NRCB | Natural Resources Conservation Board

BOARD DECISION NR 2018-01

NRCB Application No. 1601

Town of Canmore

Construct and Operate a Debris Flood Retention Structure on Cougar Creek in Canmore, Alberta

November 2018

Table of Contents

SECTION 1: INTRODUCTION

1.1: Background and Project Description

[1] In June 2013, heavy rains caused a debris flood on Cougar Creek resulting in damage to homes, property, businesses, the Trans-Canada Highway, Highway 1A, and the Canadian Pacific Railway (CPR) in the Town of Canmore (the Town). After evaluating a number of options to mitigate the debris flood hazards on Cougar Creek, the Town proposed to construct a debris flood retention structure and access road (the Project) on Cougar Creek, approximately two km northeast of the Trans-Canada Highway (Figure 1).

[2] The Project includes a 29.85 m high debris flood retention structure, spillway, and diversion tunnel (collectively the Structure), and a 0.5 km maintenance access road (the Access Road) (Figure 2). The footprint of the Structure and Access Road would be approximately 1.3 hectares (ha) and 0.3 ha, respectively. During flood events, some debris and water would be attenuated by the Structure in an inundation area. The maximum footprint of the inundation area behind the Structure would be approximately 6.0 ha (Figure 3).

[3] The Structure would be located at the site of an existing debris net, in an area where the creek channel narrows and the banks are deeply incised. The debris net would be removed upon construction of the Project. The Structure would not permanently hold water and would be designed to allow water flow to pass in a controlled manner. During normal conditions, water and smaller debris and sediment would flow unimpeded through the Structure's diversion tunnel. During flood conditions, the Structure would hold back up to 760,000 m^3 of water and limit the outflow rate to 45 m^3/s. The Project includes design and operating features that will ensure wildlife movement and human access to Cougar Creek. The Access Road would provide access to the Structure from Elk Run Boulevard for construction and maintenance. The application does not include plans for decommissioning the Structure as it is proposed as a permanent installation.

[4] During flood events the water held back in the inundation area would continue to flow through the diversion tunnel at a maximum outlet discharge rate of 45 m^3/s. Debris captured behind the Structure would be physically removed when the flood water subsides. In the event of a major flood event that exceeds design parameters, evacuation procedures would be initiated and flood water would overtop the Structure via the spillway.

1.2: The Application

[5] A water management project that requires an environmental impact assessment (EIA) is subject to review by the Natural Resources Conservation Board (NRCB or Board) in accordance with the *Natural Resources Conservation Board Act* (NRCBA). On February 12, 2015, Alberta Environment and Sustainable Resource Development, now Alberta Environment and Parks (AEP), advised the Town that it was required to prepare an EIA in accordance with the *Environmental Protection and Enhancement Act* (EPEA).

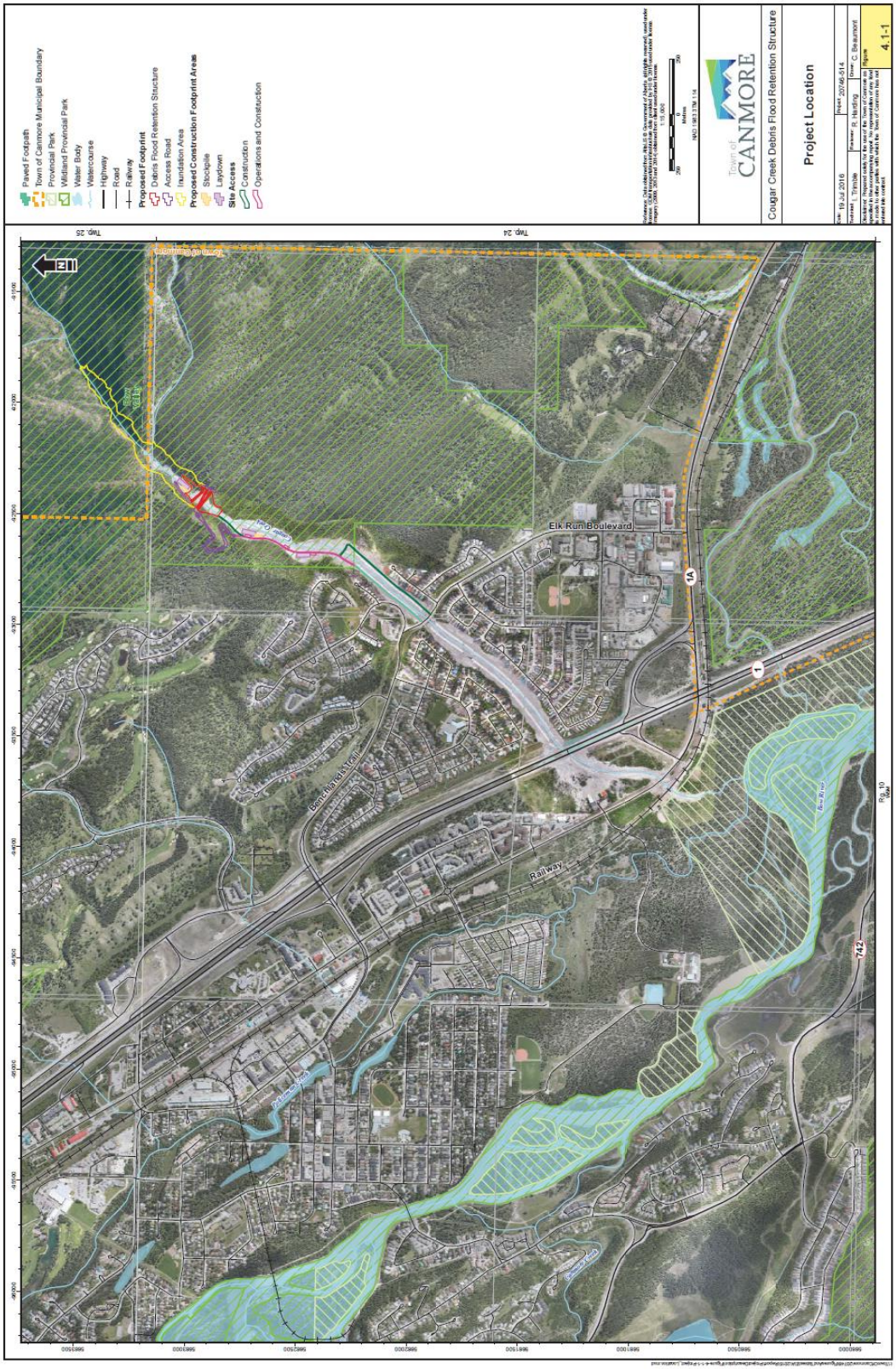


Figure 1. Project Location (based on EIA, Figure 4.1-1)

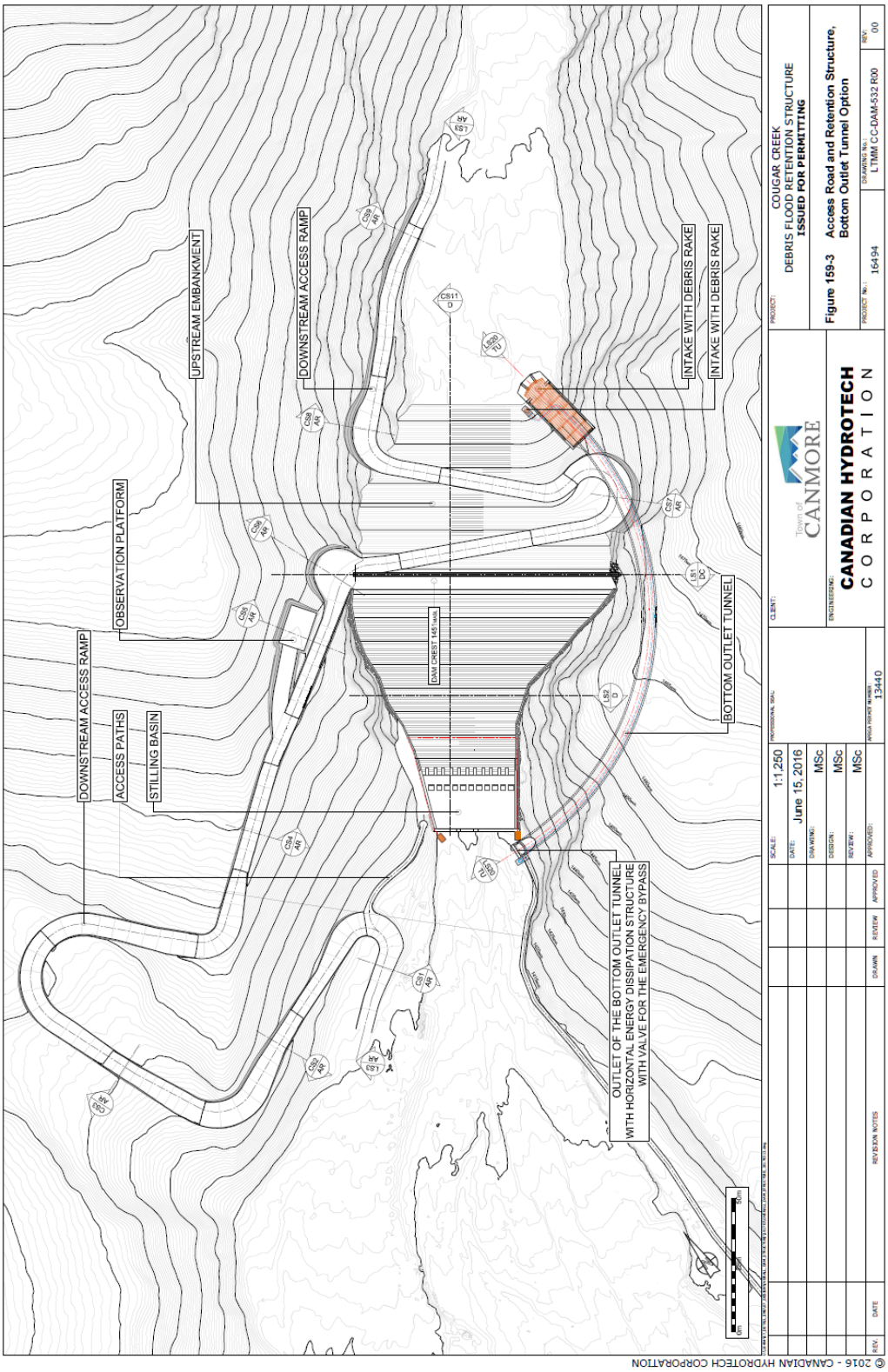


Figure 2. Project Design (based on Supplemental Information Request Round 1, Figure 159-3)

Figure 3. Project Footprint (based on EIA, Figure 4.1-2)

[6] In order to promote an efficient process, the NRCB relies primarily on the EIA terms of reference established by AEP. Through established convention, the NRCB advises AEP of any information needs that should be included in the EIA terms of reference to satisfy the NRCB application process. As a result, the EIA terms of reference serve as the NRCB application requirements, avoiding duplication and delay. While the NRCB and AEP conduct separate reviews of the common filing, they work together to develop a combined request for additional information required from the applicant (in this case, the Town), which is referred to as a supplemental information request (SIR).

[7] On August 22, 2016, the Town applied to the NRCB for an approval to construct the Project. The September 6, 2016 NRCB/AEP Joint Notice of Filing was published in the following newspapers, on the dates noted below:

- Rocky Mountain Outlook on September 15, 2016;
- Edmonton Journal on September 17, 2016;
- Calgary Herald on September 17, 2016; and
- Alberta Native News in the September 2016 edition.

[8] In addition to advising parties that the Town had filed an application with the NRCB, the Joint Notice advised parties that the Town had filed an EIA and a *Water Act* application with AEP. The notice invited interested persons to provide the NRCB with their contact information so that the Board could directly provide them with future notices.

[9] SIRs were directed to the Town on three separate occasions: December 21, 2016 (SIR #1), October 2, 2017 (SIR #2), and March 8, 2018 (SIR #3). The Town provided responses to the respective SIRs as follows:

- SIR #1 on June 12, 2017;
- SIR #2 on December 12, 2017; and
- SIR #3 on March 20, 2018.

[10] By letter dated March 23, 2018, AEP advised the NRCB that it deemed the EIA complete pursuant to section 53 (s.53) of EPEA.

[11] The Board issued a Notice of Application on April 11, 2018. The Notice of Application was published in the following newspapers, on the dates noted below:

- Crag and Canyon on April 11, 2018;
- Rocky Mountain Outlook on April 12, 2018;
- Edmonton Journal on April 14, 2018;
- Calgary Herald on April 14, 2018; and
- Alberta Native News in the April 2018 edition.

[12] The Notice of Application asked that parties file written submissions with the Board if they had concerns or objections to the Project. The Board did not receive any objections or statements of concern. The NRCB established a division of the Board, consisting of Peter Woloshyn (Chair), Page Stuart and Michele Annich (the Panel or the Board), to consider the application. The NRCB sent further questions regarding the Project to the Town on July 4 and August 14, 2018; the Town provided written responses to those questions on July 31 and August 21, 2018.

1.3: Basis of Decision

[13] The Board is directed by the NRCBA to review the Town's application to determine whether, in the Board's opinion, the Project is in the public interest. In determining the public interest, the Board must have regard to the social and economic effects of the Project and the effects of the Project on the environment. In assessing the various effects, the Board's evaluation must take into account the existing or background circumstances in order that Project impacts are considered on a cumulative basis.

[14] As a quasi-judicial tribunal, the Board must also perform its duties and exercise its powers in accordance with s.35 of the *Constitution Act, 1982*. Therefore the Project's effects on treaty and aboriginal rights are a key part of the public interest determination that the Board must consider under the NRCBA. As such, the Board must determine the adequacy of the Town's consultation with aboriginal peoples, having regard for the location of aboriginal or treaty interests in the Project area, including treaty rights and traditional land uses. The Board must also assess whether mitigation and accommodation is required.

[15] Further, the Aboriginal Consultation Office (ACO) has advised the Treaty 7 First Nations and the NRCB that the ACO and the Government of Alberta (GOA) may rely on the NRCB process to satisfy any duty that may be owed by the Crown on potential adverse impacts on s.35 rights recognized by the *Constitution Act*, *1982.* In addition, the GOA may, in part, rely on the NRCB process to assess impacts to traditional uses as defined in Alberta's First Nation's consultation policy and guidelines. The GOA has also advised that if it decides to rely on the NRCB process to satisfy the Crown's duty to consult, it will provide notice to the Board. The NRCB has not received any such notice from the GOA. Based on this direction, the Board will consider whether the Town's consultation, mitigation and accommodation regarding the Project were adequate to the point in time when the NRCB completed its record. The Board's findings are required as part of its public interest determination and decision. Following completion of the NRCB review process, and prior to issuing any GOA approvals, the GOA will make its determination regarding Crown consultation adequacy and accommodation.

[16] The Board believes that any project it approves should be justifiable; in the case of a public undertaking such as the Project, justification must have regard for the ongoing Project merit and the likelihood that the Town will operate and maintain the Project on a long-term basis. Further, it is important to understand whether the Project is capable of delivering the intended outcomes. The Board believes that, prior to conducting a detailed review of the social, economic and environmental effects, it should first consider the need for the Project and the ability of the Project to fulfill the identified need. Should the Board be satisfied that there is a need for the Project and that the Project is viable in terms of meeting that need, it will then proceed to examine the Project's social, economic and environmental effects, and the adequacy of the Town's consultation and accommodation.

1.4: Need for the Project and Viability

[17] The Town stated that there is a significant and urgent need to provide debris flood protection for residences, businesses, and infrastructure on the Cougar Creek Fan. The 2013 debris flood caused tens of millions of dollars in losses; highways and the railway were severed, and the public and emergency response teams were put at risk. Public and private infrastructure on the Cougar Creek Fan includes the Trans-Canada Highway, Highway 1A, the CPR main line, a school, a RCMP detachment, major electrical transmission lines, high pressure gas lines, and fibre optic main lines. The Town submitted that without adequate

flood mitigation measures in place, there is a high likelihood that future Cougar Creek flood events will result in considerable damage to private and public infrastructure and will continue to present an unacceptable risk to human life.

[18] Following the 2013 debris flood event, consultants with experience and expertise in flood hazard and risk assessment were retained by the Town. The consultants completed a detailed hazard and risk assessment for Cougar Creek, concluding that risks associated with flooding on the Cougar Creek Fan were unacceptable. This conclusion was founded on an assessed risk of the probability of death to an individual and group, which produced values that exceeded what are considered to be acceptable.

[19] Flood events are described by the flood return period (frequency of the specified rainfall event) and rainfall event (amount of rainfall over a specified time). The Town stated that the hydrologic design and the storage capacity of the Structure are based on a level of flood protection that covers floods resulting from storm events with return periods of up to 1,000 years. The Town stated that the design will allow flood water to flow over the Structure (overtopping) during flood events with return periods of 300 years or greater. For severe storm events that exceed flood protection design levels, the Town stated that the Project will provide adequate time to evacuate residents and businesses located on the Cougar Creek Fan.

[20] In September 2016, a Steep Creek Hazard and Risk Policy was passed by the Town Council that defines and incorporates risk of loss of life as a criterion for allowable development within the Town's steep creek hazard zones and study areas. The Town noted that similar approaches to managing steep creek hazards have been successfully used in Europe.

[21] The Town estimated the total Project construction cost at $38 million and stated that construction will require approximately 24 to 30 months to complete. The Town has a plan for the ongoing operational readiness and maintenance of the Project and intends that the Structure will be permanent.

Board Views on Project Need and Viability

[22] Public works projects address public needs that are not generally served by the private sector. These projects are usually financed by government, since they serve recreational, employment, transportation, and health and safety purposes in the greater community. The Board accepts that the Town has provided a compelling argument in support of the need to mitigate any future debris floods of similar or greater magnitude to the 2013 debris flood event. The Town's evidence on the justification for the Project focused on the risk to human life, the financial losses from damage to buildings and contents, and the economic losses from disruption of major transportation routes, including the Trans-Canada Highway. Having regard for the submissions of the Town, the Board is satisfied that there is a need for the Project.

[23] Assessing the viability of the Project requires a review of its capacity to satisfy the identified need. The Town included a number of severe rainfall and flood event scenarios to illustrate how the Project would perform under a range of conditions. In each scenario, the Town was able to demonstrate that the Project would provide critical flood mitigation, reducing property damage and risk to human life in even the most extreme forecasts. The Town asserts that the Project, in conjunction with improvements already made downstream

of the Structure, would be capable of effectively eliminating damages associated with a flood event equivalent to the 2013 debris flood.

[24] The Board accepts that the Town took considerable care to source design solutions that would serve a steep creek mountain environment. The Town consulted with subject matter experts, and chose proven technology to address the challenge of providing debris flood protection. The Board finds that the Project is designed not only to serve the water and debris retention needs that occur during flood events, but to minimize its impact during non-flood conditions by allowing normal water flows to pass through the Structure's diversion tunnel unimpeded.

[25] To conclude, the Board finds that the Project design satisfies the need to mitigate flood consequences in the Cougar Creek Fan. The balance of this Board decision assesses the Project's social and economic effects and the effects of the Project on the environment, and sets out the Panel's findings on whether the Project is in the public interest.

SECTION 2: CONSIDERATION OF ABORIGINAL AND TREATY RIGHTS

2.1: Introduction

[26] The Town was directed to consult with specified aboriginal peoples by the Government of Alberta (GOA) and the Government of Canada.

[27] The GOA, through the Alberta Aboriginal Consultation Office (ACO), advised the Town of Canmore, by letter dated August 11, 2015, to develop a consultation plan. The ACO approved the Town's Aboriginal Consultation Plan on October 1, 2015. In October 1, 2015 correspondence to the Town, the ACO indicated that it:

- retained responsibility for all procedural aspects not specifically delegated to the Town and for overseeing the consultation process by evaluating reports submitted by the Town; and
- was responsible for assessing the adequacy of Aboriginal Consultation and making recommendations to Alberta Environment and Parks (AEP).

[28] The NRCB asked for the ACO's assistance in understanding the GOA's expectations, if any, of the role of the NRCB review process in fulfilling the Crown's consultation obligations. The GOA advised the Board and Treaty 7 First Nations, in correspondence dated September 20, 2018 that:

> "… The ACO and Government of Alberta ministries may rely on the NRCB process, including but not limited to the Decision Report, to satisfy any duty that may be owed by the Crown on potential adverse impacts on Section 35 rights of the *Constitution Act,* 1982 as well as impacts to traditional uses as defined in Alberta's First Nation's consultation policy and guidelines … Consultation on the project is still ongoing … the Town may request the ACO for an adequacy recommendation to be provided to Alberta Environment and Parks (AEP), the regulatory decision maker for the *Water Act* application.…"

[29] The Government of Canada, through Infrastructure Canada (INFC), issued correspondence dated October 16, 2016 to the Town, requiring the Town to consult with particular aboriginal peoples, in addition to the Treaty 7 First Nations.

[30] As a statutory decision maker under the *Natural Resources Conservation Board Act* (NRCBA), and given the location of aboriginal or treaty interests in the Project area, the Board must consider potential impacts of the Project on Treaty 7 First Nations' rights, including treaty rights involving hunting, trapping, and fishing, and traditional land uses. The effect on treaty and aboriginal rights is a key part of the public interest determination, which the Board must make under the NRCBA. Also, as a quasi-judicial tribunal, the Board must perform its duties and exercise its powers in accordance with s.35 of the *Constitution Act, 1982*. Thus, the Board's mandate in this case includes considering whether the Town's consultation regarding the Project was adequate and whether mitigation and accommodation of treaty rights and impacts is required. The Board notes the ACO's advice that the GOA "may" rely on NRCB process to satisfy "any duty that may be owed by the Crown on potential adverse impacts on Section 35 rights …" and that "consultation on the project is ongoing." Given this direction by the GOA, the Board finds that its mandate on consultation and accommodation is narrowed to reviewing the Town's consultation record as

presented up to July 31, 2018, which includes answers to questions posed by the Board on July 4, 2018 regarding aboriginal consultation with Treaty 7 bands and with indigenous groups required to be consulted by the federal government.

[31] Consultation and accommodation by the Town and the NRCB's findings regarding consultation and accommodation adequacy are set out below.

2.2: The Crown Duty to Consult and Accommodate

[32] Pursuant to s. 35(1) of the *Constitution Act, 1982*, the existing aboriginal and treaty rights of aboriginal peoples are affirmed. The duty to consult and accommodate flows from this constitutional provision. In relation to decisions that may infringe on aboriginal and treaty rights, the duty to consult and accommodate has evolved through the common law, as various cases involving aboriginal and treaty rights have received adjudication. Most recently, the Supreme Court of Canada reviewed the principles of consultation and accommodation in the context of tribunal adjudication by the National Energy Board, in the cases of *Chippewas of the Thames First Nation v. Enbridge Pipelines Inc.* 2017 SCC 41 and *Clyde River (Hamlet) v. Petroleum Geo-Services Inc.* 2017 SCC 40. In both cases, the Supreme Court of Canada acknowledged that the Crown may rely upon a tribunal's regulatory assessment process to partially or completely fulfill the Crown's duty to consult and accommodate. The Supreme Court of Canada has also noted in these cases that the duty to consult gives rise to a specific public interest that supersedes other concerns typically considered by tribunals tasked with assessing the public interest.

[33] In this case, the GOA has advised that it "may" rely on the NRCB process and decision to satisfy any duty to consult that the GOA may owe as the Crown. However, the GOA has also advised that if it decides to rely on steps taken by the NRCB to fulfill the Crown's duty to consult, it would provide notice to the NRCB. No such notice has been provided to the NRCB. It follows that the Board may only determine the adequacy of the Town's consultation and accommodation, to the extent that the consultation record and its results are provided in the evidence before it. The Board recognizes that the GOA has already noted in its September 20, 2018 correspondence to Treaty 7 First Nations that "consultation on the project is still ongoing." By necessity, this means the full answer to the determination of the adequacy of the Crown's consultation and accommodation in regard to the Project remains with the GOA, as outlined in the GOA's September 20, 2018 correspondence.

[34] The Board notes, that in the evolution of the jurisprudence, the Supreme Court of Canada acknowledged that the following principles are associated with the duty to consult and accommodate in the regulatory context:

- a decision by a regulatory tribunal would trigger the Crown's duty to consult when the Crown has knowledge, real or constructive, of a potential or recognized aboriginal or treaty right that may be adversely affected by the tribunal's decision;

- the Crown may rely upon a regulatory tribunal to fulfil its duty to consult and accommodate, so long as the agency possesses the statutory powers to do what the duty to consult and accommodate requires in the particular circumstances;

- the duty to consult and accommodate is meant to address adverse impacts flowing from the specific Crown proposal at issue; the subject of consultation is the impact on the claimed rights of the current decision under consideration; and

- the duty to consult and accommodate involves a procedural and substantive element. Procedurally, if infringement of constitutional rights is to occur, aboriginal people must have the opportunity to have their views heard and considered (i.e., a meaningful consultation process that is carried out in good faith, including notice to ensure participation and an adequate opportunity to participate in the decision making process). Substantively, the aboriginal peoples must also have their rights accommodated through mitigation of impacts, minimal impairment, consideration of compensation or other negotiated solutions, mitigation of risks to rights through imposition of conditions, and written reasons showing the aboriginal concerns and the impact the concerns had on the decision.

2.3: The Town's Consultation and Accommodation with Aboriginal Peoples

Consultation with Treaty 7 First Nations

[35] As required by the ACO, and as outlined in the consultation plan approved by the ACO on October 1, 2015, the Town was required to consult with all Treaty 7 First Nations or Indian bands (all of whom hold reserves in the surrounding area and are listed below), to explore how the Project could affect First Nations' rights, including treaty rights involving hunting, trapping and fishing and traditional uses:

1. Stoney Nakoda First Nation (First Nations of Bearspaw, Chiniki and Wesley);
2. Blood Tribe/Kainai First Nation (Blackfoot);
3. Piikani Nation (Peigan/Blackfoot);
4. Siksika Nation (Blackfoot); and
5. Tsuut'ina Nation (Sarcee/Dene).

[36] It should be noted that the Project lands are within the boundaries of Treaty 7. Pursuant to Treaty 7, adhered to on September 22, 1877, the Blackfoot, Blood, Peigan, Sarcee and Stoney and other First Nations inhabiting Treaty 7 territory were promised that "they shall have the right to pursue their vocation of hunting through the Tract surrendered … subject to regulations as may, from time to time, be made by the Government … and excepting such Tracts as may be required or taken up from time to time…." The Project lands are located in the Bow Valley Wildland Provincial Park, where hunting is permitted, subject to provincial parks' regulations.

[37] Hunting rights under Treaty 7 have also been modified by paragraph 12 of the Alberta Natural Resources Transfer Agreement (NRTA), entered into in 1930 by the Province of Alberta and the federal government. Paragraph 12 of the NRTA expands the geographical areas in which "the Indians of the Province" may hunt, trap and fish in Alberta to "… all unoccupied Crown lands and on any other lands to which the said Indians may have a right of access," recognizing some regulation (though no seasonal restrictions), but extinguishing the commercial right to hunt, trap or fish. It follows that in considering the Project impact on these treaty rights, the Board must review and weigh all of the evidence provided by the affected Treaty 7 First Nations, including the Town's consultation and

accommodation initiatives and any evidence and submissions provided during the Board's written hearing process, to determine whether the Project is in the public interest.

[38] As part of the consultation process, the Town confirmed that it provided project notification letters, information packages, and notifications related to the EIA process to all identified Treaty 7 First Nations. The Town also conducted specific consultation meetings, including traditional land use (TLU) site visits. The Town confirmed that its representatives asked all identified Treaty 7 First Nations if they were interested in sharing traditional ecological knowledge (TEK) but no TEK was provided by any of the First Nations consulted. Information from the meetings, letter correspondences, and TLU site visits with each First Nation are summarized below:

1. Stoney Nakoda First Nation

[39] Initial correspondence received by the Town from the Stoney Nakoda First Nation included a letter dated November 3, 2015, which confirmed that the Stoney Nakoda First Nation's treaty rights and traditional uses were impacted in the proposed project area and that it had "site specific concerns." The Town met in Morley with the Stoney Nakoda First Nation consultation manager and two consultation officers on November 15, 2016 and outlined the Project design and history, including a history of Cougar Creek and information about the wildlife corridor. The Town advised that no specific concerns were raised by the Stoney Nakoda First Nation at that meeting. The Town also held a site visit with Stoney Nakoda First Nation representatives on December 2, 2016 (attended by two elders and the consultation officers of Bearspaw, Chiniki and Wesley First Nations). Discussions and issues raised at the site visit included:

- the First Nation's interest to harvest usable medicinal or ceremonial plants before construction;
- concerns about graffiti and other evidence of human use within Cougar Creek and its impact on wildlife; and
- the desire to hold a ceremony on the site before construction begins.

[40] No other issues were raised by the Stoney Nakoda First Nation. After the December 2, 2016 site visit, despite several requests, the Town did not receive a letter of non-objection from the Stoney Nakoda First Nation. Bi-monthly consultation records were consistently forwarded to the First Nation, noting the Town's expectation of receiving a non-objection letter regarding the December 2016 site visit results, with no response to the Town by the First Nation. By email dated July 17, 2018, in reviewing the Stoney Nakoda First Nation consultation, a representative from INFC confirmed that the records of consultation from the Town "should suffice."

[41] The Town has demonstrated in its September 12, 2017 correspondence to the Stoney Nakoda First Nation that a clean-up of disturbances associated with human use around the debris net on Cougar Creek was undertaken by Town staff on August 17, 2017. The Town confirmed that fire pits in the area were dismantled, graffiti was removed, and rock walls and cairns were destroyed and dispersed. The Town also advised that various items, mostly plastic, aluminum, and glass were picked up, carried out and disposed of. The Town also considered wildlife movement and the effect of human use in the Project area and determined that since the Project is within the Bow Valley Provincial Wildland Park, and under AEP jurisdiction, it has limited ability to control human activities in the area.

[42] The Town has advised in its supplementary information responses to the EIA that it would fully support the Stoney Nakoda First Nation's requests to have the opportunity to harvest traditionally used plants and to hold a pre-construction ceremony on the site.

2. Blood Tribe/Kainai First Nation

[43] The Town had an initial meeting with members of the Blood Tribe on December 10, 2015 and discussed flood risk and project design. Thereafter, the Blood Tribe held a preliminary site visit on March 14, 2016 and a further site visit with elders from the Blood Tribe on April 21, 2016. At the time of the site visit with elders, a representative of the Blood Tribe expressed a preference that native vegetative species be used for Project reclamation activities.

[44] The Blood Tribe provided a letter of non-objection to the Town dated May 19, 2016. In the letter, the Blood Tribe described that it had conducted a TLU assessment of the Project and that "no traditional sites were found on native prairie within the project right of way." The Blood Tribe stated that the letter was a "non-objection" but that it should not be construed as waiving or extinguishing the Blood Tribe's aboriginal or treaty rights.

3. The Piikani Nation

[45] The Town had an initial meeting with representatives of the Piikani Nation on November 12, 2015 and discussed project information and answered questions. Thereafter, the Piikani Nation (a representative and elder) attended a TLU site visit on April 18, 2016. No concerns were raised about the Project.

[46] The Piikani Nation provided a letter of non-objection to the Town dated April 27, 2016. In the letter, the Piikani Nation stated that the Town had consulted the First Nation on the Project, in accordance with its "…Consultation Procedure." The Piikani Nation also stated that a representative and elder participated in a TLU site visit on April 18, 2016 and confirmed that no site-specific concerns were identified. The Piikani indicated the non-objection letter would be withdrawn if the Town did not meet its commitment to ongoing issue resolution, however, no specific indications of what the issue resolutions might be are contained in the consultation record.

4. Siksika Nation

[47] The Town had an initial meeting with a representative from the Siksika Nation consultation office on April 12, 2016 and provided an overview of the Project. At that time, the Siksika Nation representative provided the Town with the Siksika Nation's expectations for conducting TLU field assessments. Thereafter, on April 15, 2016, the Town and Siksika Nation knowledge holders and representative held a site visit, at which time no specific concerns with the Project were raised.

[48] The Siksika Nation provided a letter of non-objection to the Town dated June 13, 2016. In the letter, the consultation office of the Siksika Nation stated that it had no concerns or objection to the Project "at this time." However, it requested that the Siksika Nation consultation office be notified immediately by the Town if artifacts were discovered during Project activities. The Siksika Nation consultation office stated that it had completed a TLU study and site visit of the proposed work area with Siksika Nation knowledge holders and the Town.

5. Tsuut'ina Nation

[49] The Town had an initial meeting with Tsuut'ina Nation representatives on October 29, 2015, to provide Project information and answer any questions. Subsequently, the Town and Tsuut'ina Nation representatives held a site visit on April 13, 2016 at which time no specific concerns with the Project were raised by the Tsuut'ina Nation representatives.

[50] The Tsuut'ina Nation provided a letter of non-objection to the Town dated May 26, 2016. In the letter, the Tsuut'ina Nation representatives stated that the consultation/traditional use study team had completed a preliminary assessment and had concluded at that time that it did not have any concerns with the Project. The Tsuut'ina Nation maintained the right to amend its position if new information suggested the Project could impact its treaty rights or traditional use in the area.

Consultation with Aboriginal Peoples as Directed by Infrastructure Canada

[51] On April 21, 2015, the Town received confirmation that the Canadian Environmental Assessment Agency did not require a federal environmental assessment of the Project. However, by letter dated October 19, 2016, INFC indicated to the Town that it would require the Town to consult with aboriginal peoples, since it was providing financial support to the Town for the Project.

[52] An INFC email dated October 28, 2016 requested that the Town should send notification of the Project to the Metis Nation of Alberta and the Ktunaxa Nation since "these groups have asserted rights in the vicinity of the Project." The Board notes that only two bands are listed for the Ktunaxa Nation (the Shuswap First Nation and ?Akisq'nuk First Nation), and INFC suggested that it would be good for the Town to contact the consultation coordinators of these groups and copy the coordinators on letters to these groups. INFC also describes the process as a "low scope consultation."

[53] The Town sent subsequent correspondence to Shuswap First Nation, ?Akisq'nuk First Nation, and the Metis Nation of Alberta on November 4, 2016, outlining the Project. The Town addressed the correspondence to these aboriginal groups in accordance with the directions, addresses and contacts listed in the October 28, 2016 email from the INFC Senior Environmental Review and Approval Officer. In this email, INFC indicated that it would also require review of the consultation record for the Treaty 7 consultation that had taken place between the Town and Treaty 7 First Nations, to ensure consultation adequacy.

2.4: Aboriginal Peoples and First Nations' Responses to the Town's Consultation and Engagement Initiatives

[54] The Board finds that the Town provided consultation records to the ACO and Treaty 7 First Nations. No concerns were raised by the Treaty 7 First Nations regarding the consultation record or the Town's commitments made under the EIA and its responses to supplementary information requests. Also, no concerns were raised by the Metis Nation of Alberta or the Shuswap First Nation or ?Akisq'nuk First Nation. The Metis Nation of Alberta and the ?Akisq'nuk First Nation did not respond to the Town's November 4, 2016 correspondence. The Shuswap First Nation confirmed by email that it had no concerns with the application for the Project.

2.5: The Board's Review Process

[55] The EIA and application were deemed complete by AEP on March 23, 2018.The NRCB issued a Notice of Application of the debris flood retention project on April 11, 2018. The Board finds that there were no submissions, objections or response correspondences received or provided to the NRCB by Treaty 7 First Nations, the Metis Nation of Alberta, the ?Akisq'nuk First Nation, or the Shuswap First Nation, regarding the adequacy of consultation, mitigation, or accommodation measures, or about impacts of the Project on Treaty 7 First Nation treaty rights, traditional land uses, or Metis Nation or other Nation rights or uses.

2.6: The Board's View on Adequacy of the Town's Consultation and Accommodation

[56] The Board finds that it is established that Treaty 7 First Nations hold treaty rights in the Project area, which may be impacted by the Project. Similarly, based on the INFC review, the Board finds that the Metis Nation of Alberta, ?Akisq'nuk First Nation, and Shuswap First Nation may have rights that are affected. However, based upon a review of all of the evidence before it and for the purposes of its decision on this Project, the Board is of the view that adequate consultation and accommodation by the Town have occurred (including through mitigation strategies). The Board finds that any potential impacts on the treaty or aboriginal rights of the First Nations consulted and engaged, or of the Metis Nation of Alberta, are not likely to be significant and have been effectively addressed through the mitigation strategies, commitments and conditions referenced in this decision. The Board's analysis and reasons are provided in greater detail below.

[57] Firstly, in the context of the Treaty 7 unoccupied Crown land, the Project's footprint is relatively small. As described in other sections of this decision, the Project is expected to have a low to negligible impact on wildlife and vegetation in the area. The Board therefore infers that the Project's impact on hunting or trapping rights is similarly low to negligible. Also, the Board finds that no hunting or trapping concerns have been raised by the First Nations and other aboriginal communities in the thorough consultation process conducted by the Town. Further, the Board finds that fishing rights are not impacted since it has been established that Cougar Creek is a non-fish bearing stream and that the Project will have a negligible effect on fish habitat in the Bow River and Policeman Creek.

[58] Secondly, the Board finds that the impacts raised by Treaty 7 First Nations regarding traditional uses of land and plants have been addressed by the Town's mitigation and accommodation commitments and the Board's conditions, which allow for harvesting traditional plants before construction begins and using native plants for reclamation purposes in the Project area. The Town also gave permission and committed to allow for a ceremonial event before construction of the Project commences. Thus, the Board imposes by way of condition the following requirements, to be carried out to the satisfaction of AEP:

- The Town must allow all Treaty 7 First Nations to harvest traditional plants (medicinal or ceremonial) and to participate in a ceremonial event before construction begins;
- The Town must use native plant species for Project reclamation and revegetation activities (as referenced in the discussion on revegetation;) and
- The Town must commit to ongoing issue resolution/consultation as the Project is constructed and maintained.

[59] Thirdly, the Board finds that the Town's clean-up activities conducted on August 17, 2017 in the Cougar Creek area addressed human use and graffiti, and were in direct response to concerns raised by the Stoney Nakoda First Nation.

[60] Fourthly, the Board finds, from a review of the Town's further answers to Board inquiries, that delivery of notification letters to aboriginal groups identified by INFC was confirmed and that the only group that responded to the Town was the Shuswap First Nation. The Shuswap First Nation confirmed to the Town, in its email dated November 18, 2016, that it had no concerns with the Town's application for the Project.

[61] Further, subsequent email correspondence between the Town and INFC related to Treaty 7 consultation dated July 17, 2018, and was also considered by the Board. The Board finds that the July 17, 2018 email was specifically in regard to a lack of response from the Stoney Nakoda First Nation, in providing a letter of non-objection as requested by the Town. In the email, INFC confirmed that "the records of consultation should suffice…there has been enough time elapsed to close the consultation…"

[62] In conclusion, the Board finds, based upon its review of the Town/First Nation meeting minutes and bi-monthly consultation reporting (original and revised versions), that the First Nations indicated a willingness to be engaged in meaningful consultation and engagement with the Town. This willingness is evidenced over the past three years by the First Nations' ongoing interaction with the Town's consultation consultants, their attendance at preliminary meetings and site visits, their attendance with elders at the Project site, their sharing of issues of concern with the Town and the provision of letters of non-objection to the Town. Overall, taking into account the approach by the Town and the First Nations and aboriginal communities, the Board finds that the discussions between the Town and the aboriginal communities illustrated the exchange of information for mutual understanding and the willingness to address the concerns of affected communities about impacts to their rights through mitigation measures or commitments.

[63] On the basis of the foregoing, the Board is satisfied that the conditions imposed in regards to vegetation, reclamation, ongoing consultation, and ceremonial opportunities will address the impacts to treaty and land use arising from construction and operation of the Project. In making this conclusion, the Board recognizes that the federal government and the GOA must arrive at their own conclusions regarding the duty to consult and accommodate. Further, the Board recognizes that the GOA may determine that additional conditions to accommodate adverse impacts to treaty rights and traditional land uses may need to be imposed under the Project, as a result of the GOA's ongoing consultation obligations.

SECTION 3: LAND USE AND MANAGEMENT

3.1: Views of the Applicant

[64] The Town stated that it identified key issues and potential effects of the Project on land use and management through development of the Terms of Reference for the environmental impact assessment (EIA), a literature review, and input from the Town of Canmore, First Nations, and the public. The Town concluded that potential Project effects on land use and management will be from its development in a recreation area (which interacts with tourism and recreation users), other surface land users, and unique sites.

[65] The Project (the Structure and Access Road) and the inundation area are located in an area of overlapping jurisdictions where various land use policies and resource management initiatives apply. According to the Town, most of the Access Road, and all of the Structure and inundation area, are located in the Bow Valley Wildland Provincial Park. The Town also indicated that the Bow Valley Wildland Provincial Park is administered by Alberta Environment and Parks (AEP) under the *Provincial Parks Act*. As well, the Town indicated that the Structure and Access Road are located within the Town's boundaries, along with a portion of the inundation area. Figure 4 illustrates the overlapping jurisdiction of the Town and AEP.

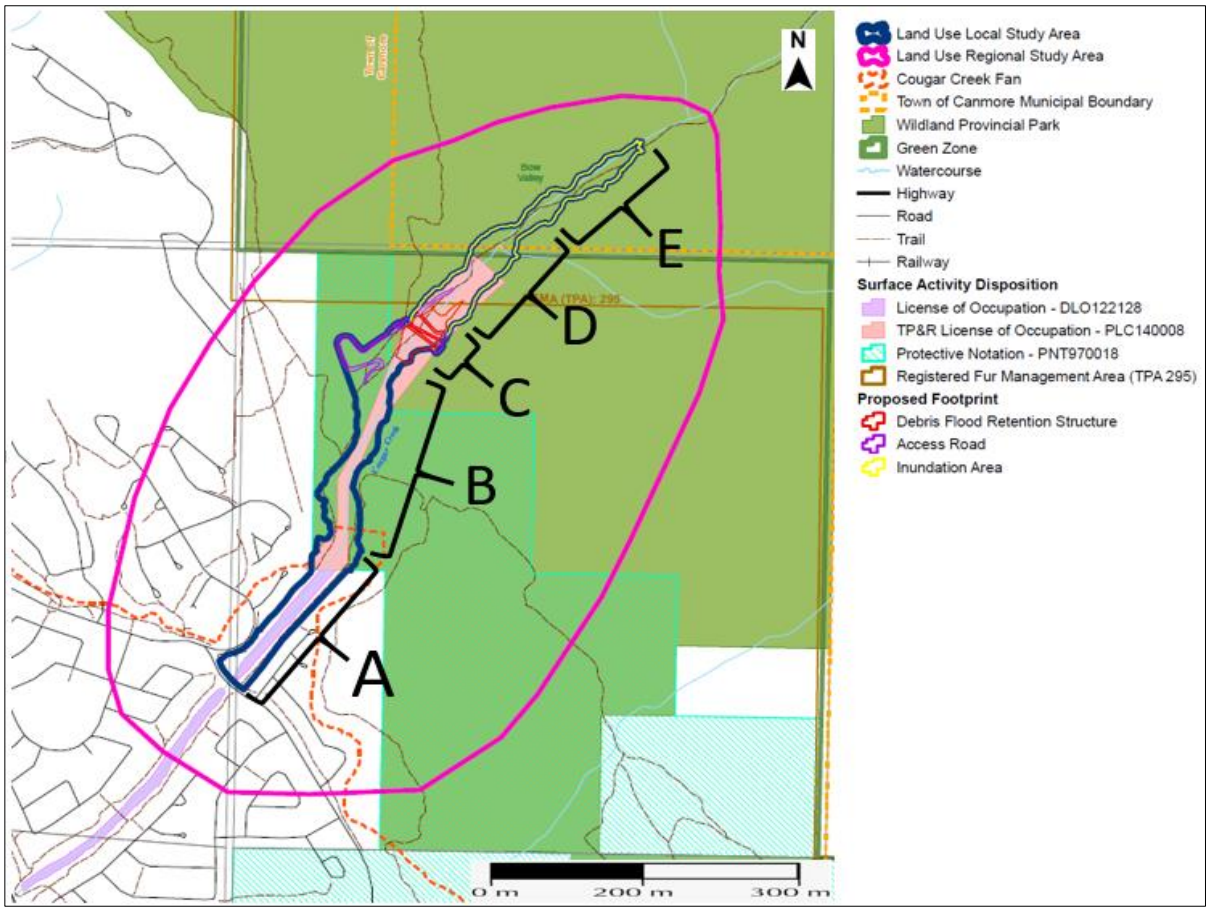
[66] It was the Town's view that the residual effect of the Project on land use and management will be positive, since it mitigates risk to existing and future land uses in the Cougar Creek Fan area.

Study Areas

[67] The Town defined a local study area (LSA) and a regional study area (RSA) to study the potential effects of the Project on land use and its management. The LSA consists of the Structure, Access Road, inundation area, bank access to Cougar Creek, and the recreational staging area off Elk Run Boulevard. According to the Town, the RSA was established to assess indirect Project effects and cumulative effects that may occur beyond the LSA boundaries.

[68] The Town illustrated by way of a map that the majority of the LSA and RSA are located in the Bow Valley Wildland Provincial Park.

[69] The Town indicated that portions of the LSA and RSA, which include the upper inundation area, are located in the Municipal District (M.D.) of Bighorn No. 8. The M.D. has a municipal development plan (Bighorn MDP) that "provides guidelines and policy direction for future land use, growth, and development of the M.D. of Bighorn." The Town stated that the Project is located in the Natural and Protected Areas land use designation of the Bighorn MDP. Since the inundation area land is under the authority of the provincial government under the *Provincial Parks Act*, the Town stated that the Bighorn MDP does not impact the Project.



Area		Bow Valley Wildland Park?	Municipality
Lower Access Road	A	No	Town of Canmore
Upper Access Road	B	Yes	Town of Canmore
Structure	C	Yes	Town of Canmore
Lower inundation	D	Yes	Town of Canmore
Upper inundation	E	Yes	MD of Bighorn

Figure 4. Land Use Management in the RSA and LSA (based on EIA Figure 8.4-2)

Land Use Policies: Regional Planning and Jurisdiction

[70] The Town stated that both the LSA and RSA fall within the boundaries of the South Saskatchewan Regional Plan (SSRP). The SSRP, delivered through the *Alberta Land Stewardship Act,* establishes a long-term vision for the region to balance economic, environmental, and social goals.

[71] The SSRP was amended in 2017 to allow for the construction and maintenance of an access road in a wildland provincial park if it is in the interest of public safety. AEP concluded that the SSRP amendment supersedes the *Provincial Parks Act Disposition Regulation,* which otherwise required Bow Valley Wildland Provincial Park lands be sold to the Town to provide for the Access Road to the Structure. The Town contended that because of this amendment, the previously proposed deregulation and land sale were no

longer required. Instead, the Town advised that if the Project was approved, AEP would issue a disposition to the Town in relation to the Access Road and Structure, and otherwise maintain jurisdiction over all activities within the Bow Valley Wildland Provincial Park.

[72] Under the provisions of the *Provincial Parks Act* and the *Public Lands Act*, specific surface interest rights may be granted by AEP to a land user through a disposition (a land use contract). Currently, the Town holds a disposition, activity code PLC 140008 (located in the B to E area on Figure 4), for an erosion control structure (the debris net). The Town indicated that AEP will issue a disposition to the Town to support the construction and operation of the Project. In addition, the Town holds disposition DLO 122128 for flood mitigation measures (erosion protection) on the portion of Cougar Creek in the Town boundaries above the Trans-Canada Highway. Three other dispositions in the LSA are held by the provincial government for a wildlife corridor, for wildfire management, and for a registered fur trapping area.

[73] The Town explained that environmentally significant areas (ESAs) are identified by the provincial government at quarter section resolution. These areas represent places in Alberta that are important to the long-term maintenance of biological diversity and physical landscape features. The Town indicated that there are three quarter sections in the LSA that are considered ESAs. The Town indicated that the largest contributors to the total “criteria value” for ESAs in the LSA were Criterion 4.0 (areas that contribute to water quality/quantity) and Criterion 3.0 (areas of ecological integrity). The Town concluded that since the ESAs overlap with the inundation area, not with the Access Road or the Structure, there will be no disturbance to the ESAs during construction.

[74] The LSA and RSA are located in areas covered by the Bow Corridor Local and Ghost River Subregional Integrated Resource Plans (IRPs) that provide resource objectives and operational guidance in the planning areas. The Town stated that the relevance of the IRPs is being reviewed by the provincial government, given the introduction of the SSRP. The Town contended that the IRPs are planning documents for making decisions regarding public land, resource development, and resource use conflicts, but have no legal status. The Town also asserted that existing IRPs remain in place until they are rescinded and that the SSRP will take precedence if there are any conflicts between the SSRP and the IRPs.

Land Use Policies: Municipal Planning

[75] The Town stated that it has responsibility for land use planning in the Project area that falls within its municipal boundaries, through the Town’s municipal development plan (MDP) and Land Use Bylaw (LUB) 22-2010. The majority of the LSA and RSA are located within the Town’s boundaries. However, since the Project area is also located in the Bow Valley Wildland Provincial Park, the Town confirmed that the legislated requirements of the *Provincial Parks Act* and regulations prevail.

[76] To facilitate the construction and operation of the Structure and Access Road, the Town updated its MDP in September 2016 (Bylaw 2016-03). The 2016 MDP also adopted the Town’s Steep Creek Hazard and Risk Policy.

[77] The Town indicated that its approach to managing steep creeks integrates hazard and risk considerations. The 2016 MDP defined and incorporated risk of loss of life as a

criterion for allowable development within the Town's steep creeks hazard zones and study areas (Table 1).

Table 1. Town of Canmore's Safety Risk Tolerance Criteria for Steep Creek Hazards (2016 Municipal Development Plan)

	Definition	Safety Risk Tolerance
Group Risk	The potential for multiple deaths in a single event	Within Acceptable or As Low As Reasonably Practical
Individual Risk	The potential for the death of an individual on a specific property in any given year, referred to as the Annual Probability of Death of an Individual (PDI)	New development: PDI shall not exceed 1:100,000
		Existing development: PDI shall not exceed 1:10,000

[78] The Town indicated that the existing individual risk in the Cougar Creek Fan exceeds the established safety risk tolerance of one in 10,000 (1:10,000 PDI). The Town has not formally placed a development hold zone on the Cougar Creek Fan, pending the outcome of the application to construct the Project. The Town stated that, if the Project were not to proceed, the Town's Engineering Department would recommend that a development hold zone be applied to the Cougar Creek Fan.

[79] The Town stated that there are a total of 15 undeveloped parcels of land in the Cougar Creek Fan. Absent the Project, five parcels do not meet safety risk tolerances and therefore could not be developed, four parcels are eligible for development, and the remaining six parcels, which are located in a "moderate" hazard risk area, could be developed if a site specific risk assessment indicates that the safety risk tolerance does not exceed 1:100,000 PDI. The Town indicated that after the Project is completed, all 15 parcels are "most likely" to be developable. Preliminary study results suggest that all areas currently in the Extreme/High & Moderate risk areas would be either outside of the hazard zone or in a low hazard area.

[80] The Town indicated that the Project is on land zoned by the Town as Environmental District (ED) and Wildlands Conservation District (WCD). Much of the ED and WCD area also overlaps the portion of the Cougar Creek valley that is within the Bow Valley Wildland Provincial Park. The Town indicated that the ED and WCD zoning is intended to promote environmental enhancement and that these objectives are consistent with the objectives of the Bow Valley Wildland Provincial Park managed by AEP under the *Provincial Parks Act*.

[81] The Town stated the development of the Project is consistent with the principles of integrated land use and resource planning applicable to an area with multiple land uses. The Town asserted that because the Project mitigates risk to existing and future land uses in the Cougar Creek Fan, the residual effect on land use would be positive and of high magnitude.

Recreation and Access

[82] The Town stated that the land use RSA supports extensive recreation and tourism, while the LSA (Project area) supports limited recreational activities, but is a well-used staging area that provides access to the backcountry. Outdoor recreational activities in the RSA include hiking, rock climbing, mountain biking, horseback riding, bird watching, and wildlife viewing. The RSA provides access to six popular hiking trails, but two of the trails, the Mount Lady Macdonald trail and Cougar Creek, can only be accessed through the LSA. The Town indicated that the Project was developed in close consultation with AEP and with recreational users and wildlife sustainability in mind.

[83] The Town stated that recreational access through or around the Project will be maintained during the construction and operation of the Project. During periods of construction or post-flood maintenance that generate high traffic on the Access Road, public safety will be protected by providing alternative routes for accessing the backcountry trails. The Town concluded that the Project will have a negligible impact on recreational activities since access will be maintained throughout the duration of the Project.

Aggregate Resources

[84] The Town estimated total aggregate requirements for the Project at 200,000 m^3. This represents a permanent removal of aggregate resources from the region; however, the Town states that there are considerable aggregate resources in the region and that the Project will not materially affect overall supply. The Town concluded that the Project will permanently decrease aggregate availability for other users; therefore, the residual effect on aggregate resources is negative and permanent, but considered to have a low magnitude.

3.2: Views of the Board

[85] The Board appreciates that land use jurisdiction in the Project area is complex. The Project is subject to various land use policies and resource management initiatives that involve the Province of Alberta and the Town of Canmore. The Town is commended for navigating through the complex jurisdictional issues in its development of the Project.

Land Use Policies

[86] The Board finds that the Town appropriately assessed land use in the Project area and the applicable municipal and provincial land use policies impacted by the Project. In particular, the Board notes the Town's efforts to implement development policies for flood hazard areas in the 2016 MDP and for creating its Steep Creek Hazard and Risk Policy. The Board accepts the Town's decision to place the Project area in the Steep Creek Hazard Zone and not to include the Cougar Creek Fan as a development hold zone, pending a decision on the Project application. By restricting developments in the Steep Creek Hazard Zone, the Board finds that the Town is meeting risk requirements and ensuring that property damages are mitigated in the event of future debris flood events in the Cougar Creek Fan. The Board encourages the Town to fulfill its commitment to implement a Development Hold Zone for the Cougar Creek Fan, should the Town decide against constructing the Project. That further action will ensure that new development is not allowed and that any increases in intensity of existing development or redevelopment do not materially increase the area's safety risk.

[87] The Board finds that the Project is an appropriate use of land to mitigate flood events for the residents, businesses, and infrastructure in the Cougar Creek Fan. The Board accepts the Town's assessment that the residual land use effect of the Project will be positive in direction and high in magnitude. The Board finds support for the Project in the fact that no intervenors or members of the public presented evidence to contradict the benefits of the Project.

[88] The Board has reviewed the Project in the context of consistency with the objectives of the South Saskatchewan Regional Plan (SSRP). The Board finds that the Project is consistent with these objectives. Sections of the SSRP[1] relevant to the Project and the Board's consideration include:

- Section 4 Implementation Plan: "Appropriate flood management contributes to long-term community sustainability and resiliency. Mitigating impacts from flooding reduces risk to public safety, developments and infrastructure, provides environmental benefits and results in savings in tax dollars for post-flood recovery costs."

- Strategy 4.12: "Support flood management planning and preparedness including … flood hazard mapping in communities that are at risk of flooding" and "municipal flood hazard mitigation plans to mitigate the threat from flooding to communities in the region."

- Strategy 8.23: "Municipalities are expected to … utilize or incorporate measures which minimize or mitigate possible negative impacts on important water resources or risks to health, public safety and loss to property damage due to hazards associated with water, such as flooding [emphasis added], erosion and subsidence due to bank stability issues, etc., within the scope of their jurisdiction."

- Section 18.2, Regulatory Details: "Notwithstanding section 18(1) or the wording of any other regulation, the Minister responsible for the Provincial Parks Act may grant or renew authority to construct and maintain an access road, if such access road is necessary to ensure the safety of the public." (This section applies to certain parks, including the Bow Valley Wildland Provincial Park.)

[89] The Bow Corridor Local IRP and the Ghost River Subregional IRP are referenced in the SSRP. The SSRP states that "They [the IRPs] will remain in effect until they have been reviewed for their relevance and incorporated as appropriate under the implementation strategies of this regional plan or future subregional or issue-specific plans with the region." The Board finds that the IRPs' primary functions are to assist decision makers regarding public land dispositions, and are subservient to the SSRP. Given the Board's finding that the Project is consistent with the SSRP and that the Town will require a disposition from AEP, the Board sees no relevance in further assessment of the IRPs.

1. Excerpted from the South Saskatchewan Regional Plan (SSRP). For more information and context readers are directed to the SSRP, which can be found on the Government of Alberta public website.

Recreation

[90] The Board finds that the Project is located in an area that is used extensively for recreation purposes, including access to backcountry trails. The Board considers it important that recreational access to the backcountry trails is maintained during the construction and operation of the Project. The Board notes that the Town's mitigation strategy provides for recreational access to the backcountry through or around the Project area during its construction and operation. Therefore, the Board requires as a condition of approval that the Town, subject to any limitations imposed by AEP, must fulfill its commitment to provide continuous backcountry access through or around the Project area during all phases of the Project.

Aggregate

[91] The Town is planning to source aggregate materials from third parties near Exshaw and from excess aggregate resources from residential developments within the Town. The Board finds that the Project will require a relatively small quantity of the total available aggregate resources in the region and therefore the impact on the regional aggregate supply will be minimal. Should aggregate demands for the Project strain regional supplies, the Board notes that the Government of Alberta has provided direction on the matter through its SSRP. Specifically, the Board notes that the SSRP recognizes the need and importance of aggregate materials as "… an essential component for development and maintenance of infrastructure throughout the region and province. … Maintaining opportunities for the development of these resources is critical to the success of surface materials industries."

Summary

[92] As stated previously, the Project is located within the boundaries of the Town and the Bow Valley Wildland Provincial Park. The Board notes that the Town and AEP have demonstrated a commitment to work together to accommodate the Project in the Bow Valley Wildland Provincial Park. The Board finds that the land use aspects of the Project can be appropriately managed through its construction and operations phases by the Town and AEP, through a combination of municipal planning tools and provincial dispositions.

SECTION 4: HISTORICAL RESOURCES

4.1: Views of the Applicant

[93] The Town conducted a Historical Resources Impact Assessment (HRIA) to determine the impact of the Project on historic, archeological, and paleontological resources. The local study area (LSA) for the HRIA consists of the Project footprint and inundation area. The LSA was proposed by a qualified archeologist retained by the Town and confirmed by Alberta Culture in the Archeological Research Permitting process. A regional study area was not defined for the HRIA.

[94] The Town reviewed previous HRIA investigations conducted in the vicinity of the LSA. Two studies were identified that assessed historical resources in the Bow Valley; however, the studies did not include an inspection of the Cougar Creek canyon.

[95] In addition to the review of previous HRIAs, the Town conducted a paleontological study and an archeology and historic sites study in the LSA. The Historical Resources Management Branch (HRMB) of Alberta Culture and Tourism issued permits to the Town to conduct the archeological HRIA of the LSA. The focus of this HRIA was to identify the presence of significant archeological or historic sites (especially in the Access Road area), inspect the canyon walls for rock art, and confirm the location of a Precontact archeological site, identified in a 1995 HRIA of the Eagle Terrace subdivision, which was believed to be located in or near the LSA. The Royal Tyrrell Museum of Palaeontology (RTMP) issued a permit to the Town to conduct the paleontological HRIA. Fieldwork for the archeological and paleontological HRIAs completed by the Town was conducted in 2015.

[96] According to the Town, the methods used for the HRIAs are consistent with procedures used in the *Historical Resources Act*, the Archaeological and Palaeontological Research Permit Regulation, and HRMB bulletins. Specific requirements for the archeological and paleontological HRIAs in the LSA are detailed in a “Schedule A” requirement letter issued to the Town by Alberta Culture and Tourism.

[97] The Town indicated that the purpose of the paleontological HRIA was to document and salvage significant fossil material, if encountered in the LSA. The field assessment conducted as part of the HRIA focused on carbonate bedrock (Spray River Group, and Rundle Group) exposures bordering Cougar Creek and on Quaternary (glacial) deposits, when encountered. According to the Town, invertebrate fossil fragments (e.g., corals) were found in cobble material in the Cougar Creek stream bed in the LSA. No fossils were observed at the proposed location of the Structure and no vertebrate fossils were observed during the field inspection.

[98] The Town indicated that the archeological HRIA involved a systematic traverse of the LSA, shovel testing of high potential sites that were encountered, and a visual inspection of Cougar Creek cliff walls for rock art sites. Photos taken of the cliff walls were processed through an image processing technique to bring out any rock art. The HRIA concluded that the Project area has low archeological potential due to the rugged, relatively steep terrain mantled in till or colluvium. No known, significant, or intact historical resources were found. The analysis of cliff art photos failed to identify any rock art elements. The Town concluded that the potential impact of the Project on archeological resources is minimal.

[99] As part of the archeological and historical HRIA, the Town conducted an assessment to determine the location of a Precontact archeological site, identified in a 1995 HRIA, which is located in or near the LSA. The reassessment determined that the site was incorrectly located in the 1995 study. The site was determined to be more than 500 m from the Project, so it was the Town's view that it would not be impacted by the Project.

[100] It is the Town's view that the Project impact on historical resources is minimal. The Project paleontologist stated that further paleontological assessments are not warranted since the potential for fossiliferous bedrock in the LSA is low and any fossiliferous exposures currently accessible would likely still be accessible after the Project is constructed. The Town's consultant forwarded the paleontological findings to the RTMP, recommending that further paleontological assessments are not justified. The Town stated that no significant archeological or historic resources are located in the LSA. The Project archeologist recommended to HRMB that a clearance certificate be granted to the Town to allow for ground disturbance activities associated with the Project to proceed.

[101] The Town indicated that the 2015 paleontological permit report undertaken for the Project was filed with the RTMP in June of 2016. In addition, the paleontology permit report and the 2016 archeological HRIA report were forwarded to HRMB for review in June of 2016. Subsequently, the Town received a *Historical Resources Act* Approval dated October 13, 2016, granting clearance for the Project and requiring that any chance discovery of historical resources was to be reported by the Town to the Minister of Culture and Tourism.

4.2: Views of the Board

Adequacy of Methodology

[102] The Board finds that the methods used for the development of the HRIAs are consistent with procedures used in Alberta's *Historical Resources Act*, the Archaeological and Palaeontological Research Permit Regulation, HRMB bulletins, and the "Schedule A" requirement letter issued to the Town by Alberta Culture and Tourism.

[103] The Board agrees with not defining an RSA for the HRIA as it is unlikely historical resources outside of the LSA will be impacted by the Project.

Sufficiency of HRMB Approval

[104] The Board acknowledges that based on the results of the historic resources impact studies conducted by the Town for archeological and paleontological resources, HRMB granted *Historical Resources Act* approval (referred to as a "clearance certificate" by the Town) on October 13, 2016 for activities described in the application. This confirmation that HRMB granted permission for the Project activities to proceed was provided by the Town to the Board in response to further questions the Board posed to the Town in correspondence dated July 4, 2018. The Board notes that the approval from HRMB requires the Town to report any historic resource discoveries made during construction of the Project to Alberta Culture and Tourism (according to "Standard Requirements under the Alberta *Historical Resources Act*: Reporting the Discovery of Historic Resources").

SECTION 5: AQUATIC ENVIRONMENT

5.1: Views of the Applicant

Assessment of Aquatic Environment

[105] The Town stated that the aquatic environment assessment for the Project included the study of hydrology, surface water quality, aquatic ecology, and hydrogeology, while acknowledging the interconnectedness of surface water and groundwater in the Project area. The Town highlighted that Cougar Creek, an incised channel in the upper reach expanding into an alluvial fan in the lower reach, is a primarily dry, non-fish bearing watercourse.

[106] The Town considered Project activities during all phases of the Project that have the potential to affect surface water. Two distinct temporal periods for activities associated with the Project were classified—construction and operation.

[107] A variety of data sources were used by the Town for the aquatic environment assessments. Potential effects on peak flow and water levels, geomorphology, and surface water-groundwater interactions were part of the hydrology assessment. Key water quality parameters were considered as part of the surface water quality assessment. Sport fish habitat (in the Bow River floodplain and Policeman Creek) and sediment load and woody debris contributions to Policeman Creek and the Bow River were considered indicators as part of the aquatic ecology assessment. Potential effects on groundwater levels and quality in the Valley/Fan Aquifer were considered relevant indicators as part of the hydrogeology assessment.

Study Areas and Baseline Conditions

[108] The Town identified a local study area (LSA) and a regional study area (RSA) for surface water that were shared for hydrology, surface water quality, and aquatic ecology assessments. The surface water LSA, approximately 10.4 km^2, included the inundation area, Project area and the area downstream of the Project, including the Cougar Creek Fan, portions of the Town, and portions of Bow Valley Wildland Provincial Park (Lower Cougar Creek Reach). The surface water RSA (approximately 51.7 km^2) included areas defined as the Upper Cougar Creek Reach (from the headwaters to the inundation area/Structure) and the Lower Cougar Creek Reach (from the Structure to the confluence with the Bow River).

[109] The Town explained that the hydrogeology assessment had slightly different local and regional study areas. The groundwater LSA (approximately 5.7 km^2) was limited downstream to the Cougar Creek Fan and the most proximate surface water bodies along the fan terminus. The groundwater RSA (approximately 33.8 km^2) was limited upstream to the immediate vicinity of the Project. The RSA incorporated a larger area downstream of the Project that included the Lower Cougar Creek Reach and extended up the Bow Valley, to incorporate regionally significant aquifers.

[110] The Town provided baseline conditions for the Upper Cougar Creek Reach and Lower Cougar Creek Reach, highlighting specifics related to descriptions of the watershed, estimations of the flow regime, normal and extreme meteorological conditions, debris and sediment yield, surface water and groundwater interactions, surface water users, and summaries of surface water quality and aquatic ecology.

[111] The Upper Cougar Creek Reach was described as mountainous with slopes near, or steeper than, the angle of repose, with six tributaries contributing to flow. From the Project, Cougar Creek flows southwest through the Lower Cougar Creek Reach, consisting of No Man's Land and the Cougar Creek Fan (with an approximate 1.1 km reach of the channel reinforced with articulated concrete mats). The Town estimated meteorological conditions and flows, given that no meteorological or hydrometric stations exist in the Upper or Lower Cougar Creek Reaches. Peak discharges were estimated for a number of return periods (or ranges of return periods) under Baseline Conditions at the location of the Structure based on numerical modelling from two studies.

[112] The Town outlined that in one study the rainfall runoff model was used to estimate peak flows. The rainfall event in 2013 was used to characterize extreme conditions in the Upper Reach and to model the flow regime at the Project and in the Lower Cougar Creek Reach. The Town stated that the rainfall event from June 19 to 21, 2013, was rare and extreme due to the relatively long duration and associated rainfall amount. The three day rainfall in the Cougar Creek watershed was estimated to be 220 mm, resulting in significant movement of surface water, sediment, and debris.

[113] The Town explained that a frequency magnitude analysis model was used to estimate peak discharges associated with debris flows. Peak flows at nearby regional monitoring stations were used to compare and predict flow values in Cougar Creek, which were estimated to be 80 m^3/s during the June 2013 debris flood, corresponding to an estimated flow return period of 400 years (according to the frequency magnitude analysis estimates).

[114] Peak discharge estimates were relatively consistent for return periods up to the 1 in 100 year return period event, regardless of the modelling method used. The Town believed that frequency magnitude analysis provided better, or more appropriate, peak discharge estimates for higher return period events, though discharge estimates were based on extensive assumptions and had related uncertainties associated with them.

Effect of Structure on Hydrology

[115] The Town stated that during operation, the Structure would attenuate flows by utilizing upstream storage within the inundation area and by preventing large sediment and debris from passing during and following flood events. The diversion tunnel outlet is designed to pass a maximum discharge of 45 m^3/s at the full impoundment level. The Town outlined that during flood events, peak outlet discharges will be less than peak inflows at the Structure, resulting in stored water in the inundation area and an increase in open water surface area upstream of the Structure. During some extreme rainfall events the Town expected that peak discharges may be equivalent to peak inflows for short periods of time. Although following a flood, the Town anticipated a longer outflow period from the Structure as a result of peak discharge attenuation, the Town considered this to be a relatively short-term impact. The Town expected the inundation area to be emptied in less than 24 hours following a flood event. The Town concluded that during normal and low-flow conditions, Cougar Creek flow would effectively be the same in baseline and application cases, and that no impacts to downstream surface water users were anticipated.

[116] The Town explained that under baseline conditions, debris and sediment from the Upper Reach would be transported downstream almost exclusively during flood events, including annual spring runoff. Debris and sediment would be deposited at various locations

downstream along Cougar Creek, though the exact quantities of debris and sediment generated in the Cougar Creek watershed were unknown. In the Lower Cougar Creek Reach, the Fan is comprised primarily of gravel, sand, silt, and till. The Town stated that the introduction of the articulated concrete mats will result in minimal lateral migration of the Cougar Creek channel and may result in increased sediment transport to downstream areas when compared to natural watercourse conditions (i.e., without confinement). The Town stated that the majority of debris and sediment that passes the debris net settles in the Lower (flat) Reach during flood events, as a result of changes in gradient from the Upper Cougar Creek Reach (36.4%) to the Lower Cougar Creek Reach (4.6%).

[117] The Town indicated that localized changes to geomorphology (including debris and sediment transport and yield, river bed aggradation, degradation, and bank erosion) were anticipated under construction of the Project as the existing channel accommodates the Structure. The Town expected localized erosion during the construction phase, though it could be mitigated through construction-related water and erosion management activities. During the operational phase, the Town expected geomorphological changes due to the accumulation of sediment and debris within the inundation area and anticipated that some slope erosion may occur during high flow events. The Town predicted no impacts to slope stability in the inundation area due to the underlying competent bedrock. The Town predicted changes to peak flows and water levels in Cougar Creek as a result of the Project, and also described a reduction in coarse sediment and debris downstream of the Structure. The Town stated that most of the large debris would be retained within the inundation area. The majority of the large sediment and debris would otherwise be caught by the current debris net or settle in the Fan before the confluence with the Bow River, in the absence of the Structure. The coarse sediment that passes the Structure would likely also deposit before the Cougar Creek and Bow River confluence and the Structure would allow normal stream bed load to reach the Bow River. Therefore the Town concluded that sediment and debris transport regimes to the Bow River were not anticipated to be impacted as a result of the Structure. Though bank erosion and creek bed aggradation were believed to be possible upstream and downstream of the articulated concrete mats, due to longer outflow durations from the Structure (as the inundation area drains), the Town expected this to be less than in the baseline case and thought it may be possible to provide further mitigation if required.

Surface Water-Groundwater Interaction

[118] The Town summarized that most precipitation generates flow in the Upper Reach as surface runoff directed toward surface water features or as interflow in the uppermost alluvium or weathered bedrock. The Upper Reach acts as a regional recharge area for downstream shallow aquifers and the bedrock, with groundwater discharge supplying Cougar Creek flow at various locations throughout the channel reach, including near the proposed Project and further downstream. The Town interpreted that a significant portion of water flows as interflow in the Valley/Fan Aquifer, as opposed to surface flow within Cougar Creek, and that there is likely a component of local recharge and interflow/runoff from the Cougar Creek watershed.

[119] The Town stated that the Structure is designed to allow surface water and groundwater to flow under normal conditions during operation, with the exception of shallow groundwater in the alluvial aquifer being brought to the surface by the cut-off wall and diverted around the Structure before re-equilibrating downstream of the diversion tunnel outlet. No effects to surface water and groundwater were anticipated, other than in the immediate vicinity of the Structure, where surface water flows will generally increase as a

result of the Structure and remain unchanged outside of the immediate vicinity. The Town considered any potential changes in evaporation patterns as a result of the inundation area to be negligible, as the Structure is designed to drain impounded water in a controlled manner within a relatively short period of time (less than 24 hours). The Town also concluded that any impact on surface water and groundwater interactions would also be negligible.

[120] No surface water licensees or registrations were identified in the Upper Cougar Creek Reach. The largest surface water withdrawals in the surface water LSA were identified to be primarily from two permitted withdrawals from the Bow River. The Town did not expect any impacts to surface water users as a result of the Project.

Surface Water Quality

[121] The Town did not provide historical data/information on surface water quality or aquatic ecology in the Upper Cougar Creek Reach, as surface water flow is often limited and discontinuous in this area. The Lower Cougar Creek Reach is often also dry, with seasonal flows restricted to rainfall and snow melt events. A review of historical resources and government databases was believed to show that Cougar Creek has rarely been studied from a surface water quality perspective and was considered to have low relevance in the aquatic ecology assessments. The Town suggested that shallow groundwater is likely representative of surface water quality during normal, low-flow conditions along Cougar Creek due to the interconnectedness of surface water and shallow groundwater. The Town determined that for baseline conditions, general and inorganic water quality parameter data indicated no exceedances of the Canadian Water Quality Guidelines for the Protection of Aquatic Life and Environmental Quality Guidelines for Alberta Surface Waters, though several parameters exceeded guidelines for total metals. All total metals concentrations were believed to be naturally occurring. The Town indicated that no previous sediment quality information was available and that surface water quality during high flows and flooding events in Cougar Creek was not available to analyze, though water quality would be expected to be different, from low flow conditions.

[122] The Town examined key water quality parameters to assess potential Project related impacts on surface water quality. The Project was designed to allow water and sediment to flow, without affecting water quality. The Town acknowledged that site preparation activities could impact surface water quality through increased soil erosion and soil stockpiling, or through the introduction of construction related deleterious substances. The Town thought these potential impacts could be mitigated or controlled and anticipated that construction impacts to water quality would be negligible. During operation, the Town stated that the potential for changes in concentration and timing of key water quality parameters would be minimal. The Town outlined that the Structure is designed to attenuate flows and store some large debris, while water and smaller sized sediment would pass through the diversion tunnel. The Town stated that the resultant downstream water quality with the Structure in place will be the same as if the Structure was not present. The Town concluded that negligible effects to surface water quality were expected as a result of the Project.

Aquatic Ecology

[123] The Town provided a brief discussion of aquatic ecology in Policeman Creek and at the confluence of Cougar Creek with the Bow River (i.e., the downstream component of the RSA). The Project was believed to have relatively little interaction with aquatic ecology. The

Town identified that gravel, sediment load, and woody debris transport and deposition downstream to the Bow River floodplain could be potentially affected during construction and operation of the Project. The attenuation of flows, and associated sediment and debris, during and following flood events will reduce the intensity of major flood events responsible for transporting gravels and woody debris from Cougar Creek to the downstream aquatic habitat. The Town believed this impact would be minimal as debris and sediment transported during such events have historically been deposited near the toe of the alluvial fan before entering the downstream aquatic system. The Town concluded that potential Project effects on the aquatic habitat and ecology were considered to be negligible.

Evaluation of Hydrogeology

[124] The Town described the bedrock geology and unconsolidated surficial sediments in the LSA and RSA. The bedrock units were not interpreted to be significant regional aquifers, with the upper sands and gravels of the Valley/Fan Aquifer (generally an unconfined aquifer) comprising the major aquifer in the area. Water levels in the surficial aquifer were noted to respond relatively quickly to precipitation events and strong hydraulic connections to surface water were expected. The Town characterized general baseline groundwater quality and identified groundwater users within the RSA and LSA.

[125] The Town assessed effects of the Project on the portion of the aquifer within the Cougar Creek Fan, as only local influences on the groundwater system in the immediate vicinity of the Structure footprint were anticipated. One-time construction effects were expected on groundwater quantity, as groundwater and surface water flow would be diverted around the construction area. No effects on groundwater quality were expected during construction (except for potential impacts related to spills and increased turbidity, which the Town indicated will be addressed by their mitigation measures). The Town proposed groundwater monitoring and sampling downstream from the Structure to validate predictions. The Town stated that a long-term impact from the Project to groundwater would potentially be due to the installation of the cut-off wall and grout curtain within the Valley/Fan Aquifer and uppermost bedrock. Groundwater will be intercepted by the Structure (estimated at 20-25 L/min) and drain through the diversion tunnel outlet. The Town anticipated that groundwater will re-equilibrate relatively quickly downstream of the Structure, and as such no impact on downstream groundwater quantity was anticipated. The Town stated that no impacts to groundwater quality were expected from long-term operation of the Project. The Town predicted no effects to the groundwater system (quantity or quality) due to operation of the Project during flood conditions. No impacts to downstream groundwater receptors were expected.

Summary of Cumulative Effects, Mitigation Measures and Overall Effect of Structure on Aquatic Environment

[126] The Town concluded that no significant cumulative effects were anticipated as a result of the Project. The Town recognized that cumulative effects of the Structure and the articulated concrete mats on Cougar Creek morphology would be medium in magnitude, but rare in frequency.

[127] The Town committed to implementing mitigation measures to reduce Project related effects on the aquatic environment and to comply with regulatory requirements. Mitigation measures for site preparation, construction, and operation were included through the environmental impact assessment (EIA), supplemental information requests (SIRs), and

updates. These mitigation measures included an erosion sediment control plan, a spill prevention and response plan and general monitoring of surface water and groundwater to reduce and manage effects on water caused by the Project's construction.

[128] Reducing peak flows, debris and sediment yield, and channel migration will have moderate environmental consequences, but are considered to be positive when accounting for public safety.

5.2: Views of the Board

[129] The Board finds that effects on the aquatic environment within the LSA and RSA of Cougar Creek, which included effects on hydrology, surface water quality, aquatic ecology, and hydrogeology, were adequately assessed and determined to range from negligible to moderate. Specifically, the impact of reducing peak flows in Cougar Creek on hydrology, as well as debris and sediment yield and channel migration on the geomorphology of Cougar Creek, were assessed by the Town to result in moderate environmental consequences. The Board finds that these effects are positive when accounting for public safety and the intended purpose of the Project. The Board notes that the Town predicted these potential effects for the construction and operation phases of the Project. The Board accepts the Town's prediction that there will be no cumulative impacts to the aquatic environment for any assessed indicators, given that no other known projects were identified and that any anticipated effects are expected to be contained within Cougar Creek before the confluence with the Bow River floodplain.

Adequacy of Methodology Used to Assess Hydrology

[130] To evaluate hydrology, the Town considered potential effects on three indicators: peak flow and level, geomorphology (including debris and sediment transport and deposition), and surface water and groundwater interactions. The Board accepts the general methodology and assessments used by the Town to evaluate potential effects of the proposed Structure on hydrology in Cougar Creek, for the reasons outlined and explained below.

[131] Given the design of the Structure, the Board accepts that some indicators typically considered for hydrology, such as changes to the channel regime during mean or minimum flows, would have little relevance given the purpose and design of the Structure, as minimum, average, and some peak flows will be unaltered. The Board also accepts that Cougar Creek is primarily a dry, non-fish bearing watercourse, with distinct characteristics in each of the Upper and Lower Reaches (as defined by the Town).

[132] The Board considers that the Town's general methodology was appropriate for estimating peak discharge, water levels, and sediment and debris transport and deposition in Cougar Creek for a variety of return periods under baseline and operation scenarios. The Board recognizes that available data is limited and that discharge, water level, and flow patterns have changed over time and will continue to do so (e.g., due to climate change, changes to creek bed shape/pattern, etc.). The Board recognizes that, depending on which models are used and the data and assumptions input into the models, the predicted peak discharges and sediment volume estimates for various return periods should be viewed with caution, given that estimated events varied significantly, particularly for higher return period events. The Board recognizes that the Town had to estimate peak discharges for ranges of return periods under baseline conditions. Therefore there are errors associated with these peak discharge values and ranges used for flood return periods under the application case

assessments, given the use of a model and assumptions. Even for the 2013 event, peak discharge estimations ranged considerably in value. However, the Board acknowledges that modelling, extrapolation, and estimations were necessary to assess the hydrology, as no hydrometric or metrological monitoring stations existed along Cougar Creek or within the Cougar Creek watershed.

[133] The Board understands that even though there are limitations in the peak flow estimations, given limited available data, uncertainties and required extrapolation and assumptions, the methodology used by the Town to determine the baseline, application and development case is acceptable and reasonable for assessing hydrology indicators, when no actual data exists that measured flow. The Board acknowledges that even if discharge data was collected following the 2013 event, specifically for the EIA, it may be of limited value as extreme peak flows may only occur every few years. Similarly, a current study may not record any useful data for flood frequency analysis, and, a traditional flood frequency analysis, using measured peak flow data and statistical distributions, may not be appropriate because such an analysis often does not account for the hydro-geomorphic processes that are known to occur in Cougar Creek (i.e., debris floods and landslide dam outbreak floods). The Board further finds that the methodology used to support the hydrology evaluation is justified and reasonable as the assessment was reviewed by three independent reviewers, who provided comment on multiple occasions until their concerns, suggestions and comments were appropriately addressed by the Town. The Board also takes into account that two of the three reviewers provided letters of support for the Town's Project and for the methodology used. These reviewers commented as follows:

- December 2, 2014 Letter from Dr. N.R. Morgenstern to Town of Canmore Engineering Manager – "… I am writing to re-affirm my support for the direction that you and the Town of Canmore are taking to mitigate the effects of future flooding on Canmore Creek … the science is right; the logic of risk assessment and management is right and the public policy leadership is right.…"

- November 22, 2014 Letter from Dr. Michael Church to Town of Canmore Engineering Manager – "… I have acted as an independent reviewer of BGC's report … BGC responded to all my comments … BGC's explorations of the upstream sources of potential sedimentation hazards represent exemplary problem analysis … I have found BGC's work consistently to be of the high scientific and professional standard … The engagement of Austrian experts and some of their techniques toward resolving the potential problems at Canmore is a further advantage that BGC has brought to their work for you … Altogether, then I believe that BGC engineering bringing a combination of geological, hydrological and engineering expertise to the task, has served your needs as well as any consultancy could and that their advice points to viable resolution of the mountain stream hazards present in your community."

Moderate Effect to the Hydrology

[134] The Board finds that the Structure will attenuate flows and reduce the amount of debris and large sediment movement downstream in Cougar Creek by retaining debris and sediment during a debris flood. By avoiding mobilization and deposition of these materials downstream, the Board finds that the risk created by debris flood events will be reduced to a broadly acceptable range, described by the Town as less than the probability of dying in a car accident. The Town's analysis indicated that the changes to the hydrology arising from

the Structure (i.e., discharge, water level, and geomorphology) would result in a moderate environmental consequence as it would alter the current natural flow regime in Cougar Creek. However, the Board finds that the public will benefit by reduced peak discharges and debris flow, and changes to timing in the flow regime. The intent of the Project is to reduce peak discharges and debris flow, and promote public safety and protect people and property (as discussed elsewhere). Upstream storage within the inundation area will reduce peak discharges during flood events and attenuate flows in the lower reach of Cougar Creek (with moderate consequence that is short term in duration). Large sediment and debris will be unable to pass through the Structure during and following flood events (also with moderate consequence that is short term in duration). The design of the diversion tunnel has a maximum discharge of 45 m^3/s (determined by the Town to be a discharge with an acceptable level of risk). Further, no parties intervened with contrary evidence to challenge the design features and predicted application case developed by the Town, and the design features and predicted application case were supported through expert peer review.

[135] The Board supports the mitigation measures proposed by the Town during construction, including employing an Erosion and Sediment Control (ESC) plan, and operation to reduce potential localized erosion. The Board agrees that slope stability issues are not predicted to pose risks, based on the existence of underlying bedrock in the inundation area.

Interaction between Surface Water and Groundwater

[136] The Board finds that the Town established, through its analysis in the EIA, that the Upper Cougar Creek Reach is a regional recharge area for downstream shallow aquifers and bedrock, with discharge supplying Cougar Creek throughout the channel reach. A review of the area and field testing by the Town illustrates that the surface water and groundwater interaction is such that most precipitation generates surface water runoff, which in part infiltrates into weathered bedrock through joints and fractures, as do inputs from groundwater discharge arising from the adjacent alluvial aquifer described as the Valley/Fan Aquifer. The hydrogeology findings support a strong hydraulic connection between subsurface flow within the alluvium and Cougar Creek Fan (interflow) and surface water flow in Cougar Creek. Therefore the Board finds that given the strong connection, the measurement of impacts to surface water and groundwater quantity and quality can be achieved by monitoring shallow groundwater through use of monitoring wells.

Negligible Effect to Surface Water Quantity and Quality

[137] The Board finds that the Structure is designed to allow water and some sediment to flow unimpeded during normal and low flow conditions, and therefore the Structure would not affect surface water quantity or quality during these times. The Structure is intended to limit discharge in Cougar Creek downstream from the Structure at 45 m^3/s. Some retention of water and gravel will also occur in the inundation area, starting at discharges greater than 14 m^3/s. The Board accepts that the inundation area will only be full during high rainfall events and will drain in a controlled manner downstream within a relatively short period of time following a flood event (typically less than 24 hours), as supported by the uncontested calculations and independent experts. The Board finds that the overall quantity of surface water flowing through Cougar Creek would remain largely unaffected by the Structure. The Board also anticipates that no surface water users (for example, licensees or registrations) will be affected by the Project.

[138] The Board understands that under baseline conditions (with the debris net in place), the majority of large debris is held back and any smaller debris and sediment transported downstream from the Upper Reach during flood events is deposited along the Lower Reach of Cougar Creek and the Fan. During the Project's operation, additional sediment and debris will be held back by the Structure and accumulate in the inundation area, with some smaller debris and sediment that passes through the diversion tunnel of the Structure continuing to be deposited within the Lower Reach. The articulated concrete mats downstream from the Structure will reduce lateral migration of Cougar Creek, potentially increase surface water flow velocity, and potentially add fine sediment to the water column through this area. The Board finds that although there will be some changes to sediment and debris yield and transport, these changes are acceptable as this is the intended purpose of the Project. Continual monitoring, mitigation, and adaptive management of possible bank erosion and river bed aggradation and degradation is encouraged, as proposed by the Town (for example, response to Question 96 in SIR Round 1).

[139] The Board notes that given the strong connection between surface water and groundwater, the existing quality of surface water can be reasonably measured through testing shallow groundwater monitoring wells within the Lower Reach in the Valley/Fan Aquifer (i.e., near the Structure) as no historic surface water quality data is available and surface water quality sampling can be difficult for most of the year. Baseline water quality results describe water with some metal exceedances (naturally occurring) and low total dissolved solids. Although during site preparation and construction, construction related deleterious substances, including sediment caused by erosion, could be introduced into the surface or groundwater, proposed mitigation described by the Town is deemed appropriate by the Board. These mitigation measures include placing erosion matting on temporary stockpiles, suspending soil handling during significant wind or precipitation events, washing, fueling and servicing machinery, and storing fuel and other materials for machinery in a way that prevents deleterious substances from entering the water body, as referenced in the EIA provisions on Mitigation Measures and committed to as part of an ESC plan. The Board concludes that the introduction of the Structure would likely result in an overall negligible environmental effect to surface water quality.

[140] The Board finds that since it is important to maintain groundwater and surface water quality in the region, it acknowledges and accepts the Town's commitment to ongoing monitoring of surface water quality and quantity. The assessment of negligible effect to surface water quality and quantity can also be validated by conducting surface water monitoring and sampling. Therefore the Board requires as a condition of approval that the Town, to the satisfaction of Alberta Environment and Parks (AEP), conduct surface water quality and quantity monitoring twice per month during construction, or at a frequency deemed appropriate by AEP, and on an annual basis, during operation of the Project. The Board requires as part of this condition of approval that the Town must develop a long-term surface water quality and quantity monitoring program for Cougar Creek, including discharge and water levels, using appropriate surface water locations and/or the shallow monitoring well identified as TH14-3 (or another suitable shallow groundwater monitoring well close to the Structure to be used as a proxy for surface water conditions). These programs must be to the satisfaction of AEP, and should be initiated prior to commencement of construction. The Town must conduct annual surface water monitoring reporting, available to the public and First Nations communities.

Negligible Effect to Aquatic Ecology

[141] The Board finds that Cougar Creek is primarily a dry, non-fish bearing watercourse. Given the absence of fish and adequate fish habitat within the Upper or Lower Cougar Creek Reaches, the Board agrees that it is reasonable to analyze potential impacts to aquatic ecology, as the Town did, by limiting review to the Creek's influence in contributing gravel, sediment, and woody debris to Policeman Creek and the Bow River, which are the downstream aquatic habitat. The Board finds that the Structure will reduce the intensity of flood events and thereby reduce gravel, sediment, and woody debris load deposited to the downstream aquatic habitat. However, the historic analysis provided by the Town establishes that gravel and sediment are primarily deposited near the toe of the Creek's alluvial fan, and therefore do not enter the downstream aquatic habitat at Policeman Creek or the Bow River. This is similarly true for woody debris, which is infrequently deposited to the downstream habitat. Therefore, the Board concludes that the Structure would have a negligible effect on the sport fish habitat downstream, given the limited contribution of gravel or other sediment and woody debris historically observed.

[142] The Board accepts that surface water in the RSA falls within the Upper Bow River Sub-basin, which was recently assessed as ranging from natural to good with respect to water quality (BRBC 2010). Policeman Creek is located upstream of the confluence of Cougar Creek and the Bow River, making surface water contributions and potential water quality interactions from Cougar Creek to Policeman Creek of little relevance. All data and information collected for aquatic ecology should be made publicly available and shared as deemed appropriate.

Hydrogeology: Negligible Effect to Groundwater Quality and Quantity

[143] The Board finds that groundwater quality and quantity would not likely be affected by the Structure in the hydrogeology LSA or RSA. Recharge to the Valley/Fan Aquifer is not reduced by introduction of the Structure, given its design, and therefore changes to groundwater levels and quantity are expected to be minimal. The quantitative assessment on groundwater quantity shows that changes to groundwater heads (levels) from the Structure are limited to a localized area around the Structure (e.g., at a distance of 200 m downgradient of the Structure-outlet tunnel, groundwater levels downstream would re-equilibrate relatively quickly and return to pre-construction levels) and therefore total recharge would not change.

[144] General groundwater quality was characterized in the area and can be useful as information on baseline conditions (i.e., pre-Project). Modelling conducted by the Town also supports that groundwater quality is not expected to be affected. Further, the Board concludes that there should be no effects to the groundwater system (quality or quantity) due to the impoundment of water behind the Structure, as the inundation area should drain within 24 hours. In addition, the Board expects no impacts to downgradient groundwater users or receptors as a result of the Project. However, the Board notes that the Town's prediction regarding groundwater quantity and quality was made with medium confidence. Also, the assessment of negligible effect to groundwater quality and quantity can be validated by conducting groundwater modelling and sampling.

[145] Therefore the Board requires as a condition of approval that the Town, to the satisfaction of AEP, conduct groundwater quality and quantity monitoring twice per month during construction, or at a frequency deemed appropriate by AEP, and on an annual basis,

during operation of the Project. The Board requires as part of this condition of approval that the Town must develop a long term groundwater water quality and quantity monitoring program, including groundwater level and gradient, using appropriate groundwater monitoring wells. These programs must be to the satisfaction of AEP, and should be initiated prior to commencement of construction. The Town must conduct annual groundwater monitoring reporting, available to the public and First Nations communities.

SECTION 6: TERRAIN AND SOILS

6.1: Views of the Applicant

Terrain and Soil Assessment

[146] The Town stated that for the terrain and soil assessment for the Project, soil was defined as naturally-occurring unconsolidated mineral or organic material at least 10 cm thick that occurs at the earth's surface and is capable of supporting plant growth. Aggregate or surficial materials that do not meet the definition of soil, including fluvial gravel and colluvial rock, were defined as "non-soil."

[147] The Town indicated that the Project may have potential direct and indirect effects on terrain and soil resources during construction and operation, including during a flood event resulting in maximum flooding of the inundation area. Direct effects considered were those associated with the Project footprint (i.e., the Access Road, the Structure, and the inundation area) such as loss of terrain resources and changes to soil quantity. Indirect effects were considered those related to Project activities during construction and operation, such as changes to soil quality. The Town established indicators for assessing direct and indirect effects of the Project on terrain and soils, which included terrain, soil quantity, soil quality, and land capability for forestry.

Study Area

[148] The Town defined the terrain and soils local study area (LSA), delineated to assess direct and indirect effects during construction and operation, by a smoothed 100 m zone of influence around the Project footprint, 20.1 ha in area. The 100 m zone of influence was not applied to the inundation area as the extent of that footprint component was considered to represent maximum disturbance. Due to the small scale of the footprint, the Project was not anticipated to impact areas outside of the footprint. The Town did not include a regional study area (RSA) for terrain and soil.

Terrain and Soils Rating for Baseline Case

[149] The Town described the terrain and soils resources for the baseline case based on a review of historical information and a baseline soil survey conducted in June 2015, focusing on the areas of development and the inundation area. Terrain in the LSA was stated to be montane (16.3 ha; 81%) and creek bed (3.8 ha; 19%). Orthic Regosol soils, of the Ishbel series (16.2 ha, 80.5%), were present, as well as unconsolidated fluvial and colluvium materials, classified as non-soil (3.9 ha, 19.5%). The reclamation suitability and land capability for forest ecosystems for Ishbel soils was rated as unsuitable and unproductive, respectively.

[150] The Town rated soils as moderate for wind erosion risk, due to the sandy loam and silt loam texture, while the wind erosion risk for non-soils was rated as low. Water erosion risk was rated as low for soils and non-soil units along level topography (6.7 ha, 33% of the LSA) and as high for soils on steep slopes, which included non-soil units (13.4 ha, 67% of LSA). Non-soil units were assessed to be unlikely to be eroded by water during normal precipitation and non-flood events. The Town also provided application case mitigation measures.

Effects on Terrain

[151] The Town stated that Project activities will have effects on existing terrain in the LSA as a result of cuts and fills, blasting, and re-contouring. The Town expected a loss of 1.1 ha of montane terrain and 0.9 ha of creek bed terrain, for a total loss of 1.9 ha (9.6%). No direct or indirect effects on terrain were anticipated for the inundation area as a result of construction or during a flood event. The Town indicated that terrestrial landform unit loss is required for construction of the Project, though design considerations were included that incorporate portions of the Project into the natural topography and environment. The Town concluded with high confidence that Project effects to terrain would be negative in direction, local in extent, medium in magnitude, irreversible, and long term. The final environmental consequence rating of the Project on terrain was considered low.

Evaluation of Soil Quantity

[152] The Town stated that soils will be redistributed within the LSA during construction. Soil will be salvaged and placed before revegetation of the upstream face of the Structure and downstream spillway and stilling basin, as well as spread along the upper slopes of the ditch along the Access Road. The Town identified a soil area of 1.1 ha to be stripped for construction of the Project (as well as 0.9 ha of non-soil). Stripped soil will be used to revegetate an area of 1.1 ha over the upstream face of the Structure and downstream spillway and stilling basin. Imported soil material will also be used as required for reclamation and revegetation. The Town indicated that any imported soil would be of similar quality and composition as soils present in the area. The Town stated that a possible indirect effect of the Project may be redistribution of soils within the inundation area during a flood event. If all soils were considered to be eroded during inundation, a loss of 3.3 ha (16.4%) would be experienced in the LSA. The Town concluded with high confidence that direct Project effects on soil quantity would be positive in direction, local in extent, negligible in magnitude, reversible, and medium-term in duration. Indirect effects during a flood event/inundation would be negative in direction, regional in scale, high magnitude, irreversible, and long term, with medium confidence. The overall environmental consequence of the Project on soil quantity in the LSA was considered low.

Evaluation of Soil Quality

[153] The Town considered susceptibility of soils to wind and water erosion, changes to physical and chemical attributes, reclamation suitability, and land capability for forest production when determining the effects of the Project on soil quality. Potential effects to soil quality included those caused by redistribution of soil during salvage and placement and during a flood event, erosion of disturbed and stockpiled soils, compaction of soil, contamination due to accidental releases, and changes in reclamation suitability due to mixing of topsoil and subsoil from poor soil handling practices. The Town provided proposed mitigation measures to reduce potential impacts to soil quality. The Town concluded with high confidence that direct Project effects on soil quality would be neutral in direction, negligible in magnitude, local in extent, reversible, and medium-term. Indirect impacts were considered on soil quality, arising from the filling of the inundation area. The Town concluded with medium confidence that these indirect effects would be negative in direction, regional in scale, high in magnitude, irreversible, and long term. The overall environmental consequence of the Project on soil quality was considered low.

Effect on Land Capability for Forestry

[154] The Town considered the Project permanent, being in place for the foreseeable future, and assessed reclaimed areas along the Access Road for equivalent forestry capability in relation to the baseline case. The Town assessed that the Project would result in direct effect disturbances of 1.1 ha of Class 5 soils (5.5% of LSA) and indirect effect disturbances, from redistribution/loss of soils within the inundation area during a maximum inundation event, of 3.3 ha (16.4%). The Town concluded with high confidence that direct project effects on land capability for forestry would be negative in direction, local in extent, medium in magnitude, irreversible, and long term, with an environmental consequence of low. Indirect effects due to flooding of the inundation area would result in impacts being negative in direction, regional in extent, high in magnitude, irreversible, and long term, with medium confidence. The Town acknowledged that the environmental consequence for indirect effects to land capability would be medium, as a result of changes to overall soil quantity assessed for land capability for forestry (i.e., soil loss), but since the soils in the LSA were considered non-productive, the loss of Class 5 soils would not reduce the overall land capability for forestry. The final environmental consequence rating of the Project on land capability for forest ecosystems was considered low.

Reclamation

[155] The Town indicated that soil in areas affected by construction will be reclaimed. Soil will be placed adjacent to and along ditches next to the Access Road, on the upstream face of the Structure, and on the downstream spillway and stilling basin, as well as in No Man's Land. The Town stated that soil for reclamation of the Project would be sourced primarily from material salvaged during construction as well as from nearby resources if required, and placed at depths ranging from approximately 0.02 to 0.20 m. Soil erosion will be limited by revegetation and matting.

[156] The Town outlined that the conceptual plan for reclamation in No Man's Land would involve minor grading, de-compacting small scattered islands, adding imported soil from the Three Sisters' development at depths of 0.2 to 0.3 m, and revegetating the areas. Created islands would be relatively small (approximately 5 by 7 m) and scattered.

[157] The Town stated that soil integrity, or quality, will be maintained for stockpiled soil and that any imported soil would have similar physical, chemical, and biological (e.g., vegetative) characteristics to that naturally occurring in the area.

Overall Effects to Terrain and Soil Resources

[158] The Town stated that when considering together all direct and indirect effects on all indicators, its overall conclusion was that the construction and operation of the Structure will have a low impact to terrain and soil resources.

[159] The Town provided some information on a conservation and reclamation plan and on revegetation of No Man's Land area, though the Town did not consider it in the effects assessment.

6.2: Views of the Board

Adequacy of Methodology in Terrain and Soils Assessment and Study Area

[160] The Board understands that to assess terrain and soil for the Project, the Town considered direct and indirect effects associated with construction and operation of the Project, including consideration of flood events resulting in maximum impoundment within the inundation area. The loss of terrain resources and changes to soil quality were highlighted.

[161] The Board finds that the historical information and literature reviewed by the Town (including detailed soil surveys of the Canmore area, provincial databases, and the classification of soils guide), as well as the 60 field soil surveys conducted by the Town in June 2015, were all components of a methodology that accorded with generally accepted practices for soils assessments. The Board is confident of the adequacy of the methodology used to determine baseline conditions and to assess potential impacts of the Project on terrain and soils in the LSA.

[162] The Board finds that it was justifiable for the Town not to include an RSA in the assessment cases on terrain and soils because of the small scale of the Project footprint and expected impacts. The Board accepts that it was reasonable to define the LSA as a smoothed 100 m zone of influence around the Project footprint, constituting some 20.1 ha.

[163] The Board finds that field soil surveys were conducted by the Town and used to update and confirm the historical information review and to determine the baseline soil and terrain resources within the LSA. The soil surveys were conducted by an integrated field crew consisting of a vegetation ecologist, a soils scientist, and a wildlife ecologist who each conducted their own discipline specific surveys. The Board finds that the Town's use of these professionals support the integrity and outcomes of the surveys and the Town's evaluation of the terrain and soils baseline assessment.

[164] The Board accepts that the terrain and soils assessment provided by the Town was effective in identifying the distribution of montane (16.3 ha) and creek bed terrain (3.8 ha) in the LSA, and in specifically determining that Orthic Regosols of the Ishbel soil series made up 16.2 ha of the LSA and unconsolidated fluvial and colluvium made up the remainder (3.9 ha). The Board also finds that the soils assessment determined that the nature of Ishbel soils in the LSA is unsuitable and unproductive for both reclamation and for supporting forest ecosystems.

Low Effect on Terrain

[165] The Board understands that the loss of terrain caused by the Project is expected to be 1.1 ha of montane and 0.9 ha of creek bed terrain. This is primarily determined by the footprint of the Structure and Access Road. No additional montane or creek bed terrain was anticipated to be affected in the inundation area. The Board agrees that, given the relatively small area affected by the Project in the LSA by construction, the environmental consequence of this loss of terrain due to the Project is low.

Negligible Effect on Soil Quantity

[166] The Board finds that a direct effect on soil quantity arising from construction of the Project is the stripping of 1.1 ha of soil in order to develop the Structure and Access Road.

An additional 3.3 ha of soil were predicted by the Town to be lost if the inundation area were to flood and all soils were eroded during a flood event resulting in maximum inundation. The Board finds that the final environmental consequence on soil quantity will be negligible during construction and operation. This finding is supported by the fact that the stripped soil will be salvaged and redistributed through the LSA, soil handling techniques proposed by the Town will mitigate against soil loss, imported soil material will replace soils lost to ensure reclamation and revegetation, and the benefits of retaining water within the inundation area are greater than the potential indirect effects of soil loss, in a relatively small area, within the inundation area.

Low Effect on Soil Quality

[167] The Board finds that during construction and operation of the Project there is risk to soil quality from soil erosion due to wind and water, soil compaction, contamination from construction activity, soil handling, and placement of woody debris. However, based upon the mitigation measures proposed by the Town (including soil salvage and redistribution, which can reverse some of these effects) the Board concludes that the effect of the Project on soil quality will be low. The Board's findings and conclusions are supported by the extensive soil handling and mitigation measures outlined by the Town, including the proposed soil testing, soil salvage and soil redistribution methods. Therefore the Board requires, as a condition of approval, that during construction, reclamation and revegetation activities, the Town test, to the satisfaction of AEP, all imported soil material to ensure that it has similar physical, chemical, and biological properties as soils naturally occurring in the Cougar Creek area, including testing for weeds and invasive species, and is appropriate to be used for reclamation activities.

Low Effect on Land Capability for Forestry

[168] The Board finds that the weight of the evidence establishes that direct effect disturbances to 1.1 ha of Class 5 soils in the LSA would arise due to construction of the Project. Indirect disturbances from loss of soils due to inundation during a maximum inundation event would disturb 3.3 ha. However, the Board accepts the Town's conclusion that these disturbances are of a low environmental consequence to land capability for forest ecosystems because the soils involved are Orthic Regosol soils of the Ishbel series, which are Class 5 soils (unproductive). The soils involved in the LSA are not considered to be a loss to land capability as they are non-productive, supporting the conclusion of a low environmental consequence to this indicator.

Reclamation Recommendations

[169] The Board determines that it is appropriate for reclamation activities to occur in areas affected by construction, specifically within the footprint of the Project (at the Structure and Access Road), and though not part of the Project, in No Man's Land. Soil salvaged, maintained, and stockpiled during construction will primarily be used for reclamation of the Structure and Access Road. As noted in the condition imposed above regarding soil handling and mitigation measure, the Board requires that in the context of reclamation, any imported soil must be tested and analyzed, to the satisfaction of AEP, to ensure it is has similar physical, chemical, and biological characteristics as soil naturally occurring in the Cougar Creek area, including for weeds or invasive species, and is appropriate to be used for reclamation activities.

SECTION 7: VEGETATION

7.1: Views of the Applicant

[170] The Town stated that the vegetation assessment for the Project included terrestrial and riparian communities, wetlands, old-growth forests, rare plants, ecological communities of concern, and weeds and non-native invasive species. Direct effects on vegetation resources, as a result of site clearing for the Project footprint, and indirect effects, as a result of potential introduction and dispersal of non-native and invasive species or due to changes to surface water levels during flood events, were identified for construction and operation activities.

Study Areas

[171] The Town outlined that the local study area (LSA) was defined by a smoothed 100 m zone around the Project footprint, while the regional study area (RSA) extended between 500 and 2,000 m beyond the Project footprint (approximately 556.4 ha), depending on conditions and terrain. Vegetation was mapped across the RSA to assess impacts to ecosystems, wildlife habitat, and biodiversity.

Baseline Case

[172] The Town stated that a combination of historic information reviews and field programs and surveys were conducted to characterize baseline vegetation resources in the LSA and RSA. The Town described that the Project is located predominantly in the Montane Natural Subregion of the Rocky Mountain Natural Region of Alberta, which can have varying vegetation communities as a result of highly variable microclimates, influenced by differences in aspect, slope and wind exposure, and has few wetlands. The Town identified that the vegetation LSA is dominated by terrestrial vegetation (16.7 ha; 83%), with some natural disturbance (cobble and rock) adjacent to the creek bed (2.1 ha; 10.2%), the creek bed (0.9 ha; 4.7%), and existing anthropogenic (human caused) disturbances (0.4 ha; 2.0%). No wetlands, riparian communities, or old-growth forests were noted by the Town in the LSA. The RSA (556.4 ha) is composed of terrestrial vegetation (485.7 ha; 87.3%), wetlands (0.9 ha; 0.2%), natural disturbances and cobble and rock (8.6 ha; 1.6%), and anthropogenic (human caused) disturbances (61.2 ha; 11%). The Town observed four rare plant species in the RSA, in eight occurrences (two within the Project footprint), no rare ecological communities, and one listed weed species during field surveys. Two environmentally significant areas were described as overlapping the inundation area. Mitigation measures for the application case were also presented and committed to by the Town.

Terrestrial Vegetation Communities

[173] The Town defined terrestrial vegetation communities as upland or lowland ecosite phases, or land cover classes, that are not wetlands and are ecologically variable in terms of vegetation composition, forest productivity, and soil characteristics. The Town stated that construction of the Project will cause direct disturbance to 1.9 ha (9.6% of the LSA), including a loss of 1.0 ha of terrestrial vegetation communities, a 6.2% reduction from baseline. Merchantable timber will be harvested and non-merchantable timber will be managed in accordance with AEP requirements. Direct Project effects were rated with high confidence to be negative in direction, local in extent, medium in magnitude, long term in

duration, continuous, and permanent. Direct Project effects were expected to impact a small proportion of terrestrial vegetation in the LSA. Direct Project effects on the RSA in the Application case were expected to result in a 1.0 ha loss in terrestrial vegetation (ranging from 0.1% to 2.1%, compared to the baseline case for each ecosite phase), with no disturbance to wetlands or rare terrestrial habitats.

[174] The Town described that indirect effects of the Project would impact an additional 4.0 ha of terrestrial vegetation communities in the LSA during a maximum inundation flood event, resulting in a 24% reduction from baseline. Disturbances from flood events were expected to be short term in duration and localized. The Town rated indirect effects in the LSA with low confidence to be negative in direction, local in extent, high in magnitude, medium term in duration, isolated, and rare in occurrence. Indirect effects to the RSA as a result of maximum inundation were predicted to result in a loss of terrestrial habitats ranging from 0.1% to 12.8% of the baseline, with no disturbances to wetlands or rare terrestrial habitats.

[175] The Town concluded that environmental consequence to terrestrial vegetation communities due to direct and indirect effects from the Project would be negligible or low.

Wetlands, Riparian Communities, and Old-Growth Forests

[176] The Town described wetlands as ecologically variable ecosystems in terms of hydrology, vegetation, soil, and water quality. Riparian communities were described as vegetation communities adjacent to and affected by surface water and groundwater associated with rivers, streams, lakes, ponds, drainage pathways, and other water features. The Town characterized old-growth forests as having a heterogeneous age structure, large canopy trees, an accumulation of snags and downed woody material, and species diversity. The Town expected no direct or indirect impacts to wetlands, riparian communities, or old-growth forests, as none are present within the vegetation LSA.

Rare Plants

[177] The Town defined rare plant species as any native plant that, because of its biological characteristics or because it occurs at the fringe of its range, or for some other reason, exists at low numbers or in very restricted areas. The Town stated that direct effects on rare plants, due to construction of the Access Road, would result in the loss of one occurrence. Indirect effects during a maximum inundation event may result in the disturbance or loss of one occurrence in the inundation area. The Town did not recommend mitigation for the isolated occurrences. The Town rated the final environmental consequences of the Project on rare plants as low.

Ecological Communities of Concern

[178] The Town characterized ecological communities of concern as “unusual” or “uncommon” assemblages of species that are rare across a landscape and therefore contribute greatly to local biodiversity. The Town stated that no ecological communities of concern were within the Project footprint. The inundation area was overlapped by two environmentally sensitive areas which may be disturbed during a maximum inundation event. The proportion of each environmentally sensitive area that would be affected was predicted to be low. The Town rated the overall environmental consequence of the Project on ecological communities of concern as low.

Weeds and Non-Native Invasive Species

[179] The Town described non-native species as plants that do not naturally occur in Alberta, but have been introduced, likely as a result of human activity, and invasive species as plants that have a competitive ability to displace less competitive species, potentially reducing biodiversity, wildlife habitat quality, and land productivity. Prohibited and noxious weeds were identified as non-native and invasive plant species that are aggressive and difficult to manage. The Town stated that the implementation of strong weed management practices and mitigation measures could limit the establishment and propagation of weeds to disturbed areas. The Town expected that competition from regenerating native vegetation following reclamation after construction will reduce the establishment and propagation of weed species. The Town concluded that the environmental consequence for weeds and non-native invasive species was rated as low.

Revegetation

[180] The Town stated that impacted areas will be revegetated, where appropriate, following Project construction and placement of topsoil. Native seed mixes and grasses appropriate to the area will be used to revegetate areas alongside the Access Road and ditches, the upstream face of the Structure and the downstream spillways and stilling basin. Hydroseeding, with a tacking agent and hydromulch, was proposed to be an appropriate way to reseed. The Town also indicated plans to revegetate select areas of No Man's Land to create an aesthetically pleasing environment consistent with surrounding undisturbed areas to provide habitat and movement routes for wildlife. The Town anticipated that revegetation would be completed within two growing seasons following reclamation. The Town stated that it will continue to manage and monitor the success of reclamation activities in the future.

Summary

[181] The Town acknowledged that construction and operation of the Project will have direct and indirect effects to vegetation resources in the LSA. Mitigation and revegetation were expected to limit predicted impacts. The Town rated the overall environmental consequences as negligible, low, or not existing for all vegetation indicators.

7.2: Views of the Board

Adequacy of Methodology for Vegetation Assessment and Study Area

[182] The Board recognizes that the vegetation assessment for the Project considered appropriate indicators, which included terrestrial and riparian communities, wetlands, old-growth forests, rare plants, ecological communities of concern, and weeds and non-native species. Direct effects, through clearing for the Project, and indirect effects were considered and local and regional study areas were reasonably delineated. The Board accepts the Town's conclusion that the overall environmental consequences are either negligible, low, or not existing for vegetation indicators.

[183] The Board finds that the historical information reviewed included ecological mapping for the region, environmental reports on vegetation in the region, and rare plant and rare community tracking lists from the Alberta Conservation Information Management System. Field programs and surveys, involving an integrated field crew consisting of a vegetation ecologist, soils scientist and wildlife ecologist, accessed the area on foot, reviewed rare

plant searches in the LSA and verified and characterized the mapped ecological land classification units in the LSA and RSA. The Board is satisfied that the historical and field review of vegetation data was thorough and consistent, noting that 75 vegetation plots were completed, with 21 in the LSA and 54 in the RSA. The Board finds that the use of an integrated team of professionals to conduct on foot vegetation surveys (including searches for rare plants within 10 km of the vegetation LSA), supports the integrity and outcomes of the surveys and supports the Town's evaluation of the vegetation baseline assessment. The Board acknowledges that the study areas are dominated by terrestrial vegetation, with some disturbed areas (natural and anthropogenic) and a creek bed. Relatively few wetlands, riparian communities, or old-growth forests were identified. The Board is satisfied with the adequacy of the baseline assessment for the vegetation RSA and LSA.

No Disturbance or Low Effect on Terrestrial Vegetation Communities and Wetlands, Riparian Communities and Old Growth Forests

[184] The Board accepts that the construction of the Project will cause a direct disturbance to 1.0 ha of terrestrial vegetation communities in both the LSA and RSA, given the need for clearing land to construct the Structure and corresponding Access Road. The Board notes that no disturbance to wetlands or rare terrestrial habitats is anticipated, given that none of these features are present in the vegetation LSA (and only a small percentage of wetlands exist in the RSA). Indirect effects from maximum inundation flood events are similarly expected to result in a loss of relatively small areas of terrestrial vegetation communities and terrestrial habitats, though such events would not disturb wetlands, rare terrestrial habitats, riparian communities or old growth forests in the LSA or RSA, given their limited presence or absence, as noted above. The Board expects that any merchantable timber will be harvested and managed in accordance with AEP during construction and operation of the Project.

Low Effect on Rare Plants and Ecological Communities of Concern

[185] The uncontradicted evidence from the field crew that conducted the vegetation field survey for the Town in 2015 confirmed that of four rare plant species detected (with a total of eight occurrences) in the RSA, two were located in the LSA within the Project footprint; one, a rare lichen, would be lost as a result of construction of the Access Road, and one, a forb, may be impacted during a maximum inundation flood event. The Board finds that these isolated losses of two rare plants do not warrant a mitigation plan. As discussed by the Town, the rare lichen has a high species ranking and there is an abundance of habitat in adjacent areas, so the species is expected to be well distributed. The forb is found in floodplains and there is isolated frequency of disturbance in the inundation area. The Board agrees that since no ecological communities of concern were located within the Project footprint, the predicted impact on such an indicator is low.

Low Effect on Weeds and Non-Native Invasive Species

[186] The Board finds that the impact of the establishment of weeds and non-native invasive species is low, particularly given that one species listed as noxious was observed during the vegetation surveys. Mitigations to reduce weed establishment and weed management practices are required and can be imposed during construction and thereafter. The Board is also confident that the already established native vegetation species in the footprint will also compete against invasion of weeds and non-native invasive species.

Impact of Revegetation

[187] The Board acknowledges that the Project will impact vegetation resources directly and indirectly, and therefore supports initiatives of revegetation to lessen these impacts. Specifically, the Board supports and expects the Town to revegetate areas along the Access Road, ditches, the upstream face of the Structure, and the downstream spillways and stilling basin, in accordance with the mitigation measures described by the Town. The Board also supports the Town's initiative to revegetate No Man's Land downstream of the Project to enhance aesthetics of the area and to create habitat and movement routes for wildlife, though it is outside the scope of the vegetation LSA. Therefore the Board requires, as a condition of approval, that all seed mixes and material used for revegetation are appropriate for and representative of the surrounding vegetation communities (i.e., native species), to the satisfaction of AEP, and consistent with First Nations aboriginal preferences for the use of native vegetation species for reclamation (as also discussed in paragraph 58).

SECTION 8: WILDLIFE AND BIODIVERSITY

8.1: Views of the Applicant

Wildlife

[188] The Town conducted baseline studies to study the effects on wildlife from the Project's development in the local study area (LSA) and regional study area (RSA). The LSA extends between 500 and 2,000 m beyond the Project footprint (the Structure, Access Road, and all associated areas needed for construction) and has an area of about 556 ha. The RSA, which covers about 31,179 ha, was established to assess potential effects of the Project on wildlife within a regional context. The aerial extent of the wildlife LSA and RSA is shown in Figure 5.

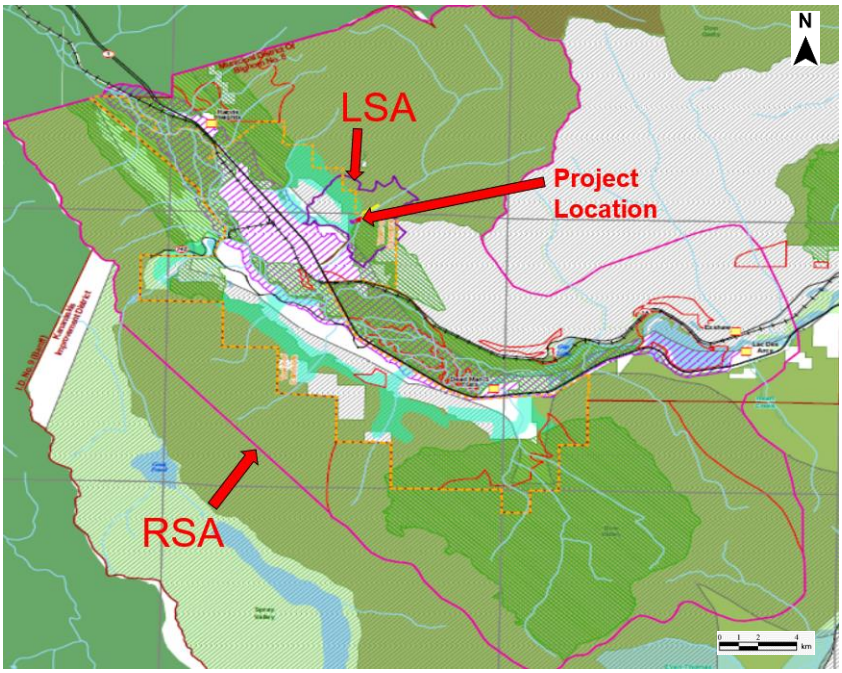


Figure 5. Wildlife Local and Regional Study Areas (based on EIA Figure 7.2-2)

[189] Methods used to conduct the studies in the LSA included a wildlife habitat use transect survey, a study using remote cameras, and a winter tracking program. As part of the baseline study, the Town also completed a summary of existing information on historical wildlife surveys in the RSA.

[190] According to the Town, baseline field studies identified 13 carnivore species that may occur in the RSA. Of the 13, six species of concern were identified (grizzly bear, bobcat, cougar, wolverine, fisher, and Canada lynx). The Town stated that the predominant ungulates in the RSA are mule deer, white-tail deer, elk, moose, bighorn sheep, and mountain goat. The remote camera program conducted by the Town, in cooperation with Alberta and Environmental Protection (AEP), indicated high numbers of humans in the LSA relative to animals.

[191] The Town also conducted a review of government databases to identify species of concern and determined that 49 provincially listed and 11 federally listed species of concern may occur in the RSA. It found that five of the federally listed species were “species at risk” – Little Brown Myotis (little brown bat), peregrine falcon, common nighthawk, olive-sided flycatcher, and the western toad. The Town concluded that the peregrine falcon, common nighthawk, olive-sided flycatcher, and western toad would likely not be impacted by the Project because they were not observed in the LSA during the field surveys. In addition, suitable habitat to support the species was not found in the LSA. The Town acknowledged that there is potential suitable habitat for the Little Brown Myotis near the Project area. However, it was the Town’s view that the Project’s impact on the Little Brown Myotis habitat would be low due to the abundance of suitable habitat (mature trees and caves) in the LSA.

[192] Indicators used by the Town to determine potential effects of the Project on wildlife included wildlife habitat availability, wildlife habitat connectivity, and wildlife mortality risk. The Town used empirical habitat models to assess changes in habitat availability due to the Project and how these changes would potentially impact identified federally and provincially protected species. The Town concluded that the Project footprint area does not provide important habitat for wildlife mainly because of the rocky creek bottom and steep slopes in the Cougar Creek valley. It stated that even though impacts of the Project on habitat loss are negative, the magnitude of habitat loss is negligible. It further stated that since the Project’s impact on habitat availability in the LSA is negligible, no wildlife impact is anticipated in the RSA.

[193] The Town used information on known wildlife use of the area, anticipated construction traffic, and potential impacts of the Structure and Access Road to determine Project impacts on habitat connectivity and wildlife dispersal movements. The Town stated that current wildlife movement along Cougar Creek is hindered by high rates of human activity and the rocky terrain on the creek bottom. It was the Town’s view that the impact of Project construction activities on wildlife movement will be low because of the proposed mitigation measures, which include reduced construction/maintenance vehicle speeds (20 km/hr) and restricted construction periods (7 am to 7 pm). The Town contends that revegetation of the Access Road ditches, the design of the Structure, and parts of No Man’s Land (the area located just downstream of the Structure) will allow for greater movement of wildlife across Cougar Creek than currently exists.

[194] While not part of the Project, the Town contended that proposed reclamation work in the No Man’s Land area is expected to increase habitat availability and provide benefits to wildlife movement along the Bow Valley Corridor. The 2013 flood resulted in a significant loss in vegetation and cover in the No Man’s Land area, which has hindered wildlife movement across Cougar Creek. The Town committed to continue working with AEP to develop a plan for revegetating parts of No Man’s Land.

[195] The Town stated that construction and operation of the Project has the potential to cause direct or indirect wildlife mortality. It stated that direct mortality can be associated with site clearing and blasting, collisions with vehicles involved in Project construction and maintenance, and drowning in the inundation area. The Town stated that mortality due to site clearing and blasting is not expected to be a concern since efforts will be made to avoid blasting and clearing activities during important nesting and breeding periods. If blasting and clearing is required during these periods, the Town stated that breeding and nesting surveys will be conducted by qualified professionals prior to the disturbance. The Town also committed to clearing large mammals from areas where blasting activities are to occur. It is

the Town's view that the reduced speed limit and limited construction time frames will reduce the potential for direct wildlife mortality due to construction activities.

[196] According to the Town, the Project's construction and its operation during a flood may cause indirect mortality risks and potential increased predation if wildlife is displaced from habitats that provide security from predators. However, the Town stated that increased vehicle traffic associated with construction and flood response is unlikely to impact indirect wildlife mortality because these events are of short-term duration. The Town stated that because the LSA is a popular recreation spot, wildlife are habituated to human activities and are therefore unlikely to be stressed as a result of the Project. It is also the Town's view that indirect mortality due to hunting is unlikely since the LSA is not known as an active hunting area, in particular given the proximity of the LSA to the Town.

[197] The Town concluded that wildlife in the LSA will be directly and indirectly impacted by the Project. However, it is the Town's view that the Project's effects on wildlife habitat availability, habitat connectivity, and mortality risk have a low to negligible environmental consequence rating. The Town contended that any of the Project impacts on wildlife habitat availability and connectivity will be mitigated by revegetation of the Structure and Access Road ditches, as well as No Man's Land, which is not part of the Project.

Biodiversity

[198] The Town used species-level indicators (species richness, and rare species or species at risk) and ecosystem-level indicators (habitat area and relative abundance, habitat richness, habitat diversity, and habitat fragmentation) to assess the Project's effects on biodiversity. The extent and distribution of each indicator was described for the baseline case. The Town then assessed potential direct and indirect Project impacts on the indicators using the following criteria: extent, magnitude, duration, direction, and frequency. Environmental consequence ratings were assigned for all of the selected indicators.

[199] The Town indicated that the Project is expected to have direct and indirect effects on biodiversity in the LSA. However, the environmental consequence ratings for biodiversity indicators were determined to range from no impact to negligible.

[200] It is the Town's view that revegetation of the Structure and Access Road ditches, as well as its commitment to work with AEP in the revegetation of No Man's Land, will offset any effects of the Project on biodiversity. The Town committed to assess vegetation and soil in the revegetated areas two to three years after the reclamation work, to evaluate the ecological succession. According to the Town, the results of the vegetation and soil assessments will be used to determine the need for additional monitoring.

8.2: Views of the Board

Adequacy of Methodology Used in Baseline Wildlife Assessment

[201] The Board finds that the historical information review and wildlife surveys methodology used by the Town to collect baseline information on wildlife and assess potential impacts of the Project on wildlife in the LSA and RSA were consistent with generally accepted practice. Historical information was obtained from technical reports and peer reviewed publications from wildlife studies in the RSA. In addition, provincial and federal databases were used by the Town to identify and map important wildlife areas in the LSA and RSA.

[202] Field surveys (wildlife habitat use transect surveys, a remote camera study, and winter tracking) were used by the Town to fill any data gaps identified by the historical information review. The remote camera study and winter tracking program were conducted in partnership with AEP, which has extensive expertise in conducting these surveys. The Board also acknowledges that the wildlife habitat use transect survey was based on published data collection methods and standards, such as the *Field Manual for Describing Terrestrial Ecosystems*, and *Species Inventory Fundamentals.*

Adequacy of Wildlife Mitigative Measures and Monitoring

[203] The Board finds that mitigative measures proposed by the Town (detailed in *Mitigative Measures*, Section 11 of the application) should effectively mitigate any negative impacts of the Project on wildlife. Notable land reclamation measures proposed by the Town to enhance habitat connectivity include revegetation of the Structure and the Access Road ditches. The Board agrees with the Town that implementation of these reclamation elements will result in an improvement of wildlife movement across the Cougar Creek valley over baseline conditions.

[204] The Board notes that the vegetation of No Man's Land is not considered part of the Project. The Board commends the Town's commitment to work with AEP to identify areas for selective revegetation of No Man's Land. While not part of the Project, it is the Board's view that revegetation in the No Man's Land area is important for improving wildlife habitat availability and connectivity.

[205] The Board encourages the Town to continue its partnership with AEP on the remote camera study of the Bow Valley Corridor to better understand the use of corridors and habitat patches by humans and animals, and to monitor the long-term effects of the Project area and revegetation of No Man's Land on wildlife distribution and movement.

Project Impacts on Wildlife

[206] The Board agrees with the Town's assessment that baseline wildlife habitat in the Project area tends to be of poor quality, mainly due to steep valley walls and the rocky bottom in the Cougar Creek valley. In addition, the Board agrees with the Town's conclusion (based on results of the remote camera study) that high amounts of human activity in the Project area contribute to already reduced animal activity in the LSA.

[207] The Town concluded that the Project effects on wildlife habitat availability, mortality risk, and habitat connectivity in the LSA are predicted to have a low environmental consequence rating. The Board has considered the Project impacts on wildlife provided by the Town and finds this conclusion reasonable.

Project Impact on Biodiversity

[208] The Board finds that final environmental consequence ratings for the Project's impacts on biodiversity during construction and operation range from no impact to negligible, due in part to revegetation of the Structure and Access Road ditches. The Board notes that the revegetation of No Man's Land was not considered by the Town in the biodiversity impact assessment since No Man's Land is outside of the LSA. The Board agrees with the Town that revegetation of No Man's Land will have positive impacts on biodiversity indicators such as species richness, habitat richness, and habitat diversity.

[209] The Board acknowledges the Town's commitment to conduct vegetation and soil assessments of the revegetated areas two to three years after the reclamation work to evaluate ecological succession. The Board supports the use of vegetation and soil assessment results by the Town to determine the need for additional monitoring.

SECTION 9: AIR QUALITY AND CLIMATE

9.1: Views of the Applicant

Assessment of Air Quality Impacts

[210] The Town conducted a study of potential air quality impacts associated with the Project's emissions. The local and regional study areas for air quality assessment were combined into a single (24 x 24 km) regional study area (RSA), as the Town expects the Project effects on air quality to be localized. The RSA included the Town and the hamlets of Exshaw, Lac des Arcs, Harvie Heights, and Dead Man's Flats. The RSA also included parts of the Kananaskis Improvement District, Banff National Park, and the Municipal District of Bighorn No. 8.

[211] The Town stated that effects on air quality may occur during construction of the Structure and Access Road, and during maintenance activities following a major flood event. According to the Town, Project activities that have the potential to impact air quality include emissions from equipment, Access Road dust, and rock blasting.

[212] The Town assessed air quality conditions for the baseline case, construction case, and maintenance case. According to the Town, the Project is not expected to generate air emissions during normal operations. Since normal operations involve quarterly/biannual inspections using a single vehicle, a normal operations case was not assessed by the Town.

Baseline Case

[213] The Town assessed meteorological and air quality baseline conditions for the RSA using historical meteorological measurements (ambient air temperature, wind speed and direction, and precipitation) from the Environment Canada Kananaskis station located about 20 km east of the Project. According to the Town, ambient temperature, wind speed and direction, and precipitation are important for understanding how air pollutants are dispersed. The Town also used hourly ambient air quality conditions from the Lafarge Exshaw cement plant air monitoring station (located approximately 12 km southeast of the Project) for the meteorological and air quality baseline assessment. The Town indicated that air quality data and meteorological data from the Kananaskis and Lafarge Exshaw stations were used because neither data set was available for the Town of Canmore.

[214] The Town stated that baseline emission sources in the RSA include dwellings in the Town, traffic (local and highway), trains, a landfill, quarries, and recreational campfires. The Town compared the baseline air quality concentrations from the Lafarge Exshaw station to relevant Alberta Ambient Air Quality Objectives (AAAQO). The baseline concentration of nitrogen dioxide (NO_2) was below AAAQO. Baseline concentrations for particulate matter with a diameter less than 2.5 micrometres ($PM_{2.5}$) were also below AAAQO, when the concentration was adjusted using a recommendation from the *Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone* (CCME 2012).

Construction Case

[215] Project construction activities that can impact air quality include Access Road dust caused by the movement of heavy equipment between Elk Run Boulevard and the

Structure, emissions from construction vehicles and equipment, and rock blasting. The Town identified $PM_{2.5}$ and nitrogen oxides (NO_X) as the Project construction air emissions most likely to affect ambient air quality.

[216] The Town indicated that heavy equipment diesel engines have significant emissions of NO_X and $PM_{2.5}$. The Town identified Access Road dust as the smallest source of $PM_{2.5}$. Rock blasting was also found by the Town to be a source of NO_X and $PM_{2.5}$. The total construction emissions (from equipment, blasting and Access Road dust) calculated by the Town are provided in Table 2.

Table 2. Total Criteria Air Contaminants Emissions for the Construction Phase of the Project[2]

Dust Source	Emissions (kg)			
	NO_X		$PM_{2.5}$	
Equipment	1.75E+05	174,600	1.84E+03	1,843
Blasting	2.49E+01	24.9	6.79E+01	67.9
Road Dust	-	-	1.04E+04	10,400
TOTAL	1.75E+05	174,624.9	1.23E+04	12,310.9
Reference	SIR1	EIA	SIR1	EIA

[217] The Town indicated that Project construction would take approximately two to two and a half years. The Town emission estimates assumed that all equipment would be in operation for 12 hours per day, six days per week for 27 months of construction, even though all equipment would not be operating at all times due to construction scheduling. The NO_X and $PM_{2.5}$ emission calculations were based on the types of equipment used for construction activities and their operating durations. The Town indicated that the construction emissions from equipment were calculated using emission factors from the *Emission Standards Reference Guide, Nonroad Compression-Ignition Engines – Exhaust Emission Standards* (U.S. EPA 2016a).

[218] The Town assessed NO_X and $PM_{2.5}$ emissions for rock blasting activities, as NO_X and $PM_{2.5}$ are common contaminants released from explosives. The Town estimated the emissions from road blasting would be less than 1% of the total NO_X and $PM_{2.5}$ emissions for construction activities. The emissions were calculated using blasting emission factors from Environment Canada's *Pits and Quarries Guidance* (Environment and Climate Change Canada 2016a). Blasting data was not available, according to the Town, so the following assumptions were used to calculate emissions associated with blasting activities:

- ammonium nitrate would be the explosive used;
- the depth of blasting area would be two metres;
- the area of blasting would be about 1,175 m^2;
- the drilling hole diameter (for explosives) would be 10 cm; and
- the blast preparation rate would be 40 m^3/hr, 12 hour shift.

2. SIR1, Question 10, Table 10-1, June 2017, page 2-15.EIA, Section 8.2.6.4, Tables 8.2-7, 8.2-8, 8.2-9, July 2016, pages 8-11 to 8-14.

[219] The Town addressed the tunnel option for the low-level outlet in the EIA. The Town's construction air emissions calculations or modelling did not include the blasting required to construct the tunnel. The Town indicated that the tunnel would be approximately 6.5 m high and 5.65 m wide, and about 150 m long.

[220] The Town used Environment Canada's Unpaved Industrial Road Dust Calculator (Environment and Climate Change Canada 2016) to estimate the amount of particulate matter ($PM_{2.5}$, PM_{10} and total suspended particles) from Access Road dust generated during the construction period.

[221] The Town used the following parameters to calculate road dust emissions:

- an unpaved road length of 2.641 km;
- total operating days of 324 days/year;
- unpaved road silt content of 24%;
- working days when roads were frozen or snow covered estimated at 179.28; and
- estimated road watering of up to four times a day.

[222] Air quality modelling was conducted by the Town on the construction case using a recognized model (AERSCREEN). According to the Town, the model provides an estimate of the highest NO_X and $PM_{2.5}$ concentrations that are likely to occur from construction activities. Assumptions used by the Town in the modelling were that all vehicles would be operating at the same time, and the closest residence would be 450 m from the Structure.

[223] The Town explained that Access Road dust was not included in the modelling since it would be mitigated by watering roads and using other dust suppressants.

[224] The Town indicated that topography can affect the distribution of air pollutants. For example, concentrations of pollutants can become trapped in low-lying areas. According to the Town, land surrounding the Project is characterized by significant elevation changes. Generally, there is a downward slope (northeast to southwest) from the Project to the Town. The Town indicated that detailed topographic information was not included in the modelling because the complex terrain between the Project and neighbouring receptors was beyond the capability of the model. Therefore, the Town used flat terrain to represent the worst case scenario available in the model.

[225] Modelling results for NO_X showed a concentration of 140.7 µg/m^3 per one-hour period at the nearest residence, which was less than the AAAQO (300 µg/m^3). For the combustion emission $PM_{2.5}$, the modelling results showed a concentration of 17.5 µg/m^3 per 24-hour period at the nearest residence, also less than the AAAQO (30 µg/m^3).

Maintenance Case

[226] Post flood maintenance air emissions were calculated by the Town for diesel-powered construction equipment and Access Road dust, using a similar methodology to that used for calculating construction emissions. Emissions from equipment and Access Road dust during the 30 day maintenance case were estimated by the Town to be 2,170.76 kg of NO_X and 3,522.9 kg of $PM_{2.5}$. The Town concluded that since the NO_X and $PM_{2.5}$ emissions from maintenance activities were less than the construction case, there was no need to model the maintenance case. Also, the Town stated that since emission estimates from the

construction case met the AAAQO, it expected that emissions from the maintenance case would also meet the AAAQO.

9.2: Views of the Board

Adequacy of Methodology used for Assessing Project Impacts on Air Quality

[227] The Board finds that the methodologies used by the Town to study air quality impacts associated with the Project for the baseline case, the construction case, and the maintenance case were acceptable and appropriate for the Project. The Board notes that the air quality modelling conducted by the Town for the construction case combustion emissions (NO_X and $PM_{2.5}$) was completed using a recognized model (AERSCREEN). The Board recognizes that the Town used a flat terrain assumption (the worst case scenario) because of the terrain limitations of the air quality model. The Board also agrees with the Town that there was no need to study air emissions associated with normal Project operations, as minimal air emissions are anticipated during these operations.

[228] The Board accepts that it was reasonable for the Town to use the Kananaskis and Lafarge Exshaw monitoring stations to obtain information for the assessment of baseline air quality conditions in the RSA, as there are no meteorological stations in the Town. The Board views the use of baseline air quality for NO_2 and $PM_{2.5}$ from the Lafarge Exshaw monitoring station to be a “worst case” scenario, as air quality is expected to be better in the Project area. The Lafarge Exshaw monitoring station is expected to have poorer air quality, because it is associated with a limestone quarry and cement plant.

[229] The Board finds that an assessment of NO_X and $PM_{2.5}$ is acceptable for the air quality assessment, as they are the most significant air emissions during the Project’s construction and maintenance phases. The Board accepts that modelling was performed only for the construction case because it was calculated to have higher air emissions than the maintenance case. The Board finds that the NO_X and $PM_{2.5}$ levels for the construction case are below AAAQO, and therefore acceptable. The Board notes that the Public Health section of this decision report includes a discussion of the Town’s human health risk assessment of all combustion emissions.

[230] The Board finds that an air quality complaint protocol for combustion emissions is not required because the air quality modelling results based on combustion emissions are within AAAQO. The Board notes the actual movement of construction air emissions would be less than the modelled results, since the Town assumed a flat terrain (worst case) with all construction equipment operating at the same time.

[231] The Board notes that although Access Road dust was not included in the air quality modelling, the Town committed to mitigate Access Road dust impacts through the implementation of a dust control management plan. Based on the calculated $PM_{2.5}$ emissions from the Town, and contrary to the Town’s assertion, the Board finds that the Access Road dust will be the largest $PM_{2.5}$ emission source during construction.

[232] The Board finds that the Town’s commitment to develop and implement a dust control management plan is important because Access Road dust is the largest $PM_{2.5}$ emission source, and was not included in the modelling. Therefore, as a condition of approval, the Board requires the Town to implement the proposed dust control management plan for construction and post flood maintenance scenarios. The plan must include dust suppression methods (road watering and other possible dust suppressants) and proactive

triggers (or thresholds) that detail when dust control will occur. In addition, the plan must include a dust complaint response protocol that identifies how complaints or concerns about Access Road dust will be addressed.

The Exclusion of Blasting Emissions from Air Emissions Calculations

[233] The Board finds that the blasting required to construct the Access Road does not need to be included in the construction air emissions calculations or modelling because it is less than 1% of the total construction air emissions of NO_X and $PM_{2.5}$.

[234] Using dimensions provided by the Town, the Board estimates that the blasting required by the diversion tunnel construction would be approximately 2.4 times the blasting required for the Access Road (5,500 m^3 versus 2,350 m^3 of rock, respectively). The Board finds that increased air emissions associated with tunnel rock blasting activities would be less than 2% of the total construction NO_X and $PM_{2.5}$ emissions, and therefore these blasting emissions do not need to be included in the air emissions calculations or modelling.

Low Impact of Project on Air Quality

[235] The Board finds that Project construction air emissions are expected to have an effect on air quality that is low in magnitude, since emissions will be local in nature and short term. The Board notes that the NO_X and $PM_{2.5}$ levels at the nearest receptor are modelled to be less than the AAAQO. Although Access Road dust was not included in the modelling, the Board finds that the implementation by the Town of their dust control management plan (as conditioned) will result in a low impact on air quality.

SECTION 10: NOISE

10.1: Views of the Applicant

Noise Impact Methodology and Assessment

[236] The Town conducted an environmental noise impact assessment to determine the potential noise effects of the Project. As part of the assessment, the Town chose a noise study area that included the Project and residential receptors located adjacent to the Project. The assessment included noise modelling of the baseline, construction and maintenance (post-flood debris removal) cases. A normal operations case was not modelled by the Town as the Project does not generate noise during normal operations, except for noise from limited vehicle access during quarterly/biannual inspections.

[237] In its evaluation of noise impacts, the Town assessed the effects of both topography and vegetation cover on noise levels in the study area. The land surrounding the Project is characterized by significant changes in elevation, with a generally downward slope (northeast to southwest) from the Project to the Town. The land in the Project area has a dense cover of pine trees that according to the Town provide significant sound absorption. Topographic information and tree cover locations were included in the Town's noise modelling. The CADNA/A software package (version 4.6.153) was used by the Town for noise modelling, and the calculation method followed International Standards Organization (ISO) 9613-2. The Town assumed that all residences ("receptors") are located downwind from all noise sources for the modelling.

[238] Railway traffic information was not available, so railway noise was not included in the modelling. The Town's noise modelling did not include rock blasting. Blasting noise associated with Access Road construction was considered by the Town to have minimal noise impacts because it was the Town's view that the noise is random, variable, and of very short duration (only a few seconds), in the middle of the day, and once every few days.

[239] The Town's noise assessment provided modelling results (baseline, construction and maintenance) for 208 receptors in the noise study area. All of these receptors are located greater than 450 m west, southwest and south of the Project. The Town stated that it is unlikely any of the receptors will have direct line of sight (and sound) to the Structure due to the topography and tree cover. The Town identified that some of the receptors located adjacent to the site Access Road along Cougar Creek will have direct line of sight (and sound) to truck traffic on the Access Road.

Results of Noise Impact Modelling

[240] The baseline case noise modelling by the Town included traffic count information from the Trans-Canada Highway and Highway 1A, as well as from other collector and residential roads where traffic counts were available. The highest noise levels for the baseline case were associated with receptors adjacent to collector roads (Elk Run Boulevard and Benchlands Trail). The Town stated that the modelled baseline noise levels for the noise study area ranged from 43.1 to 62.2 dBA (A-weighted decibels).

[241] The Town's construction case modelling included the baseline traffic noise plus the estimated noise generated from the Project's construction. The construction case modelling assumed that all Project construction equipment was operating at the same time, creating a

worst case noise scenario. Further, it was assumed by the Town that hours of work were Monday to Saturday, 7 am to 7 pm, during a 30 month construction period.

[242] The Town stated that the modelled construction case noise levels for the noise study area ranged from 43.3 to 62.5 dBA. In the modelling, the relative noise increase above baseline at individual receptors ranged from 0.0 to 8.9 dBA, with most receptors experiencing a noise increase of less than 1.0 dBA from the baseline case. Receptors adjacent to Cougar Creek showed modelled noise increases of greater than 1.0 dBA, which were attributed by the Town to be related to Access Road noise rather than construction noise at the Structure.

[243] To provide context to the relative impact of these modelled noise increases, the Town provided a listing of dBA levels for familiar noise sources (Table 3) as reference sound levels.

Table 3. Sound Levels of Familiar Noise Sources

Sound Level (dBA)	Source
30	Bedroom of a country home or Soft whisper at 1.5 m
40	Quiet office or living room
50	Moderate rainfall or Inside average urban home or Quiet street
60	Normal conversation at 1 m
70	Noisy restaurant
75	Highway traffic at 15 m or Loud singing at 1 m
80	Busy traffic intersection
90	Loud shout
95	Freight train at 15 m

[244] The Town stated that a 1 to 2 dBA change in noise level is the threshold for humans to notice a noise change, and a 5 dBA change is a strongly perceptible noise level change. A 10 dBA increase (or decrease) is typically considered double (or half) the noise level.

[245] Maintenance case noise modelling by the Town included the baseline traffic noise plus the noise associated with activities to remove rock and woody debris. This case was also modelled using a worst case scenario where all maintenance equipment was assumed to be operating at the same time. Proposed maintenance hours of work were assumed by the Town to be from 7 am to 7 pm, for an estimated 30 day duration.

[246] Modelled maintenance case noise levels by the Town ranged from 43.4 to 62.8 dBA for the noise study area. This relative noise increase above baseline ranges from 0.0 to 10.4 dBA. Similar to the construction case, most receptors would experience a noise increase of less than 1.0 dBA. The Town stated that the receptors subjected to a noise increase of greater than 1.0 dBA are located adjacent to Cougar Creek. It was the Town's view that the elevated noise levels are attributable to Access Road noise, not maintenance noise generated at the Structure itself.

[247] The Town stated that there are no municipal noise criteria that pertain to the construction or maintenance of a development such as the Project.

10.2: Views of the Board

Minimal Noise Impact

[248] The Board finds that noise associated with the Project's construction and maintenance activities will have limited impact on adjacent residential receptors. The Board is of the view that the increase in noise experienced by some receptors will be within a range reasonably expected during construction and maintenance activities.

Adequacy of Methodology for Noise Assessment

[249] The Board finds that the Town has used acceptable software and calculation methods to determine noise levels at residences ("receptors"). The Board notes that the Town has used noise modelling software that allows for the modelling of various noise sources such as road, rail and stationary sources. The Board agrees with the use of the topography and tree cover location information, and with the assumption that receptors are located downwind of all noise sources.

[250] The Board finds that because noise generated during normal operations is expected to be minimal, noise modelling of the normal operations case was not conducted and is not required. The Board accepts that railway noise was not included in the modelling. The Board notes that the Town's provision of reference sound levels for common noises and relative changes in noise (Table 3) is useful to understand the noise impacts of the Project.

Findings of Noise Impact Study

[251] The Board finds that the level of noise increase (less than 1 dBA) for most receptors during construction and maintenance is at or below the threshold for humans to notice. The Board notes that the Town's modelling of construction and maintenance activities concluded that the noise effects on receptors were primarily due to the truck traffic on the Access Road. Based on the modelling results, the Town expected that most receptors will experience a noise level increase of less than 1 dBA above the baseline case during construction and maintenance.

[252] The Board finds that residents located directly adjacent to the Access Road will experience increases of sound levels greater than 1.0 dBA (up to double baseline noise) during Project construction and maintenance activities. The Board finds these noise levels are acceptable because they will occur during similar hours addressed for construction within the Town's Noise Bylaw.

Noise Associated with Blasting Activities

[253] The Board finds that the noise impact on receptors from Access Road blasting (near the Structure) will be minimal, as assessed by the Town. The Board finds that the exclusion of the Access Road blasting noise from the noise modelling is acceptable, because it is anticipated to be random, variable, of very short duration (a few seconds), and in the middle of the day, once every few days.

[254] Using dimensions provided by the Town, the Board estimates that the blasting required by the diversion tunnel construction would be approximately 2.4 times the blasting required for the Access Road (5,500 m^3 versus 2,350 m^3 of rock, respectively). The Board notes the Town's noise assessment of Access Road construction determined that rock

blasting noise was minimal. Although the tunnel blasting is more significant in volume, the Board finds that noise from tunnel blasting is nonetheless sufficiently low in impact to have been excluded from the noise modelling. Additionally, the Board finds that diversion tunnel blasting will have a minimal noise impact on receptors, since tunnel blasting is short term in nature, and located at a distance from receptors (at the Structure).

Noise Control Management

[255] The Board finds that expected noise levels and hours of operation associated with the Project's construction and maintenance are consistent with the Town's Noise Control Bylaw 11-97 (May 1997) that limits construction activity to the hours of 7 am to 10 pm, Monday to Saturday (except statutory holidays). The noise control bylaw provides that construction noise (such as that from the Project) is exempt if all federal, provincial and municipal approvals have been obtained.

[256] The Board finds that a noise complaint protocol is not required. The Board notes that for projects requiring an EIA, a specific noise complaint protocol is typically required to ensure that the proponent establishes a communication channel to receive complaints from receptors potentially affected by noise impacts. Given that the Town is the Project proponent, the Board understands that the Town is already required to respond to resident concerns relating to nuisance issues, including noise.

SECTION 11: PUBLIC HEALTH

11.1: Views of the Applicant

Assessment of Public Health

[257] The Town conducted a human health risk assessment to study the effects of the Project on public health. The Town's assessment focused on the potential effects of air emissions on human health within the air quality regional study area (RSA), which extends across a 24 km x 24 km area (Figure 6). The Town stated that aquatic components were not considered as part of the assessment, as the EIA results indicate that residual effects on water quality, aquatic ecology, and groundwater quality are negligible.

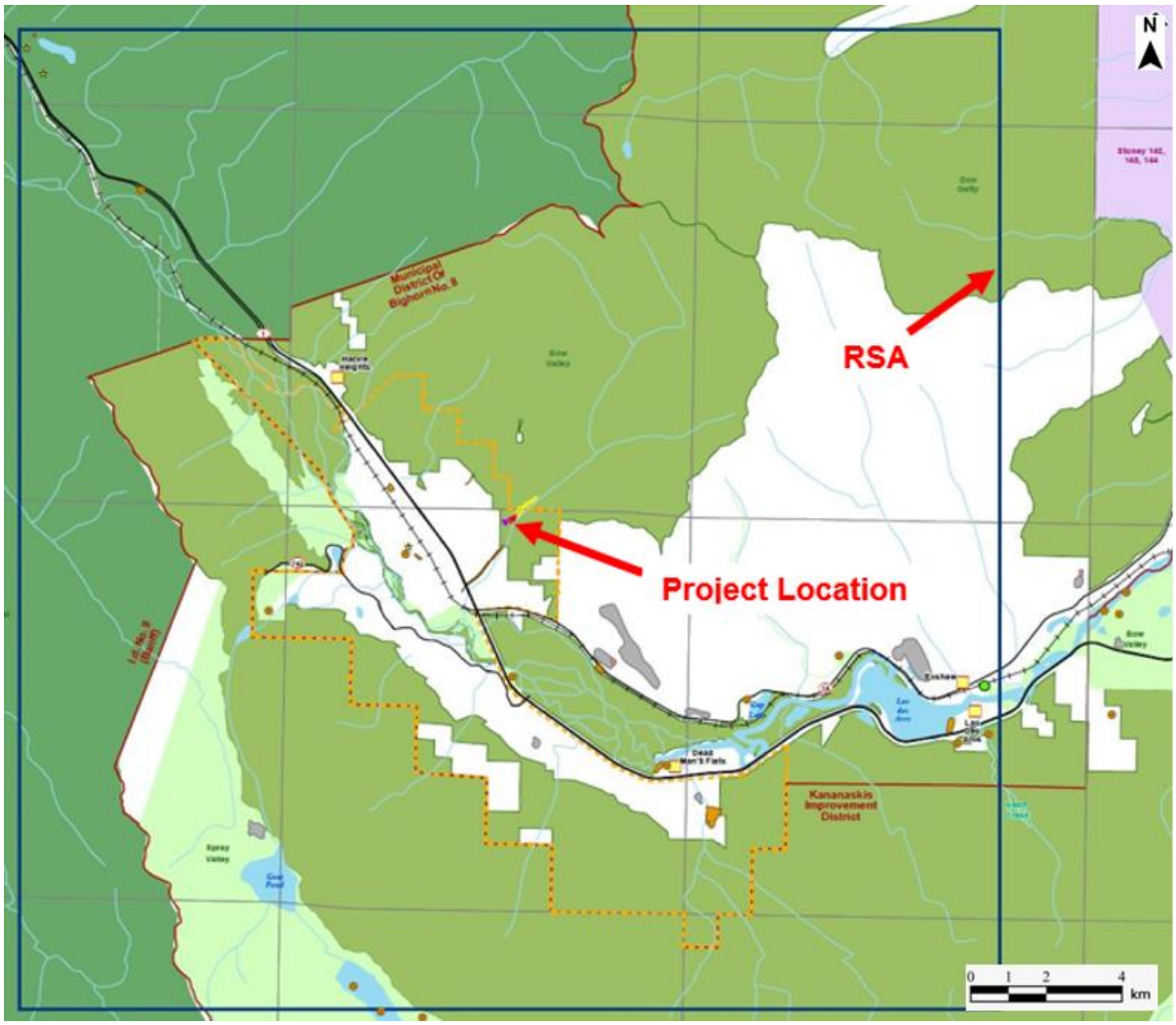


Figure 6. Air Quality Regional Study Area (based on EIA, Figure 8.2-1)

Methodology of Assessment on Public Health

[258] The Town assessed potential health effects associated with the Project by using a screening level human health risk assessment (SLHHRA) approach. Essential components of the SLHHRA included problem formulation, exposure assessment, toxicity assessment, and risk characterization.

[259] The Town relied on air emission calculations for the construction and maintenance phases of the Project (also known as “cases”) for the SLHHRA. The Town asserted that during normal operations, the Project would not generate air emissions, except for those from limited vehicle access during quarterly/biannual inspections. The Town provided detailed calculations on the air emissions generated during the construction phase and during the post-flood maintenance phase. As discussed in the Air Quality and Climate section, the construction phase would be of longer duration than post-flood maintenance activities, and thus was anticipated to have greater air emissions. Therefore, the Town used the construction phase air emissions for the SLHHRA.

[260] In the SLHHRA’s problem formulation section, the Town detailed a chemical (emissions) inventory for the Project and identified chemicals of potential concern (COPCs). Identifying receptors of concern, applicable exposure pathways, and conceptual exposure were also part of this stage. Ongoing exposure to COPCs at the nearest residence to the Structure (450 m) was selected by the Town as a reasonable worst case receptor. The Town selected the inhalation of COPCs, emitted during Project construction, as the primary exposure pathway. The Town also considered secondary exposure pathways which involve the deposition of COPCs on soil, including the inhalation of dust, inadvertent ingestions of soil, and dermal contact with soil. The Town did not select ingestion of home-grown produce and wild game as applicable exposure pathways, because they are indirectly accounted for through the soil quality guidelines.

[261] The Town’s SLHHRA exposure assessment section estimates the potential chemical exposures received by receptors of concern, using reasonable worst case assumptions. Air emissions on human health were assessed as a primary exposure pathway because of the direct effects on humans of inhaling COPCs emitted during Project construction. The Town also assessed potential secondary exposure pathways, which included determining which of the COPCs emitted during Project construction could be deposited on soil and persist (or accumulate) in sufficient quantities for exposure by people.

[262] The Town’s toxicity assessment for the SLHHRA determined health based guidelines (or exposure limits) for each COPC. For the purpose of the SLHHRA, the Town based the air inhalation exposure limits for the primary pathway on limits established by leading scientific and regulatory authorities (Canadian and international) responsible for the protection of public health. The exposure limit for soil quality guidelines was based on the Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Exposure limits were presented for both acute and chronic inhalation.

[263] For the final portion of the SLHHRA, the Town quantified the potential health risk to receptors from the Project’s COPC emissions by calculating risk estimates. The estimates were calculated by comparing exposure assessment results to the corresponding toxicity assessment. The Town stated that their estimate of non-cancer risk exposures included acute and chronic inhalations and soil related pathways. These risk estimates were calculated using a risk quotient, where the predicted exposure (or predicted soil

concentration) was divided by the exposure limit (or residential soil quality guideline). According to the Town, a risk quotient of less than 1.0 indicates negligible to low health risks, even in sensitive individuals, and a risk quotient of greater than 1.0 indicates an elevated level of risk.

[264] Cancer risk estimates (chronic air inhalation) from the Town were calculated as an incremental lifetime cancer risk (ILCR). The calculated ILCR was compared to Health Canada's ILCR of 1 in 100,000 (one extra cancer case in a population of 100,000 people; considered acceptable, tolerable, or essentially negligible).

Effect on Human Health

[265] The results of the Town's SLHHRA risks for air inhalation (acute and chronic non-carcinogenic) and soil related pathways (chronic) concluded that risk quotients for all COPCs were less than 1.0. The SLHHRA conducted by the Town also concluded that ILCRs were less than 1 in 100,000 for COPCs. Based on these findings, the Town concluded that the Project's construction air emissions are not expected to have an adverse effect on the health of area residents.

[266] In addition to the SLHHRA, the Town assessed the impact of stress on residents, a qualitative factor that may lead to adverse health effects. The Town anticipates that completion of the Project would reduce the stress felt by residents who are potentially directly affected by future Cougar Creek flood events.

11.2: Views of the Board

Assessment of Public Health Impacts

[267] The Board finds that stress reduction for residents, and air quality impacts due to Project construction activities, are not expected to have an adverse effect on public health. The Board finds that the Town's human health risk methodology and assessment appropriately focused on the potential human health effects of air emissions in the air quality RSA. The Board also accepts the Town's decision not to assess aquatic pathways, and agrees that residual effects on water quality, aquatic ecology, and groundwater quality are negligible because there are no identified Project emissions or releases to water.

Adequacy of Methodology Used to Assess Effect on Human Health

[268] The Board finds that the Town's SLHHRA methodology is acceptable because it used the highest air emissions (construction phase) as the worst case scenario for assessing the risks associated with the Project.

[269] In the SLHHRA's problem formulation section, the Town identified COPCs and receptors. The Board accepts the COPCs identified by the Town and agrees with the use of the nearest receptor as a reasonable worst case scenario. The Board accepts the Town's use of air inhalation of COPCs as the primary exposure pathway for the SLHHRA, and its use of deposition of COPCs on soil as the secondary exposure pathway (dust inhalation, inadvertent ingestions of soil, and dermal contact with soil), because they are avenues by which air emissions might travel to receptors. The Board agrees that other secondary exposure pathways (ingestion of home-grown produce and wild game) were not relevant for the SLHHRA because they are indirectly accounted for through the soil quality guidelines.

The Board accepts that the Town's SLHHRA did not assess water-related exposure pathways because there are no Project emissions/releases to water.

[270] The Board accepts the exposure assessment section of the Town's SLHHRA because it includes the direct effects of humans inhaling Project COPCs and the assessment of the COPCs that could deposit on soil and persist in sufficient quantities for human exposure to occur.

[271] The toxicity assessment section of the Town's SLHHRA determined health based guidelines (or exposure limits) for each COPC for both air inhalation and soil quality. The Board accepts that the guidelines and limits selected by the Town are appropriate for assessing toxicity of each COPC because they were established by leading scientific and regulatory authorities (Canadian and international) responsible for the protection of public health.

[272] The Town's SLHHRA calculated non-cancer risk estimates including exposures from acute and chronic inhalations and soil related pathways using a risk quotient (predicted exposure divided by exposure limit). The Town proposed that risk quotients for a COPC of less than 1.0 indicate negligible to low health risks (even in sensitive individuals), while values greater than 1.0 indicate an elevated level of risk. The Town's SLHHRA calculated the air inhalation (acute and chronic) and chronic soil related pathways risk quotients to be less than 1.0. The Board accepts the use of risk quotients because they provide a method of comparing predicted exposure to an exposure limit for each COPC. The Board notes that the use of risk quotients also allows for the comparison of relative risk from different COPCs to a single receptor.

[273] The Board accepts the Town's SLHHRA use of the ILCR method to calculate cancer risk estimates for chronic air inhalation of COPCs because it provides a method of comparing predicted exposure to the carcinogenic exposure for each COPC. The Town calculated that all COPCs have an ILCR of less than one in 100,000 for Project construction air emissions. The Board also notes that the ILCR results can be directly compared to Health Canada's ILCR of 1 in 100,000 (one extra cancer case in a population of 100,000 people).

Impacts on Human Health

[274] The Board accepts the risk quotient results, and finds that the Project's construction air emissions are not expected to have acute or chronic health effects due to air inhalation or soil related pathways, because all COPC risk quotients are less than 1.0.

[275] The Board accepts the ILCR results, and finds that the Project construction air emissions are not expected to result in an increase in cancer due to inhalation of air emissions because all COPC ILCR's are less than 1 in 100,000.

[276] The Board finds that the Project is likely to reduce stress for Town residents (resulting in positive health impacts), because the Project is specifically designed to reduce the risks of future debris flood events on Cougar Creek.

SECTION 12: PUBLIC SAFETY, MALFUNCTIONS AND RETENTION STRUCTURE SAFETY

12.1: Views of the Applicant

Design and Expected Performance of the Structure

[277] The Town retained technical specialists to conduct geotechnical investigations and develop preliminary design options for the Structure. According to the Town, the final Project design and construction details may be adjusted to accommodate field conditions encountered at the site during construction.

[278] The Town provided an assessment of all geotechnical investigations conducted for the Project. According to the Town the investigations were used to derive design values for:

- selection of a design concept appropriate to geotechnical conditions;
- assessment of vertical and horizontal deformation;
- seepage calculations and design of cut-off measures and deep foundation elements;
- grout curtain design; and
- stability analysis.

[279] The Town indicated that the most common failure mechanisms for rock and earth filled embankments are overtopping (48%), internal erosion (46%), structural failures (5%), and earthquakes (1%). According to the Town, the Structure has been designed to minimize, and almost eliminate, the risks associated with these typical embankment dam failures. The Structure is designed to withstand ground motion resulting from earthquakes with a return period of 2,500 years at full impoundment for a safety factor of 1.25.

[280] The Town has designed the Structure to withstand overtopping flood events, up to and including a probable maximum flood.

[281] The Town indicated that it modified the spillway design based on advice from Alberta Environment and Parks (AEP) dam safety reviewers. Two symmetrical training walls would be used to redirect flow during an overtopping event rather than relying on the natural rock walls. According to the Town, this revised spillway design would increase the Structure's resiliency during an overtopping event by providing better control of flow on the spillway, better energy dissipation in the stilling basin, and better control of the flow in the natural channel downstream of the stilling basin.

[282] The Town proposed that a concrete central core seal wall (placed on a cut-off wall tied into grouted abutments) would be used to control seepage and prevent internal erosion through the Structure. An impervious zone (a grout curtain tied into the bedrock) would provide additional seepage control. As an additional contingency, the Town indicated that a drainage layer would be located on the downstream side of the central core seal wall to discharge residual seepage through the Structure and away from subsurface components. The Town also stated that flood events that result in high or full impoundment should not pose an increased risk to seepage potential, since impoundment is expected to last only one to two days.

[283] The Town indicated that it would hire an experienced construction contractor to ensure that potential construction challenges are identified and appropriate mitigation options are submitted for foreseeable issues. The Town would require the contractor to follow a stringent quality assurance program. In addition, the Town stated that it would implement a comprehensive quality control program. Site-specific conditions encountered by the construction contractor that are outside the scope of design parameters would be discussed with the Structure's designer and the Town, subject to appropriate regulatory oversight.

[284] It was the Town's view that the likelihood of a structural failure is very low due to the Structure's design and the use of experienced contractors to construct the Project.

Public Safety during Construction

[285] The Town stated that the Project construction plan would take advantage of dry periods to avoid potential challenges and risks associated with working in high creek flow conditions. For example, the cut-off wall would be constructed in the July to October period when there is a low risk of flooding. As well, the diversion tunnel (located around the eastern side of the Structure) would be used to divert creek water around the construction area.

[286] The Town committed to developing a health, safety and environment (HSE) plan to minimize safety risks to the public and onsite workers during construction. Essential components of the HSE plan would include fencing and signage to secure the construction site and a traffic management plan. A site safety supervisor retained by the Town would be responsible for ensuring the HSE plan requirements are followed, and corrective actions would be implemented as required.

Debris Flood Protection

[287] The Town stated that Cougar Creek is susceptible to debris floods that generally consist of three components—clear water, woody debris and rock debris. The Town indicated that the maximum flow through the Structure would be 45 m^3/s under full impoundment conditions. The Town described all culverts and bridges downstream of the Structure as having a flow capacity greater than 45 m^3/s of clear water flow. In fact, the Elk Run Boulevard culvert has a clear water flow capacity of 160 m^3/s and the Trans-Canada Highway and Highway 1A culverts both have a clear water flow capacity of 64 m^3/s. The CPR clear span bridge is described by the Town as having a clear water flow capacity of greater than 45 m^3/s. Since the capacities of the culverts and the bridge are greater than the maximum clear water flow through the Structure, the Town concluded that infrastructure within the Cougar Creek Fan will be protected, including transportation routes, and major utilities including power, gas and communication.

[288] The Town indicated that it used its experience with the capture of woody debris at the debris net to design and model the inlet of the diversion tunnel. A rake installed at the diversion tunnel inlet would prevent woody debris larger than 0.5 m from passing through the Structure. Behind the rake, there will be a 1.1 m high throttle entrance into the completed 4.5 m diameter diversion tunnel. The Town believes that any woody debris that passes through the 0.5 m rake spacing would be unlikely to have the size and geometry to cause flow problems at the 1.1 m high throttle entrance into the diversion tunnel, or at the bridge and culverts on the Cougar Creek Fan. Based on the design and modelling of the

rake, the Town concluded that large woody debris would be captured behind the Structure in the inundation area.

[289] The Town stated that the rake at the inlet of the diversion tunnel would prevent rock debris larger than 0.5 m in diameter from passing through the Structure. The Town's initial long-term flood mitigation considerations included the installation of grade control structures on the Cougar Creek Fan. To study the movement of rock debris in Cougar Creek downstream of the Structure, the Town conducted two sets of debris flow modelling in various sections of Cougar Creek between the Structure and downstream of the Highway 1A. Based on the modelling results, it was the Town's view that no significant changes to the creek channel bed (such as the installation of grade control structures) were required.

[290] The Town stated that the creek gradient tends to be shallower near the Highway 1A culvert and the CPR Bridge, so smaller rock debris tends to accumulate in these areas during flooding events. The Town would use an excavator to remove rock debris from directly upstream of the Highway 1A culvert during flood events. The Town also stated that the CPR uses its own equipment to remove rock debris accumulation directly upstream of the CPR bridge during flood events and on an annual basis during spring runoff.

Operation, Maintenance and Surveillance

[291] According to the Town, the Structure was designed to hold back more than twice the anticipated amount of debris that could be generated for the flood scenario assessed to be the largest. Mitigation measures proposed by the Town to minimize risk to the Structure during normal operation and maintenance activities include:

- implementation of a comprehensive instrumentation network and surveillance program to detect Structure loads resulting from floods, seismic activity, temperature and wind velocity/direction, and identify problems before the safety of the Structure is compromised;
- regular inspection of the inundation area and removal of rock or woody debris as required; and
- use of a diversion tunnel located around the eastern side of the Structure for flow control, rather than a bottom outlet structure located at the centreline of the Structure.

[292] The Town developed an Operation, Maintenance, and Surveillance (OMS) Manual to meet the requirements set out in the Canadian Dam Association's (CDA) Dam Safety Guidelines 2007 (2013 edition). This manual is intended to guide the Town's response to impacts on the Structure (for example, overtopping) caused by extreme weather events, landslides, and seismic events that have the potential to affect its structural integrity. Surveillance data monitoring would be used to monitor the Structure's integrity and to determine its maintenance requirements after each major weather or seismic event.

[293] The OMS manual includes two levels of maintenance plans (Plan 1 and Plan 2), as well as a continuous surveillance and data monitoring plan. Plan 1 will be used by the Town multiple times per year (and after any "Unusual Operations" identified in the OMS Manual) to help ensure that the Structure is prepared for flood events on an on-going basis. Plan 2, which involves a more thorough analysis of components inspected under Plan 1, would be implemented every two years (and after any "Emergency Operations" identified in the OMS manual).

[294] The Town stated that an adaptive management approach would be used for erosion mitigation (as part of the OMS manual) for the Project, and would include inspections of the Structure, the Access Road and the channel downstream of the Structure. The Town also stated that the Lower Cougar Creek Reach would be inspected after major flood events for instances of erosion.

Failure Scenario Modelling

[295] The Town used a model (BASEMENT) to conduct a dam breaching and inundation analysis. To simulate a breach scenario, the modelling assumed a homogenous dam consisting of only one type of material (with no concrete central seal wall). Erosion was induced in the model by excluding the Structure's erosion control features, and the downstream slope was set to be erodible. To induce overtopping, a homogenous dam was modelled for a scenario with full impoundment and an inflow design flood resulting from a 1,000 year storm spring event with a two hour rainfall duration.

[296] The model predicted that initial overtopping would at first take place slowly at low discharge rates. Significant erosion would occur on the downstream face of the dam and outflow would start to rise rapidly about an hour after overtopping. Two and a half hours after overtopping, major parts of the dam would be destroyed and a significant breach would develop. According to the Town, the discharge would be reduced to 64 m^3/s (discharge associated with a 100 year flood event) about three hours and 45 minutes after overtopping of the dam starts.

[297] The Town indicated that for flood wave and inundation calculations, the model assumed that the flood wave was clear water and that culverts at Elk Run Boulevard, the Trans-Canada Highway, Highway 1A, and the CPR were blocked. The potential impacts of the flood wave and inundation were estimated at 13 locations using the model. Modelling results indicated that the entire Cougar Creek Fan would be flooded. The Town stated that the modelling also showed that the Canmore General Hospital and the Town's Fire and Rescue station would not be impacted. The Town's modelling also showed that Benchlands Trail could potentially serve as an evacuation route.

Emergency Preparedness and Response

[298] The Town indicated that its existing Municipal Emergency Management Plan (MEMP) was established under the authority provided to the Town by Alberta's *Emergency Management Act* and the Town of Canmore Emergency Management Bylaw (2014-19). The MEMP provides best practices for local authorities, provincial and federal governments and private sector partners to follow during major emergencies or disasters.

[299] The Town indicated that it is developing an Emergency Preparedness Plan (EPP) and an Emergency Response Plan (ERP) to address flood events. The EPP and ERP will be integrated into the Town's existing MEMP. According to the Town, the EPP will be developed in accordance with the CDA Dam Safety Guidelines and Alberta-specific guidance from the Dam Safety Branch of AEP. The EPP will include the consideration of hazards posed by the Structure, as well as roles and responsibilities of all parties, and required notifications. The Town stated that the ERP is intended to define key emergency response roles and responsibilities to implement the requirements of the EPP. The ERP will include procedures for notifying residents in the event of an emergency.

12.2: Views of the Board

[300] The Board finds that the Project design based on improved debris flood predictions is an appropriate approach to mitigating future debris flood events in Cougar Creek. The Board also finds that the Town was thorough in its analysis of historical Cougar Creek flood events, its investigation of flood event factors related to steep creek scenarios not previously studied, and its application of these variables in more advanced models that provide improved predictions of debris flood impacts.

Adequacy of Design and Expected Performance of the Structure

[301] The Board finds the geotechnical investigations used by the Town to inform design options for the debris flood retention Structure were conducted by qualified consultants and based on established engineering practice. The Board acknowledges that the Structure is designed to minimize the embankment dam failures risks of overtopping, internal erosion, structural failures and earthquakes. Based on the construction information provided, and given that the Structure's design and construction must meet the CDA Dam Safety Guidelines as administered by the Dam Safety Branch of AEP, the Board finds that the Project design proposed by the Town effectively mitigates public safety risks associated with Project incidents or malfunctions.

Adequate Public Safety and Construction Phase Safeguards

[302] The Board accepts that the combination of the contractor's quality assurance program, together with the Town's quality control program, will provide sufficient oversight to ensure that the Structure is constructed according to the final design and to any site-specific conditions that are encountered. The Board notes that the Town must secure permit(s) from AEP that will include stringent design and construction requirements.

[303] The Board accepts the Town's proposal to develop the HSE plan that would be implemented during Project construction, and views the HSE plan as essential for public safety during construction of the Project. As such, the Board requires as a condition of its approval that the Town complete the HSE plan prior to commencing construction. The HSE plan must be completed to the satisfaction of AEP.

Structure Ensures Debris Flood Protection for Public and Infrastructure

[304] The Board agrees with the Town that the Project's design substantially reduces the impact of both clear water and debris flows during flood events. Accordingly, the Board finds that the Project will protect public safety and reduce the risk of damage to infrastructure downstream of the Structure, including major transportation routes and utilities.

[305] The Board finds that the Structure's design limits clear water flow in the diversion tunnel to 45 m^3/s, which is within the rated flow capacity of the existing bridges and culverts in the Cougar Creek Fan.

[306] Based on the Town's evidence, the Board makes the following findings:

1. The Board finds that the rake at the diversion tunnel intake will prevent the flow of large (> 0.5 m) woody debris beyond the Structure. The Board accepts that any smaller woody debris that passes through the 0.5 m rake spacing is unlikely

to have the size and geometry to cause flow problems at the 1.1 m high throttle entrance into the diversion tunnel.

2. The Board finds a low likelihood that woody debris that does pass through the rake and diversion tunnel would subsequently restrict water flow at a bridge or culvert in the Cougar Creek Fan.

3. The Board finds that the rake at the diversion tunnel intake will prevent the flow of large (> 0.5 m) rock debris beyond the Structure. The Board finds that smaller rock debris (<0.5 m) will pass through the Structure rake and diversion tunnel, and will be deposited and accumulate in areas downstream of the Structure where the creek bed has a lower gradient (for example, directly upstream of the Highway 1A culvert and the CPR bridge). The Board notes that the creek bed at the Highway 1A culvert and the CPR bridge will continue to require rock debris removal.

4. The Board finds that the Town's decision to exclude grade control structures is reasonable. The Board notes that although the Town initially considered installing grade control structures on the Cougar Creek Fan as part of long-term flood mitigation, the Town subsequently concluded that the creek bed downstream of the Structure did not require further modification.

[307] In the Board's view, the Town's adaptive management approach to the Project must also include the assessment of impacts of smaller rock debris that pass through the Structure, including downstream rock erosion and deposition. Therefore, the Board requires as a condition of approval that the Town's Operation, Maintenance, and Surveillance Manual include an adaptive management approach to effectively manage on-going rock debris erosion and deposition downstream of the Structure to the satisfaction of AEP.

Structure Maintenance and Surveillance

[308] The Board acknowledges that the Town is developing an OMS manual for the Project to meet the CDA Dam Safety Guidelines and includes two levels of maintenance plans (Plan 1 and Plan 2). The Board finds it appropriate that Plan 1 will be used by the Town multiple times per year (and after any "Unusual Operations" identified in the OMS Manual), and that Plan 2 will be implemented every two years (and after any "Emergency Operations" identified in the OMS manual).

[309] The Board finds that the Town's proposed OMS manual includes continuous surveillance and data monitoring using instrumentation installed in the Structure to detect changes in Structure loads resulting from floods, seismic activity, temperature, wind velocity, and wind direction. This approach is appropriate to identify potential problems with the Structure, ensuring any issues can be addressed by the Town in a timely manner, before the safety of the Structure is compromised. As the integrity of the Structure is viewed by the Board as critical to public safety, the Board requires as a condition of approval that the Town finalize the Operation, Maintenance and Surveillance Manual to the satisfaction of AEP. Additionally, the Board requires that the Town develop a surveillance data monitoring and reporting plan for the Structure to the satisfaction of AEP, no later than one year after the completion of the Structure water storage test.

Failure Scenario Modelling Addressed

[310] The Board notes that the failure scenario modelling was conducted by the Town in accordance with the CDA Dam Safety Guidelines. The Board acknowledges that a worst case scenario was modeled since it was assumed that no erosion controls were in place and an overtopping flood event (extreme storm event) was used. The modelling results provided valuable information about the duration and extent of flooding in the Cougar Creek Fan. The Board notes that even though worst case conditions for an overtopping flood event were assumed for the modelling, the Canmore General Hospital and Canmore Fire and Rescue station remained outside the impacted areas, and Benchlands Trail was unaffected, so it could serve as a potential evacuation route.

Emergency Response Planning

[311] The Town stated that it is experienced in dealing with emergencies through its municipal obligations under Alberta's *Emergency Management Act*. The Board agrees that the Town is experienced in dealing with emergencies, as demonstrated by the Town's response to the 2013 debris flood.

[312] As the Project owner, the Town will have additional responsibilities for emergency preparedness and response activities related to the Project. It is the Board's understanding that the Town is developing an EPP and an ERP to address these additional responsibilities. The Board notes that Town (staff and/or council members) will be providing input for the development of these emergency plans. The Board requires as a condition of its approval that the Town complete and implement the Emergency Preparedness Plan and Emergency Response Plan to the satisfaction of AEP, and integrate these plans into the Town's existing Municipal Emergency Management Plan.

SECTION 13: SOCIO-ECONOMIC EFFECTS

13.1: Views of the Applicant

Introduction

[313] The Town stated that economic effects were assessed in the regional study area (RSA), which included the Town of Canmore, the hamlets of Exshaw, Lac des Arcs, Harvie Heights, and Dead Man's Flats, as well as small parts of the Municipal District of Bighorn No. 8, the Kananaskis Improvement District, and Banff National Park. According to the Town, Canmore is the largest community in the RSA and is a regional service center that provides business, medical care, accommodation, community, recreation, and social services. The main vehicle access to Canmore is the Trans-Canada Highway, from Banff to the west, and from Calgary to the east. The CPR runs through Canmore and is an important transportation link between the Pacific coast and the Prairie provinces. The major economic drivers in the Town were identified as tourism, construction, residential development, and real estate. The Town represented the majority of the population (95.6%) in the RSA in 2011. The Town is the focus of the socio-economic assessment as it is most likely to experience the socio-economic effects of traffic and potential population change arising from the Project.

[314] The Town outlined that Canmore has a general hospital and a fire-rescue service and police service. The Town is responsible for the initial response to disasters or emergencies within Canmore, as required by the province, while forest fire protection and suppression are provided by Alberta Agriculture and Forestry. Mutual aid agreements are in place between the Town and other municipalities and government departments in the RSA. As a full-service community, the Town stated it provides a variety of services within Canmore, including waste management and recycling, road maintenance, water and wastewater, and parks and recreation. The Town also has significant social, cultural, and recreational programs for residents and visitors.

[315] The population of Canmore in 2014 was 16,967, comprising 13,077 permanent residents and 3,890 non-permanent residents. The Town indicated that the main reason for its significant non-permanent population is its reliance on tourism and the large number of vacation homes.

[316] Employment data provided by the Town indicated that accommodation, food, and tourism are the predominant employment sectors in Canmore, employing 16% of the workforce in 2015. The construction sector represents nine per cent of the workforce and has a significant economic multiplier effect, according to the Town. The Town indicated that the 2008 economic downturn had a significant impact on the construction sector, with construction activity declining by 30%. The Town indicated that local employers rely heavily on temporary foreign workers to fill employment positions.

[317] According to the Town, residential, industrial, and commercial developments and public infrastructure (the Trans-Canada Highway, Highway 1A, and the CPR rail line) are located in the Cougar Creek Fan. Residential communities are adjacent to Cougar Creek, and downstream of the Project. Significant damage to these developments and critical infrastructure occurred as a result of the June 2013 debris flood caused by snow melt and heavy rains in the Bow Valley. It was the Town's view that, without the Project, there is a

high risk of damage to these developments and infrastructure as a result of future floods. Other infrastructure at risk from future floods are major utilities including an electrical transmission line, high pressure gas line, and fibre optic main lines.

Pre-Project Flood Mitigation Action

[318] The Town indicated that following the June 2013 debris flood, it immediately implemented short-term mitigation measures on Cougar Creek. These measures included extensive concrete channel armouring in Cougar Creek upstream from the Trans-Canada Highway, and installing a debris net at the proposed site of the Project. Mitigation measures were designed to reduce the amount of debris transported from the upper Cougar Creek watershed to the Cougar Creek Fan and to reduce bank erosion in the creek channel if another flood event occurred before implementation of long-term mitigation plans.

Risk of Loss of Life and Annualized Damage Costs

[319] The Town stated that mountain hazard risk specialists derived the risk of loss of life and annualized building damage costs associated with flood events from one in 30 (1:30) to one in 3000 (1:3000) year return periods. The hazard and risk assessments were used to develop and evaluate long-term flood mitigation options for Cougar Creek.

[320] According to the Town, the estimated risk of flooding on the Cougar Creek Fan is very high and outside of generally accepted thresholds. The overriding consideration in establishing design parameters for all mitigation options was to reduce:

- the individual safety risk to less than a one in 10,000 (1:10,000) risk of fatality per year for the 193 properties that currently exceed the loss of life threshold; and
- the risk of group loss of life into the as-low-as-reasonably-practicable zone.

[321] The Town stated that similar individual risk thresholds were adopted by the District of North Vancouver in 2009, following guidelines developed in 1998 by the Hong Kong Geotechnical Engineering Office. The Town indicated that the risk thresholds have been adopted in its municipal planning process for steep creeks within the boundaries of Canmore. The Town further stated that similar group risk thresholds have been applied in the United Kingdom, United States, Australia, and Canada for specific risks (for example, nuclear power, dam safety, landslide risks, and steep creek geo-hazards).

[322] The Town stated that, based on average flood hazard probability, the average annualized building damage costs were estimated as $700,000 under the baseline scenario. This estimate was based on assessed building value only, and did not include contents or inventory, cleanup and recovery, and business interruption costs. Adding these factors in, the Town stated that the damage costs would likely increase by a factor of two or more. The Town stated that damage costs would further increase with the addition of direct costs of repairing public infrastructure including roads, highways, railway, and utilities that cross the Cougar Creek Fan. These estimates did not include the cost of infrastructure disruption (for example, in 2013, the Trans-Canada Highway was out of commission for seven days and the CPR was shut down for three days).

[323] The Town stated that it used a Kepner Tregoe (KT) analysis (a process designed to make the “best possible” choice from a range of options that includes the evaluation and

mitigation of risks associated with the decision taken) to select the long-term flood debris mitigation Project from four options.

[324] The four options conceptually analyzed by the Town were described in the environmental impact assessment (EIA) as:

> Option A – A debris flood retention structure at the site of the existing debris net. The structure is 30 m high at the spillway and spans across the 45 m wide bedrock confined channel. At its highest point the structure is approximately 100 m wide. The inundation area during major events would hold back up to 650,000 m^3 of water and debris.
>
> Option B – A debris flood retention structure at the Kame Terrace site. The structure is 20 m high at the spill way and approximately 350 m wide. Maximum holding capacity of 650,000 m^3 of water and debris.
>
> Option C – A smaller debris retention structure at the Kame Terrace site. It is 12 m high and approximately 200 m wide. The structure is designed to only retain sediment, up to a maximum of 120,000 m^3. The water and finer sediment passes through large rake covered openings mostly unimpeded.
>
> Option D – No further mitigation with the debris net left in place.

[325] The Town indicated that Options A to C were developed to reduce the annual risk of individual loss of life to less than 1:10,000 years for each of the 193 properties that exceed the threshold. In addition, the options were required to reduce the group loss of life into the as-low-as-reasonably-practicable zone. The options were scored based on the following weighted objectives (listed with most important at the top, and least important at the bottom):

- minimize damage to public and private property;
- minimize potential for blocked evacuation routes;
- maintain safe passage of goods and services on major transportation links, including the Trans-Canada Highway, Highway 1A, and the CPR;
- maximize protection of major utilities including power, gas, and communication;
- minimize need for operation of heavy equipment involvement during a flood event;
- minimize impact on regional wildlife corridors;
- minimize habitat fragmentation;
- minimize annual maintenance costs including sediment removal, post-flood revegetation, and infrastructure inspection;
- minimize construction costs;
- provide access to recreation and natural areas;
- minimize impacts related to residents' views and sightlines;
- minimize impact to park users' experience; and
- minimize construction duration, with a goal of two or less construction seasons.

[326] The Town concluded that Option A, the structure located at the current site of the debris net, was selected based on the results of the KT matrix analysis, using the weighted objectives stated above. Option A provided several important benefits, including:

- highest level of risk reduction;
- preferred geotechnical conditions, when compared to the Kame Terrace site;
- reduced adverse effect on the regional wildlife corridor with potential benefits to wildlife movement after construction; and
- minimal visual disruption for residents.

[327] It should be noted that as the Town moved forward with Option A, the inundation area was recalculated to hold back 760,000 m^3 of water and debris.

[328] The Town stated that the Project will reduce the risks of flooding for governments (federal, provincial, and municipal), businesses, residence owners, and the public. The Project would be funded by the Town ($4 million), Alberta Transportation ($1.37 million), a Government of Alberta grant ($19 million), the Alberta Community Resilience Program ($10 million), and a Federal Government grant ($14.5 million) under the National and Regional Project of the New Building Canada Fund. Total provincial and federal funding committed for the Project's construction and ancillary activities, such as preparation of the EIA, design, and dam safety analysis, is $44.87 million.

[329] The Project's construction cost was estimated by the Town to be $38 million, with the majority of the capital expenditures to be spent within the region. The majority of construction costs would be for materials and handling, project management, on-site labour, and equipment.

Infrastructure, Services and Economic Impact of the Project

[330] According to the Town, housing affordability and availability in Canmore are concerns to its residents. The Project requires a maximum construction workforce of 30 people. The Town indicated that most construction workers will likely come from the RSA and the remaining workforce will likely move to Canmore on a short-term basis. The Town stated that Canmore experiences large fluctuations in tourism and temporary residency and does not expect problems accommodating the relatively small workforce associated with the Project. The Town indicated that hotels and motels will likely have the capacity to handle the temporary workforce. In addition, the Town stated that the temporary workforce for the Project may well provide benefits to hotels and motels during seasonally low occupancy periods of the year.

[331] The Town indicated that construction and operations workers are unlikely to significantly increase the demand on medical and emergency services, infrastructure and community services, and tourism, as the Town expected that most of the construction and operations workforce will be from the RSA.

[332] The Town stated that anticipated economic effects from the Project's construction will be from direct employment, employment associated with the provision of goods and services for the Project, and employment due to the spending of direct employment income. The Town expected that most expenditures on construction materials, equipment, engineering, and trucking, as well as employment, would be within Alberta and predominantly within the RSA, contributing to indirect and induced economic benefits.

[333] The Project requires ongoing operation, management, maintenance, and debris removal at a cost estimated at $140,000 annually. These annual costs are comprised of management ($40,000 per year), maintenance ($40,000 per year) and debris removal

($60,000 per year). The Town also stated that long-term management of the Project will likely be filled by part-time Town employees or new employees that are residents of the RSA.

[334] The Town stated that there are 15 undeveloped parcels of land in the Cougar Creek Fan. Five of the parcels do not meet safety risk tolerances and therefore could not be developed if the Project does not proceed. Four parcels are currently eligible for development, and the remaining six parcels, which are located in a “moderate” hazard risk area, currently could be developed if a site specific risk assessment indicates that the safety risk tolerance does not exceed the 1:100,000 probability of death to an individual. The Town indicated that after the Project is constructed, those parcels that previously did not meet safety tolerances would “most likely” be able to be developed. Preliminary study results suggest that all areas currently in the Extreme/High and Moderate risk areas will be either outside of the hazard zone or in a low hazard area. In addition, according to the Town’s Steep Creek Hazard and Risk Policy, existing developments in steep creek hazard areas will be eligible for further redevelopment if a hazard analysis indicates that the risk meets prescribed risk tolerances.

13.2: Views of the Board

[335] The Board acknowledges the commitment shown by the Town in implementing short-term flood mitigation measures in response to the 2013 debris flood. The Board also recognizes the Town’s commitment to develop and implement a long-term flood mitigation strategy to protect residents, property and infrastructure on the Cougar Creek Fan and lands adjacent to Cougar Creek, downstream from the Project.

Adequacy of Flood Hazard and Risk Assessment

[336] The Board notes that the Town contracted experts in flood hazard and risk assessment to predict loss of life and damages associated with various flood events. These assessments indicated that direct building damage without the Project had an average annualized damage cost of $700,000. The forecasted damage costs double when building contents, cleanup, recovery, and business interruption costs are included. While not directly quantified, damage costs are even higher when infrastructure repair and interruption costs are included. The Board accepts the damage estimates forecast by the Town’s risk assessment specialists, given their known expertise, and given that no contrary evidence challenged their forecasts and predictions. The Board also recognizes the significant economic losses associated with flood events on the Cougar Creek Fan, as was made clear from the evaluation of damages following the 2013 debris flood event.

[337] The Board commends the Town for its commitment to long-term planning for steep creek hazard areas located in Canmore. The Board notes that the Town has employed a “risk of loss of life” approach to guide development plans for steep creek areas. The Board further notes that the individual risk of loss of life thresholds adopted by the Town are based on well-established and accepted guidelines developed by the Hong Kong Geotechnical Engineering Office and adopted by the District of North Vancouver. The Board accepts the individual and group risk loss of life thresholds adopted by the Town. The Board notes that the Town’s approach to planning development on steep creek flood fans is guided by the requirement to meet a number of additional objectives (listed above), including avoidance of property and infrastructure damage.

[338] Further, the Board notes that two leading experts in geotechnical engineering and river geomorphology, Norbert Morgenstern and Michael Church, provided letters to the Town assessing and commending aspects of the flood risk work done. Morgenstern and Church concluded that the flood hazard and risk assessments are “an outstanding achievement” and “exemplary.” The Board finds compelling the participation in and review of the Project by Morgenstern and Church, which supports the Town’s approach to risk assessment and the approval of the Project.

Project Mitigates Flood Events

[339] The Board finds that the Town’s primary objective for developing the Project is to mitigate the effects of future flood events. The Project design is focused on reducing the risk of loss of life and protecting residences, businesses, and infrastructure when flood events occur. The Board finds that the mitigation of potential economic losses is a key consideration that favours approval of the Project. The Board also recognizes that construction activity of any kind creates economic spin-off effects. The Board agrees that the estimated Project construction cost of $38 million will produce direct, indirect and induced economic benefits to the RSA and Alberta. The Board notes that the majority of construction expenditures are associated with the provision of supplies, services, and employment in the RSA. However, since the Project objectives were not focused on economic development, and the Town did not quantify indirect or induced economic impacts, the Board has given relatively less weight to potential economic benefits associated with construction of the Project.

[340] The Board accepts the Town’s assertion that the relatively small construction workforce required for the Project can be accommodated by a combination of local hiring and the significant lodging capacity in the RSA associated with tourism. The Board accepts the assertions that the demand of the construction workforce on local services and infrastructure is negligible, given the Town’s experience in dealing with large fluctuations in the population of temporary residents and tourism and the small size of the required workforce.

[341] The Board acknowledges the Town’s commitment to provide a Project operation manager and implement a reserve fund for ongoing operations and maintenance of the Project.

[342] The Board finds that the flood mitigation objectives used to select the Project are sound and reasonable, particularly given the thorough expert evaluations secured by the Town in the years following the 2013 debris flood event. Public safety, protecting private property and public infrastructure are of paramount importance to Albertans and the Board finds these considerations weigh heavily in favour of the Project’s approval. The Board finds that the flood mitigation and associated damage avoidance arising from the Project provide significant social and economic benefits. Further, the Board finds that the estimated $700,000 average annualized building damage cost avoidance provided by the Project is a material factor favouring the Project’s approval. In addition, the Board notes that flood impacts to building contents, business interruption, infrastructure damage, and clean-up costs were estimated to double the modeled damage costs and therefore also weighs in favour of the Project’s approval. The Board finds that landowners affected by previous flood events will benefit from the added security the Project provides by mitigating the impact of future flood events. Finally, the Board notes that the provincial and federal governments

have demonstrated their support for the Project, given their provision of the majority of the Project's funding.

SECTION 14: BOARD DECISION

14.1: Introduction

[343] Having regard for the commitments made by the Town of Canmore and subject to the conditions imposed by the Board in this report, the Board finds that the Cougar Creek Debris Flood Retention Structure (the "Project") is in the public interest. The reasons for this conclusion are outlined below and should be read in conjunction with the Board's findings contained in this decision report.

[344] The Board is directed by s. 2 of the *Natural Resources Conservation Board Act* (NRCBA) to review the Cougar Creek Debris Flood Retention Structure application to determine whether, in the Board's opinion, the proposed Project is in the public interest, having regard to the social and economic effects of the Project and its effect on the environment. The Board has carefully considered the environmental impact assessment and subsequent filings from the Town in reaching the conclusions contained in this decision report.

14.2: Public Interest Test

[345] The Board does not have a fixed formula for determining whether a reviewable project is in the public interest. The outcome of a Board review is shaped by the nature of the project under review, its location, community support for the project, the project's impact on the natural environment and the project's contribution to public benefits. There is no fixed objective test, but to make the determination, the Board balances the economic, environmental and social interests in the context and time period in which they arise. In the Board's view, for a project to be in the public interest, the Board must be convinced that the identified project benefits the region and the province, and is consistent with any applicable *Alberta Land Stewardship Act* regional plan, without generating unacceptable economic, social or environmental impacts.

14.3: Procedural Determinations

[346] In this case, the notice of application for the Project, issued on April 11, 2018, generated no statements of concern. In addition, the Board finds that the affected public and aboriginal peoples were made aware of the Project, had an adequate opportunity to familiarize themselves with potential Project effects, and had the opportunity to identify any potential concerns. As a result, the Board concluded that the review of this Project could be completed without holding a public hearing.

[347] In proceeding with its deliberations on the Project, the Board focused its assessment on potential social, economic and environmental impacts predicted to arise from the Project, as outlined in materials provided by the Town and reviewed by AEP and the Board. The Board reviewed and assessed the entire record of evidence before it and after balancing the various social, economic and environmental effects concluded that the Project was in the public interest. Accordingly, references in this decision report to specific parts of the record are intended to assist the reader in understanding the Board's reasoning in reaching its decision, and do not represent the full record of evidence considered by the Board.

14.4: Public Interest Determination

[348] The Board concludes that the Project is in the public interest, because the evidence establishes a justifiable need for the Project, the social and economic effects are positive and considerable, and though most of the environmental effects are low to negligible, those that are moderate are offset by the conditions and mitigation measures imposed in this decision report, and the high resulting benefits to the local community and to the Province overall, from the reduced risk of debris floods and their financial and human safety consequences. The particulars of the Board's opinion on public interest are summarized below.

14.5: Justifiable Need for and Design of the Project

[349] As noted in its discussion in the Socio-Economic Effects and the Public Safety, Malfunctions and Retention Structure Safety sections of this decision report, the Board accepts that the Town provided compelling arguments supporting the need to mitigate future debris flood events. The Board finds that the Project's design will satisfy the identified need to increase the public safety and protect downstream infrastructure. The Board also finds that the Town has the necessary expertise, plans and funding in place to successfully construct and operate the Project.

[350] Further, the Board accepts the uncontradicted evidence of the Town that the Project is justifiable as it is predicted to reduce debris flood related risk to human life, and financial losses from damages to residential, commercial and public buildings and infrastructure, and will reduce economic losses from the disruption of business and major transportation routes.

[351] The Board views it important that the Project is constructed according to specifications developed by dam design engineers. This is particularly important given that design specifications may require adjustment to accommodate site specific conditions encountered during the Project construction phase. The Board relies on downstream regulators to ensure projects are constructed and operated in accordance with provincial and/or federal regulatory requirements. In this case, the Board has full confidence in the Town's commitment to develop and implement a construction quality control and assurance program in conjunction with hiring its own experienced contractor to oversee construction of the Project.

[352] The Board also agrees with the Town's conclusions on an adaptive management approach for the maintenance regarding erosion and debris deposition and surveillance data monitoring in relation to the Structure. Through the imposition of conditions associated with these issues, the Board recognizes the importance of proper maintenance and support for the Structure.

14.6: Positive Economic Effects

[353] The Board notes that the Town contracted consultants experienced in flood hazard risk assessment and modelling to develop science-based predictions about the potential impact of debris floods within the Cougar Creek Fan. This analysis informed the Town's creation of the 2016 MDP, and its Steep Creek Hazard and Risk Policy, which guide future development based on established risk tolerance criteria for the risk of loss of life from flood events. The Board notes that the risk of loss of life thresholds used by the Town's expert engineering consultants in developing the Project are based on well-established and globally accepted guidelines initially developed by the Hong Kong Geotechnical Engineering

Office and adopted elsewhere in Canada. Further, the Board finds that the Project reduces the risk of loss of life thresholds to within acceptable levels, as defined within the Town's Steep Creek Hazard and Risk Policy, incorporated by reference in the 2016 MDP and as outlined in the Town's EIA.

[354] As stated earlier in this decision report, the Board also notes that two leading experts in geotechnical engineering and river geomorphology reviewed the engineering work conducted by the Town's expert engineering consultants, and provided letters of support to the Town for the Project design and methodology.

[355] The Board finds that the Project provides significant public benefits as measured by the reduced risk of loss of life, and avoidance of building damage and business interruption costs. The Board also finds that the Project's $700,000 average annualized damage cost avoidance to buildings is an important factor in the Board's opinion that the Project is in the public interest. Further support for the Board's decision is the avoidance of damage costs for building contents and clean-up, which could increase damage costs by a factor of two or more. While not directly calculated by the Town, the Board recognizes that avoiding damage to public infrastructure, including transportation disruption and repairs, further benefits the public at large and all Albertans and Canadians given the importance of maintaining strong connective transportation corridors. The Board therefore concludes that the economic benefits associated with the Project are significant and are a material consideration weighing heavily in favour of the Board's opinion that the Project is in the public interest.

14.7: Positive Social Effects

[356] The Board concludes that there are no unacceptable social impacts associated with the Project. More specifically, the Board accepts the Town's assertions that the construction workforce can be accommodated by the existing lodging capacity in the RSA and effects of the workforce on local services will be negligible.

[357] The Board finds that the Project is located in a high use recreational area. Continuous access to the back country through the Project area during construction and operation of the Project is important and supports the social values of recreation and tourism in this area. In order to ensure that the social effects of construction and operation of the Project are mitigated, the Board imposes by way of condition that the Town maintain access to the back country during the construction and operation of the Project, as outlined in paragraph 90.

[358] Further, the Board finds that the Town and First Nations engaged in extensive consultation over the past three years as evidenced by ongoing interaction of First Nations with the Town's consultation consultants, their attendance at preliminary meetings and site visits, their attendance with elders at the Project site, their sharing of concerns with the Town, and the provision of letters of non-objection. Overall, the Board finds that the discussions between the Town and aboriginal communities illustrated a meaningful exchange of information for an informed mutual understanding. The Board concludes that through mitigation measures and commitments, the Town has addressed the concerns of affected First Nation communities about impacts to their rights. In particular, the Board notes that no Traditional Ecological Knowledge was raised or shared by any of the First Nations despite the Town's specific requests for such information. Overall, the Board views the commitments by the Town and the conditions imposed by the Board to allow Treaty 7 First Nations to harvest traditional plants and participate in traditional ceremonies before

commencement of Project construction, and to manage ongoing issues resolution and consultation, as important and key measures. These measures ensure that the social and environmental impacts of the Project on Aboriginal peoples are managed successfully.

14.8: Management of Environmental Effects

[359] The Board concludes that, overall, there are no unacceptable adverse environmental effects associated with the Project. In reviewing the EIA, including those studies that considered the Project's impacts to wildlife and biodiversity, vegetation, soils and terrain, noise, air quality, human health and historical resources, the Board finds that the environmental effects in those areas are generally low to negligible in effect. However, since the Project is located in a creek bed, certain environmental effects are expected, particularly in relation to the aquatic environment where moderate effects on hydrology are established by the evidence provided by the Town. Having said that, the Board finds that the Project will occupy a relatively small footprint in an area that already has extremely high human use, primarily for recreational purposes. The Project design will allow the creek to flow unimpeded through the Structure in normal (non-flood) conditions with minimal impact to the Cougar Creek aquatic environment.

[360] The Board agrees, as outlined in its review of the Aquatic Environment assessment in the EIA, that the Project will have a moderate effect on the aquatic environment of Cougar Creek with respect to hydrology (peak flow/water level and geomorphology indicators). As well, the Board also finds that effects on Cougar Creek peak flow and water levels are expected to be high in magnitude, rare in frequency and short term in duration. Effects on geomorphology are predicted to have a moderate impact based on the retention of debris and sediment, which reduces the mobilization and deposition of these materials downstream of the Structure. The operation of the Structure, along with the existing improvements in the Cougar Creek channel, will reduce the potential for channel migration within the Cougar Creek Fan. Even though the above hydrology effects are moderate, when measured against the Project's protection against debris flood events, the balancing of the public interest overall favours approval of the Project. Also, the Board finds that the environmental consequences of attenuating peak flow/water levels and effects to geomorphology will not be noticeable downstream of the confluence with the Bow River. The Board recognizes that the objective of the Project is to reduce peak discharges and minimize debris flows during flood events to protect people, property, and public infrastructure. Therefore, the Board finds that the Project design will fulfill this objective and in doing so is a project in the public interest.

[361] Further, the Board agrees with the Town's conclusion that the Project effects on groundwater and surface water are expected to be of low magnitude and low environmental consequence. However, the Board notes that the prediction confidence of this conclusion is "medium." The Town committed to ongoing groundwater monitoring to confirm predictions that water quality (and water levels) will not be adversely impacted by the Project. The Board recognizes the importance of surface water and groundwater in the region (i.e., SSRP strategy 8.23 expects mitigation of possible negative impacts on important water resources), and therefore agrees that ongoing monitoring of the quality and quantity of surface water and groundwater will address any uncertainty in predictions associated with the Project's effects on surface and groundwater. The Board is confident that with the associated conditions of approval for groundwater and surface water monitoring, the public interest in protecting water as a natural resource will be addressed.

[362] As directed under the NRCBA, the Board must ensure applications are consistent with regional plans under the *Alberta Land Stewardship Act* (ALSA). The Board has considered whether the Project is supported by the South Saskatchewan Regional Plan (SSRP) pursuant to ALSA. In the Town's analysis, with which the Board agrees, the Project is consistent with the long-term vision for the region to balance economic, environmental and social goals, as established by the SSRP. As described in the SSRP, and as noted by the Board in its findings at paragraph 88 of its discussion of Land Use Management, the SSRP contains the following objectives and expectation:

- "… mitigating impacts from flooding.…";
- "… supporting the development of municipal flood hazard mitigation plans"; and
- "[mitigating] possible negative impacts on important water resources or risks to health, public safety and loss to property damage due to hazards associated with water, such as flooding, erosion and subsidence within the scope of jurisdiction."

In comparing the description of the Project and its various constituent elements, the Board concludes that the Project is consistent with the SSRP, and this finding also founds the Board's opinion that the Project is in the public interest.

[363] While not part of the Project, the Board recognizes the considerable effort by the Town to work with AEP to identify areas for selective revegetation of No Man's Land. It is the Board's view that revegetation in the No Man's Land area is important for improving wildlife habitat availability and connectivity in the Bow Valley Corridor.

14.9: Conclusion

[364] Based on the assessment of the evidence before it, the Board concludes that the Project is in the public interest. This opinion is founded upon the evidence supporting the public benefits of mitigating debris flood events on Cougar Creek, which include social and economic effects that are positive and considerable, balanced against evidence that there are no unacceptable adverse impacts to the environment. The Board is satisfied that the conditions in the approval, together with the Town's commitments, will manage or mitigate any material environmental effects associated with the Project. Subject to receipt of the necessary authorization of the Lieutenant Governor in Council, the Board grants an approval in respect of the Town's application for the Project.

DATED at EDMONTON, ALBERTA, this 15th day of November, 2018.

Original signed by:

Peter Woloshyn, Chair

L. Page Stuart

Michele Annich

APPENDIX A: NRCB FORM OF APPROVAL

THE PROVINCE OF ALBERTA
NATURAL RESOURCES CONSERVATION BOARD ACT
NATURAL RESOURCES CONSERVATION BOARD

IN THE MATTER of a project of the Town of Canmore for approval to construct and operate a Debris Flood Retention Structure on Cougar Creek in Canmore, Alberta

APPROVAL NO. NR 2018-01

WHEREAS the construction and operation of a water management project is a reviewable project under s. 4(d) of the *Natural Resources Conservation Board Act*, and

WHEREAS the Natural Resources Conservation Board (Board) is prepared to grant approval to the application by the Town of Canmore, subject to the following conditions, and

WHEREAS the Lieutenant Governor in Council has given authorization (attached).

THEREFORE, the Board orders as follows:

1. The Project of the Town of Canmore (the Town), for construction and operation of the Debris Flood Retention Structure on Cougar Creek in Canmore, Alberta, as described in Application No. 1601 from the Town to the Board filed on August 19, 2016 and all supplemental materials supporting the application (Application) filed with the Board, is approved, subject to the undertakings and commitments in the Application and subject to the following terms and conditions.

2. The Town must:

   a) allow all Treaty 7 First Nations to harvest traditional plants (medicinal or ceremonial) and to participate in a ceremonial event before construction begins, and
   b) commit to ongoing issues resolution/consultation with Treaty 7 First Nations as the Project is constructed and operated,

   to the satisfaction of Alberta Environment and Parks (AEP).

3. The Town must:

   a) conduct surface water quality and quantity monitoring twice per month during construction, or at a frequency deemed appropriate by AEP,
   b) conduct surface water quality and quantity monitoring on an annual basis, during the operation of the Project,

c) develop a long-term surface water quality and quantity monitoring program for Cougar Creek, including discharge and water levels, using appropriate surface water locations and/or the shallow monitoring well identified as TH14-3 (or another suitable shallow groundwater monitoring well close to the Structure to be used as a proxy for surface water conditions), and
d) conduct annual surface water reporting, available to the public and First Nations communities,

all to the satisfaction of AEP.

4. The Town must:

a) conduct groundwater quality and quantity monitoring twice per month during construction, or at a frequency deemed appropriate by AEP,
b) conduct groundwater quality and quantity monitoring on an annual basis during operation of the Project,
c) develop a long-term groundwater quality and quantity monitoring program, including groundwater level and gradient, using appropriate groundwater monitoring wells, and
d) conduct annual groundwater reporting, available to the public and First Nations communities,

all to the satisfaction of AEP.

5. During construction, reclamation and revegetation activities, the Town must:

a) test all imported soil material to ensure it has similar physical, chemical, and biological characteristics as soil naturally occurring in the Cougar Creek area, including testing for weeds or invasive species, and is appropriate to be used for reclamation activities, and
b) ensure that all seed mixes and material used for revegetation are appropriate for and representative of the surrounding vegetation communities (i.e., native species), and are consistent with First Nations/aboriginal preferences of the use of native vegetation species for reclamation,

all to the satisfaction of AEP.

6. During construction and post flood maintenance, the Town must implement the proposed dust control management plan. The dust control management plan must include:

a) dust suppression methods (road watering and other possible dust suppressants) and proactive triggers (or thresholds) that detail when dust control will occur, and
b) a dust complaint response protocol that identifies how the Town will address complaints or concerns about Access Road dust,

all to the satisfaction of AEP.

7. Subject to any limitations imposed by AEP, the Town must fulfil its commitment to provide continuous backcountry access through or around the Project area during all phases of the Project.

8. The Town must complete a health, safety and environment plan (HSE Plan) to the satisfaction of AEP prior to commencing construction.

9. The Town must finalize its Operation, Maintenance and Surveillance Manual by including:

   a) an adaptive management approach to effectively manage ongoing rock debris erosion and deposition downstream of the Structure, and

   b) a surveillance data monitoring and reporting plan for the Structure, no later than one year after the completion of the Structure water storage test,

   to the satisfaction of AEP.

10. The Town must complete and implement the Emergency Preparedness Plan (EPP) and Emergency Response Plan (ERP) to the satisfaction of AEP, and integrate those plans with the Town's existing Municipal Emergency Management Plan.

Made at the City of Edmonton, in the Province of Alberta, this day of , 2018.

NATURAL RESOURCES CONSERVATION BOARD

Peter Woloshyn, Panel Chair

L. Page Stuart

Michele Annich

APPENDIX B: ACRONYMS AND ABBREVIATIONS

AAAQO	Alberta Ambient Air Quality Objective
ACO	Aboriginal Consultation Office
AEP	Alberta Environment and Parks
ALSA	*Alberta Land Stewardship Act*
CDA	Canadian Dam Association
cm	centimetre
COPC	chemicals of potential concern
dBA	A-weighted decibels
CPR	Canadian Pacific Railway
ED	Environmental District
EIA	environmental impact assessment
EPEA	*Environmental Protection and Enhancement Act*
EPP	Emergency Preparedness Plan
ERP	Emergency Response Plan
ESA	environmentally significant area
ESC	Erosion and Sediment Control
GOA	Government of Alberta
ha	hectare
Highway 1A	Known as Bow Valley Trail from the point of the Trans-Canada Highway/Highway 1A overpass west through the Town of Canmore
HRIA	Historical Resources Impact Assessment
HRMB	Historical Resources Management Branch
HSE	health, safety and environment
ILCR	incremental lifetime cancer risk
INFC	Infrastructure Canada
IRPs	Integrated Resource Plans
kg	kilogram
km	kilometre
km^2	square kilometre
km/hr	kilometres per hour
KT	Kepner Tregoe
L/min	litres per minute
LSA	local study area
LUB	land use bylaw
m	metres
m^2	square metres
m^3	cubic metres
mm	millimetre
m^3/hr	cubic metres per hour
m^3/s	cubic metres per second
M.D.	municipal district
MDP	municipal development plan
MEMP	Municipal Emergency Management Plan
NRCBA	*Natural Resources Conservation Board Act*
NRTA	Natural Resources Transfer Agreement
NO_2	nitrogen dioxide
NO_x	nitrogen oxide

NRCB	Natural Resources Conservation Board
OMS	Operation, Maintenance, and Surveillance
PDI	Probability of Death of an Individual
PM	particulate matter (e.g. $PM_{2.5}$ depicts particles of 2.5 micrometres)
RSA	regional study area
RTMP	Royal Tyrrell Museum of Palaeontology
SCC	Supreme Court of Canada
SIR	supplemental information request
SLHHRA	screening level human health risk assessment
SSRP	South Saskatchewan Regional Plan
TEK	traditional ecological knowledge
TLU	traditional land use
WCD	Wildlands Conservation District
$\mu g/m^3$	micrograms per cubic metre

Contact the Natural Resources Conservation Board at the following offices:
Dial 310-0000 to be connected toll free.

Edmonton Office
4th Floor, Sterling Place, 9940 - 106 Street
Edmonton, AB T5K 2N2
T 780-422-1977 F 780-427-0607

Calgary Office
19th Floor, Centennial Place, 250 - 5 Street SW
Calgary, AB T2P 0R4
T 403-297-8269 F 403-662-3994

info@nrcb.ca
www.nrcb.ca

Copies of NRCB process guides are available by contacting the NRCB.

ISBN 978-1-4601-4209-7 (Print)
ISBN 978-1-4601-4210-3 (PDF)