or Zika risk for people and animals, both wild and domestic. If increased mosquito activity is expected, please predict or comment on mosquito activity at the Springbank community soccer park and schools, which are approximately three km east of the reservoir. What testing and mitigation measures are proposed to manage this risk for our children?

In a flood event like SR1, residual mud up to 4m thick may be contaminated with toxins and pathogens from Bragg Creek and Redwood, and may harbour West Nile virus, Eastern Equine Encephalitis, and California Serogroup viruses during reservoir draining, endangering schools and residents (Springbank, Aspen Creek, Discovery Ridge in Calgary, Tsuut'ina) downwind.

WATER TESTING

There needs to be testing for water quality before SR1 is built as a benchmark for all landowners in the SR1 footprint and within the Springbank area, for all water cooperatives and for all water plants upstream of the Glenmore Reservoir. The reason is that some will likely have aquifers and springs running into their wells which may become contaminated or the quality of water degraded such that it may become unsafe to drink or to use for livestock.

There needs to be testing for water quality and quantity/flow rate before SR1 is built so that there is a benchmark for all landowners and their animals, all water cooperatives, and all water plants upstream of the Glenmore Reservoir in the SR1 footprint and in the Springbank area. This water a significant concern due to the fact that the Springbank area is full of springs and aquifers which would be impacted by the weight from combined weight of water and silt.

What are the Proponent's plans for testing on an ongoing basis and post-flood?

WATER REMEDIATION

Identify what water quality remediation plans will exist and what compensation or other remuneration would exist for compromised water quality (sedimentation, cyanobacteria, etc.) for landowners, water plant owners and water cooperatives.

CITY OF CALGARY'S UPCOMING WATER SHORTAGE

The Proponent has not recognized the seriousness of the City of Calgary's predicted water shortage by 2036, or sooner. This means that there will be an urgent request coming soon from Calgary that the Alberta Government must help by building a permanent dam, such as MC1.

See Appendix G. "From Flood to drought, Calgary council talks how to manage city's water supply."

AIR QUALITY & HEALTH (NRCB 447: PM 2.5)

Re: https://www.nrcb.ca/download_document/2/83/5555/sir-1-july-31-2018

Has the Proponent provided enough information to assess the impacts on the local area from the silt once the reservoir is used? Will the silt mobilize under windy conditions? If so, how long is this effect expected?

What is the range of airborne silt mobilization and what are expected quantities?

Is mobilization of silt expected through silt-cleanup or silt-redistribution to allow channels for water? Please explain.

SECTION 6: DAM SAFETY (NRCB QUESTIONS 449-528, IAAC (CEAA) QUESTIONS IR1-1)

AT Responses:

IAAC (CEAA) : https ://www.nrcb.ca/download_document/2/83/9090/20190614-at-eia-to-nrcb-re-IAAC (CEAA)-ir-response-package-1

NRCB : https ://www.nrcb.ca/download_document/2/83/9202/20190614-at-sir-to-nrcb-re-sir1-response-sec-8-damsafety

COMMUNITY QUESTIONS AND OBSERVATIONS

Flooding in the City of Calgary in 2013 resulted in the loss of 5 lives with estimated costs reported at $378 million ($55 million for emergency response plus $323 million in recovery costs). A large of portion of these costs can be attributed to flooding along the Elbow. The proposed SR1 dam will capture and store water as a means of moderating flow rates to less than170 m^3/sec below the Glenmore dam.

Historically, while it understood that dams provide significant benefits, dams can also have adverse effects on ecosystems, hydrology and water quality (N. LeRoy Poff, n.d.). Dams can negatively impact the relationships between communities and political jurisdictions in both upstream and downstream directions (Brown, 2008). Specifically, the placement of large dams upstream of populated areas do represent significant safety hazards that may present unacceptable risks.

The Proponent's report indicates that the design of the SR1 dam is based on the peak flow rate experienced during the 2013 flood (estimated to be 1,240 m^3/sec) and the need for an active storage capacity of 7,777,100 m^3 (i.e., the capacity necessary to moderate river flows below the dam to safe levels) (Stantec, 2018) (Question 1). The report further states that elements within the dam structure are designed to pass *required dam safety flow* determined as *the probable maximum flood (PMF)* ***and*** *1/3 between the 1:1,000 year and the PMF for the floodplain berm*[60] (Question 2).

Table 3-1 of the Proponent's report provides several flow rates and associated flood return periods. No return periods are provided for the Design Flood and the Probable Maximum Flood and no flow rate is given for a return period of 1:1000 year referenced in the PMF calculation. The report indicates that regression analysis was used to determine these return periods. We would also like to better understand (in simple numerical terms) how flood return frequencies

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60 *The PNF is defined as "the flood that may be expected to result from the most sever combination of critical meteorological conditions that are reasonably possible in the drainage basis".*

relate to discharge flows and storage volumes. In addition, we would like to understand the relationship between and reservoir volumes and water level in the reservoir (Question 3).

It is unclear if climate change, changing land-use patterns and urban development were considered in determining the peak discharge rates within the Elbow River basin. Climate change (linked with changes in the Earth's radiation balance due to increasing greenhouse gases) is expected to increase atmospheric and oceanic temperatures; influence the hydrological cycle and result in changes to the spatial and temporal patterns of precipitation and rates of surface runoff. For the Elbow River, the rates of surface runoff are influenced by the timing and duration of precipitation events and changing land-use patterns in the watershed such as increased urbanization and logging. Changes in climate combined with changes in land use are anticipated to increase flood frequency in mid-late spring and increase the frequency of drought conditions later in the year due to a lack of precipitation. Increased streamflow and a greater risk of flooding occurs in mid-late spring due to an increase in snowmelt and rain-on-snow events (Farjad, 2015). We would like to understand how climate change has been factored into the design of the SR1 dam (Question 4).

Trade-offs are associated with dam storage capacity and its ability to moderate stream flow, as with river flow rates and flood damage. In addition, trade-offs are associated also with dam storage capacity and the risks to individuals and society as a whole who are located downstream of a dam (i.e., the greater the volume of water stored, the greater the hazard, the higher the risk - the larger the population downstream, the larger the consequences to society, the higher the risk).

From the perspective of the City of Calgary (i.e., the desire to moderate flow rates, avoid floods, and protect residents, and homes and infrastructure) and on the basis of the Proponent's report alone, the construction of the SR1 dam appears to meet their needs. The failure of the proposed SR1 dam during storage operations, at full pool, would be characterized by a rapid high-volume release of water resulting in extreme consequences (i.e., potential consequences include loss-of-life, economic losses (direct and indirect), losses such as environmental damage

Summary of Flood Frequency Estimates at the Diversion Structure
(Table 3-1 from Stantec Report)

Flood Return Period	Estimated Peak Discharge at the Diversion Structure (m^3/s)
1:2 year	70
1:5 year	140
1:10 year	200
1:100 year	765
Design flood (2013 flood)	1,240
Probable Maximum Flood (PMF)	2,770

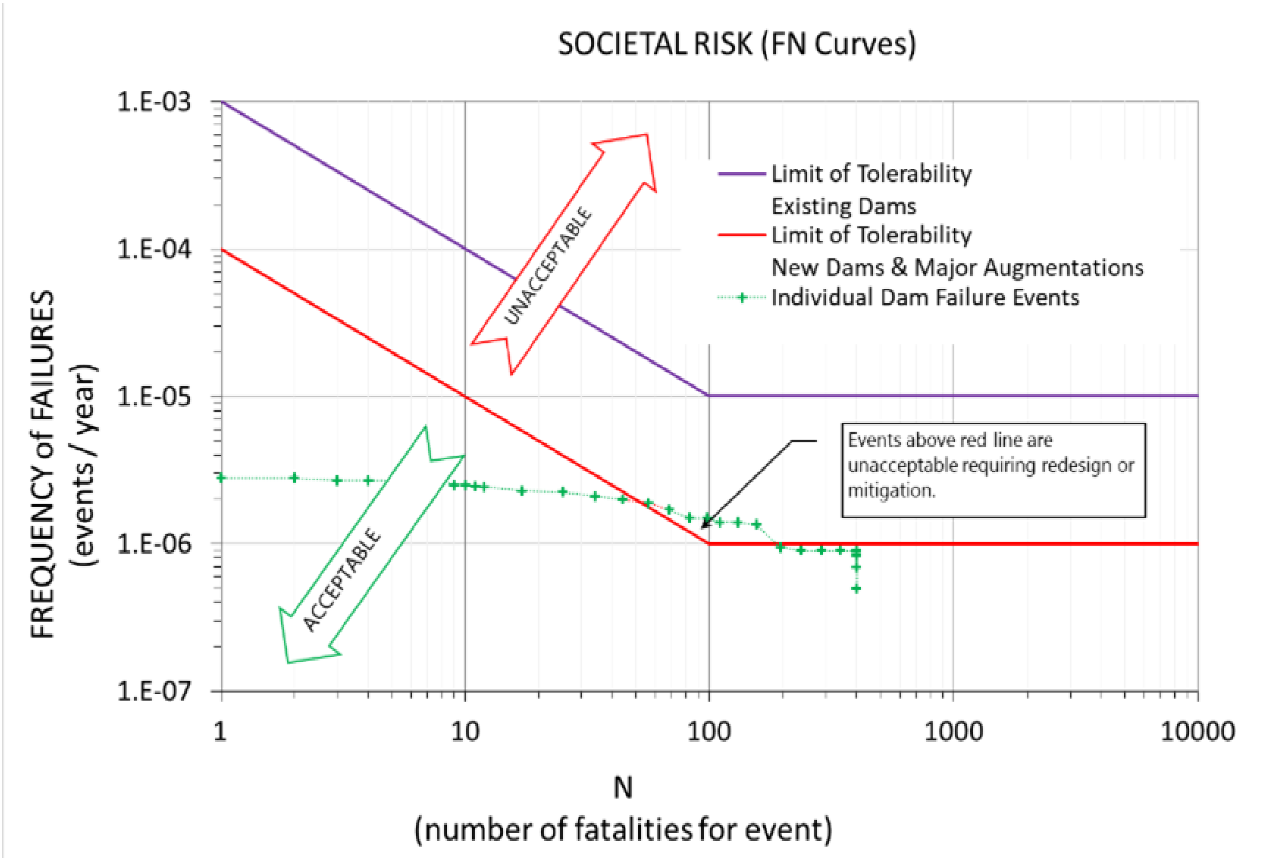
and public health impacts, and intangible consequences such as cultural heritage consequences and social trauma.).

The report indicates that the dam *'design is classified as an "extreme" consequence dam and the floodplain berm is classified as a "very high" consequence dam"*- in accordance with many standards and required factors of safety. While we agree that there is a relationship between standards and reductions in failure frequencies, failures can and do occur. It is troublesome that, having classified this dam as an *"extreme consequence dam"*, the Proponent has not seen fit to present these consequences.

It is noted that assessment and decision processes used to consider this project appear to rely on many subjective, qualitative assumptions rather than objective, quantitative ones. Guidance provided to dam owners and managers indicate that they "*should develop a comprehensive understanding of consequences of dam failure and undertake risk assessments. The details of the risk assessment should be proportionate to the level of risk."* (Department of Environment, Land, Water & Planning, 2013). It would be useful for decision makers consider the hazards and risks of a range of options using well established quantitative risk assessment (QRA) tools and methodologies. QRA methods can be used to evaluate the acceptability of the project by evaluating trade-offs in cost and the level of safety delivered; e.g., comparing reduced dam storage capacities to increased stream flow capacities (e.g., stream widening, higher berms and and/or the relocation of people and infrastructure). These comparisons may emphasize viable alternatives that deliver higher levels of safety at lower costs. Assessing alternatives using QRA methods provides a more consistent and objective basis to support decisions.

Figure 1 provides an example of QRA results used to evaluate the societal risk of a dam. The tick marks shown as a green line represents the expected frequency and the consequence (i.e. number of fatalities) associated with specific dam failure scenarios (small to catastrophic failures) and the cumulative frequency of each successive larger consequence events. These results are compared to accepted societal risk standards for new and existing dam (the solid red

*Figure SEQ Figure * ARABIC 1 Example - Societal Risk Acceptability Curves*



and purple lines).

Where societal risk (the green line) exceeds acceptable risk (the red line for new dams), the risk would be deemed unacceptable and mitigation measures or a redesign of specific dam infrastructure may be considered to preclude such events.

From the perspective of upstream communities (i.e., Bragg Creek, Tsuut'ina Nations, Redwood Meadows and portions of Springbank), this dam provides ***absolutely no mitigation of flow rates***. During periods of high stream flow conditions, flow rates will continue to be what nature delivers: i.e., dependent upon the combination of critical meteorological and hydrologic conditions that exist at the time. These conditions are expected to increase above historical rates in early spring and decrease in the summer and fall in response to climate change and increased forest harvesting and urban development in the Elbow River basin. Cumulatively these increased flow rates would be expected to contribute to greater stream meander, bank erosion and flooding at lower elevations along the Elbow River which may limit egress from the area and negatively these communities in other ways.

Specific safety concerns of upstream communities include:

- Increased flow rates in the Elbow River at levels outlined in the Proponent's report may result in flooding in the Hamlet of Bragg Creek and could result in loss-of-life and significant damage to property and infrastructure including roadways and highways. Potential flooding of roadways and highways would restrict egress from West Bragg Creek and will allow egress only to those that can access Highway 22, Highway 758 and Highway 66 to the south. The elevation of the intersection of Highway 22 and Highway 758 are relatively the same as the elevation of the river (Question 5)
- River erosion and meander is accelerated during high-energy flow conditions and is cumulative. Over time or during a high flow event, erosion occurring above and south-east of the Floodplain Berm may alter the river channel sufficiently to bypass the auxiliary spillway leaving the dam ineffective (Question 6).
- The proposed dam does not mitigate other secondary hazards associated with climate change such as drought (security of water supply) which would affect other firefighting capabilities.
- Changes required to elevate Highway 22 above reservoir height along the current (north-to south) alignment, may result in roadbed instability at higher water levels that may limit egress. During winter conditions (when the dam is not operating) and given the higher embankment of the roadway, its current alignment, and prevailing strong westerly winds in the area, the roadway may be subject to drifting and icing which would contribute to more accidents with more serious outcomes. Certainly, driving a semi along this section of highway with 90 km wind gusts would not be a pleasant experience (Question 7).
- The planned loss of access to portions of Springbank Road during normal and emergency flood operations may inconvenience local residents and more importantly, can contribute to limiting egress from the area during an emergency (Question 8).
- While the report indicates that the Floodplain Berm has been designed to rigorous standards and guidelines, many areas in Springbank are comprised of layers of clays interspersed with gravel lenses. We are concerned about the integrity of the hill and the interface between the berm and the hill at the northeast extent of the reservoir (Question 9).

Emergency management requirements for dams operating in Alberta are described in Appendix H. It is understood that that these plans are generally not required at the application stage but must be in place prior to the start of facility. The focus of emergency management planning for dams, is in the downstream direction. As noted in 'Attachment A' an Emergency Preparation

Plan (EPP) and an Emergency Response Plan (ERP) are prepared by the operator and serve as an annex to Municipal Emergency Plans (MEP) but do not replace or supersede existing MEP's or those of other responding agencies. While this process has proven effective, we wish to comment on the need for a broader based plan, one that considers the response needs (people, resources and training) and coordination for all of the communities located on the drainage system: i.e., a supper plan. For high-flow, flood situations along the Elbow generally affect everyone along the river, at the same time. Using a broader-based approach is requested as a consideration as many of communities involved have volunteer fire departments, different levels of training, may use different response systems, may use different communication protocols, and may have limited resources.

We believe it would be valuable to have a 'super ERP', in place and that such a plan be reviewed as part of a hearing process to ensure that all of the functions as outline in Attachment B are addressed and that responders are working together. We understand that this type of consideration is outside of CEAA considerations but we feel that this is an important issue to bring up at this time.

Other general comments

As citizens of Alberta we understand the need for all Albertans to be safe, protect their homes and property and their livelihoods. We want this outcome for all Albertans and for our neighbours in the City of Calgary. We also understand that flood and the recovery from the flood of 2013 resulted in many negative outcomes: i.e., deaths, environmental damage and public health impacts, and intangible consequences such as cultural heritage losses and social trauma, and costs. We also understand that these costs are borne by all Albertans.

Notwithstanding the above, the construction, manning and maintenance of the proposed SR1 dam is, and will continue to be, a costly endeavour. Despite what some have said, from the perspective of the upstream communities and from a view of the safety, our principal concern is that 'the proposed SR1 dam provides absolutely no flood mitigation along the upper Elbow River'.

Further, if we believe the science, climate change is already impacting the intensity and ferocity of precipitation events and the onset of drought conditions: the new reality. Solutions are needed now and over the longer-term. While members of the community would prefer to see a more conventional dam farther upstream (one that provide other benefits including flow management, security of water supply, revenue from electric generation, and recreational opportunities), we do expect that our communities, our properties and the beautiful land we live on will be protected as well.

We believe that the Provincial process for considering and approving this dam is flawed. From our perspectives:

- the Proponent appears predisposed to the construction of unproven ‘dry’ dam;
- the technical information supporting this project applies both quantitative and qualitative information that seem to bias the decision to toward an approval;
- the Proponent is the Government of Alberta who are at the same time charged with the decision to approve or not;
- the Government has budgeted funds within this budget year for this project; and
- the approval process limits intervenor status such that only those who directly and adversely affected (i.e., on land to be acquired for the project or those who border the project) can be heard in the hearing process.

QUESTIONS

Question 1. Please provide a digital copy of the 2013 flood hydrograph data from the Glenmore Reservoir's level gauge and the available locations and other data used in the study.

Question 2. This statement is unclear. Is the result a rate or a volume? How is PMF related to the floodplain berm?

Question 3. Please provide a summary of regression analyses and the equations used and complete the missing values the in green coloured cells on the table below. Please provide the numerical values representing the maximum storage volumes of water, surface elevation, and remaining freeboard associated with the each of the flood return periods: i.e., the yellow shaded cells on the table below.

Description	Flood Return Period	Estimated Peak Discharge at the Diversion Structure (m^3/s)	Maximum Associated Storage Volume (m^3)	Elevation at Water Surface (m)	Freeboard above Surface (m)
?	1:2 year	70	?	?	?
?	1:5 year	140	?	?	?
?	1:10 year	200	?	?	?
?	1:100 year	765	?	?	?
?	1:1000 year	?	?	?	?
Full pool	?	?	?	?	?
Maximum Over Pool	?	?	?	?	?
Design flood (2013 flood)	?	1,240	?	?	?
Probable Maximum Flood (PMF)	?	2,770	?	?	?

Question 4. Was climate change considered in the design of the SR1 dam? Please describe this consideration.

Question 5. Has the Proponent examined potential flooding at flow rates at or above the design flood rate of 1,240 m^3, at Bragg Creek, at Redwood Meadows and/or along the Elbow River between Bragg Creek and proposed diversion structure? If so, please provide this information and indicating the elevations of water at each flood location for the range of river flow rates evaluated and any recommendations developed in this examination.

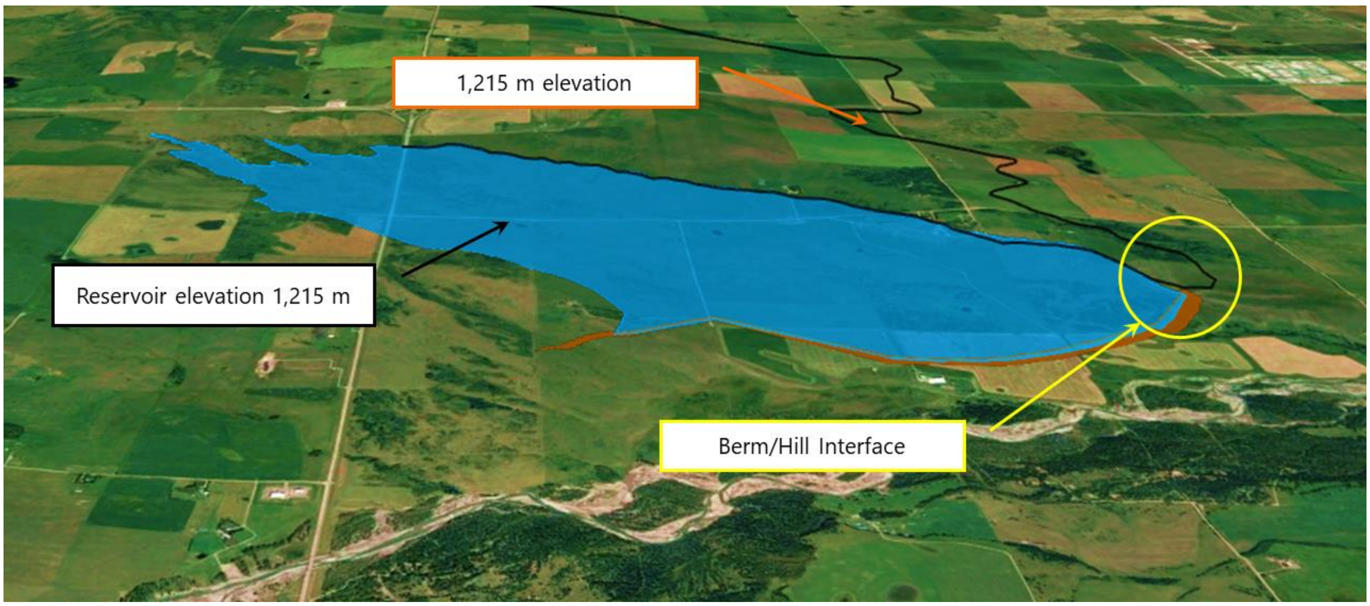
Question 6. Has the Proponent examined the possibility of cumulative erosion above and south-east of the Floodplain Berm that would result in river bypassing the auxiliary spillway? If so please indicate where it is in your materials or provide a summary of this examination and recommendations.

Question 7. Have issues of winter operations of Highway 22 been examined? If so, please provide a summary of this examination and the recommendations.

Question 8. Intermittent flooding of this road would be expected to degrade both the roadbed and road surface. At what storage volume would the road be closed to traffic and would this occur during normal testing of the facility? What is the expected frequency of closure? Is the Proponent prepared to a commitment to maintain this road bed into the future? As a comment, maintaining this road could be costly and given the current political climate, we would expect that a commitment should be provided through a legal document.

Question 9. Figure 2 on the next page shows the area of interest in the yellow coloured circle. What geotechnical studies were done to establish the integrity of the hill? Who was the consultant? Please provide a copy of their recommendations.

Figure 2 *Interface between Floodplain Berm and Hill*



Bibliography:

Alberta Environment. (2003). *Emergency Preparedness for Flood Emergencies at Dams.* Edmonton: Alberta Environment, Regional Services.

Brown, P. H. (2008). Modeling the costs and benefits of dam construction from a multidisciplinary perspective. *Journal of Environmental Management*.

Department of Environment, Land, Water & Planning. (2013). *Guidance Note on Dam Safety Decision Principles.* The State of Victoria Department of Environment, Land, Water and Planning.

Farjad, B. (2015). *A Modeling Framework to Investigate the Impact of Climate and Land-Use/Cover: Change on Hydrological Processes in the Elbow River Watershed in Southern Alberta.* Calgary: U of C.

First Response Emergency Services: A Division of Skystone Engineering. (2012). *Review of International Emergency Management Systems.* Calgary: Skystone Engineering.

N. LeRoy Poff, e. a. (n.d.). *The Natural Flow Regime: A Paradigm for River Conservation and Restoration*. Retrieved from https://journals.sagepub.com/na101/home/literatum/publisher/sage/journals/content/ppga/1986/ppga_10_1/030913338601000116/20160818/030913338601000116.fp.png_v03

Stantec. (2018, 3). Volume 1: Project Description. *Springbank off-stream Reservoir Project, Environmental Impact Assessment*, p. 253.

COMPREHENSIVE RISK ANALYSIS

We request a risk analysis of the SR1 project by a 3rd party. We don't have the confidence in STANTEC to perform an independent risk assessment of SR1. Given the importance of the structure integrity of SR1 and the requirement for the infrastructure to be operated in real-time during a flood event, it is imperative that we understand the various situations in which SR1 could be compromised and the likelihood of flood-event operations (human error, malfunctions, etc.) contributing to risk over time.

In the 2014 Bow River Basin Council report, the risk measurement approach is discussed. The BRBC proposes a risk assessment that considers "coordinates" versus "multipliers" based on "a belief that risks of an extreme impact, even ones with a remote chance of occurring, should be given greater prominence than those with insignificant impacts and a certain chance of occurring". We think that this type of risk assessment (based on "coordinates") should be considered for SR1. In fact, given the Proponent is dismissive of dam failure as a possibility, we note that the BRBC included the following table. Also note, that in 2019, the Spencer Dam in Nebraska failed. The earthen part of the berm failed, causing massive downstream flooding and one fatality.[61]

> The following addresses the question of whether or not any such extremely low probability, high consequence events have ever occurred.
>
> Major Dam Failures[15]

Dam	Year	Fatalities	Cause
South Fork Dam, Pa	1889	2,209	Over-topped , spillway design & debris
Malpasset, France	1959	423	Geological instability
Buffalo Creek, Wva	1972	125	Poor construction & heavy rain
Canyon Lake, SD	1972	238	Outlets cogged with debris
Teton, ID	1976	11	Internal erosion (earthen dam)
Laurel Run, Pa	1977	40	Heavy rain, dam over-topped
Val di Stava, Italy	1985	268	Poor maintenance, design flaws & outlet pipe failure

It is with regard to dam safety that we question the thoroughness of the Proponent's risk assessment and short-term view of the project. Many dams fail well into their life-cycle. SR1 brings particularly challenging elements to a risk assessment: quick response time for operations, high sediment and debris loading, wet/dry cycle of use, slope stability / integrity, impact of wave action over the long run, impact of silt accumulation, uncertainty of retention times, existence of pipelines traversing the reservoir, and possible weaknesses resulting from unpredictable groundwater behaviour. This is a complex project and difficult to fully assess for risk due to its unprecedented natures.

[61] https://en.wikipedia.org/wiki/Spencer_Dam

We are also concerned about egress in a flood-situation and do not think this issue has received adequate attention from the Proponent. Upstream communities have limited road access points, and in 2013, the Bragg Creek bridge was closed, cutting off access to West Bragg Creek.

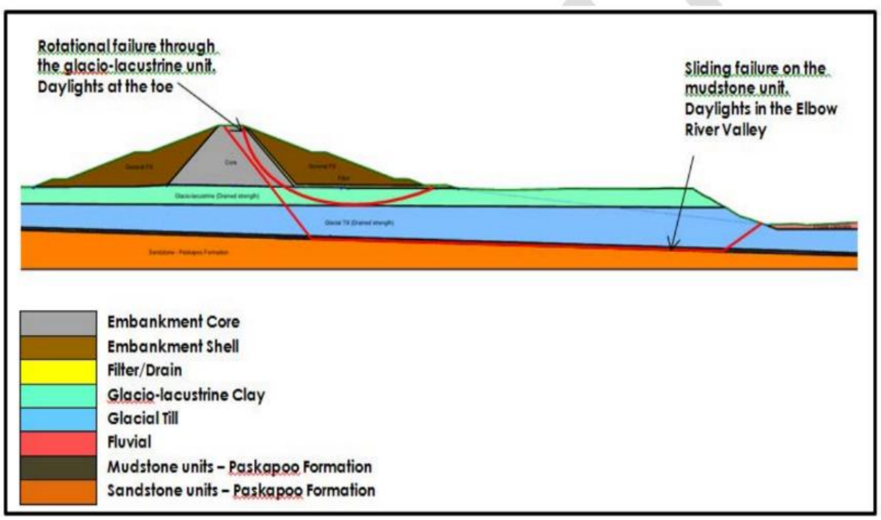
ENGINEERING:

What reports are available that discuss whether the reservoir is stable on what we know to be springs and clay?

At SR1 there is an abundance of freshwater springs along the Springbank Creek drainage within the glacial till and fluvial lacustrine sediments that underlie the proposed reservoir area. These threaten the reservoir bottom and earthen dam stability.

MC1 would be built on Wapiabi shale formation bedrock outcrops. Because MC1 would have a permanent reservoir and a bottom release outlet, steel footings in this bedrock will provide excellent stability for even a 70-100MM m^3 reservoir.

From https://www.nrcb.ca/download_document/2/83/9134/20190614-at-sir-to-nrcb-re-sir1-response-appendix-ir14-5



PIPELINE SPILL

The Plains Midstream pipeline runs under the SR1 footprint. Plains pipelines have had two spills in the last eight years (https://globalnews.ca/news/1371575/plains-midstream-pleads-guilty-fined-1-3-million-for-two-oil-spills/). What are the consequences of a spill while the reservoir is in operation? We don't think that the Proponent's suggestion to hold the spill in the reservoir until it can be cleaned up is an acceptable response. What are the health and environmental consequences of retaining a spill in the reservoir? (https://globalnews.ca/news/621417/dark-coloured-crude-oil-up-on-the-trees-the-red-deer-river-spill-one-year-later/). Further, what is the risk to the groundwater supply from a spill in the reservoir?

ENGINEERING & DAM TOE

Re: Appendix IR 14-5

This report raises issues with the dam placement, stability and the potential erosion into the dam toe by the Elbow River.

Comments below by Dr. Dave Klepacki, PhD. MIT in geology and geophysics, P. Eng.:

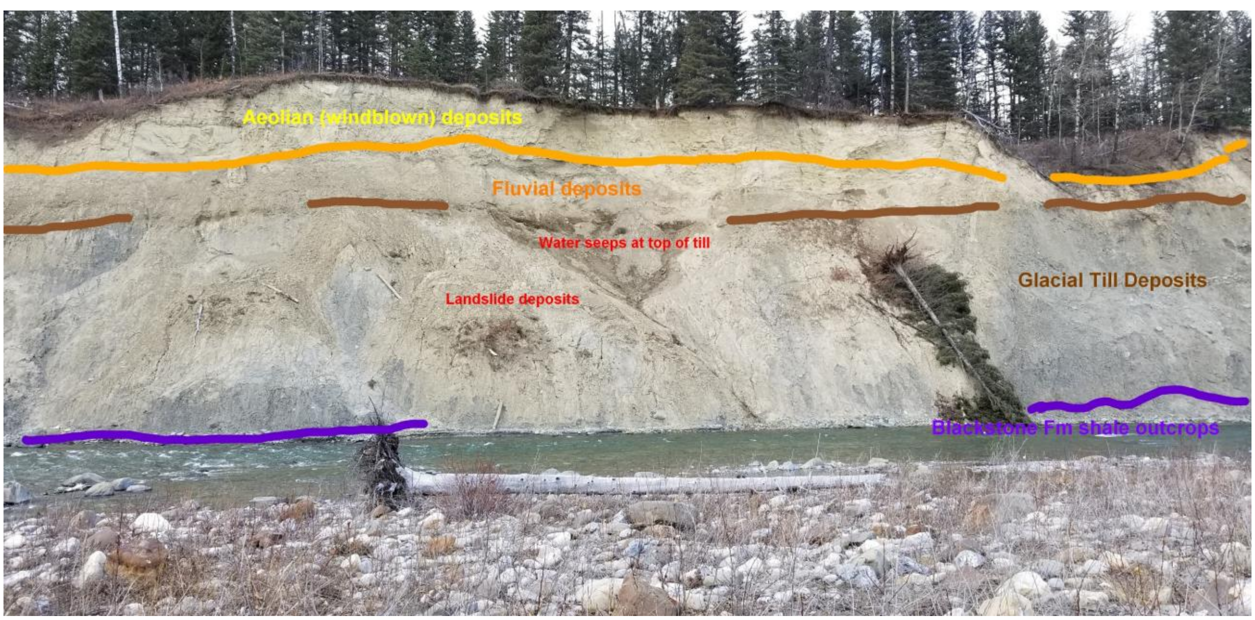
For their geotechnical and strength calculations, the Proponent says they used Slope/W by Geoslope (a Canadian firm). Based on reviews of this software, it appears to be a relatively expensive ($4,500) but clearly "second tier" software using 2D "Limit Equilibrium Methods" to calculate failure. Half a dozen engineer reviewers described the LEM assumptions as "stay away from" or "voodoo mechanics." Apparently, the best slope stability software is 3D finite element models called SVSLOPE from SoilVision, Plaxis2/3D or FLAC 3D. We believe these software choices would have yielded more accurate results by using the changing water saturations in the earthen dam structure and surrounding actual soil columns and weakness horizons.

The Proponent's geotechnical model was based on commonly used soil assumptions rather than real data as there was "limited available site data," and the model will change as "the full drilling and laboratory results become available." This was a red flag for me given the geological sections in Figures 4 and 5. The potential failure surfaces Stantec foresees are a "normal rotational failure" i.e., landslide, a failure along a mudstone layer at the top of the bedrock Paskapoo Formation and what looks like a columb slip surface (as opposed to a layer weakness in the glaciolacustrine clays and soils) to the river free face. My concern is that the mechanical properties of the actual soil column likely are significantly different from what has been modelled. The actual columns might have water seep surfaces (high pore pressure and weak) and different soil weakness layers. At the large river cutbanks near the water facility at Redwood Meadows, there is widespread water seep and landslide slip surface at the base of a 3-4 m thick tan glacial loess (windblown sediment) unit and a 5-6 m lower dark grey clay-rich till unit just above Alberta Group shale and sandstone bedrock. We do not know whether that surface extends the 5km downstream to the SR1 area, but it could be present in the report Figure 2. In my view, the Proponent should take the time to do a finite element or finite difference model with actual mechanical and porosity and water saturation properties taken from test boreholes as we mention above.

The report addresses potential erosion of the dam toe and failure by continued northward cutting of the Elbow River at the dam location. However, reliable models were not used to calculate erosion. On pages 2 and 3 they describe techniques to calculate bank erosion rates and settled on a simple model 1975 study by Hicken and Nanson of western Canadian rivers relating channel curvature to channel width. This model was superseded by a paper by Nanson and Hickin in 1986, adding variable factors for discharge, shear force and bank height, which was also superseded by a series of papers in 2001 and 2010 that discovered helical flows downstream of maximum channel curvature caused downstream migration of height. These equations modelled “normal” flood events and it seemed to me did not include sparse large flood discharge that typically induces the largest channel migration. We have noted that hydrologic models have no capability of calculating channel meander and erosion. The first somewhat successful numerical hydraulic model of meander and erosion incorporating sediment load, chaotic helical and turbid flow, and momentum transfer required a supercomputer in 2016. Bottom line, they had better overengineer hardening the banks of the Elbow at the Springbank dam.

Regardless of the modelling, their proposal to “train” the river and prevent meander cutbank erosion into the dam toe includes these measures: 1) In attachment 2.2 they propose a series of groynes (little diversion berms like those at Bowness Park) to mitigate bank erosion in a flood event (760m3/s, assuming 600m3/s is diverted into the canal and the sum 1360m3/s equals Stantec’s flood event assumption). 2) Similarly, in attachment 3.1 they propose rip rap revetment to mitigate erosion. Ultimately their alternative location on attachment 4, moving the dam farther from the river, adds additional safety from toe erosion by the river from their calculations.

The image below shows the glacial stratigraphy at Redwood Meadows, similar to that at the SR-1 site. Note the seepages at the top of the till (deposits compacted under the ice sheet). The deposits above the till appear to be sliding on this lubricated surface creating the landslide deposits. This weakness was noted by Stantec in their NRCB response. A dam should be at least seated in the till, and preferably the bedrock to mitigate this potential weak zone.



After this picture was taken by Dr. Dave Klepacki in the summer of 2019, there have been two more land slides into the Elbow River at this location in the past six months indicating that the high cutbank continues to be unstable and eroding. It is also noted that these landslides are occurring just a few meters above the Town of Redwood Meadows water intake so there will need to be monitoring of the impact of tons of clay and shale narrowing the river above the water intake, and potentially speeding up the water flow downstream to what may be the SR1 intake.

From a financial perspective, has the Proponent updated the benefit/cost analysis to include some element of bank-toe stabilization or groynes? If not, has the benefit/cost analysis been updated to include the $615k of new costs from shifting the structure?

SAFETY OF ELEVATED ROAD (HIGHWAY 22)

There are numerous winter accidents on Highway 22 north and south of Highway 1 due to the strong westerly winds, which create slippery conditions on the north/south roadway. The Proponent needs to comment on the impact of elevating a long section of Highway 22 and the risk of this section icing over in high-wind, snowy conditions versus the current at-grade roadway. Will elevating the roadway exacerbate slippery conditions (one only has to consider the bridges in Calgary, which get extremely slippery, especially on north-south roads). Further, we would like the Proponent to comment on the number of accidents near the Highway 1 interchange in winter and discuss the implications of elevating this road?

IAAC (CEAA) IR1-01 ACCIDENTS AND MALFUNCTIONS – WORST CASE SCENARIOS

- Generally, the response lacks details.
    - How many lives are at risk?
    - What infrastructure is at risk and what costs are associated with that risk?
    - Failure of the diversion structure would seem to imply that the whole SR1 system would fail, hence the consequences of that failure would be the same as if the project did not exist. That is not what Alberta Transportation claims in their response.
- Has the Proponent conducted First Nations analysis for a range of SR1 failures? Loss of life and property damage downstream?
- The risk of a pipeline rupture and the corresponding impact on fish and wildlife and humans should the oil be held in the off-stream reservoir for an extended time period is not presented. How long will cleanup take under various volume scenarios?
- Mortality of wildlife in this response and others seems to be trivialized in Alberta Transportation responses.
- Note that alternative means exist that do NOT have this oil pipeline risk – specifically MC1.
- Seems like a non-response. Any civilian could call the Environmental Response Line.
- The assertion that released product would not affect groundwater seems unsubstantiated. The project footprint has multiple free-flowing springs.
- For all questions, the references to Volumes and Sections make it unclear for a layperson to figure out where to find such references. Links would have been useful

STRUCTURAL INTEGRITY (NRCB QUESTIONS 489 – 529)

NRCB QUESTION 489: REPAIRS & SILT REMOVAL IN-RIVER, STRUCTURAL INTEGRITY

Give the expected silt deposit build-up in the reservoir and related structures at various flood scenarios. How will the build-up evolve over time (multiple uses of SR1)?

What is the risk that silt accumulation impedes the future function of ANY of the structures associated with the reservoir, diversion channel, gates, outlets, spillways, etc.? People in Redwood Meadows comment that the silt deposits from the 2013 flood have taken on concrete-like properties. Is this hardening of silt contemplated in the future functioning of the reservoir and its components?

If the silt is expected to be removed, please explain under what circumstances it will be removed, the mechanism, its expected cost and the impacts on the community (dust, trucks, noise, frequency). Explain where the silt will be moved to, if in Rocky View County.

NRCB QUESTION 491: FLOODPLAIN DIVERSION BERM – INADEQUATE INFORMATION

We need to understand the function and operations of this floodplain berm in more detail. As with most berms, it will likely narrow the river, causing a higher velocity downstream. What will this structure look like from Highway 22? We request hiring an expert regarding the impact of berms to further investigate this potential problem.

SECTION 7: APPROVALS (NRCB QUESTIONS 529-537)

AT Responses: https://www.nrcb.ca/download_document/2/83/9190/20190614-at-sir-to-nrcb-re-sir1-response-sec-9-approvals

WATER ACT (NRCB QUESTIONS 529-533)

We request that Springbank Road be evaluated by regulators as a dam.

OTHER (NRCB QUESTIONS 534-537)

Dr. Dave Klepacki wrote a letter to Mayor Nenshi which provides a good summary of the importance of not building SR1. See below.

From: Dave Klepacki
Sent: March 19, 2019 1:45 PM
To: themayor@calgary.ca
Subject: Springbank vs Mclean

Dear Mayor Nenshi and staff
I am a retired geophysicist and geologist with a deep interest in natural systems, especially the Elbow River valley where I have recreated in and lived for 30 years. In the past I have been an admirer of your administration's fact-based policy decisions. However, concerning the Springbank Off-Stream Flood Storage Project, your comments are very disappointing and betray this history of thoroughness and honesty. I do understand the political forces applied to municipal and provincial governments by some residents of Elbow Park, Rideau and Roxboro as I have attended Calgary River Communities Action Group meetings.

As a witness to (and sometimes victim of) the 1995, 2005, and 2013 floods. I have read and am familiar with the reports listed below regarding flood mitigation along the Elbow River. The decision to pursue SR-1 was a political decision made in the summer of 2015 based on reviews of previous reports with no new data gathered and analyzed in that process. Most work since 2015 deals with planning and design at SR-1 rather than data collection and analysis at MC-1 other than a short wildlife count (of 1 moose as I recall) and several geotechnical drillholes. Following 2015, MC-1 was carried forward the alternative option required in meeting federal permitting requirements.

Last November (2018) I was asked to present a review of SR-1, MC-1 and the "Tri-Rivers Project" to Deputy Transportation Minister Crystal Damer and most of the Stantec Flood Mitigation team. In that review the following points were raised.

1. No known "off stream reservoir flood control projects' are found elsewhere in the world (Winnipeg, Manila and Houston are diversions or in-stream). SR-1 would be the first of its kind in the world and is unproven in capability at other jurisdictions. Jurisdictions with similar climate and topography to SW Alberta, such as Switzerland, Germany, Norway and Japan use in-stream dams for effective flood mitigation and are currently involved in projects that allow flooding of floodplains where feasible, and deep-seated impermeable dykes where infrastructure protection is necessary.

2. SR-1 does not address the more widespread and costly basement flooding (rather than surface flooding) that occurred in Elbow Park, Rideau and Roxboro; as well as Redwood Meadows and Bragg Creek. This flooding occurs because of the widespread distribution of the subsurface gravel and sand aquifer as demonstrated by Prof Cathy Ryan and her students from the University of Calgary (Abboud et al., ENSC501). Only controlling river level height can control this flooding because of the hydraulic potential between the river level and groundwater level. Thus, berms at Redwood were ineffective and proposed berms at Bragg Creek will also be ineffective at unless seated in bedrock, significantly increasing costs. With SR-1 flows higher than 600m3/sec will continue down the Elbow to Glenmore dam with the possibility of high river levels and recurrence of widespread basement flooding in floodplain communities.
3. The benefit-cost analyses of IBI of 2015 and 2017 are now clearly inaccurate in land purchase, planning and design costs, infrastructure movement and reconstruction costs, and environmental assessment costs. SR-1 costs should include berms at Bragg Creek and Redwood Meadows as well as Upper Springbank Rd/Hwy22 and Hwy 8 interchanges and are near $700MM. Rocky View County faces significant future property tax losses at the SR-1 site and reimbursement has not been addressed. This is one point that resulted in their opposition to SR1.
4. River flow levels for both the Elbow and Bow Rivers have been decreasing in the last 80 years. Drought and water quantity and quality are and will be a significant issue and only McLean Creek as a year-round reservoir will help ameliorate water supply issues. Water demand for Calgary is expected to exceed supply in 2034 at current usage levels. Similarly, wildfire suppression such as the May 2018 Champion Lakes Wildfire will continue to be a concern for communities on the west side of Calgary.
5. Environmental reviews of soil-born pathogens in mud/dust following a flood event at SR-1 remains an issue for IAAC (CEAA).
6. The ~200 head Sibbald elk herd and some 4-6 grizzly predators have been observed and recorded at the SR-1 site creating threatened species issues in IAAC (CEAA)'s environmental assessment.
7. Geotechnical work concerning dam and levee stabilization in Springbank soils and groundwater flow at SR-1 remains to be done. Geotechnical studies at MC-1 indicate the Wapiabi formation bedrock will provide a stable footing.
8. The Tsuu T'ina Nation, who are concerned about the negative effects of any projects along the Elbow River and within their ancestral lands.

I understand that Stantec has asked for an 18-month extension in their review for IAAC (CEAA). I hope our presentation, which included the following points, supported their reassessment

I understand the political need to espouse CRCAG. If you want a more objective view, I am available to meet with you and discuss these issues (at no cost) at your convenience. As a scientist and resident of Bragg Creek my real concern is the ecological integrity of the Elbow River watershed and its ability to deliver pure and cold water to my grandchildren and the wildlife, fish and flora that depend on this riparian corridor. This includes the 600,000 (and growing) residents of Calgary that will rely on the Elbow River for their water and a sanctuary to enjoy and restore their physical and mental health.

Thank you. Dave Klepacki

Monenco 1979, Interim Report Elbow River Flood Study.

Alberta Environment, Approved Water Management Plan for the South Saskatchewan River Basin (Alberta). Alberta Environment, August 2006.
Water for Life, Assessment of Potential Water Storage Sites and Diversion Scenarios Final Report, MPE Engineering Jan 2008 Elbow River Basin Water Management Plan ERWP 2009 Community Flood Mitigation Advisory Panel (Markin, DiManno, Lindseth, Oct 2013) Report on ENSC501 Door-to-door Survery of Flooding in Redwood Meadows June 2013 WaterSMART Elbow River Historical Detention Sites Jan 2014 AMEC Southern Alberta Flood Recovery Task Force 2014 Elbow River Report Alberta Environment and Sustainable Resource Development Performance Measures Development Project Sept 2014 IBI Golder Provinical Flood Damage Assessment Study Feb 2015 IBI Benefit Cost Analyses Feb 2015 (Glenmore Reservoir, Springbank Off Stream Flood Storage, McLean Creek Benefit Cost) AMEC Environmental Overview of Conceptual McLean Creek Dam Feb 2015 WaterSMART Room for the River Bow Basin Pilot Feb 2015 Deltares "Review of Two Mitigation Projects: Bragg Creek/Springbank Off-Stream Flood Storage and McLean Creek Flood Storage". Oct 7 2015 Alberta Environment and Parks "Recommendations on the Elbow River Major Infrastructure Decisions, October 2015 Alberta Dept of Transportation Springbank Off-Stream Reservoir FAQs Openhouse Dec 2016 AMEC Foster Wheeler Bragg Creek Flood Mitigation Project (Geotechnical Data, Bridge Assessment, pHRIA report) Feb 2017 Springbank Off-Sream Reservoir Open House, Aug 2017 Stantec Springbank Off-Stream Reservoir Project Environmental Impact Assessment, Oct 2017 Springbank Off-Stream Reservoir Project Environmental Assessment, March 2018 Groundwater Flooding in a River-connected Alluvial Aquifer. Abboud, Ryan and Osborn, Jour Flood Risk Management 2018 Groundwater flooding, not Sewer Backup, blamed for damaging homes along Elbow River in 2013, M Lowry re Abboud et al., UToday June 2018
[Lunar Reconnaissance Orbiter composite]

Dave Klepacki, PhD

Essential Earth Mentoring

1500, 605 5th Ave SW, Calgary AB, Canada T2P 3H5

dklepacki@essentialearthmentoring.ca<mailto:dklepacki@essentialearthmentoring.ca>

1-403-512-4447

www.essentialearthmentoring.ca<http://www.essentialearthmentoring.ca>

APPENDIX A: WILDFIRE DOCUMENT

See separate attachment delivered via email with submission.

APPENDIX B: REDWOOD MEADOWS

This is a review of the Redwood Meadows flood of 2013. In the rush to choose a project to protect Calgary, there was little consideration of the communities of Bragg Creek and Redwood Meadows. Both communities struggled to recover from the flood of 2013.

REDWOOD MEADOWS: 2013 EXPERIENCES

The following picture shows the smallest breach of the river into Redwood Meadows. The urgency was so great at the two main breaches on the north and south parts of Redwood Meadows that no pictures were taken of the hundreds of volunteers who worked tirelessly in

those two areas.

The northern and southern parts of the berm were severely damaged, costing millions of dollars to repair, along with costly repairs needed for the water treatment plant, again, as it was not protected following the 2005 flood. Repairs to the berm were made in 1995, again in 2005, as well as in 2013, costing millions of dollars each time.

History and science indicate that dirt berms are useful for annual erosion, but they do not hold up under the ravages of flood waters nor alluvial aquifers.

The following is a picture story taken during the June 19-20, 2013 flood. Taken by Christopher Martin photography.

These clouds dropped massive amounts of rain at the same time as snowmelt was occurring in the mountains, resulting in the flood.

Shown below is the results of some of the sandbagging work of emergency workers, volunteers, residents, and skilled heavy machinery crews who kept replacing the gravel and rocks that were hauled in. The rocks were placed during the day and night because they kept being washed away. In fact, one front-end loader operator who worked overnight almost lost his life as the water tore away the dirt around his machine in the dark. Fortunately, he noticed he was in trouble just in time to move his machine back to more solid ground. Notice the mud and silt in the water, and the shark fin waves—rarely seen in a river—depicting how violent the river was as it neared its peak. Also note all the large rip rap. These were all swept away by the flood, many caused the damage on the Highway 22 bridge, closing it for repairs on its west side. This rip rap was later replaced for a third time (1995, 2005, 2015) for millions of dollars each time.

The flood waters have lowered. The town is saved. A catastrophic amount of riverbank and trees are gone. Notice there are no trees left nearby on the riverbank edge. Residents now joke that they have a clear view of the mountains, whereas before they only saw the 70-foot-high trees along this stretch.

Cement blocks were added because the dirt in the dirt berms was washed away along with rip rap. This is evidence that dirt berms do not fully protect when there is a flood like SR1, and also the lesser flood of 2005 also damaged the dirt berms significantly. Each time there's a big flood it costs the Alberta Government/taxpayers millions of dollars to repair berms. As well in 2005 the entire water intake system at Redwood Meadows was washed away and had to be replaced costing millions. In 2013, because of the damages, more millions were spent to raise the water intake. If there had been upstream protection like a dam at McLean Creek this would be prevented because the flood waters could be managed by a dam.

Layers of mud and silt, filled with toxins, blanket the once beautiful forest along the Elbow River at Redwood Meadows. The mud and silt remain six years later.

MARY ROBINSON'S PICTURES OF HER RANCH IN THE 2013 FLOOD

The following pictures depict the severe damage to Mary Robinson's property. Note that her property is located at the Proposed SR1 intake so it remains vulnerable to further floods and potential problems from the proposed SR1 Intake.

The aftermath of the flood pictures showing the silt that remained. This is likely what SR1 land will look like after a flood.

HIGHWAY 22 BRIDGE

Water full of debris, including millions of dollars of Rip Rap from Redwood Meadows berms, and 70-foot evergreen trees. This is the reason the west side of the bridge was closed for a few weeks to repair the damage. Cost is unknown for these repairs.

HIGHWAY 66 BRIDGE

The Highway 66 bridge was significantly damaged during the 2013 flood. It is susceptible to similar damage in future floods because there is no upstream protection with SR1 for this important infrastructure. Cost is unknown for these huge repairs and building a temporary bridge for summer 2013 for the thousands of tourists.

APPENDIX C: HISTORY OF THE SR1 DECISION

It is evident from the history of the SR1 decision-making process that there has been no meaningful consultation. By meaningful consultation we mean that discussions are held before a decision is made so that concerned citizens can have input. A major project such as this, which affects five communities and concerns finding the best option for flood control, requires community input from the start.

As shown in the historical summary that follows, there was no meaningful consultation, even according to Calgary Mayor Naheed Nenshi. Also, the focus of the SR1 decision was based solely on economics. It did not include environmental or social impacts as specifically stated by IBI.

1934

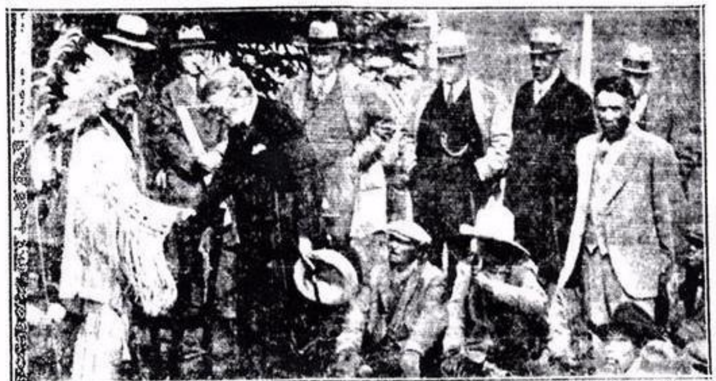
We would like to point out that Provincial / First Nations agreements are long-standing within Alberta. There has been in the past meaningful consultation with First Nations as shown in the next article stating “Indians, City Reach Agreement.” (July 1934)

It states that the councillors of the Sarcee Indian tribe voted unanimously to sell 593 acres of their reservation to the city so that that city could build the Glenmore water dam project.

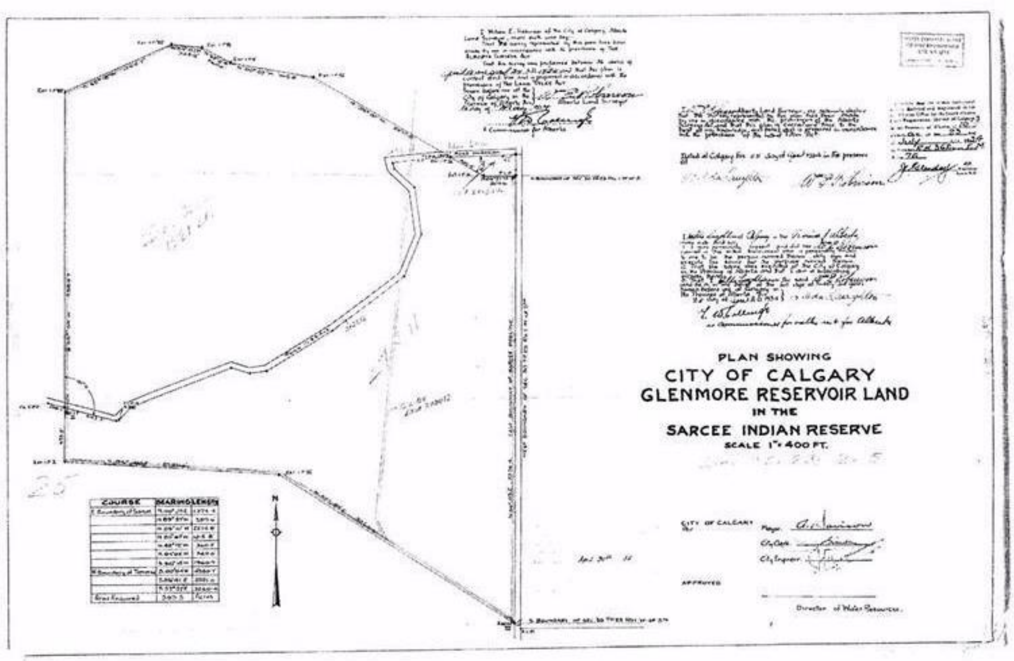
The Sarcee Nation representative is shaking hands with the City of Calgary representative to complete the negotiations. In order to have a unanimous vote, there were meaningful consultations between the two parties.

In contrast, there was no opportunity for the Tsuut’ina Nation as they are now called, to have their nation consulted nor to vote on the project and then to shake hands to seal the deal cooperatively as shown in the 1934 picture below.

INDIANS, CITY REACH AGREEMENT



Chief Joe Big Plume of the Sarcee Indians sealing the deal by shaking hands with City Solicitor L. W. Brockington, K.C., after the councillors of the Sarcee Indian tribe voted unanimously to sell 593 acres of their reservation to the city as part of the new water dam project. In the background, reading from left to right, are: Alderman R. H. Weir, H. S. Jones, valuator; Commissioner A. G. Graves, E. B. Nowers, valuator, and W. E. Robinson, city waterworks engineer.—Photo by W. J. Oliver, Herald Staff Photographer.



2014

On September 26, 2014, the Progressive Conservative Government announced that their chosen option for flood control for Calgary was SR1, see below. Notice that the decision was solely made by the Alberta Government; there was no consultation with those affected prior to this decision. It came as a surprise to everyone.

PRENTICE ANNOUNCES FLOOD PREVENTION PROJECTS IN CALGARY AND HIGH RIVER[62]

By Melissa Gilligan Online Reporter Global News

The provincial government has committed to two mitigation projects aimed at protecting Calgary and High River from future flooding.

On Friday, Premier Jim Prentice announced the Government of Alberta would be constructing a dry reservoir in the Springbank area west of Calgary to accommodate potential flood waters from the Elbow River. In addition, they'll be creating a south diversion of the Highwood River in High River.

Prentice said the projects will be completed as quickly as possible, but must first undergo both an environmental assessment and public consultation.

The Premier also committed to negotiating a long-term agreement with TransAlta to ensure the Ghost Reservoir, situated west of Cochrane along the Bow River, would be able to accommodate flood waters on the Bow River, further protecting the City of Calgary.

[62] *https://globalnews.ca/news/1584782/prentice-announces-flood-prevention-projects-in-calgary-and-high-river*

MAYOR NENSHI RESPONDS WITH CRITICISMS OF THE ONE-DIMENSIONAL NATURES OF SR1[63]

On September 27, 2014, Calgary Mayor Nenshi spoke out in response to the premier's flood mitigation commitment Friday.

He stated that the City's flood experts weren't consulted in what he calls "a significant departure from previous policy".

"The premier, just yesterday, announced he would be treating municipalities as true partners," says Nenshi. "We look forward to that." The Glenmore Reservoir has been eliminated from the province's flood diversion strategy. Previously, provincial plans suggested the reservoir would play a key role both in flood and drought years.

According to Nenshi, the alternate Springbank reservoir "dry dam would not be used except during a flood and would not allow for comprehensive water management".

Nenshi is also asking the province to share relevant engineering studies with the city. He's skeptical in regard to claims the two projects would protect Calgary during 1-in-100 to 1-in-200 year flood events.

"The Government of Canada in a recent study indicated that 1:100-year standard is no longer appropriate," says Nenshi. "Calgary needs protection to a much higher level. Recent discussions with Provincial officials have been focused on mitigation at a significantly higher standard."

2015

AUDITOR GENERAL REPORT

Six months into the SR1 process, the Auditor General (AG) already had concerns as stated in their March 24, 2015, report. The cost of the Springbank Project in this report is $214 million (p83).

They reported recommendations regarding a weakness in identifying and controlling flood hazard areas and **failing to assess the effect of mitigation projects on surrounding communities. See point 4 below.**

[63] https://globalnews.ca/news/1585968/calgarys-mayor-critical-of-prentices-flood-announcement/

What needs to be done

Experience from disasters around the world shows a window of 18 to 24 months after a major event when there is strong public and political support to spend money on measures to improve public safety. Since the 2013 flood, the department has developed a flood mitigation plan and allocated significant resources to manage future flood risks. This sense of urgency needs to continue to ensure Albertans receive the full benefit of that investment.

The Department of Environment and Sustainable Resources needs to:

- improve its processes to update its flood hazard maps and mapping guidelines, and map previously unmapped areas at risk
- implement flood risk assessment processes to justify spending money on flood mitigation
- establish processes to cumulatively assess what the effects will be of various flood mitigation efforts at the community level when approving new projects or initiatives

In other words, the Auditor General acknowledged a failure to consult early in the process that still has not been rectified. It is also notable that the provincial government's response to the Auditor General concerns were to further develop flood modelling warning systems, erosion control, water management and mitigation infrastructure. There was no mention of consultation nor consideration of more than economic issues.

In fact, **SR1 was announced in September 2014, and landowners were still concerned in March 2015-- see the next article titled "Opposition to Springbank Reservoir project voiced at community meeting." The landowners continued to be worried that officials have not properly relayed information regarding the project to them, and most importantly there has been no consultation. Instead the Alberta Government has continued to keep the landowners informed about the project, telling them about the decisions that have already been made as shown in the Alberta Government Fact Sheets**—see the next article.

One important point to note is that there is consensus from the provincial government, the City of Calgary, and local landowners that flood protection on the Elbow River is needed. No one is challenging the decision to go ahead and find a solution for flood control on the Elbow River.

Rocky View Weekly

Flood mitigation weaknesses found: Auditor General report

JOEL DRYDEN
Rocky View Publishing

Mar 24/15
p. 3

An audit of flood mitigation in Alberta has revealed "weaknesses" in key areas, according to the March 2015 Auditor General report.

Alberta's Auditor General Merwan Saher released his 128-page report on March 11, highlighting one repeated and 15 new recommendations to government, covering issues like dam safety, pipeline monitoring and low student attendance in northern Alberta schools.

The report singled out a weakness in identifying and controlling flood hazard areas, along with a failing to assess the effect of mitigation projects on surrounding communities.

Chestermere-Rocky View MLA Bruce McAllister said a responsible approach to mitigation was among his priorities.

"I have, right from the get go, advocated for the most financially sound and environmentally responsible project," he said. "I think the government has some big questions that it needs to find answers to."

"(It needs to) find answers to the environmental reports, the engineering studies, the cost benefit analysis – that all has to be complete before a project (can) move forward."

Some priorities identified by the provincial government to address the Auditor General's concerns include further development on flood modeling warning systems, erosion control, water management and mitigation infrastructure.

"We support the Auditor General's recommendations with respect to protecting Albertans from natural disasters as it relates to development in floodways. Work on this important recommendation is already well underway," said Minister of Municipal Affairs Diana McQueen in a press release. "We expect to have regulations that address existing and future developments in our province's floodways completed later this year."

One mitigation project that has citizens concerned in Rocky View County is the Springbank Off-Stream Reservoir, which was announced in September 2014. The project has landowners worried that officials have not properly relayed information regarding the project.

McAllister said that concerns surrounding mitigation projects would need to be properly assessed by government.

"We have to make sure that we're doing the right things," he said. "If the Springbank (project) turns out to be the best thing for mitigation in this province and landowners are reasonably compensated, then it's (the right move). We have to answer those questions."

The full 128-page Auditor General report is available at www.oag.ab.ca/reports

FIRST PUBLIC JUSTIFICATION OF SR1 BY THE ALBERTA GOVERNMENT

On February 23, 2015, Alberta Transportation released a "Fact Sheet" that outlined the reasons for choosing Sr1. Recall that the Project was announced nearly 6 months prior, in fall 2014.

Alberta Government

Environment and ~~Sustainable Resource Development~~

Elbow River Flood Mitigation Project Decisions Fact Sheet

Benefit-cost analysis studies show the Springbank Off-stream Reservoir offers a higher benefit-cost ratio than the McLean Creek Dry Dam or Glenmore Reservoir Diversion (also known as the Calgary Tunnel).

Benefit-Cost Ratios for Proposed Projects

	Worst-Case Damage Scenario		Anticipated Damage Scenario	
	1:100 Protection	1:200 Protection	1:100 Protection	1:200 Protection
Springbank Off-stream Reservoir	1.87	2.07	1.32	1.32
McLean Creek Dry Dam	1.43	1.65	1.01	1.05
Glenmore Reservoir Diversion	1.21	1.20	0.81	0.83

Assumptions and Methodology

Assumptions and methodology used in **all three** benefit-cost analyses:

- Damage assessments were generated for nine return frequencies to calculate average annual damages, including: 1:2 year, 1:5 year, 1:10 year, 1:20 year, 1:50 year, 1:100 year, 1:200 year, 1:500 year and 1:1000 year.
- Damage estimates were also assessed under two cases: ○ a higher, or "worst case", condition, and ○ a lower, or "anticipated case", condition.
- Costs are based on the estimated capital and operational/maintenance costs presented in Section 4 of each report.

- Benefits are based on the quantification of flood damages averted as outlined in Section 5 of each report.
- The benefit/cost analysis has been carried out using a net present value analysis.
- A 100-year economic analysis was used.
- Annual operating and maintenance costs are assessed at $1.8 million.

For both the **Springbank Off-stream Reservoir** and **Glenmore Reservoir Diversion**, $8.9 million in capital costs were added to each project to account for required mitigation measures upstream in Bragg Creek and Redwood Meadows.

For the **Springbank Off-stream Reservoir**, an additional $40 million in capital costs were added to account for land acquisition.

For the **McLean Creek Dry Dam**, an additional $45 million in capital costs were added to account for the replacement or relocation of impacted Parks infrastructure.

For both the **Springbank Off-Stream Reservoir** and **McLean Creek Dry Dam**, it was assumed that once the design event is exceeded, full damages are incurred. This is due to the absence of additional hydrologic routing.

For the **Glenmore Reservoir Diversion**, it was possible to calculate the reduced damages that would be achieved as a result of the 500 and 700 cubic metres per second diversion (1:100 year and 1:200 year protection, respectively). The incremental flow was passed downstream and damages based on the reduced flood flow were computed to determine the net benefits. Consequently, a higher benefit can be attributed to the diversion scheme based on this higher level of analysis.

February 23, 2015 Elbow River Flood Mitigation Project Decisions – Fact Sheet
Page 1 of 2

Total Estimated Costs for Proposed Projects

Below is a breakdown of the estimated costs for 2013-level protection used in the benefit-cost analysis for each project. Annual operating and maintenance costs of $1.8 million were added to each project.

	Springbank Off-stream Reservoir	McLean Creek Dry Dam	Glenmore Reservoir Diversion (700 m^3/s)
Estimated construction costs for 2013-level protection	$214,768,000	$294,581,000	$498,200,000
Land acquisition	$40,000,000		
Park/Infrastructure replacement		$45,000,000	
Bragg Creek protection	$8,900,000		$8,900,000

Environmental Impact Studies		$4,000,000	
TOTAL	**$263,668,000**	**$343,581,000**	**$507,100,000**

Provincial Flood Damage Assessment Study

The Alberta government initiated the Provincial Flood Damage Assessment Study (PFDAS) in July 2014 to:

- Update/develop flood damage curves in select communities at risk of flood to 2014 economic values and establish adjustment indices for their use in 60 different flood-prone communities across Alberta; Develop a computerized model for estimating flood damages; and
- Undertake flood damage estimates for select communities in Alberta.

Key points regarding content and structural stage-damage curves include:

- Direct flood damages were estimated separately for residential and non-residential structures, and also for losses to structures versus contents;
- Potential losses vary significantly by the type of use, reflecting differences in construction materials, techniques and quality, and also in the amount and type of contents located in those structures;
- The analysis resulted in updated depth-damage curves for various categories of residential and non-residential structures and contents based on extensive first- and second-order research including representative sampling of residences and non-residential structures within selected functional groups.

Calgary, High River, Fort McMurray and Drumheller were identified as high priority communities and will be the subject of flood damage assessments undertaken as part of the PFDAS. Flood damage assessments for High River, Fort McMurray and Drumheller will be complete at the end of March.

The City of Calgary was selected for the pilot study due to recent flood damage experience, large inventory of residential and commercial structural types and categories, recent update of hydraulic modelling in 2012 and analysis of 2013 flood flows, and availability of accurate rehabilitation costs.

Total damage along the Elbow River (within Calgary) for a 1:100 year flood Anticipated Damage Scenario

Categories of Damage	Direct	Indirect	Total
Residential	$299,716,000	$44,957,000	$344,673,000
Commercial	$10,205,000	$4,592,000	$14,797,000
Infrastructure	$69,666,000	$13,933,000	$83,599,000
Stampede	$68,900,000	$26,400,000	$95,300,000

Total	$448,487,000	$89,882,000	**$538,369,000**

The full versions of all reports are available at http://www.alberta.ca/flood-mitigation-studies.cfm.

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LACK OF CONSIDERATION OF FISH IN THE SR1 PROJECT

The impacts of SR1 on fish have long been dismissed. We ask the regulators to consider the long-term impact of SR1 in the health of the watershed and fish populations.

dhenton@calgaryherald.com

A4 July 13/15

Southern Alberta trout streams found to be threatened despite recovery plan

BOB WEBER
THE CANADIAN PRESS

EDMONTON Virtually all southern Alberta streams that spawn native trout are threatened by industrial development or overuse, says a survey from a respected fisheries biologist.

That's even though both bull and rainbow trout are protected under federal law and are supposed to be benefiting from a recovery plan, says Lorne Fitch.

"I have watched habitat and fish populations crater," says Fitch, an adjunct professor at the University of Calgary, who spent 35 years as a leading provincial biologist. "All of our systems are under extreme pressure."

Fitch studied 54 small rivers and streams that flow into the Oldman River and hold bull and cutthroat trout. He found nearly every one of the waterways face multiple pressures: from logging roads to energy development to off-highway vehicle trails.

The banks of Hidden Creek, spawning waters for up to 80 per cent of the Oldman's bull trout, are weakened by clear-cuts and stream crossings and are falling in on themselves. Cow Creek, with a confirmed cutthroat population, is contaminated by feedlot effluent and is drained for irrigation.

Fitch's survey notes everything from motorcycle races to washed-out bridges to coal mining affecting creek after creek. Again and again he concludes "long-term cumulative impacts on cutthroat trout and

Lorne Fitch

bull trout."

Scientists suggest land that contains trout streams shouldn't have more than about just over half a kilometre of trail, cutline or road per square kilometre. The disturbance density in parts of the Oldman watershed is nearly 10 times that.

The reason, Fitch said, is sediment. Nearby roads, forest disturbance and stream crossings all cause soil to wash into the current.

Scientists used to believe that silt simply washed out. No longer.

"What researchers are now finding is that this sediment actually starts to get trapped into the gravels and cobbles that make up the stream bed," Fitch said. "That stuff solidifies, so that not only is it difficult for water to permeate through, it's very difficult for trout to build a redd (nest).

"Trout would have to come equipped with a pickaxe to break through some of that substrate."

And those hardpack stream beds aren't going away any time soon, said Fitch.

"Some researchers have said this might endure for centennial time. It isn't fleeting."

The result is that cutthroat populations are estimated at five per cent of historic levels. Bull trout — Alberta's provincial fish — have lost at least 70 per cent of their original range.

Biologists used to count more than 100 redds on Hidden Creek. Last fall, after the region was

Alberta's provincial fish, the bull trout, has lost more than 70 per cent of its historic range. *THE CANADIAN PRESS*

logged, Fitch counted 15.

Alberta's previous Tory government completed a land-use plan for the South Saskatchewan River watershed, which includes the Oldman. Fitch said it barely mentions fish, contains no specific recommendations for their protection and defers most important decisions to local management bodies.

"I was underwhelmed."

Fitch said the decline over the last generation or two in southern Alberta has been echoed all over the province.

Arctic grayling, once common in the north, are down to 10 per cent of historic levels. Goldeye have all but vanished.

The declines will continue until Alberta changes its land-use policies, Fitch said.

A spokeswoman for NDP Environment Minister Shannon Phillips acknowledged trout are in decline. But Laura Tupper defended the previous government's plans.

"Headwaters protection, controlling industrial activity and monitoring water quality are just a few measures under the (plan) that will work to improve threatened fish populations," she wrote.

Tupper said the government is spending $10 million to restore streams damaged in the 2013 floods and to support other watershed management efforts.

Westslope Cutthroat Trout

A10 WEDNESDAY, SEPTEMBER 23, 2015 CALGARY HERALD

Environmental groups take legal action to protect trout

COLETTE DERWORIZ
CALGARY HERALD

Two environmental groups are taking the federal government to court for what they call a failure to protect Alberta's threatened population of Westslope cutthroat trout.

The lawsuit, filed Friday at the Federal Court of Canada, specifically targets Fisheries and Oceans Minister Gail Shea for not issuing a critical habitat order for the species, which is required by law under the Species at Risk Act.

"Without it, there's really no legal leverage for the minister to charge anyone for destroying or degrading the habitat," said Brittany Verbeek, a conservation specialist with the Alberta Wilderness Association — one of the environmental groups involved in the lawsuit.

It was filed by Shawn Fluker of the Environmental Law Centre at the University of Calgary.

No one from the Department of Fisheries and Oceans responded to a request for comment, but they said in June they were committed to protecting the environment for the fish species.

Westslope cutthroat trout, which have been listed as a threatened species in Alberta for years and were listed federally in March 2013, have experienced a decline in numbers due to habitat loss, overharvesting and the introduction of non-native species.

Scientists believe the fish now inhabit about five per cent of their original distribution.

The decline of the species led to the federal recovery plan that was finalized in 2014 and should have resulted in the critical habitat order.

Both the AWA and the Timberwolf Wilderness Society are trying to force the minister to uphold the law, which requires the federal government to issue an order within 180 days of the release of a recovery strategy for any species.

"It's now almost a year overdue and we're just basically taking them to court so that they follow the law," said Verbeek, noting habitat protection is critical to save and restore the iconic trout.

Degraded habitat could lead to hybridization with introduced rainbow trout, which is a threat to the species. Other potential threats include damage from off-highway vehicle use, clearcut logging, oil and gas development, grazing and mining, according to the two groups.

They suggest the few remaining isolated populations need quality habitat to maintain the populations so they'll survive for the longterm.

cderworiz@calgaryherald.com
Twitter: cderworiz

> *It's now almost a year overdue and we're just basically taking them to court so that they follow the law.*

FIRST PUBLIC MEETING (HOSTING BY A COMMUNITY GROUP)

The first SR1 public meeting was hosted by the Springbank Community Planning Association in March 2015. The stated purpose was to give residents information about SR1.

Rocky View Weekly Mar 10/15

Opposition to Springbank Reservoir project voiced at community meeting

JESSI GOWAN
Rocky View Publishing

The Springbank Community Planning Association (SCPA) hosted a public meeting at Springbank High School on March 2 to give residents of the area an opportunity to get more information about the proposed Springbank Off-Stream Reservoir announced by the Premier in September 2014 as the likely flood mitigation project for the area.

Despite this project being identified as a priority for the Government of Alberta, SCPA Acting Chair Gloria Wilkinson said local landowners are upset there hasn't been more information made available to them.

"The government has chosen to have meetings in Calgary and in Cochrane, but not in Springbank – where we are the people who will be directly affected by this project," she said. "We have these meetings to try and make sure (residents) have as much knowledge as we have."

The proposed $250 million reservoir would be located south of Highway 1, east of Highway 22, and north of Highway 8 – requiring Springbank Road to be rerouted. During a flood, excess water would be diverted from the Elbow River through a canal, and would remain in the reservoir until it could be released back into the river in a controlled manner.

Alberta's Assistant Deputy Minister of Operations, Matthew Machielse, attended the meeting to answer questions that have been concerning residents of the Springbank area. However, he said major decisions regarding the feasibility of the project have yet to be made.

"There is an assumption that everything is understood and this is the final thought, but it's still under development," he said. "This project was announced based on an initial design concept. We will likely give Stantec (the engineering firm tasked with the project) a year to complete further design work and assessments."

According to Machielse, the engineering and consulting firm will determine what the landscape of the area is capable of supporting in terms of volume, and will examine potential environmental impacts on the area.

Residents present at the meeting expressed concern about why the government isn't touching on the impact the potential development would have on area landowners, but Machielse said that will be evaluated by the Natural Resources Conservation Board once the technical feasibility of the project is understood.

"They will look at what is in the public interest for this project," he said. "This is a faster and easier option than some of the other potential projects, but nothing is finalized yet."

Chestermere-Rocky View MLA Bruce McAllister was in attendance at the meeting, and said he will work to ensure that the concerns of area residents are addressed during this process.

"I don't think the government is going to proceed until they have the answers to all of the questions that people have been asking," he said. "It's my job to advocate for you and take those questions to the Premier and make sure they are heard."

Groups of concerned residents like DontDamnSpringbank and DamMcLean plan to continue opposing the project as it moves forward. According to DontDamnSpringbank spokesperson Ryan Robinson, residents are hoping the government reconsiders the McLean Creek reservoir as a better solution, as it is located on government-owned land upstream of at-risk communities like Redwood Meadows and Bragg Creek.

"We love Springbank, and this is the place we call home," said Robinson. "My family has strived for years to be good stewards of the land and to do what we can to maintain the natural environment here, and each one of the other families here also has a story. We are a tight community, and we hope the government will listen to our collective voice."

GOVERNMENT OPEN HOUSES:

We cannot find any documentation from these open houses. Shortly after the Auditor General's report, there was notification of the results of the four open houses that the government had conducted to inform the public about why they chose SR1 as the best option compared to MC1. Informal surveys conducted by Margaret Barclay at each open house indicated 95% of those surveyed wanted MC1 examined in more detail (because this provides upstream protection for all Albertans near the Elbow River).

As stated in the following article "Springbank reservoir project remains Province's primary option," dated April 14, 2015, the government's initial environmental overview of MC1 identified concerns of:

- MC1 Dam would be an on-stream structure.
- The dam would create a physical barrier resulting in changes to flows, aquatic habitat, and movement of fish and wildlife.

Also, in this article, IBI Group planning consultant Stephen Shawcross stated that "upstream communities of Bragg Creek and Redwood Meadows . . . would already be protected by a reservoir on McLean Creek." This comment suggests that the IBI group thought that a second project for flood control was also needed. In fact, there was much discussion in the communities over the following years about the usefulness of two projects for flood control. This idea was never pursued.

IBI REPORT - BENEFIT/COST ANALYSIS

The following is an excerpt from the IBI Group's final report dated February 18, 2015, titled Benefit/Cost Analysis of Flood Mitigation Projects for the City of Calgary: Springbank Offstream flood storage.

Page 9 **states the study only dealt with economic efficiency. It does not include an analysis of disaster prevention, environmental impacts, incidental benefits such as recreation and drought mitigation.**

On this basis, the study is flawed from the perspective of meeting the IAAC (CEAA) review. In fact, it is also noted from the history review, that the Alberta Government had initially thought they could avoid having the IAAC (CEAA) review, which explains why these extra steps were not done at the time.

Thanks to the passage of time we now know that the "incidental benefits" are now key considerations regarding protection from fire and drought.

6.5 Triple Bottom Line Considerations

Traditional economic analyses of flood mitigation alternatives have generally assumed a straightforward objective of maximizing the net benefits (total benefits minus total costs) that accrue to a project. Society however, has other goals besides economic efficiency. These goals or objectives are the results of outcomes that society desires and have more recently been described as triple bottom line objectives which include, in addition to economic objectives, *considerations of environmental* and social impacts. In relation to flood mitigation projects, the following criteria are often considered in the evaluation process:

- Disaster prevention:
  - reduces current losses
  - reduces future losses
  - potential residential loss of life
  - potential non-residential loss of life
- Environmental impact:
  - biophysical impacts
  - social impacts
  - aesthetic impacts
- Implementation:
  - complexity
  - flexibility of integration with other measures
- Incidental benefits:
  - recreation
  - drought mitigation
  - other

This study was concerned solely with economic efficiency and consequently does not include analysis of the aforementioned non-commensurable criteria.

6.6 Summary and Conclusions

Exhibit 6.3 below illustrates the relative ranking of the flood mitigation projects.

Exhibit 6.3: Benefit/Cost Ratio

	1:100 Year Protection	**1:200 Year Protection**	**1:100 Year Protection**	**1:200 Year Protection**
SR1	1.87	2.07	1.32	1.32
MC1	1.43	1.65	1.01	1.05
Glenmore	1.21	1.20	0.81	0.83

The Springbank Off-Stream Flood Storage project achieves a positive benefit/cost ratio under all four scenarios and ranks first ahead of the other two mitigation projects with significantly higher benefit/cost ratios.[5]

Of concern, it is evident from the timing of the Alberta Government's decision to choose SR1, that IBI had not finished their file analysis of comparing SR1 to MC1, and writing a report, suggesting that the very premise upon which SR1 was chosen was political and did not meet the standards of IAAC (CEAA).

AWARENESS OF DROUGHT RISK

The following article "Flood Mitigation a Good Start," November 14, 2015, shows the continuing myths about problems with MC1. These myths are addressed and de-mystified in the following sections of this document. Myths such as:

- Irreversible habitat damage for grizzly bears that rely on riparian habitats;
- Cutthroat and bull trout, native fish unable to move freely up and down the river and that rely on clean flowing waters.

It is noted in this article that it includes a broader view stating:

Nothing addresses the risk of future drought, a problem every bit as important as flooding.

Yet in spite of the mention of dangers of drought, this huge environmental problem was ignored, likely because it would interfere with the myth that SR1 is faster, cheaper, and easier than MC1.

FLOOD MITIGATION A GOOD START

Nov 14/15 Herald A23

KEVIN VAN TIGHEM, WENDY FRANCIS, STEPHEN LEGAULT AND KATIE MORRISON

A man is trapped after his truck was submerged in flood waters in High River in June 2013. The Alberta government's first steps toward flood mitigation are promising. GAVIN YOUNG/CALGARY HERALD

The recent decision by the government of Alberta to proceed with flood mitigation along the Elbow River doubtless came as a relief to people living on the downstream floodplain. But the most important flood drainage challenges remain to be addressed.

The most encouraging aspect of the recent flood mitigation announcement — proof that our new government took its due diligence obligations seriously — was the decision not to proceed with a dry dam at the McLean Creek site. A dam on the Elbow River near McLean Creek would not only have been dangerous and potentially ineffective, it would have caused irreversible habitat damage for grizzly bears that rely on riparian habitats throughout the foothills, as well as cutthroat and bull trout, native fish that need to move freely up and down the river and that rely on clean flowing waters.

All three of these species are already in trouble, legally classified as threatened species largely because of extensive habitat damage in our headwaters.

But at the same time as we applaud the Alberta government for choosing not to add further harm to species that are already in trouble, nothing has been announced that would actually help them. Nor do the suite of actions proposed by the government address the risk of future drought, a problem every bit as important as flooding.

We have reason to be confident that Alberta's recently elected new government can get the rest of the job done. Their enlightened and inspiring decision to protect the Castle River area in the southwestern corner of the province as a new park — after three decades of inaction by previous governments — demonstrated real leadership in creating an Alberta conservation legacy for generations to come.

The decision not to build a McLean dry dam in spite of political pressure is another very positive signal.

The government has shown that it can act decisively and in meaningful ways that go well beyond the empty rhetoric we had become too accustomed to.

But the heavy flood mitigation lifting has yet to begin: we need real action to restore the water-holding capacity of badly-wounded landscapes that once were among the most beautiful places in the world. That will be this government's real test.

A truly progressive approach to mitigating flood risk would mean restoring the badly impaired forest landscapes that produce the water that drains into our rivers. Aggressive clearcut logging and motorized recreational abuse has created a landscape that drains too fast when snow melts and rain falls.

Raw gullies pull water off the land and into rivers too fast — increasing spring floods, damaging fish and wildlife habitat, and leaving the landscape parched in summer.

Policies that promote killing of beavers rather than promoting their role in holding back flood waters and recharging groundwater storage reservoirs simply make matters worse. To a large degree, the very same factors that have put native fish and wildlife species at risk make floods worse too.

This problem is not limited to the landscapes draining to the Elbow River. From the Porcupine Hills and Crowsnest Pass along the Eastern Slopes to the headwaters of the North Saskatchewan, the last government's legacy of mismanagement continues to degrade our watersheds and wildlife. Repairing the scars and restoring the water retention capacity of our headwaters would not only mitigate flood risk basin wide, it would restore the vast, green, living reservoir that stores groundwater against future droughts. It would also restore and improve habitat for the threatened grizzly bear, bull trout and west slope cutthroat — and all of us who go into the foothills and mountains in search of stunning beauty, spiritual renewal and outdoor recreation.

That would truly be a tale worth sharing with a skeptical world.

The Alberta government has taken some very promising first steps. Now they need to get on with the rest of the job.

Kevin Van Tighem is author of Heart Waters: Sources of the Bow River; Wendy Francis is program director of the Yellowstone to Yukon Conservation Initiative; Stephen Legault is co-ordinator of the Crown Conservation Initiative; and, Katie Morrison is conservation director with the Canadian Parks and Wilderness Society, southern Alberta chapter.

Politicians also did not consider the broader environmental and social impact on five communities, because not all of the five communities of Bragg Creek, West Bragg Creek, Redwood Meadows, Tsuut'ina, and Springbank had "woken up" yet. Only the Calgary community was involved. Also, Kamp Kiwanis was not aware of the impact on their land yet. So, the Alberta Government continued to say that the **reason for choosing SR1 was that "it was cheaper, faster, easier."**

This cleverly chosen myth continued to carry the Alberta Government's push forward to focus only on SR1.

On November 27, 2015, the Insurance Bureau of Canada called for a national flood plan since water was now the number one cause of home insurance losses. In 2009 water accounted for 40% of claims, followed by fire at 29%, then wind at 16%. They stated that there needed to be a culture of flood-preparedness.

We do not understand why homes along the Elbow River in Calgary were allowed to remain after being damaged. Now, one community is being sacrificed for another.

FINANCIAL POST

FRIDAY, NOVEMBER 27, 2015 CALGARY HERALD B3

Call for national flood plan

Insurance Bureau of Canada says climate change posing challenges

Don Forgeron

BILL MAH
EDMONTON JOURNAL

The head of the Insurance Bureau of Canada called Thursday for governments and industry to create a national flood program to deal with the growing costs of destruction spurred by climate change.

"There is tremendous value in a more collaborative approach between the private sector and different levels of government to solve a problem that has been growing in frequency and severity," said Don Forgeron, president and CEO of the national insurance industry association, before a speech to the Economic Club of Canada in Edmonton.

"You just go back to the 2013 floods here in Alberta — the largest insured loss in Canadian history, one of the largest natural disasters in Canadian history. A national flood program, we believe, would offer a much more mature, comprehensive and disciplined way to compensate people as a result of damage from flood."

Floods that swept across much of Alberta in 2013 cost more than $6 billion. Water has replaced fire as Canada's No. 1 cause of home insurance losses by a wide margin. In 2009, water accounted for 40 per cent of claims, followed by fire at 29 per cent and wind at 16 per cent, IBC figures show.

The private sector is starting to offer Canadians more flood coverage, but the industry is limited in what it can do, Forgeron said.

"We can probably insure somewhere around 90 per cent of consumers, but the highest-risk consumers, just by the nature of how insurance works, would never be able to afford that coverage. Therefore, we're calling on the different levels of government to work with us to arrive at a solution that would allow those people most at risk to be able to find affordable and available flood cover."

That remaining 10 per cent includes the 800,000 to one million properties at greatest risk of being flooded because they are built in river valleys or on floodplains.

In his speech, Forgeron said the bureau has identified four elements that should be in place to lay the foundation for a national program: There should be accurate, up-to-date national flood-hazard mapping, which the industry has started developing and will share with governments.

The insurance industry wants ongoing targeted investment to build and maintain flood defences and sewer and stormwater infrastructure.

The bureau is also calling for government involvement in making insurance available and affordable for the 10 per cent of properties most at risk of flooding.

That would reduce the reliance on existing federal and provincial disaster assistance, he said.

Forgeron said there needs to be a "culture of flood-preparedness" and risk awareness that motivates consumers to take steps to flood-proof their properties.

It is interesting to note that initially the NDP, before they were elected, opposed SR1 because they had been briefed about the larger community impacts, the broader financial, social, environmental considerations, and more accurate costs of SR1 that had been hidden, such as the cost of building two bridges, raising Highway 22, possibly moving Springbank Road, and relocating up to seven pipelines and electrical and telephone lines.

A plea was publicly sent through the *Herald* to the newly elected NDP on May 5, 2015, to keep their election promise to re-assess the prior Conservative government's decision on SR1. See article on the next page. Unfortunately, history shows that this was not done for some reason.

The next article called "McLean Creek Dam Best Option" indicates, according to Dr. Ed Watt, that a serious consideration in flood control is the spikes in the peak flow volume that must be controlled, making a permanent dam at McLean Creek the only option that can control flow volume.

2015

Premier Notley, please keep your promise on flood mitigation.

Hon. Rachel Notley, Premier of Alberta:

On behalf of the community of Springbank and the thousands of Albertans who have expressed their support for DontDamnSpringbank.org, congratulations on your impressive electoral victory.

Clearly, you have become the agent of a much desired change.

Now, you will be dealing with the legacy of public policy inherited from the previous PC government. Part of that legacy is the misguided proposal to turn Springbank into a "dry dam" as mitigation for possible future flooding. We are very pleased that the NDP, as well as the Wildrose party, have gone on the record opposing this poorly thought-out project.

Everyone agrees that flood mitigation is a priority. But the Springbank dry dam was bad policy from the beginning.

It's expensive.

The PC's cost-benefit analysis underestimated the cost of construction and land requirements in Springbank. The Springbank project will cost as much as, or more than, a dam upstream at McLean Creek.

It doesn't protect enough people.

A dam in Springbank would leave Bragg Creek, Redwood Meadows and Tsuu T'ina Nation under continued threat of flooding. Whereas the upstream option at McLean Creek protects all those communities *and* provides the same protection to Calgary.

It will not be faster to build.

The PC government inaccurately promoted the Springbank dam as the fastest option. It isn't. Both Springbank and McLean Creek require the same provincial and federal environmental reviews as well as the same regulatory, design and construction timelines. In fact, a McLean Creek dam may be faster as it's on public land, minimizing potential legal challenges.

You can find more reasons to continue your opposition to the proposed Springbank dam at www.DontDamnSpringbank.org

By way of this open letter, we thank you again for your party's commitment to scrapping this bad PC policy before more time and money is wasted.

A dam at McLean Creek is a better public policy option that will protect more people.

Thank-you for endorsing it.

Sincerely,

The members and supporters of DontDamnSpringbank.org

DontDam Springban .or

MCLEAN CREEK DAM BEST OPTION

Springbank diversion not as good at keeping Calgary dry during a flood

MATT MCCLURE 2015
CALGARY HERALD

The province's own modelling shows Calgary would be better protected from large floods by a dry dam that would halt most of the Elbow River's peak flow rather than the favoured diversion canal that would only stream a small portion of raging waters to a reservoir.

A recent study used by the former Tory regime to justify its decision to choose Springbank off-stream storage over the McLean Creek dry dam — because it would be more cost-effective — assumes both projects would reduce damages from a future disaster by the same amount.

Notes used by an assistant deputy minister with Alberta Environment in a presentation on the two projects last year indicate the dry dam design would ensure there was "no flood effect" on the neighbourhoods below the Glenmore Reservoir during an event similar to the one in 2013.

But the calculations used by Matt Machielse at a flood symposium last April show by comparison that the Springbank diversion as originally conceived would skim off only a quarter of the peak flow and that the city's last line of defence would be overwhelmed.

Operators at the Glenmore Reservoir would be forced to open the gates or risk having the dam overtopped.

SEE MODELLING ON A3

New McLean Creek plan brings construction bill to $342 million

MODELLING FROM A1

The notes indicate residents along the Elbow River downstream would see flows surge to an estimated 350 cubic metres per second, enough to make water levels rise over three metres above normal.

That flow rate is larger than the peak seen in Calgary during the 2005 floods that caused major damage to hundreds of homes and businesses along the river. The resulting disaster would cause more than $140 million in damages, according to conservative estimates.

Maps used by Machielse in his presentation that simulated how the McLean Creek dry dam and the Springbank diversion would perform in a repeat of the 2013 floods show dramatic differences.

While the dry dam would effectively keep the river within its banks, portions of Riverdale, Roxboro and Elbow Park would still be inundated if the Springbank diversion were built. Portions of the Stampede grounds would also be left under water.

Despite what the flood modelling showed, a cost-benefit analysis of the two projects assumed the dry dam and off-stream storage would provide similar levels of protection. The analysis was released four months after the Conservative government had already given the go-ahead to the Springbank project last fall. Then-premier Jim Prentice declared it the "most cost-effective solution."

Alberta Environment spokeswoman Katrina Bleutchen said in a prepared statement the report's assumption was based on the fact both projects would have the same protection to Calgary if there is a repeat of the 2013 disaster.

Along with an increase in reservoir capacity, the larger canal would add an estimated $55 million to the cost of the Springbank project, pushing the total bill over $273 million, she said.

Even before the diversion was doubled in size, engineers estimated they would need to move approximately 200,000 dump trucks full of earth and rock as they excavate a canal over a four-kilometre stretch from where water leaves the river until it enters the dry reservoir.

As it passed through upland areas, the bottom of the canal would be as much as 25 metres below grade and more than 170 metres wide.

"That's a mighty big ditch to build," Watt said. "It always seems in Alberta that the solution to a problem is to spend money."

The original design for the McLean Creek dry dam, which government modelling said would keep Calgary dry in a repeat of the 2013 floods, was estimated to cost about $289 million.

But Bleutchen said the current plan is to spend another $53 million to raise the dam level and increase its storage capacity, bringing the total construction bill to $342 million.

Watt questioned why the province would consider spending so much on either McLean or Springbank without having done a cost-benefit analysis that also looked at whether removing the most vulnerable structures from the floodplain and giving the river more room to flow might make more economic sense.

"(Both) can be designed to store 67,600,000 cubic metres of water," Bleutchen said.

"This is the main reason they are considered to provide equal protection."

But one of Canada's foremost experts on flood engineering says the key to any flood mitigation project is also capturing peak flows, estimated to have exceeded 1,200 cubic metres per second during the 2013 disaster.

Ed Watt, professor emeritus of civil engineering at Queen's University, said in the case of the Elbow River that means keeping the spiking water volumes from reaching Calgary and quickly filling the Glenmore Reservoir.

"When you're looking at structural solutions to prevent flooding, it's all about attenuating that quickly rising limb of the hydrograph," Watt said.

"It's not just about the size of your bathtub, but whether the plug is properly fitted so water isn't going down the drain."

Indeed, the government's modelling of the original design shows the McLean Creek project would reduce the peak flow by 700 cubic metres per second while the Springbank project would siphon off the surge by only half that amount, or 350 cubic metres per second, because of the capacity constraints in the diversion canal.

Bleutchen said the latest design for the canal calls for it to be doubled in size so it can provide full

He also wondered why the newly elected NDP government would provide a one-in-200-year level of protection from flooding to those living along the Elbow River that is not being provided to other vulnerable communities elsewhere in Alberta, including those along the Bow River.

"The new government may have other priorities like health care and education," said Watt, "that are more important than protecting people who live in flood plains."

The revelation that the cost-benefit analysis of the two projects prepared for the former Tory regime may have been based on an incorrect assumption comes in the wake of a recent critical report. It questions whether the numbers may have been skewed in favour of Springbank because the government underestimated the cost of acquiring land needed for the reservoir and canal by more than $100 million.

Environment Minister Shannon Phillips was not available to be interviewed, but her press secretary issued a statement.

"Our government is working very hard to arrive at the best decision in terms of science and the public interest," Laura Tupper said.

"The options (at Springbank and McLean Creek) are under consideration, but it is a decision that must be made with great care and not hastily."

mmcclure@calgaryherald.com
Twitter.com/mattmcclure2

2016

The following article indicates that frustration is building among Calgarians because of the delays in getting SR1 approval.

No flood project yet, so pass the sandbags please

Herald A4
Feb 17/16

INSIDE POLITICS

DON BRAID

This spring will mark the third flood season since the rivers ravaged Calgary in June 2013.

The memory is already making people nervous. Calgary-Elbow MLA Greg Clark got a note Monday from a fellow who's stocking up on sandbags.

That's a prudent man, because the province has not done one major thing to prevent another massive flood in Calgary.

Three new premiers have taken office since Alison Redford dealt with the 2013 crisis: Dave Hancock, Jim Prentice, and now Rachel Notley.

They've all slowed down the flood mitigation planning, sniffed it over for trouble, got it rolling again, always at a pace more leisurely than before.

This is a precise repetition of what happened after the 2005 flood, which was a whopper in its own right — although far less serious than the monster of 2013.

The PC government of that day promised action. A report was written. Far from being followed, it was kept secret.

One government MLA — George Groeneveld of Highwood — complained about the stalling, and lost his cabinet job.

As the years went by, the issue slid ever lower down the government's radar screen.

And then came the 2013 flood. Forced into hip waders by their own inaction, the PCs once again vowed to act.

Redford pledged to pay everyone's rebuilding costs. Major flood mitigation projects would ensure it never happened again.

But as the months and years rolled by it all bogged down in bureaucracy for disaster claimants, and a thicket of technicalities and studies for the mitigation projects.

Three years later, Calgary and the rest of southern Alberta would still be devastated.

After being elected last May, the NDP revisited the decision to build the Springbank off-stream reservoir, which ex-premier Jim Prentice had approved.

That led to nearly six months more delay, until Oct. 26, when the NDP conceded that Springbank was the right choice.

Since then there have been more promises, but no agreement to acquire the land and get moving.

Alberta Party Leader Clark, by far the best-informed Alberta MLA on the flood file, says it's now likely that Springbank can't be functional until 2020.

"Under the absolute best-case scenario, Springbank could be ready in time for the 2019 flood season, but that's if everything goes perfectly from this point, including getting land access in literally the next four weeks to start the environmental impact assessment."

Clark says there must be a four-season environmental assessment on the land. Effectively, an entire flood season is lost if that can't start this spring.

He feels the government should use a section of the provincial Expropriation Act to gain quick access to the land for environmental work.

Section 63 says that even if land agreement hasn't been reached, and before expropriation proceedings have started, the government can go on the land to do "surveys, examinations, soil tests or other arrangements ..."

Landowners are fighting the Springbank diversion, and there has to be some sympathy for them.

But Clark says the NDP should go ahead with quick expropriation if there's more delay on land deals.

"A negotiated solution is always preferable but if they can't get one, they need to stop dragging their feet and expropriate.

"They've made the right choice in going for Springbank over McLean Creek, but I haven't seen enough evidence that they're moving forward aggressively to acquire the land either through negotiations or if necessary, to expropriate.

"If this does not go ahead and we're flooded again, it will be on their head. It will be because the ND government did not act quickly enough to forestall another tragedy.

"Every year that goes by is another year that the government perhaps feels they don't have to worry about it — it didn't happen this year, so it's not a risk. That's human nature.

"But I can tell you, this is a huge risk."

It's no wonder some Calgarians put their faith in sandbags, not the government.

Don Braid's column appears regularly in the Herald

dbraid@postmedia.com

ENVIRONMENTAL ASSESSMENT ANNOUNCED

NDP Government announces **SR1 Environmental Impact Assessment, March 2016.**

The assessment is to cover: air quality, noise, vegetation, wetlands, historical resources, traditional knowledge and traditional land use.

CITY THURSDAY, MARCH 24, 2016 CALGARY HERALD A7

Springbank environmental assessment underway

Landowners say study of off-stream dry dam will prove it's unjustifiable

TREVOR HOWELL

The NDP government announced Wednesday a long-awaited environmental-impact assessment of a controversial, off-stream dry dam in Springbank is now underway, a study landowners say will confirm their suspicions the project is unjustifiable.

"They've been very anxious throughout the whole thing to move it forward ... we think the environmental-impact assessment will show the project is a white elephant," said Ryan Robinson, a representative for landowners' group Don't Dam Springbank.

The NDP government said the assessment would look at issues such as air quality, noise, vegetation and wetlands, historical resources, traditional knowledge and traditional land use.

The year-long study needs to be completed before the National Resources Conservation Board launches its own environmental, economic and social impact study, a process that could take 12 to 24 months, said Infrastructure and Transportation Minister Brian Mason.

"We'll be talking to the federal government about that because we want to minimize any additional time that might be required as a result of that," Mason said in an interview.

During the 2015 election, the New Democrats pledged to scrap the Springbank project, which former premier Jim Prentice approved in the fall of 2014, in favour of a wet dam near McLean Creek.

But the NDP reversed course after winning the election, announcing in October it would commit $264 million for the Springbank dry dam, despite concerns that project could trigger a protracted battle with landowners.

In a statement, the government said the Springbank off-stream reservoir would work in tandem with the Glenmore reservoir in Calgary and, combined, would accommodate water volumes equal to the 2013 flood.

The 2013 floods that swept through Calgary and other parts of southern Alberta took five lives and caused more than $5 billion in damages, making it the most expensive natural disaster in Canadian history. The government had earlier considered a dry dam upstream at McLean Creek to protect Calgary from future flooding but pointed to a report by Dutch firm Deltares that said the Springbank reservoir could be delivered on a shorter time frame, cost less and would have less environmental impact.

> *I know that not everybody is entirely satisfied with the approach that we've taken, but we've made the best decision we can.*

However, that study also said the province needs to look at wetland restoration, tighter restrictions on development in the floodway and removal of obstructions in the river.

Further, it warns that structural solutions like the Springbank diversion may have limited mitigation impact because future events may be big enough to overwhelm what the project is designed to handle.

"I know that not everybody is entirely satisfied with the approach that we've taken, but we've made the best decision we can," said Mason.

"We're going to see it through because we want to make sure that property owners in Calgary and other areas downstream have the best protection that we can provide," he added.

thowell@postmedia.com

OPPOSITION TO SR1 IGNORED

Although the following article was vehemently seen as biased by Calgarians, it accurately reflects the views of thousands of residents living in the five communities.

A8 THURSDAY, MAY 19, 2016 CALGARY HERALD

Poll suggests Calgarians oppose Springbank dam

SHAWN LOGAN

It's not just landowners in Springbank opposed to a dry reservoir on rural land west of Calgary, a new poll suggests.

The survey commissioned by the group Don't Damn Springbank reached out to Calgary residents for their opinions, and found 55 per cent of respondents prefer a dry dam in McLean Creek over the Springbank proposal as the best option to prevent future flooding in the city.

But Brian Mason, Alberta's minister of infrastructure and transportation, slammed the Mainstreet Research poll, charging that the questions are blatantly inaccurate and lacking in crucial details.

"I've never seen a more misleading poll that was just designed to get the answers they were looking for," he said, adding the question relating to McLean Creek also vastly downplays the potential environmental impact and risk of soaring costs.

"I've seen some pretty blatant push polls before, but this is probably the most blatant I've seen."

Respondents were asked whether they supported the Springbank option chosen by the NDP government (which initially opposed the plan during last year's provincial election), over a dam farther west in the McLean Creek area, suggesting the Springbank project would be more expensive and force property owners out.

Ryan Robinson, a landowner in the affected area who speaks for Don't Damn Springbank, said the group didn't flinch about stating the preferred plan would be more expensive than McLean Creek, noting the scope of affected land in the government's own documents have nearly quadrupled, from 690 hectares to nearly 2,750 hectares.

"There's no doubt given how much the project has been increasing in size it will be way more expensive," he said.

"I think the more time that goes by the more likely it is the government McLean Creek option."

According to the poll, only seven per cent of respondents believe Springbank is the best option, while 21 per cent favour a water-diversion tunnel under Calgary's Glenmore Reservoir — a plan long ago shelved by both the city and province — as the best option behind McLean Creek.

Some 12 per cent of respondents said they were unsure of the best option, with another five per cent saying they didn't like any of the three proposed options.

Brenda Leeds-Binder, with the Calgary River Communities Action Group, joined Mason in dismissing the poll, noting those who commissioned it represent a very small group compared with the number of Calgary residents who could be spared a repeat of the devastating 2013 deluge.

"When it comes to Springbank, there are about 17 landowners (Don't Damn Springbank say they speak for 25 property owners), and downstream in Calgary, in a one-in-100 year flood, you're looking at 6,500 homes and apartment buildings that could be impacted," she said.

"The decision to proceed with Springbank has been made."

When the province announced its intentions last October to move forward with the Springbank plan, the projected cost was $263 million, compared with $343 million for McLean Creek. Though Mason acknowledges the province is still trying to determine the actual cost given the changes in scope.

"We likely won't release numbers until we get a full handle on the costs because it can affect tenders," he said, adding he still believes it will be less expensive than the McLean Creek option.

"I think if you ask the people of Calgary what they want, it's to build the best possible flood protection available and get it done fast."

The province has targeted 2020 to complete the Springbank reservoir.

slogan@postmedia.com

Signs like this were posted throughout the communities saying that the Springbank dam would be a mistake. By 2016, people and communities were starting to wake up and to understand the ramifications of SR1.

Opponents to the Springbank dam say the project would be an extraordinarily expensive megaproject that would cause massive environmental degradation west of Calgary. It would also displace homes, families and businesses. COLLEEN DE NEVE/FILES

June 23/16 A13

SPRINGBANK DAM A MISTAKE

Province already owns McLean Creek, a better option, writes *Lee Drewry*

Three years have passed since the floods of 2013 and the government of Alberta is still beating the drum for a flawed "dry dam" at Springbank — a concept that has been shown again and again to be a massive white elephant and inferior in every way to a dam upstream at McLean Creek.

Dontdamnspringbank.org, a large and growing coalition of Springbank residents, environmentalists, rural Albertans, and yes, even a lot of Calgarians, has watched the government's messages in support of a Springbank dam constantly shift and transform to neatly avoid the facts.

Here is a sample: The PC government said Springbank was the solution to flooding because land could be rented in a flood with no major costs to taxpayers. Wrong — there is no mechanism in Alberta law that allows for that. In fact, using private lands without fairly buying the land would set a disturbing precedent.

Springbank residents understandably do not want a silt-laden dust bowl the size of Okotoks created in their community. At a presentation, the government admitted the dry dam would be flooded and drained on average every seven years and contaminants would remain. So, the dust bowl would become enormous, permanent and destructive to the entire area.

Then, when the government reluctantly admitted land would have to be bought, the PCs said Springbank would still be cheap because the footprint of the project was small. But the engineering footprint exploded, from 1,700 acres to almost 7,000 acres.

And so has the cost.

Given even conservative land acquisition costs (as compiled by the Calgary Herald), Springbank is now a much more expensive option than McLean Creek, because the government must buy almost 7,000 acres of prime land, while it already owns McLean Creek.

Then, after an election spent campaigning against a Springbank dam, the NDP government flip-flopped and argued Springbank would be faster than McLean Creek because less environmental review would be needed. But more than 1,000 residents, environmentalists, governments and First Nations called on the Canadian Environmental Assessment Agency to do a formal review of Springbank. The agency has recently agreed such a review is warranted. The area in question contains pristine prairie plant, fish and wildlife habitat. A dam that fills every seven years would destroy that. There is no environmental shortcut at Springbank.

Disappointingly, Infrastructure Minister Brian Mason marked the third anniversary of the flood by changing the narrative again, this timing saying, essentially, landowners in Springbank don't matter. There are more people in Calgary than Springbank, so Springbank residents can pound sand.

But one wonders if the minister is out of touch with Calgarians themselves. In a recent poll conducted by Mainstreet Research, only seven per cent of Calgarians favoured Springbank for flood mitigation and 55 per cent favoured McLean Creek.

The minister's 'us or them' approach reflects a major problem with this project. Unlike McLean Creek, a Springbank dam pits Albertans against Albertans.

We've been collecting data and consulting with experts for two years and the evidence is clear: A Springbank dry dam would be an extraordinarily expensive megaproject that would cause massive environmental degradation west of Calgary. It would displace homes, families and businesses that have been there for generations, without protecting upstream communities, without controlling Bow River flooding, and without an explanation to all other Albertans why they should pay hundreds of millions of dollars to protect a few Elbow River communities.

The government seems intent on flying in the face of cost/benefit analyses, voter opinion, and the rights of landowners to push through a most un-Albertan proposal. To destroy one community to save another, and then make all Albertans pay the vast costs is not the Alberta way.

Our message to the government: you're in a public policy hole. Stop digging. Halt work on Springbank and get moving on McLean Creek. Use that crown land to create a cheaper, more effective and more sustainable long-term flood plan. That's something Calgarians and Springbank residents could unite behind.

Lee Drewry is a member of dontdamnspringbank.org

JUNE 23, 2016: CEAA ISSUES STATEMENT REQUIRING FEDERAL ENVIRONMENTAL ASSESSMENT

Canadian Environmental Assessment Agency

Home > Registry > Springbank Off-Stream Reservoir Project > Additional Information
> Notice of Environmental Assessment Determination

Notice of Environmental Assessment Determination

Ottawa - June 23, 2016 - The Canadian Environmental Assessment Agency (the Agency) has decided that a federal environmental assessment is required for the Springbank Off-Stream Reservoir Project pursuant to the *Canadian Environmental Assessment Act, 2012* (CEAA 2012).

In making this determination, the Agency considered the following factors as indicated in section 10 of CEAA 2012:

- the description of the project provided by the proponent on April 28, 2016;
- the possibility that the carrying out of the project may cause adverse environmental effects; and,
- comments received within the 20 day comment period and from Aboriginal groups.

For further information regarding this project, please contact:

Springbank Off-Stream Reservoir Project
Canadian Environmental Assessment Agency
Canada Place
9700 Jasper Avenue, Suite 1145
Edmonton, Alberta T5J 4C3
Telephone: 780-495-2037
Fax: 780-495-2876
Email: CEAA.Springbank.ACEE@ceaa-acee.gc.ca

Date modified: 2016-06-23

2017

TSUU T'INA NATION VOICES OPPOSITION TO THE PROJECT

Tsuut'ina Nation vows to oppose Springbank dam

Mar 9/17 A-1

NDP defends flood mitigation plan, denies claim of lack of consultation

EVA FERGUSON

Members of the Tsuut'ina Nation are accusing the province of failing to consult them on the Springbank dry dam project, fearing it will pollute groundwater and put reserve lands at risk in the event of another flood.

Leaders with the First Nation southwest of Calgary say they will consider all legal avenues in a fight against the $200-million proposal, put forward by the NDP government as the best way to divert rising waters similar to Alberta's historic 2013 flood.

"This is a diversion that is right on our border, just a few metres away, of course we are concerned and we have never been consulted," said Tsuut'ina spokesman Kevin Littlelight.

"This thing has gotten a lot bigger than we would like and there's no question it's going to have an impact on us.

"We're exploring all our legal options and we are standing by the document the NDP has sanctioned — the UN Declaration on the Rights of Indigenous People."

After years of debate and controversy since southern Alberta suffered more than $5 billion in infrastructure damage in the 2013 flood, the NDP has decided to reduce risk along the Elbow River through the Springbank project.

A 2,400-hectare dry reservoir would be built near Bragg Creek to capture water, as well as a dry-land berm adjacent to the river.

But work cannot begin until a series of provincial and federal environmental assessments are complete.

Brian Mason, NDP Minister of Infrastructure and Transportation, said Wednesday the Springbank project is the best alternative to protect Calgary and other downstream communities from a repeat of 2013's devastation.

He added that the province has, in fact, consulted with Tsuut'ina from Day 1 and continues to make them part of the process.

"We've looked at all of the alternatives and evaluated them carefully, and based on expert advice we decided on Springbank.

"We have been consulting with the Tsuut'ina ... we've conducted a number of site visits with them and we've provided funding to them so they can participate fully in the environmental impact assessment."

But newly elected Tsuut'ina Chief Lee Crowchild says the nation only learned about the possibility of the dam's negative impacts from "third party sources," such as town hall meetings.

SEE DAM ON A4

■ SEE DON BRAID'S COLUMN ON A4

WITH TSUUT'INA REJECTION, FLOOD DAM HITS BIG SNAG

March 9/17
A 4

DON BRAID

As Calgary moves into its fourth spring since the great flood of 2013, there's suddenly a shocking question.

Without the consent of the Tsuut'ina, can the dry dam at Springbank be built at all?

The First Nation threw a jolt into the NDP Wednesday with a clear — and brand-new — declaration that it does not support the project.

"We're opposed, totally opposed," said spokesman Kevin Littlelight.

Chief Lee Crowchild insisted the dam will not go ahead until the NDP "has fulfilled its legal and moral obligation to seek Tsuut'ina's consent for this massive and permanent project."

He also said Tsuut'ina has not been consulted, a claim disputed by Infrastructure Minister Brian Mason, who says many meetings have been held.

Crowchild, who was elected last October, leaves a bit of wiggle room for more study. But the core message is that the band wants the government to return to the McLean Creek project further upstream.

I asked Mason if the government could build the Springbank dry dam without formal consent from the nation.

"We have to work together to the point where they feel they can support the project," he said. "We want to accomplish that. That's very important."

And then:

"Whether or not we would proceed without their absolute consensus is something I don't feel I can answer. I just don't know the answer to that today. We would certainly like to get their agreement."

Calgarians know very well how such projects can stall out, especially when they involve the province, Ottawa and the Tsuut'ina. Approval for the ring road through nation land took, oh, half a century.

This is tricky for the New Democrats, who believe they have done more to respect indigenous people's rights than any previous Alberta government.

Some on the nation don't see it that way. Littlelight says that he and others liked the NDP because Premier Rachel Notley campaigned against the Springbank dam in 2015.

After the election, the government reviewed both projects and switched back to Springbank.

"We were in favour of the NDP at the time," says Littlelight. "A number of people were. I know I was."

"And then they flip-flopped, and they're still proceeding (with Springbank.) That's the heart of the thing — you trust people, and all of a sudden they implement — like the past regime. That doesn't sit well with aboriginal people."

The Tsuut'ina and the government also have a sharp difference over the impact of the dam.

"Our homework is done," said Littlelight. "The dam has gotten a lot bigger. There's no doubt it will have an effect on water through the Tsuut'ina Nation.

"We will really strongly feel its negative effect. We have about 3,000 people who would be directly affected."

Crowchild says the nation has learned from a third party — not the government — that a diversion gate would be located less than half a kilometre from its land. "Water backing up during a flood diversion would directly impact Tsuut'ina, especially in the Redwood Meadows community," he adds.

Mason says:

"We had a consultation meeting with them in the Springbank area a month or six weeks ago, department officials attended, and it was pretty clear that the Tsuut'ina had formed an alliance with the Don't Dam Springbank landowners there."

The minister also disputes the claim that the dam would damage Tsuut'ina water or land.

"We don't believe it will. It's not on their land. To the best of our understanding, the project will not, even in a flood situation, affect their land.

"If there's impact on their land, then that's a matter of serious concern. But I don't think it's been demonstrated that this is the case at all. In fact, we expect it's not the case."

An environmental study due by the end of March should give a clear answer, he said.

"I think we can't lose sight of the bigger picture, which is that we need to take steps to make sure that kind of flood doesn't devastate Calgary and its economy as it did."

As for the Tsuut'ina claims, he said, "If in the end we're proven wrong, and the court or someone shows we've missed the boat, we'll have to cross that bridge when we come to it.

"But I don't think people would forgive us if we didn't see this through, and then we had the same flood, or worse."

He's got that part right.

Don Braid's column appears regularly in the Herald
dbraid@calgaryherald.com

Page 2 of Tsuut'ina's concerns. Upstream communities need protection such as that offered by MC1.

Fears flooding could contaminate drinking water

Mar-9/17 A4

DAM FROM A1

"Tsuut'ina has learned from third-party sources that this proposal will directly impact Tsuut'ina. That information did not come from the Government of Alberta," Crowchild said in a prepared statement.

"A diversion gate is less than half a kilometre from Tsuut'ina. Groundwater effects from mass water storage are unknown but could impact Tsuut'ina. Water backing up during a flood diversion would directly impact Tsuut'ina, especially in the Redwood Meadows community."

Band leaders worry that in the event of a major flood, groundwater and springs that feed their drinking water could become contaminated. They also worry a swelling, diverted river could still flood parts of Redwood Meadows.

Crowchild added that Tsuut'ina would have recourse to fight the dam under the UN Declaration on the Rights of Indigenous Peoples, which requires governments to secure the "free, prior and informed consent" of indigenous peoples prior to taking actions that affect their lands.

"The NDP have not upheld their commitment to the UN Declaration on the proposed Springbank Dam," Crowchild said.

But Mason said he believes part of the reason the Tsuut'ina has suddenly come out against a project that has long been in the making is because they are working alongside Springbank landowners.

"They've been working with landowners who have been opposed to this project for a while, so it's not a huge surprise," Mason said. "We'll continue to go ahead, absolutely, and have officials look carefully at the communique they've issued today to see if anything has changed. But proper consultation has been ongoing."

Mayor Naheed Nenshi issued a statement Wednesday strongly supporting the project.

"The Springbank Dry Dam is among the most critical elements of the flood mitigation infrastructure needed to protect Calgary," Nenshi said. "While we are working on many flood mitigation projects within city limits, the dry dam remains the most important part of the solution. Calgarians have been very patient as both the provincial and federal governments conduct environmental reviews. I am confident that the provincial government and the Tsuut'ina Nation can work together to move forward on protecting all downstream communities from future flooding."

Lee Drewry, a Springbank landowner and member of dontdamnspringbank.org, is strongly against the dry dam solution, saying it will expropriate homes and heritage ranches, and cause irreparable damage to the community, including his own cattle ranch.

"I'm worried, very worried. Our land has been in my wife's family for 130 years."

— With files from Emma Graney, Edmonton Journal
eferguson@postmedia.com

About 50 people from the Bragg Creek and Springbank area protested in front of McDougall Centre on Friday. GAVIN YOUNG

REDWOOD MEADOWS OPPOSES SR1

The title says it all: Redwood Meadows needs upstream protection. Berms didn't protect the town.

A8 THURSDAY, MARCH 16, 2017 CALGARY HERALD

Redwood Meadows joins Tsuut'ina fight

Townsite's mayor calls on province to 'reconsider' Springbank dry dam project

EVA FERGUSON

The community of Redwood Meadows has joined the Tsuut'ina Nation in a renewed fight against the Springbank dry dam project, citing concerns around the potential effects of water backup and pollutants during a major flood.

Dr. Liz Erasmus, mayor of Redwood Meadows, the townsite just north of Bragg Creek and the Tsuut'ina reserve lands, released a statement Wednesday calling on the government of Alberta to "reconsider the McLean Creek option for flood mitigation to protect all our communities."

New concerns were raised by the Tsuut'ina last week in a similar statement, saying that "third-party sources" have flagged "unknown impacts" from a diversion gate being placed three kilometres from reserve lands.

Both the Nation and Redwood Meadows are worried about groundwater effects from mass water storage, water backing up during a flood diversion and pollutants or airborne contaminants from a flood event.

"We support and share the goals of flood mitigation for Tsuut'ina, neighbouring municipalities and our quasi-municipality," Erasmus said.

"But we insist it be done with respect and in accordance with the government's consultation obligations to both the non-Aboriginal and Aboriginal communities within the impacted area."

Last week, members of the Tsuut'ina Nation accused the province of failing to consult them on the Springbank dry dam project diversion.

Leaders with the First Nation southwest of Calgary said they will consider all legal avenues in a fight against the $200-million proposal, put forward by the NDP government as the best way to divert rising waters similar to Alberta's historic 2013 flood.

Tsuut'ina Chief Lee Crowchild said the government has to stand by the UN Declaration on the Rights of Indigenous People, which requires governments to secure the "free, prior and informed consent" of indigenous peoples prior to taking actions that affect their lands.

And while the Tsuut'ina also accused the province of never consulting them about the diversion plans, Brian Mason, NDP Minister of Infrastructure and Transportation, said the province has, in fact, consulted with Tsuut'ina from Day 1, conducting a number of site visits and continues to make them part of the process.

After Redwood Meadows joined the fight Wednesday, Mason said: "We are concerned about everyone who may be impacted and we'll be reaching out to all of these folks."

After years of debate and controversy since southern Alberta suffered more than $5 billion in infrastructure damage in the 2013 flood, the NDP has decided to reduce risk along the Elbow River through the Springbank project.

A 2,400-hectare dry reservoir would be built about 17 kilometres downstream of Bragg Creek, while a diversion canal would start 14 km north of Bragg Creek, just north of Highway 8 (Glenmore Trail).

But work cannot begin until a series of provincial and federal environmental assessments are complete.

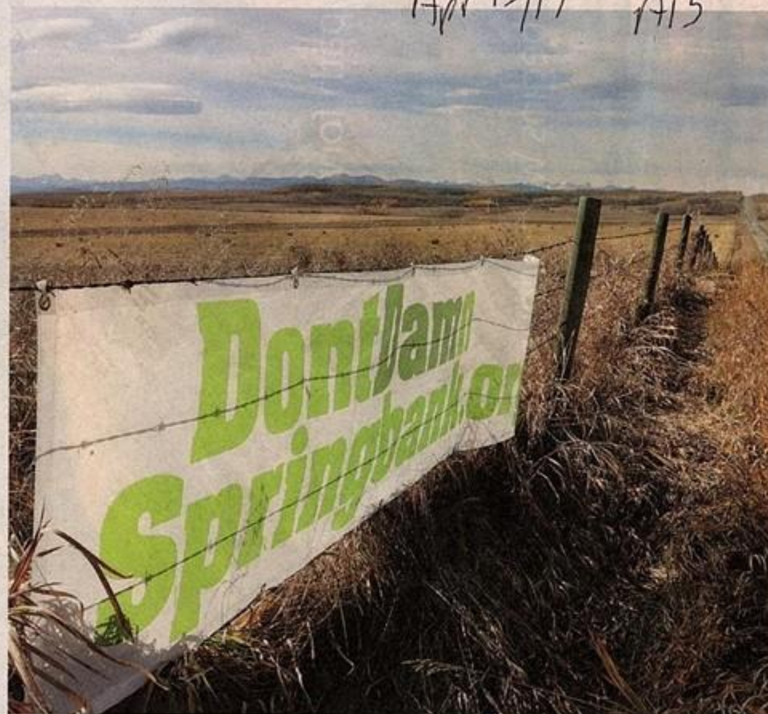
With files from James Wood, Postmedia News

eferguson@postmedia.com

SPRINGBANK DAM A NON-STARTER

Apr 15/17 A15

McLean Creek a wiser choice, writes *Chief Lee Crowchild.*



Signs supporting the DontDamnSpringbank.org movement hang on fences along Springbank Road. The area is ground zero for the proposed Springbank Dam and Reservoir. *FILES*

DaDa Nas T'ada (good day).

On behalf of the elders, council and people of the Tsuut'ina Nation, I offer greetings and sincere best wishes to Calgarians and southern Albertans.

The Tsuut'ina Nation has been pro-development for many years now. From our long-awaited agreement with Alberta on a ring road extension, to our very successful casino, hotel and entertainment centre, and plans for a massive three-part commercial development along our boundary with Calgary, we have worked hard to encourage economic development and partnerships that bring Tsuut'ina people and Calgarians together every day in business, education and entertainment.

Our opposition to the proposed Springbank dam, however, is driven by real concerns that have not been addressed. Tsuut'ina was heavily impacted by the floods of 2005 and 2013. The Elbow River runs through Tsuut'ina, is an important source of water for our treaty lands and is spiritually important to us. But it can be destructive.

We agree with Calgary and the government of Alberta that flood mitigation is needed. But any infrastructure that fundamentally affects our lands and the water running through our nation, must be approached with wisdom, even caution. It is that cautious and thoughtful approach that has led us to conclude that the competing project — a dam higher in the watershed at McLean Creek — is the vastly better solution not just for Tsuut'ina, but all flood-affected communities.

When a major project is being developed near a First Nation, the law requires meaningful consultation. Tsuut'ina set out our concerns about potential impacts of the Springbank dam on our treaty lands and water resources in a detailed letter in May 2016. Alberta has never responded to those concerns.

The government argues that because it has had a few low-level meetings with staff at Tsuut'ina about archeological sites and hunting on private lands, that they have met the consultation requirement. They have not.

In fact, the province made the decision to proceed with Springbank without a single meeting with Tsuut'ina.

The environmental assessment for the Springbank dam does not take into account the potential impacts on Tsuut'ina lands and waters. We are an oversight, a technicality, an inconvenience. That is especially ironic for a government that campaigned on a commitment to implement the United Nations Declaration of the Right of Indigenous Peoples, which says that states must seek from indigenous people their "free and informed consent prior to the approval of any project affecting their lands or territories."

That has not happened. That consent has not been sought. And because of the risk Springbank presents, and the benefits of McLean Creek, we do not give that consent. That is a not a negotiating position, this is our principled stance on Springbank.

It is my goal to build bridges between Calgarians and Tsuut'ina. And shortly, I will announce several concrete steps to do that. We need to tear down the figurative fence between our people and work together. Let's start now, by working together to ensure the provincial government gets moving right away on effective flood mitigation, at McLean Creek.

McLean Creek offers more and better flood protection. It would also offer water storage for droughts. Springbank would not. McLean Creek will protect Calgary, Redwood Meadows, Bragg Creek and Tsuut'ina. Springbank will not.

Springbank would create a massive earthen dam looming over Tsuut'ina — a failure would be catastrophic. I cannot take that risk to our people's land. And yes, as people who have had their traditional lands taken away, Tsuut'ina does sympathize with our ranching neighbours who face the loss of their lands, and heritage. Whereas, McLean Creek is Crown land, so no one need be displaced.

From Tsuut'ina's perspective, McLean Creek is a vastly better option. Springbank is just too risky.

Lee Crowchild is chief of the Tsuut'ina First Nation.

WATER SHORTAGES HIGHLIGHT SR1 SHORTFALLS

40 water shortage warnings issued

Aug 9/17 A3

A water ban reminder appears to be working in Okotoks, where water use has dropped from 15 million litres a day to 7.2 million. *LEAH HENNEL*

BILL KAUFMANN

Parched conditions have led the province to issue 40 water shortage advisories across Alberta, with some towns south of Calgary banning outdoor use.

Of those advisories, 17 apply to river sections in the Calgary region, including the Bow and Elbow, in which voluntary angling moratoriums in most cases have been posted due to lower water levels and higher temperatures that are stressing aquatic life.

But for the Sheep and Highwood rivers and Fish Creek, it goes further to include no more temporary diversion licences being accepted, while in the North Saskatchewan River Basin, that's been extended to restrictions on licensed water withdrawals.

For the past week, the town of Okotoks has banned nearly all outdoor use of water due to the sharp drop in the flow of the Sheep River and soaring demand amid the relentless summer heat.

Bans have also been put in place in the nearby towns of Black Diamond and Turner Valley, while softer restrictions are in effect in High River.

"Basically, it comes in as supply and demand, and we have a supply problem that goes a long way back," said Okotoks Coun. Tanya Thorn.

Lawn watering, vehicle washing, filling of pools and other uses are prohibited for the foreseeable future, she said, measures last taken a decade ago.

The measure has succeeded, dropping Okotoks' water use from 15 million litres a day to 7.2 million litres, said Thorn.

BKaufmann@postmedia.com
Twitter.com/BillKaufmannjrn

This is a precursor to the predicted water shortage in Calgary due to an increasing population in Calgary that relies on the Elbow River for their water, and the decreasing water flow on the Elbow River that has been happening since the 1930s. The gap between supply and demand is forecast to start by about 2034, depending on whether or not there are drought conditions.

SR1 COST NEARLY DOUBLES

NDP sticks to plan as Springbank dam cost jumps $182M

Aug 12/17

Local landowners, Tsuut'ina Nation oppose proposed flood-mitigation project

JAMES WOOD

The cost for the proposed Springbank dam has jumped $182 million over the original price tag but the NDP government says it's sticking with the project.

In a news release Friday, the province said the new cost estimate for the off-stream reservoir project at Springbank is $432 million, with the increased expense coming from engineering and construction costs, as well as the government's intention to purchase entire quarter-section parcels beyond the dam's footprint.

When construction is complete, the government intends to resell land that remains outside of the footprint, potentially lowering the project's total cost to $372 million.

The Springbank dam was conceived in response to the 2013 flood that ravaged Calgary, and the NDP has backed that project over another, at McLean Creek, which the government estimates would cost $406 million.

"Our government committed to the Springbank Off-Stream Reservoir project in October 2015, and that commitment has not wavered," said a statement from Infrastructure Minister Brian Mason, who was not made available for an interview.

"This project is the best option to protect the City of Calgary and other downstream communities from another event like the 2013 flood disaster."

The Springbank dam is intended to divert the Elbow River and temporarily store its water as protection from rising waters.

Former premier Jim Prentice announced the project in the fall of 2014, just days before calling a byelection in the flood-affected riding of Calgary-Elbow. Then, the government maintained the massive flood mitigation dam would cost an estimated $250 million — an expenditure the New Democrats roundly criticized during the 2015 election campaign.

Once in government, the NDP reversed course and declared it would proceed with the controversial off-stream reservoir despite concerns the project would trigger a protracted legal battle with Springbank landowners and questions about whether the project made economic sense. The most recent price tag for the project was $263 million.

While it has support from the City of Calgary and the Calgary River Communities Action Group, the dam is opposed by landowners who will have their properties expropriated and the Tsuut'ina Nation.

Friday's announcement comes as little surprise to Don't Dam Springbank spokesman Ryan Robinson, whose group has long criticized the project as misguided and expensive.

"It's interesting to finally get some more updated numbers, and it's really interesting that now they've come to the same conclusion as our group," he said.

"The McLean Creek dam, which protects more people, is upstream of Redwood (Meadows,) Bragg Creek and the (Tsuut'ina) Nation — protects all those communities and is cheaper."

jwood@postmedia.com

IAAC (CEAA) REJECTS ALBERTA GOVERNMENT'S ENVIRONMENTAL IMPACT STATEMENT***

BARRIERS MOUNT AGAINST SPRINGBANK DRY DAM

Herald
Nov 22/17
A2

Two groups with the smarts, the strategies make it uphill battle for mitigation project

LICIA CORBELLA

The barriers rising against the Springbank dry dam continue to grow more unbreachable. The sooner the City of Calgary and the province comprehend this reality, the cheaper and faster flood mitigation can proceed for Calgary and upstream communities that were devastated in the 2013 flood.

It was revealed on Monday that the federal government's Canadian Environmental Assessment Agency rejected the Alberta government's environmental impact statement regarding the dry dam — also known as SR1 — in a detailed 23-page report.

Complying with that report, however, is just a molehill of a barrier — even though there are a whopping 66 missing pieces of detailed information and actions required of the province to conform to the federal agency's specifications.

No, the big obstacles in the way of the Springbank dry dam are two diverse groups of people united in their rock-solid resolve against the dry dam — that will not store water, but simply divert flood waters via enormous concrete spillways into a low-lying basin that will include movable dam walls in Springbank — on land currently owned by several heritage ranching families and bordering the Tsuut'ina Nation.

"This CEAA report shows that the Tsuut'ina Nation was not consulted," said Chief Lee Crowchild Tuesday. "We were marginalized. And we won't be marginalized."

Crowchild is soft-spoken and emanates calmness, but make no mistake, there is determination behind his words.

"SR1 is on our boundary and has direct impact on treaty-protected lands, so we get to give or withhold consent," says Crowchild.

Crowchild believes that Justin Trudeau's federal Liberal government's signing of the United Nations Declaration on the Rights of Indigenous Peoples, means that the Tsuut'ina must approve of any project that will affect their lands before construction can begin. The federal government denies that consent must be given, only that consultation must take place.

"I hope this report makes it very clear to the province that they need to work with us. Not do an end run around us," adds Crowchild.

The province has been given 66 separate points of "information required to conform" with the agency's stipulations. These requirements to conform are not simple, as Mayor Naheed Nenshi assumes. "I understand that (the agency is) asking the Alberta government to dot some more i's and cross some more t's in terms of the documents that they provided to the federal government," Nenshi said Monday.

Crowchild says the Tsuut'ina prefer a multi-barrier approach to flood mitigation starting at McLean Creek, which would be built in a deep river gorge that would naturally provide three sides of a dam that could also serve as a reservoir for water during drought years.

Crowchild says a dry dam similar to SR1 would be better built on Tsuut'ina land that would divert flood waters away from more valuable band land that has housing and the Redwood Meadows Golf Course west of Calgary, owned by the band.

Ryan Robinson, a member of one of the legacy families whose heritage land would be destroyed by the 2,750-hectare Springbank dry dam project, says he is not surprised by the federal govern-

the group DontDamSpringbank.org

One of the main reasons provincial and Calgary officials say they are focusing on building the Springbank project over the McLean Creek dam is cost. In August, however, the Alberta government announced that the cost of the project had ballooned to $432 million from the original $200 million when the dry dam was first conceived. The McLean Creek plan is now estimated to cost $406 million, $26 million less than the Springbank project — which will undoubtedly continue to increase in cost owing to compensation for the affected landowners and opposition by the Tsuut'ina Nation, which is just 300 metres from the affected area.

And now some of the landowners have thrown a new barricade in the way of the province's plans. It was announced on Monday that several landowners have entered into a joint development venture with Bordeaux Developments, the developer currently building the west-side lakefront community of Harmony near the Springbank Airport.

The landowners have filed caveats, signed contracts and entered into a joint venture with Bordeaux Developments to build a master-plan community on almost 1,700 hectares of land right in the middle of where the dry dam is scheduled to be built, tentatively to be called Copithorne Ranch.

In stakeholder meetings with affected landowners, provincial officials said that when they buy or expropriate the land of these ranching families, they would pay for land assessed as empty pasture land — except where houses and outbuildings exist.

But now with Bordeaux's joint plans to build a community on the land, the assessed value of the land is expected to skyrocket, making the province's expropriation much more costly. What might have sold for $10,000 an acre might go for more than $150,000 an acre.

In other words, despite what Nenshi and a spokesperson at Alberta's Ministry of Transporta-

2018

IAAC (CEAA) UNTERTAKES DETAILED REVIEW OF UPDATED EIA

In June 2018 the Canadian Environmental Assessment Agency (IAAC (CEAA)) submitted a 16-question Information Request (IR) to Alberta Transportation for more information relating to the Springbank Off-Stream Reservoir Project (SR1) Environmental Impact Statement (EIS). *Source of this summary is the Calgary's River Communities Action Group Blog, September 17, 2018.*

Since then, two more IR packages have been submitted to Alberta Transportation, on August 20, 2018, and on August 31, 2018, totalling 86 questions.

The questions address a range of project concerns including climate change considerations, impact on wildlife, vegetation and soil, and water quality.

Throughout each IR package, the questions emphasize the requirement to evaluate any and all effects on the physical and cultural heritage of Indigenous peoples including cultural experience, traditional use of land and resources, and impacts to Aboriginal and treaty rights. Some questions highlight areas where additional community knowledge and Aboriginal traditional knowledge are needed for a complete and accurate assessment.

A few questions that stood out covered the topic of Alternate Means, as the EIS Guidelines require the Proponent to "identify and consider the effects of alternative means of carrying out the project." For example:

Given any Project updates, provide information on the comparison of MC1 and the Project, including costs/benefits.

Describe how changes to the environment from the MC1 option would affect Indigenous health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Evaluate whether the Tri-River Joint Reservoir of Alberta and the Micro-Watershed Impounding Concept are feasible alternative means of meeting the Project's purpose. Consider potential environmental effects of each alternative in this evaluation.

PROPONENT HOSTS OPEN HOUSES IN SPRINGBANK AND CALGARY

It was at these open houses where it became apparent that the project had increased in scope and scale far beyond what had originally been contemplated.

JUNE 2018: SPRINGBANK COMMUNITY ASSOCIATION SUBMITS A LETTER TO IAAC (CEAA) OUTLINING ITS CONCERNS WITH THE SR1 PROJECT.

The letter was the first formal engagement by the Springbank Community Association on the SR1 project.

JUNE 2018: NRCB IDENTIFIES HUNDREDS OF INFORMATION GAPS IN THE 2017 EIA

A long list of questions (IRs)

COMMUNITY OPPOSITION TO THE PROJECT GROWS

The Springbank, Bragg Creek and Redwood Meadows communities come together to discuss the implications of SR1. Not one of our communities had been engaged by the Proponent along the way and we wanted our voices to be heard. We collaborated with Tsuut'tina Nation members to share information and discuss the project.

2 - COCHRANE EAGLE, October 4, 2018

NEWS

Tsuut'ina and Springbank landowners unite to protest

By Lindsay Seewalt
The Eagle

A cross-cultural event in the dual spirit of reconciliation and landowners' right took to the banks of the Elbow River along Redwood Meadows on the morning of Sept. 29.

The peaceful protest, the Ride for Reconciliation and the River, drew some 50 riders from the grassroots Don't Dam Springbank group, comprised of mostly landowners who would be impacted by the controversial dry dam project proposed by the province, and the Tsuut'ina First Nation, which borders Redwood Meadows and runs through Calgary.

Elder Bruce Starlight kicked off the protest with a traditional smudging ceremony.

Both groups are adamant that the dry dam (known as SR1) is an unacceptable flood mitigation solution, which will have devastating effects to private land, water and will fail to offer any flood protection to those upstream – including Bragg Creek and Redwood Meadows.

Kevin Littlelight, spokesperson for the Tsuut'ina Nation and one of the event organizers, said the event was a great success and sent a message that communities have come together to take a stand.

"It's a message to all people ... especially to the Government of Canada and the Government of Alberta. It shows the people are united. It doesn't matter if they're native or non-native," said Littlelight.

"We expected a lot better from an NDP government – we expected more respect for the environment by the NDP ... There's a driving force behind this yet to be seen. Why are they just sticking to this site? You know there's politics in this somewhere."

Lee Drewry is one of the affected landowners who would see around two-thirds of his five-generation family land in Springbank submerged should the dam be built. He is also a spokesperson for Don't Dam Springbank.

Don't Dam Springbank and the Tsuut'ina Nation both maintain that the most suitable solution that would limit impacts on the land while affording the most flood protection possible is to build a dam at McLean Creek.

Tsuut'ina Chief Lee Crowchild bows his head in prayer before the start of the Unity Ride at Moose Hill Ranch, south of Cochrane on Saturday.

Photos by Yasmin Mayne

Please see next page

CochraneEagle.com

October 4, 2018, COCHRANE EAGLE - 3

HISTORIC RIDE OPPOSES SPRINGBANK DAM

Continued from previous page

"We're going to fight this thing to the end – it's a bad project," said Drewry, explaining that the Canadian Environment Assessment Agency review is nearly midway but is now at a standstill, requesting more information from Alberta Transportation.

"Right now, I think the Alberta government has a lot of work to do to answer the questions on environment from the federal government ... The federal review can take up to one year, but when they have these questions the clock stops ticking," said Drewry, crediting the idea for the unity ride to Tsuut'ina Chief Crowchild.

"Right now, I think the Alberta government has a lot of work to do to answer questions on the environment from the federal government."

Littlelight said the Nation is "100 per cent against the SR1," a project his people maintain has miserably failed in consultations on the part of the government, impinges on landowner rights and will impact the land and pollute the water.

"It's going to damage our waters, it's going to damage our land – we have sacred sites that will be damaged by this," said Littlelight, adding that in addition to Indigenous rights, his people feel the government is not respectful of pioneer rights – those of the Springbank landowners whose lands would be devastated, many whose residency in the region predates the City of Calgary.

Spring public consultation sessions held by the province highlighted the parameters of the $432-million project, a cost that has nearly doubled since conception. The dam project was announced by the province in 2015 in response to the devastating 2013 Calgary flood and has been met with considerable opposition from stakeholders.

This spring, Brian Mason, minister of transportation announced that the province may have to expropriate more than 3,000 acres of private lands required to build the diversion and reservoir.

Learn more at dontdamspringbank.org or transportation.alberta.ca/sr1.htm.

lseewalt@cochrane.greatwest.ca

ABOVE: Roisin McFadden drinks a hot beverage before the commencement of the Unity Ride. RIGHT: Mary Robinson arrives for the Unity Ride at her ranch, Moose Hill Ranch.

NOVEMBER 2018: FIRST MEETING BETWEEN WESTERN COMMUNITIES AND THE PROPONENT

In November 2018 Springbank Coalition and Tri-Rivers group gave presentations to Alberta Transportation's ADM Springbank, Crystal Damer's SR1 team. The GoA team was concerned about the potential animosity at the presentation which included the Springbank Community President and a rancher. The ADM Springbank contacted Dr. Karen Massey (contact for the western communities) the day before outlining concerns associated with hearing from the Springbank Community Association. Apparently, the purpose of the meeting, from their perspective, was alternatives while from the western communities' perspective, it was an opportunity to be heard for the first time. In fact, we believe that one cannot discuss the alternatives until there is an understanding of the concerns with SR1 in order to contrast outcomes with the alternative. There were no follow-ups from Alberta Transportation post-meeting and we do not recognize this meeting as consultation.

SR1 CONTINUES TO BE CONTROVERSIAL

It's time for real talk on flood prevention

Dec 20/18

City and region need a workable plan, writes *Bruce McAllister*, not bluster.

We've been conditioned to find two sides to every issue, champion our side and dig in for a fight. Ottawa, for example, is pitting itself against Alberta on a number of issues vital to our province's well-being. We need to make a clear case for our province.

Yet not all issues require one group to entrench against another. What happens when two sides are working for the common good and need to stop to see a better way?

This is where we find ourselves with the Springbank dam. After the 2013 flood, the Alberta government announced a plan to mitigate future flooding. A dry dam would be built along the Elbow River to catch flood waters racing toward Calgary in the likely event of another major flood. This plan, as it was pitched, would save the city from catastrophe for the low price of a few hundred million dollars and the inconvenience of a few rural landowners. The room nodded, politicians congratulated themselves and shovels were readied.

In actuality, lines were drawn in the political sand. You were "for" the Springbank dry dam (and the salvation of humankind) or against it (you heartless grinch). What was arguably a good concept has turned into a political red herring, a distraction aimed to assuage public fears. But what the city and region need is a flood plan, not a political shootout.

Enter Rockyview County council and a dose of clear thinking for this project. They looked at the plans and realized that it is riddled with problems. First, there are several other possibilities along various rivers that could protect the region from flooding, many perhaps much better than the Springbank dry dam. The cost of $400 million is likely half of what would be needed to build this dry dam. There's more. Experts from various flood mitigation groups have suggested the Springbank dry dam is an archaic solution not at all suited for this region. The province's best-qualified water experts from WaterSmart concluded there are several other options for flood AND drought mitigation in this region.

This is not an "us and them" political game; this is the story of Albertans from Tsuut'ina, Calgary, Redwood Meadows, Bragg Creek and, yes, Springbank saying there are better ways if only the political noise could calm down enough for new voices to speak. The move by Rockyview County is a clear-headed move to ensure that all our best efforts lead to the best possible outcome for Calgary and region. The current road leads to lawsuits, delays and bitter battles. We are 5½ years removed from the flood. It is past time for real leadership on this issue.

It's time those who gain political points stop and listen to the growing consensus. We can drop the Springbank dry dam and prepare a comprehensive flood/drought mitigation strategy that actually works best for all Albertans. To do that though, we'll need a new type of politician.

One who can move past the all too predictable tone and tenor being trumpeted by the current lot.

Bruce McAllister is executive director of Rocky View 2020, a landowner advocacy group, and former MLA for Chestermere-Rocky View.

Bruce McAllister sums up the situation over the past six years. We are seemingly two sides—Some of the City of Calgary and residents upstream of Calgary. We are all in agreement that we want one solution: Elbow River flood protection.

DECEMBER 2018: ROCKY VIEW COUNTY FORMALLY REQUESTS A HALT TO THE SR1 PROJECT

To our knowledge, the Proponent has not responded to this request.

2019

SPRINGBANK COMMUNITY ASSOCIATION HOSTS COMMUNITY INFORMATION SESSIONS

In 2019 the **western communities stand united** and strongly opposing SR1. MC1 is the preferred option for upstream protection. The communities are:

- Tsuut'ina
- Redwood Meadows
- Bragg Creek
- Springbank

They are supported by Rocky View County.

The western communities hosted information sessions in the Springbank Community and one at Bragg Creek Community Centre. The myths about MC1 and SR1 are being clarified.

Neighbor,

*We invite you to join us in a discussion about the long-term impacts of the **Springbank Off-Stream Reservoir (SR1).** Located in central Springbank this nearly $1 billion project has a footprint size of 60 Calgary Zoos.*

SR1 INFORMATION SESSIONS
MAY 7 – ELBOW VALLEY RESIDENT'S CLUB @7PM
MAY 8 – SPRINGBANK HERITAGE CLUB @7PM

SUMMARY OF OUR CONCERNS:

- No water storage to protect Calgary's drinking water supply
- No recreation – parks, pathways, camping, etc.
- No positive outcomes for Rocky View County
- No improvements to drought & fire, irrigation
- No comprehensive upstream flood protection for Bragg Creek & Redwood Meadows
- Air quality concerns (airborne contaminants, dust, West Nile)
- Lost tax revenue on the land, in perpetuity
- Possible ground water contamination
- Road closures and other transportation challenges
- Adverse tourism, environmental, aesthetic outcomes

Springbank COMMUNITY ASSOCIATION

For more information, visit: Springbankcommunity.com

During the presentations, community residents and Calgarians were surprised to learn about the facts of the new **triple threat of fire, drought, as well as flood that must be factored in what was originally just a flood management decision. We now have the advantage of time to learn about two major additional problems. MC1 helps resolve the triple threat. SR1 does not help in fire nor drought.**

Alberta Transportation Response to CEEA information requests about SR1[64]

JUNE 2019: PROPONENT RESPONDS TO NRCB IRS

On Friday, June 14, 2019 Alberta Transportation announced at a major press event that it had responded to IAAC (CEAA) and NRCB requests for information regarding the Springbank Off-Stream Reservoir (SR1) Environmental Impact Statement (EIS) that had been made in June and August, 2018.

In the 8,000-page response, the ministry answered nearly 600 questions collected from the Canadian Environmental Assessment Agency (IAAC (CEAA)), Natural Resources Conservation Board (NRCB), and Alberta Environment and Parks (AEP).

"Our government has committed to doing everything in our power to get regulatory approval for the Springbank Reservoir. Flood mitigation for Calgary and other communities is vital, and we need to move this project forward as quickly as possible through a very complex regulatory process. Our responses to regulator questions are compelling and comprehensive, and I look forward to seeing regulators move the Springbank Reservoir project forward." – Ric McIver, Minister of Transportation

The responses fall into five categories: Benefits and costs, Land use, Indigenous consultation, Water and hydrogeology, Environmental Impacts.

AUGUST 2019: CONFORMITY REVIEW HIGHLIGHTS DEFICIENCIES

In August 2019, IAAC (CEAA) identified, through three conformity reviews, deficiencies with the above responses from Alberta Transportation.

SEPTEMBER - NOVEMBER 2019: ONGOING IR RESPONSES

A series of IR submissions and conformity reviews between the Proponent and the Regulators.

DROUGHT AND FIRE: NEW THREATS

In 2019, the impact of drought and fire have been important topics. The increased profile of these risks has raised awareness of the need for water management, not just flood management. Two articles describe the concerns.

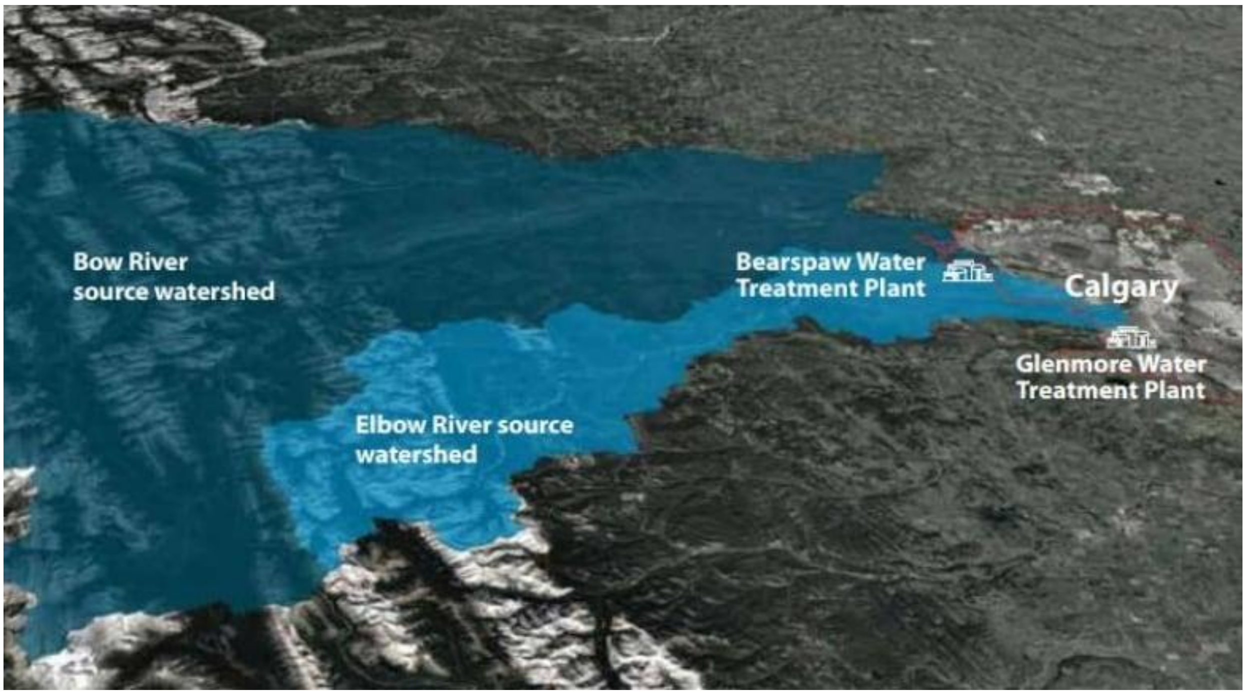
WILDFIRE CAN HARM WATER SUPPLY

[64] http://protectcalgary.com/alberta-transportation-submits-responses-to-sr1-information-requests/

Upstream wildfires could contaminate Calgary's drinking water — so the city's planning ahead[65]

The city's studying what can be done to reduce that risk

Sarah Rieger · CBC News · Posted: May 22, 2019 6:36 AM MT | Last Updated: May 22, 2019



If a wildfire sweeps through a region upstream of Calgary, it could end up impacting the city's drinking water supply. (City of Calgary)

14

comments

Wildfire season is getting longer in Alberta every year with climate change, scorching land and polluting the air with thick smoke. But, the City of Calgary is studying another, perhaps less obvious, impact of wildfires — drinking water contamination.

[65] https://www.cbc.ca/news/canada/calgary/wildfire-risk-water-supply-1.5144417

There haven't been any major fires in the Bow and Elbow river watersheds, upstream of the City of Calgary, for years. But there are fears a major fire west of the city could wash burned material into the rivers, impacting the drinking water supply for the city's 1.4 million residents.

The city has identified large, uncontrolled wildfires as one of the top risks that could impact the city's source water quality — and it's the only one that could cause a dramatic drop in water quality in a short period of time. So, the city is studying what can be done to reduce that risk.

"After storm events, there are significant water quality changes on a burned landscape, whether it's from a forest fire, grass fire or shrub fire," said Harpreet Sandhu, the team lead with watershed planning for the city. "The goal is ultimately to continue to provide safe, clean drinking water for Calgarians and to mitigate those risks." Sandhu said there are a number of possibilities being looked at to keep Calgary's drinking water safe.

Fire isn't going to know any boundaries and neither does our watershed or our water quality. - Harpreet Sandhu, City of Calgary

One is mapping areas upstream where prescribed burns could be done. Another is improving communication with emergency management agencies, so water treatment plants can be kept in the loop and possibly change their operations if needed to respond to wildfire events.

Another option — but a costlier one — would be to upgrade water treatment facilities to more easily process out those contaminants. Of course, most areas upstream that impact the city's water supply aren't under municipal jurisdiction.

FEARS OF DROUGHT AS THE CITY OF CALGARY PREDICTS WATER SHORTAGES

ALBERTA FACES FUTURE FLOOD, DROUGHT EXTREMES AS CLIMATE CHANGE HITS PRAIRIES HARD, EXPERT WARNS[66]

By **Madeline Smith**Star Calgary   Wed., May 15, 2019

CALGARY—While southern Alberta knows all too well the impact of severe flooding, experts say that drought, made more severe by climate change, poses a serious risk that the city can’t ignore.

[66] https://www.thestar.com/calgary/2019/05/15/alberta-faces-future-flood-drought-extremes-as-climate-change-hits-prairies-hard-expert-warns.html

Mayor Naheed Nenshi said Monday that the city's access to water could be under serious pressure in less than 20 years, reaching the provincial limit of daily water withdrawals from the Bow and Elbow rivers by 2036. "And the water shortages will only increase from there," Nenshi said.

"It's important now that we start making the decisions we have to make on development, growth throughout the region — conservation, how we pay for water so we can accommodate the growth here in the next decades."

David Sauchyn, a professor at the University of Regina and the director of the Prairie Adaptation Research Collaborative, warned city councillors during a session on water management that they can't get "complacent" about how Calgary handles water as climate change affects the West.

In an interview with Star Calgary, Sauchyn said that even though Calgary's 2013 flood justifiably looms large in people's minds, the city can't forget about the opposite problem: another long drought like the Dust Bowl.

Calgary's known for extreme weather but those events are increasing in frequency, says professor[67]

Scott Dippel · CBC News · Posted: May 13, 2019 5:45 PM MT | Last Updated: May 13

Calgary city council is discussing options for how to manage the city's portion of the Bow River watershed, which may face challenges like floods and droughts in the future. (Canadian Press, Dave Gilson/CBC)

In 2034, Calgary will have 1.7 million residents and it will have maxed out its water allocation from its rivers following two years of drought conditions. What then?

That was a scenario put to members of city council Monday in a closed-door session as the group talked about strategies for managing its share of the Bow River watershed. "It's an important topic, period," said Mayor Naheed Nenshi, pointing out southern Alberta is considered a semi-arid region.

However, experts who spoke to politicians at the meeting underscored the growing importance of planning for more extreme weather events in the future.

The director of the Prairie Adaptation Research Collaborative and a professor of geography and environmental design at the University of Regina, David Sauchyn, spoke to council about Calgary's climate and weather.

'It's being amplified by a warming climate'

He pointed out Calgary is well-known as a place of extreme weather events.

However, he said data shows events like heavy rainfalls and droughts are increasing in frequency and that trend will likely continue to accelerate.

[67] https://www.cbc.ca/news/canada/calgary/calgary-water-supply-management-1.5134686

"It's being amplified by a warming climate. It's being exaggerated. So going forward, the wet years are wetter and the dry years are drier."

Sauchyn said in future decades Calgary's peak rainfall season will become May, not June. There will be more winter rain events as that season will not be as cold as in the past.

He also said trends show river levels will fall further in the July to September timeframe than in the past due to greater water demand.

In recent years, the city has taken steps to reduce water consumption in recognition that it does not have unlimited access to water.

It has brought in mandatory water meters and invested in upgrades at its water treatment plants.

Year-round water storage?

City officials noted 2019's water supply outlook calls for a drier conditions this year.

An earlier run-off is expected from the eastern slopes of the Rockies and there are above normal temperatures in the forecast.

It puts Calgary into abnormally dry conditions, although parts of Alberta are forecast to see even drier, moderate drought conditions this year.

Nenshi said it does raise the question of whether any future upstream flood mitigation projects like the Springbank off-stream diversion should be converted into year-round water storage projects.

"A reservoir on the Bow River [upstream of Calgary] will be more useful. That said, I know that the new government is in the midst of doing some more analysis on Springbank and if this is somewhere that they want to go, we can certainly help them with the analysis on that," said Nenshi.

A creek in northwest Calgary. Mayor Naheed Nenshi said it's important for policymakers to look at how to get residents to think about how they use water. (Terri Trembath/CBC)

Nenshi said it's a useful conversation for policymakers to have, not only about ways of reducing water consumption but ways of getting residents to think more about how they use water.

"Do we want to implement summer water-use restrictions regardless of that particular year's water flow, so that we get used to it? So that we actually when times of drought are there, we're ready?"

There was a little too much focus on climate change for one councillor. Coun. Sean Chu said it's good to hear from experts on watershed management. But he questioned the notion that Calgary's weather is actually getting warmer or becoming wetter, a conclusion largely accepted by scientists as one of the impacts of human-caused climate change.

"We have a really cold winter, like huge. The coldest winter in how many years? And you talk about global warming? It's kind of interesting." Chu remains confident that Calgarians will find ways to cope with the climate or weather in this region. "The (temperature on) Earth's been going up and down for a long time. And we humans are very resilient. And we're going to learn, adapt and live on."

2020

JANUARY 2020: MINISTER MCIVER SENDS LETTERS TO CERTAIN AREA RESIDENTS WHO SENT IN LETTERS OF OPPOSITION

The letter continued to say that MC1 is not cheaper or quicker than SR1. [68]

JANUARY 2020: MEETING BETWEEN MINISTER OF TRASNSPORTATION AND COMMUNITY REPRESENTATIVES

This is the first meeting between our communities and any senior government official.

The presentation given to Minister McIver is available here:
https://drive.google.com/open?id=1dYNztQW_Vk-ortdcvXLtZpIdoYKr02uq

Our communities are vehemently opposed to SR1. There is nothing redeeming about this project and we are left with a litany of negative outcomes and lost-opportunities for value-creation that would result from an in-stream dam upstream.

JANUARY 2020: ETHICS WATCHDOGS CALL FOR AN INVESTIGATION INTO JUSTICE MINISTER DOUG SCHWEITZER AND APPOINTEE STEVE ALLAN

"The personal emails, obtained exclusively by CBC News from court records, show prominent Calgary businessman Steve Allan tied his political campaign support to Schweitzer publicly supporting the Springbank Dam project."

[68] https://drive.google.com/open?id=146ZnSyX5hqoMbkH5pDGR8rQT-z5yJxgc

“Government ethics expert Ian Stedman also said the relationship is an obvious example of a conflict of interest.

"It is very clear at this point that the minister is using his power to make a decision that furthers the private interests of a close associate, in Mr. Allan," Stedman said.”

https://www.cbc.ca/news/canada/edmonton/doug-schweitzer-pressured-for-support-of-springbank-dam-project-emails-show-1.5442319

Dave Klepacki: SR1 vs MC1

https://www.youtube.com/watch?v=bzhFTMblTAg&t=24s

Dr Karen Massey: Wildfire and Flood in Redwood Meadows

https://www.youtube.com/watch?v=vuPeZ1I0G4U

Mary Robinson: Impact of losing heritage land

https://www.youtube.com/watch?v=dTS8K3RNruI

Chief Lee Crowchild: Long-term water management of the Elbow River

https://www.youtube.com/watch?v=xJ_uoAQtFuQ&t=4s

Karin Hunter, Lee Drewry and Brian Copithorne: Magnitude of SR1 impacts

https://www.youtube.com/watch?v=ZKrrhPPktog

Presentations at the SR1 Information Sessions:

Springbank Impacts (Karin Hunter):
https://drive.google.com/open?id=1Eej40nwTgqTwGjHXfO1lQRZpc9qVupcr

Elbow River Watershed Considerations (Dave Klepacki):
https://drive.google.com/open?id=14oGxIlQfDzKTS0s6_yldECF4vnP-tuSD

APPENDIX E: PHOTOS OF WILDLIFE IN THE SR1 AREA

All photos are of wildlife in the SR1 footprint.

Recent Sightings of Elk Herd in SR1 area:

December 12, 2019 by Karen Massey Springbank Road near Highway 22, half the herd have easily and very quickly jumped the barbwire fence at this point, 8:15am.

December 13, 2019, by Dave Rupert west on Springbank Road

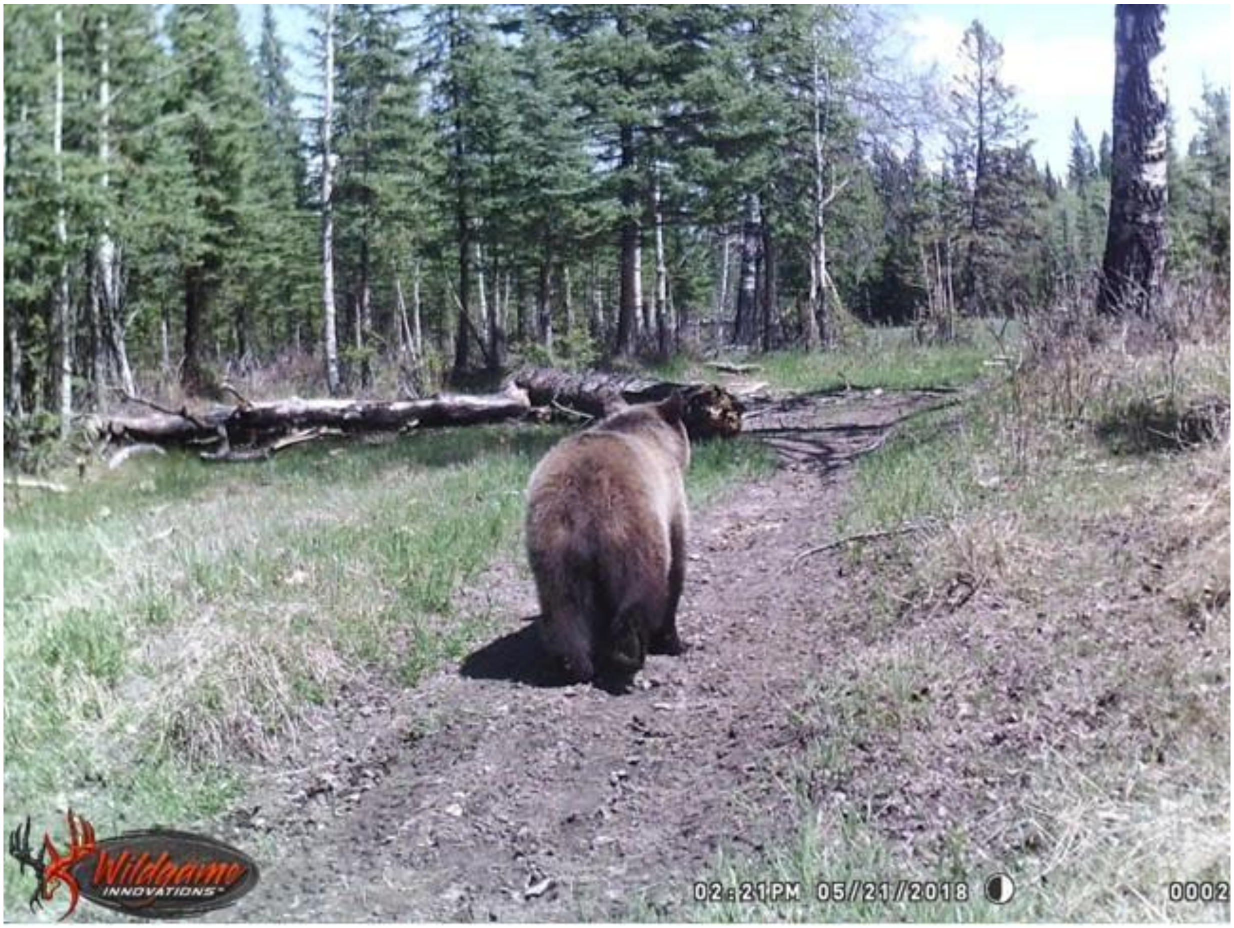
Dec. 30, 2019 Spectacular video taken by Marsha Wagner of the elk on her ranch. Double click to launch video.

Video.mov

2018 by Brian Copithorne on his ranch

Photographs taken by Brian Copithorne on Legal Description: Sections -25 &26-24-4-W5


25.84 inHg 6C 08/12/2018 11:07AM BROWNING 1


Wildgame INNOVATIONS
02:21PM 05/21/2018
0002

Great Blue Heron


Bushnell
06-09-2018 08:37:29

Brian Copithorne photo on his ranch

Elk May 24, 2019

Marsha Wagner photo on her ranch at her home

Modeling How Groundwater Pumping Will Affect Aquatic Ecosystems

Regions with dry climates and heavy agricultural industries may be the most hard-hit. General consensus holds that to maintain healthy ecosystems, groundwater extraction should not lower the natural monthly flow of a stream by more than 10% over a period of time. Credit: iStock.com/ADragan

By Adityarup Chakravorty 15 November 2019

Almost 30% of Earth's freshwater supply lies hidden from view as groundwater. These waters, though mostly invisible, are vital for us humans. Groundwater provides about half the global supply of drinking water and is used to grow the majority of the world's irrigated crops.

Groundwater is also an inextricable cog in the global water cycle. In many areas, discharge from groundwater replenishes streams and rivers, helping sustain aquatic ecosystems. Many of these ecosystems are now under threat, according to a new study.

Inge de Graaf, a hydrological environmental systems researcher at the University of Freiburg, and colleagues simulated on a global scale how current rates of groundwater extraction will affect surface streams and rivers and the ecosystems associated with them.

"We expect that by 2050 more than half of the regions with groundwater abstractions will not be able to maintain healthy ecosystems."

"Almost 20% of the regions where groundwater is pumped currently suffer from a reduction of river flow, putting ecosystems at risk," de Graaf wrote in a recent blog post. "We expect that by 2050 more than half of the regions with groundwater abstractions will not be able to maintain healthy ecosystems."

Areas already at risk include regions with relatively dry climates, such as the High Plains of the United States, and places where large amounts of groundwater are used for irrigation, such as the upper Ganges and Indus basins in the Indian subcontinent. But groundwater pumping has also affected river flow in other locations, including parts of the northeastern United States and Argentina.

Technically, groundwater is a renewable resource, but unsustainable rates of groundwater extraction can deplete reserves faster than they can be replenished by rain, snow, or surface waters. As groundwater levels drop, streams, rivers, and the aquatic ecosystems dependent on these waters can suffer tremendous, and sometimes irreversible, losses.

Building a Global Groundwater Model

Several existing hydrological models simulate the flow of groundwater and its interactions with surface water. But these models work at the level of individual catchment areas. "This is the first study I've seen that models groundwater–surface water interactions on a global scale over timescales relevant to management or planning," said Audrey Sawyer, a hydrogeologist at The Ohio State University who was not involved in the study. "The results provide a great road map for identifying areas that need higher-resolution models and more observations."

To build a global-scale hydrological model that simulates when loss of groundwater contributions will cause streamflows to fall below levels needed to sustain aquatic life, de Graaf leaned on existing models. These included the PCRaster Global Water Balance model 2 (PCR-GLOBWEB 2) developed at Utrecht University, which simulates moisture storage and exchange between atmospheric, surface, and groundwater reservoirs and accounts for water demands from agriculture, animal husbandry, household use, and industry, and the U.S. Geological Survey's modular hydrologic model (MODFLOW), which predicts groundwater status and groundwater–surface water interactions.

As inputs for the model, de Graaf used historical data on groundwater demand and extraction from 1960 to 2010. After 2010, she assumed that groundwater use would remain mostly constant through 2100, increasing only in response to irrigation needs as a result of climate change. The model also accounted for different scenarios of climate change based on the Representative Concentration Pathway 8.5 scenario from the Intergovernmental Panel on Climate Change to simulate changes in precipitation due to climate change.

Determining When Streamflow Hits Critical Levels

The model incorporates a previously defined standard that to maintain healthy ecosystems, groundwater extraction should not lower the natural monthly flow of a stream by more than 10% over a period of time. Streams naturally ebb and rise over time, but using this standard, de Graaf calculated a value (the low-flow index) that represents the groundwater discharge needed to maintain at least the minimum natural streamflow necessary to sustain aquatic life in different streams.

Streamflows were assumed to reach critically low levels if monthly flow was 10%

below the low-flow index for more than 3 months of a year for two consecutive years.

However, groundwater levels and streamflows can be affected by more than groundwater extraction. Climate change, for example, can also affect both. To distinguish between alterations to streamflow driven by climate change alone and those caused by climate change and groundwater pumping, de Graaf ran simulations from 1965 through 2099 that either included groundwater and surface water use by humans or were "natural runs" that excluded human activity. Flow limits reached under both conditions were excluded because they could not be attributed solely to groundwater pumping.

"Only a small drop in groundwater levels can cause these critical river flows."

Using results from the model, de Graaf estimates that by 2050 streamflows will be affected in the majority of watersheds worldwide, sometimes even before major groundwater loss. "Only a small drop in groundwater levels can cause these critical river flows," de Graaf wrote. "Moreover, the impact of groundwater pumping will often become noticeable only after years or decades. This means that we cannot detect the future impact of groundwater pumping on rivers from the current levels of groundwater decline. It really behaves like a ticking time bomb."

Results from de Graaf and her team's research were published in October in *Nature*.

The global scale of the model makes it "a great starting point for identifying watersheds and regions where we need more surface water and groundwater data and higher-resolution models," Sawyer said. But the scale of the model also means that "we need to follow-up with observations and more refined models relevant to the scale of land use planning and ecosystem processes," she said.

—Adityarup Chakravorty (chakravo@gmail.com), Science Writer

Citation: Chakravorty, A. (2019), Modeling how groundwater pumping will affect aquatic ecosystems, *Eos, 100,* https://doi.org/10.1029/2019EO136426. Published on 15 November 2019.

APPENDIX H: MAJOR BUILDING BLOCKS OF EMERGENCY MANAGEMENT SYSTEMS REPRESENTING BEST PRACTISE

Alberta Emergency Management Requirements for Dams

Alberta Environment publishes general guidance for dam owners and operators that outlines requirements for the preparation of an Emergency Preparation Plan (EPP) and Emergency Response Plan (ERP) for dams operating in Alberta (Alberta Environment, 2003). EPP's for individual dams provide an annex to existing Municipal Emergency Plans (MEP), but an EPP does not replace or supersede existing MEP's of Local Authorities or other responding agencies. A dam site-specific ERP defines emergency measures to be implemented by owners, key operators and contractors, such as: response structure to be used; specific and roles and responsibilities of key personnel; training requirements; resource requirements; and communications protocols.

In 2012 a review of the major building blocks, associated elements, and implementation *(i.e., prescriptive, goal-based, objective)* of emergency management measures applied in several other jurisdictions was conducted (First Response Emergency Services: a Division of Skystone Engineering, 2012) as a means of defining best practices. A summary of these considerations is provided in Table 1 below, along with a ranking of the thoroughness of each process as implemented in individual jurisdictions.

It is further noted that the template available from Alberta Environment are a starting point for developing an EPP and ERP and additional components (as noted above) may be required to provide a supportable basis for minimizing damage to existing infrastructure and maximizing the safety of the public following a major flood and/or dam breach.

While we would prefer to have had the opportunity to review a site specific, non-confidential version of the EPP and ERP, it is our understanding that these documents will not be available until after the completion of the CEAA process.

EMS Building Blocks Assessed	Elements Considered
OVERALL THEMES	Prescriptive (rule-based) approaches
	Objective (goal-based) approaches
	Approval process
	Updating cycle
	Plan, Do, Check, Act cycle
	As Low As is Reasonably Practicable
	Use of Hazard and Risk
	Prevention policy / national standard
	Safety report / case vs. ERP focus
HAZARD IDENTIFICATION / RISK ASSESSMENT / PREVENTION AND MITIGATION STRATEGIES	Hazard identification
	Risk assessment
	Prevention strategies based on hazard identifications and risk assessments (high risk should be eliminated)
	Hazard monitoring system establishment (non-eliminated hazards - non high/high hazards)
	Interim and long term actions to eliminate hazards
	Mitigation strategies to limit or control consequences or severity of non-high/-high risk hazards
	Mitigation plan for interim & long term actions to reduce hazards that cannot be eliminated (ALARP)
CORPORATE EMERGENCY MANAGEMENT PROGRAM RESPONSIBILITY	Executive / senior management accountability
	Executive approved policy (HSE) statement
	Program coordinator designated
	Program advisory committee
	Program budget / financial support
	Program records management process
	Program review / change management
	Program goals and objectives description
	Program elements determination: prevention, mitigation, preparedness, response, recovery
PLANNING PROCESS	Public awareness program for public impacted by hazard
	Stakeholder participation in planning process
	Identification of internal and external agencies, organizations, departments and positions
	Resource capability assessment

	Identification of logistics support and resource requirements
	Mutual aid assistance
	Inventory of internal and external resources
INCIDENT MANAGEMENT	Incident management system (complete with role assignment and coordination)
	Priorities of strategies (people, property, and environment)
	Immediate actions / first on the scene / plan activation
	Operational procedures for responding to specific hazards (on-site and off-site)
	Primary and alternate EOCs
INTERNAL AND EXTERNAL COMMUNICATION	Internal communication protocol developed
	External communication protocol developed (external agencies)
	External communication protocol developed (public - sheltering / evacuation / other)
CRISIS COMMUNICATIONS / MEDIA RELATIONS	On-site
	Corporate
	External agency liaison
TRAINING / FREQUENCY OF TRAINING	Personnel orientation
	Communication system drill (plant muster alarm
	Limited drills
	Table top exercise
	Simulation exercise
	Full scale exercise
	Post incident review
PLAN / PROGRAM DISTRIBUTION	Internal - field
	Internal – corporate
	External

Source: Table 1 Major Building Blocks and Elements of International Emergency Management Systems (First Response Emergency Services: a Division of Skystone Engineering, 2012)