Water Act File No. 387101
NRCB Application No. 1701

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1 Acronyms

The following acronyms are used in this Supplemental Information Request.

AAAQO	Alberta Ambient Air Quality Objectives
AAD	average annual damage
AADT	average annual daily traffic
AAQO	Alberta Air Quality Objectives
AEP	Alberta Environment and Parks
BCA report	Benefit/Cost Analysis report
BOD	biochemical oxygen demand
CAAQS	Canadian Ambient Air Quality Standards
CAC	criteria air contaminant
CDA	Canadian Dam Association
CEAA	Canadian Environmental Assessment Agency
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
COPC	chemicals of potential concern
Dam^3	cubic decameter
DEM	digital elevation model
DEP	diesel emission particulate
DO	dissolved oxygen
EC	electrical conductivity
ECO	environmental construction operations
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ER	exposure ratio
ERBWMP	Elbow River Basin Water Management Plan
FSL	full supply level
fTOR	final Terms of Reference
GOA	Government of Alberta
Ha	hectares
HD	hydrodynamic
HHRA	Human Health Risk Assessment
IDF	inflow design flood
km	kilometre
kt	kilotonnes
LAA	local assessment area
LiDAR	Light Detection and Ranging
LLO	low level outlet
LSA	local study area
Ltd.	limited
m	metre
m^3/s	cubic meters per second
MC1	McLean Creek Dam
MPOI	maximum point of impingement
MT	mud transport
NAAQO	National Ambient Air Quality Objectives
NRCB	Natural Resources Conservation Board
NO	nitric oxide
NO_2	nitrogen dioxide
O_3	ozone
OLM	ozone limiting method

PAH	polycyclic aromatic hydrocarbon
PDA	project development area
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter
PMF	probable maximum flood
PMP	probable maximum precipitation
RAA	regional assessment area
RCC	roller compacted concrete
RSA	Regional Study Area
SIR	supplemental information request
SO_2	sulphur dioxide
SOMC	species of management concern
SR1	Springbank Off-Stream Reservoir Project
ST	sediment transport
TDS	total dissolved solids
TGP	total gas pressure
TOC	total organic carbon
TOR	Terms of Reference
TSP	total suspended particulate
TSS	total suspended sediment
TRV	toxicological reference value
VC	valued component
VOC	volatile organic compound
WHO	World Health Organization
WSC	Water Survey Canada
WTP	willingness to pay

2 Natural Resources Conservation Board

2.1 General

1. EIS Summary, Section 3.6.2.4, Page 3.24
Volume 1, Section 2.2.5, Pages 2.25 and 2.26

Alberta Transportation lists two options when discussing alternatives for the low-level outlet channel: *upsizing the existing stream to convey to peak design flow to the Elbow River and delay reshaping the channel until it is necessary*. Alberta Transportation also states that the *choice was made to delay maintenance on the channel until such a time as it may be required*.

a. Provide rational for considering channel work in the existing stream maintenance instead of deferred construction.

b. Provide the cost of upsizing the existing channel in the existing stream to peak design flood at the time of Project construction.

2. Volume 1, Section 1.3.2.1, Page 1.12
Volume 3A, Section 12.4.2, Page 12.24
Volume 4, Appendix D, Section 5.1.3, Page 5.1

Alberta Transportation states *Area C: has options for grazing through public leases. The land would be publicly owned and privately stewarded*.

Alberta Transportation states in Volume 3A that *AEP would own and manage these areas. (including Area C).*

Alberta Transportation then goes on to state in Volume 4 that *Area C is generally north of the Springbank Road and west of Highway 22 and would be inundated at the design flood. These lands would remain under private ownership and management. Current land uses, which are mainly agricultural, can continue*.

a. Clarify the future ownership of Area C.

3. Volume 1, Section 2.2.1.3, Table 2-2, Pages 2.10 and 2.11
EIS Summary, Section 3.6.1, Table 3-2, Pages 3.16 to 3.17
Table 2-2 describes recreational use of the MC1 area including loss of campsites and impact on hiking, cross country skiing, snowshoeing, guiding, outfitting, etc.

a. Clarify the extent to which recreational activities described in the tables are expected to be available in the operational phase of MC1.

4. Volume 1, Section 2.2.1.3, Table 2-2, Page 2.12
EIS Summary, Section 3.6.1, Table 3-2, Page 3.18
In the category of *Construction Timelines*, Alberta Transportation states that '*Special measures would be required for winter construction, including heating and hoarding for concrete, and the continuous 24-hour per day earthfill operations" should rapid year-round construction proceed. Such measures would also affect the cost of construction.*

a. Costing for MC1 appears in numerous sections of the EIA including the cost-benefit analysis. Confirm whether year-round construction was contemplated for MC1 and whether the additional costs were included in the MC1 construction cost estimates used throughout the document.

5. Volume 1, Section 2.2.1.3, Table 2-3, Page 2.13
EIS Summary, Section 3.0, Page 3.2 and Volume 1, Section 1.2, Page 1.3
Volume 1, Section 2.2.1.2, Page 2.5

Alberta Transportation states the *Catchment Area* for the Springbank Project is *868 km^2* and for the MacLean Creek (MC1) Option is *695 km^2*.

Alberta Transportation also states in the EIS Summary that the Project *can hold 77,771,000 m^3 of water as active flood storage*.

Alberta Transportation then states on page 2.5 that the MC1 Option is *designed to withstand the probable maximum flood (PMF) of 2770 m^3/s. The maximum reservoir volume, when passing that flood, would be 93 million m^3…*

a. Explain the methodology and rationale for concluding that flood protection is greater with a SR1 larger catchment area even though SR1 has a smaller maximum reservoir when compared to MC1.

6. Volume 1, Section 2.2.1.3, Table 2-2, Pages 2.9 to 2.12
Volume 1, Section 2.2.1.3, Table 2-3, Page 2.13
EIS Summary, Section 3.6.1, Table 3-2, Pages 3.15 to 3.18

a. Provide a concordance table showing references for each bulleted item in the tables.

b. Identify which of the comparisons between the Project and MC1 in these tables are currently applicable.

7. Volume 1, Section 2.2.1.3, Table 2-3, Page 2.13

Alberta Transportation states that the Project is *Operational in 2020* while the MC1 Option is O*perational 5.5 years from decision to move forward* under the project timeline.

a. Clarify baseline project timelines for SR1 and MC1 under the assumption that each project is initiated at the same time.

8. Volume 1, Section 2.2.1.3, Table 2-3, Page 2.13

For the parameter, *Flooding Risk During Construction*, Alberta Transportation states *Minimal risk to downstream communities during construction*.

a. What is the minimal risk compared to?

b. What is the maximum flood event downstream communities would be protected from during each year of the Project construction?

9. Volume 1, Section 2.2.1.3, Table 2-2, Page 2.12
EIS Summary, Section 3.6.1, Table 3-2, Page 3.18

Under the category of Conclusions, Alberta Transportation states that *Overall, the assessment and scoring for SR1 are considerably more favourable than for the proposed MC1. When social and recreational values enter into the equation the evidence is overwhelmingly in favour of the social good created by the Project from a cost, environmental and risk basis.*

a. Provide references for the scoring and evidence that supports this statement including references to the social good created by the Project.

10. Volume 1, Section 2.2.1.3, Table 2-3, Page 2.13
Volume 3A, Section 17.4.1.5, Table 17-14, Page 17.25
Volume 3A, Section 17.4.1.5, Table 17-15, Page 17.26
Volume 4, Supporting Documentation, 1. IBI Report, Executive Summary, Page 2
Volume 4, Supporting Documentation, 1. IBI Report, Section 6.2.2, Exhibit 6.1, Page 35
Reference Document: Springbank Off-stream Storage Project, Preliminary Design Report (DRAFT), Stantec Consulting Services Ltd., March 31, 2017, Section 13.4, Page 200
Reference Document: Springbank Off-stream Storage Project, Preliminary Design Report (DRAFT), Stantec Consulting Services Ltd., March 31, 2017Appendix G Construction, Page 3112 of 3119.

Alberta Transportation states that *$372 million (including the estimated $60 million the government will recover from the sale of any surplus land purchased*…. (Volume 1), that *Project construction is estimated at $249 million* (Volume 3A), $291.7 million plus another $80 million for land costs (Volume 4), and a total cost opinion of *$279 million* (Reference Document).

a. Provide detailed final costs for the Project and clarify these discrepancies.

11. Volume 1, Section 2.2.2.2, Page 2.20
Volume 1, Section 3.2.1.2, Page 3.7

Alberta Transportation states on page 2.20 that Obermeyer Crest Gate's *inability to pass bedload during floods is partially mitigated with the addition of the adjacent sluiceway, which passes flow and sediment*. While on page 3.7 the sluiceway is not listed or described with the service spillway and its components.

a. Describe the sluiceway location and function.

12. Volume 1, Section 3.2.6, Pages 3.18
EIS Summary, Section 3.6.2.4, Page 3.24
Volume 1, Section 2.2.5, Pages 2.25

Alberta Transportation states *The conduit will discharge into an 18 m long energy dissipation basin to reduce the speed of the water entering the channel*.

Alberta Transportation also states that *The existing stream is undersized to handle the design peak discharge and, therefore, it would likely erode and scour during high discharges from the low-level outlet works.*

a. Assess potential accidents and/or malfunctions at the off-stream dam due to erosion and scouring of the existing stream channel.

13. Volume 1, Section 3.3.8, Table 3-7, Page 3.32
Reference Document: Springbank Off-stream Storage Project, Preliminary Design

Report (DRAFT), Stantec Consulting Services Ltd., March 31, 2017, Appendix G Construction, Pages 3109 to 3112
Alberta Transportation states *Temp Bridge Construction is scheduled to occur in May, June and July of 2019.*

Temporary bridge construction costs (installation and removal) are not included as a line item in the cost table.

a. Provide the construction costs of the temporary bridge installation and removal.

14. Volume 1, Section 8.0, Page 8.1 to 8.3
Volume 4, Supporting Documentation, Section 8, Pages 8-1 to 8-7
Alberta Transportation references reports for the Project (Stantec) and for the MC1 alternative (from Opus) which are not included in the Supporting Documentation.

a. Provide the final report(s), as listed in Section 8.0, in the Supporting Documentation.

15. Volume 1, Section 8.0, Page 8.3
Alberta Transportation references *Stantec Consulting Ltd. 2017b. Springbank Off-stream Storage Project Interim Design Report*, dated March 31, 2017 which is watermarked DRAFT and has no signature or stamp.

a. Provide a final (signed and stamped) version of this report.

b. Provide an updated concordance table with any report and EIA section changes if required.

16. Volume 3A, Section 4.3, Page 4.21
Volume 1, Section A.2.1.3, Page A.6
Alberta Transportation suggests that blasting may be required for the diversion channel, and that details on the blasting would be submitted by the contractor to Alberta Transportation.
Alberta Transportation states *If rock is encountered, it will be mechanically removed using rippers or pneumatic or hydraulic breakers. Blasting will not be permitted*.

a. Explain if bedrock is expected to be encountered during diversion channel excavation.

b. Provide details of permitting and requirements for blasting.

c. Clarify the depth of bedrock that can be removed using rippers or breakers.

d. If blasting is planned then explain:
   i. The additional noise effects of blasting on receptors.
   ii. The additional air quality effects of blasting (during wet and dry conditions) on receptors.

e. If blasting is not planned then explain:
   i. The noise effects of the bedrock excavation construction techniques (rippers and/or breakers).
   ii. The air quality effects of the bedrock excavation construction techniques (rippers and/or breakers).

17. Volume 3A, Section 17.4.1.2, Page 17.24
Reference Document: Springbank Off-stream Storage Project, Preliminary Design Report (DRAFT), Stantec Consulting Services Ltd., March 31, 2017, Section 13.3.3, Page 200

Alberta Transportation states that *cost estimates considered the conceptual designs presented in Stantec (2017)* and that *cost estimates are considered Class D (accurate to within +/-50%) (Volume 3A)*.

Alberta Transportation states in the reference document that a *contingency factor of 15% is utilized at this point in the process to reflect the level of study and knowledge that is possessed currently*.

a. Explain why a cost contingency factor of 15% is appropriate for the Project if the cost estimates are +/-50%.

b. Update the cost contingency factor percentage and/or the cost estimate percentage for the Project.

18. Volume 3B, Section 17.3, Tables 17-4 to 17-6, Pages 17.8 to 17.10
Volume 3B, Section 17.7, Page 17.12
Volume 4, Supporting Documentation, 1. IBI Report, Section 5.2, Page 34
Volume 4, Supporting Documentation, 1. IBI Report, Section 5.1.1, Page 27
Volume 4, Supporting Documentation, 1. IBI Report, Section 5.1.2, Page 31

Alberta Transportation states *Upstream protection to the 1:200-year level on the Elbow River results in a reduction of $27.7 million in AAD from the existing mitigation amount*.

The data in Tables 17-4 to 17-6 are not included in the referenced reports.

a. Provide the report source for the data in Tables 17-4 to 17-6.

b. Provide information detailing the calculation of the $27.7 million AAD in Section 5.2, similar to the information detailed in the 2017 IBI Report section 5.1.1 and 5.1.2.

19. Volume 3D, Section 1.2.2, Page 1.2

Alberta Transportation states *failure or breach of the service spillway, auxiliary spillway, or flood plain berm during flood operations as a result of electrical or design failure of the diversion structure*.

While the potential of electrical failure at the service spillway is listed as an item to be discussed, potential electrical failure at the diversion inlet is not included in this list. Other sections of the EIA contain details on the potential malfunctions of electrical failure on the diversion structure.

a. Describe the failure or breach of the service spillway, diversion inlet, auxiliary spillway, or flood plain berm during flood operations as a result of an electrical failure at the service spillway and the diversion inlet.
   i. Include failure of service spillway to be raised (left, right or both sides) and failure of the diversion inlet gates to be raised (left, right or both gates).
   ii. Discuss time implications (and associated flood water volumes passing downstream of the service spillway) arising from an electrical failure at the time the service spillway and diversion inlet would be activated to divert flood waters for the 1:100 and 2013 floods.

20. Volume 3D, Section 1.6.2, Page 1.31

Alberta Transportation states *Floodplain berm/diversion structure (f)ailure or breach would result in similar effects to VCs relative to an unmitigated flood (in the absence of the Project), including inundation of surrounding areas, as well as commercial property; however the effects are predicted to be short term (approximately 30 minutes).*

a. Clarify how an unmitigated flood (in absence of the Project) has predicted short term effects of approximately 30 minutes. Include the flood effects of:
   i. the volume (and flow rate) of water held behind the floodplain berm/diversion structure at one moment in time; and
   ii. the volume (and flow rate) of water that would flow through a failed floodplain berm/diversion structure from the time of failure until the end of the flood.

21. Volume 4, Supporting Documents, 1. IBI Group Report, August 2017, Page 1
Volume 4, Supporting Documents, 1. IBI Group Report, August 2017, Exhibit 4.1, Page 11
Volume 4, Appendix E, Attachment 3A, Section 3A.3.1, Page 3A.11
Reference Document: McLean Creek (MC1) Dam, Updated Conceptual Design Report – Final – Vol 1 of 2, Opus Stewart Weir, August 23, 2017
Section 10.3.1, Page 51
Appendix A, Page 97 of 134

Alberta Transportation provides the costs of the *Off-Stream Storage Dam* as *$38,643,000*.

Alberta Transportation states *Earth material for the construction of the off-stream dam will be borrowed primarily from the diversion channel excavation (4.75 million m^3). Additional earth material (1.09 million m^3) will be borrowed from a designated are within the PDA (Borrow Area 1).*
Alberta Transportation states *the estimated 4.5 million m^3 of dam earthworks.*

Alberta Transportation states in Appendix A that the *SUB-TOTAL, MAIN DAM $98,699,300.*

The Project dam and the MC1 dam require a similar volume of earthworks for construction of an earth fill dam.

a. Explain the cost difference between the Project dam ($38 million) and the cost of the MC1 dam ($98 million).

22. Volume 4, Supporting Documentation, 1. IBI Report, Page 2

The Treasury Board of Canada recommends the application of a discount rate of 8% for regulatory interventions and 3% for the evaluation of social goods (enviro/human health, etc.)

a. Describe how the discount rate of 4% was selected and indicate if the 4% real rate is intended to reflect the time value of money, risk, or both.

b. Provide a sensitivity analysis of the real discount rate ranging between 3% and 8%.

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 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.

24. Volume 4, Supporting Documentation, 1. IBI Report, Exhibit 5.9

The table shows total estimated average annual damages under the existing mitigation scenario at $116,579,000 million.

The $116.6M is broken down to the Bow River $57,128,000 and the Elbow River at $41,451,000, totaling $98,579,000.

a. Explain the discrepancy in the totals.

25. Volume 4, Supporting Documentation, 1. IBI Report, Section 4.1.2.2, Page 12-13.

Alberta Transportation states *for the purpose of the benefit/cost analysis, it is assumed that the land (residual) and improvements acquired outside the Project Perimeter would be re-soild at comparable values (acquisition prices)*. The possibility of injurious affection suggests a potential differential between the purchase and resale of land.

a. Provide justification for the assumption that the market value for land will be unchanged between the purchase and resale of land after affected portions are removed.

b. If a price differential is anticipated, adjust the benefit/cost analysis accordingly.

26. Volume 4, Supporting Documentation, 1. IBI Report, Section 4.1.2.9.1, Page 19

Alberta Transportation states *Due to a lack of full access to parcels and information, IBI Group was unable to take into account potential losses in income from cell phone towers, oil and gas wells, or other parcel specific sources of income*.

a. Confirm that there are no current oil or gas wells that will be impacted by the Project.

b. Provide the results of discussions with mineral rights holders about the Project.

27. Volume 4, Supporting Documentation, 1. IBI Report, Exhibit 4.12, Page 22

The text preceding Exhibit 4.12 states that the *…total potential leaseback income for the Project Perimeter is $1,392,000 per year*. However, the total potential income presented in the table is $714,620.

a. Explain the income discrepancy.

28. Volume 4, Supporting Documentation, 1. IBI Report, Section 5.1.1.2.3, Page 28

Regarding indirect damage estimates for habitat restoration:

a. Provide justification for the monetization method used for avoided habitat damages. Clarify why a benefits-transfer method was not used to evaluate values for habitat.

b. Clarify whether any environmental damages are anticipated to result from the construction and/or operation of either SR1 or MC1. If so, included these damages as project costs in the benefits/cost analysis.

29. Volume 4, Supporting Documentation, 1. IBI Report, Section 5.1.1.2.4, Pages 28 and 2

Alberta Transportation states *The methodology for assigning a monetary value to intangible damages such as public health is detailed in the Calgary Flood Mitigation Option Assessment study. These amounts represent the present value of annual payments for 100 years derived from secondary research on household willingness-to-pay to avoid the intangible effects of flooding*. The willingness to pay (WTP) estimates used in the calculation of avoided intangible damages seem high compared to published WTP estimates for reduction in morbidity or mortality (for example see Adamowicz et al., 2011 and Alberini et al., 2006, respectively).

a. Provide the rationale for the willingness to pay estimates used to calculate avoided intangible damages.

b. Clarify if/how intangible damages were adjusted to account for the probability of a flood occurring.

c. Provide references for willingness to pay estimates or adjust the calculations as required.

d. Provide the Calgary Flood Mitigation Option Assessment study.

30. Volume 4, Supporting Documentation, 1. IBI Report, Section 5.1.4.2, Page 34
Volume 4, Supporting Documentation, 1. IBI Report, Section 5.1.4, Page 33

Alberta Transportation states *Detailed design of the dyke system has been estimated at $32.8 million (previously estimated at $6 million)* under the heading *Flood Defences at Bragg Creek. The Province is initiating this solution independent of considerations relating to benefits accruing to MC1 vs SR1. Accordingly, these are considered "sunk costs" and no additional benefits to MC1 or costs to SR1 associated with this standalone alternative have been factored into the benefit/cost analysis.*

Page 33 of the IBI Report states that *Given the total value of flood recovery projects associated with the 2013 flood ($5.6 million) it is suggested that the additional benefits would be nominal in any event and would not impact the benefit/cost ratio significantly.*
Alberta Transportation discusses that Bragg Creek and Redwood Meadows *could be afforded partial, if not full protection, by the proposed McLean Creek project. These potential damages averted constitute costs over and above those accruing to the City of Calgary and would logically be taken into consideration as part of the benefit/cost analysis.*

a. Explain what additional flood mitigation is necessary at Bragg Creek with the MC1 option.

b. Provide updated results for the net present value and benefit/cost ratio for the Project and MC1 when the costs and benefits of the flood protection dykes at Bragg Creek are included.

31. Volume 4, Supporting Documentation, 1. IBI Report, Section 6.2.3, Page 36

Alberta Transportation states *To fairly include this difference in the benefit/cost analysis, the annual benefits (average annual damages averted) begin in 2020 for the SR1 project and in 2023 for the MC1 project. Over the same 100 year period (2018-2118), with the 4% discount rate, the four-year advantage gives SR1 $74 million in additional present value of benefits compared to MC1*.

Under *Assumptions regarding timing,* Alberta Transportation lists that the annual benefit amounts begin in year 3 for SR1 and year 6 for MC1.

a. Explain the contradiction between the 4 year differential for annual benefits in the explanatory text compared to the 3 year differential stated in the assumptions. Which year differential was used to calculate the present value of benefits?

b. Provide the difference in present value of costs between SR1 and MC1 given that the costs for SR1 are expended in two years when compared to MC1 costs that occur later and spread over a longer period.

32. Volume 4, Supporting Documentation, 1. IBI Report

Apart from the probability of flooding, the BCA report does not specifically address the risk and uncertainty associated with key parameters in the benefit cost analysis.

a. Provide a robust sensitivity analysis that identifies uncertain variables in the study and demonstrates the magnitude of changes in these parameters on the study outcome. A Monte Carlo simulations in place of traditional sensitivity analysis is acceptable.

33. Reference Document: McLean Creek (MC1) Dam, Updated – Conceptual Design Report – Final – Vol 1 of 2, Opus Stewart Weir, August 23, 2017.
Section 1.2, Page 3
Section 6.1.4.1, Pages 28 and 29

Alberta Transportation states that the McLean Creek option is proposed to work in conjunction with the Glenmore Reservoir to attenuate flood events.

a. Clarify how the storage at the Glenmore Reservoir is to be considered in conjunction with the McLean Creek option to mitigate the design (2013) flood.

b. Describe how the two reservoirs would work together.

c. Identify structural and/or operational modifications to the Glenmore Dam and Reservoir that will be required in order to operate McLean Creek as designed.

34. Reference Document: McLean Creek (MC1) Dam, Updated Conceptual Design Report – Final – Vol 1 of 2, Opus Stewart Weir, August 23, 2017, Section 6.1.4.4, Page 32
Reference Document: McLean Creek (MC1) Dam, Updated Conceptual Design Report – Final – Vol 1 of 2, Opus Stewart Weir, August 23, 2017, Section 6.1.4.5, Page 33
Reference Document: McLean Creek (MC1) Dam, Updated Conceptual Design Report – Final – Vol 1 of 2, Opus Stewart Weir, August 23, 2017, Appendix A, Page 100/134
Reference Document: McLean Creek (MC1) Dam, Updated Conceptual Design

Report – Final – Vol 2 of 2, Opus Stewart Weir, August, 2017, Appendix 5, McLean Creek Damsite MC1-Workshop #2 Value Engineering & Risk Analysis, December 14, 2016, Page 15
Reference Document: McLean Creek (MC1) Dam, Updated Conceptual Design Report – Final – Vol 2 of 2, Opus Stewart Weir, August, 2017, Appendix 5, McLean Creek Damsite MC1 Value Engineering - Evaluation Phase, February 20, 2017, Page 6.

Alberta Transportation states *The simulation implies that the 1000-year flood could be managed without mobilizing the service spillway. Peak water levels would be just at the crest elevation of the ogee weir.*

Alberta Transportation then states on in section 6.1.4.5 on page 33 that *The basin response to the PMF rainfall would require the tunnel gates to be fully opened, and the reservoir level would continue to climb, mobilizing first the service spillway, and after that, the auxiliary spillway. Peak outflows through the tunnel would reach 1000 m^3/s, peak outflows from the service spillway would reach 600 m^3/s, and peak outflows through the auxiliary spillway would reach 1000 m^3/s.*

Alberta Transportation references:
SUB-TOTAL SERVICE SPILLWAY $45,893,000
SUB-TOTAL, AUXILIARY SPILLWAY $1,488,000

Alberta Transportation indicates that the idea/option of *12-Eliminate service spillway and use expanded auxiliary spillway*.

Alberta Transportation states on page 6 *40. Eliminate service spillway and use expanded auxiliary spillway. (eliminate, not feasible)*
MC1 spillways are activated for floods greater than the 1000-year flood. The service spillway has a maximum peak outflow of 600 m^3/s and a cost estimate of $45,893,000. The auxiliary spillway has a maximum peak outflow of 1000 m^3/s and a cost estimate of $1,488,000.

a. Explain why it is not feasible to eliminate the service spillway and use an expanded auxiliary spillway at MC1.

b. Provide the cost of spillways at MC1 if the service spillway was eliminated and the auxiliary spillway was designed for floods greater than the 1000-year flood and designed for 1600 m^3/s peak flow of the PMF flood.

c. Provide the updated total cost for MC1, if the spillway cost difference is greater than $1 million from the reference document spillway costs.

35. Reference Document: Springbank Off-stream Storage Project, Preliminary Design Report (DRAFT), Stantec Consulting Services Ltd., March 31, 2017, Appendix G Construction, Page 3111 of 3119
Reference Document: McLean Creek (MC1) Dam, Updated Conceptual Design

Report – Final – Vol 1 of 2, Opus Stewart Weir, August 23, 2017. Appendix A, Page 97 and 100 of 134

Alberta Transportation states in Appendix G:

Item	*Unit Price $/m^3*
Emergency Spillway	
Structural concrete	*1340.82*
Off-Stream Storage Dam	
Zone 1A – Impervious Fill	*3.00*
Zone 2A – Random Fill	*1.50*
Fine filter – Zone 3A	*55.00*

Alberta Transportation states in Appendix A:

Item	*Unit Price $/m^3*
Service Spillway (Page 100)	
Concrete	*730.00*
Main Dam (Page 97)	
Zone 1A – Impervious	*10.00*
Zone 2A – Unclassified Fill	*10.00*
Zone 3A – Fine filter	*20.00*

Both the reports list similar sources and methods for developing the cost estimate for the respective projects. However, some of the unit prices in the line cost items are quite different between the projects.

a. Review the detailed line item costs for the Project and MC1 of comparable products and services. If the unit price difference is significant, and the quantity required makes a "material difference" (greater than $1 million) to the cost of the Project or MC1, then:
   i. provide project specific justification for the material difference.
   ii. provide an appropriate unit price for use with both projects (Project and MC1) and explain why that choice was made; or
   iii. provide multiple pricing options (high and low, at minimum) for that line item.

b. Provide updated costs for both the Project and MC1, if the total cost is materially different.

c. Update any EIA sections affected by the updated costs.

36. Reference Document: Springbank Off-stream Storage Project, Preliminary Design Report (DRAFT), Stantec Consulting Services Ltd., March 31, 2017, Appendix G Construction, Page 3109 of 3119

Alberta Transportation states that:

Highway 22 Bridge Crossing	*See Separate Breakout*
Township Road 242 Bridge Crossing	*See Separate Breakout*
Grade and Resurface Hwy 22 and Springbank Rd	*See Separate Breakout*

The separate cost breakouts for these items were not supplied.

a. Provide the separate cost breakouts for the stated items.

37. Volume 3A, Section 10.2.2.2, Figure 10-3, Page 10.20 and Volume 3A, Section 10.2.2.3, Page 10.29
Volume 3A, Section 10.4.4.1, Page 10.50

Alberta Transportation states on page 10.29 that *Three plant species of management concern were identified during rare plant surveys in the PDA….*

Alberta Transportation states on page 10.50 that *Effects on plant SOMC from vegetation clearing are not anticipated, because none were observed in the PDA.*

a. Clarify the contradiction between these two statements and confirm the number of plant SOMC in the PDA.

38. Volume 3A, Section 10.4.5, Page 10.51
Volume 3A, Section 10.5, Page 10.52
Volume 3A, Section 10.5, Table 10-14, Page 10.53

Alberta Transportation states on page 10.51 that *Residual project effects are expected to be adverse, moderate in magnitude*…

Alberta Transportation states on page 10.52 that *All residual project effects are expected to occur during construction, be low in magnitude*…

Alberta Transportation indicates that the magnitude of all residual effects is L (Low) on page 10.53.

a. Clarify the contradiction in the above statements and confirm the Projects residual effects for Wetlands.

39. Volume 3A, Section 10.4.3, Page 10.50
Volume 3A, Section 10.5, Table 10-14, Page 10.53

Alberta Transportation indicates that the change in community diversity effects would be reversible for temporary disturbances, and irreversible for permanent project components (page 10.50). While on page 10.53 Alberta Transportation indicates that the change in community diversity effects would be reversible.

a. Clarify the reversibility of residual effects for the Change in Community Diversity.

40. Volume 3A, Section 5.3, Page 5.28
Volume 3A, Section 5.4.2.1, Page 5.30

Alberta Transportation states that construction of the water diversion structure is not expected to interact with groundwater resources. However, in Section 5.4.2.1, page 5.30 Alberta Transportation states that the project has the potential to change groundwater quantity in and near the PDA as a result of local dewatering that might be required for the various project components, including the diversion channel.

a. Explain the contradiction between these two sections.

41. Volume 3A, Section 5.4.2.2, Page 5.32

Alberta Transportation states that *The Project has the potential to change groundwater quantity in and near the PDA as a result of local, shallow and temporary subsurface dewatering that might be required to facilitate construction of the diversion channel, dam and floodplain berm, outlet works, bridge, excavation of borrow pits, and utility requirements*.

a. Comment on the potential impact of the cones of depression associated with dewatering activities on yield from local water wells.

b. What mitigation measures will be taken to reduce any impacts on water wells caused by dewatering activities?

42. Volume 3B, Section 5.2.1, Page 5.2

Alberta Transportation used a mathematical model to depict the subsurface geologic setting and associated physical parameters that govern the flow of groundwater through porous media.

a. Comment on the significance of groundwater flow through fractures in local geological deposits (e.g., glacial till, shallow bedrock).

b. Comment on the impact of not considering fracture flow on modelling prediction scenarios.

43. Volume 3B, Section 5.2.1.1, Page 5.3

The mathematical model was calibrated using a combination of heads measured in monitoring wells situated within the LAA, heads measured in domestic wells situated in the RAA, and other information. Since the length of the open interval and depth of water wells can be highly variable it can be challenging to use water level information from wells to generate an accurate potentiometric surface since the hydraulic head information can be extremely variable.

a. Comment on how variability of hydraulic head in water wells was accounted for during mathematical model calibration.

44. Volume 3B, Section 5.2.3.2, Page 5.50

Alberta Transportation states that water wells in the PDA will be decommissioned as part of the construction phase. Proper decommissioning or reclamation of the wells will be important to ensure these wells do not provide a pathway for surface water to impact groundwater quality (particularly in the off-stream storage area).

a. Provide details on the process that will be used to "decommission" water wells in the PDA.

b. Indicate whether the monitoring wells installed in the PDA as part of the hydrogeological/geotechnical assessment will also be "decommissioned".

45. Appendix 1, Hydrogeology Baseline Technical Data Report, Section 2.6, Page 2.14

Alberta Transportation states that *An interpreted poteniometric surface for the unconsolidated deposits and poteniometric surface for the bedrock units were created for the RAA. A potentiometric surface represents the elevation to which water would rise in the aquifer if it was not confined, and is equivalent to the water table in the unconfined areas of the aquifer*.

a. Given that some unconsolidated deposits and bedrock units are confined, comment on the significance of considering the geologic units to be unconfined when developing the potentiometric surfaces.

46. Volume 3C, Section 2.3, Page 2.3

a. Clarify if the proposed groundwater monitoring is a one-time event or will it be on-going.

b. Provide information on the sampling frequency and parameters analyzed if the monitoring is on-going.

47. Volume 3A, Section 11.4.2.2, Page 11.39

Alberta Transportation states that when an active nest or den is found, provincial or federal disturbance setback distances for SOMC will be used.

a. Clarify what setback distance will be used for SOMC identified in the PDA that are not listed in the provincial or federal tables (e.g., olive-sided flycatcher).

48. Volume 3A, Section 11.4.6, Table 11-4, Page 11.66
Volume 3A, Section 11.7.2, Page 11.68

The table states that changes in movement are expected to be *reversible*. Yet, in Section 11.7.2 (Page 11.68) it is stated that *there is some uncertainty how ungulates and other wildlife would respond to these structures if they are encountered during daily or seasonal movements.*

a. Given the uncertainty of how ungulates and other wildlife would respond to permanent project structures (e.g., diversion channel), comment on why changes in movement are expected to be reversible?

49. Volume 3B, Section 11.3.2.1, Page 11.9

Alberta Transportation states that *flood events of moderate magnitude can help maintain riparian habitat.*

a. Clarify what flood intensity is considered moderate.

50. Volume 3B, Section 11.3.2.2, Page 11.9

Alberta Transportation states that a qualified biologist would be employed to conduct nest searches when sediment cleanup and debris removal from the off-stream storage area occurs seven days following reservoir draining and during the Restricted Activity Period.

a. Why would the nest searches occur seven days following reservoir draining (i.e., why not before seven days)?

51. Volume 3C, Section 2.9, Page 2.4

a. Clarify if there will be wildlife monitoring during maintenance activities in the restricted activity period (esp. during post flood sediment clean-up).

52. Volume 1, Section 3.1, Page 3.1

Alberta Transportation states that *the diversion capacity and combined storage of Glenmore Reservoir allows the Project to mitigate downstream flood damages* and that available active flood storage at Glenmore Reservoir is 10,000,000 m^3.

a. Clarify if storage at the Glenmore Reservoir is to be considered in conjunction with the Project and if the capacity at the Glenmore Reservoir is required for the Project to mitigate the design (2013) flood.

b. Describe how the two reservoirs would work together.

c. Describe structural and/or operational modifications to the Glenmore Dam and Reservoir that would be required in order to operate the Project as designed or for potential future joint operation.

53. Volume 3A, Section 6.1.4.1, Figure 6-1, Page 6.6
Volume 4, Appendix J, 2.1, Page 2.1

Alberta Transportation states that the *LAA included the PDA and the Elbow River from Redwood Meadows to the inlet of Glenmore Reservoir* (Volume 3A 6.1.4.1), that the *LAA extends from the diversion structure*…(Appendix J, 2.1). In Figure 6-1 (which is used again in various sections) it appears it may start below Redwood Meadows (i.e., inlet structure) and that the LAA may include the Glenmore Reservoir.

a. Clarify and explain the boundaries of the LAA for the hydrology assessment scenarios.

b. Update any of the hydrology and surface water quality sections of the EIA affected by the boundaries of the LAA, ensuring that the assessments include all areas of the LAA where applicable.

54. Volume 3A, Section 6.1.4.1, Figure 6-1, Page 6.6
Volume 4, Appendix J, 2.1, Page 2.1

Alberta Transportation states that the *RAA is the Elbow River watershed from headwaters to Glenmore Dam* (Volume 3A, 6.1.4.1), that the *RAA is the Elbow River watershed, including Glenmore Reservoir* (Appendix J, 2.1), and Figure 6-1 appears to include the entire watershed, including the Glenmore Reservoir and upstream and downstream of the Glenmore Reservoir.

a. Clarify and explain the boundaries of the RAA for the hydrology assessment, including why the Glenmore Reservoir and downstream of the Glenmore Reservoir is, or is not, included in either of the assessment areas given that the goal of the Project is to limit discharge downstream from the Glenmore Reservoir to less than 160 m^3/s.

b. Provide a description of the hydrology of the Elbow River at the Glenmore Reservoir and below the Glenmore Dam to the confluence with the Bow River. If it is determined to be within the RAA, explain why this assessment was not completed.

c. Update the hydrology and surface water quality sections affected by the boundaries of the RAA, ensuring that the assessments include all areas of the RAA.

55. Volume 3A, Section 6.1.5, Page 6.10
Volume 3A, Section 6.1.5, Table 6-2, Page 6.8

Alberta Transportation states that *[t]he definitions for magnitude of effects on hydrology, including sediment transport is further defined as follows…low magnitude change (<15%)…moderate magnitude change (15-30%)…high magnitude change (>30%)*…
These definitions do not appear to be used when assessing the magnitude of effects throughout the hydrology assessment and does not appear to be consistent with Table 6-2 on Page 6.8. The term *negligible* is often used when discussing magnitude, though is not defined here in the text.

a. Use the provided definitions, or provide definitions for the terms used, for assessing magnitude of effects throughout the hydrology sections of the EIA. Provide updates

and make all necessary changes throughout the hydrology sections in both text and tables.

56. Volume 3A, Section 6.2.2.4, Table 6-5

a. Provide mean (1979-2016) monthly peak flows for Bragg Creek and Sarcee Bridge stations in the Table, or in a new separate table (TOR 3.4.1B).

57. Volume 3A, Section 6.2.2.4, Page 6.33

Alberta Transportation states that *there are several small, naturally occurring waterbodies in the PDA. These waterbodies are primarily fed by the low-level outlet and its tributaries.*

a. Confirm that these waterbodies are primarily fed by the unnamed creek and its tributaries.

b. Provide a figure identifying the approximate areas of these waterbodies.

58. Volume 3A, Section 6.2.2.6, Table 6-9, Page 6.36

Alberta Transportation states that *water licences allocated within the LAA and associated volumes are summarized in Table 6-9.*

a. Provide a figure showing the locations of each water licensee identified in the table.

59. Volume 3A, Section 6.5.2, Page 6.40

Alberta Transportation states that *flow estimates from the five intersected tributaries are extremely low, likely intermittent and are already affected by roads, cultivation, and dugouts.* Although likely low in volume (or intermittent) during normal years, these tributaries appear to be permanently intersected by the diversion channel following construction and may convey greater volumes during flood years.

a. Provide details on how water is being diverted or managed from these tributaries.

b. Estimate the frequency, volume, and duration of flow that would drain from the low-level outlet as a result of inputs from the tributaries, as well as the suspended sediment concentration within this water.

c. Identify mitigation measures that could be implemented if required (e.g., for sedimentation).

d. Evaluate residual effects on potentially impacted areas (e.g., indicator fish species and life stage).

60. Volume 3A, Section 6.5.2, Page 6.40

Alberta Transportation states that *during dry operations, there is potential for increased flows in the low level outlet through the intersection of the diversion channel with shallow groundwater seepage…the spatial extent of groundwater seepage would be determined by the depth of local water tables.*

a. Quantify the amount of groundwater expected to be discharged through the low level outlet and how this change relates to baseline conditions.

b. Discuss effects this may have on unnamed creek downstream from the low level outlet.

61. Volume 3B, Section 6.0, Page 6.1

a. Explain what effects (cumulative or otherwise) any changes or upgrades at Bragg Creek or Redwood Meadows may have on future flow dynamics during flood events (e.g., increase water volume, speed, etc.).

62. Volume 3B, Section 6.1, Page 6.2
Volume 3B, Section 6.4, Page 6.12
Volume 3B, Section 6.5, Page 6.75

Alberta Transportation states that *[n]o definition for significance is provided because the purpose of the Project is to actively modify the hydrology of the Elbow River during floods by diverting flows greater than 160 m^3/s.*

a. Provide assessments for the significance of the Project on hydrology and determine the significance for changes in hydrology, including an assessment of if these changes may be neutral, positive, or negative. Without a determination of a significance change in hydrology during Project operation may not be effective. This should include how target discharge below the Glenmore Dam is achieved and maintained.

63. Volume 3B, Section 6.2.1, Page 6.3

Alberta Transportation states that *the slope value decrease can be interpreted as indicating that a significant proportion of fine sediment goes into storage between Bragg Creek and Sarcee Bridge during high flows….the remobilization of stored sediment likely explains why the rating curve parameters suggest that suspended sediment concentrations at Sarcee Bridge are higher at low flows…*

a. Explain what was defined as *fine sediment* in this statement.

b. Clarify what processes control how fine sediment settles out during high flows and then is remobilized during low flows or if it is proportionally more significant.

64. Volume 3B, Section 6.2.1, Table 6-2, Page 6.6

a. Clarify if values are estimated (as suggested by title of the table) or based on samples (as suggested in the text).

b. Explain the error associated with suspended sediment concentration laboratory analysis and whether there is any statistically significant difference between the Bragg Creek and Sarcee Bridge locations for each month.

c. Describe any potential differences in interpretations if loads are considered as opposed to concentrations.

65. Volume 3B, Section 6.2.2, Figure 6-2, Page 6.7
Volume 4, Appendix J 3.3.4.1, Page 3.32 and 3.35

Alberta Transportation states that *analysis of the D50 surface/D50 subsurface for the Elbow River suggests that surface armouring increases downstream and coarse sediment transport becomes increasing supply-limited (Figure 6-2).*

a. Provide greater justification and support for this statement. The figure (top portion; ratios) does not indicate a significant difference with greater distance from source

(i.e., near or as high ratios at 80-85 km and ~92 km as >105 km; and low ratio at 105 km as <80 km). The last ratio is the highest, but the relationship is weak at best.

b. Describe the type of analysis that was conducted to reach this conclusion.

c. What is the statistical significance of this conclusion (i.e., show that there is a significant different in the ratio from upstream to downstream)?

66. Volume 3B, Section 6.4.1.1, Page 6.14
Volume 3A, Section 6.2.2.4, Table 6-7, Page 6.29
Alberta Transportation explains that *a single peaked, high flood flow in 2008 had an hourly peak of approximately 204 m^3/s…the hourly hydrographs from these floods are used as a best representation of the approximate 1:10…flood in the model*.

a. Explain if any changes in model interpretations and assessments would be required if data from the 2005 flood flows were used for the 1:10 year event (slightly greater, but similar peaks, and greater overall discharge volume; Volume 3A Table 6-7).

67. Volume 3B, Section 6.4.1.4, Page 6.15

a. Describe the calibration and validation methods used for the hydrodynamic modeling.

b. Provide modelling confidence and errors (or ranges) associated with the made predictions.

68. Volume 3B, Section 6.4.2.3, Page 6.23
Alberta Transportation states *because this percentage is well below 10%, the effect on the hydrological regime for the design flood, in terms of annual volume, is negligible in magnitude and transient*.

a. Confirm that this statement, and associated numbers, are for the 1:100 year flood and not the design flood.

b. Use defined terms for magnitude (i.e., low, moderate, high).

69. Volume 3B, Section 6.4.3, Page 6.26
Alberta Transportation states that *the effects of diversion would be to change suspended sediment concentrations and local suspended sediment yields in the Elbow River*.

a. Explain how diversion would change suspended sediment concentrations in the Elbow River, including assumed stratification and/or variation in concentrations between diverted and non-diverted water. If suspended sediment load (yield) was meant, update text and associated assessments.

70. Volume 3B, Section 6.4.3.2, Page 6.35

Alberta Transportation states that *peak concentrations modelled at the confluence of the low-level outlet and Elbow River are in the range of 18,000 g/m^3 but decline to 5,700 g/m^3 approximately 1.0 km downstream (Table 6-7). Historical data suggests that monthly suspended sediment concentrations at the time of release 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)…flow and storage effects in the Elbow River dilutes this suspended sediment input to 68.6 kt, a 25% decrease by approximately 1.0 km downstream of the confluence with the low-level outlet*.

a. Discuss implications of changes to movement of the suspended sediment and increased deposition within the 1.0 km stretch downstream from the confluence of the low-level outlet with the Elbow River (i.e., difference in timing of sediment transport, sediment characteristics, and changes in deposition rate and location between baseline conditions and Project flood conditions).

b. Assess potential effects of releasing water with relatively higher TSS concentrations for longer duration from the reservoir post-flood, relative to natural flood patterns.

71. Volume 3B, Section 6.4.3.3, Page 6.39

Alberta Transportation summarizes that *suspended sediment concentrations would reduce slightly, but with suspended sediment yields reduced by up to 65% during active diversion.*

a. Provide an assessment on the potential impacts of this (positive or negative) and the potential magnitude of these impacts.

72. Volume 3B, Section 6.4.4, Page 6.52

Alberta Transportation states that *under flood conditions, the primary particle size transported in the Elbow River would likely be gravel sized material, with a median grain size of 21 mm.*

a. Clarify how flood conditions are defined here (e.g., use of discharge ranges or exceedance may be appropriate).

b. Clarify how material smaller than gravel size are prevented from mobilizing during flood conditions, or if this is by relative volume/weight.

73. Volume 3B, Section 6.4.4.1, Page 6.53

Alberta Transportation states that *to assess the effect of active diversion on downstream geomorphology, three locations are used to illustrate potential effects. These locations represent changes in the upper, middle, and lower sections of the Elbow River downstream of the diversion inlet.*

a. Estimate the spatial extent (i.e., upstream distance and surface area) of potential backwater effect on the Elbow River for each Project phase.

b. Explain any differences that may occur on geomorphology upstream of the diversion inlet as a result of the diversion structure operations (e.g., due to changes in elevation, velocity, volumes, etc.).

c. Estimate the type, volume, and depth of sediments deposited and the locations of deposition upstream of the diversion structure.

74. Volume 4, Appendix J, Section 2.1, Page 2.1

Alberta Transportation states that *the LAA also encompasses the water quality modelling domain*.

a. Provide details on water quality modelling. It does not appear that modelling of water quality is provided in other sections (i.e., water quality section), only summaries of data.

75. Volume 4, Appendix J, Section 2.3.4, Page 2.24

Alberta Transportation states that *suspended sediment yields were estimated from the converted turbidity data and discharge data*.

a. Provide details (e.g., data or graphs) on how this relationship between turbidity and sediment was determined specific to the study area.

76. Volume 4, Appendix J, Section 2.3.5, Page 2.26

Alberta Transportation states that *TDS in mg/L was estimated by applying a multiplier of 0.55 to the EC values, as per the manufacturer's recommendation.*

a. Explain how appropriate this multiplier is to this stretch of the Elbow River.

b. Show validation results of this relationship or if it was not completed, explain why validation of this multiplier was not completed (e.g., through comparison with calculated TDS values or comparison with select samples for TDS analysis).

77. Volume 4, Appendix J, Section 2.4.2, Page 2.37

Text is missing from the paragraph that starts *modelling of sediment transport was based on a combination of field collected data and site specific mathematical relationships between discharge and the.*

a. Provide the rest of the missing text.

78. Volume 4, Appendix J, Section 3.3.2.2, Page 3.25

a. If TDS was determined by a multiplier of EC, justify why it is appropriate to discuss TDS here and not simply EC as a measured parameter?

79. Volume 4, Appendix J, Section 3.3.4.1, Page 3.35

Alberta Transportation references that *long-term data sets were sourced from Alberta Environment and Parks and the City of Calgary water quality data bases (see Appendix D4 for detail).*

a. Where can Appendix D4 be found in the provided material? If not originally included, provide Appendix D4.

80. Volume 3A, Section 7.2.2, Page 7.10

Alberta Transportation states that *water quality in the Elbow River upstream of Glenmore Reservoir* (referred to as upper Elbow River in this section) *is good in relation to aquatic ecosystem and human uses of water from the river*.

a. Explain why the upper Elbow River is defined differently here when compared to the upper and lower areas in the hydrology section.

b. Include a summary and characterization of current Elbow River water quality (current conditions and during flood conditions in Volume 3B), including quantification of specific physical (e.g., temperature and DO), chemical (e.g., nutrients and metals), and microbiological (e.g., fecal coliform and E. coli) parameters.

c. Assess baseline water quality for the entire RAA (TOR 3.5.1).

81. Volume 3A, Section 7.4.2.1, Page 7.14

Alberta Transportation states that *water withdrawals for dust suppression and other construction needs can be required and can affect downstream water quality…*

a. Explain the appropriateness of water withdrawals for dust suppression during construction given recommendations from the South Saskatchewan Regional Plan and difficulties in obtaining water licenses.

b. Discuss whether there are alternative water sources for dust suppression during construction activities.

82. Volume 3B, Section 7.1, Page 7.1

Alberta Transportation states that *an assessment of suspended sediment, temperature, dissolved oxygen, and metal methylation* was provided.

a. Provide an assessment (including quantification) for lead, arsenic, and cadmium (mercury methylation and suspended sediment completed), as well as for major ions, nutrients, bacteria, invertebrates, aquatic plants, algae, temperature, and DO for all phases (i.e., flood operation, post-flood operation, construction, and dry-operations) in the Elbow River, within the Project Reservoir (flood and post-flood), and at the Glenmore Reservoir. Identify any potential changes due to storage and release of flood water in the Project reservoir on receptors and relative to applicable guidelines.

83. Volume 3B, Section 7.2.2.2, Page 7.8

Alberta Transportation states that *the upper Elbow River dissolved oxygen concentrations varied seasonally, but were not associated with any apparent spatial pattern*.

a. Indicate when (e.g., time of day and associated temperature and solar radiation) dissolved oxygen concentration measurements were made and any implications that diurnal cycling of dissolved oxygen (in response to photosynthesis/respiration cycling, productivity, and temperature) may have on assessments and predictions.

b. What is the current understanding of the productivity or trophic status of the Elbow River? Include a discussion on photosynthesis/respiration cycling and influences on water quality parameters (e.g., nutrients, DO, EC, pH, metals, etc.) in the Elbow River.

84. Volume 3B, Section 7.4.2, Page 7.22

Alberta Transportation states that *it is assumed the parameters likely behave similarly to suspended sediment during a flood because the physical mechanism of negatively charged suspended sediment particles attracting positively charged matter remains the same during flood conditions.*

a. Clarify how some parameters, such as nutrient and bacteria, which are commonly associated with suspended sediments under normal/low flow, can be affected by re-suspension into the river column during flood or high flow conditions.

b. Clarify potential effects due to this process.

85. Volume 3B, Section 7.4.2, Page 7.21

Alberta Transportation states 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 operations (i.e., reducing flow rate) and, possibly, also with sediment and silt fences*.

a. Clarify to what degree (i.e., concentrations) suspended sediment concentrations can be reduced.

b. Describe the type, and number of sediment and silt fences proposed.

86. Volume 3B. Section 7.4.2. Page 7.23

Alberta Transportation states that *reservoirs act as nutrient sinks with sedimentation and sediment water processes regulating the nutrient status of a reservoir*.

a. Provide estimated (modelled or calculated) water quality parameter concentrations in water retained within the reservoir and during release back to the Elbow River. Include physical, major ion, nutrient, metal, and microbiological parameters, and assess any potential effects on the Elbow River downstream (including at Glenmore Reservoir).

87. Volume 3B. Section 7.4.3. Page 7.25

Alberta Transportation states that *for the design flood, the release of retained water…is higher in the more likely floods and smaller in the unlikely design flood*.

a. Discuss implications of changes in total loading patterns of water quality parameters in the Elbow River (and Glenmore Reservoir) as a result of water retention and release from the Project Reservoir post-flood.

88. Volume 3B. Section 7.5. Page 7.34

Alberta Transportation concludes that *the effect of the Project on water quality is not significant because the change in water quality is not anticipated to cause acute or chronic toxicity or change the trophic status of the Elbow River or Glenmore Reservoir*.

a. Clarify how conclusions were determined on trophic status and toxicity when parameter concentrations were not estimated and productivity (e.g., macrophytes, periphyton, biomass, invertebrates, etc.) was not assessed.

89. Volume 4, Appendix K, Table 3-1, Page 3.9

a. All of the columns for dissolved oxygen and temperature, say dissolved oxygen and temperature respectively. Provide the information for these parameters and update the table.

90. Volume 4, Appendix K, Section 3.2.2.1, Page 3.13

Alberta Transportation states that *the upper Elbow River mainstem is not reported to have substantial macrophyte (aquatic plant) growth in literature*…

a. Provide the reference(s) for this statement. Is this consistent for periphyton and algae? Explain.

91. Volume 1, Section 3.4.1, Page 3.33
Volume 1, Section 3.5.1, Table 3-8, Page 3.35

Alberta Transportation states *During dry operation, the diversion inlet gates will close and the service spillway gates will open (lowered)*. This statement is inconsistent with Volume 1, Section 3.5.1, Table 3-8 which indicates that *for Flow Rate < 160 m^3/s the right gate will be raised and the flow will be through left spillway*.

a. Clarify the inconsistency.

b. Describe expected spillway gate configuration at a flow < 160 m^3/s during Dry-operation service spillway maintenance activities.

c. Does the spillway gate configuration at a flow < 160 m^3/s during Dry-operation service spillway maintenance activities influence the effectiveness of fish passage mitigation? If this does not influence the effectiveness of fish passage explain how this conclusion was reached. If it does effect the effectiveness of fish passage then evaluate the effects on each indicator of fish population and explain how these effects can be mitigated.

92. Volume 3A, Section 8, Report Section 8.2.2

Requirements specified in ToR 3.6.1 Baseline Information should be reviewed. The Desktop review provides a general overview of ecology and habitat requirements of fish species and relative abundance of fish expected to occur in the LAA. For each survey site habitat quality was rated for fish groups, not for fish species.
Baseline information that describes the species composition, distribution, abundance, movements, habitat use, habitat quality, and life history parameters of fish populations currently residing within the LAA are not fully presented. There is no comprehensive discussion of the ecology of species populations identified as indicator fish species to be used by the effects assessment.

a. Based on the review, identify gaps in the baseline information that may hinder the ability to evaluate Project effects.

b. Identify specific components of the baseline information data gap that that may hinder the ability to evaluate Project effects (e.g., timing and duration of Bull Trout population movements in the vicinity of the diversion structure, location and size of Mountain Whitefish spawning habitat sites downstream of the diversion structure, distribution of the Rainbow Trout population relative to the location of the diversion structure).

93. Volume 3A, Section 8.4.2.1, Pages 8.49 and 8.50
Volume 3A, Section 8.4.3.8, Page 8.55

Alberta Transportation states *During dry operation of the project, 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. The transition from the concrete gates to the spilling basin may also create a drop that is too tall for small fish to jump up (Section 8.4.2.1) and that Boulders would be added to increase the bed roughness of the channel immediately downstream of the diversion structure, which would increase water depths and reduce velocities, and Boulder V-weir structures would be constructed in the channel downstream of the gates to provide slower velocity and deeper resting zones (Section 8.4.3.8)*.

a. Provide the rationale for the use of physical works in the Elbow River channel downstream of the service spillway and stilling basin as a mitigation measure to provide safe unhindered upstream and downstream fish passage through the service spillway and stilling basin.

b. Provide empirical evidence that illustrates how mitigation measures in the Elbow River channel downstream of the service spillway and stilling basin mitigate water depths shallower than 18 cm that occur within the service spillway and how mitigation measures in the Elbow River channel downstream of the service spillway mitigate a water elevation drop between the service spillway and the stilling basin.

c. Discuss whether Elbow River bed material transport through the service spillway area during Dry Operation and during Flood and Post-Flood Operation will influence the performance of mitigation measures in the Elbow River channel downstream of the service spillway and within the stilling basin. The discussion should include an evaluation of the expected life span of the mitigation measures in terms of structural stability and as-built specifications. Use experience gained from other Alberta Transportation mitigation sites to inform the discussion.

94. Volume 3A, Section 8, Report Section 8.4.4.2, Page 8.58

Alberta Transportation states *During construction, fish passage concerns would be mitigated with passage around the site*.

a. Provide information that demonstrates safe, unhindered upstream and downstream fish passage during operation of the Elbow River diversion channel. The information should indicate whether the diversion channel will operate during the entire period of river diversion and what measures will be applied to provide suitable water velocities and water depths for upstream and downstream passage of each indicator fish species and life stage.

b. If there are periods when the diversion channel is not operating and/or effective fish passage cannot be provided by the diversion channel at all flows, identify the duration and timing of hindered fish passage and indicate the indicator fish species and life stage that will be affected.

c. If safe, unhindered upstream and downstream fish passage during operation of the Elbow River diversion channel cannot be provided revise the effects assessment of fish passage during construction.

95. Volume 3A, Section 8.4.4.2, Pages 8.60

Alberta Transportation states *With mitigations, fish migrations past the structure would not be impeded in a manner that would affect the sustainability of the fish populations, the distribution, or abundance of fish, including fish that support CRA fishery, in the LAA.*

Discussion of Project effects on fish passage focuses on a comparison of pre-construction conditions to post-construction conditions of the Elbow River channel downstream of the service spillway. The general conclusion from the discussion, for modelled discharges, is that pre- and post-construction conditions of the Elbow River channel are similar.

Alberta Transportation states that *During discharges at 69.5 m^3/s (BSP2-3Q10max)..... Fish movement would be possible over the structure along the margins....* (Page 8.60).

Fish passage through the service spillway during Dry Operations may be the most important potential effect of the Project on the health of Elbow River fish populations, but a limited evaluation of the issue is presented.

a. Provide a table that summarizes fish passage requirements of each indicator fish species and life stage. The table should include the period when passage is required, the direction of passage, the expected size range of fish that require passage (ensure that this information conforms to baseline information), and the estimated swimming ability of each indicator fish species life stage.

b. Provide a table that summarizes water velocity and water depth values modelled by Volume 4, Appendix M, Attachment 8A Fish Passage Analyses for post-construction conditions specific to the service spillway structure and specific to the stilling basin structure. In order to establish precision of the model outputs, the summary should include the average and range of each modelled value. Use 95% Confidence Interval as the metric for range.

c. Provide illustrations of model results for post-construction conditions specific to the service spillway structure and stilling basin structure. Ensure illustrations are of sufficient scale to allow clear identification of preferred fish movement routes within the service spillway and within the stilling basin (i.e., zones that provide suitable water velocity and suitable water depth for fish passage).

d. Based on the above information conduct an evaluation of the Project effects on fish passage within the service spillway and within the stilling basin. Ensure the evaluation includes each indicator fish species and life stage.

96. Volume 3B, Section 8.2.2, Page 8.6

Alberta Transportation states that auxiliary spillway may also activate for smaller flood events 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.

a. Estimate the frequency of occurrence of auxiliary spillway activation for smaller flood events. Consider blockage of the service spillway by large woody debris at all high flow events, including flows less than 160 m^3/s. Use experience gained from other water diversion projects located in Alberta.

b. Discuss the implications of auxiliary spillway activation on permanent alteration of fish habitat using the pathway effects approach. Consider erosional effects associated with overland flow, and volume of sediments generated by erosional effects.

c. Identify mitigation measures that could be applied.

d. Evaluate residual effects on each indicator fish species and life stage caused by auxiliary spillway activation.

97. Volume 3B, Section 8.2.2.2, Page 8.12
Volume 3B, Section 8.2.4.2, Page 8.16

The extent, complexity, and duration of Post-flood repairs and maintenance activities requires careful consideration to ensure adequate mitigation.

a. Describe mitigation measures that will be used to avoid adverse effects to fish habitats during instream removal of sediment deposits located upstream of the service spillway and diversion inlets, as well as from the reservoir.

b. Describe mitigation measures used to ensure unhindered upstream and downstream fish passage through the service spillway during debris removal and infrastructure repairs.

c. Assess the effectiveness of mitigation measures to reduce or eliminate the potential effects.

d. If mitigation measures are not completely effective evaluate the residual effects of post-flood repairs and maintenance activities.

98. Volume 3B, Section 8.2.2.3, Page 8.11

Alberta Transportation states *Sediment removal is likely to be an ongoing maintenance concern in the diversion channel and in the Elbow River immediately upstream from the auxiliary spillway and diversion structure*.

The Project has the potential to cause a backwater effect during Dry Operation, as well as Flood and Post-flood Operation and has implications to upstream and downstream fish habitats. In addition to fish passage through the service spillway and stilling basin.

a. Estimate spatial extent (i.e., upstream distance and surface area) of the backwater effect on the Elbow River channel for each Project Phase.

b. Evaluate the effects of changes in channel morphology in the upstream backwater zone for each indicator fish species and life stage. Include a discussion of the duration of effect in terms of predicted number of years of altered channel morphology.

c. Evaluate the effects of increased suspended sediment concentrations and the deposition of sediment on fish habitat in the upstream backwater zone and downstream of the diversion structure for each indicator fish species and life stage.

d. Discuss how changes may influence the ability of fish to pass the service spillway and stilling basin. Evaluate the effectiveness of fish passage mitigation given the expected changes to channel morphology caused by the backwater effect.

99. Volume 3B, Section 8.2.2.3, Page 8.10
Volume 3B, Section 6.4.4.1, Table 6-10, Page 6.54
Volume 3B, Section 6.4.4.3, Figures 6.29 to 6.31

Alberta Transportation states Volume 3B, *Section 6 (Hydrology) indicates that changes in morphology in Elbow River may result in reduced mobilization on bar heads and a decrease degradation and aggradation. Modelling (see Section 6) shows that for the 1:10 year flood, the pattern of erosion of bar heads and subsequent deposition downstream would be maintained during active diversion, albeit with a moderate reduction in magnitude of approximately 24%.*

a. Provide an estimate of the total LAA surface area downstream of the diversion that will be affected by a reduction in channel morphology processes caused by active diversion of flows >160 m^3/s for a 1:10 year flood. An estimate can be generated using values presented in Table 6-10 of Volume 3B, Section 6 (Hydrology) and spatial areas illustrated on maps of Elbow River Net Bed Morphology Changes With and Without Diversion presented in Figures 6.29 to 6.31 of Volume 3B, Section 6 (Hydrology).

b. Estimate the surface area of fish habitats downstream of the diversion that would be susceptible to channel aggradation and to channel degradation by indicator fish species and life stage.

c. Evaluate the effects of changes in channel morphology caused by active diversion of flows >160 m^3/s on each indicator fish species and life stage. Include a discussion of the duration of effect in terms of predicted number of years of altered channel morphology following the diversion. Include a discussion of long-term consequences caused by elimination of flood events > 160 m^3/s. Discuss the effects for the river section that likely will be subjected to the greatest potential effect (i.e., immediately downstream of the diversion structure).

100. Volume 3B, Section 8.2.2.3, Page 8.12

Alberta Transportation states *The 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. Given the low probability of diversion occurrence and with the implementation of mitigation measures, 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 planned post flooded reservoir drainage*.

a. Compare the predicted suspended sediment concentrations released by the Low-level Outlet discharge during Post-Flood River to the Elbow River background suspended sediment concentrations.

b. Consider the effects of sediment release from the Low-level Outlet for 30 days when the Elbow River flow is < 20 m^3/s.

c. Using the above information quantify the effects of predicted suspended sediment concentration on each indicator fish species and life stage using an accepted stress index metric.

d. Estimate the spatial extent of suspended sediment effect and sedimentation effect on Elbow River fish habitat downstream of the diversion.

e. Estimate the expected duration of effect following completion of the off-stream reservoir release period in days, months and years.

f. Using this information evaluate effects of increased suspended sediment concentrations and the deposition of sediment on fish habitat for each indicator fish species and life stage.

101. Volume 3B, Section 8.2.2.3, Pages 8.11 and 8.12
Volume 3B, Section 7.4.3, Page 7.24

Alberta Transportation states *As the water from the reservoir is released, it would mix with Elbow River water. Generally, temperature in the river can increase as a result of this release and dissolved oxygen concentrations can decrease. The effect on dissolved oxygen is expected to be localized because of rapid aeration of water… For additional details on changes in temperature and dissolved oxygen, see Volume 3B, Section 7.4.3*.

The change in water temperature of retained water was not quantified by Volume 3B, Section 7.4.3.

a. Estimate water temperatures of the reservoir based on historical air temperatures and wind data for the study area. Use this information to predict water temperature of retained water released to the Elbow River.

b. Provide water temperature sub-lethal and lethal thresholds for each indicator fish species and life stage.

c. Based on this information evaluate the effects of elevated water temperature on the health of fish and fish use of habitats for each indicator fish species and life stage.

102. Volume 3B, Section 8.2.4, Page 8.13

Spillways on water control structures can cause an increase in dissolved gas pressure, also referred to as total gas pressure (TGP). Excessive TGP is potentially harmful to fish and other aquatic organisms. Elevated TGP conditions are known to extend long distances downstream in flowing water because dissolved gases are not easily released from dilution in fluvial environments.

a. Provide an evaluation of the effects of elevated TGP on indicator fish species populations. The evaluation should include:
   i. Estimates of TGP levels for expected flood flows caused by differences between the spillway gate crest water elevation and stilling basin water elevation.
   ii. Estimated downstream extent of elevated TGP levels within the Elbow River.
   iii. Evaluation of consequences to fish habitat use, consequences to fish health, and long-term consequences to fish population health for each indicator fish species.

b. If a residual effect is identified, complete a residual effects evaluation.

103. Volume 3B, Section 8.2.4.3, Page 8.17
Volume 3B, Section 6.4.3.1, Table 6-6, Page 6.28

Alberta Transportation states *The mortality from entrainment is dependent on the number of fish entering the reservoir and those fish returned to Elbow River during draining of reservoir*, that *During post-flood operations, stranding in the reservoir is expected to cause mortality of fish that do not swim out of the reservoir during post-flood draining*, and that *The number of fish potentially lost is unpredictable and is based on the ability to rescue fish, which is related to reservoir ponding areas, drawdown rate, and sediment deposition in the reservoir*.

a. Provide an estimate of the portion of fish passing the facility that will be entrained into the diversion canal at each of the flood flow levels. Assume that the portion of fish that are entrained equals to the portion of water that is diverted. Estimate the portion of the fish population that may be entrained based on the spatial distribution of fish species populations in the Elbow River.

b. Predict the potential for survival of each indicator fish species and life stage entrained into the reservoir using assumptions for residence times and a suspended sediment concentrations presented in Volume 3B, Table 6-6.

c. Evaluate the effects of fish entrainment into the diversion canal on the health of each indicator fish species population. Discuss the expected portion of the population entrained (i.e., population mortality rate) and the frequency of occurrence of entrainment events. Include a discussion of additive mortality rate (mortality rate caused by entrainment + natural population mortality rate).

d. Provide an estimate of the portion of fish that will pass through the service spillway. For the estimate assume that the portion of fish passing the through the service spillway is equal to the portion of water that is passed. Estimate the portion of the fish population that may pass through the service spillway based on the spatial distribution of fish species populations in the Elbow River.

e. Predict the potential for survival of each indicator fish species and life stage that must pass over the spillway when the gates are in the raised position.

f. Evaluate the effects of population health from fish passage through the service spillway on each indicator fish species. Discuss the expected portion of the population injured or killed (i.e., population mortality rate) and the frequency of occurrence of events. Include a discussion of additive mortality rate (mortality rate caused by entrainment + natural population mortality rate).

104. Volume 3C, Section 1, Section 1.2.4, Page 1.25

Alberta Transportation lists *projects that have the potential to act cumulatively with residual environmental effects from the Project.*

a. Describe any cumulative effects of Glenmore Dam and Reservoir operations on aquatic ecology.

105. Volume 4, Appendix M, Attachment 8A.

This attachment consists of two documents, the Springbank Off-stream Storage Project (SR1) – Hydraulic Modelling to Support Fish Passage Assessment and SR1: Fish Passage Flows Analysis. SR1: Fish Passage Flows Analysis generated estimates of Elbow River discharge which were used as a basis of hydraulic modelling by the Springbank Off-stream Storage Project (SR1) – Hydraulic Modelling to Support Fish Passage Assessment.

The precision of hydraulic modelling output can be influenced by the precision of the input data and the accuracy of the hydraulic modelling output can be influenced by the accuracy of the input data.

a. Identify the precision of the digital terrain model and illustrate the triangular mesh size used in the model domain for the service spillway, stilling basin and surrounding river channel.

b. Comment on the change in the hydraulic model output that would result by replacing the average river discharge (each of 8 values) presented in SR1: Fish Passage Flows Analysis Table 4 with the Upper 95% Confidence Interval value and the Lower 95% Confidence Interval value associated with each average river discharge.

c. Comment on the effects of ice and the effects of large woody debris within the service spillway gate structure on the accuracy of the hydraulic model output for water velocity and water depth.

d. Indicate whether hydraulic modelling assumed *flow through right gate and flow through left gate*.

e. If modelling assumed flow through both right and left spillway gates, comment on applicability of model outputs if spillway operation < 160 m^3/s will use *right gate raised, flow through left gate*.

106. Volume 1, Section 7.4, Table 7-3, Page 7.11

Alberta Transportation states that Tsuut'ina Nation has indicated that they *should be a decision maker and want the SR1 project to require Tsuut'ina's "Consent" as part of the current process.*

a. Provide comments on Tsuut'ina's request to be consented as part of the current Project process.

107. Volume 1, Section 7.4, Table 7-4, Page 7.35
Volume 4, Part 1 Appendices, Section 3.1.4, Page 3.23

Alberta Transportation states that *Stoney Nakoda Nation confirmed the SR1 project is in their Traditional Territory. They want to be able to complete an internal Cultural Review of the project area with Elders.*

The Stoney Nakoda Nation feel a Cultural Use Study, a Stoney Hydrology report, and a wildlife impacts study are required.

a. Provide an update on Stoney Nakoda Nation's request for Cultural Review with Elders, a Stoney Hydrology report, and a wildlife impacts study, in addition to studies completed in the EIA.

108. Volume 1, Section 7.4, Table 7-4, Page 7.36

Alberta Transportation states that Stoney Nakoda Nation has *expressed concerns with the Stoney lack of mapping capability and requested some assistance understanding the SR1 mapping.*

a. Comment on whether Alberta Transportation is planning to review the SR1 mapping with the Stoney Dakoda Nation and if this has been conducted.

109. Volume 1, Section 7.4, Table 7-4, Page 7.36

Alberta Transportation states that Stoney Nakoda Nation has indicated the *desire to do a site visit with Elders* and that *at the time of the request Alberta Transportation's agreement with landowners for access had expired. Any additional access will need to be requested on an owner by owner basis*.

a. Provide an update on Stoney Nakoda Nation's request for site visits with Elders.

110. Volume 1, Section 7.4, Table 7-4, Page 7.39

Alberta Transportation indicates that the Stoney Nakoda Nation has informed Alberta Transportation that *there are two trap lines out there and Stoney members use the area for trapping*. Alberta Transportation stated *there are no registered traplines within the PDA. Alberta Transportation has requested the locations of the two traplines and were the Stoney members trap in order to determine if there is potential impact from the project.*

a. Discuss potential impacts on the two traplines.

b. Provide proposed mitigation measures for potential impacts.

111. Volume 1, Section 7.4, Table 7-7, Page 7.55
Volume 4, Appendix B, Section 3.1.1, Page 3.6

Alberta Transportation states that the Kainai First Nation requested *clarification as to why Kainai First Nation* was (is) *being asked for comments on the EIA, given that the EIA does not conform to the EIS guidelines*.

a. Provide information on areas that do not conform to EIS guidelines in the EIA.

b. Discuss whether further study or work would be carried out to address these deficiencies.

112. Volume 1, Section 1.4.1, Pages 1.14 to 1.17

A discussion of necessary Crown land dispositions was not provided as outlined in the Terms of Reference, Sections 2.4.[C] and 3.10.1[B].

a. Provide the information as indicated in the Terms of Reference.

113. Volume 3A, Section 12.4.2, Page 12.24 and Figure 12-5, Page 12.25
Volume 3A, Section 12.4.2.1, Page 12.31
Volume 3A, Section 12.4.2.2, Pages 12.34 to 12.35

Volume 3B, Section 12.2.2.1, Page 12.6
Volume 3B, Section 12.2.2.2, Page 12.7

Alberta Transportation states *AEP would own and manage these areas. Area D, dam and reservoir infrastructure: there is no public access and would be fenced for public safety and security purposes*.

On page 12.31 Alberta Transportation states that *some recreational boating (e.g., kayaking, canoeing, rafting) does occur on the river in the PDA and LAA and the right of safe public navigation of any waterway must be maintained during the construction and operation of the Project (Transport Canada 2014).*

Alberta Transportation states in Section 12.4.2.2 that *AEP would avoid the substantial interference with public navigation of the Elbow River through the following design practices:*

- *As part of construction, a permanent portage will be developed around the in-stream water intake components.*
- *Signs will be installed along the Elbow River channel and on the dam. Multiple signs will be placed upstream and downstream of the water intake components on both banks of the Elbow River. These signs will warn users on the Elbow River that they are approaching in-stream water intake components and of the associated danger with this infrastructure and direct them to a portage location. A floating, high visibility boom will be in place upstream and downstream of the water intake components.*

Areas B, C, and D will be restricted to public access using barbed wire fencing, gates and signs indicating "Danger" and "No Trespassing".

Similar wording referring to the permanent portage is included in Volume 3B, Section 12.2.2.1, Page 12.6. Similar mitigation wording on public access, fencing and signage is included in Volume 3B, Section 12.2.2.2, Page 12.7.

a. Explain how restricting access to Area D with barbed wire fencing maintains the right of safe public navigation on the Elbow River.

b. Clarify why the bed and shores of the Elbow River (upstream and downstream of the diversion structure) are included as dam and reservoir infrastructure with restricted public access.

c. Describe the location of the portage relative to Area D and the PDA, and explain how it will be accessible to the public.

114. Volume 3A, Section 12.2.2.1, Figure 12-2, Page 12.14 and Page 12.18
Volume 3A, Section 16.2.3.1, Page 16.10
Volume 1, Section 2.2.6.2, Page 2.30
EIS Summary, Section 3.6.3.3, Page 3.29

Volume 3A, Section 16.2.3.1, Page 16.11
Volume 3A, Section 16.2.3.1, Table 16-5, Page 16.12

Under the heading Aggregate Development, Alberta Transportation states *Alberta Transportation holds a disposition reservation (DRS) for surface material extraction in the LAA, in NW-11-024-04 W5M. There are no other quarries or pits in the assessment areas*.

Alberta Transportation states *Township Road 242, west of Highway 22 functions as a two-lane roadway. It primarily serves a small number of country residential dwellings and the Copithorne gravel pit.*

Alberta Transportation states *Table 16-5 lists the AADT volumes on Township Road 242 west of Highway 22. The average annual growth rate between 2003 and 2015 was 126.3%, but from 2003 to 2014 it was 19%. It is speculated that the increase in the growth rate on Township Road 242 between 2014 and 2015 can be attributed to the Copithorne gravel pit operations.*

Figure 12-2 shows the PDA, LAA and RAA and the Township and Range Roads. Township Road 242 is shown extending beyond the LAA and ending prior to the RAA. The only road shown that connects Township Road 242 to other township roads is Highway 22.

a. Provide the legal land location of the Copithorne gravel pit.

b. Describe the Copithorne gravel pit location relative to the PDA, the LAA and RAA for:
   i. Land Use and Management
   ii. Air Quality and Climate
   iii. Acoustic Environment
   iv. Infrastructure and Services

c. Explain when the Copithorne gravel pit began operation and its life expectancy.

d. Update any Aggregate Development sections throughout the EIA.

115. Volume 4, Appendix N, Attachment 12A, Section 12A.3.3, Table 12A-3 and Table 12A-4, Pages 12A.8 to 12A.13

Table 12A-4 identifies business, institutional and recreational organization receptors in the LAA and RAA by name, as well as listing residential receptors. Table 12A-3 lists landowners within the PDA, but does not include if there are residences (or business, institutional and recreational organization receptors) on those land parcels.

a. Identify the current land use for each land parcel within the PDA, and identify the land parcels within the PDA that contain residences.

116. Volume 3A, Section 12.4.2.1, Page 12.32
Volume 1, Section 2.2.6.2, Page 2.30

Alberta Transportation states that *an overpass would be constructed at the intersection of Highway 22 and Springbank Road.*

On page 2.30 Alberta Transportation states *Design option 2 maintains existing the Springbank Road except for the modifications necessary to permit an at-grade intersection with raised Highway 22. Design option 2 is the preferred option for Springbank Road*.

a. Describe the intersection proposed at the junction of Highway 22 and Springbank Road.

117. Volume 3A, Section 16.1.4.1, Page 16.4
Volume 3A, Section 16.1.4.1, Figure 16-1, Page 16.5

Alberta Transportation indicates the *RAA follows the boundary of Rocky View County, and includes the City of Calgary. The only Aboriginal Reserve in the RAA is Tsuu T'ina Nation 145.* Figure 16-1 shows the RAA includes a portion of the Stoney Nakoda Nation's land.

a. Clarify which Aboriginal Reserves are located within the RAA for infrastructure and services.

118. Volume 3A, Section 16.2.3.1, Page 16.11 and Table 16-5, Page 16.12
Volume 1, Section 2.2.6.3, Page 2.30 and 2.31
EIS Summary, Section 3.6.3.3, Page 3.29
SR1 – Annex 2: A) Early Technical Issues, Response 1, Pages 1 to 11

Alberta Transportation states *Table 16-5 lists the AADT volumes on Township Road 242 west of Highway 22. The average annual growth rate between 2003 and 2015 was 126.3%, but from 2003 to 2014 it was 19%. It is speculated that the increase in the growth rate on Township Road 242 between 2014 and 2015 can be attributed to the Copithorne gravel pit operations.*
On pages 2.30 and 2.31 Alberta Transportation states that *design option 1 maintains the existing Township Road 242 alignment, but with a bridge crossing over the diversion channel. Design option 1 is the preferred option for Township Road 242.*
In the EIS Summary Alberta Transportation states *Design option 1 is the preferred option for Township Road 242. It provides the least disruption to the existing travel distance and the least requirement for new road construction*.
In the Early Technical Issues response Alberta Transportation states *For the Township Road 242 options, the environmental evaluation was based on the overall effects on undisturbed land, where a higher potential for environmental effects exists. As a result, the construction of the bridge crossing over the channel diversion on the existing Township Road 242 alignment (Option 1) has less environmental impact than Option 2 and 3 that traverses undisturbed land*.

a. Provide the construction costs for the three design options for Township Road 242.

b. Describe how Copithorne gravel pit access was or was not a factor in the design option decision for Township Road 242.

119. Volume 3A, Section 16.3, Page 16.13
Volume 3A, Section 16.2.3.1, Table 16-3, Page 16.10
Volume 3A, Section 16.2.3.1, Page 16.9
Volume 3A, Section 16.4.2.3, Page 16.17

Alberta Transportation states *Project would require approximately 450 workers. It is assumed that nearly all of the construction workers would live within daily commuting distance*.
Alberta Transportation states Highway 22 is a two-lane undivided rural highway. Alberta Transportation has plans for twinning the highway on its current alignment in the next ten years, although a date for the twinning has not been set.
On page 16.17 Alberta Transportation states *Employee commuter traffic and traffic delivering construction materials, supplies and services to the site may increase traffic volumes; however, with mitigations described above and the capacity of the local road network, the traffic associated with the Project can easily be accommodated.*

a. Quantify worker commuting trips per day on Highway 22 when the construction work force is at its peak and clarify if this is during 24 hour construction.

b. Quantify construction vehicle trips per day on Highway 22 when the work force is at its peak.

c. Provide the AADT volume required to twin Highway 22.

d. Describe how the traffic associated with the Project will be accommodated on a two-lane highway that has (or is projected to have) high enough traffic volumes that highway twinning is planned in the next ten years.

120. Volume 3A, Section 16.2.3.1, Page 16.9

Alberta Transportation states that *Highway 22 is a two-lane undivided rural highway. Alberta Transportation has plans for twinning the highway on its current alignment in the next ten years, although a date for the twinning has not been set*.

It is reasonable to assume the future cost of twinning Highway 22 through the PDA would be greater with the Project (e.g., additional costs to raise a twinned highway across the reservoir and a second Highway 22 bridge over the diversion channel).

a. Justify whether (or not) these additional costs for Highway 22 twining should be included as Project costs.

121. EIS Summary, Section 3.6.3.2, Page 3.24 and Volume 1, Section 2.2.6.2, Page 2.30
EIS Summary, Section 3.6.3.1, Page 3.24 and Volume 1, Section 2.2.6.1, Page 2.27

Alberta Transportation discusses the option of raising Springbank Road above the 2013 flood level to maintain traffic during a flood event and states *The road embankment would be classified as a dam under the Dam and Canal Safety Guidelines, leading to higher engineering, construction, safety, maintenance, and licensing costs that for a typical roadway*.

Alberta Transportation also states *Design Option 1 raises Highway 22 above the reservoir design flood level…The design elevation allows 0.5m for freeboard and 1.0m for the pavement structure depth above flood design level, which results in an embankment height of approximately 5 m at the Springbank Road intersection. The length of the raised roadway is approximately 1,800 m*.

a. Explain why the raised Highway 22 is not classified as a dam under the Dam and Canal Safety Guidelines.

b. Provide added costs if the Highway 22 road embankment was classified as a dam.

122. Volume 1, Section 3.2.2 and 3.2.3, Page 3.11

Alberta Transportation states that the design maximum flow for the diversion channel is 600 m^3/s and that the design discharge capacity of the emergency spillway is 354 m^3/s. The emergency spillway is designed to operate when the diversion inlet gates cannot be closed, and the capacity of the reservoir is exhausted.

a. Describe how the emergency spillway, with a 354 m^3/s capacity, will accommodate the maximum diversion channel flow of 600 m^3/s?

123. Volume 3A, Section 15.2.1, Page 15.9 and Volume 4, Appendix O, Human Health and Risk Assessment Technical Data Report, Section 2.6.1, Page 2.7
Volume 3A, Section 3.4.3.3, Page 3.47
Volume 3A, Section 3.4.3.3, Page 3.48

Volume 4, Appendix O, Human Health and Risk Assessment Technical Data Report, Section 3.4, Figure 3-2, Page 3.13

Alberta Transportation states that *particulate matter is also modelled to address dust concerns in the post-flood operations phase, where high winds during dry periods can cause wind erosion and dust storms and that the COPC from air emissions in the HHRA are those associated with gasoline and diesel combustion exhaust during the construction phase (i.e., CACs, VOCs, PAHs and trace metals), and particulate matter in the air resulting from dust storms during the post-flood operations phase*.

In Section 3.4.3.3 Alberta Transportation states *Project emissions during construction are associated with the operation of the off-road construction equipment and earth moving activities for the construction of the major components of the Project. The following emissions sources due to construction activities are estimated:*

- *Diesel combustion exhaust emissions from off-road construction equipment and haul trucks*
- *Fugitive dust emissions from scraping, bulldozing and grading of topsoil and overburden*
- *Mechanically generated dust by off-road equipment in transition*
- *Fugitive dust emissions from truck loading and unloading*
- *Mechanically generated dust by truck traffic along haul roads*
- *Fugitive dust emissions from wind erosion on topsoil and overburden stockpile*

On page 3.48 Alberta Transportation states *Most of the $PM_{2.5}$ and TSP emissions are associated with the fugitive haul road dust emissions.*

In Volume 4 Alberta Transportation states:

- *Project Phase: Construction*
- *COPC Source: Haul Road Dust*
- *COPC: PM2.5*
- *Exposure Media: Ambient Air*
- *Exposure Route: Inhalation of Air*
- *This exposure pathway is operable for Residents (all age groups) and Indigenous Receptors (all age groups).*

In portions of Volume 4 (Appendix O) and Volume 3A (Sections 3 and 15), Alberta Transportation suggests that the $PM_{2.5}$ road dust emissions both were and were not included in the Human Health Risk Assessment (Appendix O).

a. Clarify if $PM_{2.5}$ haul road dust emissions were included in the Human Health Risk Assessment (Appendix O) and Volume 3A, Section 15. Determine if the proposed mitigations for $PM_{2.5}$ emissions continue to be appropriate.

124. Volume 4, Appendix O, Human Health and Risk Assessment Technical Data Report, Section 6.2.1, Page 6.4.

Alberta Transportation states *For $PM_{2.5}$,…ERs are greater than 1.0 at 18 residential receptor locations (including SR38). These receptor locations do not include Indigenous receptor locations, or institutional facilities such as schools.*

a. What are the specific health effects of $PM_{2.5}$ on receptor SR38 (Camp Gardner)?

125. Volume 4, Appendix O, Human Health and Risk Assessment Technical Data Report, Section 6.2.1, Page 6.4.

Alberta Transportation states *Short term exposures to DEP were assessed by comparing 1-hour concentrations to the acute (2-hour) DEP exposure limit. The ERs at multiple residential locations were higher than the benchmark of 1.0; the ERs at Indigenous receptor locations and schools were less than 1.0*.

a. What are the specific health effects of DEP on receptor SR38 (Camp Gardner)?

126. Volume 3A, Section 15.4.4.1, Page 15.46; Volume 3A, Section 15.4.4.1, Page 15.46 Volume 4, Appendix O, Human Health and Risk Assessment Technical Data Report, Section 6.2.1, Page 6.4

Alberta Transportation states that *For $PM_{2.5}$, the short-term (1-hour or 24-hour) and long term (annual) ERs are greater than 1.0 at 16 residential receptor locations* (Volume 3A) and that *for $PM_{2.5}$, the short-term (1-hour or 24-hour) and long term (annual) ERs are greater than 1.0 at 18 residential receptor locations* (Volume 4).

a. Clarify the number of residential receptors where ERs are greater than 1.0.

3 General

3.1 Public Engagement and Aboriginal Consultation

127. Volume 1, Section 6.2, Table 6-2, Page 6.2

In Table 6-2 Alberta Transportation indicates that the only AEP attended the Water Collaborative meeting in which the purpose of the meeting was a Project update.

a. Confirm if Alberta Transportation should have been included under the *Attending* column for this meeting. If so, correct the table so that the change is reflected. If not, why was Alberta Transportation not in attendance for a meeting in which the purpose was to discuss an update to their proposed Project?

128. Volume 3A, Section 11.2.2.2, Page 11.23

Alberta Transportation describes Species of Management Concern and species of cultural importance raised during the Project-specific Indigenous Engagement program.

a. Explain why Tsuut'ina Nation and the Stoney Nakoda Nations' input was cited. Was input from the other Treaty 7 First Nations incorporated into the identification of traditionally used species? If so, describe.

129. Volume 3A, Section 14.1.1, Page 14.1
Volume 1, Section 7.2, Page 7.1

Alberta Transportation states *The assessment of TLRU is guided by: The Government of Alberta's Guidelines on Consultation with Treaty 7 First Nations on Land and Resource Management (the Guidelines), which commits Alberta to consultation with Treaty 7 First Nations where land management and resource development have the potential to adversely impact Treaty rights and traditional uses (GOA 2014).* A similar statement was provided in Volume 1, Section 7.2, Page 7.1. The Guidelines (2014) speak to First Nations consultation, however, they do not speak to the assessment of Traditional Land and Resource Use (TLRU).

a. Clarify what is meant by the statements saying that TLRU was guided by the Government of Alberta's Guidelines (2014) considering that these guidelines do not speak to the assessment of TLRU.

130. Volume 3A, Section 14.1.2, Page 14.8

Alberta Transportation provided a summary of the Traditional Use Studies (TUS) reports submitted to Alberta Transportation from Treaty 7 First Nations by the time of EIA filing.

a. Has Alberta Transportation received a joint final report from Kainai First Nation and Siksika Nation and reports from Stoney Nakoda Nations, or Tsuut'ina Nation since the filing of the EIA? If so, provide the dates of when the reports were submitted.

131. Volume 3A, Section 14.1.2, Page 14.9

Alberta Transportation has committed to reviewing project specific TLRU against the results of the EIA and providing a formal response to the Treaty 7 First Nations.

a. If this commitment has been completed when was it completed? If it has not been completed when does Alberta Transportation expect to provide the formal response to the Treaty 7 First Nations?

132. Volume 3A, Section 14.1.4.1, Page 14.15

Alberta Transportation has described the local and regional assessment areas for wildlife and biodiversity and aquatic ecology being used for spatial boundaries for TLRU. However, Alberta Transportation has not explained how vegetation and wetlands were considered. A component of traditional use is plant gathering for medicinal and cultural purposes.

a. Explain why the vegetation and wetlands boundaries were not incorporated into the spatial boundaries for TLRU. If it had been included, explain if the results would have changed the overall assessment of impacts of the Project on current use.

133. Volume 3A, Section 14.1.7, Page 14.19
Volume 3A, Section 14.1.7, Page 14.20

Alberta Transportation states that First Nations *have the ability to exercise rights on unoccupied Crown land or other Crown land to which they have a right of access for that purpose. Alberta Transportation also states that a small portion of the Project is located on Crown land and includes rights-of-way (ROWs) for roads and road allowances and the bed and banks of the Elbow River and its tributaries.*

a. How much of the Project Development Area (PDA) is currently Crown land (in ha) versus private land (in ha)?

b. How much Crown land will be unoccupied should the private land be purchased or expropriated?

134. Volume 3A, Section 14.1.2, Page 14.8
Volume 3A, Section 14.1.7, Page 14.20
Alberta Transportation has stated that Tsuut'ina Nation submitted a draft TUS report, however, did not provide *permission to use the information in the report in this assessment had not been received as of March 16, 2018.* However, the EIA also states *Tsuut'ina Nation noted that the TUS results should be included in the EIS*. The statements are contradictory to each other.

a. Was any of the information contained in the draft TUS incorporated into the EIA? If yes, explain where and how it was incorporated.

135. Volume 3A, Section 14.2.1, Page 14.22
Volume 3A, Section 14.2.1, Page 14.23
Alberta Transportation described workshops held in February and March 2018 with a few Treaty 7 First Nations.

a. Since March 16, 2018, has Transportation held additional workshops with any Treaty 7 First Nations?

136. Volume 3A, Section 14.2.2.1, Page 14.25
Volume 3A, Section 14.2.2.2, Page 14.26
Volume 3A, Section 14.2.2.3, Page 14.27
Volume 3A, Section 14.2.2.4, Page 14.28
Volume 3A, Section 14.2.2.4, Page 14.29
Volume 3A, Section 14.2.2.5, Page 14.30
Volume 1, Section 7.2, Table 7-1, Page 7.3
The EIA describes the reserve(s) for each Treaty 7 First Nation and for some Treaty 7 First Nations provides a distance from the Project Development Area (PDA) to the reserve.

a. Explain why Alberta Transportation chose to describe the reserves that they did within the EIA.

b. Provide the distance of each reserve from the PDA.

c. Provide an explanation for how distance was calculated (e.g. straight line between the two areas, road travel distance, etc.).

137. Volume 3A, Section 14.2.3, Page 14.40
Footnote 12 states that the *Project Area is used when specific areas were not provided by Indigenous groups and is assumed to be the RAA in this assessment.*

a. Explain why the Regional Assessment Area (RAA) was assumed and not the Local Assessment Area (LAA) or PDA.

138. Volume 3A, Section 14.2.6, Page 14.56
Volume 3A, Section 14.2.6, Table 14-5, Page 14.58

Alberta Transportation states that *Siksika Nation and Kainai First Nation expressed the importance of the Elbow River to Blackfoot traditions and culture in the TUS report for the Project.* However, Table 14-5 does not list the Elbow River under Siksika Nation and Kainai First Nation culture use sites and areas.

a. Clarify the discrepancy between the statement and Table 14-5.

139. Volume 3A, Section 14.3.2.1, Pages 14.61-14.66
Volume 3A, Section 14.1.3.2, Table 14-1, Page 14.13
Volume 3B, Section 14.2.2.1, Pages 14.3-14.6

This section describes the potential pathways that could affect the availability of traditional resources as identified by Indigenous groups as well as the results from analyses completed in other sections of the EIA (e.g. Section 8 Aquatic Ecology). The potential pathways in Sections 14.3.2.1 and 14.2.2.1 do not completely match the effect pathways as shown on Table 14-1.

a. Clarify the discrepancy between the potential pathways in Sections 14.3.2.1 and 14.2.2.1 versus Table 14-1.

140. Volume 3A, Section 14.3.2.1, Page 14.62
Volume 3A, Section 14.3.2.1, Page 14.66

Change in Riparian Vegetation was listed as a potential project pathway, as Piikani Nation noted a concern regarding potential effects on the health of riparian vegetation that require flooding and scouring to survive. Alberta Transportation's response was that the *Project would not eliminate flooding and scouring of Elbow River* and that water will only be diverted from the Elbow River when the Glenmore Reservoir cannot handle larger floods, therefore has not been analyzed further as a potential Project pathway for TLRU.
On page 14.62, Transportation states *Siksika Nation…also noted the potential effects on downstream waters and riparian areas from construction.* This was included under the Change in Habitat project pathway.

a. Explain why the potential effects on riparian areas from construction was not included under Change in Riparian Vegetation.

141. Volume 3A, Section 14.3.3.2, Page 14.75

Alberta Transportation states *the area along the Elbow River flood plain (Area A) will be accessible for some TLRU activities; this will be a conservation zone with public access and opportunities for low impact recreation.*

a. Describe the TLRU activities that will be permitted in Area A.

b. Describe what low impact recreation means.

142. Volume 3A, Section 14.3.3.2, Page 14.75
Volume 3A, Section 14.1.3.2, Table 14-1, Page 14.13
Volume 3A, Section 14.3.3.3, Pages 14.75-14.76
Table 14-1 includes measurable parameters for the Potential Environmental Effect of Change in Access to traditional resources or areas for current use. Many of the listed measureable parameters haven't been fully described in Sections 14.3.3.2 and 14.3.3.3, such as *area (ha) with access restrictions.*

a. Provide a description of these measurable parameters and the potential change in access to traditional resources or areas for current use.

143. Volume 3A, Section 14.3.4.1, Page 14.78
A project interaction and pathway identified by Tsuut'ina Nation was that *access to private land currently used to practice traditional activities* will be removed as a result of the Project. This project pathway was included in the Potential Environmental Effect for Change in Sites or Areas for Current Use. However, not in Change in Access to Traditional Resources or Areas for Current Use.

a. Explain why it was not included in the Access to Traditional Resources or Areas for Current Use.
   i. Would this pathway change the results of the assessment after application of mitigation measures and assessment of residual effects? Explain why or why not.

144. Volume 3A, Section 14.3.4.1, Pages 14.76-14.78
Volume 3A, Section 14.3.4.2, Table 14-7, Pages 14.79-14.80
Volume 3A, Section 14.3.2.2, Table 14-6, Pages 14.67-14.68
Some Treaty 7 First Nations stated that gathering sites for medicinal plants are found in the PDA including the Elbow River near the diversion inlet and sluiceway. Table 14-6 presents a recommendation from Siksika Nation and Kainai Treaty 7 First Nation to relocate medicinal and ceremonial plant to another area for future use. This was not included in Table 14-7, however.

a. Clarify the discrepancy between Table 14-6 and Table 14-7.

145. Volume 3B, Section 14.1.1, Page 14.2
Volume 3A, Section 14.1.3.2, Table 14-1, Page 14.13
Alberta Transportation states *potential effects, effects pathways and measureable parameters used to characterize and assess effects on TLRU are provided in Volume 3A, Table 14-1*. Review of Volume 3A, Table 14-1 shows various effect pathways that are specific to construction and dry operations, however, there are no specific effect pathways for flood and post-flood operations. For example, under the Potential Environmental Effect for Change in access to traditional resources or areas for current use an effect pathway was listed as *Construction and dry operations could result in the loss, alteration, or restriction of access (including trails and travelways) to current lands and resources used for traditional purposes*. A tangible, direct effect pathway was not provided for flood and post-flood operations.

a. Explain why flood and post-flood operations are not reflected in Volume 3A, Table 14-1.

b. What effect pathways were used for flood and post-flood?

146. Volume 3B, Section 14.2.2.2, Page 14.6
Volume 3A, Section 14.3.2.2, Table 14-6, Pages 14.67-14.68
Volume 3A, Section 14.3.2.2, Page 14.69
This section references mitigation measures previously discussed in Volume 3A, Section 14.3.2 and the mitigation measures discussed in the various biophysical and socio-economic assessments for flood and post-flood operations.

a. Provide a table summarizing the mitigation measures referred to in the sections above to assist in the review and understanding of Residual Effects on TLRU.

147. Volume 3B, Section 14.2.3.1, Page 14.12
Volume 3B, Section 12.5.1, Page 12.12
Alberta Transportation states that access along trails potentially located in Area A *would likely be maintained during floods*, however, Section 12.5.1 states *recreation in Area A…would be suspended* in the event of a flood.

a. Clarify the discrepancy between the two statements.

148. Volume 3B, Section 14.2.3.1, Page 14.13
Alberta Transportation states that *discussion of access to current use sites or areas will not be undertaken further* (i.e. mitigation, residual effects, etc.) as they are assumed to be within the *area of the reservoir, where sedimentation is most likely to occur, but where access to the public would be limited after construction.* However, an assumption was made that the trails, although their locations are not exactly known, could be in Area A.

a. Why was the assumption made that other current use sites (e.g. ceremonial sites, cultural landscapes, etc.) are only within the reservoir footprint and do not extend into Area A?

b. Would the assessment on access to current use sites change if other current use sites are assumed to be in Area A?

149. Volume 3B, Section 14.2.3.2, Page 14.13
Volume 3B, Section 12.5.1, Page 12.12
Residual effects on change in access to Area A did not speak to the access restriction during a flood as discussed in Section 12.5.1.

a. Provide a discussion on any residual effects, taking into consideration potential mitigation measures, on access to Area A as a result of access restrictions during a flood.

b. Discuss when access restrictions would potentially be lifted in a post-flood scenario.

150. Volume 3B, Section 14.2.6, Table 14-2, Page 14.18
Volume 3B, Section 14.2.4.3, Pages 14.16 and 14.17

In Table 14-2, Alberta Transportation states that the change in current use sites or areas is reversible, however, Section 14.2.4.3 states *the effects resulting from flood and post-flood operations of the project would be restricted to the PDA (the reservoir), short term and reversible, except for effects from deeper sedimentation… Effects on cultural sites would be long term in these areas.*

a. Explain whether Table 14-2 should also include a reference to the irreversibility for cultural sites under sediment > 10 cm, as was done for other categories where this consideration was applicable.

151. Addendum May 14, 2018, Debris Deflector, Section 2.4, Page 2.3

Alberta Transportation states *indigenous engagement for the project is ongoing and the debris deflector will be incorporated in those ongoing engagement activities.*

a. Since the filing of the addendum in May 2018, has Alberta Transportation had the opportunity to discuss the debris deflector with the Treaty 7 First Nations?
   i. If yes, were any issues or concerns raised regarding this project component? How were these issues and concerns addressed?
   ii. If no, when does Alberta Transportation anticipate discussing the addendum with the Treaty 7 First Nations?

152. Volume 1, Section 7.4, Tables 7-3, Pages 7.8-7.34
Volume 1, Section 7.4, Table 7-4, Pages 7.35-7.41
Volume 1, Section 7.4, Table 7-5, Pages 7.42-7.47
Volume 1, Section 7.4, Table 7-6, Pages 7.48-7.53
Volume 1, Section 7.4, Table 7-7, Pages 7.54-7.60

Alberta Transportation described the Treaty 7 First Nations concerns and follow-up responses from Alberta Transportation.

a. Confirm if this information is the same information in a summary format as presented in the Specific Concerns and Response Tables as part of the Government of Alberta's consultation documentation.

b. Describe the efforts undertaken by Alberta Transportation to discuss the concerns expressed by the Treaty 7 First Nations.

153. Volume 1, Section 7.4, Tables 7-3, Pages 7.8-7.34
Volume 1, Section 7.4, Table 7-4, Pages 7.35-7.41
Volume 1, Section 7.4, Table 7-5, Pages 7.42-7.47
Volume 1, Section 7.4, Table 7-6, Pages 7.48-7.53
Volume 1, Section 7.4, Table 7-7, Pages 7.54-7.60

Tables 7-3 to 7-7 summarize the issues, concerns and recommendations from Treaty 7 First Nations and the responses and outcomes from Alberta Transportation.

a. Since the filing of the EIA in March 2018, have any new issues, concerns and/or recommendations been raised by Treaty 7 First Nations? Has there been any subsequent responses and outcomes provided from Alberta Transportation?
   i. If yes, explain the new information from the Treaty 7 First Nation(s) and Alberta Transportation's response.

154. Volume 1, Section 7.4, Table 7-4, Page 7.38

Alberta Transportation states *Alberta Transportation has requested the location of the two traplines and where the Stoney members trap in order to determine if there is potential impact from the Project.*

a. Has this information been provided to Alberta Transportation? If so, will the assessment of potential impacts on TLRU change when incorporating this information?

155. Volume 4, Appendix B, Section 3.1.1, Page 3.4
Volume 4, Appendix B, Section 3.1.2.1, Page 3.10
Volume 4, Appendix B, Section 3.1.3.1, Page 3.15
Volume 4, Appendix B, Section 3.1.4.1, Page 3.22
Volume 4, Appendix B, Section 3.1.5.1, Page 3.28 and 3.30

Site visit dates were provided for the Treaty 7 First Nations.

a. Provide a list per Treaty 7 First Nation of site visit dates including any site visits completed since filing of the EIA.

156. Volume 4, Appendix D

TOR 1[B] requires Alberta Transportation to describe how Aboriginal community input was incorporated into aspects of the EIA including reclamation. It is unclear where in Volume 4, Appendix D Aboriginal input on reclamation was incorporated.

a. Explain how Treaty 7 First Nations input on reclamation was incorporated into the conservation and reclamation section of the EIA.

157. Volume 3A, Section 14.2.7, Page 14.60
Volume 3A, Section 14.3.5.1, Page 14.82
Volume 3A, Section 8.2.2.1, Page 8.20
Volume 3A, Section 14.2.7, Page 14.60
Volume 3A, Section 12.2.2.1, Page 12.19

The concordance table lists Sections 8.2.2, 12.2.2, 14.2.7 and 14.3.5 as the sections that speak to current and potential use of the fish resources by Aboriginal, sport or commercial fisheries. Sections 14.2.7 and 14.3.5 do not speak to the current and potential use of the fish resources by Aboriginal, sport or commercial fisheries. It speaks to other Indigenous commercial activities. Section 8.2.2 directs the reader to Section 12 and 14. Section 12 provides a high level summary that Treaty 7 First Nations harvesting activities for subsistence may include fishing (and other activities).

a. Where in the EIA is the information regarding current and potential use of the fish resources by Aboriginal fisheries? If this information is not in the EIA provide this information or explain why this information was excluded.

158. Volume 3A, Section 11.2.2.2, Page 11.23
Volume 3A, Section 8.2.2.3, Table 8-4, Page 8.28

Alberta Transportation states *of the 86 wildlife SOMC that have the potential to occur in the RAA, 31 are wildlife species of traditional importance to Indigenous communities.*

a. Provide a table of the 31 species of traditional importance similar to Table 8-4.

159. Volume 3C, Section 2.1.3, Page 2.2

Alberta Transportation states that they are *willing to discuss possible monitoring and economic opportunities with Indigenous groups.*

a. Have discussions occurred with the Treaty 7 First Nations regarding the proposed monitoring program?
   i. If yes, describe what discussions occurred and what the outcomes of the discussions were.
   ii. If no, explain why this discussion has not yet occurred.

b. Describe what monitoring was performed in conjunction with the Treaty 7 First Nations.

160. Volume 3C, Section 2.0, Pages 2.1-2.16

TOR 1[B] requires Alberta Transportation to discuss how Aboriginal community input was incorporated into monitoring for the Project. It is unclear how Alberta Transportation incorporated Aboriginal community input into current and proposed monitoring programs.

a. Describe how Treaty 7 First Nations input was incorporated into the Project's current and proposed monitoring programs.

161. Volume 3C, Section 2.0, Pages 2.1-2.16

It is unclear whether a commitment has been made to disseminate monitoring data to Aboriginal communities.

a. How will monitoring data be disseminated to Aboriginal communities?

b. What type of monitoring data will be provided?

3.2 Noise

162. Volume 1, Section 4.3, Page 4.1

Alberta Transportation states *The Project will comply with noise level restrictions required by the County of Rocky View or potential conditions within the development permit issued by the County for the Project.*

a. Alberta Transportation does not indicate what the noise level restrictions are for the County of Rocky View. Provide the noise level restrictions. Are there any phases of the Project where noise is expected to exceed the restrictions set by the County of Rocky View? If so, how will this noise be mitigated to ensure no noise exceedances? How will noise be monitored to ensure that noise exceedance does not occur and that the proposed mitigation measures are working throughout the various phases of the project?

b. Has Alberta Transportation applied for the development permit? If so, what are the noise conditions specified in the development permit? If not, when does Alberta Transportation plan to apply for the development permit? Once this permit has been issued how will the potential noise conditions specified within this permit be communicated to AEP?

163. Volume 3A, Section 4.1.1, Page 4.1
Volume 3A, Section 4.1.2, Page 4.1

Alberta Transportation states *the overall assessment scope of the acoustic environment is guided by the Canadian Environmental Assessment Agency (CEA Agency)* and that *The effects of the assessment focuses on humans; it does not discuss effects on wildlife*.
Alberta Transportation then goes on to state *The effect of noise on animal behavior is further discussed in Volume 3A, Section 11*.
These statements are contradictory.

a. Was the effect of noise on animal behavior addressed in volume 3A, Section 11? If so, list the specific sections where the effects of noise are addressed. Correct the required statements and update the section to correct the contradiction.

b. If no effects of noise were addressed in Volume 3A, Section 11 then questions (b) – (f) apply. Explain why noise resulting from all stages of the project did not include wildlife especially when project construction is to occur 24 hours a day. List the species in the area that could be affected from noise. Be sure to include species that may be drawn to the PDA as a result of the noise and those that may move further away from the PDA to avoid the noise.

c. How does noise impact the species movement and mortality risk (if species are drawn to the noise would this increase the number of vehicle collisions as they would be drawn to the PDA)?

d. If any species are to avoid the noise where is it expected that these species will move to?

e. If any of the species from (c) move to another area is there a chance that predator prey relationships might change? Explain and provide the rationale behind the conclusion.

f. What are the proposed mitigation measures on the wildlife that could be affected by noise? Explain how these mitigation measures will be implemented and followed throughout the life of the project.

164. Volume 3A, Section 4.4.2.3, Page 4.43
Volume 3A, Section 4.4.2.2, Page 4.42
Volume 3A, Section 4.4.2.3, Page 4.45

Volume 3C, Section 1.1.3.3, Page 1.3
Volume 4, Part 2, Appendix F, Page 4C.2-4C.7
Alberta Transportation states on page 4.42 that *The application of mitigation options discussed in Section 4.4.2.2, may be applied in order to reduce the noise contribution from the construction activities and achieve compliance with the thresholds*.
Alberta Transportation states *However, with the application of mitigation, such as those discussed in Section 4.4.2.2, the residual effect on the acoustic environment are expected to be reduced to achieve Health Canada's noise objectives at many of the receptor sites*.
Alberta Transportation also states that *Mitigation measures were not incorporated in the acoustic models for the assessment of effects since the construction equipment list and schedule are preliminary.* Alberta Transportation provides the *complete list of all Project construction related noise sources* in Appendix 4C.
Alberta Transportation goes to state that *Upon availability of the detailed construction execution plan, Mitigation measures will be developed to meet assessment noise thresholds.*

a. The sentences from page 4.42 and 4.43 are contradictory. Confirm if Alberta Transportation has mitigation measures in place for noise. If so, what are these mitigation measures? How will Alberta Transportation ensure that these mitigation measures will be adopted and followed throughout all stages of the project? Correct the statements above so that all sections within the EIA are consistent and say the same thing regarding mitigation.

b. If there are no mitigation measures in place explain why none have been developed and provide mitigation measures. Appendix 4C indicates that it is the complete list and goes on to list all construction related equipment. With this list being provided in addition to the noise levels then mitigation measures should be able to be developed. Discuss if the utilization of this equipment will result in any noise level exceedances. If there are noise exceedances how will these be monitored and addressed?

c. With no mitigation measures discussed how does Alberta Transportation know that they will be able to meet noise thresholds if no assessment and study has been conducted in order to determine what mitigations will and won't work?

3.3 Socio-Economic

165. Volume 1, Section 2.2.1, Page 2.2
Alberta Transportation states *Five potential locations for flood mitigation measures on the Elbow were identified (AMEC Environmental and Infrastructure 2014)*.

a. Describe how AMEC (2014) searched for new sites. Explain how AMEC assured the sites were the *best options*.

166. Volume 1, Sec. 2.2.1.1, Table 2-1, Page 2.4
Volume 4, Supporting Documents, 1. IBI Report", Page 3, PDF page 13 of 884

Alberta Transportation states *In 2015, the IBI Group (2015) was commissioned by the GOA to undertake a benefit/cost analysis of the Glenmore Reservoir underground diversion tunnel. … Table 2-1 reports the results of the analysis.*
In 2017, the IBI Group updated the results for the MC1 and off-stream reservoir options based on further engineering and environmental studies IBI Group (2017).
In addition, Alberta Transportation provides the IBI Report *Benefit/Cost Analysis (2017)* in Volume 4.
Alberta Transportation does not state in the EIA the Flood Mitigation Options Assessment report by IBI/Golder (February 2017) for the City of Calgary. IBI/Golder (February, 2017) indicates a benefit/cost ratio of 3.22 on pdf page 24 (the page in not enumerated in the document). The IBI/Golder (February 2017) is not referenced in the EIA.

a. Explain why cost-benefit ratio in Volume 1, Table 2-1 is different from the cost-benefit ratio in Volume 4?

b. Explain why the benefit/cost ratios in Volume 1, Table 2-1 are lower than the 3.22 benefit/cost ratio in the IBI report (February 2017) considering that IBI made both estimates.

c. Explain how two floods with the same frequency yield different levels of damage.

167. Volume 1, Section 2.2.1, Page 2.4

Alberta Transportation states *The costing for the Project included the costs of additional flood mitigation to protect Bragg Creek and Redwood Meadows.*

a. Explain whether estimates of the Project's costs and benefits exclude all planned or built flood mitigation projects/efforts on the Elbow River. If not, list all non-Project mitigation efforts and provide estimates of the double-counted benefits.

168. Volume 3A, Section 17.4.2, Page 17.30

Alberta Transportation states *The Project's workforce is estimated to peak at 360 persons during construction with an additional 155 persons directly employed through contractors retained by the Project.*

a. Identify:
   i. the types and approximate number of trades and professionals needed for each stage of the project.
   ii. other major construction projects in the Economic Regional Assessment Area during the Project's construction period.
   iii. potential regional shortages of trades and professionals during construction.

169. Volume 1, Section 3.3.3, Page 3.28
Volume 1, Section 3.3, Page 3.22
Volume 1, Section 3.3.8, Table 3-7, Page 3.31

Alberta Transportation states *The workforce for both the construction and operation of the Project are expected to be sourced from Calgary and vicinity and to be housed at facilities in the Calgary area. There will be no work camps.*
Alberta Transportation also states that *Project construction will be continuous (24 hours per day), weather permitting.*

a. Identify:
   i. Trades and professionals that would work 7 day a week on 12 hour shifts.
   ii. Trades and professionals that would be required on site continually over several days and why.
   iii. The break areas and what these break areas will entail.

b. Explain whether the 24 hour a day schedule is, in part, to reduce the overall construction time and thus reduce the length of time adjacent residents are subject to light, noise, traffic, and dust impacts. If not, explain why a 24 hour schedule is proposed.

170. Volume 3A, Section 17.4.1.4, Page 17.25
Volume 3A, Section 17.4.2.4, Page 17.31

Alberta Transportation states *Alberta transportation will adhere to government procurement policies and procedures with respect to labour and goods and services.*

a. List the Alberta Government procurement policies and procedures relevant to the project and explain how these apply to the Project.

171. Volume, 3A, Section 17.4.1.5, Table 17-14, Page 17.25
Volume 3A, Section 17.4.1.5, Table 17-15, Page 17.26

a. Provide and explain the rationale behind the assumptions that:
   i. All expenditures are made in Alberta.
   ii. 20% of expenditures are made outside the LAA (Local Assessment Area for the socio-economic assessment).

172. Volume 3A, Section 17.4.3.5, Page 17.36

The concordance table indicates that the engineering and contracting plan is located in Volume 3A, Section 17.4.3.5. There is no engineering and contracting plan at that location.

a. Provide the engineering and contracting plan. Update the concordance table if required so it reflects the location of the engineering and contracting plan.

173. Volume 3B, Section 12.2.2.1, Page 12.6

Alberta Transportation states *deposits such as gravel and debris would be cleaned up.*

a. Confirm whether the cost of cleaning gravel and debris was included in operational costs. If it is not included in operational costs explain why not.

174. Volume 3A, Section 12.4.2.3, Page 12.35

Alberta Transportation states *Residual effects because of changed in industrial land use, change in recreational land use, and indirect effects because of noise, light, and air emissions are predicted to be moderate because they are outside normal range of variability for the region.*

a. Does Alberta Transportation mean to say *inside* normal range as opposed to *outside* normal range? If so, correct the statement to reflect this change. If not, explain how the impacts are expected to be moderate when outside of the normal range.

175. Volume 3A, Section 12.5, Page 12.39
Volume 1, Section 3.3.8, Page 3.31

Alberta Transportation states *integrated landscape management would also be employed in the PDA through timely reclamation of the construction area.*

a. The Construction Schedule in Volume 1 Section 3.3.8 does not include the timing of when reclamation will occur. Clarify when reclamation is anticipated to occur.

176. Volume 3A, Section 16.3, Page 16.13

Alberta Transportation states P*roject workers are anticipated to be local, it is not likely that additional population-based demands would be placed on community infrastructure and services.*

a. Explain Alberta Transportation's planned emergency medical scenarios.

b. Explain how sanitation, waste and power services are provided to the construction site and if there are any links to local services.

177. Volume 3A Section 16.4, Page 16.14

Alberta Transportation states *the presence of construction vehicles and equipment on the local roads and highways and transportation of project workers to the project site would periodically increase local traffic and cause brief traffic disruptions.*

a. Estimate the maximum additional traffic that might occur, for example, during shift change. Estimate how many truck trips are to occur during the busiest one-week period. Clarify whether a highest traffic scenario was created. If not, why not?

178. Volume 4, Appendix A Concordance Tables, Table A-1, Page A.43

The Terms of reference states *Describe the impacts of additional proposed flood mitigation projects or a combination of those projects on the effectiveness of the project.*

a. Provide a list of the names and locations of all planned or built flood mitigation projects and actions for the Elbow River from the McLean Creek project to the City of Calgary. Indicate when these projects were built or will be built.

b. Describe the flood mitigation impacts of these mitigation measures. Clarify whether the benefits of the Project were adjusted to consider the impact of each of these projects as this relates to TOR 7.1A.

179. Volume 3B, Section 17.2.2.1, Page 17.2
Volume 3B, Section 17.2.2.2, Table 17-2, Page 17.4
Volume 3B, Section 17.3.1.5, Table 17-6 Page 17.11

Alberta Transportation states *The 2013 flood was of similar magnitude to a 1:200 year flood and resulted in extensive flood damages. This included approximately $2 billion in insured losses private property, uninsured costs to private property, disaster relief and management costs, as well as costs to repair and restore damaged public infrastructure*.

a. Indicate whether the damages in Table 17-2 were estimated using the modified RAPID model. If the modified RAPID model is used to estimate the damages, has the output of the modified RAPID model been compared to actual damage estimates for flood costs like that in 2013? Explain why or why not.

b. Explain when the modified RAPID model is likely to be accurate versus inaccurate and the level of uncertainty. Explain whether the version of RAPID used for Table 17-2 considers all post 2013 mitigation measures implemented and, if not, what measures are not considered.

c. Provide an estimate of flood-damage-cost reductions due to post 2013 mitigation by each of the following categories:
   i. New protection for provincial, city and utilities or re-siting of infrastructure;
   ii. Commercial building owners purchasing supplemental generators and flood protection; and,
   iii. Residential sump pumps, generators and other measures.
   iv. Explain how the direct, indirect and intangible costs are calculated and the data used.

d. Explain how damages on the Elbow River are $1910.1 million for a 1:200 flood (design flood) when on page 17.2 damages for the 2013 flood were 2 billion for both the Bow and Elbow rivers, considering that:
   -Bow damages are greater than Elbow damages,
   -private mitigation efforts have improved the flood readiness of residential and commercial buildings in Calgary, and
   -municipal and provincial governments have improved flood readiness of infrastructure.

180. Volume 3B, Section 17.2.2.2, Page 17.3

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.

181. Volume 3B, Section 17.2.2.2, Page 17.7

Alberta Transportation states *Existing mitigation measures would reduce predicted flood damage by an estimated $598 million for the 1:50 year flood. The reduction in flood damages due to existing mitigation is $576 million for the 1:100 year flood and $544 for the flood design, indicating that the effectiveness of some measures decline with increased magnitude of flooding.*

a. Explain what types of measures fail as the intensity of the flood increases.

182. Volume 3B, Section 17.2.2.2, Page 17.5

Alberta Transportation states *Flooding of the Bow River would result in the majority of the total flood damage, ranging from 69% for a 1:50 year flood to 61% for a 1:200 year flood.*

a. Explain how damages are calculated for each basin independently based on the high of the flood and the population of buildings in each basin as described in the modified Rapid model. Thus, the *69%* and *61%* are calculated based on an assessment of water levels in each building in the Bow and Elbow river basins.

183. Volume 3B, Section 17.2.2, Page 17.3

Alberta Transportation states *Due to these adjustments, the magnitude of the potential flood damage estimated in 2017, as reflected in the annual average damages (AAD), has been estimated at double that provided in the previous estimates provided in IBI and Golder (2015*).

a. Explain the how damage estimates have increased by category and the reasoning behind this increase. Include areas such as direct costs public infrastructure, private infrastructure, commercial buildings, and residential buildings. Explain how indirect costs have changed for emergency versus loss of livelihood.

184. Volume 3B, Section 17.5, Page 17.12

a. Assess confidence intervals for the RAPID model estimates. Provide an explanation of how the confidence intervals were calculated.

185. Volume 3A, Section 17.4.3.5 Table 17-25, Page 17.36

a. In Table 17-25:
   i. Separate engineering and project management costs or modify label.
   ii. Separate labour costs from constructions services or modify label.
   iii. Add to the table:
   Land acquisition costs;
   Relocation of infrastructure costs;
   Contingencies;
   Separate costs according to LAA, Alberta, outside Canada.

b. Add debris barrier costs as a separate line item.

c. Explain why contingency costs for McLean Creek are 25% of all costs and contingency costs for Springbank are 15% excluding land acquisition and relocation costs.

d. Why do Springbank costs no longer include mitigation costs for Bragg Creek and Redwood Meadows?

186. Volume 3A, Section 17.2.2.5, Table 17-11, Page 17.17

a. Provide a definition for *employment income* and *total income*.

b. Explain why total income is lower than employment income in Table 17-11 for each of the locations identified. The values appear contra intuitive that reported total income is lower than employment income, considering that Statistics Canada defines total income as employment income and other income.

187. Volume 3A, Section 17.2.2.8, Page 17.19

a. Provide a description of the LAA's GDP and share of relevant industries over regional GDP. Calculate the economic effect of developing the project over the LAA regional economy.

188. Volume 3A, Section 17.4.1.5, Page 17.27

Alberta Transportation states *The total labour income in Canada associated with project employment is estimated at $119 million*. Net new income created by the Springbank project should only account income of currently unemployed workers that wouldn't be able to earn an income in the region unless they are hired by the Springbank project.

a. Explain if the $119 million represent a measure of workers gross total income or if it is a measure of net new income that wouldn't be created unless the project was developed.

189. Volume 3A, Section 17.4.1.5, Page 17.28

Alberta Transportation states that the *residual effects on the provincial economy are expected to be positive… but low in magnitude*.

a. Provide an estimate of what a positive but low in magnitude impact would be. Calculate what that impact is in reference to the LAA's GDP.

190. Volume 3A, Section 17.4.2.1, Table 17-19, Page 17.29
Volume 3A, Section 17.4.2.2, Page 17.29

Alberta Transportation states that the adjustment factor for labor force in LAA is 82% in Table 17-19. However, in section 17.4.2.2, p.17.29 it is stated that the adjustment factor value is 80%.

a. Confirm the adjustment factor value. Update the sections so that the correct value is referenced throughout the EIA.

191. Volume 3A, Section 17.4.2.3, Page 17.30
Volume 3A, Section 17.4.2.5, Page 17.31
Volume 3A, Section 17.4.1.5, Page 17.26

Alberta Transportation states *the Project's workforce is estimated to peak at 360 persons during construction with an additional 155 persons directly employed through contractors retained by the Project*. However, on page 17.26, Alberta transportation states *The Project's direct workforce is estimated to peak at 450 persons during construction.*

a. Confirm the highest numbers of workers to be directly employed under the project at a specific time. Update the sections so that the correct value is referenced.

b. How many jobs would be effectively *net new jobs*? This should be the number of jobs that does not represent workers that left their existing jobs (i.e. if they already worked for another project/employer) to work at the Springbank project.

192. Volume 3A, Section 17.4.3.2, Page 17-34

In section 17.4.3.2, Alberta Transportation states that cost estimates of construction and dry operations are accurate to within ±50%.

a. Does this mean that the project cost could be 50% higher than already stated?

b. Explain if this variability would affect the cost/benefit ratio already estimated. If so, calculate how much the variability would affect the cost/benefit ratio.

193. Volume 3A, Section 17.4.3.2, Page 17-34
Volume 3A, Section 17.4.3.5, Page 17.37
Volume 3A, Section 17.4.2.5, Page 17.31

Alberta Transportation states *Project spending can benefit and adversely affect regional businesses... ...Adverse effects relate to increased demand for labour, goods, and services, which can increase operational costs (and therefore decrease revenues) through wage inflation and employee turnover. Increased competition for labour can also decrease the capacity of local businesses through labour shortages. Project spending can also adversely affect the affordability of accommodations through the in-migration of workers to the LAA in search of Project employment.*

At the same time however, page 17.37 states *Adverse effects of Project spending relate to increased operational costs due to wage inflation and employee turnover. Increased competition for labour, leading to wage inflation, could also decrease the capacity of local businesses through labour shortages.*

Alberta Transportation goes on to state on page 17.31 that *As the estimated available supply of skilled labour in these occupations exceeds the project demand, direct employment with the Project is not expected to contribute to labour shortages in the LAA.*

These statements contradict each other.

a. Clarify what is the actual risk of labour shortages, wage inflation and other potential adverse effects. Update the sections so that the information is consistent.

194. Volume 3A, Section 12.4.2.1, Page 12.28

Alberta Transportation states *There are five companies that hold dispositions for active pipelines that intersect the PDA. These pipelines would be retrofitted and/or re-routed prior to construction.*

a. Provide an estimate of the cost/loss of revenue associated to the relocation of these pipelines. Explain if this cost will be absorbed by the company in charge of the pipeline and if this cost has been included in the cost-benefit analysis for the Springbank project.

195. Volume 3A, Section 12.4.2.1, Page 12.32
Volume 3A.Section 17.4.3.5, Table 17-25, Page 17-36

Alberta Transportation states *As part of construction, Highway 22 would be raised in its existing location and moved a maximum of 42 m west. Springbank Road would remain in its existing location. An overpass would be constructed at the intersection of Highway 22 and Springbank Road. Range Road 40 and Township Road 250 would be upgraded for use as a detour route in the event of a flood. Two new bridges are proposed on Highway 22 and on Township Road 242 over the diversion channel…*

a. State the cost of making changes to existing infrastructure and building new infrastructure as described on page 12.32. Explain if these costs have already been included in the cost-benefit analysis. If not, update the cost-benefit analysis to include these costs.

b. Identify these costs in the list of project cost estimates located in Volume3A.Sec.17.4.3.5 Table 17-25 p. 17-36.

196. Volume 3A, Section 12.4.2.2, Page 12.34

Alberta Transportation states *Alberta Transportation is in consultation with operators of utilities in the PDA to discuss retrofitting and relocation of utilities. Alberta Transportation will develop crossing agreements with operators of utilities in the PDA. Alberta Transportation will continue to consult with utility operators in the PDA and LAA regarding rerouting and realignment of utilities on a case by case basis*.

a. Calculate the cost of retrofitting and relocating utilities.

b. Explain if these costs have been included in the cost-benefit analysis of the project. If these costs have not been calculated and/or not included in the cost-benefit analysis, re-calculate the cost-benefit analysis to reflect these costs. How has the cost-benefit analysis changed?

197. Volume 3A, Section 12.4.2.2, Page 12.35

Alberta Transportation states *Signs directing traffic to detours will be installed during construction of road realignments and modifications.*

a. Calculate the costs associated with traffic detours during construction, road realignments and modifications.

b. Explain if these costs have been included in the cost-benefit analysis of the project. If these costs have not been calculated and/or not included in the cost-benefit analysis re-calculate the cost-benefit analysis to reflect these costs. How has the cost-benefit analysis changed?

198. Volume 3A, Section 16.4.2.1, Page 16.16

Alberta Transportation states *Project construction would involve the movement of materials and use of equipment and construction vehicles along or across public roads. The addition of this equipment to the local roadways for Project construction, employee commuter traffic, and traffic delivering materials to the site would increase demands on road infrastructure and might cause traffic disruptions.*

a. Calculate the cost associated with increased use of infrastructure and traffic disruptions related to project construction (i.e. quicker wear down of roads by machinery, additional vehicles, etc.).

b. Explain if these costs have been included in the cost-benefit analysis of the project. If these costs have not been calculated and/or not included in the cost-benefit analysis, re-calculate the cost-benefit analysis to reflect these costs. How has the cost-benefit analysis changed?

199. Volume 3B, Section 12.2.3.3, Page 12.10

Alberta Transportation states Ecological and socioeconomic context—residual effects occur in an area that have been disturbed by human development.

a. Explain the nature of these residual effects. If this addressed in another section of the EIA indicate where this information can be found.

200. Volume 3A, Section 14.3.2.3, Page 14.69
Volume 3A, Section 14.3.2.3, Page 14.70

Volume 3A, Section 14.3.2.3, Page 14.71
Volume 3A, Section 14.3.2.3, Page 14.72

a. Estimate the loss of value (i.e. wellbeing) associated the identified negative residual effects on current traditional land use (hunting, fishing, trapping, plant harvesting) and recreational activities (camping) such as:

- Lower availability of traditional resources such as water, soils, birds, roots, herbs and medicines;
- Reduction or loss of habitat including wetlands, and fish habitat;
- Hinder the movement of traditionally harvested areas due to blockage of natural corridors with physical barriers and sensory disturbance;
- Increased mortality of traditionally harvested wildlife; and
- Reduced water quality.

b. Incorporate this loss on value (i.e. wellbeing) in the cost-benefit analysis of the project. How has the cost-benefit analysis changed?

201. Volume 1, Section 7.3, Page 7.7
Alberta transportation states *Alberta Transportation will encourage companies owned by Indigenous groups to bid on construction contracts for the Project. Members of Indigenous groups may be hired as monitors during construction.*

a. Identify and discuss specific economic opportunities potentially available to Aboriginal communities and groups, other local residents and businesses regarding employment, training needs, and other economic development opportunities arising from the Project.

202. Volume 1, Section 7.5, Page 7.69
Alberta transportation states *Engagement with Indigenous groups will continue as the Project progresses. Alberta Transportation is committed to providing project information to Indigenous groups as the design becomes internally reviewed and approved.*

a. Elaborate on strategies to be followed to engage Indigenous groups as the Project progresses.

b. Are there any proactive initiatives (e.g. training) to help Aboriginal and local companies be more successful in the competition for contracts related to the project?

3.4 Transportation

203. Volume 1, Section 3.2.7, Page 3.18
Alberta Transportation states *All permanent access roads for the Project will be gated with swing gates and vehicle access will be limited to AEP operations and maintenance*.

a. Will the public have access to any parts of the permanent access roads? If so, describe the scenarios where the public may be using parts of these roads. In addition to the swing gates will any signage be in place to indicate that the road is restricted to the public? If so, indicate what signs will be in place, where and how many.

b. Can anyone move the swing gates or are there locks in place to ensure that only AEP staff can move these gates to obtain access? Explain.

c. How will Alberta Transportation ensure that the gates remain closed after AEP maintenance and operations come and go from the site? Explain.

d. Will there be any way to monitor if the public uses the restricted roads despite having the swing gates in place?

204. Volume 3A, Section 16.4.2.2, Page 16.16

Alberta Transportation states *A project specific traffic accommodation strategy will be developed for the Project*.

a. Why was the traffic accommodation strategy not completed prior to the EIA being submitted considering the fact that the access routes for the Project had already been determined? When will the traffic accommodation strategy be ready? How will this strategy be communicated to AEP so it can be reviewed? If the traffic accommodation strategy has already been developed provide the strategy and the methodology behind how it was developed.

4 Air

4.1 Emissions management

205. Volume 3B, Section 3.2.4.1, Page 3.9

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?

206. Volume 3A, Section 3.4.4.1, Page 3.55

Alberta Transportation states *Therefore, chemical dust suppression will be applied on an as-needed basis during high wind conditions or if PM concentrations are in exceedance of the Alberta Air Quality Objectives and if an increase of watering is determined ineffective or unfeasible at the time.*

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.

4.2 Dispersion Modelling

207. Volume 4, Appendix E, Section 3C.3.5, Page 3C.10
Volume 4, Appendix E, Section 3C.3.6, Page 3C.11

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.

208. Volume 4, Appendix E, Section 3B.4, Page 3B.13
Volume 4, Appendix E, Section 3B.3, Page 3B.11

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.

4.3 Air Quality Assessment

209. Volume 3B, Section 7.4.3, Page 7.24
Volume 4J, Section 2.4.2, Page 2.37

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 m^3/s before release could occur. This threshold was based on a maximum design release rate of 27 m^3/s and the effective discharge for suspended sediment transport of between 35 and 50 m^3/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 hydrogen sulphide odours.

a. What measures would be considered to mitigate air quality if an anoxic condition occurs?

210. Volume 4, Appendix E, Section 3C.3.2.1, Page 3C.5
Volume 4, Appendix E, Figure 3C-2, Page 3C.7
Volume 3A, Section 3.4.1.1, Page 3.40.
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?

5 Water

5.1 Water Management

211. Volume 1, Section 3.2.1.4, Page 3.8
Alberta Transportation states that the floodplain berm …*acts to constrain flow in the Elbow River and direct it to the diversion structure*. The CEAA 2012 Project Description Executive Summary Figure 3 identified that this affects a 93 ha area upstream of the diversion structure. There does not appear to be any information on the environmental impacts to this area.

a. Describe the potential changes to hydrology and geomorphic conditions upstream of the diversion structure.

b. Describe the environmental effects predicted during various flood events in the area upstream of the diversion structure. This should address hydrologic effects and include effects of sediment and debris deposition on vegetation, fish habitat and land productivity.

212. Volume 1, Section 3.2.4, Table 3.3, Page 3.12
Alberta Transportation has identified the potential duration of discharge for various flood frequency events. The detention time in the off-stream reservoir has implications for sedimentation time, uptake of elements from the reservoir soil, and operational interactions with the Glenmore Reservoir.

a. Provide a detailed outline for a *Water Management Plan* that could be included in the proposed *Operation, Maintenance and Surveillance Plan* for both the filling and release of water from the Project under all foreseen operating conditions.

b. Within the *Water Management Plan* provide scenarios that would provide options for the operation of the Project discharge in conjunction with the operation of the Glenmore Reservoir to reduce the impact of flow on the Elbow River in Calgary.

213. Volume 1, Section 3.5, Page 3.34
Volume 1, Section 5.2, Pages 5.6 – 5.8
Volume 3B, Section 6.4, Pages 6.12 and 6.13

The TOR asked for a description of how the project will be utilized to manage back to back storm events. The EIA identifies that once the project design inflow is reached then excess flow will be passed onto the Glenmore Reservoir which is assumed to also be full.

a. How is the Glenmore Reservoir equipped to manage back to back storms given that the Project is not able to accommodate flows beyond those of the 2013 flood event and given the lengthy residence and release times in the off stream reservoir?

b. Provide information on the potential for overland flow from the Glenmore reservoir to the Bow River if the Glenmore Dam Spillway is not able to manage the floodwater inflow.

214. Volume 1, Section 3.5.1, Page 3.35

Alberta Transportation states *The flow in the diversion channel would be monitored continuously. The reservoir elevation and fill rate also would be monitored, as well as the pore pressure within the dam and at its foundations*.

a. Provide details on how flows in the river and the diversion channel as well as fill rates in the reservoir will be monitored.

b. Will Alberta Transportation or the operator, Alberta Environment and Parks assess impacts on the Glenmore reservoir and other downstream users as well as determine losses for the purposes of the Prairie Provinces Water Board Master Agreement on Apportionment by monitoring of flows leaving the Project through the outfall?

c. If the answer to (b) is yes, provide the means and frequency of monitoring.

d. If the answer to (b) is no, provide details on why monitoring is not necessary.

5.2 Hydrogeology

215. Volume 3A, Section 5.2, Page 5.2
Volume 3B, Section 5.4, Page 5.29

Volume 4, Appendix I, Section 4.2, Page 4.4
Volume 4, Appendix I, Figure 5-2 and 5-3, Pages 5.4-5.6

Alberta Transportation states *Distributed groundwater recharge was not applied to the model domain. As discussed in Section 2.3, the annual evapotranspiration rate exceeds the annual precipitation rate, meaning there is minimal groundwater recharge from precipitation.* (Volume 4 - Appendix I, Groundwater Numerical Modeling Technical Data R, Section 4.2, Page 4.4)
The groundwater model is used for the Environment Impact Assessment for different scenarios. The evaporation data is based on a shallow lake area. The groundwater evapotranspiration is different from the evaporation data, as it varies based on the surface vegetation, soil type and groundwater depth. No groundwater recharge appears to have been applied to the model, which appears to have caused the simulated groundwater levels to be less than the observed groundwater levels (Volume 4, Appendix I - Groundwater Numerical Modeling Technical Data Report, Figure 5-2 and 5-3, Pages 5.4-5.6).
During a flood, the groundwater recharge fully saturates the soil so precipitation cannot infiltrate, even for a significant period after the flood. Therefore, the assumption of no groundwater recharge in the modeling is not realistic for the flood scenarios.

a. Re-calibrate the groundwater model using a reasonable groundwater recharge to improve the matching of the simulated groundwater levels vs. the observed groundwater levels. Then use the re-calibrated groundwater model to do the Environmental Impact Assessments for the scenario of "Construction and Dry Operations".

b. Apply significant groundwater recharge to the model to create surface run-off, then use it for the Environmental Impact Assessment for the scenario of "Flood and Post-Flood Operations".

216. Volume 3B, Section 5.2.2.1, Page 5.45
Volume 4, Appendix I, Section 4.2, Page 4.4

Alberta Transportation states *From Figure 5-27, the net change in head, at the point in time the reservoir is filled, varies from an increase of 28 m (near the upstream toes of the dam) to a decrease of 7 m (in the diversion channel near the inlet structure). This increase in head in the reservoir is a result of the added "weight" of the water stored there.*
….. However, in all cases, effects on groundwater levels are well within the LAA, and changes are only observed north of the Elbow River.
A textbook example of the loading effect of a passing train's weight can cause the groundwater level to instantaneously increase in a confined aquifer (Veatch 1906; Jacob 1939). The Springbank off-stream reservoir covers a large area (Figure 5-27) and the maximum thickness of water would be 28 m during Design Flood conditions. The loading effect on confined aquifer would be much bigger and longer than the passing train effect. The fully saturated soil during flooding would also add loading on the confined aquifer.
When the groundwater level in confined aquifer is higher than the topography (artesian condition), the groundwater may gush out through weak overburden areas, such as thinner overburden locations, unsealed boreholes, improperly sealed wells or basements, etc.

a. Simulate the loading effect of the Springbank off-stream reservoir on the confined aquifer.

b. Predict the potential artesian areas under the loading conditions, such as the area to the East and South-East of the low topography areas in the Local and Regional

Assessment Areas. If there is clay layer underneath the sand and gravel layer in the Elbow River, the artesian area may extend to the south of the Elbow River.

c. Assess the Environmental Impact of the loading effect.

d. Propose a monitoring plan for the loading effect.

e. Design a mitigation plan for the loading effect.

217. Volume 3A, Section 5.4.2.2, Figure 5-10
Volume 3A, Section 5.4.2.2, Figure 5-11
Volume 3A, Section 5.4.2.2, Figure 5-12
Volume 4 Appendix I

The majority of this section is a repeat of Volume 4 Appendix I. The assessment presented in Volume 3A does not appear to be a true impact assessment for construction and dry operations.

a. Subtract Figure 5-10 by Figure 5-11 to get the drawdown for Dry Operations. Identify what reasons produced the positive and the negative drawdown areas.

b. Compare Figure 5-12 with the above drawdown for Dry Operation and analyze if the positive head change in Figure 5-12 is caused by the additional infiltration of water into this area or caused by other reasons.

c. What kind of boundary condition exists and where is it applied in the groundwater model to produce the positive and negative head change in Figure 5-12?

d. Provide the calibration results around the local diversion channel area including groundwater data in both of the surficial and bedrock layers. In the regional model, geology layers are simplified. Local important sand units may not be shown in the regional model.

e. Analyze and discuss if the regional groundwater model can properly characterize conditions for the local impact assessment. If not, how can the calibration and prediction be improved?

f. How much seepage discharge is anticipated into the diversion channel during the dry operation? Explain.

g. How will the groundwater flow direction and velocity be altered around the diversion channel for the dry operation scenario when compared to the pre-construction scenario?

h. What is the expected water chemistry from the channel seepage water?

i. During drought years, seepage water will flow out of the channel to the reservoir and the velocity of water will likely decrease in the off-stream reservoir. As a result, TDS will likely increase in the reservoir due to slow movement and evaporation. What is the expected TDS increase?

j. How much salt is likely to be deposited in the reservoir during drought years?

k. What will be the impact on vegetation and groundwater by the salty water?

l. Are there any requirements or plans to monitor and mitigate the impact? If not, why not? If there are plans in place to monitor the impact explain what they are.

m. Compare the local groundwater discharge from the diversion channel area to the Elbow River under the conditions of pre-diversion channel and post-diversion channel construction.

n. Evaluate the local groundwater mounding and local ponding around the off-stream Dam to determine:
   i. What is the groundwater level increase compared with the pre-construction conditions?
   ii. What are the changes to the groundwater discharge to the Elbow River at this location?

218. Volume 3A, Section 5.1.3, Table 5-1, Page 5.4

In the row of "Change in groundwater quantity" and in the column "Measurable Parameter(s) and Units of Measurement", the following needs to be added:

a. Seepage rate (cubic meter per day). Update and provide the updated table.

219. Volume 3A, Section 5.2.1, Figure 5-2, Page 5.10
Volume 4, Appendix I, Table 3-1; Figure 2-3

Alberta Transportation states *Single well response tests were conducted on 15 monitoring wells*. 15 wells were monitored, but only 10 are shown.

a. Clarify in the third paragraph that 15 tests were completed but only 10 were successful. Add the 5 wells that were tested but unsuccessful to Table 3-1 in Volume 4, Appendix I, Hydrogeology Baseline. Populate the K-values as 'N/A' and add a footnote that the tests were unsuccessful. Add a paragraph(s) where both documents are explained for consistency and clarity.

b. In Figure 5-2, the green, light blue and dark blue colours are difficult to distinguish. Adjust the colour selection to correct for this issue (apply this change to Figure 2-3 in Volume 4, Hydrogeology baseline).

c. Post the well IDs for the groundwater monitoring wells (apply this change to Figure 2-3 in Volume 4, Hydrogeology baseline).

220. Volume 3A, Section 5.2.2.2, Figures 5-7 and 5-8, Pages 5.19-5.21
Volume 4, Appendix I

A number of springs were identified based on air photos and the model, but only one was verified/discovered in the field.

a. Explain how the air photographs and 3D CSM were used to identify springs.

b. Expand the map area to the east to include Range Road 33 to show how many springs exist east of the PDA, and if there are any changes to the spring's locations and number during the 2013 flood compared to a normal year.

c. Was the field-verified spring used as a data point when creating any of the potentiometric surface maps? If not, why not? Were any attempts made to verify the other springs when the field survey was conducted? If not, why not? Did any landowners talk about springs on their property (existence, use and changes)? If so, explain what landowners described about the springs on their property.

d. It is difficult to correlate location of springs shown on the 3D map (Figure 5-7) to the 2D maps due to distortion of scale. If the springs were used to develop the potentiometric map, show their locations and labels on Figure 5-8.

e. Apply changes to figures and explanations with similar sections in Volume 4, Appendix I, Hydrogeology Baseline.

221. Volume 3A, Section 5.4.3.1, Page 5.40
Volume 3A, Section 5.2.2.3, Page 5.23 to 5.26

Alberta Transportation states *…natural groundwater flowpaths can be disturbed at a local scale, potentially resulting in changes in groundwater quality*.
In addition, Section 5.2.2.3 Groundwater Quality also discusses the presence of high sodium, TDS and sulphate concentrations in groundwater samples from the unconsolidated deposits.

a. Discuss any risks/concerns with discharging groundwater to the surface and affecting surface water, shallow groundwater and soil within the PDA and LAA, and subsequent implications for terrestrial or riparian vegetation, wildlife and aquatic resources, including wetlands.

222. Volume 3A, Section 5.5, 5.6 and 5.7, Page 5.43
Volume 3A, Section 5.4.3.3, Table 5-4, Page 5.42

The determination of significance is based on domestic consumption (sufficient yield and quality meeting CDWQG). As such, the changes/residual effects to GW quantity and quality are deemed to be *not significant, with a moderate degree of confidence*. However, in the previous Table 5-4 and Section 5.4.3.3, the effects (when dry) are quantified as being *moderate in magnitude…, continuous…, long-term…, irreversible… and disturbed*.

a. Revise the determination of significance by including all receptors, including vegetation, wildlife and aquatic resources. If receptors are excluded, provide the rationale.

b. Discuss what would be required to increase the level of confidence above 'moderate'.

223. Volume 3B, Section 5.2.1.3, Figures 5-3 to 5-14, Pages 5.6-5.24

Alberta Transportation states *The potentiometric head distribution presented in Figure 5-3 suggests that shallow groundwater flow patterns are controlled to a large degree by the regional topography.* (Page 5.6)
Since no recharge has been applied to the groundwater model, the shallow groundwater level is mainly controlled by the boundary conditions, such as the river boundary, constant head boundary etc. Topography should not control slopes of groundwater levels. For example, cross sections A-A' (Figure 5-4, 5-8 and 5-12) show no groundwater mounding at topographic highs. The groundwater water table is a sloped line controlled by the river boundary conditions.

a. Apply recharge rates on the groundwater model to improve calibration.

b. Update the figures referenced above and the associated wording.

224. Volume 3B, Section 5.2.1.2, Figure 5-2, Pages 5.5-5.7

Last paragraph: potential locations of interest were identified, *up to near the LAA boundary*. Two points were within the RAA (shown on Figure 5-5).

a. What is the rationale for selecting each location of interest (e.g. adjacent to dam structure, flooding area, hydrostratigraphic units of interest, etc.)? Do any of them correlate with existing monitoring well locations?

225. Volume 3B, Section 5.2.1.3. Pages 5.6-5.24

Based on visual inspection, groundwater levels are nearly the same for scenarios EE1, EE2 and EE3. For example, Figures 5-4, 5-8 and 5-12 (cross sections A-A') are similar. The same, Figures 5-5, 5-9 and 5-13 (cross sections C-C') are similar, Figures 5-6, 5-10 and 5-14 (cross sections B-B') are also similar. Figures 5-3, 5-7 and 5-11 (potentiometric head distributions for the three proposed flood scenarios) are also similar. This is interpreted to mean that the groundwater conditions will not change according to the flood conditions, regardless if it is the Design (2013) Flood, 1:100 Year Flood or 1:10 Year Flood. These results are unrealistic.

a. Show the river valley on all cross sections. Confirm the river has been incorporated into the model as a boundary condition and how is it varied according to the different flood scenarios.

b. Apply recharge on the groundwater model to improve the calibration.

c. Update the figures referenced above and associated wording.

226. Volume 3B, Section 5.2.1.3, Figures 5-4, 5-8, 5-12, Pages 5.6-5.21

There is a water level drop at the location of a well to the right of cross-section A-A' in all three figures.

a. Explain the cause of the water level drop. Is there a pumping well in the model at this location?

b. How many pumping wells are included in the model calibration and prediction? If any were used, plot the pumping wells in a map to identify the locations.

c. Label the pumping rates on the map to illustrate the diversion rates at each location. Explain how the pumping rates influence the water levels at each location.

227. Volume 3B, Section 5.2.1.3, Figures 5-6, 5-10, 5-14, Pages 5.6-5.23

There are three wells in cross-section B-B'. The simulated potentiometric surfaces at the location of the Diversion Channel in the cross-section B-B' for different scenarios (EE1, EE2, EE3, PP1, PP2 and PP3) are all below the top of bedrock layer, which are lower than the recorded water level. The actual monitored data around the Diversion Channel show the water levels are above the top of bedrock layer:
MW 16-19-19 (DC-25D) – water level is 6.57 mBGS on June 08, 2016, it is about 3.79 m above the top of bedrock layer.
MW 16-18-10 (DC-21D) – water level is 1213.25 masl in May 2017, that is roughly 3.62 m above the top of bedrock layer.

a. Compare and analyze the difference of observed water levels vs. simulated water levels at the wells' locations for the scenarios EE1, EE2 and EE3.

b. If there is significant difference between the observed water levels and the simulated water levels, recalibrate the models by incorporating the monitored data in the Diversion Channel area.

c. Update all the above Figures and the associated report.

d. There is no visual water level difference in Figures 5-6, 5-10 and 5-14. Are there any differences for the river boundary conditions in Elbow River for the three scenarios EE1, EE2 and EE3? Explain.

228. Volume 3B, Section 5.2.1.4, Figures 5-16, 5-17, 5-20, 5-21, 5-24 and 5-25, Pages 5.24-5.40

Groundwater levels drop sharply outside the boundary of the off-stream reservoir, which is unrealistic.

a. Verify the modeling to confirm the simulation converged properly.

b. Check the grid size around the groundwater level drop-off area. If the grid size is too large, the model may not simulate the water level transition change. What are the findings after checking the grid size?

c. Check if the time step is too large. If it is too large, the model cannot handle the transition change. What are the findings after checking the time step?

d. Refine the grid size at the location of the groundwater level drop-off area and combine this with the reduction of the time step to modify the model to simulate a more gradual decrease in the groundwater level. Report the findings.

229. Volume 3B, Section 5.2.1.4, Figures 5-18, 5-22 and 5-26, Pages 5.24-5.41

Alberta Transportation states *Additional boundary conditions were also added within the FEFLOW model in areas that would become wetted during operation of the Project. Such areas include the diversion channel and the footprint of the off-stream reservoir. Head conditions over time within these features were based upon hydrographs extracted from the hydrodynamic model.* The results of the hydrographs extracted from the hydrodynamic model are not provided. The volume of water applied in the scenarios is not quantified.

a. What is the depth of the water contained in the diversion channel for the scenarios PP0, PP1, PP2 and PP3?

b. What is the volume of groundwater discharge to the diversion channel for the scenarios PP0, PP1, PP2 and PP3?

230. Volume 3B, Section 5.2.1, Page 5.2

Alberta Transportation states *A mathematical groundwater model is used to depict the subsurface geologic setting and associated physical parameters that govern the flow of groundwater through porous media (in this case for the PDA, unconsolidated and/or bedrock materials)* – Page 5.2. The potentiometric head distribution for the water table across the RAA is presented and discussed mainly for the unconsolidated layer. For the confined shallow bedrock aquifer:

a. Provide the potentiometric head in the confined bedrock layer for the scenarios of PP0, PP1, PP2 and PP3.

b. Produce the potential artesian area for the scenarios of PP0, PP1, PP2 and PP3.

c. Evaluate the impact of the potential artesian conditions.

d. Propose a monitoring plan for the confined shallow bedrock aquifer.

e. Design a mitigation plan to reduce or eliminate the potential artesian impact.

231. Volume 3B, Section 5.2.2.1, Figure 5-27, Pages 5.42 and 5.43

Alberta Transportation states *Groundwater levels in the RAA are anticipated to respond to floods in the Elbow River due to their hydraulic connection to surface water and interactions between the hydrologic and hydrogeologic systems. These responses to floods are anticipated to occur with or without the Project.*

This statement is contradictory because the groundwater level effects shown in the different modelling scenarios show very little effect.

a. Explain with evidence where and in which geological/hydrogeological conditions groundwater levels in the RAA will respond to floods in the Elbow River.

232. Volume 3B, Section 5.2.3.3, Page 5.50

Alberta Transportation states *The potential effects on groundwater quality related to flood and post-flood operations of the project can be characterized as follows:*
Direction would be positive or adverse, depending upon the chemical species under consideration…..
Magnitude would be low to high depending upon the chemical species under consideration.

a. List the chemical species that may have positive effects on groundwater quality and how.

b. List the chemical species that may have adverse effects on groundwater quality and how.

c. List the chemical species that may have high magnitude effects on the groundwater quality and how.

233. Volume 3A, Section 5.4.2.4, Pages 5.38 and 5.39
Volume 3C, Section 1.2.3, Page 1.22

Alberta Transportation states *Adverse residual effects on hydrogeology from the Project are anticipated to occur during the construction phase only and not during dry operation.*
Alberta Transportation also states *The potential effects on groundwater quantity related to groundwater seepage into the diversion channel (when dry) can be characterized as follows:*
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. The above statements are contradictory to one another. Explain the contradictory statements and revise the statements to be consistent.

234. Volume 3C, Section 2.4, Page 2.4

Alberta Transportation states *To monitor for potential effects to groundwater, a selection of domestic water wells outside the PDA but within the LAA will be sampled during dry operations and as soon as practical following a diverted flood.*
Monitoring the potential loading effect areas is very important for public safety.

a. Identify the key monitoring locations to continuously monitor the baseline information.

b. Will any of the existing project-specific monitoring wells be included in the monitoring program? If so, identify monitoring wells within the RAA to be included in the monitoring network. If not, why?

c. Will any wells have continuous water level monitoring throughout the life of the project? If so, identify continuous water monitoring wells within the RAA to be included in the monitoring network. If not, why?

d. Will an assessment of springs be included in the monitoring programs? If so, which ones? If not, why?

e. Provide a description of mitigation options for all potential effects, including seepage around the diversion structure and channel, and from potential loading effects on existing groundwater users and artesian areas.

235. Volume 4, Appendix I – Hydrogeology Baseline, Section 2.0, Page 2.1

Geological mapping of outcrops was completed but the results were not provided.

a. Show the mapped areas/outcrops on a figure (e.g. field-verified survey figure or other figure).

b. Provide a discussion of the mapping results, such as the geological units, layers, etc.. Do the mapping results correlate with the local area geology from the literature review and other available data? If not, provide the explanation for the differences in results.

236. Volume 4, Appendix I – Hydrogeology Baseline, Table 2-1, Page 2.6 and 2.7

Baseline water level data should be provided for comparison throughout the EIA.

a. Add the baseline water level data (May 2016) to the table for comparison.

237. Volume 4, Appendix I – Hydrogeology Baseline, Section 2.2, Page 2.2

Alberta Transportation states *The LAA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA includes the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur.*

a. Based on the above description of the LAA, modify the extent of LAA to include the area affected by the loading effects area in the confined aquifer.

238. Volume 4, Appendix I – Hydrogeology Baseline, Section 2.3, Page 2.9; Table 2-1, Page 2.7; Section 3.2.4, Page 3.39

The third paragraph states that five nested well pairs were installed. Table 2-1 and Section 3.2.4 (Page 3.39) indicates there are only four.

a. Confirm if five or four well pairs were installed. Update the required pages so that the number of well pairs is consistent.

239. Volume 4, Appendix I – Hydrogeology Baseline, Section 2.3, Page 2.11

a. Add the ground elevations and top of casing elevations to the borehole logs in Attachment A for comparison.

240. Volume 4, Appendix I – Hydrogeology Baseline, Section 3.1.7, Page 3.23

No local geological cross-sections are included in the EIA.

a. Using the monitoring well logs and geotechnical borehole data, create two localized cross-sections (NW-SE) to include the local detailed aquifer and aquitard features in the Project Area; one across the Diversion Structure and one across the Off-Stream Dam, extending across the Elbow River and including the proposed development features. Label water levels in the river and in the boreholes.

b. Compare them against the two similar cross-sections derived from the regional model. Analyze the differences.

c. Explain which model most accurately represents the actual situation for the local impact assessment.

241. Volume 4, Appendix I – Hydrogeology Baseline, Section 3.2.1 Page 3.29

Alberta Transportation states *The response test analyses are presented in Attachment A*, however, the response test analyses are not presented in Attachment A.

a. Include the Response Test Analysis results.

242. Volume 4, Appendix I – Hydrogeology Baseline, Figures 3-17 & 3-19, Page 3.37

To improve the calibration, use the observed data to constrain the model, especially for the shallow bedrock aquifer:

a. List the data points [well ID, UTMx, UTMy, aquifer name, surface elevation (masl), and groundwater level (masl)] used to generate Figure 3-19 potentiometric surface contour in a table as an attachment.

b. Add these points to the groundwater model calibration.

c. Produce the groundwater depth map in the Upper Bedrock layer.

d. Subtract the potentiometric surface in the Unconsolidated Deposits (Figure 3-17) by the potentiometric surface in the Upper Bedrock layer (Figure 3-19). Map and analyze if there is an upward gradient in the area.

243. Volume 4, Appendix I – Hydrogeology Baseline, Section 3.2.4, Page 3.39

Alberta Transportation states *Vertical hydraulic gradients between the unconsolidated and bedrock deposits indicate the potential for upward-directed groundwater flow (discharge) at each of the four nested monitoring well locations…. In addition to the contact springs discussed in Section 3.2.2, the relatively high magnitude vertical gradients likely result in artesian springs along the valley walls and in low-lying areas where the confining layers are thin or in areas of more permeable material.*

a. Describe or show where the high magnitude vertical gradients are located and state whether or not they were incorporated into the model. If they were not, explain why.

b. Subtract the DEM by the potentiometric contours (Figure 3-19) to analyze if there are any artesian areas. Label MW16-8-8/MW16-8-19 and MW16-6-11/MW16-6-20 to verify if they are situated in the predicted artesian areas.

c. Survey the well owners to the east and south east of the PDA to find out if there were any artesian wells or water level increases in the domestic wells during the 2013 flood, particularly for the wells screened in the shallow bedrock aquifer.

d. Modify Section 3.2.4 if necessary, based on the above information. Provide the updated information.

244. Volume 4, Appendix I – Hydrogeology Baseline, Section 3.2.5, Figures 3-20, 3-21, Pages 3.39-3.42

Groundwater level fluctuations are discussed but the visual information provided is limited and difficult to correlate with lithological conditions and specific locations in the LAA. Monitoring was completed in nested wells pairs but a discussion of the water level results and significance is not provided. The artesian conditions in individual and nested wells should be discussed, as the impact to these areas will likely be significant during flood events.

a. Provide the rationale for selecting which wells have data logging pressure transducers.

b. Make x-axis and y-axis labels larger and/or bolder, as they are difficult to read when printed.

c. Use the same scale for all charts.

d. Update the charts to extend the date range and include monitoring data collected since June 2017.

e. The charts for MW16-6-20 and MW16-28-18 show water levels above ground elevation, indicative of artesian conditions.
   i. Do any other wells have artesian conditions? If so, which ones?
   ii. Discuss the hydrogeological significance and extent of the artesian conditions in these wells and any other wells where the water level is above ground level.
   iii. For all the bedrock monitoring wells, identify which ones belong to confined or unconfined aquifers.
   iv. Is this data reflected in the potentiometric surface maps and incorporated into the model as actual data points? If not incorporate this data into the map and model and provide the updated information. If this data was not reflected why was it excluded?

f. The charts for nested wells MW16-8-8/MW16-8-19 show that the water levels in the bedrock aquifer are higher than the water levels in the unconsolidated deposits.
   i. Discuss the hydrogeological significance of this (e.g vertical gradients, connectivity).
   ii. Show the groundwater elevations, ground elevation and top of bedrock elevation for both wells in one chart to facilitate analysis (the scale for this chart may be different than the others due to the broader range of the y-axis).

g. The charts for nested wells MW16-6-11/MW16-6-20 show that the water levels in the unconsolidated deposits and bedrock aquifer are at or near ground level.
   i. Discuss the hydrogeological significance of this (e.g vertical gradients, connectivity).
   ii. Show the groundwater elevations, ground elevation and top of bedrock elevation for both wells in one chart to facilitate analysis (the scale for this chart may be different than the others due to the broader range of the y-axis).

245. Volume 4, Appendix I – Hydrogeology Baseline, Figure 3-24, Table 3-3, Pages 3.46 to 3.49

a. Of the 392 relevant records, 19 were field-verified during the domestic well testing program. The only data provided is the analytical summary Table 3-5 and the locations summarized in Attachment B.
   i. Provide an explanation for the low number of field-verified locations. How many landowners were contacted and how many responded?
   ii. Describe what was done during the field-verified survey (collection of GPS coordinates, water levels and/or water samples, etc…).
   iii. Provide the field-verified survey results in a table, including water levels and sampling, etc.
   iv. Was surface water and spring locations included in the survey? If not, why not?
   v. Where is the discussion and/or report outlining the methodology and complete results of the domestic well testing program? If this was not included provide the discussion and/or report. If they are in a separate document, provide a reference.

b. Figure 3-24 only shows the histogram of water well depth. Show the amount of wells completed in overburden material and bedrock.

c. To visually show the locations and densities of the field-verified and licensed water users, post the locations in Table 3-3 on a map using different symbols to differentiate between the groundwater and surface water licences and registrations. Include spring locations on the figure and differentiate between confirmed (e.g. field-verified) and interpreted locations.

d. Assign ‘Groundwater’ as the water sources for Licences 0025968-00-01 and 0032320-00-00 in Table 3-3, since they are identified as being production wells in the groundwater licence.

e. Explain whether or not the allocated groundwater licence volumes were incorporated into the groundwater model for calibration.

246. Volume 4, Appendix I – Hydrogeology Baseline, Section 3.4. Table 3-5. Pages 3.49, 3.56
Volume 3A, Section 5.2.2.3, Pages 5.23 to 5.26
A total of 31 groundwater samples were collected from monitoring wells within the LAA (17 from wells screened in unconsolidated deposits, 14 from wells screened in bedrock). Analysis of groundwater from wells screened in unconsolidated deposits was conducted on wells sampled in fall 2016. Analysis of groundwater from wells screened in bedrock was conducted on wells sampled in fall 2016 and from the April 2016 domestic well testing program.

a. Where are the results of the April 2016 domestic well testing program captured? Include a reference to the existing report or tabulate and append the data to the Baseline report. Show the locations of the tested domestic wells in a figure. Include completion information for the domestic wells, including the source aquifer.

247. Volume 4, Appendix I – Groundwater Numerical Modelling, Section 2.3.1, Page 2.4

a. Define the eastern boundary of the perimeter of the model domain.

248. Volume 4, Appendix I – Groundwater Numerical Modelling, Section 3.2, Figure 3-1, Page 3.2
To view the conductivity zones clearly in different layers;

a. Split Figure 3-1 into a series of maps to present the calibrated conductivities clearly, with overlays (such as RAA, LAA, PDA and highways etc.) to identify the relative locations of the conductivity zones:
   i. Provide the conductivity distribution in the deep bedrock layer;
   ii. Add the conductivities for the shallow bedrock aquifer on top of the deep bedrock layer;
   iii. Add the conductivities for the basal silt, sand and gravel on top of the shallow bedrock aquifer;
   iv. Add the conductivities for the till layer on top of the basal silt, sand and gravel;
   v. Add the conductivities for the glaciolacustrine clay on top of the till; and
   vi. Add the conductivities for recent fluvial sand and gravel on top of the glaciolacustrine clay.

b. Was a universal conductivity or variable conductivities applied to the same geologic/hydrogeologic units after the calibration? Explain why or why not.

249. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 3.2.2, Page 3.8
Alberta Transportation states *The potentiometric surface of the upper water table…These groundwater elevations were used as initial hydraulic heads during calibration of the numerical model.*

a. Were the data points or the digitized contours used as the initial hydraulic heads? Explain the rationale for the selection.

b. Were any bedrock data points (Figure 3-19, Page 3.37 of Hydrogeology Baseline Report) used for the initial hydraulic heads? Why?

250. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 4.1, Page 4.1

a. How many layers of 3-D mesh are in the groundwater model?

b. Which geological/hydrogeological units are correlated to which mesh layers?

c. Is there only one layer for the bedrock unit? If so, two layers are recommended to represent the upper bedrock aquifer and the underlying low permeability bedrock to model the practical features in the field. If there is only one layer for the bedrock unit explain why only one was selected.

251. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 4.2, Page 4.4

a. Alberta Transportation states *Time varying river water level boundary conditions along Elbow River, at the diversion channel and off-stream reservoir were applied to assess response of groundwater system to three floods.*

b. Were the off-stream reservoir time-varying water level boundary conditions applied to the whole off-stream reservoir area or only around the edge of the reservoir? Explain why or why not.

c. To which mesh layer(s) were the time-varying water level boundary conditions applied? Explain the rationale.

252. Volume 4, Appendix I – Groundwater Numerical Modelling, Section 4.2.1, Page 4.4

Alberta Transportation states *Figure 4-6 to Figure 4-14 present time varying water level boundary conditions used in the model for the design flood for both the existing environment … The time varying surface water level hydrographs were obtained from the hydrodynamic modeling results (Volume 4. Appendix H).*

a. Make changes to the time-varying water level boundary conditions if the hydrodynamic modeling results change as a result of SIR1.

253. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 4.2.1, Figure 4-4, Page 4.4-4.5; Section 4.2.2, Figure 4-15, Page 4.16

Alberta Transportation states *Prescribed head boundaries, dirchilet boundaries, were specified to the top…and at the perimeter of the model domain.*
Fluid-flux boundaries, Neumann boundaries, were used to represent inflows and outflows for saturated aquifers in the model domain…The location of the prescribed-flux boundaries is presented on Figure 4-15.

a. There is already a prescribed head boundary (Figure 4-4) at the location of the prescribed-flux boundaries (Figure 4-15). How does the model choose the boundary condition at these locations for the simulation when two boundary conditions were applied to the same nodes?

b. Why were the prescribed flux boundary conditions applied at these locations (Figure 4-15)? Are there other similar hydrogeological condition locations where the prescribed flux boundary should be applied?

254. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 5.1.1, Figures 5-1, 5-2 and 5-3, Table 5-2, Pages 5.1-5.6

Alberta Transportation states *The spatial distribution of the monitoring well water level points that were used for model calibration is shown on Figure 5-1. Additional domestic well records were also considered during the model calibration within the border RAA (not shown)*.

a. Explain why there are no calibration targets located beyond the LAA boundaries and discuss how this affects the modeling results.

b. Show the locations of the additional domestic wells used for the calibration.

c. Add the monitoring data from Upper Bedrock (Figure 3-19, Hydrogeology Baseline) for the calibration, if it has not already been done.

d. Update Figures 5-1, 5-2, 5-3 and Table 5-2.

e. How will monitoring occur in the diversion channel area after construction? Will the monitoring wells in the diversion channel area be destroyed during construction? If so, will they be replaced? If not, why not?

255. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 5.1, Table 5-1, Page 5.3

Table 5-1 shows Shallow Bedrock Hydraulic Conductivity Zones in the *West Zone, Central Zone* and *East Zone*. These zones are not discussed elsewhere in the EIA and are difficult to correlate with what has been presented in the geologic setting for the RAA. Hydraulic conductivity values are presented but no rationale is provided.

a. Provide a map to correlate to the table and show where the zones are distributed in relation to the bedrock subcrops.

b. The shallow bedrock's conductivity varies significantly from 3.40e-6 m/s to 4.27e-9. Discuss the geological and hydrogeological reasons for this. Do the zones correlate to the upper bedrock subcrops throughout the RAA? If not, why? If so, include the bedrock units in the table so they can be correlated to the zones.

c. Alberta Transportation states *Groundwater use in the RAA is primarily from the shallow bedrock aquifers* (Page. 3.45 of Hydrogeology Baseline). Are there any groundwater users located in the low permeable area (East Zone with hydraulic conductivity of 4.27e-9 m/s)? If so, what is the typical yield of the well(s)?

d. Is there any pumping test data to support the hydraulic conductivity variance? If not, why?

e. What are the hydraulic conductivity differences between the shallow and the deep bedrock units?

256. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 5.2, Figures 5-2, 5-3, Table 5-2, Pages 5.3-5.6

a. There are 27 points in Figure 5-2 and 5-3, and 31 points in Table 5-2. Why are they different?

b. Modify Table 5-2 to include well IDs, simulated water heads, observed water heads, differences of simulated water heads vs observed water heads, and the statistics parameters.

c. Expand the modified Table 5-2 to include the simulated and observed water heads in the Upper Bedrock layer.

257. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 6.1, Figures 6-2, 6-3, 6-4, 6-5, 6-6, 6-10, 6-11, 6-12, 6-15, 6-16, 6-17, Pages 6.3-6.21

There are at least two major aquifers in the study area – one aquifer in the unconsolidated layer and one confined aquifer in the shallow bedrock layer. It looks like all the above maps are related to the aquifer in the unconsolidated layer.

a. For all of the above Groundwater Hydraulic Head Distribution maps, explain which overburden material layers belong to each map.

b. Update the above maps with reasonable recharge in the groundwater model.

c. Provide similar updated maps in the Shallow Bedrock confined aquifer, applying the loading effect.

258. Volume 4, Appendix I – Groundwater Numerical Modeling, Section 6.1, Figures 6-7, 6-8, 6-9, 6-13, 6-14, 6-18, 6-19, Pages 6.3-6.24

a. Change the size and colours of the pink and light blue control point labels so they are easier to read.

b. The above Figures mention Control Points and simulated hydrographs. In which layer(s) are they screened?

c. Apply a reasonable recharge rate to the groundwater model. Update the above figures.

d. Add Control Points at the locations of the deepest water thickness in the reservoir and to the east and southeast of the PDA in the low-lying topographical areas. Screen the new Control Points in the upper bedrock aquifer. Simulate and plot the hydrographs at the new Control Points with the loading effect incorporated into the model.

259. Volume 2, Section 5.2, Table 5-2, Page 5.10

a. Explain why hydrogeology was not flagged as having a potential interaction during 'water diversion construction' and 'retention of water in reservoir'.

b. Ensure all blank squares are populated.

5.3 Hydrology

260. Volume 1, Section 3.1, Page 3.1

Alberta Transportation states *The data used to develop the design hydrograph is considered preliminary data. In January 2017, Water Survey Canada (WSC) released hydrometric data for the 2013 flood that is herein referred to as "the 2013 hydrographs" and their respective monitoring stations*.

a. Was the preliminary and official (released on January 2017) data compared? If the data was compared how are they different? If the data was not compared, compare the data and explain how the data is different.

b. What are the potential implications of using the preliminary data?

261. Volume 1, Section 3.1, Page 3.1
Volume 3B, Section 6.1, Page 6.1
Volume 3B, Section 6.4.1.1, Page 6.14

Alberta Transportation states *The estimated peak flow rates of the Elbow River at the diversion site are presented for different return periods in Table 3-1*.
Alberta Transportation states on page 6.1 that *The (2013) design flood volume that is used to estimate engineering storage volumes required for the Project is based directly on volumes derived from the estimated hydrograph at Glenmore Reservoir, not at Bragg Creek, due to data limitations at the time*.
Alberta Transportation states on page 6.14 that *The hydrographs used in the analytical assessment are primarily based on hydrographs sourced from the WSC for the WSC Station 07BJ004 Bragg Creek*.

a. Provide a clear description on which flow data from which location was used to do the frequency analysis to determine peak flows for design flood, 1:100 year flood and 1:10 year flood.

b. Describe which flow data from which location was used to estimate storage volume of the reservoir. Was any other local runoff volume other than the Elbow River flow volume used to estimate the total storage capacity of the reservoir? If yes, describe these local areas, and show them on the respective figures. Explain how these runoff volumes were estimated. If not, describe why these local runoff volumes were not included in estimating the reservoir storage volume and describe the impacts of not considering these volumes in the estimation of total flood storage for the proposed reservoir.

262. Volume 1, Section 3.2.1, Page 3.2

a. In the reach of the river where the diversion inlet, service spillway and flood plain berm will be located will the width of the river at the service spillway location be constricted when compared to the existing natural width? If so, then describe the effects of this constriction on upstream bed scour and bank erosion.

b. What is the potential of the bed scour upstream and downstream of the diversion inlet and service spillway and how the potential erosion and scour in this dynamic zone be mitigated?

c. What is the bank full discharge rate at this diversion location and what is the frequency of occurrence of this bank full discharge.

d. How frequently will water get stored behind the flood plain berm when the flow is above bank full discharge and for how long will water be stored during the different flood events?

e. Describe the effect of a flood plain berm on other return period floods (example, 1:2 year flood, 1:5 year floods etc.).

263. Volume 1, Section 3.2.2, Page 3.11

Alberta Transportation states *In areas of the channel where the cut does not reach the bedrock, the erosion and scour potential is low enough for lower diversion rates and erosion in non-critical areas during a major flood diversion will not constitute a failure.*

a. Does this sentence mean that no erosion protection will be provided in this area of the channel?

b. Describe what is meant by 'lower diversion rate' in this case?

c. What is the erosion potential in the channel for high diversion rates and what is planned to mitigate erosion?

264. Volume 1, Table 3-3, Page 3.12
Volume 3B, Section 6.4.1.4, Page 6.17

Alberta Transportation states *Because the diverted flows have a lesser volume, maximum release rates are based on volume drawn down over approximately 40 days (Figure 6-7).*

a. What is the maximum release rate used for each flood scenarios?

b. Describe the reason for keeping the release time at approximately 40 days for all scenarios instead of releasing the Design Flood and 1:100 year flood at a slower rate which could avoid a sudden rise in Elbow River flow, or releasing the1:10 year flood at a faster rate.

265. Volume 1, Section 3.5.1, Page 3.34

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?

266. Volume 1, Table 3-10, Page 3.37

There is no description on post-flood repair and maintenance activities for the area behind the flood plain berm that will be flooded to divert the Elbow River flow through the diversion inlet.

a. Provide a description on post flood clearing, repair, and maintenance of the flood plain berm and the area upstream of the berm.

b. Include information on what needs to be removed (e.g. debris, sediment etc.) post-flood from the area behind the flood plain berm.

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.

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

a. Describe if runoff volume from the Local Inflow Basin (including the unnamed creek and five other tributaries) was considered when determining the total storage capacity of the reservoir. If not, what will be the impact of not considering this volume on the total storage volume calculation and how will the impacts be mitigated?

b. In addition to 'a', was runoff volume from the area between the low level outlet and the Glenmore Reservoir considered when estimating the capacity of the proposed reservoir? If not, what will be the impact of not considering this volume on the total storage volume calculation and how will these impacts be mitigated?

c. What is the expected runoff volume from the Unnamed Creek Basin and five other tributaries located within the Local Inflow Basin for the three flood scenarios (Design flood, 1:100 year flood and 1:10 year flood)?

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.

270. Volume 1, Section A.5.1, Page A.28
Volume 3B, Section 6.4, Page 6.13

Alberta Transportation states *For example, release rates may be increased if two back-to-back floods are forecast, or decreased to minimize potential effects on mobilization of sediment in the low-level outlet and remobilization of sediment in Elbow River downstream.*
Alberta Transportation states on page 6.13 that *This variability could occur, for example, from high release rates if back-to-back floods are expected or low release rates if a smaller flood is diverted*.
The maximum release rate from the outlet structure of the dam is limited and may not be enough to draw down the storage quick enough for the second flood, if any.

a. Provide further details on the reservoirs capabilities to manage back to back floods. Describe how much volume can be emptied into the reservoir, at what release rate and within what time period in case back to back floods are expected.

b. Explain how effective the method proposed by Alberta Transportation is to handle back to back floods. Provide an example with two large back to back floods to explain how the back to back flood scenario will be handled?

c. What other mitigation measures will be taken to handle back to back floods?

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.

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.

273. Volume 3A, Section 6.1.4, Page 6.6
Volume 3A, Figure 6-1, Page 6.7
Volume 4, Appendix J, Section 2.1, Page 2.1

Alberta Transportation states *The local assessment area (LAA) included the project development area (PDA) and the Elbow River from Redwood Meadows to the inlet of Glenmore Reservoir, including the proposed dam, reservoir, diversion channel, and low-level outlet (i.e., the unnamed creek that runs through the off-stream reservoir). The regional assessment area (RAA) is the Elbow River watershed from headwaters to Glenmore Dam. Figure 6-1 presents the spatial boundaries for the hydrology assessment*.
PDA, LAA, RAA boundaries described in Section 6.1.4 do not match the boundaries shown on Figure 6-1 and with the boundaries mentioned in Volume 4, Appendix J, Section 2.1.

a. Correct the description of the boundaries in Section 6.1.4 if it is incorrect. The rest of the EIA appears to use the boundaries shown in Figure 6-1 and Appendix J. Use the correct boundaries in the applicable sections of the EIA and correct all the corresponding analyses and information if those are based on incorrect boundaries. For any corrections provide the sections where the changes were made.

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?

275. Volume 3A, Section 6.2.2.4, Page 6.36

a. Include a map showing the locations of the water bodies in the PDA.

b. Describe whether these water bodies will be preserved or destroyed by construction and sedimentation from flood water.

c. Identify which water bodies will be preserved and how they will be preserved.

d. Describe how these water bodies will be maintained post-flood.

276. Volume 3A, Section 6.2.2.6, Table 6-9, Page 6.36

TOR 3.4.1[C] identifies that Alberta Transportation is to *Provide an inventory of all surface water users who have existing approvals, permits or licenses in the local and regional study areas*. There is a summary of total water allocations by source in Table 6-9 but there is no inventory.

a. Provide the inventory required by the TOR.

b. Provide an assessment of the regulatory requirements for any licences that are allocated to the project lands and an assessment of the impacts the project may have on downstream licence withdrawals.

277. Volume 3A_S06, Section 6.3.1, Page 6.37

Alberta Transportation states *All instream works will be completed in a manner that allows for water conveyance. Therefore, hydrology in the Elbow River and low-level outlet will not interact during construction of the water diversion structure, dam and berm, and low-level outlet structure and are not assessed further*.

a. The above sections do not mention if the runoff from tributaries 1 through 5 are going to drain into the diversion channel, or be diverted during construction so that water conveyance from these tributaries is maintained and uninterrupted and does not flow into the construction area. Explain what is to happen to tributaries 1 through 5 during construction.

278. Volume 3B, Section 3.2.4.1, Page 3.9

Alberta Transportation states *To some extent, natural mitigation with respect to future potential fugitive dust emissions has already occurred. 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*.

Geomorphic processes in watersheds are continuous natural processes that provide a continuous supply of soil particles of various sizes on land surfaces as well as in stream bed and banks. A large flood can have an impact on sediment distribution for some period of time, however, that impact is not permanent. Moreover, Figure 5-5 of Volume 3A_S05, Page 5.16 of the EIA also presents the fact that the watershed, including the PDA and the upstream watershed contain unconsolidated deposits of Clay and Till that will influence the types of sediment that have the potential to get deposited in the reservoir after flood events.

a. Update this section so that all types of sediments (fine and coarse) are considered.

279. 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.

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.

280. Volume 3B, Section 6.4, Page 6.12

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.

281. Volume 3B, Section 6.4, Page 6.12

Alberta Transportation states *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.*

a. Discuss the implications of altering high flows on the hydrological regime.

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).

283. Volume 3B, Section 6.4.2.1, Table 6-4, Page 6.20

a. Add the maximum release rates used in the table for each of the flood scenarios. Provide the updated tables.

284. Volume 3B, Section 6.4.2.1, Table 6-5, Page 6.21

Evaporation volume will be higher for the Design flood if it happens earlier in the year.

a. Provide the evaporation volume and other relevant parameters presented on the table if the Design flood happens at the end of May or early June.

b. Provide a figure and description of the design flood hydrograph used in the analysis for answering 'a' with peak shifted earlier in the year.

285. Volume 3B, Section 6.4.3.1, Table 6-6, Page 6.28
Volume 3B, Section 6.4.3.2, Figure 6-12, Page 6.31

Estimated reservoir sedimentation depth, loss of reservoir retention volume due to sediment remaining in the reservoir will be higher if the design flood happens earlier in the year and residence time in the reservoir increases.

a. Describe what would be the reservoir sedimentation depth, suspended sediment mass released into the low-level outlet, loss of retention capacity and other relevant parameters of Table 6-6 if the design flood happens at the end of May or Early June.

b. Provide a figure and description of the design flood hydrograph used in the analysis for answering 'a' with peak shifted earlier in the year.

c. Explain why modelled suspended sediment mass released into the low-level outlet for design flood is less (90 kt) than the 1:100 year flood (220 kt). Include if this is due to modelling limitations. If so, what are those limitations and how should these results be interpreted and used?

286. Volume 3B, Section 6.4.3.4, Figure 6-21, Page 6.46
Volume 3B, Section 6.4.3.4, Figure 6-24, Page 6.51

a. The grey graphs are not visible behind the solid blue graphs. Change the solid blue into semi-transparent or use line graphs to make all the items in the legend visible.

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 m^3/s.

288. Volume 4, Appendix J, Section 2.2.4, Page 2.13
Volume 4, Appendix J, Table 2-6, Page 2.14

a. Describe how data from flow gauge station 05BJ001 was used in the frequency analysis. If flow data from the regulated period was used in the frequency analysis describe if this data was naturalized before being used in the frequency analysis.

b. If so, describe how the regulated flow data was naturalized.

c. If not, explain why the regulated flow data was not naturalized for the frequency analysis. What is the impact of using regulated flow data in estimating the peak flow rate and volume using the frequency analysis, in estimation of storage volume of the Springbank reservoir and on HD, ST and MT modelling results.

289. Volume 4, Appendix J, Section 2.4.1, Page 2.30
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.

290. Volume 1, Section 3.1, Page 3.1
Volume 1, Section 3.2.4, Table 3.3, Page 3.12
Alberta Transportation has identified that *The diversion capacity and combined storage of Glenmore Reservoir allows the Project to mitigate downstream flood damages and keep flows downstream of Glenmore below 160 m^3/s for floods up to the 2013 flood or equivalent. That flood had an estimated peak flow of 1,240 m^3/s, a 7-day volume of 149,600,000 m^3 and is estimated to be slightly greater than a 1:200 year flood*. It also identifies different reservoir residence times and discharge durations in three scenarios: design flood, 1:10 year and 1:100 year frequencies.

a. Provide a detailed explanation of a scenario where the 2013 flood could occur earlier in June in conjunction with snowmelt runoff and detail how this would change the estimates of sediment loading, detention times in the reservoir and subsequent effects on hydrogeology and water quality in the reservoir.

b. Provide a hydrograph that shows the 2013 flood occurring in conjunction with snowmelt runoff.

5.4 Surface Water Quality

291. Volume 3A, Section 7.2.2, Page 7.10

Alberta Transportation states that *There are no approved wastewater discharges to the Elbow River upstream of Glenmore Reservoir.* This was from a 2004 report that is outdated with respect to the topic of wastewater releases.

a. Provide details of the potential impacts on the Project and on Elbow River water quality as a result of overflows or bypasses during flood events or approved release from;
   i. Bragg Creek Wastewater Treatment Plant (continuous release);
   ii. Wintergreen Wastewater Treatment Plant (seasonal irrigation);
   iii. Redwood Meadows Lift Station and Lagoon (under Federal jurisdiction);
   iv. Petro-Canada Lagoon at Highway 22 and TransCanada Highway (retained on site, not approved under EPEA); and
   v. Calaway Park Lagoon (seasonal irrigation).

292. 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.

293. Volume 4, Appendix J, Section 2.4, Page 2.29
Volume 4, Appendix J, Section 2.4.1, Page 2.30

Alberta Transportation indicated that *the spatial density of the flexible mesh was also varied, depending on the necessity for higher, or lower, resolution within the modeling domains*. Additionally, the model domain included the *Elbow River from Bragg Creek to Glenmore Reservoir and the entire Glenmore Reservoir*. However, there are no modelling results for the Glenmore Reservoir.

a. Provide a map of the model domain including the mesh network, the different sub-domains and any boundary conditions used (e.g. tributaries).

b. Provide the results for the Glenmore Reservoir. Otherwise, indicate why these results are not included as this is part of the LAA and RAA.

294. 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.

295. Volume 4, Appendix J, Section 2.4.2, Page 2.37
Volume 3B, Section 6.4.1, Page 6.17

Alberta Transportation identified that *the second criteria for release is based on the length of time to drain the reservoir using the engineering design full service volume of approximately 84,500 dam^3*. The criteria used seems to define the upper limits of the release rate. However, there is still operational flexibility to release at lower rates.

a. Discuss the advantages/disadvantages of different lengths of time to drain the reservoir and still be able to meet the two criteria provided (lower release rates). This will include moving the peak concentration of TSS and other related parameters later in the year and different dilution rates.

b. Provide scenarios with different operational release rates leading to different lengths of time to drain the reservoir to minimize impact to water quality.

296. Volume 4, Appendix J, Section 2.4.3, Page 2.39

Alberta Transportation indicates that *the models were firstly calibrated using the existing available hydrographic data from historical observation and project field measurements and then applied to project specific modelling.*

a. Provide details on the model calibration procedure including:
   i. Data used.
   ii. Qualitative and quantitative model performance results.

b. Provide a list of the main parameters calibrated and how they compare to literature values.

c. Perform a sensitivity analysis for key parameters with a wide range of possible values indicating how that can affect the model results.

d. Discuss the uncertainty of model results related to the calibration results.

297. Volume 3B, Section 2.4.3, Page 2.40

Alberta Transportation's modelling results on suspended sediment indicated that *without further mitigation, the resulting increase in the Elbow River of suspended sediment concentrations is likely to exceed the Canadian Water Quality Guideline*. Interpretation of dynamic modelling results is aided by graphical and spatial representations of the concentrations compared with baseline conditions and/or against appropriate guidelines.

a. Provide graphs and maps to demonstrate the temporal and spatial extent of any water quality guideline exceedance in the Elbow River with and without mitigation measures (e.g. graph of suspended sediment concentration in the Elbow River during release against the guideline).

b. Demonstrate the effect of the project during the water release by comparing the suspended solids concentration change from Baseline conditions (no release).

c. Indicate how these results can be interpreted for other parameters that behave similarly to suspended sediment.

298. Volume 3B, Section 7.4.2, Page 7.21

Alberta Transportation states that *there are no analogous measurements or surrogate parameters in the area of the Project for evaluating the effects of short term water retention in a relatively low organic carbon environment […]. Therefore, there are no available parameters to calibrate and validate a model.* The DO and water temperature was assessed using only qualitative methods. Although the calibration of a hydrodynamic model for the off-stream reservoir may be limited by the available data, there are analytical methods to calculate DO and water temperature that can provide a better characterization of any potential water quality issues in the reservoir and in the Elbow River after mixing. The time that the reservoir will have water is in the order of 1-3 months during the summer when critical DO and water temperature conditions are observed. Additionally, the water diverted during the floods will most likely have high content of BOD/TOC.

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.

299. Volume 3B, Section 7.4.3, Page 7.24

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.

300. Volume 3B, Section 7.4.2, Page 7.23

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.

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)?

302. Volume 3C, Section 2.6.3, Page 2.7
Volume 3C, Section 2.5.3, Page 2.5
Volume 3B, Section 7.4.2, Page 7.20
Volume 4C, Table C-2, Page C.28 to C.39

Alberta Transportation states *Following a flood that results in the diversion of water to the reservoir and prior to discharge from the reservoir, water samples will be collected at the low-level outlet channel*. Alberta Transportation also states *Suspended sediment concentration is predicted to increase during the last few days of discharge*. In addition, surface water sampling is planned as: *Suspended sediment levels will be monitored following a flood. This will include suspended sediment levels in the Elbow River following the flood but prior to release of water from the reservoir and then following release of the water.*

a. Provide details as to what would be a representative sampling program prior to, and during, the release of a flood event from the reservoir; depending on the duration of discharge and the stated fact that sediment loading would increase near the end of discharge.

b. Provide information on how a reservoir inflow water quality monitoring program would be beneficial for assessing contaminant and sediment loading to the reservoir.

c. Provide details on the means for the safe collection of samples under normal and adverse weather conditions at the diversion channel, in the reservoir and at the outfall of the reservoir.

d. Provide details on impact assessment and any proposed mitigation for the potentially prolonged release of turbid water to downstream small utility drinking water intakes such as the Westridge municipal water intake, Calaway Park water intake etc. as this may pose a burden on water treatment processes.

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.

304. 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)

305. 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.

306. Volume 3B, Section 7.4., Page 7.25
EIS Summary, Section 6.10.2.1, Page 6.64

Alberta Transportation proposes the land use of Area C as optional grazing area as stated *The area of the off-stream reservoir north of Springbank Road will be publicly owned and privately stewarded, and have grazing options through public 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.

307. Volume 3A, Section 5.4.3.3, Page 5.38
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.

308. Volume 3B, Section 7.2.2.1, Page7.7
Volume 4, Appendix K, Section 3.2, Figure 3-2, Page 3.5

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).

309. 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?

310. Volume 3B, Section 7.4.3, Page 7.24
Volume 4J, Section 2.4.2, Page 2.37

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.

311. Volume 3B, Section 7.4.3, Page 7.24

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?

312. Volume 3B, Section 8.2.2.1, Page 8.6

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.

313. Volume 3C, Section 2.6, Page 2.7

Alberta Transportation identified that *Following a flood that results in the diversion of water to the reservoir and prior to discharge from the reservoir, water samples will be collected at the low-level outlet channel and analyzed….*

a. Approximately how many samples will be taken?

b. Will samples also be taken periodically from the outflow during post-flood discharge from the reservoir? If so, explain whether a datasonde might be installed for continuous monitoring of turbidity; pH, conductivity, DO, and temperature.

c. The parameter list for water sample analysis is missing TKN.

314. Volume 3D, Section 3-1, pg. 3.16

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.

315. Volume 4, Appendix K, Section 3.2.2.2, Figure 3-24, Pages 3.34. and 3.35

Alberta Transportation stated that *Temperature COVs were generally greatest during the winter months […] temperatures are most variable during the winter.* However, the figure shows a lower variability during winter. The COV could be affected by the mean temperature close to zero during winter.

a. Confirm that winter is the season with highest temperature variability.

316. Volume 4, Appendix K, Section 3.2.2.3, Page 3.37.

Alberta Transportation states that *dissolved ortho phosphate…and dissolved sodium concentrations have no apparent seasonal patterns…these parameters are, therefore, the most different from TSS.* However, dissolved phosphorus was found to behave similar to TSS.

a. Discuss this apparent inconsistency and the confidence of each result based partially on the number of samples.

317. EIS Summary, Section 6.6.2.1, Page 6.29

Alberta Transportation identified that *Construction activities could change sediment concentrations, water temperatures, […], nutrient concentrations.*

a. Missing is a comment on water temperature and nutrient concentrations; only sediment concentration was provided. Provide this missing comment.

318. 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. How would the remaining sediment be flushed under non-extreme peak flows and affect water quality downstream?

319. Volume 3A, Section 7.1.4, Page 7.6

Alberta Transportation indicated that *The regional assessment area is used to evaluate potential cumulative changes to watercourses resulting from the Project and other development in the watershed; it encompasses the Elbow River watershed from its headwaters to Glenmore Dam.* The RAA does not include the Bow River but Section 3.5.2 [H] of the terms of reference states *Describe any potential cumulative effects in the Bow River and the implications to the WQMF and regional initiatives such as the Bow River Phosphorus Management Plan.*

a. Describe any potential cumulative effects in the Bow River as required by the Terms of Reference.

320. Volume 3A, Section 7.4.2.1, Page 7.14

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

a. Indicate what a relatively small quantity means.

b. What are potential implications if the construction happens during a drought year?

321. Volume 3A, Section 7.4.2.2, Page 7.15

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?

322. Volume 3A, Section 7.6, Page 7.18

Alberta Transportation indicated that *Prediction confidence in the effect of herbicide application during dry operations on water quality is moderate*.

a. Describe the herbicides monitoring plan.

323. Volumes 3A, Section 7.2.2, Pages 7.10
Volume 3B, Section 7.5, Page 7.10
Volume 4, Appendix K, Section 3.1, Page 3.1
Volume 4, Appendix K, Section 2.2.4.4, Page 2.18

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?

324. Volumes 3A, Section 7.2.2, Page 7.10
Volume 3B, Section 7.2.2, Page 7.5

Alberta Transportation states that *These changes were potentially related to runoff from livestock wintering areas and seepage from septic fields. And -non-point source runoff from agriculture, recreation and residential development upstream of the City of Calgary; - urban runoff that is conveyed to the Elbow River and Glenmore Reservoir*.

a. Provide a map of current land uses.

b. Identify and map the main non-point sources in the RAA.

325. Volume 3B, Section 7.4.1.1, Page 7.19
Volume 3B, Section 7.1.1.5; Table 7.1, Page 7.4

Alberta Transportation stated that *The assessment of change in suspended sediment associated parameter concentration is based on existing conditions data analysis on which parameters behave like suspended sediment and the sediment transport modeling results.*

Table 7-1 indicates that the measurable parameters to assess potential environmental effects is relevant water quality and sediment quality parameters such as total phosphorus in mg/L; however, the assessment did not report the effects on the sediment related parameters on those terms.

a. Report the effects on sediment related parameters as the potential increase in concentration (e.g. mg/L) due to the Project and implications for the water uses.

326. Volume 3B, Section 7.4.1.3, Page 7.20

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.

327. Volume 3B, Section 7.4.2, Page 7.23

Alberta Transportation indicated that *The extent of nutrient release from the reservoir is dependent on water residence time […]*

a. Provide the residence time used for this assessment and justify why that number was chosen.

328. Volume 3B, Section 7.4.2, Page 7.23

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.

329. Volume 3B, Section 7.4.3, Page 7.25
Volume 3B, Section 7.4.3, Figure 7-11, Page 7.26

Alberta Transportation states that *For the design flood, the release of retained water from the reservoir would contribute 29% to 59% of total flow in Elbow River downstream of the low-level outlet. For the 1:100 year flood, the release of retained water from the reservoir would contribute 5% to 34% of total flow in Elbow River downstream of the low-level outlet. For the 1:10 year flood, the released water would contribute less than 5% of the total flow in the Elbow River.*

a. What is the temperature, DO and nutrient concentrations expected in the water released from the reservoir?

b. Figure 7-11 shows an outlet channel flow % of total during discharge never below 20% for the 1:100 flood. Clarify the statement that says 5% to 34%.

330. Volume 3B, Section 7.4.4, Page 7.29

Alberta Transportation indicates that *water would be in the reservoir from the start of diversion to the end of emptying for the following durations: design flood 62 days, 1:100, 84 days; 1:10, 74 days.* This is assuming that the design flood starts in late June and not in May as the other floods.

a. Provide analysis of the probability of having different start times for the flood and indicate how this might affect the duration of water in the reservoir.

b. What is the maximum time that the water would be in the reservoir assuming and early flood?

331. Volume 3B, Section 7.4.4, Figures 7-14 to 7-16, Pages 7.30-7.31

Figure 7-16 has a smaller inundated area and a shorter retention time than the scenarios in Figures 7-14 and 7-15 yet the methylmercury concentrations are very similar.

a. Explain why the methylmercury concentration is very similar in all three flood scenarios.

332. Volume 3B, Section 7.7, Page 7.34
Volume 3B, Section 6.4.3.2, Table 6-7, Page 6.35

Alberta Transportation identified that *During the last few days of water release back into the 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/m^3 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.

333. Volume 3D, Section 3.0, Table 3-1, Page 3.15

Alberta Transportation states *The following potential project effects are assessed for surface water quality: change in surface water quality.* This statement does not adequately list the potential effects assessed.

a. Indicate in more detail which potential effects were assessed (refer to the reporting method used for Aquatic Ecology, same table).

334. Volume 4, Appendix K, Section 2.2.4.1, Page 2.17

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.

335. Volume 4, Appendix K, Section 2.2.4.6, Page 2.29

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.

336. Volume 4, Appendix K, Section 3.2, Figure 3-1, Page 3.4

One or more extreme values were removed for seven box charts.

a. Further justify this as a reasonable approach.

337. Volume 4, Appendix K, Section 3.2.2.2, Figure 3-25, Page 3.36
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.

338. Volume 4, Appendix K, Section 3.3, Page 3.48
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.

339. Volume 4, Appendix J, Section 2.3.1, Page 2.19
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.

340. 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.

341. 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.

5.5 Aquatics

342. Volume 3A, Section 8.2.1.1, Page 8.16
Alberta Transportation states *The review of aquatic resources was used to identify species composition, species at risk, distribution, relative abundance, status, movements, habitat use and life history parameters.*

a. Describe how quantitative population estimates of fish resources have been assessed.

b. Provide quantitative population estimates for the fish species found within the Elbow River.

343. Volume 3A, Section 8.2.2.3, Table 8-5, Page 8.30

Alberta Transportation presented the upstream migration times of various fish species in Table 8-5.

a. How were migration patterns of fish species in the Elbow River determined apart from general life history patterns?

b. Describe which of these species moves through the area of the diversion structure where migration may be affected during the times described in the table.

344. Volume 3A, Section 8.4.2.1, Page 8.49
Volume 3A, Section 8.4.4.2. Page 8.59

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.

345. Volume 3A, Section 8.4.3.2, Page 8.51

Alberta Transportation describes measures to avoid introducing invasive species by cleaning equipment prior to arrival during construction of the project.

a. Describe measures to ensure aquatic invasive species do not occupy or establish in the project infrastructure. Will any testing be completed to check for the presence of invasive species? Explain why or why not.

b. Describe measures to remove aquatic invasive species should they be found.

346. 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.

347. Volume 3A, Section 8.4.4.2, Page 8.58
Volume 3C, Sec 01, Section 1.2.4.2, Page 1.27

The diversion of the unnamed tributary (ID 1350) into the constructed diversion channel is an example where habitat may require offsetting which was briefly described. 1,854m^2 of fish habitat for the diversion structure and 900m^2 of habitat for the debris deflector was calculated to be destroyed as a result of the construction of this project (Volume 3C, Sec 01, Section 1.2.4.2, Page 1.27).

a. Identify plans to offset losses in the productivity of the fish habitat identified.

b. Indicate how environmental protection plans address applicable provincial and federal policies on fish habitat including the development of a "No Net Loss" fish habitat objective.

348. 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.

349. Volume 3B, Section 8.2.2.3, Page 8.11

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.

350. Volume 3B, Section 8.2.4.1, Page 8.14

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.

351. 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.

352. Volume 3C, Section 2.6.3, Page 2.6

Alberta Transportation states that following a flood that results in the diversion of water to the reservoir and prior to discharge from the reservoir, water samples will be collected at the low-level outlet channel and analyzed for various parameters and those results will be provided to the City of Calgary water services department.

a. Which test results will be used by Alberta Transportation to make decisions regarding water release from the reservoir?

b. Describe the duration and frequency of monitoring.

c. Describe any thresholds for measured concentrations or levels of total suspended sediment, temperature, and dissolved oxygen that may trigger actions or notification to compliance or resource management departments due to potential harm caused to fish or other aquatic life.

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.

353. Volume 3C, Section 2.7.3.2, Page 2.8

Alberta Transportation states that follow-up monitoring during dry operations will include monitoring of fish passage over the diversion structure, and that details of fish passage success criteria will be developed with regulatory agencies.

a. Describe what monitoring will entail including frequency, time of year, and techniques.

b. Describe how Alberta Transportation will contribute to current and proposed regional monitoring programs.

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.

355. Volume 3D, Section 3.0, Table 3-1 Page 3.16

Alberta Transportation states in Table 3-1 that *During post-flood cleanup, it is not anticipated that the Project would measurably affect water quality in Elbow River or Glenmore Reservoir.*

a. Describe changes to hydrology on the Elbow River below Glenmore Reservoir due to all aspects of water operations.

356. Volume 3D, Section 3.0, Table 3-1 Page 3.18

Alberta Transportation states in the summary table in volume 3D under Aquatic Ecology that *The residual effects on fish habitat, as a function of bedload movement in Elbow River and low-level outlet during the post-flood phase are of a high magnitude, short-to-long term duration.* The column describing the overall magnitude of the various potential effects only lists those effects as low or negligible.

a. Provide an update to the summary table which shows the full range of magnitude for potential effects.

357. Volume 4, App M Aquatic Ecology, Section 3.1.1, Page 3.3

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.

358. Volume 4, App M Aquatic Ecology, Attachment A, Section A-1 Table A1, Page A.3-4

Alberta Transportation provides a summary table of the 14 surveyed reaches of the Elbow and tributaries. Reach lengths do not appear to be listed.

a. Provide the lengths of the reaches assessed.

b. Discuss the resulting ratio of assessed habitat area to total habitat area in the local assessment area and the applicability of using those measurements to determine characteristics of unassessed habitat.

359. 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.

360. Volume 4, App M Aquatic Ecology, Attachment A, Section A-2 Habitat Survey Sheets, (Page 158-159 PDF)
The first two habitat survey sheets describe an Unnamed tributary to the Elbow River (Tributary 1350). These two habitat surveys appear to be assessments of separate locations but contain identical information including site name, photographs, and some data.

a. Clarify if these are separate sites. Provide the corrected and updated data for each site.

361. Volume 4, App M Aquatic Ecology, Section 3.1.3 – 3.1.14
Alberta Transportation describes fish habitat assessed at 12 reaches and as relative percentages of the reach.

a. Provide mapping of fish habitat and aquatic resources of the Elbow River and tributaries affected by the project and all ancillary project components.

6 Terrestrial

6.1 Land Use and Land Management

362. Volume 1, Section 1.3.2.1, Page 1.10 to 1.12
Volume 1, Section 1.4.1.1, Page 1.14
Volume 1, Section 1.4.1.2, Page 1.14

Volume 1, Section 1.4.1.2, Table 1-1, Page 1.15 and 1.16
Volume 1, Section 1.4.1.3, Table 1-2, Page 1.17

Volume 1, Section 1.3.2.1 Land Use states *Most land within or near the Project is privately owned; public land is limited to the rights-of-way for roads and road allowances, and the bed and banks of the Elbow River and its tributaries*.
Volume 1, Section 1.4.1.1 Provincial Environmental Impact Assessment Requirements states: *The Project requires an Environmental Impact Assessment (EIA) under the Alberta Environmental Protection and Enhancement Act.* In Section 1.4.1.2 Other Provincial Regulatory Approval Requirements states: *"The Project will be subject to other provincial approval or notification requirements as listed in Table 1-1.* In Section 1.4.1.3 Other Applicable Provincial Regulatory Requirements states: *Other applicable provincial environmental legislation that could directly affect Project activities is listed in Table 1-2.*

- Table 1-1 Provincial Approvals or Notifications Required for the Project lists the *Natural Resource Conservation Board Act, Historical Resources Act, Water Act* and *Fisheries Act*
- Table 1-2 Other Applicable Requirements for the Project lists the *Soil Conservation Act, Weed Control Act* and *Wildlife Act*

The bed and shore of the Elbow River and its tributaries are crown owned under section 3 of the Public Lands Act. The *Public Lands Act* is not mentioned in either Section 1.4.1.2 or 1.4.1.3, or listed in either Table 1-1 or 1-2.
Authorizations will be required under the *Public Lands Act* for the following activities and occupations:

- For instream works within the Elbow River and its tributaries
- For instream infrastructure permanently installed within the Elbow River and its tributaries.

a. The bed and shore of the Elbow River and its tributaries are crown owned under Section 3 of the *Public Lands Act*. Has Alberta Transportation submitted an application under the *Public Lands Act* for instream works within the Elbow River and its tributaries and for instream infrastructure permanently installed within the Elbow River and its tributaries? If so when were these applications submitted? If there were application numbers assigned provide them. If these applications have not yet submitted when does Alberta Transportation plan to submit the applications?

6.2 Conservation and Reclamation

363. Volume 1, Section 3.3.1.3, Page 3.24
Volume 1, Section 3.3.4, Page 3.28
Volume 1, Section 3.2.1, Figure 3-1

Alberta Transportation states that Rock or soil materials that are unsuitable for construction will be left as spoil near the diversion structure (see Figure 3-1).

a. Describe and map the designated spoil location(s) as it was not included on Figure 3-1 as stated in Section 3.3.1.3 (page 3.24) or Section 3.3.4 (page 3.28).

b. Describe the characteristics of rock or soil materials that would deem them unsuitable for construction.

c. Describe related field screening methods and laboratory analytical testing that will be conducted to determine suitability for construction.

d. Describe the storage, transport, and disposal methods for unsuitable rock or soil material if contaminants of concern are identified.

e. Describe the soil sampling that may be conducted in spoil storage areas to ensure that contaminants of concern have not leached into the soil from the spoil piles, prior to the reclamation of the storage areas.

364. Volume 1, Section 3.3.1.4, Page 3.24
Volume 4, Appendix D, Section 4.5, Page 4.14
Volume 4, Appendix D, Figure 2-2, Page 2.7

Alberta Transportation states that *A temporary laydown/stockpile area to support construction will be set up within the reservoir area, near the dam in a location accessible from the existing road network (Figure 3-1).*

a. Describe and map the temporary laydown/stockpile area to support construction of the off-stream reservoir as it was not included on Figure 3-1 as stated in Section 3.3.1.4.

b. Provide a figure to illustrate the location of salvaged topsoil and subsoil as Figure 2-2 does not illustrate salvage/ stockpiling sites.

365. Volume 3A, Section 9.5, Page 9.43
Volume 4, Appendix D, Section 4.2, Page 4.5
Volume 3A, Section 9.7.2, Page 9.44
Volume 3A, Section 9.4.3.3, Figure 9-13, Page 9.40
Volume 3A, Section 9.4.3.3, Table 9-14, Page 9.38
Volume 3A, Section 9.1.6, Page 9.8

Alberta Transportation states in Volume 3A that *There is a reduction in the areal extent of land rated as agricultural capability class 3 (mode) by 7% of the LAA during construction and dry operations (Table 9-13). This reduction is the result of the construction of the Project components. Because post-construction, the dam and reservoir will not be under agricultural land use, the effect of the changes on soil quality and soil quantity are assessed as not significant*. However, Alberta Transportation states in the Conservation Principles in Volume 4, Appendix D that *To the degree practical, the reconstructed landscape will have land capabilities equivalent to what is present under existing conditions; this does not infer that identical uses will occur but the potential to support similar uses will exist.*
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. 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.

366. Volume 4, Appendix D, Table 4-3, Page 4.11-4.12
Volume 4, Appendix D, Section 4.4.2, Page 4.11
Volume 4, Appendix G, Technical Data Report, Table 3-22, Page 3.38
Volume 4, Appendix G, Technical Data Report, Figure 3-7, Page 3.40
Volume 4, Appendix G, Technical Data Report, Figure 3-8, Page 3.41

Alberta Transportation indicates in Volume 4, Appendix D that 0.25 m of topsoil and 0.25 m of subsoil will be salvaged and that *Most of the soil map units have similar reclamation suitability ratings so that minor amounts of over-stripping into the upper subsoil should have no adverse effects on topsoil quality*. Alberta Transportation also shows the range of average topsoil and subsoil depths within the LAA (Volume 4, Appendix G Table 3-22), and many areas have more than 0.25 m of topsoil and 0.25 m of subsoil, and map units within the Regosol soil order have less than 0.25 m of topsoil and 0.25 m of subsoil.

a. Explain how the conservation (salvage) depths for topsoil and subsoil were selected.

b. Explain why unique conservation (salvage) depths for topsoil and subsoil were not selected for the dominant soil orders within each Project feature area as an effort to reduce over-stripping and admixing.

c. Explain the measures that will be implemented in areas where the colour transition between the topsoil and subsoil is not visually apparent.

d. Discuss the potential residual impacts on the environment for PDA areas that are not represented by the selected salvage depths of topsoil and subsoil.

367. Volume 4, Appendix D, Section 4.4.2, Table 4-3, Page 4.12
Volume 4, Appendix D, Section 5.2.2, Table 5-1, Page 5.5

Alberta Transportation states in Note 3 on both tables in Volume 4, Appendix D that Borrow Source #1 *will be developed and reclaimed in compliance with the requirements of Alberta Transportation 2013b and GoA 2004*.

a. Summarize the relevant portions of these references and explain how they relate to soil handling and reclamation of borrow sources for this Project.

b. Summarize how the processes in these references will help to mitigate potential effects from borrow source development.

368. Volume 4, Appendix D, Section 5.2, Page 5.3
Volume 3A, Section 9.4.3.3, Table 9-14, Page 9.38
Volume 3A, Section 9.4.3.3, Figure 9-13, Page 9.40
Volume 3A, Section 9.1.3, Table 9-1, Page 9.3
Volume 3A, Section 9.4.3.2, Page 9.36

Volume 1, Section 3.3.14, Page 3.24
Volume 4, Appendix D, Figure 4-1, Page 4.13
Alberta Transportation states in Volume 4, Appendix D that *Undisturbed soil profiles consist of topsoil that overlies subsoil and unaltered parent materials; however, this is not the case with soil that has been salvaged and is replaced in the landscape. The replaced materials might be technically the same if what is removed is replaced in two lifts, but they will be functionally different*. However, the project construction areas within the off-stream reservoir basin where soil will be stripped, salvaged, and replaced appear to have not been accounted for in the Changes in Extent of Agricultural Land Capability in Table 9-14 and Figure 9-13 (Volume 3A).

a. Clarify the areas within the off-stream reservoir basin that will be stripped, salvaged, and reclaimed with subsoil and topsoil. Provide figures to illustrate these areas.

b. Explain why areas within the reservoir that will be stripped and reclaimed are not included in the post-construction and reclamation changes in the extent of agricultural land capability (Table 9-14 and Fig 9-13).

c. Revise Table 9-14 to include changes in agricultural land capability after construction for areas that will be stripped and reclaimed.

d. Revise Figure 9-13 to illustrate changes in agricultural land capability after construction for areas that will be stripped and reclaimed.

369. Volume 4, Appendix D, Section 5.2.2, Page 5.3
Volume 4, Appendix D, Section 4.5, Page 4.14
Volume 4, Appendix D, Section 4.2, Page 4.5
Alberta Transportation states that *After rough grading of permanent features has been completed, areas where soil replacement and revegetation occur would be de-compacted, as directed by the environmental inspector*.

a. Clarify the agency, department, or company who would employ the environmental inspector.

b. Clarify the role and qualifications of the environmental inspector to the environmental supervisor identified in Section 4.2.

370. Volume 4, Appendix G, Technical Data Report, Section 3.2.6.10, Page 3.70
Volume 4, Appendix G, Technical Data Report, Section 3.3.1, Page 3.76
Volume 4, Appendix G, Technical Data Report, Section 3.2.6.10, Tables 3-38, 3-39, 3-40, and 3-41
Volume 3A, Section 9.2.4, Tables 9-7 and 9-8, Pages 9.22 and 9.23
Volume 3A, Section 9.2.4, Figures 9-5, Page 9.25
Volume 3A, Section 9.2.4, Figures 9-7 and 9-8, Pages 9.27-9.28
Volume 3A, Section 9.4.3.3, Table 9-15, Page 9.41
Alberta Transportation states in Volume 4, Appendix G that *For the second lift, most of the LAA—except for the portions not rated (5%) for reclaimed and disturbed soil units, and the medium to coarse-textured glaciofluvial units (SRCca, TBR and ZGC)—is rated as poor (81%) to unsuitable (4%).* Alberta Transportation concludes that *LAA soils typically had fair reclamation suitability for the first lift and poor reclamation suitability for the second lift.*

a. Evaluate and discuss potential Project effects related to poor and unsuitable reclamation suitability ratings for construction and reclamation.

b. Explain why areas of reclaimed and disturbed land (identified in Volume 3A, Figure 9-5) are deemed *Not Applicable* in Volume 3A, Tables 9-7, 9-8 and Figures 9-7 and 9-8 for Reclamation Suitability.

c. Provide a figure to illustrate the Changes in Extent of Reclamation Suitability Class that are listed in Table 9-15 in Volume 3A.

d. Describe the mitigation measures to account for the poor and unsuitable reclamation suitability ratings for the second lift in the LAA.

e. Describe the potential residual impacts of poor and unsuitable reclamation suitability ratings for the second lift, following implementation of the mitigation measures.

371. Volume 3A, Section 10.3.1, Table 10-11, Page 10.38, Page 10.39
Volume 3A, Section 10.4.1, Page 10.40
Volume 4, Appendix D, Section 4.1.1, Page 4.4
Volume 4, Appendix D, Section 5.3, Table 5-2, Page 5.6

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.

372. Volume 3A, Section 10.4.1, Page 10.40
Volume 4, Appendix D, Section 4.1.1, Page 4.4
Volume 4, Supporting Documentation. BMP 22, Page viii (page 605 of 884)
Alberta Transportation states *agricultural cover types that are disturbed by the Project would be reclaimed using Alberta Transportation agronomic seed mix and are predicted to become tame pasture*. Examination of the agronomic seed mixture indicates two of the perennial species (Dahurian wild rye and pubescent wheatgrass) proposed in the mixture tend to be short lived under Alberta's environmental conditions and the third perennial species (Sheep fescue) is known to invade native fescue grasslands.

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.

373. Volume 3A, Section 8.4.3.7, Page 8.54
Volume 3A, Section 9.4.2.2, Page 9.33
Volume 3B, Section 9.2.2.2, Page 9.5
Regarding reclamation Alberta Transportation states *streambanks and approach slopes will be revegetated using an appropriate native seed mix or erosion control mix.* Similar comments are made regarding channel banks and channel bank stability.

a. What species are under consideration in the event an erosion control mix is used and how does the composition of such a mixture differ from a native seed mix? Explain how species under consideration in the erosion control mix were determined. Provide the justification behind why the erosion control mix and the native species mix will be different if at all.

6.3 Terrain and Soils

374. Volume 1, Section 3.2, Figure 3-1, Page 3.3
Volume 1, Section 3.2.4, Page 3.12
Volume 1, Section 3.3.1.4, Page 3.24
Volume 4, Appendix D, Table 2-2, Page 2.5
Volume 4, Appendix D, Figure 2-2, Page 2.7

Volume 4, Appendix D, Section 4.4.2, Table 4-3, Page 4.11
Volume 4, Appendix D, Section 5.2.2, Table 5-1, Page 5.5
Alberta Transportation illustrates two borrow source areas on Figure 3-1 in Volume 1. However, only one borrow source is mentioned elsewhere in Volume 1 and Volume 4, Appendix D. For example, Alberta Transportation states in Volume 1 that *Should the amount of soil material generated by excavation of the diversion channel be insufficient to meet all the construction requirements for fill, the shortfall will be made up with material excavated from the borrow area in the reservoir* and *The borrow area construction sequence will be: pre-construction inspection…*

a. Clarify and harmonize the number of borrow source areas to be utilized.

b. Describe the *pre-construction inspection* protocols for the borrow area construction sequence (Volume 1, Page 3.24).

c. Describe the analytical sampling methods and laboratory testing that will be conducted on soil samples from the source area(s) to ensure the borrow material does not contain any potential contaminants of concern, including but not limited to salinity, anions and cations, nutrient parameters, petroleum hydrocarbons, and metals.

d. Describe the mitigation measures that will be taken should the borrow material contain contaminants of concern.

e. Describe the storage, transport, and disposal methods that will be undertaken should the borrow material contain contaminants of concern.

375. Volume 1, Section 3.2.1.2, Page 3.7
Alberta Transportation states that the service spillway will include a *concrete stilling basin backfilled with native substrate*.

a. Describe and map the source of the native substrate to demonstrate that the source soil is located away from areas that may have been previously contaminated by anthropogenic activities, and thus is suitable as construction material.

b. Describe the field screening methods and laboratory analytical testing that will be conducted to ensure that the native substrate does not contain any potential contaminants of concern, including but not limited to salinity, anions and cations, nutrient parameters, petroleum hydrocarbons, and metals.

c. Describe mitigation measures that will be undertaken if native substrate is found to contain potential contaminants of concern.

376. Volume 1, Section 3.2.1.4, Page 3.9
Volume 1, Section 3.2.1.4, Figure 3-5, Page 3.9
Volume 1, Section 3.3.1.2, Page 3.23
Alberta Transportation states that the floodplain berm is *an earth embankment*, and Figure 3-5 shows that *Random Fill* will be used in Zone 2A.

a. Describe and map the source of the earth and random fill to demonstrate that the source soil is located away from areas that may have been previously contaminated by anthropogenic activities and thus is suitable as clean construction material.

b. Describe the field screening methods and laboratory analytical testing that will be conducted to ensure that the earth and random fill does not contain any potential contaminants of concern, including but not limited to salinity, anions and cations, nutrient parameters, petroleum hydrocarbons, and metals.

c. Describe mitigation measures that will be undertaken if earth or random fill is found to contain potential contaminants of concern.

377. Volume 1, Section 3.2.1.5, Page 3.10
Volume 1, Section 3.2.1.5, Figure 3-6, Page 3.10

Alberta Transportation states that the auxiliary spillway is *a roller compacted concrete (RCC) gravity structure founded on bedrock and covered with earth*, and Figure 3-6 states that *Fill Anticipated to Erode for Major Storm Events* will cover the concrete.

a. Describe and map the source of the earth fill/ backfill to demonstrate that the source soil is located away from areas that may have been previously contaminated by anthropogenic activities, and thus is suitable as construction material.

b. Describe the field screening methods and laboratory analytical testing that will be conducted to ensure that the earth fill/ backfill does not contain any potential contaminants of concern, including but not limited to salinity, anions and cations, nutrient parameters, petroleum hydrocarbons, and metals.

c. Describe mitigation measures that will be undertaken if earth fill/ backfill is found to contain potential contaminants of concern.

d. Describe potential residual impacts if earth fill/ backfill containing potential contaminants of concern is eroded during major storm events.

378. Volume 1, Section 3.2.5, Pages 3.14-3.15
Volume 1, Section 3.2.5, Figure 3-8, Page 3.14
Volume 1, Section 3.2.5, Figure 3-9, Page 3.15

Alberta Transportation states that *the dam includes two zoned earthen embankments*…and Figure 3-8 shows *Embankment Core* and Figure 3-9 shows *Impervious Zone 1A* and *Random Fill Zone 2A.*

a. Describe and map the relationship between the two zoned embankments, the Primary Embankment (Figure 3-8) and Secondary Embankment (Figure 3-9), of the off-stream dam and their components. For example, explain the relationship between the Embankment Core and the Impervious Zone 1A.

b. Describe and map the source of the earth fill to demonstrate that the source soil is located away from areas that may have been previously contaminated by anthropogenic activities, and thus is suitable as construction material.

c. Describe the field screening methods and laboratory analytical testing that will be conducted to ensure that the source soil does not contain any potential contaminants of concern, including but not limited to salinity, anions and cations, nutrient parameters, petroleum hydrocarbons, and metals.

d. Describe mitigation measures that will be undertaken if source soil is found to contain potential contaminants of concern.

379. Volume 1, Section 3.2.8.1, Pages 3.20 and 3.21
Volume 1, Section 3.2.8.1, Figure 3-12, Page 3.21

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.

380. Volume 1, Section 3.2.8.2, Page 3.22

Alberta Transportation states that *AltaLink operates a transmission line that crosses the diversion channel (Figure 3-12). Power pole locations will be adjusted to permit a clear span over the channel.*

a. Describe field screening methods and laboratory analytical testing that will be conducted to ensure that the soil remaining in the footprint of the relocated power poles does not contain any potential contaminants of concern.

b. Describe mitigation measures that will be undertaken if soil remaining in the footprint of the relocated power poles is found to contain potential contaminants of concern.

381. Volume 1, Section 3.3, Page 3.22 and 3.23

Alberta Transportation states that *Other Alberta Transportation guidance documents that apply to the project deal specifically with erosion and sediment control (Alberta Transportation 2011) and borrow excavations (Alberta Transportation 2013a, 2013b, 2013c).*

a. Summarize the relevant portions of these references in terms of environmental protection during construction related to erosion, sediment control, and borrow excavations.

b. Summarize how the processes in these references will help to mitigate potential effects from construction of the Project.

382. Volume 1, Section 3.6.1, Table 3-10, Page 3.37
Volume 1, Section 3.6.5, Page 3.38
Volume 1, Section 4.5, Table 4-1, Page 4.2
Volume 3B, Section 9.1, Page 9.2

Volume 3B, Section 9.2.3.2, Page 9.8
Volume 4, Appendix D, Section 6.2, Page 6.2

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.

383. Volume 1, Section 3.6.5, Page 3.38
Volume 1, Section 3.6.1, Table 3-10, Page 3.37
Volume 1, Section 4.5, Table 4-1, Page 4.2

a. Alberta Transportation states that Wastes generated during post-flood operations would consist primarily of sediment and debris removed from Project Components and that sediment will be landfill tested and either integrated into the landscape or hauled to an appropriate facility.

b. Describe sampling methods, field screening methods and laboratory analytical testing that will be conducted to assess whether post-flood sediment contains any potential contaminants of concern, including but not limited to salinity, anions and cations, nutrient parameters, petroleum hydrocarbons, and metals.

c. Describe conditions where flood sediment may be integrated into the landscape.

d. Describe how flood sediment may be integrated into the landscape.

e. Provide a figure to illustrate the landscape where flood sediment may be integrated.

f. Describe evaluation criteria that will be used to assess whether post-flood sediment will be suitable for integration into the landscape or require disposal at an appropriate facility.

g. Define appropriate facility as stated in Table 4-1.

384. Volume 3A, Section 9.2.3, Page 9.16
Volume 4, Appendix G, Technical Data Report, Section 1.2, Page 1.3
Volume 4, Appendix G, Technical Data Report, Section 3.1.1.1, Page 3.1
Alberta Transportation described the physical setting of the Local Assessment Area (LAA) using data *obtained from published sources including AGRASID (Alberta Soil Information Centre 2003) and from the soil survey for the Calgary Urban perimeter (MacMillan 1987).*
The methods do not include a Phase 1 Environmental Site Assessment to review existing background information on potential soil contamination from previous or current anthropogenic activities.

a. Provide figures and summarize the results of database reviews for potential existing soil contamination within the LAA and PDA, including, but not limited to a search of the Environmental Site Assessment Repository (ESAR).

b. Identify all potential historic and current anthropogenic activities within the LAA and PDA that may be a source of existing soil contamination, including but not limited to:
   i. Oil and gas activities, including two sites with historic Surface Land Reclamation Certificates
   ii. Agricultural farm sites
   iii. Highway maintenance yards
   iv. Underground and aboveground storage tanks
   v. Septic fields and underground septic systems
   vi. Garbage pits or unregistered landfills

c. For each anthropogenic activity identified, describe how potential soil contamination will be investigated. Describe the field screening methods and laboratory analytical testing that will be conducted to ensure that the soil in these areas does not contain any potential contaminants of concern.

d. For each anthropogenic activity identified, describe how impacts from potential soil contamination will be mitigated.

e. For each anthropogenic activity identified, describe how residual impacts from potential soil contamination that cannot be mitigated may affect the Project components and the environment.

385. Volume 3A, Section 9.2.4, Page 9.16
Alberta Transportation states that *Reclaimed and disturbed land makes up approximately 5.2% of the LAA.*

a. Describe and map each occurrence of reclaimed or disturbed land, at a 1:5000 scale or finer resolution.

b. Identify measures that will be taken to ensure the physical and chemical suitability of the soil from reclaimed and disturbed land for inclusion in the components of the reservoir Project.

c. Describe the field screening methods and laboratory analytical testing that will be conducted to ensure that the soil in these areas does not contain any potential contaminants of concern that could be mobilized into flood water, groundwater, or surrounding soil as a result of the use of the reservoir during and after flood

operations. The contaminants of potential concern include but are not limited to salinity, anions and cations, nutrient parameters, petroleum hydrocarbons, and metals.

d. Describe mitigation measures for impacts from potential contaminants of concern in soil.

386. Volume 3A, Section 9.6, Page 9.44

Alberta Transportation states that *If borrow pit development becomes more certain, additional standards of Alberta Transportation (2013) could be applied to better characterize topsoil and subsoil properties in the specific borrow sites*.

a. Describe and explain how these standards differ from the approaches to characterize topsoil and subsoil in all other areas of the Project Development Area.

387. Volume 3B, Section 9.2.3, Page 9.6

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.*

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.

388. Volume 3B, Section 9.2.3.1, Page 9.7
Volume 3B, Section 9.2.3.2, Page 9.8

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.

389. Volume 3B, Section 9.2.3.2, Page 9.8

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.

390. Volume 3B, Section 9.2.3.2, Page 9.8
Volume 4, Appendix D, Section 6.2, Page 6.2
Volume 3B, Section 9.2.3.1, Page 9.7
Volume 3B, Section 9.2.3.3, Page 9.11
Volume 4, Appendix D

Alberta Transportation states that *Most sediment deposition thicknesses would be less than 0.5 m but there would be some areas with 1.0 m to 3.0 m thickness and a few isolated areas with up over 4 m thickness(see Section 6). This sediment is not expected to be removed*. However, Alberta Transportation states in Volume 4, Appendix D that *The reservoir has been designed so that it can function as required with up to 10% of its capacity lost…It is, therefore, not necessary to remove post-flood deposits that do not reach this level*.

a. Clarify the sediment deposition thickness that will and will not be removed.

b. Describe all potential changes to the physical properties of soil during a flood or post-flood, including but not limited to texture, structure, and bulk density.

c. Discuss mitigation measures that will be undertaken to address potential changes to all soil physical properties.

d. Provide the mitigation measures for post-flood sediment deposition to include all potential mitigation measures that may occur under different sediment depths.

e. Identify and describe all residual impacts of the Project on all physical soil properties following implementation of mitigation measures for post-flood sediment.

f. Identify and describe residual impacts for the different sediment depths that may remain in the reservoir.

391. Volume 3B, Section 9.2.3.3, Page 9.11
Volume 3B, Section 9.2.3.2, Page 9.8

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.

392. Volume 3B, Section 9.2.3.3, Page 9.12

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.

393. Volume 3B, Table 9-7, Page 9.22
Volume 3B, Section 9.2.4, Page 9.23
Volume 3B, Section 9.3, Page 9.23 and 9.24

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.

394. Volume 4, Appendix D, Section 5.4, Page 5.7
Volume 4, Appendix D, Section 5.4.1, Page 5.8
Volume 3C, Section 2.8, Page 2.10

Alberta Transportation states in Volume 4, Appendix D that *Alberta Environment and Parks will be responsible for instituting short and long-term monitoring programs for the Project lands and lists* soil parameters that may be assessed.

a. Provide a Construction Monitoring Plan to ensure that soil used within the Project (i.e. used as base or berms) does not contain potential contaminants of concern.

b. Provide the framework for the Short-Term Soil Monitoring Plan mentioned in Volume 4, Appendix D, Section 5.4. Identify parameters and metrics that will be monitored, providing rationale for each parameter/ metric.

c. Provide a Post-Flood Sediment Monitoring Plan to assess post-flood sediments for potential contaminants of concern and to ensure appropriate handling and disposal as required.

d. Clarify the terrain and soils monitoring required in Volume 3C during the different Project phases.

395. Volume 4, Appendix G, Attachment 9A, Section 9A.2.3, Page 9A.3
Volume 4, Appendix G, Technical Data Report, Section 1.2.5, Page 1.6
Volume 4, Appendix G, Technical Data Report, Section 1.1, Page 1.1
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.

396. Volume 4, Appendix G, Attachment 9A, Section 9A.3, Page 9A.18
Volume 3B, Section 9.2.3.2, Page 9.9
Volume 4, Appendix D, Section 4.6, Page 4.15
Alberta Transportation states in Volume 4, Appendix G that *An alternative (it will protect soil from wind erosion over winter) is using a tackifier… It is proposed that a sprayable erosion control product be applied to the reservoir floodplain to reduce soil erodibility due to wind if vegetative controls are not effective. An example sprayable erosion control product is composed of thermally processed wood fibre, wetting agents, and other ingredients.*

a. Identify the ingredients (chemical constituents) in the tackifier or sprayable erosion control product.

b. Discuss whether the tackifier or sprayable erosion control product may release contaminants into the environment.

c. Describe mitigation measures that will be undertaken if the ingredients in the tackifier or sprayable erosion control products contain potential contaminants of concern.

d. Describe the potential residual impacts of the Project following implementation of mitigation measures for the tackifier or sprayable erosion control products.

397. Volume 4, Appendix G, Technical Data Report, Section 3.1.3, Pages 3.6-3.7
Volume 4, Appendix G, Technical Data Report, Attachment C.4 and C.5

Alberta Transportation states that *Selected horizons were analyzed for one or more of the following soil properties:*

- *pH and electrical conductivity (saturated paste)*
- *soluble cations (calcium, magnesium, sodium and potassium) and anions (sulphate, chloride)*
- *saturation percentage and sodium adsorption ratio (SAR)*
- *cation exchange capacity and base saturation of upper horizons*
- *exchangeable calcium, magnesium, sodium, potassium*
- *calcium carbonate equivalent*
- *total organic carbon*
- *particle size analysis.*

All soil properties listed in this section have not been reported in Attachment C.4 and C.5. For example, cation exchange capacity, chloride and sulphate results are missing from Table C-17. Also, the Maxxam Certificate of Analysis is titled "Partial Results".

a. Explain why some of the soil properties are missing from the results and laboratory reports.

b. Explain why the Maxxam laboratory analytical package was changed from Salinity 4 to Salinity 3, as indicated on the Chain of Custody Record for Maxxam Job # B690828 D_T.

c. If all stated soil properties were not analyzed, describe how and when the missing data will be collected, or justify why the missing data is not required for assessment of the Project effects.

398. Volume 4, Appendix G, Technical Data Report, Section 3.1.3, Page 3.7

Alberta Transportation states that *Previously published sources of chemical data were used when analytical results were not available from samples collected*.

a. Identify the previously published sources used, and identify the resulting data that was used.

b. Explain why analytical results were not available from samples collected. If analytical results are now available, provide them.

399. Volume 4, Appendix G, Technical Data Report, Section 3.2.6.7, Page 3.54
Volume 4, Appendix G, Technical Data Report, Figures 3-13 and 3-14, Pages 3.58-3.59
Volume 4, Appendix G, Technical Data Report, Tables 3-29, 3-30, 3-31, and 3-32, Pages 3.55-3.57
Volume 4, Appendix G, Technical Data Report, Section 3.3.1, Page 3.76

Volume 3A, Section 9.1.3, Table 9-1, Page 9.3
Volume 3B, Section 9.1, Table 9-2, Page 9.3
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.

400. Volume 4, Appendix G, Technical Data Report, Tables 3-33, 3-34, 3-35, Pages 3.61-3.62
Volume 4, Appendix G, Technical Data Report, Figures 3-15 and 3-16, Pages 3.63-3.64
Volume 4, Appendix G, Technical Data Report, Section 3.2.6.8, Page 3.60
Volume 4, Appendix G, Technical Data Report, Section 3.3.1, Page 3.76
Volume 3A, Section 9.1.3, Table 9-1, Page 9.3
Volume 3B, Section 9.1, Table 9-2, Page 9.3
Alberta Transportation indicates in Tables 3-33, 3-34, and 3-35 that 49% of the LAA is rated as moderate to high soil rutting risk. However, potential effects of soil rutting have not been evaluated for the different Project phases.

a. Evaluate and discuss potential soil rutting effects during construction and dry operations.

b. Evaluate and discuss potential soil rutting effects during flood and post-flood operations.

c. Describe mitigation measures at each Project phase to address the moderate to high soil rutting risk for topsoil and subsoil.

d. Describe the potential residual impacts of each Project phase related to moderate to high soil rutting risk for topsoil and subsoil, following implementation of the mitigation measures.

6.4 Vegetation

401. Volume 1, Section 1.3.2.1, Figure 1-8, Pages 1.12 and 1.13

Alberta Transportation states *there is limited or no public access* planned for Area B as it is the reservoir. Given that flooding of the reservoir is anticipated to occur infrequently has Alberta Transportation considered grazing or haying of all or part of Area B in years once the peak flood risk has passed without incident to:

a. Mitigate against the potential fire hazard created by unutilized vegetative biomass production?

b. Mitigate against the potential creation of favourable microsites for noxious weed colonization commonly associated with unutilized vegetative biomass production over extended periods?

402. Volume 1, Section 3.4.1, Page 3.33
Volume 3A, Section 6.2.2.4, Figure 6-12, Page 6.31
Volume 3A, Section 10.1.3. Table 10-1, Page 10.7
Volume 3A, Section 10.2.2.2, Figure 10-3, Pages 10.19 and 10.20
Volume 3A, Section 10.4.3, Table 10-12, Pages 10.46 to 10.49

Alberta Transportation states potential *changes in wetland function include indirect alteration of surface and groundwater flow patterns*.

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.

403. Volume 3B, Section 6.4.3.2, Figure 6-12, Pages 6.29 and 6.31
Volume 3B, Section 6.4.3.3, Figure 6-17, Pages 6.39 and 6.40
Volume 3B, Section 10.2.4, Table 10-12, Pages 10.25 and 10.26

Alberta Transportation states up to 3.8 *m* depths of sediment deposition are possible in portions of the reservoir following a design flood with comparable amounts of sediment possible in the event of a 1:100 flood.

a. In a 1:100 flood or design flood could enough sediment be deposited to alter the topography of the reservoir to the point where some lowland areas near the low level outlet no longer function as wetlands and shift to upland habitat? If so, are the areas

referenced in Table 10-12 of 1.4 ha of high value wetland, 3.4 ha of moderate value wetland, and 0.04 ha of low value wetland the total expected permanent loss of wetland following a design flood due to sediment deposition or is the total lost wetland area potentially greater? If the area is potentially greater provide the supporting documentation and the updated areas of wetlands to be affected. If this is not expected to occur provide the justification behind how this conclusion was reached.

404. Volume 3A, Section 10.2.1.2, Page 10.15

Alberta Transportation states *specimens requiring further examination or species confirmation were collected with the exception of plants where seed heads or flowers required for identification to species level were unavailable or where plant populations were small… Photographs were taken of the specimen and notes made on the development stage and health.*

a. Were any potentially rare plant species noted where insufficient vegetative material existed to positively identify small patches or single plant occurrences to species level?

b. If so, how many sites/species were identified in the plant surveys? Provide a map outlining where these species were located.

405. Volume 3A, Section 10.2.2.3, Table 10-5, Pages 10.22, and Pages 10.24 to 10.28
Volume 4, Appendix L, Section 10A.2, Table 10A-1, Page 10A.20

Alberta Transportation states *twelve lichens, two liverworts, fourteen mosses…species of management concern have also been previously identified within the RAA* (Regional Assessment Area) yet only one non-vascular plant species was identified within the project development area.

a. Was only one non-vascular species present within the Project Development Area or was the intent of the plant survey to focus on vascular plant species? If more non-vascular plant species were found within the PDA list these species and their abundance. Why were these excluded from the EIA? Update the tables and the section as required to reflect these species. What are the proposed mitigation measures for the non-vascular plant species in the PDA?

406. Volume 3A, Section 10.2.1.1, Page 10.12
Volume 3A, Section 10.2.2.2, Figure 10-3
Volume 3A, Section 10.2.2.2, Table 10-4, Page 10.21 and 10.22

Alberta Transportation states *upland land units (ecosites) were classified using Range Plant Communities and Range Health Assessment Guidelines for the Foothills Parkland Subregion of Alberta* for the Local Assessment Area. Assessment of the level of existing disturbance within native plant communities is better determined through determination of the plant community types as opposed to the ecosite phase.

a. Did the field surveys of the native plant communities within the Project Development Area contain sufficient information to describe the actual plant communities present? If so, provide this data.

b. What was the per cent cover of non-native species noted in the native plant communities within the Project Development Area?

407. Volume 4, Appendix D, Section 5.4, Pages 5.7 and 5.8
Volume 4, Appendix D, Section 6.2, Page 6.2
Regarding monitoring of revegetation success for both post-construction phase and post-flood phase has Alberta Transportation developed:

a. Threshold densities of plant cover below which attempts at re-seeding are triggered? If so what are these threshold densities? How were these densities determined? If no threshold densities have been developed explain why not.

b. Threshold lengths of time where insufficient revegetation will trigger further re-seeding attempts? If so what are these threshold lengths of time? How were these lengths of time determined? How often will monitoring take place after re-seeding to determine if there is insufficient vegetation or will the same length of time originally applied be used? If no threshold lengths of time are developed explain why not.

6.5 Wildlife

408. Volume 3A, Section 11.1.4, Page 11.10
Volume 3A, Section 11.1.4.1, Table 11-3, Page 11.11
Volume 3A , Section 11.4.4.1 , Page 11.61
In Section 11.1.4 Alberta Transportation stated that *some effects on wildlife lack defined, quantifiable parameters to measure such affects…For example, increased mortality risk due to increased traffic volumes and potential vehicle collisions with wildlife is assessed qualitatively*. However, Section 11.4.4.1 references a data set; *Alberta Transportation, 2017. Animal-vehicle collision data set for Highway 22*. As well, AB Transportation collects wildlife movement and monitoring data via the Alberta Wildlife watch App and RCMP collision reports and AEP records wildlife collision data in the ENFOR Occurrence system.

a. Explain why these data were not used to quantify site specific mortality due to increased traffic volumes and vehicles collisions.

b. Provide a map of these collision locations in the PDA, LAA, and RAA.

409. Volume 3A, Section 11.1.4, Table 11-3, Page 11.11
Volume 3B , Section 11.4.1, Table 11-2, Page 11.4
Volume 4, Appendix H, Section 3.7.1, Figure 3-5, Page 3.28
Volume 4, Appendix H, Section 3.7.3, Page 3.32
Alberta Transportation indicated that for wildlife *Effects on change in movement is assessed qualitatively* for both construction and dry operations, and for flood and post flood operations. 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.

410. Volume 1, Section 2.2.6, Pages 2.26 to 2.33
Volume 3A, Section 11.4.3, Page 11.56
Volume 3B, Section 11.3.3, Page 11.22

In Volume 1 Section 2.2.6 Alberta Transportation discussed the *Realignment and Modifications of Public Roads*. Volume 3A Section 11.4.3 and Volume 3B Section 11.3.3 Alberta Transportation discussed changes in movement in broad terms but did not specifically indicate how changes to the road system will impact ungulate movement.

a. Explain how the upgrades to Highway 22 will affect ungulate and bear movement on the Highway 22 and Springbank roads.

b. Explain how detours on Range Road 40, under the existing Highway 1 underpass, then west on Township Road 250 to Highway 22 will impact ungulate movement.

c. Explain how the EIA assessment and monitoring methods enable or prevent the ability to detect project effects via adequacy or lack of statistical power in the sampling design as it relates to wildlife movement.

d. Quantify highway and dam operations traffic volumes expected as a result of the project and indicate how this will impact wildlife.

411. Volume 1, Attachment A, Section A.2.1.6, Page A.9

Alberta Transportation stated that *The road and bridge works will be constructed using standard equipment, materials and methods codified in Alberta Transportation's Standard specifications for highway construction*. Road and bridge infrastructure will affect wildlife movement.

a. Explain whether designs that facilitate wildlife movement were considered and if not, provide rationale for why these designs were not considered.

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.

413. Volume 4, Appendix C, Table C-1, Page C.13

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.

414. Volume 3A, Section 11.7, Pages 11.88 and 11.89
Volume 3B, Section 11.6, Pages 11.55 and 11.56

The assessment conclusions for both the Construction and Dry Operation Phases, and the Flood and Post Flood Recovery phases indicate that the project is *unlikely* to impact wildlife through changes in habitat, movement, mortality or biodiversity. However, given that all assessments were qualitative, there are no quantities provided to numerically indicate what the impacts might be.

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.

415. Volume 3A, Section 11.4.3.3, Page 11.60
Volume 3A, Attachment, Table A-1, Page A.13
Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report, 3.6.1, Page 3.27
Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report, 3.6.1, Table 3-9, Pages 3.24 to 3.26

Grizzly bears are known to frequent areas to the north of the Elbow River and along highway 22 including north of the TransCanada highway, with historical sightings and occurrences recorded in the ENFOR database by AEP.

a. AEP bear use of the area is known to be greater than what this EIA monitoring reports. How will proposed public access to this acquired land affect grizzly bear conflict and conflicts with other wildlife species?

416. Volume 3A, Section 11.2.2.4, Figures 11-6 & 11-7

Elk summer and winter feeding habitat suitability is mapped. It identifies areas near roadways as very low quality habitat yet some of these areas are critical to movement and mortality risk.

a. Explain why other types of habitat suitability for elk were not mapped (movement etc.)

b. How will the future presence of people and roads caused by this dams activities effect future habitat values along roadways or human access areas?

417. Volume 3A, Section 11.4.3, Page 11.56
Volume 3B, Section 11.3.3, Page 11.22

The Concordance Table indicates the above Sections provide required information on *how improved or altered access may affect wildlife*… however, the impact of changes to access is not cleared outlined.

a. Clearly outline how changes to access may impact wildlife.

418. Volume 3A, Section 11, Attachment A, Table A-1, Page A.13 and A.15

Alberta Transportation sites *wildlife-human conflict (e.g. removal of nuisance animals)* as a potential project effect on both grizzly bears and elk. However, this effect is not clearly assessed in the EIA. For grizzly bears, destruction of dens is also a potential project effect.

a. Define nuisance animals and outline how they will be dealt with.

b. Quantify the potential effect on elk and grizzly bears of wildlife-human conflict.

c. Quantify the potential effect on wildlife den destruction.

d. Define nuisance animals and outline how they will be dealt with.

e. Quantify the potential effect of wildlife-human conflict on elk and grizzly bears.

f. Quantify the potential effect of wildlife-human conflict on wildlife den destruction.

g. Define nuisance animals and outline how they will be dealt with.

h. Quantify the potential effect of wildlife-human conflict on elk and grizzly bears and wildlife den destruction.

419. Volume 3A, Section 11.4.2, Page 11.52

Construction activities are predicted to result in both a permanent loss of habitat due to the infrastructure footprint and a temporary loss of ungulate habitat due to construction activities and sensory disturbance. A total of approximately 117 ha of high and 377 ha of moderate winter elk feeding habitat will be affected by the Project.

a. Detail how this will affect elk movement and habitat use.

b. Why wasn't elk habitat mapped along the highway buffers in the associated maps?

c. Explain why the habitat wasn't mapped along roads and identified before being buffered in the maps?

420. Volume 3A, Section 11.4.2.3, Page 11.52 and 11.53
Volume 3A Section 10.3.1, Page 10.39

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?

421. Volume 3C, Section 2.9.1, Page 2.11

a. Clarify how you can native upland vegetation and wetland community's habitat is predicted to be altered, but there is no loss of this habitat.

b. How will plant species and community change be determined after the dam is completed and after each flood event? Provide the plant survey methodology that was used in the assessment.

422. Volume 3B, Section 10.2.2, Page 10.3

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.

423. Volume 1, Attachment A, Water management Plan, Figure A-3, Page A-25
Volume 1, Attachment A, Water management Plan, Figure A-4, Page A-26

a. Explain whether downstream wildlife habitat will still receive periodic floods adequate to maintain habitat function and health.

424. 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.

425. Volume 4, Appendix C, Table C-1, Page C.14

a. Detail what the wildlife mitigation and monitoring plan content will include.

426. Volume 3C, Section 2.10, Page 2.12

a. Explain the rationale why monitoring is only for a limited group of species and will only occur for a few select locations of the project.

b. Why were amphibian and avian surveys not proposed post-construction as these species will not be captured via remote camera surveys?

427. Volume 3A, Section 11.4.5.2, Page 11.66

a. Provide rationale why there are no additional mitigation measures recommended when there are many mitigation measures that would be effective at further reducing impacts on wildlife.

428. Volume 4, Appendix C, Table C-1, Page C.36

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.

429. Volume 3A, Section11.1.1.1, Table 11.2 , Page 11.4

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?

430. Volume 3A, Section 11.2.2.5, Page 11.37

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?

431. Volume 3A, Section 11.2.1.2, Page 11.20
Volume 3A, Section 11.6, Page 11.88
Volume 3A, Section 11.1, Page 11.1
Alberta Transportation indicates that *wildlife field surveys were conducted in the LAA to estimate wildlife abundance and distribution*.

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.

432. Volume 3A, Section 11.4.5.3, Page 11.66

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.

433. 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.)?

434. Volume 3A, Section 11.4.3.1, Pages 11.56

a. Explain why change in mortality risk and movement did not identify areas where conflicts should be addressed via planning, design, and mitigation, as well as monitoring.

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.

7 Health

436. Springbank Final Terms of Reference, 6.2 [A] a), c), d), e)

The Final Terms of Reference (fTOR) 6.2[A] states *[A] Describe aspects of the Project that may have implications for public safety. Specifically:*

a) describe the emergency response plan including public notification protocol and safety procedures to minimize adverse environmental effects, including emergency reporting procedures for spill containment and management;
b) document any safety concerns raised by stakeholders during consultation on the Project;
c) describe how local residents will be contacted during an emergency and the type of information that will be communicated to them;
d) describe the existing agreements with area municipalities or industry groups such as safety cooperatives, emergency response associations, regional mutual aid programs and municipal emergency response agencies; and
e) describe the potential safety impacts resulting from higher regional traffic volumes.

Supporting information addressing all Public Safety in the fTOR were not provided for 6.2 [A] a), c), d), e) in the revised EIS.

a. Provide supporting information to address fTOR 6.2[A] a), c), d) and e).

437. Volume 3A, Section 15.4.1.4, Table 15-10, Page 15.41
Volume 4, Appendix O, Section 4.2.1, Pages 4.5 and 4.6

In Table 15-10, Alberta Transportation states the criteria health effects for $PM_{2.5}$ are *not specified*; whereas the toxicological discussion of $PM_{2.5}$ in Appendix O describes health effects associated with exposure to $PM_{2.5}$ as cardiovascular and respiratory morbidity and mortality. The potential adverse health effects associated with exposure to $PM_{2.5}$ is well described in the literature (Health Canada and WHO). Table 15-10 and Appendix O contradict each other.

a. Explain why Alberta Transportation states that the criteria health effects for $PM_{2.5}$ are not specified when there is data supporting health effects with $PM_{2.5}$ in Appendix O.

b. Update Table 15-10 as required so that the information is representative of the information in Appendix O.

438. Volume 4, Appendix O, Section 4.2.1, Page 4.3

Alberta Transportation states *As NO_2 has been classified as having non-threshold effects, the acute and chronic TRVs for NO_2 are based upon the CAAQS, as they are more conservative than the AAAQO and NAAQO*.

a. Provide a discussion of the health basis for the derivation of the NO_2 CAAQS and the complete source citation.

b. Provide a health-based discussion of the AAAQO and NAAQOs, the TRVs and the complete source citation for each.

439. Volume 4, Appendix O, Section 4.2.1, Page 4.4

Alberta Transportation states *The CAAQS for SO_2 were developed in recognition of the respiratory health effects associated with acute inhalation exposures, and represent the most recent (and most conservative) of the AAAQO, NAAQO and CAAQS*.

a. Provide a discussion of the health basis for the derivation of the SO_2 CAAQS and the complete source citation.

b. Provide a health-based discussion of the AAAQO and NAAQOs, the TRVs and the complete source citation for each.

440. Volume 4, Appendix O, Section 4.2.1, Pages 4.2 to 4.8
Volume 4, Appendix O, Section 4.2.6, Table 4-1, Page 4.22 to 4.25
Volume 3A, Section 15.4.1.4, Table 15-10, Page 15.40

Alberta Transportation states *the chronic, annual SO_2 TRV applies the lowest annual objective among the AAAQO, NAAQO and CAAQS, which is an ecosystem-based objective to protect vegetation.*

Health Canada (2016) did not derive a chronic TRV due to the lack of evidence of long term exposure resulting in adverse human health effects. It is incorrect to apply a vegetation based TRV to assess potential human health risk.

Tables 4-1 and 15-10 incorrectly describe the critical effect of chronic exposure to SO_2 as Respiratory effects.

a. Provide a scientific discussion supporting why the chronic assessment of SO_2 for human health should not be conducted.

Update Tables 4-1 and 15-10 without a chronic SO_2 TRV.

Health Canada. 2016. Human Health Risk Assessment for Sulphur Dioxide (CAS RN: 7446-09-5), Analysis of Ambient Exposure to and Health Effects of Sulphur Dioxide in the Canadian Population, Water and Air Quality Bureau, Safe Environment Directorate.

441. Volume 4, Appendix O, Section 4.2.1, Pages 4.3 and 4.4

In their assessment of sulphur dioxide (SO_2), Health Canada (2016) and the World Health Organization (WHO 2005) provide a toxicological reference value (TRV) for 10-minute exposure to SO_2 as short-term exposures (5-10 minute) have the strongest evidence of causality compared to 1 hour, or 24 hours exposures.

a. Provide an assessment of 10-minute SO_2 exposure using the TRV derived by Health Canada (2016).

Health Canada. 2016. Human Health Risk Assessment for Sulphur Dioxide (CAS RN: 7446-09-5), Analysis of Ambient Exposure to and Health Effects of Sulphur Dioxide in the Canadian Population, Water and Air Quality Bureau, Safe Environment Directorate.

WHO (World Health Organization). 2005. Air Quality Guidelines, Global Update 2005. Particulate matter, ozone, nitrogen dioxide and sulfur dioxide.

442. Volume 4, Appendix O, Section 4.2.1, Page 4.5

Alberta Transportation states *For the purposes of this HHRA, the AAAQO and NAAQO for acute and chronic exposures were used to characterize the health risk from $PM_{2.5}$.*

a. Provide a discussion of the health basis for the derivation of the TRVs and the complete source citation.

443. Volume 4, Appendix O, Section 3.1.1, Pages 3.1 to 3.4

Ozone (O_3) and PM_{10} were not included as COPC in the HHRA. $PM_{2.5}$ was identified as a COPC in the HHRA.

a. Provide the rationale for the exclusion of O_3 and PM_{10} from the HHRA or include an assessment of potential risk of adverse human health effects associated with the exposure to O_3 and PM_{10}.

b. Confirm that the formation of secondary particulates was included in the predicted $PM_{2.5}$ ground level air concentrations or provide a rationale for exclusion of assessment of secondary particulates.

444. Volume 4, Appendix O, Section 6.2.1, Table 6-1, Pages 6.2 and 6.3

Alberta Transportation identifies exposure ratios (ERs) greater than 1.0 for the maximum point of impingement (MPOI) receptor locations for NO_2, $PM_{2.5}$ and diesel emission particulate (DEP). The predicted concentrations for acute exposure to DEP were >10 times the exposure limit at the MPOI (ER = 18).

a. Provide a figure illustrating the location of the MPOI for each COPC with a concentrations ratio greater than 1.0.

b. Provide a discussion of the MPOI locations with respect to receptor locations identified in the HHRA and the likelihood a person will be exposed to predicted air concentrations at the MPOI locations.

c. Provide a discussion of potential health effects associated with exposure to air concentrations predicted at the MPOI (10x higher than the TRV).

445. Volume 4, Appendix O, Attachment C, Page C.1

Alberta Transportation applied a formula for the calculation of soil concentrations.

a. Provide the complete source citation supporting the use of the formula used to predict C_S.

446. Volume 3A Section 3.4.4.1, Page 3.55
Volume 3C, Section 2.2, Pages 2.2 and 2.3
Volume 3A Section 15.1.2, Page 15.2
Volume 3A, Section 15.4.4.1, Page 15-46

Volume 3A, Section 3.4.4.1, Alberta Transportation states *Therefore, chemical dust suppression will be applied on an as-needed basis during high wind conditions or if PM concentrations are in exceedance of the Alberta Air Quality Objectives and if an increase of watering is determined ineffective or unfeasible at the time.… Additional mitigation measures can be implemented on an as-required basis.*

Volume 3C, Section 2.2, Alberta Transportation states *As maximum total suspended particulate (TSP) and $PM_{2.5}$ concentrations and dustfall deposition are predicted to be greater than the ambient air quality criteria outside the PDA during construction, an ambient air quality monitoring program will be used to determine TSP concentrations, $PM_{2.5}$ concentrations, and dustfall during construction. The air quality and climate follow-up program will be conducted to validate the success of particulate matter mitigation measures.*

Volume 3A, Section 15.1.2, Alberta Transportation states *Concerns were received following engagement with Indigenous groups, the public and regulators. Concerns were raised regarding air quality around the construction areas near residences because people could inhale emissions from vehicles and construction equipment.*

Volume 3A, Section 15.4.4.1, Alberta Transportation states *The results indicate that with partial mitigations to reduce $PM_{2.5}$ along the haul road and borrow material area, there could still be an unacceptable short-term risk to human health for residents and people adjacent to the PDA … More intensive dust mitigation measures can be applied during the construction phase.*

Adequate discussion of additional mitigation strategies to be applied in the event of short term air quality exceedance and communication strategies with local communities were not provided.

a. Provide additional details of the more intensive dust mitigation measures that can be applied. Include details of what will trigger implementation of the additional mitigation measures.

b. Describe how TSP and $PM_{2.5}$ exceedances identified in the air quality monitoring program will be communicated to residents in the LAA.

c. Provide a description of how Alberta Transportation will receive and respond to complaints regarding dust and air quality during the construction phase.

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

e. Describe the implementation plan for this mitigation measure.

447. Volume 3A, Section 15.7, Page 15.65
Volume 3A, Section 15.4.4.1, Tables 15-13, Pages 15.49 to 15.51

Volume 3A, Section 15.4.4.1 Table 15-14, Pages 15.52 and 15.53
Volume 4, Appendix O, Section 8.0, Page 8.1

Volume 3A, Section 15.7, Alberta Transportation states *The assessment of public health shows that the effects from air quality, water quality and country foods are not significant for the construction and dry operations phases.*

This statement is not supported by the technical data report (Volume 4, Appendix O) ER results tables and conclusions which report risk of potential health effects associated with acute inhalation exposures as follows in Volume 4 Appendix O:

- *Acute concentrations of $PM_{2.5}$, for which both short-term (1-hour or 24-hour) and long-term (annual) ERs are greater than 1.0 at up to 18 of the 58 human receptor locations. Even with partial mitigations, model results indicate there could still be an unacceptable short-term risk to human health for residents and people adjacent to the PDA. Although concentrations of $PM_{2.5}$ are expected to be lower than the modelled predictions, more intensive dust mitigation measures may be considered during the construction phase, including dust suppressants or water on haul roads on an as-needed basis during dry periods with high wind conditions.*
- *1-hour concentrations of DEP at some receptor locations may exceed the acute (2-hour) DEP exposure limit (maximum frequency of exceedances is less than 5%). Based on multiple studies on test subjects, Health Canada (2016b) concluded that at concentrations above the DEP exposure limit, healthy and/or mildly asthmatic participants may experience increased measures of airway resistance and/or respiratory inflammation. Additional mitigation that may be used to reduce $PM_{2.5}$ exposures (such as adjusting the construction schedule to reduce the number of vehicles operating in an area during dry periods with high wind conditions) would also mitigate acute DEP exposures.*

a. Discuss $PM_{2.5}$ and DEP risk results in the conclusion section of the Public Health report (Volume 3A, Section 15.7) or provide rationale for their exclusion.

448. Volume 3A, Section 15.4.1.4, Page 15.39
Volume 3B, Section 15.4.1.4, Page 15.18
Volume 4, Appendix O

The conclusions of the HHRA are dependent on the predicted air dispersion modelling results. Through the SIR process, additional air modelling may be required for the air quality portions of the application thus generating new predicted air concentration data.

a. In the event that new or additional air dispersion data is generated for selected COPC, compare the results to health-based Toxicity Reference Values (TRVs) and discuss the potential health impact or provide justification for not completing these steps.

8 Dam Safety

449. Volume 1, Section 1.3, Figures 1-6
Volume 1, Section 1.3.2.1, Figure 1-7
Volume 1, Section 1.3.2.2, Figure 1-8

The Project Development Area (PDA) is shown as a contour level in the reservoir area but is not described as such.

a. What is the contour level shown for the PDA in the reservoir? Does it correspond with the PMF? If it does not correspond with the PMF explain the discrepancy.

450. Volume 1, Section 3.1, Page 3.1

Alberta Transportation states that *The Project will provide 77,771,000 m^3 of active flood storage.*

a. For the active flood storage of 77,771,000 m^3, clarify the storage retained within the reservoir and if a portion is contained within the downstream section of diversion channel.

451. Volume 1, Section 3.1, Pages 3.1 to 3.2
Preliminary Design Report (draft) Appendix B.4-1PMF Analysis Report, Section 3.5, Page 27

Alberta Transportation states that some of the project components are designed for the PMF, which was estimated using a PMP analysis and hydrologic modelling.
In the draft PMF report included as Appendix B.4-1, Section 3.5, Page 27 of the draft Preliminary Design Report, the initial calibration of the hydrologic model to the 2013 and one of the 2005 floods was inconsistent with the results of the flood frequency analysis when simulating a 1:100 year rainfall. The model was therefore adjusted to replicate the 1:100 year peak from the flood frequency results. Alberta Transportation also states in the Preliminary Design Report that *floods on the Elbow River are from a mixed population of snowmelt, spring rain on snow, and summer rainfall only floods*.

a. Was any snowmelt contribution considered when adjusting the model to match the 1:100 year peak discharge from the frequency analysis? If so, what was that contribution? If not, what is the rationale for adjusting the model to match the results of the frequency analysis of a mixed population when simulating a purely rainfall event?

b. Provide verification of the adjusted model by showing the observed and simulated hydrographs of the 2005 and 2013 events.

c. Why were the other two flood peaks that occurred in 2005 not used for calibration or verification?

452. Volume 1, Section 3.1, Page 3.2
Volume 1, Section 3.2.5.1, Page 3.15
Volume 3D, Section 1.5.1, Page 1.18

Alberta Transportation states that *The off-stream dam is classified as an "extreme" consequence dam…*. Similarly, in Volume 1, Section 3.2.5.1, Page 3.15 Alberta Transportation states that *The dam and its appurtenances are designed as an "Extreme" hazard facility in accordance with CDA Guidelines and Alberta Dam and Canal Safety Guidelines*. In other places within the EIA (i.e. Volume 3D, Section 1.5.1), Alberta Transportation states that the dam has been designed to standards consistent with a hazard classification of *very high* per the AEP guidelines and *extreme* per the CDA guidelines.

a. The Alberta Dam and Canal Safety Guidelines (March 1999) by AEP are no longer used for determination of consequence classification. Clarify the consequence classification.

453. Volume 1, Section 3.1, Page 3.2
Volume 1, Section 3.2.1.4, Page 3.8

Alberta Transportation states that *….the floodplain berm is classified as a "very high" consequence dam. As such, the system elements are designed to safely pass the required dam safety design flows; the probable maximum flood (PMF) for the dam and 1/3 between the 1:1000 year and PMF for the floodplain berm.* In Volume 1, Section 3.2.1.4, Page 3.8, Alberta Transportation states that *The height and southerly extent of its alignment, as determined by dam safety requirements for "Very High" consequence dams, prevents a circumvention by flood events, up to 1/3 between the 1:1000 year and the PMF*. The CDA states that the IDF for a *Very High* consequence dam is 2/3 between the 1:1000 year and PMF. Alberta Transportation states in other sections of the EIA that the consequence classification for the floodplain berm is *High*.

a. Clarify throughout the EIA which consequence classification and IDF is applicable for the floodplain berm. Update the sections as required so they are consistent.

454. Volume 1, Section 3.2.1, Page 3.5

Alberta Transportation states that *The hydraulic performance and debris management features of the diversion inlet and service spillway were refined using 2-dimensional hydraulic modelling and a 1:16 scale physical model...*

a. Provide the physical model study report by the National Research Council Canada to provide details on the modelling work

b. It appears that the situation with the diversion gates closed and river discharges approaching 160 m^3/s was not modelled with sediment loading. What is the risk that sediment will deposit immediately upstream of the diversion structure during the early part of the flood while the diversion gates are closed, resulting in reduced diversion capacity?

c. Discuss the level of confidence that the diversion will perform as intended under flood, debris, and sediment loading, addressing the uncertainty introduced by:
   i. The necessary adjustments that had to be made for modelling purposes, such as the truncation of the grain size distribution curve;
   ii. The fact that the combination of simultaneous sediment movement and floating debris was not simulated.

455. Volume 1, Section 3.2.1, Figure 3-1, Page 3.3
Borrow sources #1 and #2 appear to be along the toe of the valley walls.

a. Will the borrow excavations impact the stability of the perimeter slopes after final grading and reclamation? Explain why or why not.

b. What testing was carried out for the potential borrow materials? Describe the suitability of the materials based on the test results.

456. Volume 1, Section 3.2.1.1, Page 3.6
For the diversion inlet:

a. Provide the design diversion capacity and water level, main structure components, and principal dimensions and elevations.

b. Describe measures to prevent seepage/piping and drainage measures.

c. Describe erosion protection measures (e.g. at entrance and downstream of the stilling basin).

d. Describe construction requirements including temporary works (e.g. site clearing and grubbing, dewatering systems, foundation preparation, etc.).

457. Volume 1, Section 3.2.1.2, Page 3.7
For the service spillway:

a. Provide the design discharge capacity (e.g. gates down) and design water levels (e.g. gates down and gates in operation).

b. Describe the main structure components and provide the principal dimensions and elevations.

c. Describe measures to prevent seepage/piping and drainage measures.

d. Explain the reasons for backfilling the stilling basin with native substrate. Does this have to be maintained?

e. Clarify if erosion and destabilization of the left downstream bank between the river and the diversion channel is a concern. If it is, describe the measures that are being provided to address it. If it is not a concern explain how this conclusion was reached.

f. Clarify if redundancies have been included to ensure that the gates can be operated (raised to permit diversion) during a flood. Explain the implications of not being able to raise one or both gates to divert flows under various flood events.

g. Describe construction requirements including temporary works (e.g. site clearing and grubbing, dewatering systems, foundation preparation, etc.).

458. Volume 1, Section 3.2.1.3, Page 3.8
For the control building:

a. Describe the primary and backup power supply and communications provisions for the gates and controls.

459. Volume 1, Section 3.2.1.4, Pages 3.8 and 3.9

Alberta Transportation states that *The height and southerly extent of its alignment* (i.e. floodplain berm), *as determined by dam safety requirements for "Very High" consequence dams, prevents a circumvention by flood events, up to 1/3 between the 1:1000 year and the PMF.* On Page 3.9, Alberta Transportation also states that *The crest is set at 1 m above the calculated 1:1,000 year flood elevation and would pass the probable maximum flood without overtopping.*

a. Clarify the consequence classification and design flow for the floodplain berm and the corresponding design freeboard that accompanies this design flow. Update the sections as required so they are consistent.

b. Clarify the statement that the floodplain berm is capable of passing the PMF.

460. Volume 1, Section 3.2.1.4, Figure 3-5, Page 3.9
Volume 1, Section 3.3.1.2, Page 3.23

Figure 3-5 shows a typical cross section of the floodplain berm with a deep cutoff trench penetrating the alluvial soils and weathered bedrock. The cutoff trench is backfilled with impervious fill Zone 1A material and a filter zone is provided on the downstream side. There is no mention that groundwater dewatering will be required in the alluvial soils. The seepage cutoff is intended to protect the embankment against piping during flood operation. Also, the upstream slope of the floodplain berm is protected with riprap, however, no bedding gravel layer(s) is shown.

a. What means of dewatering in the alluvial soils are being considered to facilitate placement of the filter layer on the excavation slope as well as placement of the impervious fill?

b. Due to the depth of cutoff trench and potential groundwater problems, were other cutoff means considered? If so, what was the basis for selecting an impervious fill cutoff? If other cutoff means were not considered explain why.

c. Does the riprap protection include bedding gravel layer(s)? Explain.

461. Volume 1, Section 3.2.1.5, Page 3.10
Volume 1, Section 3.2.1.4 , Page 3.9

Alberta Transportation states that *The auxiliary spillway is designed to withstand overtopping for flood events up to 1/3 between the 1:1000 and the PMF with an overtopping depth of 1.5 m*. It was previously stated in Section 3.2.1.4 that the floodplain berm is capable of passing the PMF.

a. Clarify the flood criteria for the design of the auxiliary spillway.

b. Are all of the facilities on the Elbow River designed on the same basis (e.g. same consequence classification and same IDF)?

c. Can the auxiliary spillway pass the PMF? If so, under what conditions related to the diversion and service spillway flows during the PMF? If not, explain how the PMF is managed.

462. Volume 1, Section 3.2.1.5, Page 3.10

Alberta Transportation states *The auxiliary spillway may also activate for smaller flood events 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*.

a. How is the influence of debris and sediment taken into account for the floodplain berm design for the crest elevation?

b. Explain the implications if the auxiliary spillway is activated.

c. If the auxiliary spillway activates at smaller flood events then depending on the maximum discharge capacity of the activated auxiliary spillway, will it still be possible to divert flows to utilize the full storage capacity of the Springbank Offstream Reservoir? Explain why or why not.

463. Volume 1, Section 3.2.2, Page 3.11

For the diversion channel:

a. Describe the soil conditions where bedrock is not present and its erodibility.

b. Where does the channel cross existing large creeks? Explain how these channel crossings are being addressed.

c. Provide elevations (top of bank, invert and FSL) at the upstream and downstream ends of the canal and at the emergency spillway.

d. Describe the channel outlet and grade control structure, their function and design, and provide the main dimensions and elevations.

e. Provide typical design cross sections in cut and fill.

f. Describe the excavation and stockpiling requirements.

g. For the two bridges across the diversion channel, explain if large debris that finds its way past the diversion inlet can collect at the bridge piers and block the channel.

h. Describe construction requirements including temporary works (e.g. site clearing and grubbing, dewatering systems, foundation preparation, etc.)

464. Volume 1, Section 3.2.3, Page 3.11

Alberta Transportation states *The (emergency) spillway has a crest at the reservoir full service elevation of 1,210.75 m and a discharge capacity of 354 m^3/s at 1.25 m of head*. The design capacity of the diversion canal is 600 m^3/s, however, flows may exceed this amount during the PMF.

a. What is the maximum capacity of the emergency spillway and at what elevation does this occur?

465. Volume 1, Section 3.2.4, Table 3-3, Page 3.12

The residence time and release time for the 2013 design hydrograph is less than the 1:100 year flood. Alberta Transportation states *Table 3-3 shows the reservoir filling times for hypothetical floods and the 2013 design hydrograph. Actual residence time and release rates will vary depending on conditions downstream post flood, performance of the dam while storing water, and other factors.*

a. Why are the residence and release times for the larger 2013 flood less than that for the 1:100 year flood?

b. Explain the reservoir evacuation criteria (e.g. levels and times) in case of an emergency at the dam, that are being used.

c. Provide the reservoir's operating rules with actual filling and releasing times/rates/levels corresponding to various flood events and conditions.

466. Volume 1, Section 3.2.4, Page 3.12

TOR 2.6[F] B requires Alberta Transportation to *Describe the construction activities for reservoir preparation, including: … methods for managing wood debris and shoreline stabilization during reservoir filling*. Alberta Transportation provided a discussion about debris management at the diversion structure but there is no discussion about shoreline stabilization within the reservoir.

a. Provide a discussion regarding shoreline stability during reservoir filling and drawdown.

467. Volume 1, Section 3.2.4, Table 3-2, Page 3.12

Table 3-2 does not indicate the reservoir level corresponding to each of the flood magnitudes.

a. Provide the reservoir levels corresponding to each flood magnitude.

468. Volume 1, Section 3.2.5.1, Figure 3-8, Page 3.14
Volume 1, Section 3.2.5.4, Page 3.17

The foundation conditions including any variances that may occur underlying the offstream dam are not described. In particular, the differences in soil conditions between the majority of dam foundation and the areas at the dam abutments and No Name Creek are not described.

a. Provide a discussion on foundation materials underlying the dam and saddle dyke including what seepage control requirements are necessary and how these requirements might vary across the bottom of the valley and abutment areas. Describe or show the typical dam cross sections in the vicinity of the low level outlet near the No Name creek channel.

b. Explain why a nominal cutoff trench would be sufficient for part of the dam when a deep cutoff trench is required for the floodplain berm on the Elbow River and drains are proposed near the low level outlet structure.

469. Volume 1, Section 3.2.5.1, Page 3.15

The composition of the dam includes an impervious core, random fill shells and a sand/fine filter internal drain. Quantities of the various construction materials are not provided. Other embankments such as the floodplain berm are described similarly with the exception that some areas of the embankments are also protected with riprap on the upstream slope.

a. Provide the approximate quantities of material used to construct the dam and appurtenant structures.

b. Discuss the various zone types for fill materials to be used in the dam embankments including specification requirements.

c. Will high plastic soils or bedrock be encountered in the borrow areas and required excavations? Will these then be used in embankments? Explain why or why not.

d. What portion of the excavation and borrow materials will consist of high plastic materials?

e. If more than one type of random fill is used in the dam, how will the embankment be zoned for these materials which require different placement and compaction procedures?

470. Volume 1, Section 3.2.5.2, Page 3.15

Alberta Transportation states *Since the reservoir will not have a permanent pool, wave wash protection will not be necessary. In addition, any flood pool will be a temporary condition*.

a. Since residence time in the reservoir is in the order of 40 days and can be delayed longer if downstream damages are significant thereby limiting outflows that may be released, how much erosion could occur during the period of impoundment?

b. Is there a critical elevation range near FSL that should include riprap protection? Explain.

c. Is there any infrastructure or buried lines that will be present on the upstream slope in the vicinity of the low level outlet that may be exposed or damaged due to a wave attack? If so, how will these facilities be protected?

d. If there is slope erosion during the period the reservoir is inundated, how would the corresponding sediment accumulation in the bottom of reservoir while the gates are shut affect gate operation of the low level outlet when they are eventually opened?

471. Volume 1, Section 3.2.5.2, Page 3.16

Alberta Transportation states *The design also includes a storm drainage channel along the toe of the dam, upstream and downstream. The channel is sized to convey runoff from the 100-year storm and is grass lined*. There is no mention that gravel armour or riprap would be placed in ditches on the steep sections of the toe ditch such as the abutment slopes.

a. Is there a requirement to include erosion protection for some sections of the toe ditch where gradients may be excessive for grass protection? Is there a specific gradient where erosion protection would change from grass lining to armour?

472. Volume 1, Section 3.2.5.3, Table 3-4, Page 3.16

Alberta Transportation states that *Table 3-4 identifies the evaluated load cases and the required factors of safety* for the dam embankment. Alberta Transportation uses the terms *instream design flood*, *inflow design flood*, *design flood*, and *design flow*. According to the glossary (Section 9), the first two terms have different meanings, but the referenced table equates the design flood with the IDF.

a. Clarify that the design meets the minimum required factors of safety and indicate calculated values.

b. Provide a discussion to differentiate between the various terms.

c. Clarify the definition of the IDF in the footnote of the referenced table and the list of definitions.

473. Volume 1, Section 3.2.4, Table 3-2 Page 3.12
Volume 1, Section 3.2.4, Figure 3-7, Page 3.13
Volume 1, Section 3.2.5.1, Figure 3-8, Page 3.14
Volume 1, Section 3.2.5.1, Figure 3-9, Page 3.15
Volume 1, Section 3.2.5.3, Table 3-4, Page 3.16

The terms for *design flood* shown on Figure 3-7 and *IDF pool level* at El. 1212.0 m shown on Figure 3-8 are confusing. The IDF pool level is higher than the emergency spillway crest elevation of 1210.75 m.

a. Confirm if this is correct. Clarify the terminology between IDF and the 2013 Design Flood. Update the sections as required so they are consistent.

474. Volume 1, Section 3.2.5.5, Page 3.17
Volume 3D, Section 2.3.2.2, Page 2.6
Volume 3D, Section 2.3.2.2, Page 2.7

Alberta Transportation states that *The dam stability was assessed for an Earthquake Design Ground Motion (EDGM) with an Annual Exceedance Probability of 1/10,000, in accordance with CDA Dam Safety Guidelines (2007) and the Extreme hazard classification*. Volume 3D, Section 2.3.2.2, Pages 2.6 and 2.7 identify measures to mitigate the risk of induced seismic events such as establishing an exclusion zone around the Project for commercial operators.

a. Was dam embankment stability assessed taking into account the effects of induced seismicity or is the design contingent upon establishing an exclusion zone?

475. Volume 1, Section 3.2.6, Figure 3-10, Page 3.17

Alberta Transportation states that *The low-level outlet structure (Figure 3-10) consists of an approach channel, discharge gate, gatehouse, discharge conduit and outlet channel. The gate is operated locally by the gatehouse*. Figure 3-10 is labeled Low Level Outlet but only shows the basin at the downstream toe. The photo in this figure is a picture of another project with a similar basin but with twin conduits that are round instead of the actual conduit shape for this project.

a. Provide the discharge capacity (e.g. rating curve).

b. Describe the main structure components and provide the principal dimensions and elevations.

c. Provide a section showing the entire configuration of the low level outlet, including upstream gate, gate control location in the gate house, control lines, vent pipe,

conduit including joints, and outlet structure. Provide the backfill configuration including measures to prevent seepage/piping and drainage measures.

d. Describe erosion protection measures for the low level outlet.

476. Volume 1, Section 3.2.6, Page 3.18

Alberta Transportation states that *The gate system controls are situated in a lit gatehouse at the inlet to the low-level outlet*. The gatehouse is located on the dam crest which is offset from the submerged inlet structure. The method of operating the gate is not discussed in this section of the EIA. However, it is understood from the preliminary engineering design report that the gates are operated by hydraulic lines buried on the upstream slope between the inlet and gatehouse. As well, a vent pipe is buried in the dam embankment on the upstream slope. The entire low level outlet conduit is downstream of the gate and will be unpressurized when the gate is closed and the reservoir is full or partly full.

a. Provide details regarding the gate operation for the low level outlet.

b. What protective measures will be provided for the hydraulic lines buried on the slope?

c. What type of hydraulic fluid will be used in the event there is a leak or rupture?

d. Can the vent pipe and hydraulic lines accommodate settlement due to the embankment?

e. Describe if any backup measures or redundancies were incorporated should the gate be inoperable due to problems with the hydraulic system or the gate itself?

f. What are the backfill requirements for the section of the low level outlet conduit upstream of the impervious core? In particular, how will the joints be protected against the infiltration of backfill material due to the seepage gradient towards the unpressurized conduit during the period when the reservoir is inundated and the gate is closed?

g. What other gate arrangements were considered and explain why the proposed upstream gate arrangement is considered preferable?

477. Volume 1, Section 2.2.6.1, Page 2.27

Alberta Transportation states that *Design Option 1 raises Highway 22 above the reservoir design flood level in the location of the future southbound lanes (twinning to the west side). The design elevation allows 0.5 m for freeboard and 1.0 m for the pavement structure depth above design flood level, which results in an embankment height of approximately 5 m at the Springbank Road intersection*.

a. Clarify which design flood level is referred to for the design crest level of the road.

b. Is the design crest elevation of the road a minimum of 1.5 m above the design flood level or 0.5 m or 1.0 m above the design flood level? It is not clear from the above wording. What are the actual elevations of the flood level and design crest level of the roadway?

c. Will the road be inundated during a PMF?

d. For the proposed culvert size, what is the head differential to maintain the required flow during filling and draining?

e. How are the exterior slopes and any buried utilities in the road embankments protected against wave attack? Clarify whether there is armour or riprap protection provided?

478. Volume 1, Section 2.2.6.2, Page 2.30

Alberta Transportation states that *The road embankment would be classified as a dam under the Dam and Canal Safety Guidelines (Alberta Environmental Protection 1999), leading to higher engineering, construction, safety, maintenance, and licensing costs than for a typical roadway.*

a. Clarify on what basis the embankment would be classified as a dam.

b. Does the embankment act as a barrier to flow or is there a culvert?

c. Would the preferred option still be Option 2 for Springbank Road if the road embankment is not classified as a dam?

d. If Alberta Transportation considers Springbank Road as a dam, then is the Highway 22 embankment also considered a dam? If not, what are the differences?

479. Volume 1, Section 3.2.8, Page 3.20

Regarding utilities:

a. Discuss utilities that will be required for the Project components including their alignment (e.g. power for operation of the gates, etc.).

480. Volume 1, Section 3.2.8.1, Figure 3-12, Page 3.21

Figure 3-12 shows several pipelines crossing the reservoir. Alberta Transportation states that retrofitting including weighting of the pipe for flotation will be carried out for pipelines crossing the reservoir.

a. What provisions are included for erosion protection for the pipelines on the valley slopes in reservoir areas exposed to wave action during inundation?

481. Volume 1, Section 3.3, Page 3.22

Alberta Transportation states that *On the north side of Elbow River, the main access to the PDA will be a gravel road on the southeast side of the diversion channel, with gated approaches on both sides of Highway 22*. The diversion canal excavation slopes are up to 37 m deep on the northwest side of the canal channel and over 20 m on the southeast side. Access roads for the diversion canal are situated at the top of the cut slopes and there is no access berm at lower elevations on either side.

a. How will maintenance activities including possible clean out of slump debris occur in the diversion canal during operation with no access route for equipment at lower elevations?

482. Volume 1, Section 3.3, Figure 3-1
Volume 1, Section 3.3, Page 3.22

Alberta Transportation states *See Figure 3-1 for the locations of temporary construction laydown areas, which typically include a site trailer, toilet facilities, and areas for parking, fueling, waste and recycling bins, and storage of equipment and materials*. Temporary construction laydown areas are not shown on Figure 3-1.

a. Provide details for locations of the temporary construction laydown areas. Update the EIA to reflect the proper locations.

483. Volume 1, Section 3.3.1.1, Page 3.23

Alberta Transportation states that *The direct material haul to the floodplain berm construction site from the diversion channel will require installation of a temporary bridge across the diversion channel.*

a. Clarify if the temporary bridge is across the diversion channel or the Elbow River.

b. Provide details showing the location of the temporary bridge crossing and the proposed access route on the valley slope of the Elbow River.

484. Volume 1, Section 3.3.1.2, Page 3.23
Volume 1, Section 3.2.5.3, Table 3-7, Page 3.31

Table 3-7 indicates that the schedule for the floodplain berm extends from September to November 2019 followed by two additional periods in May to June and August of 2021. Section 3.3.1.2 does not include any explanation for the staged construction of the floodplain berm nor does it describe the interim condition of the embankment after the 2019 construction season.

a. What is the condition of the floodplain berm after the 2019 construction season (i.e. what portions are completed)?

b. What components of the floodplain berm are constructed during each of the construction stages shown on the schedule?

c. Is part of the floodplain berm construction intended to be for the auxiliary spillway? Identify which parts of the schedule apply to the auxiliary spillway.

d. Clarify if the floodplain berm construction between September and November 2019 includes the RCC auxiliary spillway? If so, explain how cold weather placement of the RCC will be carried out.

e. What temporary works are required for protection of the auxiliary spillway foundation excavation during operation of the service spillway? Explain how the auxiliary spillway excavation will be dewatered in close proximity to the service spillway during periods of river flow in the service spillway even if the left bay of the spillway takes most of the normal flow.

485. Volume 1, Section 3.3.1.3, Figure 3-1,
Volume 1, Sections 3.3.1.3, 3.3.1.4, 3.3.1.5, Page 3.24
Volume 4, Appendix D, Figure 2-2., Page 2.7
Alberta Transportation states that *Rock or soil materials that are unsuitable for construction will be left as spoil near the diversion structure (see Figure 3-1)*. Locations of spoil piles are not shown on Figure 3-1 but are shown on Volume 4, Appendix D, Figure 2-2.

a. Provide layout details for areas of disturbance at spoil pile locations on Figure 3-1.

b. Provide details related to spoil pile volumes, heights, side slopes, compaction requirements and drainage details.

486. Volume 1, Section 3.3.1.4, Figure 3-1, and Page 3.24
Alberta Transportation states that *A temporary laydown/stockpile area to support construction will be set up within the reservoir area, near the dam in a location accessible from the existing road network (Figure 3-1)*. Locations of the laydown/stockpile are not shown on Figure 3-1. This section also refers to borrow areas located in the reservoir area and shows their locations on Figure 3-1.

a. Provide layout details for areas of disturbance for the laydown/stockpile areas.

b. Provide details for the borrow areas approximate depths and side slopes and indicate whether they become part of the reservoir. Refer to Figure 3-1 where locations are shown.

487. Volume 1, Section 3.3.8, Table 3-7, Page 3.31
Volume 1, Section 5.1.1, Page 5.2
Volume 1, Attachment A, Section A.2.1.1, Page A.6
A river diversion with cofferdam embankment will be used to allow the diversion inlet and service spillway to be constructed *in the dry*. The river diversion extends through the RCC auxiliary spillway.

a. Explain the basis for selection of the 1:10 year flood event for the cofferdam.

b. Given that the auxiliary spillway abuts with the service spillway, clarify the water management requirements and construction staging for the auxiliary spillway considering instream construction windows.

488. Volume 1, Section 3.3.6.1, Page 3.29
Alberta Transportation states that *The integrity of the dam will be tested during the construction phase*.

a. Clarify this statement. What testing will be carried out during the construction phase to ensure the integrity of the dam?

b. What testing of backup power supply systems (e.g. standby diesel generators) will be provided if backup is supplied?

489. Volume 1, Section 3.4.1, Table 3-10, Page 3.33

Following flood deposition, removal of debris and sediment will be required within the river. The connection points and bladders for the Obermeyer gates are located in the river and will likely be submerged.

a. What are the regulatory approval requirements, timelines and the implications on completing removal of debris and sediment in the river?

b. Explain how inspections of the gate connections and bladders will be conducted?

c. What are the regulatory approval requirements, timelines and implications on carrying out repairs to the gates when required?

490. Volume 1, Section 1.2.1, Page 1.6
Volume 1, Section 1.2.1, Figure 1-5, Page 1.7
Volume 1, Section 3.3.8, Table 3-7, Page 3.31

Alberta Transportation states that *At present, the Project is scheduled to be functionally operational (able to accommodate a 1:100-year flood event) for floods in the spring of 2021, and be completely constructed (able to accommodate the design flood) for the spring of 2022*. However, the schedule on Table 3-7 on Page 3.31 shows several unfinished items of work in the spring of 2021 including completion of the diversion channel excavation, offstream dam embankment and floodplain berm which are all scheduled for the summer of 2021.

a. Describe the extent of unfinished work in the spring of 2021 at which time it is stated that a 1:100 year flood can be accommodated?

b. Discuss the flood handling procedures during the construction period prior to all of the works being completed by the end of 2021?

c. Clarify the extent of temporary/permanent power and control systems that will be provided to operate the facilities in the spring of 2021.

d. Explain how flow would be diverted to the offstream storage reservoir in the spring of 2021 if the diversion canal is not complete?

e. Explain how the low level outlet gate will be operated if the offstream dam is only partly completed and the hydraulic controls not yet installed and functional?

f. Explain the potential dam safety challenges/issues related to the project while partly completed in 2021 and identify the proposed mitigation measures.

491. Volume 1, Section 5.0, Page 5.2

Alberta Transportation indicated a hazard classification (under CDA guidelines) of *Extreme* for the offstream storage dam and *High* for the floodplain diversion berm. A rationale for the classification of the offstream storage dam has been provided, but there is no equivalent discussion for the floodplain diversion berm. Alberta Transportation also states that *A dam breach inundation study was completed for the off-stream dam and is discussed in Section 5.4*.

a. Provide the rationale for the consequence classification of the floodplain diversion berm, considering that the effect of the berm failure is not only a breach flood wave but also a potential reduction in the flood mitigation effectiveness of the entire SR1 system if the breach reduces the capacity of the diversion.

b. Similarly provide the consequence classification and rationale for other project components including the diversion channel.

492. Volume 1, Section 5.1.2, Tables 5-2, Page 5.3
Volume 1, Section 5.1.2 Table 5-3, Page 5.4

Tables 5-2 and 5-3 describe potential dam safety issues at the Diversion Inlet and the Service Spillway.
Table 5-2 indicates that the gates for the diversion inlet *were selected based on their mechanical reliability* while a similar statement is not provided on Table 5-3 for the service spillway gates.

a. Explain if potential issues that could affect the required operation of the diversion inlet (e.g. debris or sediment) and/or service spillway (e.g. debris or non-operable gates) to divert flood flows and thereby provide flood protection to the City of Calgary have been examined and what mitigation measures have been identified. If these potential issues have not been examined explain why not.

b. Describe the reliability of the service spillway gates relative to the diversion inlet gates. Provide information on the long-term performance of the type of gate selected for the service spillway in rivers with significant sediment transport. Explain their performance due to sediment accumulation on or against them.

c. Explain how future major maintenance, which requires removal of the diversion inlet or spillway gates, would be carried out (e.g. equipment, access, etc.).

493. Volume 1, Section 5.1.2, Table 5-2, Page 5.3

Alberta Transportation states that *The gate hoists are planned as wire rope hoists. They will close by gravity, controlled by a braking system. Should the rope and/or brake system fail, the hoist brakes can be released and the gates lowered*. If the ropes or brakes fail, the gates will likely drop and may be damaged or rendered ineffective.

a. Clarify how the gates will be lowered without damaging the gate if the wire ropes fail.

494. Volume 1, Section 5.1.2, Table 5-2, Page 5.3

The consequences of one or more diversion gates failing to raise at the beginning of a high flow event have not been discussed.

a. If these gates cannot be raised, explain how the effectiveness of the diversion structure will be impacted and the corresponding consequences at the onset of a flood exceeding 160 m^3/s.

495. Volume 1, Section 3.2.1, Figure 3-2, Page 3.4

Figure 3-2 shows a floating boom upstream of the diversion structure.

a. Describe the function and operation requirements for the boom.

496. Volume 1, Section 5.1.2, Table 5-3, Page 5.4

Alberta Transportation states that *The gates and pneumatic bladders* (of the Obermeyer gates) *are designed to fail open. That is, failure of the bladder would result in the gates opening and a reduced risk to dam safety*. If the gates fail in the open position during a flood and cannot be closed, less flow can be diverted to the reservoir, however, flows downstream of the service spillway will exceed the maximum permissible rate of 160 m^3/s to the Glenmore Reservoir.

a. What is the impact on diversion flows to the reservoir if one or both service spillway gates fail in the open position? What is the split of flow (i.e. service spillway versus diversion channel) if both structure gates are open for various flood magnitudes?

497. Volume 1, Section 5.1.2, Table 5-4, Page 5.4

Table 5-4 does not discuss potential dam safety issues related to the operation of the low level outlet and there is no separate table for dam safety issues at the low level outlet.

a. Identify mitigation measures relative to dam safety issues regarding a failure that prevents either opening or closing of the LLO gate.

b. Explain if measures for monitoring seepage/piping when the reservoir is inundated are proposed. Explain why or why not.

498. Volume 1, Section 5.2, Page 5.6

Regarding embankment breaches along the diversion channel:

a. Explain the potential for and the implications of a breach in the diversion channel bank (e.g. high fill section across an existing creek).

499. Volume 1, Section 5.2, Page 5.6

Four breach scenarios were considered but only three were analyzed.

a. Clarify if the numbering of scenarios should be revised from 1, 1, 2, and 3 to 1, 2, 3 and 4.

b. A flood-induced failure of the off-stream dam was considered but not analyzed. Although this scenario may be of low probability due to the combination of two events (i.e. failure of the dam by piping in combination with failure of the diversion inlet to close), there is some risk of potential downstream inundation due to the dam failure during high inflows such as the PMF. Explain the timing of these two scenarios on the receding limb of the hydrograph and whether the downstream impact would be different with potentially different reservoir levels and inflow.

c. Scenarios 3 and 4 refer to flood-induced and post flood failures of the diversion structure. The term diversion structure appears to refer to the entire diversion system on the Elbow River. Clarify which components are susceptible to failure and how they each impact downstream inundation.

d. Scenario 3 refers to a flood-induced failure of the auxiliary spillway. Clarify if there is a risk that the floodplain berm could fail potentially due to piping. If appropriate, describe a floodplain berm failure and its impact on downstream inundation.

500. Volume 1, Section 5.2, Page 5.7

The following information regarding the Glenmore Dam was obtained from Klohn Crippen Berger Ltd. who are currently working on the upgrades under construction at the Glenmore Dam.

- Top of dam/bridge deck – El. 1083.906 m, Maximum dam height is 30 m.
- Spillway crest – El. 1075.353 m
- Top of closed 2.5 m high spillway gates – El. 1077.853 m
- Top of containment wall at the non-overflow section of the dam – El. 1079.92 m (existing) and El. 1080.55 m (after proposed upgrades)
- Top of high section of the Southeast Dyke – El. 1081.30 m
- Top of low section of the Southeast Dyke – El. 1080.44 m

a. Clarify if the above information is consistent with that used to assess the cascade effects at the Glenmore Dam due to a failure of the Springbank off-stream dam.

b. Evaluate the cascade failure at the Glenmore Reservoir as a result of flood induced failure of the Springbank offstream dam.

501. Volume 1, Section 5.2, Page 5.7

Alberta Transportation evaluated the potential for downstream cascading failures at the Glenmore Reservoir as a result of the failure of the Springbank off-stream dam for the post-flood scenario.

a. Was the planned bridge and embankment at Stoney Trail included in the hydraulic model? Why or why not? What are the implications of the construction of those works on the potential for cascade failures?

b. Explain the work/basis with regards to the statement *Failure of the concrete gravity dam is considered unlikely to occur in combination with a full breach of the Southeast Dyke*. Explain whether the CDA (2007) guidelines, which specify that the evaluation of the consequences of a dam failure should include the consequences of the failure of downstream dams caused by the failure of the subject dam, are appropriately accounted for in this statement and describe the differences in consequences of failure of the Glenmore Dam versus the SE Dyke.

502. Volume 1, Section 5.2, Table 5-5, Page 5.8
Preliminary Design Report (draft), Appendix C.5 Breach Analysis and Inundation Mapping Report, Section 4.1.2, Table 4, Page 4.10

Alberta Transportation replicated Table 4, Page 4.10 from the *Breach Analysis and Inundation Mapping Report* (Appendix C.5 of the Preliminary Design Report), but modified the footnotes.

a. Clarify whether the footnotes are correct on Table 5-5 of the EIA or Table 4 of the *Breach Analysis and Inundation Mapping Report*.

503. Volume 3A, Section 5.1.2, Page 5.3
Volume 3A, Section 5.1.3, Table 5-1, Page 5.4

In Section 5.1.2, Alberta Transportation states *As of January 1, 2018, no project-specific intangible concerns were identified with respect to hydrogeology*. In Table 5-1, Alberta Transportation states *Interactions between the Project and groundwater quantity can include: groundwater withdrawals for construction dewatering; groundwater seepage into open excavations; groundwater seepage into the diversion channel when dry.*

a. Specifically, what are the existing groundwater conditions in areas of significant excavation such as the diversion channel? What is the depth of excavation below the groundwater table?

b. After excavation of the diversion channel, what will the effect of groundwater seepage be on slope stability? Is this the same on both sides of the diversion channel or is one side more susceptible to seepage discharging on the slope?

c. How will groundwater seepage on the excavation slopes be controlled or mitigated to prevent erosion or instability?

d. What is the proposed groundwater level monitoring program?

e. What is the expected seasonal variation in groundwater level?

504. Volume 3A, Section 5.2.2.4, Page 5.26

A significant number of groundwater wells were identified in the RAA some of which were located in the LAA. Groundwater quantity and quality effects are expected during dry operation of the diversion canal.

a. How close are some of the water wells to the diversion canal excavation?

b. Which water wells, if any, are within the project development area and require abandonment and which wells are affected by the diversion canal excavation?

c. What is the effect and proposed mitigation measures if required for the wells in close proximity to the diversion canal?

505. Volume 3A, Section 9.4.2.2, Page 9.33
Volume 3A, Section 9.4.2.3, Page 9.33

Alberta Transportation states that *After standard construction mitigation, there would be a change in terrain stability along the excavated diversion channel banks, off-stream dam and at the diversion structure (Figure 9-11 and Table 9-12).*

a. Other than a change in slope gradient for the excavation or embankment fill, what other specific factors will lead to the change in stability?

b. What mitigation measures will be incorporated for areas of instability? Section 9.4.2.2 on Page 9.33 does not appear to incorporate any measures to address other types of change in stability.

506. Volume 3A, Section 9.4.2.3, Table 9-12, Page 9.35

Alberta Transportation states in Table 9-12 that there is a slight decrease in Stability Class IV terrain for potentially unstable slopes.

a. Will the presence of groundwater and high plastic soils in the diversion channel excavation (with slopes up to 37 m high) result in some increase in areas of potentially unstable slope? Explain why or why not.

b. Similarly does the construction of the offstream dam embankment on the valley bottom sediments result in some increase in potentially unstable slope? Explain why or why not.

507. Volume 3B, Section 5.2.1, Figure 5-6, Page 5.11
Volume 3B Section 5.2.1, Figure 5-10, Page 5.17
Volume 3B, Section 5.2.1, Figure 5-14, Page 5.23
Volume 3B, Section 5.2.1, Figure 5-18, Page 5.29
Volume 3B, Section 5.2.1, Figure 5-22, Page 5.35
Volume 3B, Section 5.2.1, Figure 5-26, Page 5.41

Alberta Transportation indicates in the figures listed above that for cross-section B-B' at the diversion channel that the groundwater table is situated in the bedrock and the channel excavation only impacts the water table near the base of channel excavation.

a. Is there a groundwater table in the clay and till overburden that will be affected by the channel excavation? Explain.

508. Volume 3B, Section 5.2.2.1, Page 5.45

Alberta Transportation indicates for the 2013 design flood that *the net change in head, at the point in time where the reservoir is filled, varies from an increase of 28 m (near the upstream toes of the dam) to a decrease of 7 m (in the diversion channel near the inlet structure)*. Lesser values for net change in head (positive and negative) are predicted for the smaller 1:10 and 1:100 year floods.

a. What are the impacts on slope stability in the reservoir during the periods of drawdown after the reservoir is drained?

b. If horizontal permeabilities are greater than vertical permeabilities in the bedrock, how will this influence the drawdown cone (i.e. net change in head) at the base of the diversion channel? Will this result in seepage discharge being higher on the slope? What will the effects be on slope stability? What will the freeze-thaw effects be?

509. Volume 3B, Section 5.2.2.3, Page 5.46

Alberta Transportation states that *Direction is adverse (in areas where net change in groundwater level is negative) and positive (in areas where net change in groundwater level is positive).*

a. How is a positive net change in groundwater level (i.e. surcharge in water level) considered positive if there can be negative effects on stability, saturation of subsoil, etc.?

510. Volume 3B, Section 9.2.2.2, Page 9.5

Alberta Transportation states that *Key mitigation to reduce the effect of soil pore water pressure change within the reservoir during reservoir draining include:*

- *drawdown of stored flood waters will be conducted in a controlled manner to avoid soil erosion and to maintain slope stability.*

Alberta Transportation also goes on to state that *The predicted residual effects on slopes after recommended post-flood mitigation would be a temporary imbalance in soil pore water pressure within the reservoir. This could result in minor, localized bank slumping immediately following reservoir draining and before the dissipation of pore water pressure.*

a. Explain what control measures will be incorporated to maintain slope stability of the reservoir slopes during drawdown.

b. Will there be a limitation on the rate of drawdown (e.g. control the rate of flow release from the reservoir)? If so, what are the limitations and corresponding reservoir elevation ranges that might be considered critical?

c. If there is a limitation on the rate of drawdown in order to ensure that sufficient drainage occurs in the slope so that landslides do not occur, how will this affect the time to drain the reservoir? How will these delays affect other factors such as erosion of the dam slope with no riprap?

d. As indicated above Alberta Transportation states that *drawdown of stored flood waters will be conducted in a controlled manner to avoid soil erosion and to maintain slope stability*. Subsequently, it is also stated that drawdown will result in *minor, localized bank slumping*. Explain how slope instability is avoided yet bank slumping will occur. What are the differences?

e. Once bank slumping occurs, won't this increase in size over time? Explain why or why not.

f. Which reservoir slope areas are most susceptible to slumping? Explain.

g. What is the risk of slumping adjacent the dam abutments? Explain.

511. Volume 3B, Section 9.2.3.1, Page 9.7

Alberta Transportation states that *Both reservoir filling and reservoir drainage are expected to contribute to water erosion.*

a. Describe the potential for soil erosion on the reservoir slopes adjacent the dam abutments.

512. Volume 3B, Section 9.2.3.2, Page 9.8

Alberta Transportation states that *Riprap will be installed along some edges of the diversion channel side slopes in critical areas such as outside curves, and on the water face of the off-stream Storage Dam.*

a. Placement of riprap on the water face of the off-stream Storage Dam was not mentioned elsewhere in the project description. Explain where riprap will be placed on the upstream slope of the dam.

513. Volume 3D, Section 1.5.1, Pages 1.18 and 1.19
Volume 1, Section 5.1 Page 5.2 to 5.5

Alberta Transportation very generally discusses the downstream impacts in the event of a PMF failure of the dam embankments and for lesser floods simply indicates that less damages would occur. Volume 1, Section 5.1 describes some of the challenges to dam safety which are potential failure modes.

a. Describe more specifically the extent and severity of damages and mitigations provided to reduce impacts for various levels of floods resulting from the different types of failures described in Volume 1, Section 5.1.

514. Volume 3D, Section 1.5.1, Page 1.18

Alberta Transportation states that *Accordingly, the off-stream dam has been designed to standards consistent with a hazard classification of "very high" per the AEP guidelines and "extreme" per the CDA guidelines (see Volume 1, Section 5.0 for details on dam safety design)*. AEP guidelines are no longer used for consequence classification.

a. Clarify the extent of consequences for each category of damages (e.g. loss of life) while recognizing that all of the consequence damage categories may not be of the same severity and state which categories dictate the overall classification for each component.

515. Volume 3D, Section 1.5.1 Page 1.18
Preliminary Design Report (draft), Section 10.1.2, Figure 39, Page 152

Alberta Transportation states that *Another design feature that serves-dual purpose in dam safety is the inclusion of breast walls above the diversion inlet gate bays. If the diversion inlet gates fail to close during flood operations, the breast walls would limit the flow of flood water into the off-stream reservoir to 600 m3/s, which can be managed by the emergency spillway*. Background documents (Preliminary Design Report Figure 39) indicate a peak diversion of over 850 m^3/s.

a. Confirm whether the design flow of 600 m^3/s for the canal is for the 2013 flood and explain whether flows can exceed this amount for larger floods such as the PMF.

516. Volume 3D, Section 1.6.2, Page 1.31
Volume 1, Section 3.2.1.5, Page 3.10

Alberta Transportation states that *The service spillway and auxiliary spillway have the capacity to pass up to 1/3 the flow rate between the 1:1000 year flood and the PMF, in accordance with the guidelines. The auxiliary spillway is designed to activate when inflow exceeds the capacity of the service spillway and diversion inlet*. Volume 1, Section 3.2.1.5, Page 3.10 states that *The auxiliary spillway is designed to withstand overtopping for flood events up to 1/3 between the 1:1000 and the PMF with an overtopping depth of 1.5 m*.

a. Clarify which portion of the design flood can be discharged through the service spillway and at what flood frequency/magnitude the operation of the auxiliary spillway is activated with and without diversion to the offstream reservoir.

517. Volume 3D, Section 1.6.2, Page 1.31

Alberta Transportation states that *The pneumatic system that raises the service spillway gates are designed to operate effectively if one or more air bags are damaged and fail in the downward position for safe passage of flow.*

a. Describe the number of air bags for each gate and indicate the minimum number of air bags to raise the gates in the event that one or more air bags fail.

b. Confirm that air supply lines for each air bag are separate and not affected by a malfunction or damage to one or more air bags.

518. Volume 3D, Section 2.3.3, Page 2.7

Alberta Transportation states that *Damage to infrastructure caused by wildfires, seismic events, or tornadoes during flood operations could result in dam failure or breach.*

a. Describe how wildfires and tornadoes would result in a dam failure or breach and what mitigation measures have been included.

519. Preliminary Design Report (draft) Appendix B.4-1 PMF Analysis Report, Section 4.3.1, Page 33

Alberta Transportation states that *a common practice in British Columbia (BC) and Alberta is to precede the PMP with a 100-year 24 hour rainfall leaving a period of three days between the storms.*

Alberta Transportation describes that antecedent event selection is a common practice in the United States, but is not a common practice in Canada. It recommends that the antecedent precipitation for Alberta projects be taken as the 1:10 year 48-hour rainfall that finishes five days before the PMP.

a. Discuss the implications for the PMF estimate of using a PMP with a different antecedent event.

520. Volume 1, Section 3.1, Pages 3.1
Volume 1, Section 3.1, Page3.2

Alberta Transportation states that some of the project components are designed for the PMF, which was estimated using a PMP analysis and hydrologic modelling.

a. Provide details on the derivation of the PMF.

b. Provide a comparison of the SR1 PMF estimate with PMF values estimated in other studies for sites in the same region (e.g. on a Creager plot).

521. Volume 1, Section 3.2.1.1, Page 3.6

For the diversion inlet:

a. Discuss the structural design of the main structure components including design approach, loading conditions and parameters.

b. Discuss the stability of the main structure components including loading conditions, parameters, target and actual factors of safety.

c. Discuss instrumentation to monitor performance (e.g. deformations).

d. Discuss anticipated quantities of construction materials required.

e. Describe construction requirements including temporary works (e.g. site clearing and grubbing, dewatering systems, foundation preparation, etc.).

522. Volume 1, Section 3.2.1.2, Page 3.7.

For the service spillway:

a. Discuss the structural design of the main structure components including design approach, loading conditions and parameters.

b. Discuss the stability of the main structure components including loading conditions, parameters, and target and actual factors of safety.

c. Discuss instrumentation to monitor performance (e.g. deformations).

d. Discuss anticipated quantities of construction materials required.

523. Volume 1, Section 3.2.2, Page 3.11

For the diversion channel:

a. Discuss the stability of the canal slopes including the extent of toe erosion expected. Provide the loading conditions, parameters, and actual and target factors of safety.

b. Discuss the testing and suitability of excavated materials for use as fill.

c. Discuss anticipated quantities of construction materials generated and required.

524. Volume 1, Section 3.2.5.1, Page 3.14
Volume 1, Section 3.2.5.1, Figure 3-8, Page 3.14
Volume 1, Section 3.2.5.4, Page 3.17

The foundation conditions including any variances that may occur underlying the offstream dam are not described. In particular, the differences in soil conditions between the majority of the dam foundation and the areas at the dam abutments and No Name Creek are not described.

a. Provide a discussion on foundation materials underlying the dam and saddle dyke including what seepage control requirements are necessary and how these requirements might vary across the bottom of the valley and abutment areas. Show or describe the typical dam cross section in the vicinity of the low level outlet near the No Name Creek channel.

b. Explain why a nominal cutoff trench would be sufficient for part of the dam when a deep cutoff trench is required for the floodplain berm on the Elbow River and drains are proposed near the low level outlet structure.

525. Volume 1, Section 3.2.5.1, Page 3.15

The composition of the dam includes an impervious core, random fill shells and a sand/fine filter internal drain. Quantities of the various construction materials are not provided. Other embankments such as the floodplain berm are described similarly with the exception that some areas of the embankments are also protected with riprap on the upstream slope.

a. Provide a summary of the field and lab testing that has been performed to determine the suitability of the materials.

b. Provide the characteristics/geotechnical properties and design parameters of the in-situ and construction materials and describe their suitability for use as construction materials.

c. Clarify if the earthfill specifications for impervious and random fill will permit the use of high plastic soils? If so, how will the CWMS be modified to account for the use of high plastic soils?

d. Clarify if the stability analyses for the excavations and embankments account for the use of high plastic materials in the embankments and foundation soils?

e. Discuss availability of various fill materials from excavations and requirements for sorting, moisture conditioning or other processing requirements.

526. Volume 1, Section 3.2.6, Figure 3-10, Page 3.17

Alberta Transportation states that *The low-level outlet structure (Figure 3-10) consists of an approach channel, discharge gate, gatehouse, discharge conduit and outlet channel. The gate is operated locally by the gatehouse.*

a. Discuss the structural design of the main structure components including design approach, loading conditions and parameters.

b. Where applicable, discuss the stability of the main structure components including loading conditions, parameters, and target and actual factors of safety.

c. Discuss instrumentation to monitor performance (e.g. deformations).

d. Discuss anticipated quantities of construction materials required.

527. Volume 1, Section 5.1.2, Table 5-3, Page 5.4

Alberta Transportation states that *Sediment deposition simulations were performed to evaluate potential effects on water surface elevations and freeboard established appropriately* (at the service spillway). There is a discussion of the uncertainty involved in sediment transport calculations, and in particular the differences between various sediment transport models, but the uncertainty related to selection of a sediment size or gradation is not discussed. The sediment transport calculations rely on a single composite grain size distribution based on four bar samples.

a. Provide information on the sample locations relative to the site and the local morphology (e.g. where on the bar).

b. Provide information on the sample size.

c. Provide a plot showing individual gradation curves for all four samples.

d. Discuss the uncertainty inherent in the mathematical and physical models related to uncertainty and variability of bed material gradations, and the consequences of that uncertainty for the expected performance of the diversion system.

528. Volume 1, Section 5.1.2, Table 5-4, Page 5.4
Preliminary Design Report (draft) Section 10.1.2, Page 151
Preliminary Design Report (draft) Section 10.1.2, Figure 39, Page 152
Alberta Transportation states that *adequate freeboard has been provided in the design to account for inflows from the probable maximum flood and potential wave run-up* (for the off-stream dam). Section 10 of the draft Preliminary Engineering Report states that *Inflow from the Diversion Channel is based on an assumed failure of the Diversion Inlet gates during a PMF on the Elbow River.*

a. Provide details of the freeboard calculation including routing and wind-wave analysis.

b. The starting reservoir elevation (on Figure 39) is said to account for sedimentation and local runoff. Does it also account for stored water remaining after passage of the antecedent rainfall event? Explain why or why not. Provide a complete figure showing inflow and outflow hydrographs and reservoir levels throughout the antecedent event and the PMF.

c. What return period event was assumed for estimation of the local runoff into the reservoir during passage of the PMF hydrograph? What was the rationale for that selection?

d. What is the reason for the horizontal portion of the inflow hydrograph in the Preliminary Design Report between hour 18 and hour 26? If it is to account for some duration of proper operation of the diversion structure gates, what is the rationale for the selection of that duration?

e. Why is the reservoir inflow shown on Figure 39 consistently slightly less than the diversion channel inflow even when the emergency spillway is not operating?

9 Approvals

9.1 Water Act

529. Volume 4C, Table C-1, Page C.12
Volume 3A, Section 10.3.1, Table 10-11, Page 10.39
Volume 4D, Section 6.1, Page 6.1
Volume 4D, Section 6.2, Pages 6.1 and 6.2
Alberta Transportation states that *A site specific erosion and sediment control plan will be developed*. In addition, it provided *Soil Handling and Revegetation Mitigation Measures* that provided an overview of how sediment would be removed from drainage courses inside the reservoir as required.
Alberta Transportation also committed that *AEP will have an Operation, Maintenance and Surveillance Plan developed for the reservoir will be that would include sediment stabilization and debris (sic)*.

a. Identify if the *Site Specific Erosion and Sediment Control Plan* will be a stand alone document or incorporated into the *Operation, Maintenance and Surveillance Pla*n for the post construction operation by AEP.

530. Volume 3A, Section 10.2.2.2, Table 10-4, Page 10.21
Volume 3A, Section 10.2.2.4, Table 10-9, Page 10.36
Volume 3A, Section 10.4.5, Table 10-13, Page 10.52
Volume 3B, Section 10.2.2.3, Table 10-8, Page 10.14
Volume 3B, Section 10.2.2.3, Table 10-11, Page 10.22
Volume 3B, Section 10.2.4, Table 10-12, Page 10.26

Alberta Transportation identifies that the LAA area covered by wetlands is 311.6 ha (3A Table 10-4). It then identifies that the wetlands in the LAA with a value cover of 123 ha prior to 30 ha being lost to construction (3A Table 10-13).
Alberta Transportation noted that the design flood would cover 70.3 ha of wetland in the reservoir (3B Table 10-8). It also notes that 29.8 ha out of 108.2 ha of wetlands would be covered by more than 3 cm of sediment in the reservoir (3B Table 10.11) and then it noted that wetlands in the PDA with a value totaling 15.3 ha would have 12 ha inundated (3B Table 10-12).

a. The 108.2 ha of wetlands in the reservoir identified in Volume 3B, Table 10-11 did not appear to have a source and it is inconsistent with the 70.3 ha to be flooded as identified in Volume 3B, Table 10-8. Provide a breakdown of the wetland areas in the LAA, the reservoir, and the area of these wetlands that will be removed by construction and the wetlands that will be inundated by floodwater.

b. Provide details on the wetland assessment method used to arrive at *estimated* values for wetlands and identify where the valued wetlands are located.

531. Volume 3B, Section 10.2.2, Table 10-4, Page 10.4
Volume 3B, Section 10.2.2.3, Page 10.12
Volume 3B, Section 10.2.2.3, Page 10.23
Volume 3B, Section 10.2.4, Page 10.26

Alberta Transportation made the following statements:

- For 3-10 cm of sediment deposition; *Most species comprising upland and wetland plant communities at existing conditions are retained in addition to recruitment of new species (Van der Valk and Bliss 1971; Van der Valk et al. 1983; Limon and Peco 2016). Small changes to existing species diversity and abundance are expected*.
- *Plants species that comprise wetland plant communities have inherent adaptation to seasonal or periodic flooding (Cronk and Fennessy 2001). Thus, wetland plant communities would be more tolerant to prolonged flooding*
- For 3-10 cm of sediment deposition; *Sediment of this depth has been shown to negatively affect vegetation productivity; however, high rates of mortality have not been observed (Van der Valk and Bliss 1971; Van der Valk et al. 1983; Limon and Peco 2016).*
- *The inundation duration from the design flood is 62 days and deposition of sediment greater than 3 cm would likely alter wetland plant composition and abundance. It has been observed that sediment deposition of 3 cm to 4 cm is enough to affect productivity of wetland plant species in Alberta (Van der Valk and Bliss 1971). Deposition of sediment is likely to alter wetland topography, resulting in changes to surface flow and alteration of wetland basin shape and depth.*

a. These statements provide contradictory information. Provide a detailed explanation of the effect of the design flood regarding sediment deposits on wetlands. Provide an update so that the contradictory information is corrected and the new information is added.

b. Provide an assessment of the cumulative effect of multiple floods on all wetlands identified within the PDA with an estimate of the number of 1:100 and greater floods that would result in the wetlands being impaired by sediment depth. Include an assessment of the depth of sediment that would result in the wetlands becoming upland sites.

c. Identify what mitigation (restoration or replacement) is proposed for each of the wetlands identified in the PDA that will be affected by sediment deposition due to flooding.

532. Volume 1, Section 3.4.1, Page 3.33

Alberta Transportation states *The low-level outlet would remain open to carry the flow of the unnamed creek over which the dam was built*. This permits natural flow from the unnamed creek basin to flow unimpeded during spring runoff and other local rainfall events. The Elbow River Basin Water Management Plan (ERBWMP) has an objective to *Manage water source areas to improve water quality in the Elbow River* and Appendix B of the ERBWMP provides water quality objectives.

a. Provide an assessment of the possible methodology and benefits to water quality and hydrology of operating the outlet during non-flood periods to provide storm water retention behind the dam with a post-storm controlled release to meet water quality objectives.

b. Identify how AEP, as the reservoir operator, can work with watershed authorities on managing water quality between flood events and identify if that information can be placed in the *Operation, Maintenance And Surveillance Plan* to be provided to AEP. If the information can be placed in the *Operation, Maintenance and Surveillance Plan* can Alberta Transportation commit to having that information added?

533. Volume 1, Section 3.2.8.1, Figure 3.12, Page 3.21
Volume 1, Section 3.2.8.1, Page 3.28
Volume 3D, Section 1.4.6, Pages 1.15 and 1.16
Volume 3D, Section 1.5.6, Pages 1.25 and 1.26

Alberta Transportation is proposing that pipelines carrying gas and oil through the Project are to be relocated. In addition, an abandoned pipeline (Plains Midstream Canada ULC) is identified as being within the proposed reservoir.

a. Clarification is required with regard to the relocation and abandonment of pipelines. Describe and provide a sketch of pipelines that will be:
   i. abandoned in place;
   ii. removed; and
   iii. new construction (relocations).

b. If pipelines are to be left within the reservoir explain the mechanisms for weighting pipe when the pipeline is already buried.

c. There is a potential for an abandoned pipeline to leach contaminants from coatings and from products left in the pipeline. Provide details on how each pipeline will be cleaned and abandoned with reference to requirements in CSA Z662 as well as giving consideration to removal of the pipeline.

d. If abandoned pipelines are not removed they may act as water conduits under the reservoir and dam which would be a potential hazard to the reservoir operation. What mitigation measures will be used to prevent a water conduit effect from happening on abandoned pipelines?

9.2 Other

534. Volume 3A, Section 3.2.1.3, Page 3.20

Alberta Transportation states *Light monitoring was conducted during the night of January 6 and 7, 2017 (ground was snow covered) at four sites (Figure 3-2) either adjacent to or with unobstructed views of the PDA*:

Testing over two nights and only during the 2017 year is a very small time frame and not representative enough to determine the effects of light especially considering the fact that construction will take place 24 hours a day, and will continue throughout the year until construction is finished. This means that during construction light trespass will occur over all seasons and a variety of climatic conditions.

a. Justify and explain why light testing was not conducted throughout the year under a variety of different circumstances such as seasonal conditions (winter, summer, spring, fall) and climatic conditions (rain, snow, etc.).

535. Volume 3A, Section 3.4.1.2, Page 3.40
Volume 3A, Section 3.5.2, Page 3.132

Alberta Transportation states *Lighting can become obtrusive if the light criteria in Table 3-4 and Table 3-5 are not met. The effects of Project lighting on nearby residential locations is assessed by comparing the predicted light changes to the these light criteria.*

Alberta Transportation also states *a significant environmental effect on lighting is defined as an increase in Project related light emissions that are greater than the CIE guidelines (Section 3.1.5.1) for light trespass and glare in a rural environment (E2) and the resulting conditions related to sky glow would be altered toward those of an urban environment.*

At no point are the impacts from light on wildlife addressed. Within the EIA changes in wildlife movement, mortality risk, biodiversity, etc. are all discussed.

a. Why did Alberta Transportation not look at the impacts to wildlife from light especially when construction is to take place 24 hours a day? List the species in the area that could be affected from light trespass at night. Be sure to include species that may be drawn to the PDA at night as a result of the light and those that may move further away from the PDA to avoid the light.

b. How does the light impact the species movement and mortality risk (if species are drawn to the light would this increase the number of vehicle collisions as they would be drawn to the PDA)? Explain.

c. If any species are to avoid the light during nighttime conditions where is it expected that these species will move to?

d. If any of the species from (c) move to another area is there a chance that predator prey relationships might change? Explain and provide the rationale behind the conclusion.

e. Can the mitigation measures discussed for light trespass in a rural area be applied wildlife? If there are different mitigation measures that apply for light trespass on wildlife discuss the different mitigation measures and if these mitigation measures will be adopted. If they will not be adopted why not?

536. Volume 3A, Section 3.4.4.2, Page 3.55 and 3.56

Alberta Transportation states *To limit potential effects from the use of the mobile lighting on light trespass, glare, and sky glow, the following mitigation measures would be employed:*
Lights will be positioned so that the luminaires can be pointed downward with no more than a 10^{o} tilt from the horizontal, so that only the working area is illuminated.
Adherence to lighting design guidelines, such as CIE, IDA, IES, and the lighting requirements for workspaces as enforced by Labour Canada.
Alberta Transportation goes on to list 4 other mitigation measures in addition to the two listed above.

a. How will Alberta Transportation ensure that all the mitigation measures listed are being followed and adhered to? Will any checks be in place? Will any policy or procedures be created for workers on site to ensure that before starting work or throughout the work day/night that all the mitigation measures are be followed and checked? If no check, policies, or procedures are to be in place justify and explain why this is not required.

537. Volume 1, Section 1.1.1.1, Page 1.3
Volume 4, Supporting Documentation, Section 5: Alberta Transportation EMS Manual
Volume 3C, Section 2.1, Page 2.1
Volume 4C, Page C.2
Volume 4C, Table C-2, Page C.28 and C.39

Alberta Transportation is to have an Adaptive Management approach for the life of the project. However, Alberta Transportation states *As the operator of the Project, Alberta Environment and Parks will be provided an operation, maintenance and surveillance plan developed by Alberta Transportation for the operation of the Project. Alberta Environment and Parks (AEP), will be responsible for the mitigation measures required for the flood and post-flood phases of the Project, summarized in Table C-2.*

a. The description of the Adaptive Management approach appears to be how Alberta Transportation adapts its operations as a result of its EMS. How does adaptive management occur with the *Operation, Maintenance And Surveillance Plan* Alberta Environment and Parks is to receive for the Project?

b. Final follow-up programs are proposed to be developed following approvals. How will these be passed on to AEP?

c. Section C-2 is for *Flood and Post-Flood Phase of the Project*. Parts of the table identify that the *Environmental Construction Operations Plan* (ECO Plan) will be used for such things as fire and spills. Describe how the ECO Plan is going to be part of the *Operation, Maintenance And Surveillance Plan* or edit Table C-2 to identify how AEP will manage those aspects of the operation.

10 Errata

538. Volume 1, Section 1.3.1, Page 1.10
Volume 1, Section 7.4, Table 7-3, Page 7.12
Section 1.3.1 states that Tsuut'ina Nation is located 619 m south of the southernmost part of the PDA. Whereas Table 7-3, Page 7.12 references a distance of 395 m in the first column but then states in the second column that the closest point of the Project to the Tsuut'ina Reserve is 930 m.

a. Clarify the distance between the PDA and the Tsuut'ina Nation. Update the sections as required so that the correct distance is used.

539. Volume 1, Section 1.3.2.1, Figure 1-8, Pages 1.12 and 1.13
Volume 4, Section 5.1.3, Page 5.1
Regarding Area C, Alberta Transportation states in Volume 1 that *the land would be publicly owned and privately stewarded*. In Volume 4 Alberta Transportation then states that *these lands will remain under private ownership and management.* These statements are contradictory.

a. Clarify which statement is correct. Update the required section to correct for the discrepancy.

540. Volume 1, Section 3.2, Figure 3-1, Page 3.3
Volume 1, Section 3.3.4, Page 3.28
Figure 3-1 is referenced in the EIA as the location for a designated spoil location, but this Figure contains no such information.

a. Provide the correct figure reference for the designated spoil location. Update the section so the correct figure is referenced.

541. Volume 1, Section 3.6.1, Table 3-9, Page 3.37
Alberta Transportation uses two different terms *Minimum Reservoir Draining Time* and *Release Time* to describe time to release water from the reservoir. A single term should only be used consistently throughout the EIA to describe this item.

a. Select one term and update the required sections.

542. Volume 2, Section 2.0, Page 2.1
Alberta Transportation states *The Project meets the requirement for a mandatory activity under (c), (d), and (e) of the Regulation.*

a. In the bullets this statement is referencing there is only (a), (b), and (c). Confirm that (c), (d), and (e), are supposed to be (a), (b), and (c). Update the section so that the correct numbering is reflected.

543. Volume 2, Section 4.0, Page 4.1
Volume 3D, Table of Contents, Page 1.i
Alberta Transportation states *Volume 3D assesses the environmental effects of accidents and malfunctions and the effects of the environment on the Project*.

a. Does Alberta Transportation mean to say the *effects of the project on the environment* instead of *effects of the environment on the Project*? If so, correct this statement and update the section. In addition, update Volume 3D so the correct title

is referenced throughout the EIA. If this is not an error explain what is meant by this statement as Volume 3D addresses Accidents and Malfunctions of the Project. Some of the categories listed in Volume 3D address a dam failure, hazardous materials spills, a fire, etc. which all appear to be impacts to the environment as a result of this project.

544. Volume 2, Section 7.1.1, Page 7.1
Volume 3A, Section 9.1.4.2, Page 9.5

Volume 2 states that construction will take place over a 27-month period while Volume 3A, Section 9.1.4.2 states that construction will take place over a 36-month period.

a. The statements reference two different construction timelines. Clarify the construction timeline and update the sections as required so that the correct timeline is used.

545. Volume 3A, Section 9.2.4, Figure 9-6, Page 9.26

Alberta Transportation refers to Tables D7-15 and D7-16 for Agricultural Land Capability Class descriptions in the footnote on Figure 9-6. These tables cannot be located.

a. Provide the correct table references.

546. Volume 3A, Section 9.5, Page 9.43

Alberta Transportation states that *There is a reduction in the areal extent of land rated as agricultural capability class 3 (mode) by 7% of the LAA during construction and dry operations (Table 9-13).* However, the changes in extent of agricultural land capability are presented in Table 9-14.

a. Table 9-13 is the incorrect reference. Correct the table reference.

547. Volume 3A, Section 10.2.2.3, Figure 10-5, Pages 10.34 and 10.35

Reference is made to the presence of hound's tongue, but no point for this species can be located on Figure 10-5.

a. Point out the presence of Hounds Tongue on Figure 10-5.

548. Volume 3A, Section 10.3, Table 10-11, Page 10.39

In the concordance table, Volume 3A, Section 10.3, Table 10-1 is indicated as the location of information related to identifying key vegetation indicators used to assess the Project impacts and the rationale for the indicator's selection. However, section 10.3 does not contain a table 10-1. It does contain Table 10-11 which describes key mitigation measures, but not indicators.

a. Clarify the location of the information on key vegetation indicators and the location of the rationale for their selection?

549. Volume 3A, Section 15.3.3, Page 15.27

Alberta Transportation states *Groundwater quantity and quality are not expected to be materially affected due to the limited extent and duration of Project effects on groundwater. Therefore, it is anticipated that there will be no effects on the ability of Tsuut'ina Nation to use groundwater in the Elbow River Alluvial Aquifer or the Elbow River for drinking water; effects to functioning of the identified wells on the Tsuut'ina Nation reserve within the hydrogeology RAA are not anticipated (See Section 14.3.23).* There is no Section 14.3.23.

a. Provide the correct section reference.

550. Volume 3B, Section 3.2.5.3, Table 3.2-4, Page 3.17

The table reference footnotes are missing for *c* and *d*.

a. Correct the footnote to include the missing references.

551. Volume 3B, Section 5.0, Page 5.1

Alberta Transportation states groundwater *quantity quality*. There appears to be a word missing between *quantity quality*.

a. Add the missing word and update the section.

552. Volume 3B, Section 6.4.1.1, Page 6.14

Alberta Transportation states *The hydrographs used in the analytical assessment are primarily based on hydrographs sourced from the WSC for the WSC Station 07BJ004 Bragg Creek*.

a. WSC station number is incorrect. The correct number is 05BJ004. Update this section so that the correct number and name of the station is referenced.

553. Volume 3B, Section 6.4.3.3, Figure 6-20, Page 6.45

a. Provide the y-axis label for the top plot of Figure 6-20 as it is missing.

554. Volume 3B Section 6.4.1.4, Page 6.17
Volume 4, Appendix J, Section 2.4.2, Table 2-9, Page 2.34

Alberta Transportation indicates that the design full service level of the reservoir is 77,200 dam^3 in Volume 3B and 84,500 dam^3 in Volume 4, Appendix J.

a. What is the correct full service volume? Update the required section so that the correct full service volume is indicated and consistent throughout the EIA.

555. Volume 3B, Section 6.4.3.1, Page 6.27
Volume 3B, Section 6.4.3.1, Table 6-6, Page 6.28

Alberta Transportation states in Section 6.4.3.1 that *This mass is minimal compared to the larger floods and is indicative of the relative size of the 1:10 year flood. Volumetrically, the deposited sediment remaining in the reservoir after release is estimated as 0.5% of the full-service volume (Table 6-6).*

a. Table 6-6 lists loss of retention volume due to sediment remaining in the Reservoir for a 1:10 year flood as 0.0%. What is the correct percentage? Correct the number and update the table or the explanation so that both percentages are same.

556. Volume 3B, Section 9.2.3.1, Page 9.7
Volume 4, Appendix D, Section 6.2, Page 6.2
Alberta Transportation states that *Sediment is expected to be dominantly in the sand size class*, whereas Volume 4 Appendix D indicates that a different composition for sediment: *The fine fractions (sand/silt/clay) are likely to stay in suspension longer, settle out and be deposited in the reservoir*.

a. Clarify the expected grain size and composition of post-flood sediment.

557. Volume 3B, Section 9.2.3.3, Page 9.11
Alberta Transportation states that *Effects were included in those presented in Table 9-10*. Table 9-10 does not exist in Volume 3B, Section 9.

a. Provide the correct table reference.

558. Volume 3B, Section 10.2.1, Page 10.3
Reference is made to Volume 3B, Section 6.5.1.3 for information on sediment deposition but no such section exists.

a. Section 6.5.1.3 does not exist. What is the correct section? Update the section so the correct reference is referred to.

559. Volume 3C, Section 1.2.1.2, Page 1.17
Volume 3A, Section 3.4.3, Page 3.46
Alberta Transportation states *Project mitigation measures are identified in Volume 3A, Section 3.4.3*. Section 3.4.3 *Air Emissions Rates* provides a discussion of contaminant emission into air for the Project.

a. Provide the correct section reference.

560. Volume 3D, Table 3-1, Pages 3.9 to 3.12

a. Delete the duplicated points stated on Pages 3.11 and 3.12 (repetitive with points on Pages 3.9 and 3.10).

b. Revise the wording in the column Significance of Residual Effect(s) once the Conclusions have been reworded in other sections.

561. Volume 4, Appendix A, Table A-1, TOR 3.4.2[E], Page A.23
Alberta Transportation is to *Describe impacts on other surface water users resulting from the Project. Identify any potential water use conflicts*. The reference Volume 3A, Section 6.4.2 is not available.

a. Update the reference so it is linked to the correct section in the EIA.

562. Volume 4, Appendix A, Table A-1, TOR 10 [A]g), Page A.47
The concordance table references Volume 3C, Section 4.0 which does not exist.

a. Update the concordance table and the reference so that the correct reference is listed.

563. Volume 4, Appendix A, Table A-1, TOR 2.7.2[A]b), Page A.11
The concordance table reference for this TOR is Volume 3A sections 6.4.2, 6.4.4, 10.2 and Volume 3B sections 6.4.2, 6.4.4, 10.2.4. Volume 3A sections 6.4.2 and 6.4.4 do not exist.

a. Update the concordance table so that the appropriate reference is listed or delete this reference.

564. Volume 4, Appendix A, Table A-1, TOR 3.4.1[C], Page A.21
The concordance table reference for this TOR is at Volume 3A, Section 6.2.2.8. However, there is no section by that number.

a. Update the concordance table so that the correct reference is listed.

565. Volume 4, Appendix D, Table 4-2, Pages 4.7 and 4.8

a. Identify the units for the numbers shown in Table 4-2.

566. Volume 4, Appendix D, Section 4.4.2, Page 4.11
The first sentence of this section refers to Table 5-3, which does not exist in Volume 4, Appendix D.

a. Provide the correct table reference.

567. Volume 4, Appendix E, Section 3B.3.2, Table 3B-8, Page 3B.3.3.
The title of Table 3B-8 reads *Mean Monthly and Annual Total Precipitation, Rainfall and Snowfall at Fort Springbank Airport (1980-2010).* The airport is the Springbank Airport.

a. Confirm the airport is the Springbank Airport.

568. Volume 4, Appendix G, Technical Data Report, Section 1.2.6, Page 1.6
Alberta Transportation states that *Land Use within the LAA is further explored in Volume 4, Appendix M*, however Land Use is explored in Volume 4, Appendix N.

a. Correct the reference so the appropriate appendix is referred to.

569. Volume 4, Appendix G, Technical Data Report, Section 3.0, Pages 3.5 to 3.31
The references throughout the section state that supporting information is provided in Section 5.4 (i.e. soil series site data and analytical methods and quality assurance reports). Section 5.4 does not exist in Volume 4 Appendix G.

a. Update the references throughout the section.

570. Volume 4, Appendix G, Technical Data Report, Section 3.1.5.5, Page 3.14
Alberta Transportation states that *Susceptibility to soil compaction is dependent on soil physical properties…Generally, compatibility increases with higher clay content, higher soil moisture content and lower organic matter content*.

a. Correct the spelling mistake as *compatibility* is a typo.

571. Volume 4, Appendix J, Section 2.2.5, Page 2.14
Alberta Transportation states *However, the overall pattern of degradation/aggradation.*

a. The sentence is not complete. Complete the sentence and update the section.

572. Volume 4, Appendix J, Section 2.4.2, Table 2-9, Page 2.34

Table 2-9 *Flow and Volume Estimates at Brag Creek and Sarcee Bridge for Modelled Floods* includes three column headings with *FFA.*

a. Define this abbreviation.

573. Volume 4, Appendix J, Section 2.4.2, Page 2.37

Modeling of sediment transport was based on a combination of field collected data and site specific mathematical relationships between discharge and the.

a. This sentence is incomplete. Complete the sentence and update the section.

574. Volume 4, Appendix J, Section 2.4.2, Page 2.37

Alberta Transportation states *This threshold was based on a maximum design release rate of 27 m^3/s and the effective discharge for suspended sediment transport of between 35 and 50 m^3/s (see Volume 4 Appendix J Hydrology for more detail).*

a. Volume 4, Appendix J, Hydrology was referenced within Volume 4 Appendix J, Hydrology. This is not the correct reference. Provide the correct reference.

575. Volume 4, Appendix J, Section 2.4.2, Page 2.37
Volume 3B, Section 6.4.1, Page 6.17

Alberta Transportation identified that *the second criteria for release is based on the length of time to drain the reservoir using the engineering design full service volume of approximately 84,500 dam^3*.

In Volume 3B, Section 6.4.1, Page 6.17 Alberta Transportation identified that *the second criteria is based on the length of time to drain the reservoir using the engineering full service volume of approximately 77,200 dam^3*. The two statements use different full service volumes.

a. Why are the full service volumes different? Clarify what the full service volume should be. Correct the required section so that the correct full service volume is indicated.

576. Volume 4, Appendix J, Section 2.4.3, Page 2.40

However, the overall pattern of degradation/aggradation

a. This sentence is incomplete. Complete the sentence and update the section.

577. Volume 4, Appendix J, Figure 3-12, Page 3.23
Volume 4, Appendix J, Figure 3-14, Page 3.26

a. Provide legends for the grey and red circles used in the plots.

578. Volume 4, Appendix J, Section 3.3.4.1, Page 3.35

Alberta Transportation states *The long-term data sets were sourced from Alberta Environment and Parks and the City of Calgary water quality data bases (see Appendix D4 for detail)*

a. Appendix D4 is not available in the EIA. Provide the correct appendix.

579. Volume 1, Section 7.4, Table 7-5, Page 7.47
Volume 1, Section 7.4, Table 7-7, Page 7.54
Alberta Transportation states a request in the Siksika Nation table to *begin a process that would work concurrently with the study of the physical reservoir, toward a community benefits agreement for Kainai.* Based on the text this request appears to be for Kainai First Nation, not Siksika Nation. The request could not be found in the Kainai Treaty 7 First Nation table (Table 7-7).

a. Clarify the discrepancy between Table 7-5 and Table 7-7. Update the Tables as required so the correct First Nation is identified.

580. Volume 4, Appendix B, Section 3.1.4, Page 3.21
Alberta Transportation mentions a meeting request with Stoney Nakoda Nations Chiefs and their Chief Executive Officers to provide a project update in July 2014. However, this statement was included in the time period of June 27, 2016 – September 15, 2016.

a. Clarify when this request was made.

581. Volume 3A, Section 7, Page 7.1
Alberta Transportation's definition of *surface water quality as Surface water quality refers to the chemistry of water in watercourses* does not include other key aspects. A broader definition would include chemical, physical, biological and radiological characteristics of water in watercourses, and would also include parameters such as temperature, sediment (turbidity), and algae/ bacteria.

a. Confirm Alberta Transportation agrees with this definition.

582. Volume 3A, Section 7.3, Page 7.13
There is an *Error! Reference source not found* in the first paragraph of this section.

a. Provide the correct reference.

583. Volume 3A, Section 7.2.2, Page 7.10
Volume 3A, Section 7.4.2.1, Page 7.14
Alberta Transportation indicated that *For a description of changes in turbidity conditions in the Elbow River and the outlet channel based on continuously collected data since 2015, see Volume 3A, Section 6 Hydrology.* The information could not be found in that section.

a. Provide the correct reference.

584. Volume 3A, Section 7.4.2.2, Page 7.15
Alberta Transportation indicated that *For more information on construction mitigation measures see Volume 3A, Section 8.4.7.* However, this section does not exist.

a. Provide the correct reference to find construction mitigation measures.

585. Volume 3A, Section 7.2.2, Page 7.10
Volume 4, Appendix K, Section 3.1, Page 3.1
Alberta Transportation indicated that *There are no approved wastewater discharges to the Elbow River upstream of Glenmore Reservoir*.

a. Review this statement as there are point sources in this area.

586. Volume 3B, Section 7.2.2.1, Page 7.7

Alberta Transportation states that *Based on quantitative analysis, the following parameters were very similar to suspended sediment in data patterns: total phosphorus, total coliforms, dissolved phosphorus, total dissolved phosphorus, and total organic carbon.*

a. In this statement, what is the difference between dissolved phosphorus and total dissolved phosphorus? If there is no difference, revise the statement.

587. Volume 4, Appendix K, Section 2.2.4.4, Page 2.22

Equation 3 shows a parameter TVM that was not defined in the preceding text.

a. Clarify the TVM parameter in equation 3.

588. Volume 4, Appendix K, Section 2.2.4.6, Page 2.29

Alberta Transportation states that *Out of the nitrogen species, nitrate and nitrite are available for plant uptake, while ammonia … need oxidation before they can be used.*

a. Confirm ammonia is also considered readily available as a nutrient for plant uptake.

589. Volume 4, Appendix K, Section 3.2, Figure 3-2, Page 3.5

The graph is supposed to show the seasonal variation for the Elbow River mainstem and at the Glenmore Reservoir. The Glenmore Reservoir bars are missing.

a. Add the Glenmore Reservoir bars and provide the updated graph.

590. Volume 4, Appendix K, Section 3.2.2.2, Page 3.34

Alberta Transportation indicated that *Water temperature and dissolved oxygen conditions change similarly in response to the diversion of flood water and retention in the reservoir prior to release back into the Elbow River.*

a. Clarify this statement as the temperature and dissolved oxygen changes are normally inversely proportional.

591. EIS Summary, Section 6.4.2.1, Page 6.20

Alberta Transportation identified that *Sediment and erosion control measures as detailed in Section 5.6.2.1, Aquatic Ecology will be used.* That section is not within the EIS Summary report.

a. Update the reference.

592. Volume 3B, Section 7.2.2.1, Page 7.7
Volume 3B, Section 7.2.2.1, Figure 7-2, Page 7.9

Alberta Transportation states *that suspended sediment concentrations in the upper Elbow River mainstem were […]* and refers to Figure 7-2. However, the figure refers to Total Suspended Solids concentration instead of suspended sediment.

a. Clarify if suspended sediment and total suspended solids are used interchangeably in this report.

593. Volume 4, Appendix K, Section 3.2, Figure 3-3, Page 3.6

The figure has a legend for different lines and areas in the graph.

a. Include a legend for the black dots.

b. Explain why all five dots for the month or May are outside the Lowess 95% confidence interval area.

c. The figure heading indicates that it applies for the summer season; however, the 'x' axis includes months for a full year. Clarify this discrepancy.