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Your file *Votre référence*
EA1415-01

Our file *Notre référence*
15-HCAA-01626

Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
Box 938, 5102-50th Ave.
Yellowknife, NT X1A 2N7
Attention: Marc Cliffe-Phillips, Executive Director

Email: mcliffephillips@reviewboard.ca

Subject: Fisheries and Oceans Canada's Technical Report - EA1451-01 - Final Submission

The Fisheries Protection Program (FPP) of Fisheries and Oceans Canada (DFO) has conducted a technical review of the proposed Developer's Assessment Report and subsequent documents submitted by Canadian Zinc Corporation to the Mackenzie Valley Environmental Impact Review Board on April 23, 2016.

DFO-FPP's attached comments are based on our departmental mandate under the *Fisheries Act*, specifically the management and protection of fish and their habitat.

DFO-FPP will be attending the Public Hearing scheduled in Fort Simpson April 28-29, 2017 and will be available to answer questions regarding our technical report at this time.

Thank you for the opportunity to comment to allow the process to move to the public hearing phase. If there are questions regarding DFO-FPP's intervention report, please contact Jessica Taylor by mail at Jessica.Taylor@dfo-mpo.gc.ca or by phone at 867-669-4926.

Sincerely,

Dale Nicholson
A/Regional Director General
Central & Arctic Region
Fisheries and Oceans Canada

ATTACHMENT: TAB 1: Technical Report – Final Submission

cc. Martin Curtis, DFO - Winnipeg
Jessica Taylor, DFO – Yellowknife
Véronique D'Amours Gauthier, DFO- Yellowknife



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FISHERIES AND OCEANS CANADA

Final Submission/Technical Report

EA1415-01

Prairie Creek All Season Road
Canadian Zinc

Submitted to:

Mackenzie Valley Environmental Impact Review Board (MVEIRB)

March 10, 2017

DFO-FPP File No.: 15-HCAA-01626

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Executive Summary

Fisheries and Oceans Canada (DFO) has reviewed Canadian Zinc's (CZN) Prairie Creek All Season Road (Project) pursuant to the *Fisheries Act*. DFO's Fisheries Protection Program will determine what aspects of the Project could impact fish and fish habitat and work with the Proponent to avoid, mitigate and offset impacts.

DFO's comments are based on our departmental mandate under the *Fisheries Act*, specifically the management and protection of fish, marine mammals and their habitat. DFO's primary focus in reviewing proposed developments in and around fisheries waters is to ensure that works, undertakings and activities are conducted in such a way that the proponents are in compliance with the applicable provisions of the *Fisheries Act*.

The fisheries protection provisions of the *Fisheries Act (2013)*, specifically subsection 35(1), state that "No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery or to fish that support such a fishery." However, under paragraph 35(2)(b) of the *Fisheries Act*, the Minister of Fisheries and Oceans may issue an authorization with terms and conditions in relation to a proposed work, undertaking or activity that may result in *serious harm to fish*.

DFO-FPP is providing the following final technical report to the Mackenzie Valley Environmental Impact Review Board (MVEIRB). The technical review comments in this submission are categorized under the following general topics:

High Water Mark Definition

Sundog Creek Channel Realignment

Water Crossings

Liard River Crossing

Flows

Blasting

Offsetting Opportunities

1.0 Introduction

The final technical submission summarizes Fisheries and Oceans Canada, Fisheries Protection Program (DFO-FPP or the Program) assessment and recommendations concerning Canadian Zinc Corporation's (CZN or the Developer) proposed Prairie Creek all-season road project. The purpose

of this report is to provide expert advice based on DFO-FPP's mandate to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) to assist in their assessment of potential environmental impacts associated with this proposed project.

As directed by the MVEIRB, this submission focuses on detailed analysis of the Developer's Assessment Report (DAR) documentation, with the objective of assessing the quality of the supplemental and/or revised information presented by the Developer in support of the Project proposal, and reflects DFO's mandate.

2.0 Mandate, Relevant Legislation and Policy

The *Constitution Act* (1982) provides the federal government with exclusive authority for coastal and inland fisheries within Canada's territorial boundaries. DFO's guiding legislation includes the *Oceans Act*, which charges the Minister with leading oceans management and providing coast guard and hydrographic services on behalf of the Government of Canada. DFO also exercises power through the administration of the *Fisheries Act* and some aspects of the *Species at Risk Act*.

Under the *Fisheries Act*, DFO is responsible for the management, protection and conservation of fish (which include marine mammals as defined by the *Fisheries Act*) and their habitats. The Minister of Fisheries and Oceans is one of the competent ministers under the *Species at Risk Act* (SARA).

In general, the Fisheries Protection Program of DFO undertakes the review of proposed developments in and around fisheries waters to ensure that works, undertakings and activities are conducted in such a way that the proponents are in compliance with the applicable provisions of the *Fisheries Act*.

The mandate of the Fisheries Protection Program is to maintain the sustainability and ongoing productivity of commercial, recreational and Aboriginal fisheries. Subsection 35 (1) of the fisheries protection provisions of the *Fisheries Act* states that "No person shall carry on any work, undertaking or activity that results in *serious harm to fish* that are part of a commercial, recreational, or Aboriginal fishery or to fish that support such a fishery.

Fisheries and Oceans Canada interprets *serious harm to fish* as:

- the **death of fish**;
- a **permanent alteration** to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes;
- the **destruction of fish habitat** of a spatial scale, duration, or intensity that fish can no longer rely upon such habitats for use as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of these life processes.

However, under paragraph 35(2)(b) of the *Fisheries Act*, the Minister of Fisheries and Oceans may issue an authorization with terms and conditions in relation to a proposed work, undertaking or

activity that may result in *serious harm to fish*, subject to the consideration of the four factors in Section 6 of the *Fisheries Act*:

1. The contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries;
2. Fisheries management objectives;
3. Whether there are measures and standards to avoid, mitigate or offset *serious harm to fish* that are part of a commercial, recreational or Aboriginal fishery, or that support such a fishery; and
4. The public interest.

The Fisheries Protection Program is guided by the “Fisheries Protection Policy Statement (2013),” the intent of which is to provide guidance to Canadians to ensure that they are complying with the *Fisheries Act*. It strengthens the Government’s ability to address key threats to the productivity and sustainability of our fisheries, through standards and guidelines to avoid, mitigate and offset impacts to fisheries and to ensure compliance with these requirements.

The “Fisheries Productivity Investment Policy: A Proponent’s Guide to Offsetting (2013)” provides guidance on undertaking effective measures to offset *serious harm to fish* that are part of or that support a commercial, recreational or Aboriginal fishery, consistent with the fisheries protection provisions of the *Fisheries Act*. The objective of offsetting is to counterbalance unavoidable *serious harm to fish* and the loss of fisheries productivity resulting from a project. For more information, see: <http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index-eng.html>

The *Species at Risk Act* is intended to prevent Canadian indigenous species, subspecies and distinct populations of wildlife from being extirpated or becoming extinct; to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity; and to manage species of special concern to prevent them from becoming endangered or threatened. The Minister of Fisheries and Oceans is the competent minister for listed aquatic species that are fish (as defined in section 2 of the *Fisheries Act*) or marine plants (as defined in section 47 of the *Fisheries Act*).

Environment Canada (EC) is responsible for the administration and enforcement of the pollution prevention provisions of the *Fisheries Act* on behalf of DFO (section 34 and sections (36-42)).

3.0 Technical Review Comments

3.1 High Water Mark Definition

Subject / Topic	High Water Mark Definition
Issue	Interpretation of High Water Mark
Developer's Conclusion	<p>The September 6, 2016 Hatfield Memo divided Sundog Creek habitat into three categories: "(A) normally wetted (functional) habitat within 1:2 year return, (B) normally dry (non-functional) within 1:2 return; and (C) outside the 1:2 year return but without established vegetation".¹</p> <p>Hatfield, in response to Information Request Round 2, wrote: "The use of the 1:2 year flood flow return level was adopted from the following DFO operational statement: Bridge Maintenance Fisheries and Oceans Canada, Nunavut Operational Statement Version 3.0 DFO/2007-1329, which states: "Ordinary high water mark (HWM) – The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the <i>active channel/bank-full level</i> which is often the 1:2 year flood flow return level. We note that this advice also appears in other DFO operational statements. We purposely included category C in order to acknowledge that when wetted (although infrequently), this habitat can also be used by fish. However in our opinion, the loss of any category C habitat will not result in any serious harm to fish, nor result in any changes to aquatic function, or integrity, of Sundog Creek."²</p>
Fisheries and Oceans Canada's Conclusion	<p>Conclusion and Rationale: Ephemeral habitat that is only available for brief periods is very common in northern environments, providing important migration, spawning, rearing or foraging habitat.</p>
Fisheries and Oceans Canada's Recommendations	<p>3.1.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a <i>Fisheries Act</i> Authorization for the Project. When submitting, in order to avoid</p>

¹ Hatfield Memo (September 6, 2016) "Prairie Creek Mine, All season road habitat loss and offset – DRAFT"

² Developer's response (October 29, 2016) to Undertaking #7

	<p>confusion, DFO-FPP recommends habitat within the 1:2 year High Water Mark is not divided into categories as outlined by Hatfield.</p> <p>3.1.2 Recommendation: DFO-FPP recommends that CZN utilize the terms <i>serious harm</i>, <i>permanent alteration</i>, and <i>destruction</i> as provided in the Fisheries Protection Policy Statement (defined above in Section 2.0 Mandate) instead of using terms such as habitat categories A, B, C, and habitat of low/medium/high importance.</p> <p>Impact if not implemented: Consistent terminology and understanding of habitat use is vital in DFO’s Regulatory Review to fully comprehend potential impacts. Providing this information now will aid DFO in a timely review. If not implemented, DFO is concerned there will be inconsistent comprehension of all potential <i>serious harm</i> to fish and fish habitat.</p>
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3.2 Sundog Creek Channel Realignment

Subject / Topic	Sundog Creek Channel Realignment
Issue	“No net loss”
Developer’s Conclusion	<p>The Developer asserts that there will be “no net loss” of fish habitat, since the proposed new channel will provide the same aquatic function as the existing channel”.³</p> <p>The Developer wrote, “the diversion of flow from the existing channel between [kilometer point] KP35.4 and KP36.9 to a historical channel is, in our opinion, habitat mitigation”.¹ The Developer provided DFO’s definition for mitigation: <i>measures to reduce the spatial scale, duration, or intensity of adverse effects to fish and fish habitat that cannot be completely avoided.</i></p>
Fisheries and Oceans Canada’s Conclusion	<p>Conclusion and Rationale: It is expected and intended that fish will no longer access habitat in the existing channel via downstream migration (due to the berm), nor upstream migration (due to insufficient flows or intentional barriers to avoid stranding of fish). Since this habitat will no longer be available, by definition, <i>serious harm to fish and fish habitat</i> may result.</p>

³ Developer’s response (October 29, 2016) to Undertaking #7 Response to DFO #4B, PR#366

	<p>In the absence of detailed information, it is unclear at this time what the full suite of measures is that CZN intends to implement to avoid, mitigate or offset <i>serious harm</i> as defined in the <i>Fisheries Act</i> as a result of activities, undertakings, or works proposed for the Sundog Creek realignment. During the regulatory phase, DFO-FPP will determine the extent of <i>serious harm</i> that may result from the project.</p>
<p>Fisheries and Oceans Canada's Recommendations</p>	<p>3.2.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a <i>Fisheries Act</i> Authorization so that DFO-FPP can review proposed mitigation.</p> <p>3.2.2 Recommendation: DFO-FPP recommends that hydrographs, modelling, and detailed designs for the existing channel and the proposed channel are submitted to DFO-FPP during the regulatory phase.</p> <p>3.2.3 Recommendation: DFO-FPP recommends that the Developer implement natural channel design principles into the proposed constructed channel.</p> <p>Impact if not implemented: If appropriate avoidance and mitigation measures are not implemented during design, construction, maintenance and closure, <i>serious harm to fish</i> may result.</p>

3.3 Water Crossings

<p>Subject / Topic</p>	<p>Water Crossings</p>
<p>Issue</p>	<p>Measures to avoid and mitigate effects to fish and fish habitat</p>
<p>Developer's Conclusion</p>	<p>In Appendix C of the DAR Addendum, the Developer addressed DFO's <i>Measures to Avoid Causing Harm</i> such as timing, site selection, and fish protection. The Developer has committed to avoid sensitive fish spawning periods; develop an erosion and sediment control plan; and, utilize best practices for the operation of machinery.⁴</p>

⁴ DAR Addendum Appendix C (September 2, 2016), PR#90

	<p>The Developer indicated a commitment to monitor watercourses during freshet by “conducting formal inspections during spring runoff and after intense summer rainfalls”.⁵</p> <p>The Developer referenced best management practices for the design of minor water crossings, such as “a <5% gradient, no step at outlets, oversized and allow natural gravels along bottom”.⁶</p>
<p>Fisheries and Oceans Canada’s Conclusion</p>	<p>Conclusion and Rationale: The Developer has highlighted the use of timing windows, freshet monitoring, and culvert installation best practices. However, in the absence of detailed plans for sediment and erosion control and decommissioning of the water crossings, it is unclear what the full suite of measures are that the developer intends to implement to avoid, mitigate or offset <i>serious harm to fish</i> as defined in the <i>Fisheries Act</i> as a result of watercourse crossings proposed for the project.</p>
<p>Fisheries and Oceans Canada’s Recommendations</p>	<p>3.3.1 Recommendation: DFO-FPP recommends that the Developer implement all available best management practices to avoid, mitigate, or offset <i>serious harm</i> as defined in the <i>Fisheries Act</i> as a result of water crossing construction, operation, and decommissioning. This includes, but is not limited to: appropriate design of water crossings to facilitate passage at both high and low flows; bank stabilization by protecting and replanting riparian vegetation; adhering to timing windows to avoid spawning, incubation, and hatch times for all species using the water courses, and the installation and maintenance of sediment and erosion control measures.</p> <p>3.3.2 Recommendation: DFO-FPP recommends that an appropriate water crossing maintenance and monitoring plan be in place to ensure that barriers to fish passage do not form over time as a result of crossing damage due to ice blockage, flooding or movement of debris, such as may occur at freshet.</p> <p>3.3.1 Recommendation: DFO-FPP recommends that the Developer provide DFO with detailed engineering plans of all water crossings that are fish bearing, supported by measured or modeled stream flow data, for review prior to construction.</p> <p>Impact if not implemented: If appropriate avoidance or mitigation</p>

⁵ Allnorth Memo (August 10, 2016) Response to Undertaking #26, PR#282

⁶ Allnorth Memo (May 3, 2016) (p. 14-15)

	practices are not employed in water crossing design, construction, maintenance and decommissioning, <i>serious harm to fish</i> may occur.
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3.4 Liard River Crossing

Subject / Topic	Liard River Crossing
Issue	Ramp
Developer’s Conclusion	<p>The Developer wrote, “the proposed construction of an upstream dike to deflect and shelter the ramp structure will greatly assist in reducing hydrological forces on the ramp”.³</p> <p>In the Undertaking #7 Response, the Developer wrote, “The word ‘ramp’ was used in the DAR and appendices to refer to the landing areas for the barge on the Liard River. However, since the IR appears to be primarily about the diversion on Sundog Creek, we assume that “ramp” was intended to refer to the dike/berm to be installed to ensure the stream is diverted into the new channel”.³</p>
Fisheries and Oceans Canada’s Conclusion	Conclusion and Rationale: It seems as though a miscommunication regarding the word ‘ramp’ took place.
Fisheries and Oceans Canada’s Recommendations	<p>3.4.1 Recommendation: DFO-FPP recommends that standard best practices are utilized for the design, construction, and decommissioning of the Liard River crossing and consistent terminology.</p> <p>Impact if not implemented: If appropriate design, construction, mitigation and closure is not implemented for the Liard River crossing ramp, <i>serious harm to fish</i> may result.</p>

3.5 Flows

Subject / Topic	Flows
Issue	Sundog Creek realignment
Developer's Conclusion	<p>The Developer explained that flows in Sundog Creek naturally sub-surface at certain locations at certain times of the year. The October 29th Memo to DFO writes, "It should be noted that surface flows in the Sundog Creek system are not always permanent within much of the existing channel. In July and September, 2014 Sundog Creek surface flows were absent (went to ground) in at least half of the existing channel. In July, we observed flows going to ground at approximately km 32 and resurfacing at km 36.2".³ The Developer summarized further, "The reality is there are periods of the year (summer-fall) when sections of the creek are dry. Flow is not guaranteed".⁷</p> <p>The Developer writes, "the width of the excavated channel is narrowed from the originally suggested 20m width to avoid unnecessary excavation beyond what is necessary to convey the 100-year design flow, while not adversely altering water velocities which influence fish passage".⁸</p>
Fisheries and Oceans Canada's Conclusion	<p>Conclusion and Rationale:</p> <p>Post-construction, the berm will divert surface water into the newly active channel and a "minimal" amount of water will still surface in certain locations in the existing channel during high flow events due to subsurface/groundwater inputs⁷. To avoid stranding of fish, DFO-FPP recommends that a barrier to fish passage be incorporated in the design, upstream from the proposed offsetting overwintering pool (approximately km 36.9).</p>

⁷ Teleconference meeting minutes (February 17, 2017)

⁸ TetraTech Memo "Sundog Creek Realignment Reach, KP 35-38, Preliminary Design" (August 10, 2016)

	<p>Once diversion takes place, depending on the saturation of the alluvium in the presently historic channel, the channel could exhibit a period of adjustment and flows may “go to ground” for a length of time. If this scenario were to take place, water levels in the new channel may be insufficient for the passage of fish for a period of time. DFO-FPP recommends the Developer consider this possibility and develop a mitigation plan to avoid this.</p> <p>Sundog Creek is a braided and relatively dynamic system in a mountain environment. The substrate is coarse and permeable, and there are subsurface inputs throughout the floodplain (in both the existing and historic channel). In the absence of detailed information, the full suite of measures that the Developer intends to implement to avoid causing <i>serious harm to fish</i> is also unclear at this time.</p>
<p>Fisheries and Oceans Canada’s Recommendations</p>	<p>3.5.1 Recommendation: To avoid stranding of fishes, DFO-FPP recommends the Developer incorporates a barrier to upstream fish passage (e.g. steps) into their designs. The barrier would be located upstream of the offsetting pool proposed in the approximate location of km 36.9.</p> <p>3.5.2 Recommendation: DFO-FPP recommends the Developer consider the possibility of a channel readjustment phase and develop a plan to mitigate these potential adverse effects.</p> <p>3.5.3 Recommendation: DFO-FPP recommends that the Developer implement all available best management practices in the design of the proposed constructed channel to avoid and mitigate <i>serious harm to fish</i> as a result of the realignment. This includes, but is not limited to, appropriate design of the new channel to facilitate fish passage at both high and low flows for Arctic Grayling and any other species of fish that may use Sundog Creek at all relevant life stages. Such fish may have different capacities for swimming performance (Gervais & Katopodis, 2015), which may affect the design of the new channel.</p> <p>Impact if not implemented: If appropriate flow mitigation is not implemented during the construction, operation, and decommissioning of the Sundog Creek realignment, <i>serious harm to fish</i> may result.</p>

3.6 Blasting

<p>Subject / Topic</p>	<p>Blasting</p>
<p>Issue</p>	<p>Avoidance and mitigation of effects of blasting of fish</p>
<p>Developer’s Conclusion</p>	<p>In the DAR Addendum Appendix C, the Developer explained: “Blasting will be needed at four stream crossings, three in the upper reaches of Sundog Creek (km 23, 25 and 28), and one on Grainger River (km 123). The km 23 and 25 locations are upstream of an obstruction to fish passage (a large waterfall), so blasting here will not constitute a hazard to fish. Blasting at the other areas will be done in a way that minimizes impacts on fish by utilizing timing window, encouraging fish to move from the blast area, and minimizing the required blast energy.”⁴</p> <p>Additionally, the Developer indicates that blasting will be required between 36+650 to 37+150 (kp 36.65 to 37.15) (page 29/88 of <i>EA1415-01_CanZinc_responses_to_outstanding_adequacy_items.PDF</i> cover page dated April 11, 2016 with CZN logo at the top).</p>
<p>Fisheries and Oceans Canada’s Conclusion</p>	<p>Conclusion and Rationale: DFO-FPP recommends that Developer uses a threshold limit of 50 kPa for instantaneous pressure change in order to more appropriately mitigate the effects of blasting on fish (Cott & Hanna, 2005). This may affect the setback distance calculations to avoid impacts to fish and fish habitat. A recalculation of required setback distances may also require revisions to blasting mitigation plans to allow for change in charge size, location, timing and the use of fish deterrents.</p>
<p>Fisheries and Oceans Canada’s Recommendations</p>	<p>3.6.1 Recommendation: DFO-FPP recommends that the Developer utilize an instantaneous pressure threshold limit of 50 kPa, which may require appropriate setback distances, in order to develop adequate mitigation measures to address the effects of blasting on fish and reduce the risk of <i>serious harm to fish</i> as a result of the Project.</p> <p>3.6.2 Recommendation: DFO-FPP recommends that the Developer avoid blasting during sensitive spawning periods as per DFO’s NWT fish spawning timing windows.</p> <p>Impact if not implemented: If appropriate avoidance and mitigation practices are not employed in blasting plans and mitigation strategies, <i>serious harm to fish</i> may result.</p>

3.7 Offsetting Opportunities

Subject / Topic	Offsetting opportunities
Issue	Proposed offsetting opportunities
Developer's Conclusion	<p>The Developer has proposed to construct “one or more deep pools [...] to provide overwintering habitat” and “a low gradient side channel off of Sundog Creek either upstream or downstream of the diversion” as potential offsetting opportunities⁴.</p> <p>The Developer expressed their opinion that ideal locations for offsetting are likely limited to the risk of pools and/or side channels being washed out by other streams⁹.</p> <p>The Developer expects that the pond will have sufficient under-ice oxygen throughout the winter to support fish. The October 29th Memo to DFO writes, “due to the coarse nature of the alluvium and consequent hyporheic flows, we anticipate good oxygen perfusion into the pond over winter”.</p>
Fisheries and Oceans Canada's Conclusion	<p>Conclusion and Rationale: DFO-FPP concurs with the Developer's proposal to create habitat that is limiting in the Sundog system such as overwintering pools and side channels. In the September 6, 2016 Hatfield Memo, an overwintering pool is proposed in a location slightly upstream from where the proposed constructed channel will meet back with the existing channel⁴, i.e. the overwintering pool will be fed solely by sub-surface water except during high flows.</p> <p>More information regarding present and anticipated (post-construction) hydrological conditions are required to deem whether these preliminary propositions satisfy requirements of the <i>Fisheries Act</i>. A monitoring plan would be required to assess if the habitat is successful (functional) over the long-term.</p>
Fisheries and Oceans Canada's Recommendations	<p>3.7.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a <i>Fisheries</i></p>

⁹ Telephone conversation with John Wilcockson of Hatfield consultants February 2, 2017

	<p>Act Authorization so that offsetting and monitoring plans can be reviewed in more detail.</p> <p>Impact if not implemented: If this recommendation is not implemented, <i>serious harm to fish</i> may result.</p>
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4.0 Summary of Recommendations

Aquatic Environment		
1. High Water Mark Definition		
1	Ref. 3.1.1	3.1.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a <i>Fisheries Act</i> Authorization for the Project. When submitting, in order to avoid confusion, DFO-FPP recommends habitat within the 1:2 year High Water Mark is not divided into categories as outlined by Hatfield.
2	Ref. 3.1.2	3.1.2 Recommendation: DFO-FPP recommends that CZN utilize the terms <i>serious harm, permanent alteration, and destruction</i> as provided in the Fisheries Protection Policy Statement (defined above in Section 2.0 Mandate) instead of using terms such as habitat categories A, B, C, and habitat of low/medium/high importance.
2. Sundog Creek Channel Realignment		
3	Ref. 3.2.1	3.2.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a <i>Fisheries Act</i> Authorization so that DFO-FPP can review proposed mitigation.
4	Ref. 3.2.2	3.2.2 Recommendation: DFO-FPP recommends that hydrographs, modelling, and detailed designs for the existing channel and the proposed channel are submitted to DFO-FPP during the regulatory phase.
5	Ref. 3.2.3	3.2.3 Recommendation: DFO-FPP recommends that the Developer implement natural channel design principles into the proposed constructed channel.
3. Water Crossings		
6	Ref. 3.3.1	3.3.1 Recommendation: DFO-FPP recommends that the Developer implement all available best management practices to avoid, mitigate, or offset <i>serious harm</i> as defined in the <i>Fisheries Act</i> as a result of water crossing construction, operation, and decommissioning. This includes, but is not limited to: appropriate design of water crossings to facilitate passage at both high and low flows; bank stabilization by protecting and replanting riparian vegetation; adhering to timing windows to avoid spawning, incubation, and hatch times for all species using the water courses, and the installation and maintenance of sediment and erosion control measures.
7	Ref. 3.3.2	3.3.2 Recommendation: DFO-FPP recommends that an appropriate water crossing maintenance and monitoring plan be in place to ensure that barriers to fish passage do not form over time as a result of crossing damage due to ice blockage, flooding or movement of debris, such as may occur at freshet.
8	Ref. 3.3.3	3.3.3 Recommendation: DFO-FPP recommends that the Developer provide DFO with detailed engineering plans of all water crossings that are fish bearing, supported by measured or modeled stream flow data, for review prior to construction.
4. Liard River Crossing		

9	Ref. 3.4.1	3.4.1 Recommendation: DFO-FPP recommends that standard best practices are utilized for the design, construction, and decommissioning of the Liard River crossing and consistent terminology.
10	Ref. 3.4.2	3.4.2 Recommendation: DFO-FPP recommends that CZN continue to work with DFO-FPP leading up to and during DFO-FPP regulatory process.
5. Flows		
11	Ref. 3.5.1	3.5.1 Recommendation: To avoid stranding of fishes, DFO-FPP recommends the Developer incorporate a barrier to upstream fish passage (e.g. steps) into their designs. The barrier would be located upstream of the offsetting pool proposed in the approximate location of km 36.9.
12	Ref. 3.5.2	3.5.2 Recommendation: DFO-FPP recommends the Developer consider the possibility of a channel readjustment phase and develop a plan to mitigate these potential adverse effects.
13	Ref. 3.5.3	3.5.3 Recommendation: DFO-FPP recommends that the Developer implement all available best management practices in the design of the proposed constructed channel to avoid and mitigate <i>serious harm to fish</i> as a result of the realignment. This includes, but is not limited to, appropriate design of the new channel to facilitate fish passage at both high and low flows for Arctic Grayling and any other species of fish that may use Sundog Creek at all relevant life stages. Such fish may have different capacities for swimming performance (Gervais & Katopodis, 2015), which may affect the design of the new channel.
6. Blasting		
14	Ref. 3.6.1	3.6.1 Recommendation: DFO-FPP recommends that the Developer utilize an instantaneous pressure threshold limit of 50 kPa, which may require appropriate setback distances, in order to develop adequate mitigation measures to address the effects of blasting on fish and reduce the risk of <i>serious harm to fish</i> as a result of the Project.
15	Ref. 3.6.2	3.6.2 Recommendation: DFO-FPP recommends that the Developer avoid blasting during sensitive spawning periods as per DFO's NWT fish spawning timing windows.
6. Offsetting Opportunities		
16	Ref. 3.7.1	3.7.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a <i>Fisheries Act</i> Authorization so that offsetting and monitoring plans can be reviewed in more detail.