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Impact Assessment Agency of Canada (IAAC/CEAA)
Attention: Jennifer Howe (IAAC / CEAA)

April 26, 2021

Re: SR1 Flood Effectiveness

Summary of Findings:

The MC1 project is superior to SR1 for flood mitigation for all communities and at flood events far larger than the 2013 event. This is demonstrated through a comparison of flow rates. This information was available in March 2016, at the latest, and was reaffirmed in 2017 reports for MC1. Why weren't SR1 and MC1 compared using flow rates? Why was the basis of the comparison between the two projects total storage volume? Were flow rates accidentally overlooked or was this comparison intentionally avoided?

Storage Volumes vs River Flow Rates: An unacceptable oversight

At the NRCB hearing for SR1, Alberta Transportation (AT) stated clearly that floods are caused by flow rates, not volumes. NRCB Exhibit 350 Transcript page 156: Matt Wood stated "It is the peak, you know, that is the most important when it comes to flood damages." Yet, flow rates were not used as an evaluation criterion to choose between SR1 and MC1 (or any other alternative, for that matter). Is an oversight of this magnitude acceptable? This is an oversight that undermines the entire justification for choosing SR1 over MC1! The long-term nature of this project – hundreds of years - necessitates that it is considered with all seriousness and thoroughness. It is evident based on the rate comparison that the decision to choose SR1 was not thorough. A thorough analysis would have considered rates and performed rate analysis for various flood hydrographs! This oversight cannot be allowed to stand.

The March 2016 MC1 Conceptual Update¹ included the following table:

¹ Pdf page 30, <https://open.alberta.ca/dataset/37255199-1ed8-4f60-8bf6-71c483a54929/resource/982f0523-ff3c-425c-918d-23636ff2f241/download/aep-attachment-4-elbow-river-dam-mclean-creek-dam-conceptual-design-upgrade.pdf>

Table 5.2 Elbow River Dam at McLean Creek (MC1) Pertinent Operations Data

| Description (Peak Values) | Summer | Winter | Floods | | | | |
|--|-----------|--------------|---------|----------|-----------|----------|---------|
| | July Mean | January Mean | 20-year | 100-year | June 2013 | 500-year | PMF |
| Peak reservoir inflow rate (m ³ /s) | 13.4 | 3.0 | 440 | 930 | 1,240 | 1,625 | 2,770 |
| Gated conduit outlet structure peak discharge rate (m ³ /s) | 13.4 | 3.0 | 212 | 220 | 260 | 310 | 340 |
| Ungated chute service spillway peak discharge rate (m ³ /s) | 0 | 0 | 0 | 0 | 0 | 210 | 1,800 |
| Auxiliary earth channel peak discharge rate (m ³ /s) | 0 | 0 | 0 | 0 | 0 | 0 | 260 |
| Maximum reservoir water surface elevation (m) | 1,406.0 | <1,406.0 | 1,409.8 | 1,420.5 | 1,424.3 | 1,425.9 | 1,431.2 |
| Maximum total contained water volume (dam ³) | 18,000 | <18,000 | 25,000 | 61,000 | 79,000 | 87,000 | 118,000 |

The 2017 Opus Report on MC1² included the following table:

Table 6.1: Summary of Flood Passage

| Description (Peak Values) | Floods | | | | |
|---|---------|----------|--------|-----------|--------|
| | 20-year | 100-year | Jun-13 | 1000-year | PMF |
| Peak reservoir inflow (m ³ /s) | 440 | 930 | 1240 | 1984 | 2770 |
| Tunnel outlet structure peak discharge rate (m ³ /s) | 212 | 212 | 212 | 830 | 1000 |
| Service spillway peak discharge (m ³ /s) | 0 | 0 | 0 | 0 | 600 |
| Auxiliary earth channel peak discharge (m ³ /s) | 0 | 0 | 0 | 0 | 1000 |
| Maximum reservoir water surface elevation (m) | 1404.7 | 1419.8 | 1424.4 | 1424.5 | 1428.1 |
| Maximum total contained water volume (dam ³) | 13,400 | 52,100 | 73,500 | 73,600 | 93,000 |

SR1 can only divert a portion of the water (between 480m³/s and 600m³/s) to the SR1 reservoir, leaving river flow rates in a design flood between 640m³/s and 760m³/s. The SCLG used the 2017 Opus report on MC1 to prepare the following illustration³:

² Pdf page 46 <https://www.nrcb.ca/natural-resource-projects/natural-resource-projects-listing/83/springbank-off-stream-reservoir-project/documents/9142/20190614-at-sir-to-nrcb-re-sir1-response-appendix-ir14-1>

³ Pdf page 6 https://www.nrcb.ca/download_document/2/83/11035/354-20210323-sclg-sub-to-nrcb-hearing-powerpoint-karin-hunter

| Scenario 1: 930 m3/s Flood ⁽¹⁾ "1:100" | | | | Scenario 2: 1,240 m3/s Flood ⁽¹⁾ "Design Flood" | | | | Scenario 3: 1,984 m3/s Flood ⁽¹⁾ "1:1000" | | | |
|--|-------------------------------------|---|----------------------------------|---|---------------------------------------|---|----------------------------------|---|------------------------|---|----------------------------------|
| | River Flowrate | | | | River Flowrate | | | | River Flowrate | | |
| | Upstream of SR1 | Between SR1 and Glenmore Reservoir ⁽⁵⁾ | Downstream of Glenmore Reservoir | | Upstream of SR1 | Between SR1 and Glenmore Reservoir ⁽⁵⁾ | Downstream of Glenmore Reservoir | | Upstream of SR1 | Between SR1 and Glenmore Reservoir ⁽⁵⁾ | Downstream of Glenmore Reservoir |
| SR1 | 930 m3/s Flooding ⁽²⁾ | 330 m3/s Flooding ⁽⁴⁾ | 160 m3/s | SR1 | 1,240 m3/s Flooding ⁽²⁾ | 640 m3/s Flooding ⁽⁴⁾ | 160 m3/s | SR1 | 1,984 m3/s Flooding | 1,384 m3/s Flooding | ?? |
| MC1 ⁽³⁾ | 212 m3/s | 212 m3/s | 170 m3/s | MC1 ⁽³⁾ | 212 m3/s | 212 m3/s | 170 m3/s | MC1 ⁽³⁾ | 830 m3/s | 830 m3/s | ?? |
| | SR1 Inferior | SR1 Inferior | Neutral | | SR1 Inferior | SR1 Inferior | Neutral | | SR1 Inferior | SR1 Inferior | SR1 Inferior |

Notes:

1. Scenarios and rates for MC1 from MC1 Conceptual Design Report, Exhibit 101, page 46, dated August 23, 2017
2. Bragg Creek Berms designed for 990m3/s or 1:100 level of overland flooding; protection against groundwater flooding not expected
3. Maximum target outflow of MC1 was designed at 212 m3/s as the level required for Glenmore Reservoir operations
4. Groundwater flooding and some overland flooding experienced in the 2005 flood for these communities. 2005 flood ~300m3/s
5. Assumed diversion rate for SR1 of 600m3/s per 2018 EIA. Exhibit 159, page 83 reduces this to 480m3/s, which is not reflected above

| |
|-----------------------|
| MC1 Better Protection |
| Neutral |
| SR1 Inferior to MC1 |

SR1 is blatantly inferior in higher flowrates

Notes: See page number 22 for details. MC1 numbers and return periods from Exhibit 101 MC1 Conceptual Design Report, pg 46. SR1 assumed 600m3/s diversion capacity, which is adjusted to 480m3/s in Exhibit 159.

When compared using flow rates, MC1 is clearly superior to MC1. In fact, MC1 is so much more effective than SR1 at flood mitigation that it reduces flow rates below SR1 to 1/3 the flow rates that SR1 would! MC1 is so much more effective at flood mitigation than SR1 that it would protect communities to a much higher flood event, even 1:1000! Clearly, volumes are only one piece of the equation and SR1 and MC1 should have never been declared "equal" because of their equal volumes. Again, whether this is intentional or accidental, it is not acceptable.

We are shocked and utterly devastated by this comparison of flow rates. We are a group of volunteers who rely on our elected officials and their experts to use independence, good judgement and transparent decision making. To be honest, we feel absolutely misled and deceived by this information on flow rates for MC1 vs SR1. Perhaps for traditional dams, flow rate analysis is not important. Perhaps, with traditional dams, it is all about volume. Perhaps this analysis was not performed because traditional dams don't have an intake "cap" like SR1. However, it is inconceivable that no one at AT read the MC1 reports and questioned whether MC1's superior flood mitigation capabilities were relevant public information.

It is simple. SR1 is not the best project for flood mitigation, based on information available today. It was not the best project for flood mitigation based on information available in 2016, two years before the EIA was submitted! Yet, was this information presented by Alberta Transportation? Not to our knowledge. We are not dam experts. We did not understand that SR1 created a disproportionate reliance on river flow rates, due to its diversion limitation until just before the NRCB hearing. Did IAAC understand this? If so, where is it mentioned? If IAAC is at all concerned that flood peaks will increase, or that climate change will increase the severity of flood, SR1's intake limitation is a risk factor that must be acknowledged and reviewed.

Unequal Outcomes for Residents between Glenmore Reservoir and SR1: SR1's intake restriction creates a two-tiered system by allowing significant flows of water to pass downstream, through Springbank, before floods are fully attenuated to the desired 160m³/s at Glenmore Reservoir. The 160m³/s was chosen as this is the maximum flow level before overland and groundwater flooding does damage to Calgary residents below Glenmore Dam. In a design flood of 1,240m³/s, SR1 will allow flows of 640m³/s to 760m³/s to bypass SR1 and head down the river. This is a significant amount of water that will flood Springbank. In 2016, the MC1 report reduced river flow levels to 260m³/s from an estimated 1,240 in a design flood! In 2016 (through to today), SR1 only reduced river flow levels to 640m³/s! MC1's flood effectiveness improved in the 2017 Opus Report, with outflow rates of 212m³/s. Does this not shock anyone? Are we the only group that did not know this? These numbers are 4 years old and yet, this comparison was not presented. Did anyone at IAAC compare river outflows between the two projects to reach the conclusion that MC1 was fairly assessed?

This flood mitigation inequity was not communicated to Springbank residents by the Proponent. Our homes, lands, roads and recreational amenities, including three golf courses, still flood with SR1 in a design flood. None of Alberta Transportation's documents, presentations or open house boards state this.

If you take away the SR1 intake limitation of 600m³/s and increase SR1's volume to match the volume of MC1 at a 1:1000 flood of 93,000 dam³, the two projects are equal for residents downstream of SR1. But can you do that? Can you double SR1's intake volume? That means that you fill up the reservoir in 18-25 hours rather than the 36-50 hours expected today in a design flood. Is that safe? Can you fill up an extreme consequence reservoir – from dry to full - in 18 hours and be certain it is safe?

MC1 would protect Bragg Creek and Redwood Meadows to a 1:1000-year flood level, yet the berms at Bragg Creek are being constructed for 1:100-year flows! These berms are creating a culvert out of what once was a beautiful river. The Bragg Creek flood mitigation report on the Rocky View County website states⁴:

It should be noted that the selected 990 m³/s design value is approximately 16% lower than the 1150 m³/s flood peak which occurred in 2013. The 2013 flood peak is just lower than the AMEC 2014 1:200 year flood peak value estimate of 1197 m³/s. As discussed later in this report, the water level resulting from the 2013 flood would be contained within the minimum 0.6 m freeboard provided above the 990 m³/s water level as determined by hydraulic modelling. However, system integrity could be compromised should a flood larger than the 1:100 Design Standard occur.

What happens to Bragg Creek "if system integrity" is compromised? Where is this factored into any decision on SR1 vs MC1? Where is the modelling that shows the flooding if a large flood breaches the Bragg Creek berms?

⁴ Pdf page 31

<https://www.rockyview.ca/Portals/0/Files/BuildingPlanning/Planning/UnderReview/BraggCreekFlood/Bragg-Creek-Flood-Mitigation-Design-Report-2017-06.pdf>

MC1 would not create winners and losers like SR1 does. MC1 would not burden Rocky View County with inferior flood mitigation that will no doubt cost Rocky View County taxpayers to either build incremental flood mitigation to a 1:200 level or repair damages to berms, infrastructure, roads, bridges, etc. from flood.

SR1 does not even meet the standard of a 1:100 level of flood protection for Springbank residents. **How is a new project built for flood mitigation that does not even meet the minimum 1:100 flood design standard for Alberta?** How was this missed? This is not even disputed by the Proponent (Ex 350), who stated, “There are some residences; part of Rocky View County, there's some golf courses...it is only those who have built very close to the river who may get flooded...those who are down low may still have the problems in a 2013 event that [what] they get for living near the river”. Is this statement not diametrically opposed to the entire purpose of SR1 which is to protect residents and inner-city locations that are next to the river?

In our view, this comparison provided by the SCLG at the NRCB hearing undermines Alberta Transportation’s decision to choose SR1. It further negates the conclusion reached by IAAC that the alternatives were fairly considered. MC1 was not fairly considered. Further, this comparison of rates – at this late stage, as the Project sits before regulators – is a scathing indictment of the last 7 years of analysis by the Proponent. It indicates that MC1 and SR1 were only compared at a high level and that SR1’s limitations were not well-understood.

Reduction of the SR1 Intake to 480m³/s

At the NRCB hearing and in the December 18 2020 Preliminary Design Report, we were confused to see the 600m³/s diversion reduced to 480m³/s for the “routing”. At the Hearing, the Proponent stated that the 480m³/s is the diversion rate needed to keep the levels below Glenmore Reservoir to 160m³/s, which is the project purpose. However, this 480m³/s makes the outcomes for Rocky View County residents worse by 120m³/s! AT stated that the 480m³/s reflects a “safety factor” of 25%. This “safety factor” creates increased inequality of flood protection for residents along the Elbow River upstream of Glenmore Reservoir and the wealthy residents of the City of Calgary below Glenmore Reservoir for whom the Terms of Reference are written. The Proponent does not seem to care about and is not interested in remedying this inequality through financial compensation or new flood mitigation projects downstream of SR1 and above Glenmore Reservoir.

Climate Change:

The Proponent sized SR1 using a historical flood. At the hearing, the Proponent stated that floods will not be larger than 2013! If that is the case, why are we building this project? How was this conclusion arrived at? The SCLG hydrologist Dr Fennel highlighted that historically wet and dry cycles coincide with flood and drought. Dr Klepacki highlighted that historically, there have been more extreme events than 2013. Yet, AT does not want to work with these historical events that weren’t measured with modern technology. Again, AT states that they don’t expect flood events to be more severe than 2013.⁵ This

⁵ Pdf page 114 https://www.nrcb.ca/download_document/2/83/11075/379-nrcb-transcript-vol-6-march-29

view appears to contradict climate science, as more and more jurisdictions are building dams to higher magnitude events (In Canada, Quebec and Saskatchewan).⁶

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ALBERTA TRANSPORTATION TOPIC #4 PANEL

Cross-examined by Mr. Secord

1 the general agreement in all of the models that you've
2 looked at, Mr. Wood, the peak flows will be lower?
3 **A. MR. WOOD:** **Mr. Chairman, I may ask Dave Luzi**
4 **to elaborate. But what I believe they're suggesting is**
5 **that flooding will be more frequent. Flood peaks may**
6 **increase, but on the extreme end, the very extreme**
7 **events like those that occurred with 2013, right now,**
8 **there's not the evidence to suggest that those type of**
9 **events will become more severe, more frequent.**

⁶ Pdf page 5 Quebec https://www.nrcb.ca/download_document/2/83/10772/20210225-fwmc-sub-to-nrcb-hearing
and Saskatchewan Pdf page 92 https://www.nrcb.ca/download_document/2/83/11075/379-nrcb-transcript-vol-6-march-29

AT retracted their comments about rain on snow events.⁷

2 There was some discussion about which station was
3 being used. The station was the Little Elbow Summit
4 station; however, as I mentioned, I was incorrectly
5 using mid-winter snowpacks.

6 What Mr. Fennell and Mr. Secord have presented in
7 the aid to cross appears to be annual snowpacks, and
8 that is the data that should be looked at for such an
9 analysis.

10 As noted in the aid to cross, when you consider
11 the annual snowpack, the percentiles change and there
12 are more years when snowpack was larger and floods
13 occurred.

14 So, as a result of my error, Alberta
15 Transportation wishes to retract portions of the
16 rebuttal to Dr. Fennell's intervener submission,
17 specifically Figure 1 graph showing snow water
18 equivalents for the five largest floods in Exhibit 327,
19 page 48; Figure 2 graph showing floods from years when
20 snowpack exceeded 75th percentile from that same

SR1's capped intake is problematic for floods with high peaks that might result from rain on snow events or climate change.

The Tesemma Report, mentioned by the Proponent at the hearing, has not been peer-reviewed, which is a red flag. Further, we have the following statement on this report:

Pomeroy was the ninth author (meaning he probably read it but didn't have much contribution) was funded by Natural Resources Canada, AEP the City of Calgary and Environment and Climate Change Canada and Global Water Futures. In reading this report in more depth it looks like it was commissioned by AEP and the City of Calgary and the other funders likely contributed building and some G&A. It is a computer model called MESH with many inputs and especially "downward scaled" general circulation models.

Regarding calibration of the model for the Elbow at Sarcee Bridge, upstream from Glenmore on pdf 38/96:

⁷ Pdf page 7 https://www.nrcb.ca/download_document/2/83/11111/406-nrcb-transcript-vol-9-apr-1

“The hydrographs, calibration and validation statistics for the entire calibration and validation period, for both Bow River at Banff and Elbow River at Sarcee Bridge, are shown in Figure 13 and Figure 14. The performance model varied by basin and calibration and validation period, with the best performance of NSE=0.78 for the Bow River at Banff, and the worst performance of NSE=0.16 for Elbow River at Sarcee Bridge. In most cases, the model does an excellent job of capturing the hydrograph and timing. Both rainfall runoff and snowmelt runoff peak events are normally captured for Bow River at Banff, but the flood peaks are often underestimated for the Elbow River at Sarcee Bridge. Further efforts to improve the calibrations are unlikely to lead to improvements in performance as the quality of the driving data imposed a significant limitation. For the two years (2005 and 2013) with a known flooding event, the rainfall-runoff plot shows very small precipitation that caused the large underestimation for the peak flow for Elbow River at Sarcee Bridge while the Bow River at Banff captured that peak flow as the precipitation was large enough to produce it.”

The NSE and PBIAS stats were not good at simulating the peak and that is what the focus should be on, as it is the peak that causes flooding! It also only indicated a 8% or so decline in flow volume for the Elbow. Volume, not peak. This is a critical point because they are relying on unreviewed modelling.

In conclusion, the model referred to in the Tessema report is immature. There is a long list of model limitations listed in the conclusions, including the problem of quantifying uncertainty because of the computational expense for the WRF climate change input and the downscaling of the GCM inputs, pdf 85-86. Without peer review, we submit that this interesting but not compelling information. The model needs significant “tweaking” as modellers say.

Regarding drought, the 2017 MC1 report (Exhibit 101, pg 55) stated clearly that MC1 could be used for drought. SR1 is useless for drought.

It should be noted that the preliminary operating strategy for MC1 has focused primarily on flood management. However, the permanent storage of the facility can also be used to provide additional water supply in the event of an extreme drought. If needed, the projects 3,500 dam³ permanent storage volume could be utilized to augment flow releases during a severe drought period. Depending on the value associated with this type of flow augmentation capability, it may even be desirable to increase the project permanent pool level. This could be assessed as a part of future optimization studies should the project advance past the conceptual level of study.

We ask the IAAC to reject the narrow frame of reference for SR1 that focussed solely on flood mitigation. This project now costs over \$500 million, more than 2.x times its original budget. It is not appropriate to ignore drought any longer, especially considering the significant cost and scope escalations that have occurred over time. There is absolutely no reason, given the number of changes to SR1 that the judgment by regulators shouldn't include drought. In our opinion, allowing a narrow frame of reference to restrict regulatory review sets a dangerous precedent. SR1 establishes that proponents can choose a narrow scope of reference, ignore inconvenient or contrary criteria, in effect setting up a favourable regulatory review.

Crown Consultation

Rocky View County

When asked whether Rocky View County was aware of the superior outcomes for flood mitigation at MC1, Alberta Transportation stated that they provided an update to Rocky View County (“RVC”) on the Opus Report. We ask IAAC to review this report and determine whether the comparison of flood effectiveness that was now evident as superior at MC1 in the Opus report was clearly communicated to Rocky View County.⁸ There is no mention of rates in the update to RVC. There is no mention of the increased storage volume at MC1, up to 93,000 dam3. Was Rocky View County ever made aware of SR1’s inferior outcomes for Rocky View County residents, from Bragg Creek through the city of Calgary’s western border? Was Rocky View County aware that it was solely responsible for repairs to Bragg Creek berms that will inevitably be damaged in future floods, just as they were at Redwood Meadows in 1995, 2005 and 2013? New Provincial policy (NRCB Ex 356) is to hold municipalities responsible for 10% of damages from flood and cap landowners to a maximum of a one-time \$500,000 disaster recovery payout. This disproportionately harms RVC residents due to the choice of SR1 over MC1, while inner City Calgary residents are advantaged. Is this the outcome that Albertan’s deserve?

Public:

The public was not informed of the unequal outcomes of SR1 relative to MC1. Nor was the public informed of MC1’s superior flood mitigation outcomes. When was this known by Alberta Transportation? Did they know in 2016, when the MC1 update came out that these homes and business would be better off with MC1? Did they know by the time they submitted the EIA in March 2018? Why didn’t they tell the Springbank community this?

In summary, it is clear that that an independent comparison of MC1 relative to SR1 was not performed. It is clear that the public was misled – intentionally or accidentally – regarding the effectiveness of SR1. For these reasons, the SR1 project must be rejected by the IAAC. These recent findings are shocking and terribly disappointing. This project must not be allowed to proceed until a fulsome and independent analysis of flood effectiveness, including climate change, has been performed. The inadequate decision process must not be allowed to stand. We contend that SR1 is the result of politics gone awry. For a project that sits in a growing community, next to a city of 1.3 million, we can all do better. We all deserve better.

Regards,

Karin Hunter

⁸ Pdf page 33-35 <https://www.rockyview.ca/Portals/0/Files/Government/Boards/PP/2017/Agendas/2017-09-05-Policy-Priorities-Agenda.pdf>

President, Springbank Community Association

CC. Dan Henn, RVC Reeve, Kent Robinson, Acting CAO, Rocky View County, Kim McKylor, RVC Councillor, Div 2, Mark Kamachi, RVC Councillor, Div 1, Kevin Hanson, RVC Councillor Div 3, Laura Friend, NRCB