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# Blackwater Gold Project
# Fish Habitat Compensation Plan

## Pursuant to Section 27.1 of the Metal and Diamond Mining Effluent Regulations

***Palmer Project #***
2006501

***Prepared For***
BW Gold Ltd.

January 10, 2023

Palmer™

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January 10, 2023

Claude Asselin, M. Ing.
Senior Program Engineer, Environmental Protection Branch
Environment and Climate Change Canada, Government of Canada

Dear Claude Asselin,

**Re: Blackwater Gold Project**
**Fish Habitat Compensation Plan**
**Project #: 2006501**

Palmer is pleased to submit the attached Compensation Plan for fish habitat at the Blackwater Project, in support of an application for amendment to Schedule 2 of the Metal and Diamond Mining Effluent Regulation (MDMER).

This report has been prepared in accordance with Section 27.1 of the MDMER. This Compensation Plan specifically offsets losses to fish habitat that result from the deposition of a deleterious substance into water bodies beneath the tailings storage facilities C and D (excluding dam footprints), the low-grade and high-grade ore stockpiles, and the upper overburden stockpile. Other mine impacts and offsetting, specific to the *Fisheries Act* Authorization will be detailed in the separate Offsetting Plan that will accompany the application for Authorization.

This Compensation Plan describes how BW Gold Ltd. proposes to offset residual losses to fish habitat. It describes proposed mine development, existing fish and fish habitat, the effects assessment and residual effects, and proposed compensation measures aimed at restoring, creating and enhancing fish habitat.

If you or technical reviewers have any questions about this report, please feel free to contact Rick Palmer at 604-787-8013 or at rick.palmer@pecg.ca.

Yours truly,

Palmer™

R. Palmer

Rick Palmer, M.Sc., R.P.Bio.
CEO, Senior Fisheries Biologist

# Executive Summary

BW Gold Ltd. (BW Gold), a wholly-owned subsidiary of Artemis Gold Inc. (Artemis), proposes to develop the Blackwater Project (the Project), an open pit gold mine, in central British Columbia, approximately 112 kilometres (km) southwest of Vanderhoof, and approximately 160 km west-southwest of Prince George. The proposed mine consists of an open pit, ore processing facilities, a Tailings Storage Facility (TSF), a freshwater supply system, waste rock dumps and stockpiles, camps, a transmission line, and access roads.

Based on comprehensive baseline and risk studies, BW Gold has minimized predicted impacts of the Project on fish and fish habitat through design, refinement and mitigation measures. However, some residual loss of fish habitat is predicted to occur as a result of the Project development, so the Project will require both an Authorization under Paragraph 35(2)(*b*) of the *Fisheries Act* (1996), and an amendment of Schedule 2 of the Metal and Diamond Mining Effluent Regulations (MDMER; 2002). The amendment to Schedule 2 of the MDMER (2002) will be required to designate portions of Davidson Creek within the TSF and the Environmental Control Pond (ECP) and the portions of tributaries to Davidson Creek and Creek 661 under the Overburden and ore Stockpiles as tailings Impoundment Areas (TIAs).

This document presents the Blackwater Project Fisheries Compensation Plan (Compensation Plan) to avoid, mitigate, and offset the loss of fish habitat resulting from the deposit of a deleterious substance into the TIAs, in accordance with Section 27.1 of the MDMER (2002). Offsetting specific to the *Fisheries Act* Authorization will be detailed in the separate Offsetting Plan that will accompany the application for Authorization.

The Blackwater Project mine site is located within the Nechako River basin. All of the proposed mine site is located in the upper extents of the Davidson Creek and Creek 661 watersheds. Davidson Creek drains the majority of the Blackwater Project and empties into Chedakuz Creek just north of Tatelkuz Lake, a large lake near the headwaters of Chedakuz Creek. Creek 661 drains portions of the east side of the mine area and drains into Chedakuz Creek upstream of Tatelkuz Lake.

This Compensation Plan focuses on the only fish species encountered in the affected upper reaches of Davidson Creek and Creek 661 – Rainbow Trout (*Oncorhynchus mykiss*).

Measures taken to avoid Project effects on fish and fish habitat include clustering and massing mine facilities, avoiding the Blackwater River Watershed and its environmental and heritage values, avoiding any direct footprint effects to kokanee habitat, and maximizing the use of existing access routes and disturbed areas for linear corridors. Complete avoidance of fish habitat loss was determined unfeasible through an alternatives assessment. Despite the application of avoidance and mitigation measures, some loss of Rainbow Trout habitat is predicted to occur as a result of the Project development.

To quantify habitat loss subject to the Schedule 2 amendment process, baseline fish habitat data gathered during the Environmental Assessment (EA) process was analyzed using three methods:

1. Calculation of the areal extent (surface area) of affected instream habitat (in $m^2$) using stream channel measurements collected during baseline field programs, and spatial analysis using Geographical Information System (GIS) software;

2. Habitat Evaluation Procedure (HEP) to calculate Habitat Units (HU), a metric that integrates habitat quality with quantity; and
3. Calculation of the riparian habitat (in $m^2$) using stream buffers applied to stream segments, based on fish-bearing status assessed during baseline field programs.

The HEP process has been widely used across North America as a reliable model for quantifying habitat loss, including in recent environmental assessments for similar projects in British Columbia and elsewhere in Canada. It provides a means of quantifying biologically relevant habitat loss (or gain) by taking into account the habitat preferences and requirements of a species at varying life stages. The HU values calculated by the HEP form the basis for the habitat balance (i.e., gain:loss ratio) calculation. Impacts to riparian habitat were determined based on the predicted areas of disturbance or loss of vegetation within stream-side buffers that reflect the type of vegetation and the suitability and sensitivities of adjacent, in-stream habitats. The assessments predict a loss of 57,773 $m^2$ of instream area, 58,096 Rainbow Trout HU, and a loss of 51.5 hectares of riparian habitat.

To offset the residual impacts outlined above, BW Gold and Palmer have identified and developed detailed designs for fish habitat compensation measures occurring within Indigenous Nations territories affected by the Project. All of the proposed instream offsets occur within Lhoosk'uz Dené (LDN)and Ulkatcho First Nations (UFN) territories and a significant portion of the riparian offsets occur within LDN and/or UFN territories. These offsets address known limitations to fisheries productivity in the affected watersheds. Compensation measures aim to alleviate productivity bottlenecks as well as restore and enhance degraded habitat and were developed based on a screening analysis that applied criteria as outlined in federal and provincial policies and guidelines.

Several compensation measures are proposed to offset instream and riparian habitat loss:

1. Mathews Creek channel restoration/enhancement;
2. Mathews Creek off-channel pond creation;
3. Mid-Mathews Creek off-channel pond creation;
4. Chedakuz Creek (Dykam Ranch) mainstem channel restoration/enhancement;
5. Chedakuz Creek (Dykam Ranch) tributaries channel restoration/enhancement;
6. Chedakuz Creek (Dykam Ranch) off-channel pond creation; and
7. Ormond Creek riparian planting.

The HEP was applied to calculate the net gain of instream habitat from the compensation measures, in order to ensure comparable quantification to net impacts. HU were calculated in a consistent manner to describe habitats in the Project area that will be located beneath the TIAs, as well as for habitats that will be constructed and/or enhanced through implementation of compensation measures. Use of a consistent accounting system to assess existing and future habitat conditions facilitates the quantitative comparison between HU losses due to the Project actions and HU gains through the implementation of the above-named compensation measures.

Total gain and restoration of 104,060 $m^2$ of instream habitat, 173,958 Rainbow Trout HU, and 1,003,369 $m^2$ of riparian habitat are predicted. This provides a compensation gain:loss ratio of approximately 1.80:1 for instream habitat (as $m^2$), 2.99:1 for habitat units, and 1.95:1 for riparian habitat (as $m^2$). Detailed information on the habitat balance and the quality of lost and gained instream and riparian habitat is available in Section 6.7 Habitat Balance.

# Table of Concordance – Indigenous Nations Major Issues

The following Table of Concordance presents the issues raised by LDN and UFN in their November 4, 2022 "Major Fisheries Concerns" document and by Carrier Sekani First Nations (CSFN) in their June 3, 2022. Fish Habitat Compensation Plan review comment document and indicates where information to address the concerns has been incorporated into this version of the Fish Habitat Compensation Plan (FHCP). The Table also includes issues on the FHCP prepared to support the amendment to Schedule 2 of the Metal and Diamond Mining Effluent Regulation (MDMER), and concerns that have been raised in writing since receipt of the November 4, 2022 "Major Fisheries Concerns" document.

| Topic | Issue Description | Summary Information and Location in FHCP |
|---|---|---|
| Offsetting ratios (LDN and UFN) | Nations want area-based habitat ratios of 2:1 for instream and 1:1 for riparian. For both FAA and Schedule 2<br><br>They are nearly there for the FAA, but right now for Schedule 2, it's:<br><br>0.44:1 for instream<br>0.17:1 for riparian<br><br>Reasons:<br>-They are using very thin riparian corridors (15 m and 5 m) to calculate habitat loss<br>-Previous DFO concerns with them deflating value of impacted areas and inflating value of restored areas<br>-They are rounding low habitat values to 0 | BW Gold has added riparian and instream habitat offsetting measures to increase area ($m^2$) ratios to 1.95:1 for riparian and 1.80:1 for instream habitat. This included nearly doubling riparian area offsetting within Lhoosk'uz Dené (LDN) and Ulkatcho First Nations (UFN) territories, taking the riparian area offsetting ratio from 0.17:1 to 0.32:1.<br>Information added to:<br>6.7 Habitat Balance |
| Offsetting not in territory (LDN and UFN) | Most of current offsetting is outside of territory. Offsetting does not address reduced ability to practice fishing rights. There is a need for nation-wide restoration planning so that restoration can result in direct benefits to the nation.<br><br>-Dykam Ranch additional offsetting for Schedule 2: Artemis has mentioned this but no plans have been provided<br>-Complimentary measures in FAA may be able to fund some of this? | Additional offsetting in the territories of LDN and/or UFN includes Chedakuz Creek (Dykam Ranch) instream and riparian habitat that is presented in the following sections and appendices:<br>6.1 Compensation Alternatives<br><br>6.7 Habitat Balance<br><br>Appendix E – Habitat Compensation Detailed Design Drawings<br>Appendix F4– Riparian Planting Plan – Chedakuz Creek (Dykam Ranch)<br><br>BW Gold has engaged in discussions with LDN and UFN in regard to 'Nation-led initiatives' within the Nation territories (see Section 6.10.3 Contingency Compensation Measures). |

| Topic | Issue Description | Summary Information and Location in FHCP |
|---|---|---|
| Asking for permits with missing info or incomplete plans (LDN and UFN) | Artemis has a number of plans in development to address deficiencies in their permitting documents, yet they are wanting to get permits first before having these completed/reviewed. Regulators have expressed that major components of the Schedule 2 must be complete and adequate prior to initiation of streamlining process and, ultimately, Schedule 2 approval.<br><br>Major deficiencies:<br>-planting plans for FAAA and FHCP (update: a preliminary plan have been received but not reviewed)<br>-additional offsetting measures in Dykam Ranch (FHCP)<br>-enumeration components in the AEMP (this falls under Major Works)<br>-monitoring plans need more substance, clarity, objectivity, and improved methods.<br><br>It does not make sense to issue permits without major deficiencies addressed. | Planting plans for Mathews Creek, Chedakuz Creek (Dykam Ranch) and Ormond Creek, as requested and discussed in the November 23 meeting, are presented in Appendices F1 to F5 – Planting Plans. These plans were submitted to LDN and UFN on December 12, 2022.<br><br>BW Gold has added riparian and instream habitat offsetting measures for Chedakuz Creek (Dykam Ranch), as per meetings with the Nations on November 9, 15, and 17, to:<br>6.7 Habitat Balance<br><br>Enumeration components in the AEMP have been updated in a separate AEMP document (ERM 2022).<br><br>Monitoring of the offsetting measures has been updated to include more detail on methods and success criteria metrics (e.g., statistical comparability, overwintering water depth) as discussed in the November 17 meeting. This information is presented in:<br>Appendix H – Effectiveness Monitoring Plan<br><br>BW Gold understands that the level of detail provided in this version of the FHCP is adequate for this stage of review. BW Gold acknowledges that this plan is an 'evergreen' document and looks forward to continuing to work with all parties as the level of design and detail increases prior to construction and over the life of the Project. |
| Monitoring plans (LDN and UFN) | Some of their recent field efforts have been thin and may be a reflection of their under-developed monitoring plans with vague metrics of success. They are merely checking boxes rather than gathering meaningful data.<br><br>Example: Matthews Creek baseline monitoring - site card. Those are meant for reconnaissance, not for baseline studies targeted at measuring specific outcomes (like # of LWD/boulders --> area of instream cover; monitoring spawning gravels, channel changes, substrate). Furthermore, Matthews Creek only has 3 monitoring stations, 1 of which is a reference. They also appear to be having trouble capturing Rainbow Trout in the system. Their programs, though broad, have little substance.<br><br>Example: hydraulic function monitoring for their instream and off-channel ponds does not include design specifications. Need to have design specs to monitor against. Not just a visual check. | More specific success criteria metrics (e.g., statistical comparability, overwintering water depth) have been added, as discussed in the November 17 meeting, to:<br>Appendix H – Effectiveness Monitoring Plan |

| Topic | Issue Description | Summary Information and Location in FHCP |
|---|---|---|
| Post-closure WQ exceedances (LDN and UFN) | WQ Exceedances may be one of the greatest threats to downstream fish habitat in Davidson Creek and Creek 661. What is Artemis' responsibility if there are unexpected WQ exceedances resulting in fish kills or chronic toxicity to fish? These things are often dealt with by a relatively small fine. Are there additional conditions/measures we can put in place so that they will take responsibility for potential loss of downstream habitat? Artemis has maintained that WQ exceedances don't have anything to do with Schedule 2 or FAA, but without good WQ, there is no habitat. | BW Gold is of the view that this comment is directed more towards DFO, however relevant information in the FHCP is located in the sections noted below.<br><br>Potential water quality issues (e.g., erosion and mobilization of sediment into the receiving environment) and mitigation measures (e.g., site isolation, winter construction, erosion and sediment controls) have been added to:<br>Table 6-4 Potential Effects and Mitigations Associated with Implementation of Compensation Measures<br><br>More specific success criteria metrics for water quality (e.g., requirement to meet BC ENV water quality guidelines), as discussed in the November 17 meeting and subsequent weekly fisheries meetings (November 23 and December 7), have been added to:<br>Appendix H – Effectiveness Monitoring Plan |
| Stream crossings (LDN and UFN) | Closed-bottom culverts should not be used for fish-bearing streams. Roadways and stream crossings contribute to cumulative effects. Given how much we have learned from past culvert practices, these should be a thing of the past. Does DFO/ECCC have a policy on this? | A previous version of the FHCP indicated closed-bottom culverts may be used, but use of only open-bottom culverts is confirmed and is discussed in:<br>4.2.1 Mitigation Measures |
| Limiting factors (LDN and UFN) | Artemis has made assumptions about limiting factors fish without producing supporting evidence. There is concern that a lot of their justification for offsetting relies on these assumptions.<br><br>Question for DFO/ECCC:<br>1) is much known about the limiting factors in offsetting locations (Matthews, Murray, Greer) beyond what is hypothesized? Do they think that creation of rearing/overwintering habitat only is sufficient? | BW Gold clarified to LDN and UFN in a November 9 meeting that the basis of the plan is habitat area and not an assumption of productivity, water temperature, or single habitat types being limiting factors. This clarification on limiting factors is presented in the following sections:<br>3.4.1.2 Kokanee<br><br>6.4.2 Mathews Creek and Mid-Mathews Creek Off-Channel Ponds |
| Long-term protection of restored areas (LDN and UFN) | The Nations currently are not satisfied with the current plans to protect restored areas in the long-term (i.e., SROW). SROWs do not function well in remote areas where there is little enforcement. | BW Gold discussed this matter with the Nations in meetings on November 9, 15, 17, 23, December 5, 15 and 23 and respectfully disagrees with the comment. All of the offsetting is proposed to occur on private lands which offer the strongest form of tenure. The SROWs and restrictive covenants (and related license agreement in the case of Dykam Ranch) that BW Gold is in the process of registering come with legal consequences should a party not adhere to their obligations. The SROWs and restrictive covenants would run with the properties such that if one of the properties were to be sold, the SROW |

| Topic | Issue Description | Summary Information and Location in FHCP |
|---|---|---|
| | | and restrictive covenant would continue to be in effect.<br><br>Furthermore, BW Gold expects to have obligations under its approvals to ensure the works are functioning as planned. The works are proposed to occur near the Blackwater Mine and BW Gold has committed to allowing its provincial Environmental Assessment Certificate-required Aboriginal Group Monitors to perform monitoring of the FHCP implementation as a means of providing feedback transparently to LDN and UFN.<br><br>In regard to duration of the protection of the works, BW Gold has successfully negotiated to extend the proposed term of the SROW on the Dykam Ranch property to 99 years in response to LDN/UFN concerns. BW Gold owns the Mathews Creek property and so duration of the offsetting is not an issue in the same was as with Dykam, however, BW Gold is also registering a SROW and restrictive covenant on the property for a period of 99 years.<br><br>Further information regarding the property securement is presented in:<br>6.4.8.1 Mathews Creek<br><br>6.4.8.2 Chedakuz Creek (Dykam Ranch) |
| Riparian offsetting ratio (CFSN) | Given the proponents response, it appears that they are not in agreement with CSFN's proposed riparian habitat offsetting ratio of 1:1 despite the sound ecological rationale provided by CSFN. Rather the proponent suggests that a proposed riparian habitat offsetting ratio of 0.15:1 (even less that the original offsetting plan ratio of 0.17:1) is adequate to offset the loss in Davidson Creek.<br><br>Given the above information, CSFN still maintains its position that the MMER fisheries offsetting plan does not adequately offset riparian habitat losses due to project development. CSFN maintains its position that riparian habitat be offset at a ratio of 1:1, which is supported by sound ecological rationale.<br>The proponent suggests that riparian habitat is not limiting fisheries productivity in the watershed but does not state what does in the watershed, nor does the fisheries offsetting procedure even account for a limiting habitat assessment approach. While the proponent states a 0.15:1 is appropriate for offsetting, they provide no supporting ecological information on why specifically that ratio is appropriate. Given the lack of supporting rationale, CSFN is of the perspective that the selected ratio is simply driven by the maximum amount of riparian habitat gained at the Matthews | BW Gold has included additional riparian planting area in the Ormond Creek, Mathews Creek, and Chedakuz Creek Watersheds to raise the riparian compensation ratio to 1.95:1 (ratio of area gained to area lost).<br><br>Information on additional planting areas is provided in:<br><br>Section 6.4 - Detailed Description of Habitat Compensation Measures; and<br><br>Section 6.6 – Habitat Gains from Proposed Compensation Measures |

| Topic | Issue Description | Summary Information and Location in FHCP |
|---|---|---|
| | Creek offsetting site since this is the sole site proposed under the MMER fisheries offsetting plan. | |

# Table of Concordance – DFO Issues

The following Table of Concordance presents major issues raised by Fisheries and Ocean Canada (DFO) in their November 10, 2022 letter to ECCC and the location where information to address each issue can be found in the Fish Habitat Compensation Plan (FHCP) prepared to support the amendment to Schedule 2 of the Metal and Diamond Mining Effluent Regulation (MDMER).

| Topic | Issue Description | Summary Information and Location in FHCP |
|---|---|---|
| Compensation Measures | DFO understands that the Proponent is currently identifying contingency compensation measures for inclusion in the FHCP, however, none have been proposed. The FHCP requires a high-level description of these contingency measures should compensation measures not meet the objectives outlined in the Effectiveness Monitoring Plan. | Contingency compensation measures are described in Section 6.10.3. These measures include First Nation-led initiatives, additional pond construction, and additional ranchland stream restoration. |
| Compensation Measures | DFO is of the view that the proposed compensation measures do not adequately counterbalance the residual effects of the Project due to the following:<br>i. The riparian compensation ratio of 0.17:1 remains inadequate. DFO understands that additional compensation measures have been identified at Shovelnose Lake and Dykam Ranch. However, a plan for additional compensation has not been proposed.<br>ii. The proposed instream compensation is inadequate and does not provide equivalent value when compared to the permanent instream losses due to the Project. DFO is of the view that the habitat equivalency analysis presented in the application overvalues the benefit of enhancement of aquatic habitats.<br>iii. The FHCP does not adequately compensate for the uncertainty surrounding the effects to Rainbow Trout productivity as a result of spawning habitat loss in the Davidson Creek watershed. | i. BW Gold has added riparian habitat offsetting measures to increase ratio to 1.95:1 for riparian. Information added to:<br>6.7 Habitat Balance<br>Appendices F1 to F5 – Planting Plans<br><br>ii. BW Gold has added instream habitat offsetting measures to increase ratio to 1.80:1 for instream habitat and 2.99:1 for habitat units, which increases confidence in the adequacy of proposed offsetting measures.<br>Regarding habitat equivalency analysis overvaluing the benefit of enhancement, HU calculations were reviewed and updated. All aspects of the predicted conditions, including dominant plant communities, instream cover, and habitat type/class associations, were critically examined and revised. This review resulted in the lower HU gain values for Mathews Creek and Ponds presented in this version of this Fish Habitat Compensation Plan.<br>Information added to:<br>6.7 Habitat Balance<br>Appendix J Detailed HEP Data – Habitat Gains<br><br>iii. New offsetting measures have been added to the Chedakuz Creek Watershed to support the directly |

| Topic | Issue Description | Summary Information and Location in FHCP |
|---|---|---|
| | | affected population of Rainbow Trout to address concerns with uncertainty related to productivity and habitat loss. Information on the additional offsets is located in:<br>Section 6.4.3 Chedakuz Creek (Dykam Ranch) Restoration and Enhancement<br>Section 6.4.4 Chedakuz Creek Tributaries (Dykam Ranch) Restoration and Enhancement<br><br>Potential Project effects concerning Rainbow Trout productivity are addressed in more detail in the FAA. Memos are cited in the FAA to address concerns about double-counting (Appendix R Offsetting Habitat Value (DFO IR#17 Memo in the FAA application) and concerns about spawning habitat loss effects on productivity (Appendix G Rainbow Trout Productivity (DFO IR#13 Memo) in the FAA application). |
| Budget | The estimates for land purchase/lease, maintenance, seasonal adjustment, availability of local expertise, and inflation protection must be included the budget presented in Table 6-5 of the FHCP. | Land purchase/lease costs are not included, as those costs have been incurred or will be incurred prior to the amendment of Schedule 2 of the MDMER.<br>Budget estimates including seasonal adjustments, availability of local expertise and inflation protection are included in:<br>6.11 Cost Estimate, Table 6-5 |

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# 1. Introduction

## 1.1 Purpose and Report Organization

BW Gold Ltd. (BW Gold) proposes to construct and operate the Blackwater Project (the Project), an open-pit gold and silver mine located 112 kilometres (km) southwest of Vanderhoof, and approximately 160 km west-southwest of Prince George, British Columbia (BC).

The previous owner of the Project, New Gold Inc. (New Gold), received an Environmental Assessment Certificate #M19-01 (Certificate) on June 21, 2019 under the *Environmental Assessment Act* (2002) and a Decision Statement on April 15, 2019 under the *Canadian Environmental Assessment Act*, 2012. In August 2020, BW Gold acquired the mineral tenures, assets, and rights to the Blackwater Project that were previously held by New Gold, including the Certificate and Decision Statement.

As part of the Environmental Assessment (EA) process, an effects assessment was completed, including for fish and fish habitat, which were identified as Valued Components (VCs). It was determined through this process that the Project will likely result in harmful alteration, disruption or destruction (HADD) of fish habitat, as defined by the federal *Fisheries Act* (1996).

Before construction of certain works can commence, the Project requires both an amendment of Schedule 2 of the Metal and Diamond Mining Effluent Regulations (MDMER; 2002) and an Authorization under Paragraph 35(2)(*b*) of the *Fisheries Act* (1996). The amendment to Schedule 2 of the MDMER (2002) specifically applies to the loss of fish habitat in tailings impoundment areas (TIAs) resulting from the placement of mine waste. *The Fisheries Act* Authorization application will address all other effects on fish and fish habitat resulting from Project activities.

A Conceptual Fisheries Mitigation and Offsetting Plan was prepared as part of the EA Application/Environmental Impact Statement (the Application/EIS), which outlined project activities, effects, and offsetting measures proposed at the time of the Application/EIS submission (AMEC 2014, Appendix.5.1.2.6C of the Application/EIS). The Conceptual Fisheries Mitigation and Offsetting Plan was updated based on comments received from Indigenous Nations, Fisheries and Oceans Canada (DFO) and the Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (MFLNRORD) and divided into two plans: a Fish Habitat Offsetting Plan for the *Fisheries Act* Authorization and a Fish Habitat Compensation Plan (FHCP) for the amendment to Schedule 2 of the MDMER (2002).

This FHCP presents the approach to avoid, mitigate, and offset the unavoidable loss of fish habitat resulting from the deposition of a deleterious substance into a TIA, in accordance with Section 27.1 of the MDMER (2002). Offsetting specific to the *Fisheries Act* Authorization will be detailed in the separate Offsetting Plan that will accompany the application for Authorization.

As required by Section 27.2 of the MDMER (2002), this document provides a description of the location of the tailings impoundment area and the proposed work, undertakings and activities associated with the Project (Section 2 Proposed Works, Undertakings and Activities). Section 3 Description of Fish and Fish Habitat provides a description of fish and fish habitat that will be affected by the deposit. Section 4 Fish and Fish Habitat Effects Assessment Summary outlines the anticipated effects on fish habitat as a result of the

Project, including a quantitative assessment of the tailings deposit on fish habitat, as well as an outline of avoidance and mitigation measures (Section 4.2 Summary of Avoidance and Mitigation Measures). Section 5 Habitat Loss Assessment outlines the assessment of residual effects to fish habitat. The proposed compensation measures are presented in Section 6 Compensation Measures, including a timeline for implementation of the plan, a description of mitigation measures, and an estimate of the cost of implementing each element of the plan.

Several planned compensation sites in the FHCP are located in wetland areas and include creation of ponds and vegetation planting that will help to restore wetland functionality. This plan will be combined with the efforts of the Project's Wetland Management and Offsetting Plan (WMOP; ERM 2022), which covers areas outside of the fish habitat compensation sites. These two plans focus on creating the environmental conditions conducive to the recovery of wetlands as well as surrounding habitat areas, including riparian zones and open water. Maintaining the interconnectivity of habitat types promotes the health of the ecosystem and maximizes functionality. Ecosystem restoration strategies are aimed at places of disturbance where ecosystem functions, habitats, and communities have been reduced, lost, or are threatened.

Prioritizing the restoration of ecosystem function over attempting to return to pre-disturbance conditions can result in ecosystem benefits manifested over a shorter timeframe. Many goals, such as restoring the hydrology to a former wetland area by filling anthropogenic drainage features (e.g., ditches) can help restore a number of ecosystem functions and improve habitat for local species, even if the ecosystem restored is not exactly the same as its historical reference. For example, a well-vegetated wetland system can filter groundwater supplies and reduce direct nutrient loads into streams.

## 1.2 Proponent Contact Information

**Name and Address of Owner**
BW Gold Ltd.
Suite 3083 – 595 Burrard Street
Vancouver, BC
V7X 1L3

**Authorized Contact Person**
Ryan Todd
Vice President, Environment and Social Responsibility
Telephone: 604 329 8179
Email: rtodd@artemisgoldinc.com

## 1.3 Environmental Regulations and Policy

The Project will affect fish and fish habitat in association with the deposition of deleterious substances (i.e., mine tailings and waste rock) into fish-bearing portions of Davidson Creek and Creek 661, as well as potentially causing HADD and the death of fish associated with other mine components. These impacts to fish and fish habitat will require both an Authorization under Paragraph 35(2)(*b*) of the *Fisheries Act* (1996) and an amendment of Schedule 2 of the MDMER (2002).

Environment and Climate Change Canada's (ECCC) *Guidelines for the Assessment of Alternatives for Mine Waste Disposal: Annex 2* (Environment Canada 2011) describe that in situations where a tailings impoundment area is established in a stream valley, as is the case for the Blackwater Project, two separate fish habitat compensation/offsetting plans are required:

1. Section 27.1 of the MDMER (2002) requires fish habitat compensation to offset losses of fish habitat associated the deposition of a deleterious substance into the water body(ies) that are added to Schedule 2; and
2. Subsection 35(2) of the *Fisheries Act* (1996) requires fish habitat offsetting to compensate for the losses of fish habitat associated with the construction of the works themselves, such as the footprint of a tailings dam or other containment structure.

Figure 1-1 illustrates the typical division of fish habitat compensation areas.

Stream areas included in this Compensation Plan for Section 27.1 of the MDMER (2002) and those included in a separate Offsetting Plan for *Fisheries Act* Subsection 35(2) Authorization are shown in Figure 5-1. Section 5 Habitat Loss Assessment includes a detailed description of the stream segments that will be affected by deposition of a deleterious substance.

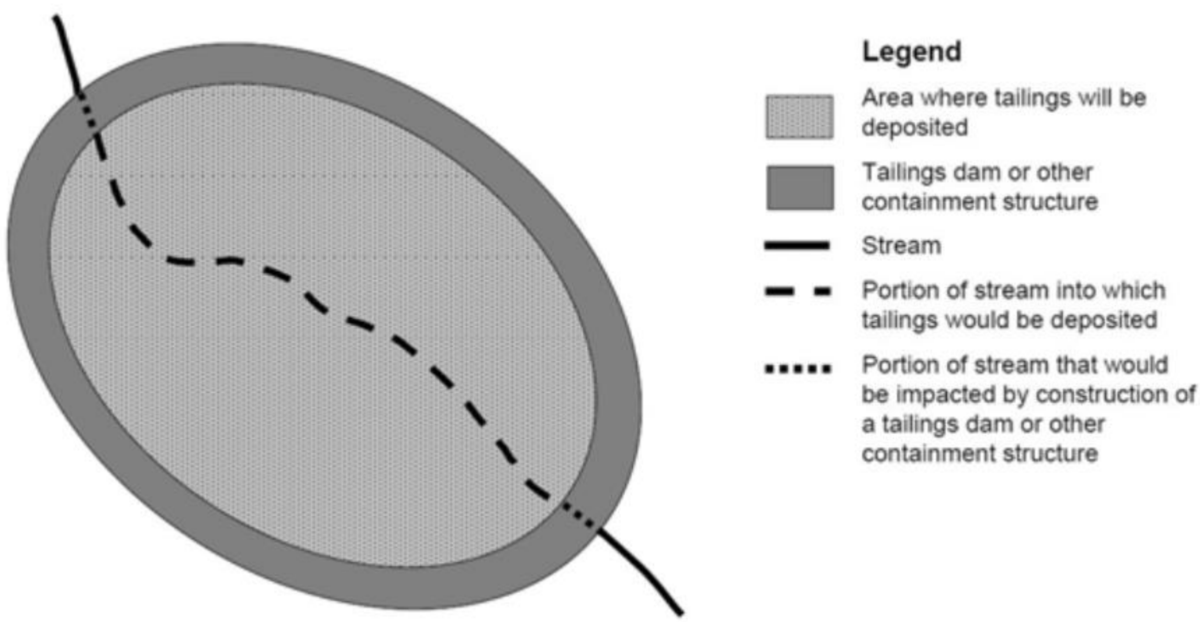



***Figure 1-1. Fish Habitat Compensation Requirements in Typical Tailings Impoundment Areas***

*Source: ECCC Guidelines for the assessment of alternatives for mine waste disposal: annex 2 (Environment Canada 2011) (available at: https://www.canada.ca/en/environment-climate-change/services/managing-pollution/publications/guidelines-alternatives-mine-waste-disposal/annex-2.html)*

### 1.3.1 Fisheries Act – Section 35

The *Fisheries Act* (1996) was amended in 2019 as part of the Government of Canada's Review of Environmental and Regulatory Processes initiative. Amendments introduced at this time reinstated protection for all fish and fish habitat, including prohibition of HADD of fish habitat (Section 35(1)) and death of fish by means other than fishing (Section 34.4). If a project cannot avoid, or is likely to cause, death of fish and/or HADD of fish habitat, then a *Fisheries Act* Authorization is required.

A separate application for a *Fisheries* Act Authorization will be prepared in accordance with the information requirements outlined in Schedule 1 of the Authorizations Concerning Fish and Fish Habitat Protection Regulations, enacted under the *Fisheries Act* (1996), to address the unavoidable HADD of fish habitat and death of fish that are anticipated to result from the construction of mine infrastructure.

### 1.3.2 Schedule 2 – Metal and Diamond Mining Effluent Regulations

Using a natural water body frequented by fish for mine waste disposal requires an amendment to Schedule 2 of the MDMER (2002). Obtaining an amendment to Schedule 2, which lists water bodies designated as TIAs, requires federal legislative action. The MDMER (2002) was enacted in 2002 under Subsections 34(2), 36(5), and 38(9) of the *Fisheries Act* (1996) to regulate the deposition of mine effluent, waste rock, tailings, low-grade ore and overburden into natural waters frequented by fish. The MDMER (2002) is administered by ECCC on behalf of DFO.

An amendment to Schedule 2 of the MDMER (2002) will be required to designate portions of stream channels impacted by mine waste as TIAs. These stream channels include portions of Davidson Creek within the Tailings Storage Facility (TSF) and portions of tributaries to Davidson Creek and Creek 661 under the low-grade and high-grade ore stockpiles, and the overburden and non-acid-generating (NAG) waste rock storage facilities. On July 19, 2021, ECCC provided guidance to Artemis that the Environmental Control Pond (ECP), a part of the seepage collection system, would be considered to be a part of the TSF and, therefore, would need to be included in the Schedule 2 amendment and accounted for in this Compensation Plan (A. Petropoulos, ECCC, pers. comm.)

As required by ECCC for the Schedule 2 amendment process, BW Gold has assessed alternatives for tailings, waste rock, and low-grade ore deposition. This report documenting the alternatives assessment has been submitted under separate cover (ERM 2021).

Subsection 27.1(1) of the MDMER (2002) Division 4 – Tailings Impoundment Areas describes the requirement to submit a Compensation Plan to the Minister of the Environment and Climate Change and obtain approval for the plan. Subsection 27.1(2) states that the purpose of the Compensation Plan is to offset the loss of fish habitat resulting from the deposition of any deleterious substance into a TIA and identifies the required components of the Compensation Plan. The required components and relevant section references are presented in Table 1-1.

*Table 1-1. MDMER Subsection 27.1(2) Compensation Plan Requirements*

| Section 27.2(2) Compensation Plan Requirement | Document Section Reference |
|---|---|
| A description of the location of the tailings impoundment area and of fish habitat that will be affected by the deposit | Section 3 |
| A quantitative impact assessment of the deposit on fish habitat | Sections 4 and 5; Appendix C |
| A description of the measures to be taken to offset the loss of fish habitat | Section 6; drawings presented in Appendix E |
| A description of the measures to be taken during the planning and implementation of the Compensation Plan to mitigate any potential adverse effects on fish habitat that could result from the plan's implementation | Section 6.9; Appendix G |
| A description of the measures to be taken to monitor the plan's implementation | Section 6.9; Appendix H |
| A description of the measures to be taken to verify the extent to which the plan's purpose has been achieved | Section 6.9; Appendix H |
| The time required to implement the plan that allows for the achievement of the plan's purpose within a reasonable time | Section 6.8; Appendix K |
| An estimate of the cost of implementing each element of the plan | Section 6.11; Appendix L |

Subsection 27.1(3) specifies the requirement for the owner or operator of a mine to submit an irrevocable letter of credit (LOC) to cover the plan's implementation costs, which shall be payable upon demand on the declining balance of the implementation costs. It is BW Gold's understanding that the LOC is submitted after the Compensation Plan is approved by the Minister.

## 1.4 Linkage to Other Management Plans

The FHCP is linked to the:

- Wetland Management and Offsetting Plan (WMOP; ERM 2022);
- Reclamation and Closure Plan (RCP; Chapter 4 of the Joint Mines Act/Environmental Management Act Permits Application [Application]);
- Construction Environmental Management Plan (Appendix 9-C of the Application);
- Surface Erosion Prevention and Sediment Control Plan (SEPSCP; Appendix 9-A of the Application);
- Vegetation Management Plan (VMP; Appendix 9-F of the Application);
- Invasive Plant Management Plan (IPMP; Appendix 9-G of the Application);
- Wildlife Mitigation and Monitoring Plan (Appendix 9-H of the Application); and
- Fish habitat offsetting plans, and related mitigation measures, required by Decision Statement Conditions 3.11 and 3.12.

## 1.5 Consultation

### 1.5.1 Background

BW Gold is committed to continuing to communicate clearly and openly about the planning of the Project, and to soliciting and incorporating feedback received through its consultation process. Since conception of the Project, BW Gold and the previous owner New Gold have regularly consulted regulatory agencies, Indigenous Nations and local communities, and the public through a combination of site field tours, community meetings and through the framework of the EA process (Table 1-2).

The Blackwater mine site is located within the traditional territories of Lhoosk'uz Dené Nation, Ulkatcho First Nation, Skin Tyee Nation, Tŝilhqot'in Nation, and Métis Nation British Columbia (Government of Canada 2012). The Schedule 2-related impacts will occur in the traditional territories of these Indigenous Nations. Other Project components, including the existing Kluskus and Kluskus-Ootsa Forest Service Roads (FSRs) and proposed transmission line, cross the traditional territories of the above-noted Indigenous groups and the Saik'uz First Nation, Stellat'en First Nation, Nadleh Whut'en First Nation, Nazko First Nation, and Nee-Tahi-Buhn Band.

In addition to consultations carried out by BW Gold and New Gold, federal and provincial agencies conducted consultation processes for the Project. The Canadian Environmental Assessment Agency consulted Indigenous groups during the federal EA process to fulfill Canada's duty to consult under CEAA (Government of Canada 2012). The Lhoosk'uz Dené Nation, Ulkatcho First Nation, and the Saik'uz First Nation, Stellat'en First Nation, and Nadleh Whut'en First Nation (collectively the Carrier Sekani First Nations) were consulted with high depth. The Nazko First Nation was consulted with moderate depth, based on the overlap of the transmission line route with the First Nation's traditional territory. Skin Tyee Nation, Tsilhqot'in Nation, Métis Nation British Columbia, and the Nee-Tai-Buhn Band were consulted with low depth during the federal EA process.

Throughout the provincial EA process, the BC Environmental Assessment Office (EAO) consulted the Lhoosk'uz Dené Nation, Ulkatcho First Nation, and the Carrier Sekani First Nations according to the deeper end of the consultation spectrum described in 2004 by the Supreme Court of Canada in Haida Nation v. British Columbia (Minister of Forests). The EAO consulted with Skin Tyee Nation, Tsilhqot'in National Government, Nee Tahi Buhn Band, Cheslatta Carrier Nation and Yekooche First Nation at the lower end of the Haida consultation spectrum (EAO 2019). The Project is supported by the LDN and UFN, who submitted letters of support for the Project towards the completion of the EA process.

### 1.5.2 Fisheries Compensation Opportunities

Valuable insight into fisheries compensation opportunities has been provided by Indigenous Nations through field reconnaissance visits, community meetings and technical workshops. Several fisheries-related meetings and site visits were conducted from 2016 to 2022 to engage and consult with regulators, third party reviewers, and Indigenous Nations (Table 1-2). Feedback and input on fisheries compensation measures should align with provincial, federal, and Indigenous Nations fisheries management objectives.

Meetings in 2021 and 2022 with representatives from LDN, UFN, and the CSFNs have led to updates to this plan, including:

- A commitment to apply the Habitat Evaluation Procedure (HEP; Section 6.5.2 Habitat Evaluation Procedure) post implementation of the compensation projects (i.e., post-restoration), with the aim of comparing the predicted habitat gains to actual habitat gains, to the extent possible, given the inherent natural variability of the restored system and the variability of the habitat measurements used for HEP.
- A commitment to conduct vegetation community surveys in Mathews Creek to update existing information and to inform the development of a detailed planting plan.

- Adjustments to the HEP calculation process to refine estimates of habitat quantity and quality.
- Incorporation of additional metrics to the Effectiveness Monitoring Plan (EMP; see Appendix H).
- Evaluation of additional compensation measures, including pond creation in mid-Mathews Creek, habitat restoration in Chedakuz Creek (Dykam Ranch) and riparian planting at Ormond Creek.

### 1.5.3 Additional Instream Habitat and Riparian Areas

Following receipt of DFO's letter dated November 10, 2022 which referenced comments from LDN and UFN dated November 4, 2022, LDN, UFN and BW Gold (and at some points DFO and ECCC) have met and discussed ways to address the request for additional instream and riparian areas. A summary of those meetings is provided below:

- November 9, 2022 – LDN and UFN presented to BW Gold on their outstanding technical issues on the project, including in regard to the FHCP. Fish issues discussed included requested data sharing, the need for 2023 baseline studies prior to instream work, agreement on a kokanee spawner sampling plan, and further issues to be discussed in the November 17, 2022 meeting.
- November 15, 2022 – BW Gold met with LDN and UFN and discussed additional offsetting measures that had been presented to the Nations earlier in 2022 (e.g., mid-Mathews Creek Ponds, Chedakuz Creek (Dykam Ranch) habitat restoration, Ormond Creek riparian planting), Nation-led restoration plans, and long-term protection measures.
- November 17, 2022 – BW Gold met with DFO, ECCC, LDN and UFN; DFO reviewed their November 10 letter and discussed additional offsetting measures presented at November 15, 2022 meeting, Nation-led restoration plan, long-term protection measures, and ECCC Regulatory timelines. Additional discussion occurred on issues pertaining to the Effectiveness Monitoring Program success criteria. LDN and UFN raised the concept of Nation-led initiatives as a way to address the deficiency in riparian and in-stream habitat area. ECCC expressed that time is of the essence in terms of a streamlining decision and a decision on the Schedule 2 amendment by the end of June, and that every day counts at this point. BW Gold expressed its plan to address the points in the DFO letter including the Nations' November 4 issues as soon as possible as a Schedule 2 amendment decision in June is critical for the project.
- November 23, 2022 – BW Gold met with LDN and UFN and discussed the proposed additional offsetting measures (Mid-Mathews Ponds, Chedakuz Creek (Dykam Ranch) habitat restoration, Ormond Creek riparian planting), vegetation prescription plans for the new offsetting, Nation-led restoration planning, and ECCC timelines.
- December 5, 2022 – BW Gold met with LDN, UFN and ECCC; LDN and UFN presented on their feedback and concerns on the measures to address the need for additional instream and riparian compensation areas, presented on interactions between fish and wetland offset areas and provided an update on Nation-led initiatives. Concerns raised by the Nations included potential for disturbance to existing wetlands by building fish habitat offset ponds, concern that Ormond Creek offsets are outside of LDN/UFN territory and that additional information is needed to review eligibility for an offset, uncertainty around the protection measures for the offset areas, plans needing additional design to be complete, concerns with accounting of instream habitat areas. BW Gold presented their views on the concerns raised by the Nations, including information to enhance the collective understanding of the proposals and potential effects. BW Gold followed up after the meeting to see if the LDN/UFN concerns had been addressed, but did not receive confirmation. The Nations presented some information on Nation-led initiatives, including interest in a fish passage project on the Dean River, and a general

interest in the restoration of fire, mountain pine beetle and logging disturbed areas within the territories. BW Gold had previously reviewed and visited the Dean River opportunity with the Nations during the Project's EA stage, and communicated concerns with viability owing to the project being located within a provincial park, that the project is located within a steep canyon with no room to relocate the river, unstable slope conditions immediately above the falls and no road access. No additional information (e.g., locations) was provided on the restoration initiatives. BW Gold noted that target to submit an updated FHCP by the end of the week, and that the lack of detail on the Nation-led initiatives was creating challenges for incorporation into the FHCP at that point. Following the meeting, BW Gold followed up with the Nations to see if the information presented by BW Gold had addressed the issues raised by the Nations and also to ask for additional detail on the potential Nation-led initiatives, and the Nations responded that they would get back to BW Gold.

- December 14, 2022 – BW Gold met with LDN and UFN; LDN and UFN raised concerns with the Dykam SROW and restrictive covenant, in particular that:
    - Nations want to be assured that the SROW and restrictive covenant provide long-term legal protection.
    - Nations want to be sure inspections of the land will occur and the SROW terms will be enforced.
    - Nations need to review and accept SROW language prior to finalization.
- December 15, 2022 – BW Gold, LDN, and UFN brought their external counsel to discuss the issues raised at the December 14 meeting in regard to the Dykam SROW and restrictive covenant, with interest in discussing the mechanism of securing the proposed Dykam ranch offsetting area. BW Gold and LDN/UFN each invited their legal counsel to discuss the proposed securement mechanism. BW Gold explained its proposal and LDN/UFN counsel expressed their views on the proposal and alternatives including a s.219 covenant. The Nations also expressed interest in access to the secured properties, which the parties discussed. BW Gold followed up the call by providing a written summary of the draft SROWs and restrictive covenants to LDN, UFN and their counsel for further consideration.
- December 23, 2022 – BW Gold met with LDN and UFN to discuss the mechanism of securing the proposed Dykam ranch offsetting area in follow up to the December 15 meeting, again inviting legal counsel. The possibility of a s. 219 covenant was again raised by counsel for LDN/UFN and we discussed the mechanics of how a s. 219 covenant would function on Dykam Ranch. BW Gold raised concerns regarding the feasibility of a s. 219 covenant given the land is owned by a private third-party landowner. Following this discussion, counsel for LDN and UFN stated that he did not think our proposed mechanism is acceptable.
- December 29, 2022 – LDN/UFN legal counsel emailed BW Gold requesting certain information in regard to the proposed mechanism of securing the Dykam ranch offsetting area and requesting clarification as to how BW Gold would provide the Nations with access to the properties.
- January 4, 2023 – LDN, UFN and BW Gold met. BW Gold provided an update on status of the FHCP including intended timing of submission of the updated plan, as well as on its work to respond to the December 29, 2022 email. The parties discussed the Nation-led initiatives and BW Gold explained that while they understand that the Nations are working on a proposal for Nation-led initiatives, the initiatives are not sufficiently developed to include as offsets in the FHCP. BW Gold also explained its intent to continue to work with LDN and UFN in attempt to identify Nation-led initiatives for the Fisheries Act Authorization FOP.
- January 5, 2023 – BW Gold responded to LDN/UFN legal counsel's December 29, 2022 email with the requested information on the SROW and restrictive covenant, information in regard to accessing the proposed offsetting areas by LDN and UFN for monitoring, and related matters. The email expressed

that the owner of Dykam Ranch is not open to a s.219 covenant or to granting the Nations unilateral access to the SROW. The email further explained that the Dykam Ranch owner is willing to contemplate the right for duly appointed First Nations monitors to attend the site for inspections. BW Gold elaborated that the terms of reference for its provincially-required Aboriginal Group's Monitoring Plan already includes provisions for First Nation monitors to monitor the fish offsetting works that would be constructed, monitored and maintained by BW Gold. BW Gold signalled its intent to proceed with the proposed SROW and restrictive covenant for Dykam Ranch.

- January 6, 2023 – LDN responded to BW Gold's January 5, 2023 email expressing a position that because the s.219 covenant and associated access was rejected by the Dykam Ranch owner, the proposal cannot be supported by the Nation and that the Nation intends to bring its concerns forward to regulatory authorities.
- January 10, 2023 – BW Gold responded to LDN's email, maintaining its view that the SROW and restrictive covenant are viable securement mechanisms for Dykam Ranch and reaffirming its commitment to work with the Dykam Ranch owner to provide for monitoring access for First Nations monitors duly appointed under the relevant provincial EAC condition requiring Aboriginal Group Monitors.

BW Gold is committed to continuing to explore Nation-led initiatives with LDN, UFN and DFO. Because the Nation led initiatives remain under development by the Nations, BW Gold has communicated to LDN and UFN a commitment to continue to collaborate on such initiatives within its Fisheries Act Authorization application. The application is currently undergoing revision to incorporate comments from DFO received in a letter November 3, 2022, requesting additional riparian area offsetting and instream area offsetting. BW Gold proposes Nation-led initiatives be included in the Fisheries Act Authorization to help meet the requirement for additional riparian area offsetting and instream area offsetting, provided that the initiatives meet DFO's satisfaction to be considered as offsets. Any Nation-led initiatives must meet BW Gold's requirements as well.

Based on discussions with DFO, BW Gold understands that the contingency measures need only to be developed to a high-level, conceptual level. Because specifics of viable Nation-led initiatives have not been brought forward during development of this iteration of the FHCP, BW Gold has incorporated the notion of Nation-led initiatives into its contingency measures for the FHCP and has communicated this approach to LDN and UFN with rationale. Please refer to 6.10.3 Contingency Compensation Measures for additional information.

### *Table 1-2. Summary of Fisheries Offsetting-related Meetings and Site Visits, Blackwater Project, 2016-2022*

| Date(s) | Meeting/Site Visit, Location, Objectives | Attendance |
|---|---|---|
| 05-Jan-2016 | Discuss DFO comments received during EA Application/EIS review | New Gold, Palmer, DFO |
| 20-May-2016 | Overview of Fish Offsetting Plan, Vancouver | New Gold, Palmer, FLNRO, DFO, CEAA |
| 07-Jul-2016 | Fisheries Offsetting, New Gold Office Vanderhoof | New Gold, SFN, NWFN |
| 17-Oct-2016 | Fisheries Offsetting – Sturgeon Research, Phone | Palmer, Freshwater Fisheries Society |
| 27-Oct-2016 | Fisheries Offsetting – Sturgeon Research, Phone | Palmer, Freshwater Fisheries Society, UBC |
| 22-Jul-2016 | Present and discuss potential offsetting projects | Meeting with CSFN |
| 04-Nov-2016 | Present offsetting options and solicit feedback | Meeting with DFO |
| 24-Nov-2016 | Complementary Measures – Nechako Sturgeon Recovery Geomorphic Discussion, UBC | Palmer, MOE, UBC |
| 30-Nov-2016 | Fisheries Offsetting Tour, Vanderhoof | New Gold, Palmer, SFN, NW FN, DFO, NEWSS |
| 1-Dec-2016 | Habitat suitability curves in the IFN assessment, Prince George | Meeting with DFO (Phone), FLNRO |
| 30-Jan-2017 | Lessons learned from Mount Milligan Overwintering Ponds, Teleconference | Palmer, DFO |
| 17-Feb-2017 | Meeting with Dennis Ableson (consultant for Saik'uz, Nadleh Whut'en and Stellat'en FN) to discuss options for offsetting, Teleconference | Palmer, Terra Quatics |
| 14-Mar-2017 | Fisheries Offsetting Update, Vancouver | New Gold, Palmer, ERM, CEAA, DFO |
| 25-Apr-2017 | Fisheries Offsetting Update, Prince George | New Gold, Palmer, FLNRO |
| 25-Apr-2017 | Fisheries Offsetting Update, Prince George | New Gold, Palmer, CSFN |
| 8-May-2017 | Fisheries Offsetting Update, Williams Lake | New Gold, Palmer, LDN, UFN |
| 7-Jun-2017 | Fisheries Offsetting Update, Vancouver | Working Group Meeting |
| 22-Jun-2017 | Fisheries Offsetting Update | New Gold, Palmer, DFO |
| 06-Mar-2019 | Provided NWFN, SFN and StFN with supporting materials requested during their review of the draft consultation summary reports (covering reporting periods: 1) August 13, 2016 to August 31, 2017; and 2) September 1, 2017 to | NWFN, SFN, StFN, and BW Gold |

| Date(s) | Meeting/Site Visit, Location, Objectives | Attendance |
|---|---|---|
| | August 10, 2018). Materials provided included April 25, 2017 Fisheries Offsetting Meeting Minutes (June 19, 2017 email) | |
| 06-Nov-2020 | Provided an update to multiple account analysis report to support MDMER Schedule 2 amendment. Provided a memorandum detailing fish habitat areas within the Project footprint which would be identified on Schedule 2 of the MDMER (2002). Provided information related to submission logistics and timing (to be submitted to Environment and Climate Change Canada in Q1 2021), E-mail | NWFN, SFN, StFN, and BW Gold |
| 06-Nov-2020 | Provided update regarding timing of submission of various documents in support of permits, including those in support of the Schedule 2 amendment, E-mail | LDN, UFN, and BW Gold |
| 23-Nov-2020 | Provided update regarding timing of submission of various documents in support of permits, including those in support of the Schedule 2 amendment, Email | NWFN, SFN, StFN, and BW Gold |
| 02-Dec-2020 | Provided a Project update and an update on Schedule 2 amendment process and timing of submission. Provided an overview of why the Schedule 2 amendment is needed. Discussed setting a follow-up technical meeting, Teleconference | LDN, UFN, and BW Gold |
| 18-Dec-2020 | Provided overview of Schedule 2 amendment process and requirements, explained proposed compensation plan, planned timing of submission and scheduled a follow-up meeting for January 15, 2021, Teleconference | LDN, UFN and their technical advisors, and BW Gold |
| 12-Jan 2021 | Provided update regarding timing of submission of various documents in support of permits, including those in support of the Schedule 2 amendment, Email | NWFN, SFN, StFN, and BW Gold |
| 15-Jan-2021 | Fisheries Compensation Plan Update, presented details of the fish habitat compensation plan that will be submitted in support of the Schedule 2 amendment. teleconference | LDN, UFN and their technical advisors, BW Gold, and Palmer |
| 19-Jan-2021 | Provided notes of January 15, 2021 meeting to LDN and UFN as well as action item, Email | LDN, UFN, and BW Gold |
| 14-May-2021 | Provided an update on the proposed fisheries offsetting work that was in progress. The meeting included soliciting feedback and input, answering questions, and discussing opportunities for collaboration. | LDN, UFN and their technical advisors, BW Gold, and Palmer |
| 9-Sep-2021 | BW Gold met with UFN/LDN and FLNRORD (Lori Borth) regarding land securement for Mathews Creek Ranch | LDN, UFN and their technical advisors, FLNRORD, BW Gold, and Palmer |

| Date(s) | Meeting/Site Visit, Location, Objectives | Attendance |
|---|---|---|
| 08-Jun-2021, 14-Jun-2021, 21-Jun-2021, 26-Jun-2021 | Series of meetings for consultations on the proposed authorization for mine waste disposal under the Metal and Diamond Effluent Regulations (MDMER), including the Assessment of Alternatives and the Compensation Plan | CSFNs, UFN, LDN, and their technical advisors, ECCC, DFO, BW Gold, Palmer |
| 07-Oct-2021, 25-Oct-2021, 23-Nov-2021, 06-Dec-2021, 09-Dec-2021, 13-Dec-2021, 06-Jan-2022, 10-Jan-2022, 26-Jan-2022, 03-Feb-2022, 16-Feb-2022, 23-Feb-2022, 24-Aug-2022, 21-Sep-2022, 12-Oct-2022, 26-Oct-2022 9-Nov-2022 23-Nov-2022 7 Dec-2022 | Series of regular meetings to discuss technical aspects of the Project's fisheries offsetting, including the Compensation Plan and the Fisheries Act Authorization Application. Numerous topics were discussed, feedback was provided, and revisions were incorporated into offsetting planning. | CSFNs, UFN, LDN, and their technical advisors, ECCC, DFO, BW Gold, Palmer, additional participation from regulators or other experts to address specific topics.<br>CSFN chose not to attend the meetings after Feb 16, 2022 (Pers. Comm. Georgina Farah on Feb 16, 2022). |
| 9-Nov-2022, 23-Nov-2022, 5-Dec-2022 14-Dec-2022 15-Dec-2022 | Series of meetings to discuss Major Issues raised by the UFN/LDN. | UFN, LDN, and their technical advisors, ECCC, DFO, BW Gold, Palmer, additional participation from regulators or other experts to address specific topics. |

Notes: *LDN- Lhoosk'uz Dené Nation, UFN – Ulkatcho First Nation, SFN – Saik'uz First Nation, StFN – Stellat'en First Nation, NWFN Nahleh Whut'en First Nation, STN – Skin Tyee Nation, NFN – Nazko First Nation, TNG – Tsilhqot'in National Government, CSFN – Carrier Sekani First Nations, ECCC – Environment and Climate Change Canada, DFO – Fisheries and Oceans Canada, FLNRO – Ministry of Forests, Lands, Natural Resource Operations., UBC – University of British Columbia, CEAA – Canadian Environmental Assessment Agency.*

# 2. Proposed Works, Undertakings and Activities

## 2.1 Blackwater Project Overview

This section provides an overview of the Project including the principal mine components and associated infrastructure that have the potential to affect fish and fish habitat in the Project area. Additional details on the principal mine components are available in the *Assessment of Alternatives for the Blackwater Gold Project for Mine Waste Disposal* (Assessment of Alternatives; ERM 2021), the *Blackwater Gold Project Initial Project Description* (Initial Project Description; ERM 2020), the *NI 43-101 Technical Report on Pre-Feasibility Study* (Pre-Feasibility Study; Artemis 2020), and in Section 2 (Project Overview) of the Application/EIS (AMEC et al. 2014).

The Project is a greenfield gold and silver open-pit mine and associated ore processing facilities with a proposed initial milling capacity of 15,000 tonnes per day (t/d; 5.5 million tonnes per annum [Mtpa]) for the first five years of operation. After the first five years, the milling capacity will increase to 33,000 t/d (12 Mtpa) for the next five years of operation, and to 55,000 t/d (20 Mtpa) until the end of the planned mine life. Gold and silver will be recovered by a combination circuit of gravity and whole ore leaching to produce a gold-silver doré. The mine life is expected to be 23 years, including processing of a low-grade stockpile.

Several main components comprise the Project (Figure 2-3):

- Mine site;
- A freshwater reservoir and water management pond;
- Freshwater Supply System (FWSS) and associated infrastructure;
- Electrical transmission line and associated access, borrow, and laydown areas;
- Airstrip, airstrip access road; and
- Mine access road.

### 2.1.1 Project Location

The Blackwater Project is in the Nechako River Watershed, in central BC, approximately 112 km southwest of Vanderhoof and 160 km west-southwest of Prince George. The universal transverse Mercator (UTM) coordinates for the centroid of the proposed mine site are 5893000 N and 375400 E (NAD 83 Zone 10). A large-scale plan showing the proposed mine site facilities and other components (linear corridors), as well as landmarks, water bodies and other geographical features in the wider area, is shown in Figure 2-1. The location of the Project, within the sub-watersheds of the Nechako River Watershed, is shown in Figure 2-2. A small-scale site plan indicating the size and spatial relationship of the proposed mine site components is shown in Figure 2-3. Water bodies in the vicinity of the Project, based on the water bodies identified in the aquatics Local Study Area (LSA), specific to the mine site[1] in the EA, and their UTM coordinates are listed in Table 2-1.

[1] *This mine site aquatics LSA included watersheds potentially affected by the mine site, excluding off-site effects associated with linear infrastructure.*

The mine site is accessed by vehicle via the Kluskus FSR, the Kluskus-Ootsa FSR and an exploration access road, which connects to the Kluskus-Ootsa FSR at kilometre (km) 124.5. BW Gold is planning to build a new approximately 14 km access road to the mine site, which will replace the existing exploration access road. The Kluskus FSR joins Highway 16 approximately 10 km west of Vanderhoof. Driving time from Vanderhoof to the mine site is about 2.5 hours. Access via helicopter is available from nearby heli-bases.

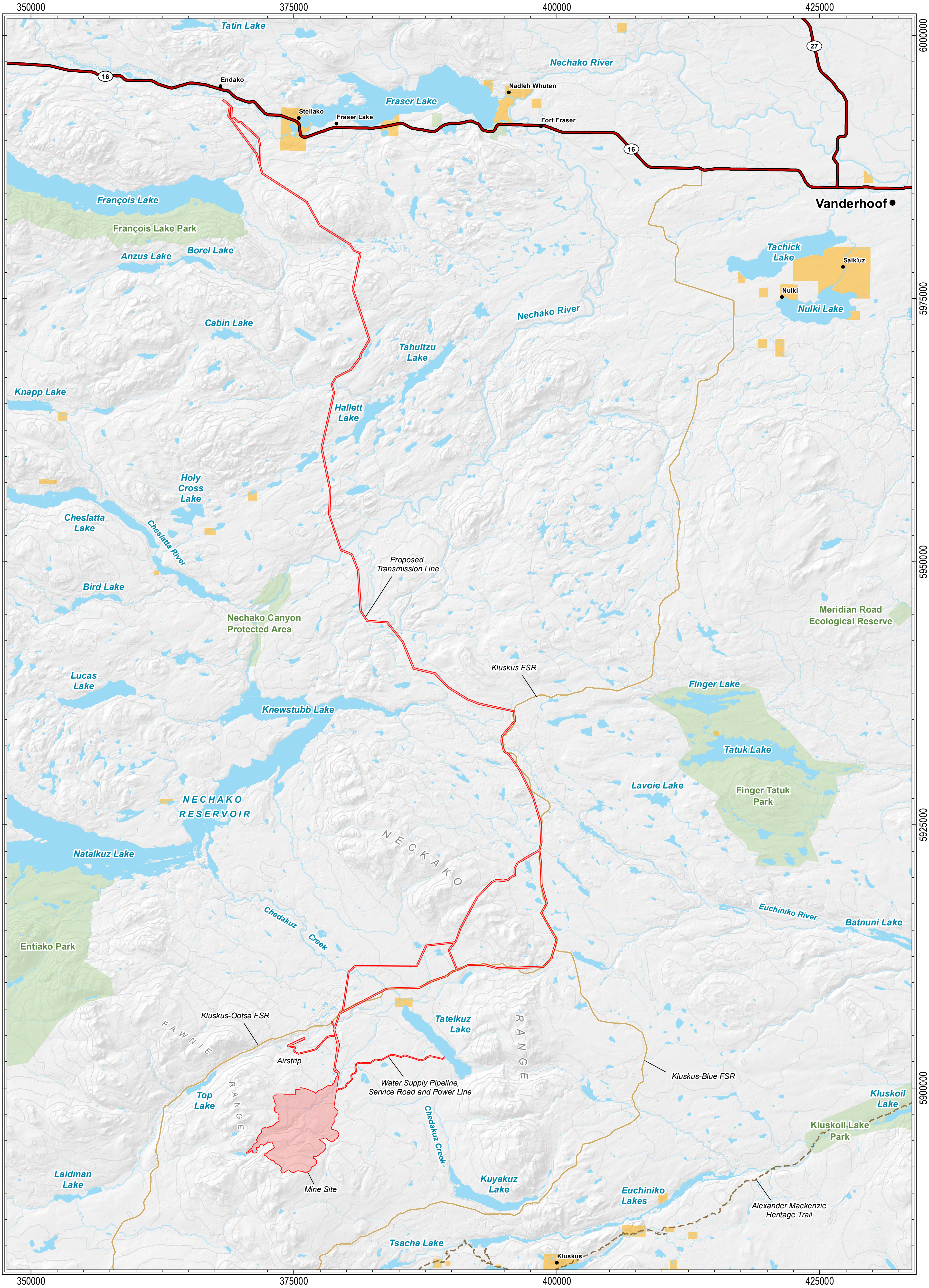
Based on information from the Canadian Environmental Assessment Agency regarding the Environmental Impact Statement, the Project has the potential to affect Aboriginal rights and Treaty rights and related interests of the following Aboriginal Groups:

- Lhoosk'uz Dené Nation;
- Ulkatcho First Nation;
- Nazko First Nation;
- Nadleh Whut'en First Nation;
- Saik'uz First Nation;
- Skin Tyee Nation;
- Stellat'en First Nation;
- Tsilhqot'in National Government; and
- Métis Nation of British Columbia.

The nearest Reserve to the Project is Indian Reserve No. 28 (Tatelkuz Lake) of the Lhoosk'uz Dené Nation.

Other communities within 100 km of the Project are:

- Endako;
- Engen;
- Fort Fraser;
- Fraser Lake; and
- Nulki.




## Legend

- Populated Place
- Highway
- Major Forest Service Road (FSR)
- Heritage Trail
- Watercourse
- Elevation Contour (100 m interval)
- Waterbody
- Indian Reserve
- Park or Protected Area
- Mine Footprint


Scale 1:350000
UTM Zone 10N
NAD 1983 Datum

0 5 10
kilometres

Prepared For:

**CLIENT:** Artemis Gold Inc.
**PROJECT:** Blackwater
DRAWN: B. Elder
CHECKED: I. MacLeod
PROJECT: 2006501
DATE: Jun 10, 2021

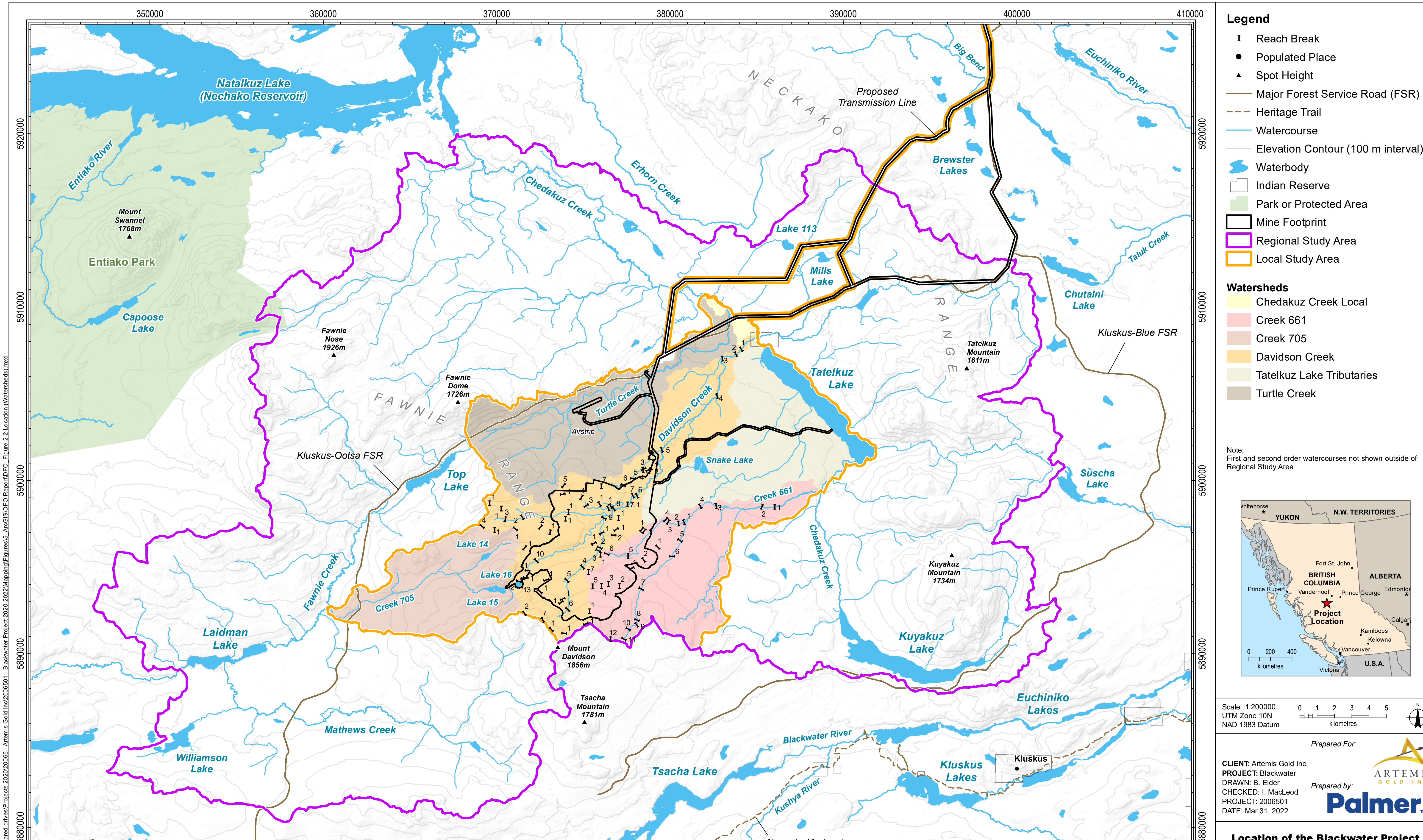
Prepared by:

**Location of the Blackwater Project South of Vanderhoof, BC**

**FIGURE 2-1**

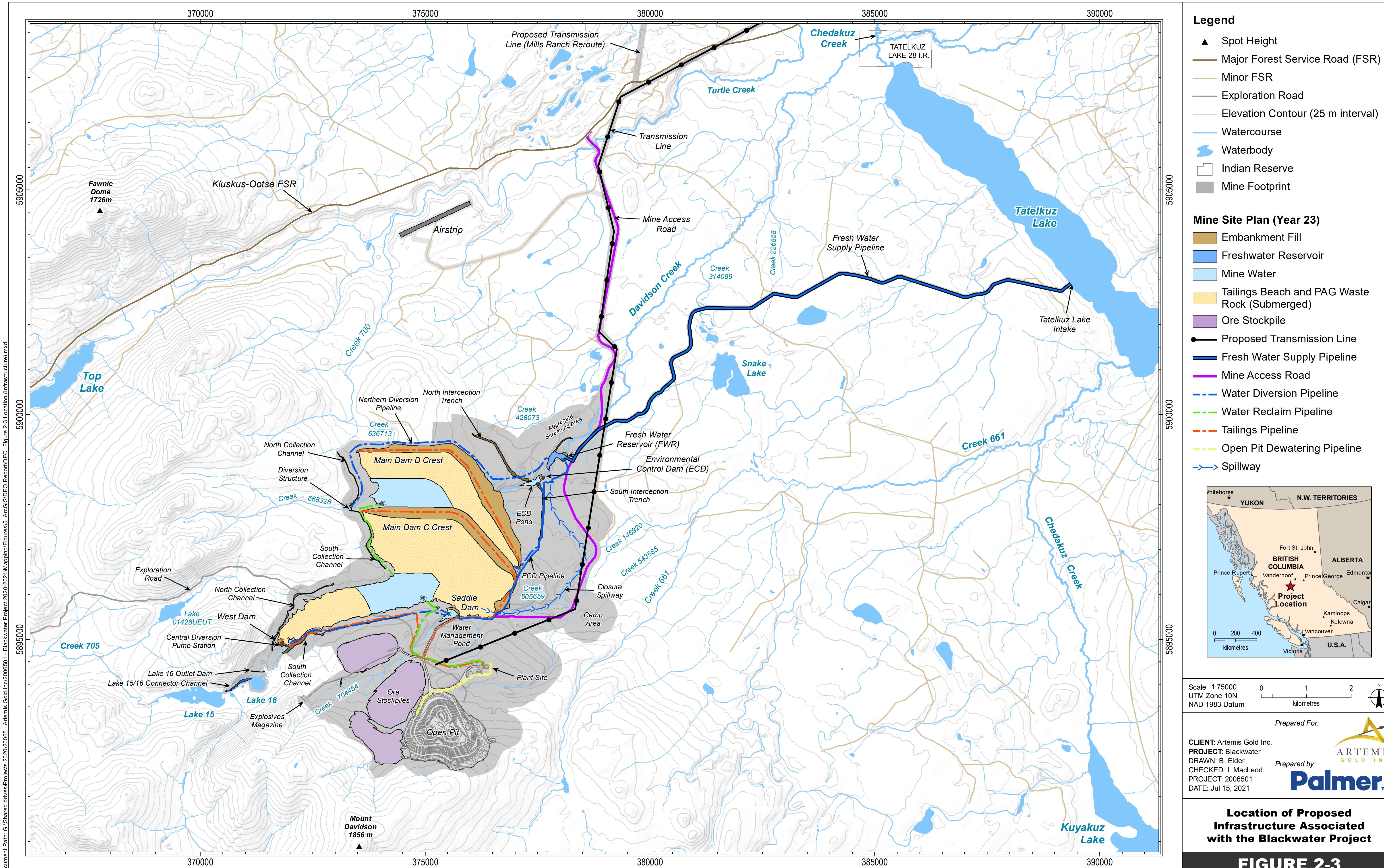


Document Path: G:\Shared drives\Projects 2020\20065 - Artemis Gold Inc\2006501 - Blackwater Project 2020-2021\Mapping\Figures\5_ArcGIS\DFO Report\DFO_Figure 2-1 Location.mxd




**Location of the Blackwater Project in Relation to the Davidson Creek and Creek 661 Watersheds**

**FIGURE 2-2**




**Location of Proposed Infrastructure Associated with the Blackwater Project**

**FIGURE 2-3**

*Table 2-1. Water Bodies in the Mine Site Aquatic Local Study Area of the Blackwater Project*

| Water Body Name | Description | Location Description within the mine site aquatic Local Study Area (LSA)1 | UTM Zone 10 | |
|---|---|---|---|---|
| | | | Easting | Northing |
| Davidson Creek | Davidson Creek flows northeast into lower Chedakuz Creek upstream of the Turtle Creek confluence. | The boundary of the LSA is defined by the western and southern boundaries of the Davidson Creek Watershed | 380730 | 5903190 |
| Lower Chedakuz Creek | Lower Chedakuz Creek flows out of the Tatelkuz Lake at its north end, to the Nechako Reservoir. | Lower Chedakuz Creek flows between Tatelkuz Lake and the confluence with Turtle Creek. The LSA boundary is defined by the eastern bank of Lower Chedakuz Creek. | 385088 | 5907939 |
| Middle Chedakuz Creek | Middle Chedakuz Creek flows from Kuyakuz Lake to Tatelkuz Lake. | The northern portion of middle Chedakuz Creek from the confluence with Creek 661 downstream to Tatelkuz Lake is within the LSA. | 389154 | 5900008 |
| Tatelkuz Lake | Largest Lake in the LSA, approximately 9 km long by 1 km wide, with a surface area of 910 ha and mean depth of 21.4 m. | The LSA boundary is defined by the southern and eastern shores of Tatelkuz Lake. | 389073 | 5904125 |
| Tatelkuz Lake Tributaries | The Tatelkuz Lake Tributaries drain northeast into the west side of Tatelkuz Lake. | The tributaries are located in the north-eastern end of the LSA. | - | - |
| Creek 661 | Creek 661 drains the northeast side of Mount Davidson from the Project mine site towards middle Chedakuz Creek upstream of Tatelkuz Lake. | Creek 661 and tributaries are distributed around the centre and southern end of the LSA. | 381210 | 5898005 |
| Turtle Creek | Turtle Creek flows northeast into lower Chedakuz Creek. | The main tributary of Turtle Creek is Creek 700, which drains to the west from the Project mine site. The LSA boundary is defined by the northwestern and western boundaries of the Creek 700 Watershed. | 376428 | 5904596 |
| Creek 705 | Creek 705 drains the southwest slope of Mount Davidson into Fawnie Creek, a tributary of the Entiako River. Lake 14 and Lake 15 are headwater lakes of Creek 705. | The LSA boundary is defined by the northwestern and southern boundaries of the Creek 705 Watershed. | 366051 | 5894520 |
| Lake 01682LNRS (Lake 16) | Headwater Lake of Davidson Creek having a circular basin of approximately 9.2 ha, and mean depth of 5.5 m. | Lake 16 is located in the western end of the LSA, near the drainage divide between the Chedakuz and Fawnie Creek watersheds. | 371261 | 5894062 |
| Lake 01538UEUT (Lake 15) | Headwater Lake of Creek 705, located in the Fawnie Creek Watershed (of which the Creek 705 Watershed is a sub-watershed). | Lake 15 is Reach 7 of Creek 705, located in the western end of the LSA. | 369888 | 5893794 |
| Lake 01428UEUT (Lake 14) | Headwater Lake of Creek 705, located in the Fawnie Creek Watershed (of which the Creek 705 Watershed is a sub-watershed). | Lake 14 is located in the western end of the LSA. | 369320 | 5895648 |
| Snake Lake | Snake Lake is in the Tatelkuz Lake Tributaries Watershed | Snake Lake is approximately in the centre of the LSA. | 381549 | 5900972 |

*Notes: 1 – More information on the aquatic local and regional study areas (LSA and RSA) defined in the Application/EIS is provided in Section 3.1 Mine Site Aquatic Local and Regional Study Areas*

### 2.1.2 Principal Mine Components and Infrastructure

The mine components and infrastructure are described in detail in the Assessment of Alternatives (ERM 2021), Initial Project Description (ERM 2020), and the Pre-Feasibility Study (Artemis 2020). A list of each component is provided below, with additional detail provided for components that may interact with fish and fish habitat and are subject to the MDMER (2002) Schedule 2 amendment process.

#### *2.1.2.1 Project Components Located on the Mine Site*

The mine site contains the following Project components:

- The open pit and dewatering system;
- TSF, dams, spillways and barge reclaim system;
- TSF seepage collection system, including environmental control dam and plunge pool;
- Freshwater reservoir;
- Waste rock and overburden storage facilities, including surface water diversions;
- Low grade ore, high grade ore and live ore stockpiles, including diversion channel, low permeability foundation and seepage collection system;
- Water management infrastructure including ponds, dams, ditches, foundation drains, pipelines and structures for managing surface water;
- Southern, Central, and Northern diversions;
- Mine water treatment plants, ponds, pumps and piping;
- Process plant buildings (mill, reagent, adsorption, crushing and grinding circuits and gold room);
- Reclaim conveyors;
- Elution and refinery building;
- Whole ore leach tanks;
- Borrow areas and quarries;
- Sand and gravel screening and cement batch plant;
- Fire suppression system;
- Ancillary buildings including truck shop, warehouse, administrative building, mine dry and emergency services building;
- Soil stockpiles;
- Groundwater wells for potable and firewater use;
- Domestic sewage treatment system;
- Incinerator system;
- Waste management handling facilities (hazardous and non-hazardous (recyclable) waste storage and off-site shipment);
- Soil bioremediation cell;
- Electrical distribution system, including pole line, electrical substation and portable substations;
- Temporary Construction phase power plant and emergency standby power plant;
- Satellite, telecommunications and security systems;
- Main truck shop;
- Administration and emergency services buildings;
- Laboratory;
- Explosives storage and emulsion plant;
- Fuel farm;

- Permanent camp;
- Airstrip and airstrip access road;
- Helipad;
- Haul roads and other site access roads;
- Portions of the Mine Access Road; and
- Portions of the electrical transmission line.

Components off the mine site include:
- Portions of the Mine Access Road;
- Portions of the electrical transmission line;
- Portions of the freshwater supply system (FWSS), including service road, overhead power distribution line and stepdown transformers, pipeline, booster pump stations, borrow, equipment and material laydown areas, water intake and pumping stations, and
- Transmission line access roads, borrow, equipment and laydown areas.

The mine site will be located in the headwaters of Davidson Creek and Creek 661, with the majority of the footprint falling within the upper watershed of Davidson Creek.

#### *2.1.2.2 Mine Components Subject to Schedule 2 Amendment*

The TSF, ECP, low-grade and high-grade ore stockpiles, and the overburden and NAG waste rock storage facilities (i.e., the mine components that are subject to the Schedule 2 amendment process) are described in the following sections. Additional detail is available in the Assessment of Alternatives (ERM 2021), the Initial Project Description (ERM 2020), and the Pre-Feasibility Study (Artemis 2020).

*Tailing Storage Facility*

The primary design objectives for the TSF are to:
- Have minimal long-term environmental effects;
- Provide reliable and durable long-term containment with low maintenance and monitoring requirements; and
- Be able to safely and effectively contain tailings and potentially acid generating and metal leaching potential (PAG/ML) waste rock produced over the life of the mine.

The TSF is designed to permanently store 334 Mt of tailings, in addition to 467 Mt of PAG and NAG waste rock (PAG1, PAG2 and NAG3[2]). The TSF design includes the following requirements:
- Permanent, secure and total confinement of all solid waste materials within engineered disposal facilities;
- Control, collection and removal of free-draining liquids from waste rock and tailings during Operations for recycling as process water to the maximum extent practicable;
- Prevention of acid rock drainage (ARD) and minimization of metal leaching (ML) from potentially reactive tailings and waste rock;

*[2] PAG1 is potentially acid generating and has a neutralization potential ratio (NPR) of less than or equal to 1.0; PAG2 has an NPR of greater than 1.0 and less than or equal to 2.0; NAG3 is non-acid generating with an NPR > 2.0 and Zinc ≥ 1,000 ppm*

- Inclusion of monitoring features for all aspects of the facility to confirm performance goals are achieved and design criteria and assumptions are met; and
- Staged development of the facility over the life of the mine.

The TSF comprises two adjacent sites, TSF C and TSF D. The Pre-Feasibility Study includes a shift of the Main Dam C downstream relative to its location in the Project's Application/EIS (New Gold 2014). This shift was required to:

- Simplify water management during early Operations;
- Optimize initial capacity and haul distances;
- Improve constructability due to more gentle terrain; and
- Use the existing drivable trails network to facilitate construction to the extent practicable.

The ultimate TSF footprint remains unchanged from the footprint reviewed and assessed during the EA, and the TSF general arrangement is shown in Figure 2-3.

The TSF embankments will be engineered, water-retaining, zoned earthfill/rockfill dams with compacted low-permeability core zones and appropriate filter/transition zones. A total of four embankments will be constructed across the two sites: the Main Dam D, the Main Dam C, the Saddle Dam, and the West Dam. The dam construction materials balance is integrated with the mine plan to limit the need for additional external borrow material sources following initial site establishment and early TSF construction. Several borrow sources should be available in the vicinity of the TSF basin, including pit-run granular fill materials for the dam shell, fine-grained glacial till for the core zone, and aggregate materials that could be crushed and/or screened to produce desirable quantities and grain size distributions for engineered fill materials.

TSF C will be constructed first to provide storage capacity for process plant start-up. TSF C is designed to contain up to approximately 17 years of tailings and the first six years of PAG/NAG3 waste rock and includes a storage allowance for the supernatant pond to provide a continuous source of process water for mill operations. The first stage of the Main Dam C will be constructed to provide sufficient capacity for a start-up pond up and to impound tailings and PAG/NAG3 waste rock generated during the first year of Operations, with additional capacity to contain the Inflow Design Flood (IDF). The Main Dam C will be raised annually thereafter through year 15 using centerline construction methods to reach an ultimate elevation of approximately 1,353 metres above sea level (masl). The West Dam will be constructed in a single stage to an elevation of 1,353 masl in approximately Year 6 to constrain the western extent of TSF C. A saddle dam will also be required on the southeastern side of TSF C beginning in approximately Year 6 and will be raised annually with the Main Dam C. The dam raise schedule includes consideration for several downstream step-outs of the shell zone, which are designed to support several staged vertical raises of the embankment. Each raise is designed to provide enough storage for the following year of Operations, a sufficient supernatant pond allowance ranging from approximately 2 to 10 $Mm^3$ (which is aligned with the staged capital expansion of the mill facilities), and additional capacity to store the IDF.

The TSF D will be formed by constructing the Main Dam D parallel to and downstream of TSF C beginning in Year 5 to provide additional storage capacity for PAG/NAG3 waste rock and tailings. Filling of TSF D will begin in Year 7 following two years of initial construction. The facility is designed to contain PAG/NAG3 waste rock generated between Years 7 and 18 and up to approximately six years of tailings beginning Year

17 when TSF C reaches design capacity. The Main Dam D will be raised by centreline method beginning in Year 7, reaching an ultimate elevation of 1,340 masl.

Tailings from the process plant will be delivered by gravity through a pipeline to either TSF C or TSF D. Expansions to the tailings distribution system will coincide with expansions to the mill facilities and to provide sufficient tailings distribution capacity at each stage of mine development. An additional pipeline extending to TSF C will be constructed in a suitable location to allow for emergency discharge of tailings to the TSF. Tailings will initially be discharged into TSF C from one or more points on the west side of the facility with PAG/NAG3 waste rock deposited directly upstream of the Main Dam C during the first six years of Operations to enhance stability on the upstream side of the dam. The tailings distribution system will be extended along the crest of the Main Dam C during Year 6 to allow for tailings discharge from the dam crest beginning in Year 7 to cover submerged PAG/NAG3 waste rock and manage the location of the supernatant pond. The tailings distribution system will be extended along the crest of the Main Dam D in approximately Year 16 to allow for tailings discharge from the dam crest beginning in approximately Year 17 to cover submerged PAG/NAG3 waste rock. Process water recovered following discharge of tailings to TSF D will be pumped to the supernatant pond in TSF C for reuse in ore processing.

Geotechnical instrumentation will be installed during construction along representative instrumentation planes within the West Dam, Main Dam C, Saddle Dam, and Main Dam D. The geotechnical instrumentation will consist of vibrating wire piezometers, slope inclinometers, settlement and movement monitoring points, and it will be installed within the foundations, embankment fill, and on embankment crests. Instrumentation monitoring will be carried out routinely during construction and operation. Daily measurements will be taken and analyzed during construction to monitor the response of the embankment fill and the foundation from the loading of the embankment fill. The operational monitoring systems will be connected to an automated data acquisition system that provides real-time access to the monitoring data.

The full extent of the TSF C overlays the upper reaches[3] of the Davidson Creek mainstem (portions of Reaches 10 and 11 and unnamed tributaries), Creek 704454 (portions of Reaches 1 to 4), and Creek 505659 (portions of Reaches 6 and 7, and an unnamed tributary).

The full extent of the TSF D overlays the Davidson Creek mainstem (portions of Reaches 8 to 10 and unnamed tributaries), Creek 704454 (lower portion of Reach 1), Creek 668328 (portions of Reaches 1 and 2 and unnamed tributaries), and Creek 636713 (portions of Reaches 1 to 4 and unnamed tributaries).

*Environmental Control Pond*

The primary seepage collection point downstream of the TSF following construction of TSF D will be the Environmental Control Pond (ECP), located approximately 1km downstream at a topographic low point in Davidson Creek, upstream of the FWR. The ECP will be created by constructing an approximately 12 m high Environmental Control Dam (ECD) across Davidson Creek (Figure 2-3). The pond will be fed by two interception trenches. The primary pumpback system at the ECD is designed to convey flows to TSF D and maintain the pond at a minimum water level. The ECD design will also include a spillway for dam safety

[3] *Reach boundaries defined the Application/EIS (New Gold 2014) are shown on Figure 2-2 and are further described in Section 3.3 Fish Habitat.*

purposes. The ECD will have an embankment drain system, seepage collection sump and monitoring device, and secondary pump-back system to collect and recycle seepage.

The ECP overlaps a portion of Reach 7.1 in Davidson Creek.

*Low-Grade Ore and High-Grade Ore Stockpiles*

When ore is mined from the pit it will be delivered either to the crusher, the run-of-mine (ROM) stockpile located next to the crusher, the low-grade ore stockpile, or the high-grade ore stockpile (Figure 2-3). The low-grade ore and high-grade ore stockpiles are co-located and will receive ore that is of lower grade than that which will be delivered directly to the crusher or the ROM stockpile.

The stockpiled ore (low grade and high grade) is planned to be re-handled back to the crusher during the mine life. Processing of the high-grade ore stockpile would be completed earlier than the low-grade ore stockpile. Under the current mine plan, the ore stockpiles will reach their greatest total volume in Year 9 of mining operations. The stockpiles will be designed to be meet the BC Mine Waste Rock Pile Research guidelines (Sections 10.1.6 and 10.6.7 of the Code [EMLI 2022]).

Current estimates have up to 111 Mt of ore (combined low-grade and high grade), with the majority being low-grade stored at the stockpiles.

Ore is classified as PAG with a relatively short lag time to acid production and the ore stockpiles are expected to generate acidic drainage with elevated metals until the ore is processed. The stockpiled ore will be placed on a low-permeability foundation with surface water and seepage collection and monitoring systems. The drainage will be collected, then neutralized with lime, prior to discharge to the TSF.

The low-grade and high-grade ore stockpiles are located in the upper reaches of the Creek 704454 Watershed. The low-grade ore stockpile footprint, at its largest extent, overlaps portions of Reaches 5 and 6 of Creek 704454 and unnamed tributary streams. The high-grade ore stockpile overlaps a portion of Reach 5 of Creek 704454 and one unnamed tributary stream.

*Overburden and Non-Acid Generating Waste Rock Storage Facilities*

Stockpiles are planned for surplus NAG waste materials from the open pit in the waste rock storage facility. Overburden and NAG waste not used in the construction of the TSF will be placed in either the upper overburden stockpile or the lower overburden stockpile. The stockpiles will be designed to meet the BC Mine Waste Rock Pile Research guidelines (Sections 10.1.6 and 10.6.7 of the Code [EMLI 2022]). These stockpiles are shown in Figure 2-3.

The upper overburden stockpile will be located directly west of the pit limits and will store solely overburden waste materials. The lower overburden stockpile will be located 1.5 km northwest of the pit limits and will store of NAG waste rock and overburden.

The waste rock storage facility stockpile layouts are designed to minimize surface water control requirements. Foundation drains will be installed in areas of existing drainage lines or when excessive seeps or springs are encountered during clearing and grubbing. Non-contact surface water will be diverted around the waste rock storage facilities during Operations and Closure and will be field-fit with the advancing fill platforms. Water that infiltrates through the waste rock storage facilities will be collected in ditches near the toe of the waste rock storage facilities and routed to a sediment basin before discharge to the TSF.

The upper overburden stockpile is located in the upper headwaters of Creek 704454. The footprint overlaps portions of Reaches 6 and 7 of Creek 704454 and portions of two first order tributaries to Creek 704454.

The lower NAG and overburden stockpile is located between the Davidson Creek and Creek 704454 catchments and does not overlap any mapped stream segments.

#### *2.1.2.3 Project Components Located on the Mine Site not Subject to Schedule 2 Amendment*

The following components on the mine site may have interactions with fish and fish habitat, but are not directly associated with the Schedule 2 Amendment.

*Water Management*

The water management facilities will be developed by identifying the size and position of the planned mine site facilities and establishing estimated catchment area boundaries based on the mine site development concept. All drainage from the mine will flow by gravity into the TSF to simplify water management, spill control and mine closure. Water within the Project area, excepting clean water diversions, will collect runoff from the mine site area and recycle process water to the maximum practicable extent. The tailings and mine water management plan will include the following strategies:

- Manage sediment mobilization and erosion by installing sediment controls prior to land disturbance and limiting land disturbance to the minimum practicable extent.
- Include appropriate temporary erosion and sediment control measures or use Best Management Practices (BMPs) prior to and during initial land disturbance.
- Use water within the Project area by collecting and managing site runoff from disturbed areas, maximizing the recycle of process water, and storing water within the TSF to the maximum practicable extent.
- Include staged engineered diversions (Southern, Central and Northern diversions) to allow diversion of upstream flows from significant undisturbed catchment areas around the TSF to the Fresh Water Reservoir (FWR). Flow diversions will be operated as part of the mine site water balance and will be used for ore processing or Davidson Creek instream flow needs as required.
- During operations, drainage from the low-grade, high-grade and coarse ore stockpiles may become acidic with elevated metals content; the drainage will be collected and neutralized with lime to increase the pH and precipitate metals before discharge to the TSF. Pit water is predicted to be of neutral pH with relatively low metals content during operations; it will be pumped to a small holding/monitoring pond, which will overflow to the TSF or be treated/released to a permitted discharge location in the downstream receiving environment.
- Collect recoverable TSF seepage downstream of the main dam during operations and post closure until the pit lake overflows or the water is acceptable for direct discharge to Davidson Creek.
- Monitor surface water and groundwater quality, maintain fish habitat, adhere to fish habitat offset plans, and reclaim disturbed areas.

Components of the Water Management System are described in the following sub-sections.

Fresh Water Reservoir

The FWR is an in-creek water reservoir that will be created by constructing an approximately 14 m high dam across Davidson Creek. The reservoir will have a storage capacity of up to approximately 400,000$m^3$. The purpose of the FWR is to maintain a suitable source of fresh water to support mine operations and provisional flows to lower Davidson Creek as required to reduce the Project's potential impacts on fish and fish habitat. The FWR will receive inflows from the following several sources:

- Direct precipitation on the FWR and runoff from contributing catchment;
- Diverted flows from undisturbed areas upgradient of the TSF that will be conveyed around the TSF to the FWR;
- Mine contact water that is suitable for release to the downstream receiving environment; and
- Fresh water from Tatelkuz Lake supplied by the FWSS.

Water release from the reservoir will be controlled by a discharge structure, including temperature and flow measurement devices. A spillway will route storm flows through the reservoir and around the dam.

Southern Diversion

The Southern Diversion will be located up-gradient of TSF D and will be constructed during the initial construction period to divert upstream flows around mine infrastructure and the TSF. The Southern Diversion intake structure will consist of a small (i.e., less than 5 m high) concrete intake structure to submerge the water conveyance pipeline. The intake structure will include a gated sluice pipe to clean out sediment accumulation and a spillway sized to convey an appropriate design peak flow in the event that the water conveyance pipeline and gated sluice pipe became inoperable. The spillway will consist of a wide broad-crested weir capable of passing the design storm while maintaining sufficient freeboard. Flows will be conveyed around mine facilities within the water conveyance pipe and discharged to the FWR. The pipeline will be relocated and extended in Year 6 during construction of TSF D. The ditches to convey flows to the intake structure will be shallow trapezoidal shaped ditches with erosion resistant material placed over a non-woven geotextile, which will help prevent erosion of any underlying fine soils.

Central Diversion

The Central Diversion will consist of a small berm to impound water within Davidson Creek upstream of the TSF area, and skid-mounted pump systems and water conveyance pipeline to route flows to the Southern Diversion or around the TSF area to the FWR. The Central Diversion intake infrastructure will initially be located near the existing exploration access road during initial Project construction and will be relocated in approximately Year 6 to the west of the West Dam following its construction. The berm will be less than approximately 5 m high and constructed of locally borrowed overburden materials. A second flow-through berm will be constructed of screened gravel and cobble-sized materials upstream of the water collection area to limit fish access from upper Davidson Creek.

Northern Diversion

The Northern Diversion will be located up-gradient of TSF D and will be constructed in approximately Year 6 to divert upstream flows around the TSF. The Northern Diversion intake structure design will be similar to the Southern Diversion, consisting of a small (i.e., less than 5 m high) concrete intake structure to submerge the water conveyance pipeline. The intake structure will include a gated sluice pipe to clean out sediment accumulation and a spillway sized to convey an appropriate design peak flow in the event that the water conveyance pipeline and gated sluice pipe became inoperable. The spillway will comprise a broad-crested weir capable of passing the design storm while maintaining sufficient freeboard. Flows will be conveyed around the mine facilities within the water conveyance pipe to the FWR. The ditches to convey flows to the intake structure will be shallow trapezoidal shaped ditches with erosion resistant material placed over a non-woven geotextile, which will help prevent erosion of any underlying fine soils.

Water Reclaim System

Water reclaimed from the supernatant pond at TSF C will be delivered to the reclaim water tank at the mill. The reclaim water system will initially comprise a barge-mounted pump station and reclaim water pipeline. The reclaim barge will be anchored on the southern side of the TSF C supernatant pond throughout operations, and tailings will be selectively discharge to the TSF to maintain the location of the supernatant pond. The reclaim water system in TSF C will be twinned in Year 5 and a third parallel system will be added in Year 10. In addition, a barge-mounted pump station will be added to TSF D in Year 16 to convey flow from TSF D to TSF C.

Interim Environmental Control Dam

A seepage collection pond, the interim ECD, will be created downstream of the Main Dam C at a topographic low point in Davidson Creek. This pond will provide containment for seepage and mine-affected surface water runoff downstream of TSF C prior to construction of TSF D. The interim ECD will be equipped with a spillway for dam safety purposes and include a pumpback system and pipeline to convey collected flows back to TSF C.

*Water Supply*

Mine Operations Water Supply

Water for mine operations will be sourced by collecting runoff from the mine site area and recycling process water to the maximum practicable extent. All mine site contact water during operations and closure will drain by gravity to the TSF. Seepage from the TSF and WRSFs will also be collected and directed to the TSF. The water supply sources will include:

- Runoff from catchment areas above the TSF, other than runoff captured by the Northern, Central or Southern diversions;
- Direct precipitation onto the TSF and runoff from mine site facilities;
- Water recycled from the TSF supernatant ponds and the water management pond;
- Groundwater and surface water from open pit dewatering and depressurization;
- Water extracted from groundwater wells within the mine site area;
- Runoff water from undisturbed areas diverted around the mine facilities to the FWR; and

- Fresh water pumped from Tatelkuz Lake.

Water stored in the TSF C start-up pond will be the primary water source for processing at the start of mill operations. An adequate volume of water within TSF C will be maintained throughout operations to provide a continuous source of water for mill operations. Runoff water accumulating in TSF D beginning in Year 5 will be conveyed to TSF C (via the pump system at the interim ECD) as necessary to control the rate of inundation of PAG/NAG3 waste rock and to maintain sufficient freeboard to manage the IDF. Once tailings deposition in TSF D commences in Year 17, process water conveyed with the tailings slurry will be transferred from TSF D to TSF C pond prior to being reclaimed to the mill to support ore processing. Additional makeup water, if required, will be provided from the Southern, Central and Northern diversions.

Freshwater Supply System

The FWSS will pump water from Tatelkuz Lake to the FWR to offset flow reductions in lower Davidson Creek and meet instream flow needs for downstream fisheries. The FWSS is described in more detail in Section 2.1.2.4 Project Components Located off the Mine Site not Subject to Schedule 2 Amendment.

*Water Treatment Plants*

At the start of operations, water treatment plants will be installed to provide water management flexibility by allowing the release of excess water should it accumulate on site. During post-closure, mine-affected water is expected to require treatment before discharge to the environment.

*Power Supply*

A new approximately 135 km, 230 kilovolt (kV) overland transmission line will connect to the BC Hydro grid at the Glenannan substation located near the Endako mine, 65 km west of Vanderhoof. The incoming transmission line will terminate at the site main substation adjacent to the main process facilities. The anticipated maximum connected load is 110 megawatt (MW) for the fully expanded Project. Commissioning of power to the mine site is planned for Year -1, prior to commissioning of the operations. Further detail on the off-site transmission line is provided in Section 2.1.2.4 Project Components Located off the Mine Site not Subject to Schedule 2 Amendment. Emergency power will be available from a standby power station.

*Buildings*

A variety of buildings will be constructed on site to support mine operations, including process plant buildings (e.g., mill building, crusher facility buildings), offices, a laboratory, equipment maintenance buildings, and worker accommodations.

*Mine Site Roads*

Mine site roads will be necessary to provide access to the plant, accommodation, truck-shop, explosives store and other ancillary facilities. Depending on frequency of use and safety considerations, these roads may be single or double-laned with variable width to accommodate anticipated traffic.

*Borrow Sources*

There are potential borrow source locations within the mine site. The following areas have been identified as potential sources:

- Approximately 500,000 m3 of material could be generated from excavations at the plant site;
- Several suitable borrow sources should be available within 2 km of the Main Dam C;
- In excess of 3 Mm3 of materials could be sourced from a site approximately 5 km north of the plant site alongside the new mine access road;
- In excess of 3 Mm3 of sand and gravel materials are available from an Esker deposit located within the CPD, approximately 10 km from the plant site area straddling the mine access road; and
- Additional borrow sources may be identified during site preparation and the materials assessed for suitability for use in construction (e.g., open pit stripping).

#### *2.1.2.4 Project Components Located off the Mine Site not Subject to Schedule 2 Amendment*

The following components fully or partially off the mine site may have interactions with fish and fish habitat but are not directly associated with the Schedule 2 Amendment.

*Freshwater Supply System*

The FWSS is proposed to augment flow reductions in middle and lower Davidson Creek and consists of a water supply pipeline, an outlet at the FWR, booster pumpstation(s), and connections to the FWR outlet works. The intake and pipeline system will pump water via pipeline from Tatelkuz Lake to the FWR built in Davidson Creek downstream of the TSF. Controlled release of water from the reservoir will be used to supplement flows in Davidson Creek during portions of Operations and Closure phases. The FWSS, as designed, has sufficient capacity to meet instream flow needs of Davidson Creek.

The life of mine water balance (Knight Piésold 2021a) which is reflective of optimizations made to the project since the EA indicates that under average climate conditions, the FWSS is not required to meet IFN during Construction and the first five years of Operations. During this time the FWR will be used to meet IFN without the need to withdraw water from Tatelkuz Lake. Mitigation of effects to Tatelkuz Lake and Chedakuz Creek due to pumping of water as part of the FWSS was identified as an important consideration for project implementation during and subsequent to the EA, and this consideration is reflected in Decision Statement condition 3.10 and 3.16 and provincial EAC condition #31.

When considering the range of potential climate scenarios, under a drier than average year, the FWSS is predicted to have a 25% likelihood of being needed within the first five years of Operations. For this reason, combined with the interest in minimizing impacts to Tatelkuz Lake and Chedakuz Creek, BW Gold is proposing to construct the FWSS to supplement flows starting in Year 6. Before that time, the mine will use the FWR and outlet system to maintain flows in Davidson Creek, at or above a temporary minimum flow threshold (Palmer 2022a). Monitoring data on flows, temperature, and other biophysical elements collected during the first 5 years of Operations will be used to drive adaptive management and implementation of the pipeline after this period. The intake and pipeline system is predicted to be consistently needed from Year 6 of Operations through Closure, providing approximately 10% to 40% of total annual IFN flows under average conditions.

The FWSS comprises the following major components:

- An intake facility on Tatelkuz Lake, including screened pipes, a pump station, a laydown area, and any required bank protection;
- A 14 km-long pipeline and associated pump booster station, maintenance access roads, and transmission line extending from Tatelkuz Lake to the FWR in Davidson Creek immediately downstream of the ECD;
- A temperature and flow control system that will contain multiple outlets at varying elevations to accommodate water temperature requirements for Davidson Creek. The outlets are designed to feed through the Temperature and Flow Control Chamber to assist with flow and temperature regulation.

The intake structure will be located on the western shoreline of Tatelkuz Lake. The water intake is envisaged to be via a land-based, permanent, two level, wet-well concrete structure on the Tatelkuz Lake shoreline.

The FWSS pipeline and access road traverse the Davidson Creek and Creek 661 watersheds and will cross tributaries to Tatelkuz Lake that enter from the south. A total of eight watercourses will be crossed, with the pipeline buried at five of the crossings. At three crossings, the pipeline will be attached to a bridge structure. One booster pump station will be required to reach the FWR. The right of way (ROW) for the proposed pipeline is 10 m wide and has an area of 21.1 ha. An access road will parallel the pipeline alignment along existing logging roads, with some new construction required. The remainder of the pipeline parallels the mine access road.

Water from the FWSS will be stored within the FWR prior to release to Davidson Creek. The FWR includes multiple outlets at varying elevations to accommodate water temperature requirements for Davidson Creek. The outlets are designed to feed through the Temperature and Flow Control Chamber to assist with flow and temperature regulation. In addition, an ultrasonic flow meter will be installed on the pipes upstream of the outlet valves to accurately measure flows.

The FWR will be in middle Davidson Creek, downstream of the ECD. This reservoir will be created by constructing an approximately 14 m-high dam and will have an estimated storage volume of 400,000 $m^3$. The dam for the FWR will be located at the top of Reach 6 and will back-flood Davidson Creek upstream to the ECD.

*Transmission Line*

An approximately 135 km, 230 kV overland transmission line will be constructed to connect the Project to the BC Hydro grid at the Glenannan substation located near the existing Endako mine, 65 km west of Vanderhoof. The transmission line has been routed to follow existing linear infrastructure (roads and transmission lines) and avoid increasing disturbance within remaining areas of intact forests as much as practicable.

Overall, the transmission line crosses 119 drainages, of which 39 are confirmed fish-bearing, 7 were assigned default fish-bearing ratings, and 73 were assessed as non-fish-bearing, non-classified drainages, or not watercourses (ERM 2017).

*Airstrip*

An airstrip may be constructed to the north of the mine, accessed via and access road branching from the new Mine Access Road. The airstrip will not be located near any aquatic habitat.

*Roads*

A 15.6 km long new Mine Access Road will be constructed, starting at about km 124.5 of the Kluskus-Ootsa FSR and terminating at the Mine Site. The Mine Access Road will be 5 m wide during Construction and up to 10 m wide. It will cross five permanent fish-bearing streams and four non-classified drainages. Fish bearing stream crossings will be constructed with permanent clear-span bridges.

Construction of new access roads will be required for the transmission line. An off-site road will also be needed for the FWSS to the pumping station on Tatelkuz Lake and for water pipeline maintenance and monitoring. The FWSS pipeline routing follows existing roads where possible, but some new road construction will be required.

An airstrip access road, approximately 500 m in length, will also be constructed. The access road will cross three watercourses, via two existing crossing structures and one new clear-span bridge.

### 2.1.3 Project Timeline

The proposed mine plan includes two years of construction followed by a 23-year operations phase. Open pit mining is expected to run from year 1 through year 18. Low grade ore will be stockpiled and processed from approximately year 10 through year 23 of operations.

Reclamation of areas not reclaimed by the end of the mine life will occur following mine closure except where these areas are needed to support Closure and Post-Closure activities. Table 2-2 shows the scheduled phasing of the Project.

***Table 2-2. Blackwater Project Phases and Schedule***

| Project Phase | Duration | Project Year |
|---|---|---|
| Construction1 | 2 years | Year -2 and Year -11 |
| Open Pit Operations1 | 18 years | Year 1 to Year 181 |
| Low-Grade Ore Stockpile Rehandle1 | 5 years | Year 19 to Year 231 |
| Reclamation and Closure2 | 24 years | Year 24 to Year 47 |
| Post-Closure2 | n/a ł | Year 47 onwards ł |

*Notes:*
1. *The timing of these phases is based on Pre-Feasibility Study (Artemis 2020)*
2. *The timing of these phases is estimated*
3. *Post-Closure monitoring and maintenance will continue until the long-term environmental objectives are achieved.*

#### *2.1.3.1 Construction*

Construction activities associated with the mine site are listed in approximate chronological order based on the Assessment of Alternatives (ERM 2021), the Pre-Feasibility Study (Artemis 2020), and EA (some activities will overlap):

- Clear and grub the initial pit phases, the ex-pit haul road, plant and primary crusher site and portions of the ore stockpiles and upper overburden piles;
- Construct mine site roads and water management structures;
- Prepare stockpile pads and Main Dam C construction;
- Construct water diversion and management structures and the starter dam for tailings storage facility;
- Establish construction camp and services and the explosives magazine;
- Construct borrow pits and starter pit;
- Deliver construction rock to the process area (for use in the conveyor pads) and to the Main Dam C;
- Stockpile high-grade ore on the run-of-mine (ROM) pad and live ore stockpile for use in mill commissioning;
- Stockpile low-grade ore in the low-grade and high-grade stockpiles for storage until later in mine life;
- Deliver excess mined overburden to the upper overburden stockpile; and
- Construct the water treatment plant as well as the plant, processing, and tailings infrastructure.

A Sediment and Erosion Control Plan (SECP) will be implemented during the Construction phase of the Project (Appendix 2.2A-5 of the Application/EIS).

Construction activities associated with the linear development components of the Project include:

- Tree-removal, clearing, grading, topsoil storage, and placement of materials for mine access roads, transmission line access roads;
- Installation of stream crossings along roads where required;
- Tree-removal, clearing, grading, top-soil storage, and placement of materials for the FWSS access road, pump-house, booster pump stations and pipeline;
- Construction of the FWSS pipeline and stream crossings where required;
- Construction of the water intake pump house and the intake in Tatelkuz Lake;
- Tree and vegetation clearing and management along the transmission line ROW; and
- Installation of transmission line poles and cable stringing.

#### *2.1.3.2 Operations*

The Operations phase of the Project will focus on ore extraction and processing. Ore will be removed from the open pit, transported to the mill, processed, and disposed of into the TSF. Project activities during the Operations phase include:

- Progressive expansion of pit and stockpile areas;
- Drilling, blasting, and excavating ore and rock from the open pit and borrow pits;
- Processing the ore, which entails crushing, and feeding the crushed ore into a cyanide leach gold-silver recovery mill;
- Waste rock and tailings management (waste rock and over-burden will be segregated by type and placed in designated storage areas, tailings will be placed in TSF sites C and D);
- Raising of the Main Dams C and D, as required;

- Water management including construction of an environmental control dam that will capture seepage and surface runoff from TSF D (this water will be pumped back to the TSF) and treatment and discharge of site water;
- Operation of the FWSS to meet mill make-up water requirements and instream flow needs in Davidson Creek;
- Maintenance of the water management system;
- Progressive reclamation of the over-burden storage areas and waste-rock dumps using stockpiled topsoil and vegetation from clearing activities;
- Hazardous materials management (waste, explosives, spills), camp and offices waste management; and
- Site infrastructure and roads maintenance.

The Pre-Feasibility Study (Artemis 2020) and the Assessment of Alternatives (ERM 2021) contains further detail on the activities that will take place during the Operations phase.

#### *2.1.3.3 Closure/Decommissioning*

Project Construction and Operation will be undertaken in a manner that contributes to early planning for life-of-mine progressive reclamation and mine closure and reclamation to the extent possible. A Reclamation and Closure Plan will be submitted with the joint *Mines Act* (1996) and *Environmental Management Act* (2003) permits application.

The primary objective of Closure and reclamation initiatives is to return the mine site to a self-sustaining landscape that satisfies end land use objectives developed in collaboration with Indigenous Nations and government regulators. Reclamation objectives will consider land and resource management objectives and strategies in the Vanderhoof Land and Resource Management Plan. Methods to achieve end land use will include soil management and use, landform design, decommissioning and site preparation, revegetation prescriptions for specified ecotype targets, and seeding and planting densities.

Mine facilities will be reclaimed according to the approved Reclamation and Closure Plan and accepted practices at the time of Closure and in a manner that maintains long-term geochemical and physical stability. All buildings not needed beyond Closure will be removed, disturbed lands rehabilitated, and the property will be returned to otherwise functional use according to approved reclamation plans. Site infrastructure required for water management following Closure will be maintained and operated according to approved Closure water management plans.

The Reclamation and Closure Plan and follow-up monitoring and compliance reporting will include proposed performance standards, management, and monitoring strategies to verify reclamation success, and a timeline for reclamation and monitoring activities, along with reclamation research programs. The plan will include strategies for temporary closure and premature closure. The plan will emphasize soil, vegetation, and wildlife habitat reclamation, and provide a cross-reference to relevant management plans. A Closure and Post-Closure Water Quality Management Plan will be developed.

Conceptual end land use objectives will be included in the joint Application for *Mines Act* (1996) and *Environmental Management Act* (2003) permit application and confirmed in the final Reclamation and Closure Plan.

#### *2.1.3.4 Post-Closure*

The Post-Closure phase will commence once the open pit has been backfilled with water and water treatment demonstrates that water can be discharged downstream into Davidson Creek. Activities in the Post-Closure phase include:

- Monitoring of reclamation activities throughout the mine area and at off-site locations; and
- Treating site contact water before discharge to Davidson Creek; and
- Decommissioning of the FWSS and any other related water management infrastructure once the pit is filled and water quality is released into downstream Davidson Creek.

# 3. Description of Fish and Fish Habitat

The baseline studies on fish and fish habitat in the Local and Regional Study Areas of the Project are described in baseline reports (Appendix 5.1.2.6A and 6B of the Application/EIS). Although this Compensation Plan applies only to those areas subject to the Schedule 2 amendment, relevant information in the baseline reports for the mine site, as a whole, is summarized here to provide context.

## 3.1 Mine Site Aquatic Local and Regional Study Areas

Baseline studies for the Project commenced in 2011. A mine site aquatic Local Study Area (LSA) was defined that encompassed the region near the mine site where direct effects of mine activities are anticipated. The mine site aquatic LSA contains the following streams and lakes (Figure 2-3):

- Davidson Creek;
- Creek 661;
- Turtle Creek;
- Chedakuz Creek (from its confluence with Creek 661 downstream to its confluence with Turtle Creek);
- Tatelkuz Lake and its unnamed tributaries that enter from the south;
- Creek 705 in the Fawnie Creek Watershed;
- Lake 01682LNRS (Lake 16) in the Davidson Creek Watershed;
- Lake 01538UEUT (Lake 15) in the Creek 705 Watershed;
- Lake 01428UEUT (Lake 14) in the Creek 705 Watershed; and
- Snake Lake in the Tatelkuz Lake Tributaries watershed.

The aquatic Regional Study Area (RSA) for the Project encompasses the area surrounding the mine site aquatic LSA in which both direct and indirect effects may occur and comprises the entire Chedakuz Creek drainage and part of the Fawnie Creek drainage. The aquatic RSA contains the following streams and lakes (Figure 2-3):

- Kuyakuz Lake and all its tributaries;
- Middle Chedakuz Creek between Kuyakuz Lake and Tatelkuz Lake, and all its tributaries;
- Lower Chedakuz Creek between the confluence of Turtle Creek and the Nechako Reservoir, and all tributaries flowing into that stretch of the creek from the north-east and north-west;
- Tributaries to Chedakuz Creek between the outlet of Tatelkuz Lake and the confluence with Turtle Creek, including Davidson and Turtle creeks and those streams that drain Lake 113 and Mills Lake; and
- Upper Fawnie Creek Watershed from Laidman Lake upstream to Top Lake, and upstream of the headwaters of Creek 705 and Mathews Creek.

Separate study areas were defined for the transmission line and roads, and watercourse crossings along these linear corridors were assessed during baseline studies. These study areas are not relevant to the Schedule 2 amendment and are not considered further.

## 3.2 Fish and Fish Habitat Assessment Methods

Fish habitat and fish communities within the mine site aquatic LSA were assessed through field studies and reviews of existing information. For the mine site aquatic RSA, fish habitat and fisheries resources were characterized using existing information only. Information reviews utilized primary and secondary information sources, and covered studies conducted between 1977 and 2010. Baseline field studies of streams and lakes in the mine site aquatic LSA followed provincial and federal standards and guidelines.

Studies included sampling of aquatic biota (fish and other aquatic organisms), collection of continuous stream temperature, lake bathymetry and physical limnology data, habitat assessments, spawning surveys, and DNA microsatellite analysis to determine relatedness of same-species fish populations in adjacent watersheds. Field studies spanned multiple years (2011–2013) and seasons. Different methods, including electrofishing, gillnetting, minnow trapping, and angling, were employed to conduct stream and lake fish sampling and inventory. The methods for conducting information reviews and field assessments are further detailed in the Fish and Aquatic Resources Baseline Reports (Appendix 5.1.2.6A&B of the Application/EIS, Avison 2013a, 2013b).

## 3.3 Fish Habitat

Fish habitat that may be affected by the Blackwater Project is described in the Fish and Aquatic Resources Baseline Reports (Appendix 5.1.2.6A&B of the Application/EIS), and the Fish and Fish Habitat Effects Assessment (Section 5.3.8 and Section 5.3.9 of the Application/EIS). The following sections summarize the most pertinent information from those reports (i.e., the descriptions of fish habitat in the mine site aquatic LSA). Fish and fish habitat in the RSA (e.g., Kuyakuz Lake and its tributaries, Chedakuz Creek outside the LSA boundaries, and water bodies in the upper Fawnie Creek Watershed) are described in the baseline reports and are not summarized here as no impacts due to the deposit of tailings or waste rock will occur in these areas.

Detailed description of the areas subject to Schedule 2 amendment in relation to these watersheds is provided in Section 4.1 Potential Effects of the Deposit of Deleterious Effects at the Mine Site.

### 3.3.1 Davidson Creek Watershed

Fish habitat in Davidson Creek and its tributaries is described in Section 5.8.1 of the 2011-2012 Fish and Aquatic Resources Baseline Report (Appendix 5.1.2.6A&B of the Application/EIS).

Most of the Project infrastructure will be built in the upper Davidson Creek Watershed. Lake 16 is the headwater lake of Davidson Creek (Figure 2-2). Two headwater tributaries, Creek 688328 and Creek 704454, enter Davidson Creek in the upper watershed. Mainstem Davidson Creek was divided into three sections for the purposes of the baseline studies and effects assessment.

**Lower Davidson Creek (Reaches 1 to 4):** This section of Davidson Creek extends approximately 6 km upstream from the confluence with Chedakuz Creek and has riffle-pool morphology. The substrate contains abundant, suitably-sized gravels for kokanee (the lacustrine form of Sockeye Salmon, *Oncorhynchus* *nerka*) and Rainbow Trout (*O. mykiss*) spawning. These reaches also have stable banks, deep pools, and good channel and hydraulic habitat complexity from large woody debris, which contribute to high-quality habitat for fry and juvenile Rainbow Trout rearing. Existing land use in these reaches includes cattle grazing and forestry, which have influenced sections of the creek. Within the LSA, Davidson Creek provides approximately 6% of the available kokanee spawning habitat.

**Middle Davidson Creek (Reaches 5 to 8):** This section is approximately 11 km long, and is characterized by riffle and glide habitat, with fewer pools than are present in the lower section of the creek. Cobbles and boulders form the dominant substrate, with spawning gravels present in more isolated pockets than in Lower Davidson Creek. Habitat quality for Rainbow Trout spawning/egg incubation is good but only fair for summer rearing and overwintering due to the limited pool habitat. Existing land use in these reaches includes forestry.

**Upper Davidson Creek (Reaches 9 to 12):** This section is approximately 6 km long and is dominated by glides and runs. As a result, habitat complexity and suitability for spawning and juvenile rearing is lower than in the middle and lower sections of Davidson Creek. A cascade acts a partial barrier to fish at the bottom of Reach 11 and prevents fish passage for Rainbow Trout that migrate up from Tatelkuz Lake. Only the resident Rainbow Trout population in Lake 16 are able to use habitat in Reaches 11 and 12 of Davidson Creek. Those Rainbow Trout can migrate downstream over the cascade barrier.

Lake 16 is the headwater lake of Davidson Creek, near the summit of Mount Davidson. It has a circular shoreline with a perimeter of 1,667 m, a maximum depth of 16.3 m, and a surface area of 91,860 $m^2$. The lake is deep enough to stratify thermally in summer. The bathymetry of Lake 16 is shallow, which creates a large littoral area relative to its total surface area (62% of total area). The lake has one inlet located on the southwest shoreline, and one outlet to Davidson Creek exiting at the northeast corner of the lake. The upper watershed contains limited spawning and overwintering habitat. Stream spawning habitat for Rainbow Trout in Lake 16 is less than 50 $m^2$.

The lower reaches of the headwater tributaries to Davidson Creek provide some limited spawning and rearing habitat for Rainbow Trout. Habitat in these reaches is typically riffle-pool morphology. Cover is abundant and consists of large woody debris, overhanging vegetation, and under-cut banks. Farther upstream, substrates are more embedded with silt and fine organics, and habitat quality decreases. There are limited pools with sufficient depth and flow to support overwintering fish.

Water temperature is also a factor likely limiting Rainbow Trout and kokanee production in the Davidson Creek Watershed. Annual water temperatures in Davidson Creek are cooler than optimal temperatures for Rainbow Trout and kokanee. This is due to the northern aspect of Davidson Creek and its tributaries, and the influence of groundwater, which contributes approximately 90% or more of stream flow for over nine months of the year (Knight Piésold 2014).

### 3.3.2 Creek 661 Watershed

Fish habitat in Creek 661 and its tributaries is described in Section 5.8.3 of the 2011-2012 Fish and Aquatic Resources Baseline Report (Appendix 5.1.2.6A&B of the Application/EIS).

The Creek 661 Watershed lies to the east of the Davidson Creek Watershed and flows into Chedakuz Creek, which drains into Tatelkuz Lake. Creek 661 is fed by three headwater tributaries: Creek 505659, Creek 146920, and Creek 543585. The lower section of Creek 661 (Reaches 1 to 3) is approximately 7.5 km long and has high quality (i.e., suitably-sized and unembedded) spawning gravels providing approximately 11% of the available kokanee spawning habitat in the LSA. This section is used by kokanee and Rainbow Trout for spawning.

Above Reach 3, habitat in Creek 661 is used only by Rainbow Trout, primarily for rearing. Spawning habitat for Rainbow Trout is limited upstream of Reach 4 because the substrates are generally too large. Habitat in the lower reaches of Creek 505659 is suitable for all life stages of Rainbow Trout. Riffle habitat is predominant, with abundant stream cover as well as suitable spawning gravels. Habitat in Creek 146920 and Creek 543585 is only suitable for summer rearing.

### 3.3.3 Turtle Creek Watershed

Fish habitat in Turtle Creek and its tributaries is described in Section 5.8.2 of the 2011-2012 Fish and Aquatic Resources Baseline Report (Appendix 5.1.2.6A&B of the Application/EIS). The Turtle Creek Watershed lies west of the Davidson Creek Watershed. The creek has one named headwater tributary, Creek 700. The lower to middle reaches of Turtle Creek are dominated by low-gradient pools and glides with numerous beaver dams and ponds present. As a result of beaver activity, multiple wetlands have formed, particularly in the lower half of the watershed. The substrate is dominated by fines, and spawning gravels for Rainbow Trout are present only in isolated pockets in the middle and lower reaches and are generally of poor quality. The beaver dam ponds and other impounded areas provide ideal juvenile rearing habitat, due to the abundant cover created by overhanging vegetation, deep pools, and woody debris.

### 3.3.4 Tatelkuz Lake and Tributaries

Tatelkuz Lake is a long, narrow and relatively large (910 ha surface area) dimictic lake with a maximum depth of 33.7 m. It has a relatively small littoral zone (11% of lake area) and is relatively steep along its shorelines. The shoreline is dominated by fines and gravels. The mean annual lake level is approximately 927.60 masl. Annual variation in lake level is 0.80 m with levels highest in May and lowest in January/February. However, total lake elevation changes over the previous 40 years were 2.0 m. Monthly lake elevation changes during this period ranged from 0.2 m in February to 1.5 m in May.

Fish habitat in Tatelkuz Lake tributaries is described in Section 5.8.5 of the 2011-2012 Fish and Aquatic Resources Baseline Report (Appendix 5.1.2.6A&B of the Application/EIS). The Tatelkuz Lake Tributaries Watershed lies between Davidson Creek and Creek 661 watersheds. Streams in the Tatelkuz Lake Tributary Watershed are typically narrow, shallow, and low gradient and support only limited rearing habitat. Spawning habitat is absent in most of these streams and there is little to no overwintering habitat.

### 3.3.5 Chedakuz Creek

Fish habitat in Chedakuz Creek and its tributaries is described in Section 5.8.6 of the 2011-2012 Fish and Aquatic Resources Baseline Report (Appendix 5.1.2.6A&B of the Application/EIS). Middle Chedakuz Creek (from the confluence of Creek 661 to Tatelkuz Lake) and lower Chedakuz Creek (from the outlet of Tatelkuz Lake to the confluence with Turtle Creek) are within the LSA of the Project. Lower Chedakuz Creek has diverse habitat, with regularly alternating patterns of glides, riffles, and pools. Abundant gravels provide good quality spawning habitat for Rainbow Trout and kokanee. Lower Chedakuz Creek provides approximately 65% of the available kokanee spawning habitat in the LSA. The habitat is also highly suitable for juvenile Rainbow Trout rearing with deep pools and instream vegetation providing cover. Chedakuz Creek provides approximately 30% of Rainbow Trout spawning habitat and 25% of rearing habitat in the LSA. Abundant off-channel habitat also exists in the form of side-channels, sloughs, and wetlands.

### 3.3.6 Creek 705 Watershed

Fish habitat in Creek 705 and its headwater lakes is described in Sections 5.8.4, 5.9.2, and Section 5.9.3 of the 2011-2012 Fish and Aquatic Resources Baseline Report (Appendix 5.1.2.6A&B of the Application/EIS). The Creek 705 Watershed flows southwest into Fawnie Creek. Besides the two headwater lakes (Lake 14 and Lake 15), Creek 705 is fed by several small unnamed tributaries downstream of the confluence of the two lake outlets. The lower to middle reaches of Creek 705 contain good quality habitat for Rainbow Trout spawning, rearing, and overwintering. Spawning habitat quality in the upper watershed, ranges from good to poor depending on the availability of suitably sized gravel substrates. However, there are areas of habitat with suitable spawning gravels at the outlets of both headwater lakes, which may be used by lake-resident adults.

## 3.4 Fish Community

The fish communities in the Blackwater Project mine site LSA are detailed in the following sections of the Application/EIS:

- Section 5.10 of the Fisheries Baseline Report for 2011-2012 (Fish Communities);
- Section 5.1.2.6.3.2 of the Aquatic Baseline Report (Fish); and
- Section 5.3.8.2 of the Fish Effects Assessment (Valued Component Baseline).

A summary of the fish communities is provided below.

### 3.4.1 Fish Community

Twelve fish species were captured or observed in streams and lakes of the mine site LSA during baseline studies in 2011, 2012, and 2013 (Table 3-1 and Table **3-2**). Rainbow Trout are the most ubiquitous species in the LSA and were present in every watercourse and water body except Snake Lake. Longnose sucker were the second most common species, followed by mountain whitefish, and then kokanee. The remaining nine species were each present in only one to three water bodies.

More information on fish species richness in the Project area can be found in Section 5.1.2.6.3.2.2 of the Application/EIS.

### *Table 3-1. Fish Species Present in the Mine Site LSA*

| Common Name | Scientific Name | BC Fish Species Code |
|---|---|---|
| Rainbow Trout | Oncorhynchus mykiss | RB |
| Longnose Sucker | Catostomus catostomus | LSU |
| Mountain Wwhitefish | Prosopium williamsoni | MW |
| Kokanee | Oncorhynchus nerka | KO |
| Largescale Sucker | Catostomus macrocheilus | CSU |
| Northern Pikeminnow | Ptychocheilus oregonensis | NSC |
| Burbot | Lota lota | BB |
| Slimy Sculpin | Cottus cognatus | CCG |
| Lake Chub | Couesius plumbeus | LKC |
| Brassy Minnow | Hybognathus hankinsoni | BMC |
| White Sucker | Catostomus commersonii | WSU |
| Longnose Dace | Rhinichthys cataractae | LNC |

*Source: Application/EIS – Assessment of Potential Environmental Effects, Section 5.3.8, Table 5.3.8-4 (New Gold 2014)*

Of these species, only brassy minnow is classified as sensitive or vulnerable according to the BC Conservation Data Centre (BC CDC 2020). Brassy minnow is a Blue-listed species because its distribution in BC is disjunct, with isolated populations in the lower Fraser Valley and in the Nechako Lowlands near Vanderhoof and Prince George. This is believed to make them vulnerable to human activities or natural events. Blue-listed taxa are at-risk, but are not extirpated, endangered or threatened. Brassy minnow was found only in Tatelkuz Lake and not in any of the habitat in the Davidson Creek Watershed that will be affected by the deposit of mine tailings or waste rock. None of the fish species in the Project area are identified as at-risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; COSEWIC 2020).

### *Table 3-2. Fish Species Detected in the Streams and Lakes of the Mine Site LSA*

| Stream/Lake | RB | LSU | MW | KO | CSU | NSC | BB | CCG | LKC | BMC | WSU | LNC | Total Species |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Davidson Creek | X | - | X | X | - | - | - | - | - | - | - | - | 3 |
| Turtle Creek | X | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Creek 661 | X | - | - | X | - | - | - | - | - | - | - | - | 2 |
| Creek 705 | X | X | X | - | - | - | X | - | - | - | - | - | 4 |
| Chedakuz Creek | X | X | - | X | - | - | - | X | - | - | - | X | 5 |
| Lake 01682LNRS | X | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Lake 01538UEUT | X | X | - | - | - | - | - | - | - | - | - | - | 2 |
| Lake 01428UEUT | X | X | - | - | - | - | - | - | - | - | - | - | 2 |
| Snake Lake | - | - | - | - | - | - | - | - | X | - | - | - | 1 |
| Tatelkuz Lake | X | X | X | X | X | X | X | X | - | X | X | - | 10 |
| Subtotal | 9 | 5 | 3 | 4 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | - |

*Notes: An "X" indicates fish species detected. A dash "-" indicates a fish species not detected.*

*Source: Application/EIS – Assessment of Potential Environmental Effects, Section 5.3.8, Table 5.3.8-5 (New Gold 2014)*

#### *3.4.1.1 Rainbow Trout*

Section 5.10.1.2 of the Fish and Aquatic Resources 2011-2012 Baseline Report (Appendix 5.1.2.6A&B of the Application/EIS) provides a detailed description of the Rainbow Trout populations in the Blackwater LSA, including relative abundance and life history, population structure and number of populations, and population-specific information by watershed.

Rainbow Trout is the predominant species in streams of the Blackwater LSA and was also the most common species captured or observed during surveys of stream crossings along the Project's linear corridors. There are an estimated seven populations of Rainbow Trout in the LSA: two in Davidson Creek, three in Creek 705, one in Creek 661, and one in Turtle Creek. Genetic testing indicates the intra-population differences are approximately 10 times greater than the inter-population differences consistent with Rainbow Trout populations across BC and Alberta (Taylor 2012).

In Davidson Creek, Rainbow Trout come from two semi-separate populations, both of which reside in stream reaches affected by the deposit of mine tailings or waste rock :

1. A migratory population that resides in Tatelkuz Lake/Chedakuz Creek but spawn and rear in Davidson Creek downstream of a cascade barrier in Reach 11; and
2. A resident population in Lake 16 that spawns in Reach 11 or 12 of Davidson Creek, upstream of the cascade barrier.

In spring, adult Rainbow Trout from Tatelkuz Lake and Chedakuz Creek migrate up Davidson Creek to spawn. The spawning period is typically during May-June, after which adults return to Tatelkuz Lake and Chedakuz Creek where they remain until the following spring when the cycle is repeated. Rainbow Trout can spawn multiple times in a lifetime. Davidson Creek contributes an estimated 20% of the Rainbow Trout population in Tatelkuz Lake with the remaining 80% coming equally from Turtle Creek and Creek 661 (Section 5.1.2, Aquatic Baseline of the Application/EIS).

Fry emerge from the spawning gravels after several weeks of incubation (the timing of emergence is water temperature dependent). Rainbow Trout fry (age 0) and juveniles rear in middle and lower Davidson Creek and their tributaries for one or two summers before migrating downstream to Tatelkuz Lake. They spend the next few years (typically 3 to 5 years) foraging and rearing in the lake until they reach sexual maturity and can make the annual spring migration to spawning habitat. No adult Rainbow Trout or Rainbow Trout older than 3 years of age were captured in Davidson Creek, and densities of juveniles (3.7 fish/100 $m^2$; Palmer 2013) were below BC provincial bio-standards (9.7 fish per 100 $m^2$) in the majority of streams in the LSA (Slaney and Zaldokas 1997).

The resident Rainbow Trout population in Lake 16 is isolated from the downstream migratory population, owing to a cascade barrier at the bottom of Reach 11 of Davidson Creek. The barrier impedes upstream passage of fish from the migratory population (Tatelkuz Lake), however, fish from the resident population (Lake 16) can move downstream over the cascade and mix with the migratory population. Spawning habitat for the headwater lake population is limited to small patches (less than 50 $m^2$) of gravel in Reach 11 of Davidson Creek, or upstream of the Lake.

Adult Rainbow Trout also move into Creek 661 and Turtle Creek in the spring for spawning. Fry and juveniles of these migratory populations use the pools and glides of Creek 661 and the numerous beaver ponds in Turtle Creek to rear and forage.

Migratory Rainbow Trout from Fawnie Creek as well as resident Rainbow Trout populations in Lake 15 and Lake 14 use spawning habitat in Creek 705. Therefore, fry and juveniles that use Creek 705 in summer for rearing are a mixture of these three populations.

#### *3.4.1.2 Kokanee*

Kokanee live in lakes, and migrate out of these residence lakes to spawn in tributary streams. Spawning takes place in late summer and fall. Within the LSA and RSA, kokanee reside in Tatelkuz Lake and Kuyakuz Lake, respectively, and spawn in lower Davidson Creek, lower Creek 661, and Chedakuz Creek. Kokanee are the most abundant fish species in lower Davidson Creek, lower Creek 661, and in Chedakuz Creek in summer (July/August), when they move from Tatelkuz Lake and Kuyakuz Lake and enter creeks to spawn. These stream reaches that support kokanee spawning in Davidson Creek and Creek 661 are located downstream of the Project and will not be directly affected by the deposit of mine tailings or waste rock.

In Davidson Creek, kokanee spawning is limited to the lower creek, which extends approximately 6 km upstream from the mouth of Davidson Creek. In Creek 661, kokanee spawn as far upstream as Reach 3 (approximately 7.5 km upstream from Tatelkuz Lake). In middle Chedakuz Creek, kokanee spawn in the mainstem between Kuyakuz Lake and the Creek 661 confluence. In lower Chedakuz Creek, they use mainstem habitat downstream of Tatelkuz Lake to at least the Turtle Creek confluence.

Adult kokanee die within several weeks of spawning, and the eggs incubate in the gravel over winter. Kokanee fry emerge from the gravels of Davidson Creek, Creek 661, and Chedakuz Creek after ice break-up, and immediately migrate to their residence lake. Once the fry have out-migrated and the adult spawners have died, kokanee are not present in any creek until the following summer and fall.

Section 5.10.1.1 of the Fish and Aquatic Resources 2011-2012 Baseline Report (Appendix 5.1.2.6A&B of the Application/EIS) provides a detailed description of the relative abundance, life history, and population structure of kokanee in the Blackwater LSA.

#### *3.4.1.3 Other Fish Species*

Mountain Whitefish were found in Tatelkuz Lake during baseline surveys, comprising an estimated 3% (26,000 individuals) of the fish in the lake. Mountain whitefish in the LSA generally spawn in tributary streams in late fall. Based on known habitat requirements, spawning of Mountain Whitefish could occur in the littoral zone of Tatelkuz lake or in Chedakuz Creek. The absence of evidence for lake spawning and the steep gravel/cobble littoral zone of Tatelkuz lake suggest most Mountain Whitefish in Tatelkuz Lake use Chedakuz Creek for spawning. However, fall spawning surveys within the LSA indicate very low usage of Chedakuz Creek tributaries for whitefish spawning. For example, Davidson Creek is typically unsuitable for whitefish spawning in the fall due to its shallow (typically 0.3 m wetted depth and 0.6 m residual pool) and slow flowing nature. Therefore, it is likely that most Mountain Whitefish residing in Tatelkuz Lake spawn in the main channel Chedakuz Creek because it is the main inlet and outlet of the lake and is the largest stream in the immediate vicinity of the lake. Habitat in lower Chedakuz Creek immediately downstream of Tatelkuz Lake is deeper and faster that other streams in the LSA (e.g., 1 m residual pool depth). Middle Chedakuz Creek is the most likely spawning location because newly-emerged fry would be washed downstream into Tatelkuz Lake. Mountain Whitefish were observed in low numbers in lower Creek 705 (Appendix 5.1.2.6A of the Application/EIS).

Northern Pikeminnow was the fifth most common species captured or observed in Tatelkuz Lake in July 2013, comprising 1.5% (or 11,600 fish) of the total number of fish estimated to be in Tatelkuz Lake (Section 5.1.2.6.3.2.4.4 of the Application/EIS). Captured individuals ranged from 62 to 495 mm and 8 to 14 years old for individuals that were aged. This species is likely the dominant predator of the Tatelkuz Lake fish community. Pikeminnow were not captured during the stream surveys conducted in 2011 and 2012. No pikeminnow were captured during the spring hoop net survey conducted in Davidson Creek, Creek 661 and Turtle Creek in 2011. No Northern Pikeminnow were captured during a spring hoop net survey conducted in Davidson Creek, Creek 661 and Turtle Creek in 2011, indicating they likely spawn in Chedakuz Creek upstream of Tatelkuz Lake, or in Tatelkuz Lake itself.

Three sucker species have been captured in the LSA: White, Largescale, and Longnose Sucker. Juveniles and adults of all three species, up to 470 mm in length, have been captured in Tatelkuz Lake. Longnose Sucker was the most abundant sucker species (approximately 14,000 fish) in Tatelkuz Lake during baseline surveys. No Largescale or White Sucker have been captured in streams around the mine site (Davidson Creek or tributaries). However, Longnose Sucker were captured in the two headwater lakes of Creek 705 (Lakes 14 and 15). Spawning suckers from Tatelkuz Lake likely use middle and lower Chedakuz Creek given the presence of suitable habitat and absence of adults in Chedakuz Creek tributaries, including Davidson Creek and Creek 661, during spring spawner surveys and summer juvenile surveys.

Burbot were caught in low numbers in Creek 705 in 2011 and in Tatelkuz Lake in 2013, comprising less than 0.1% of the species captured in multiple years of baseline surveys. Four individuals were captured in lower Creek 705 during spring Rainbow Trout spawning suggesting a feeding movement from a nearby lake, possibly Laidman Lake. One 5-year-old individual (323 mm and 195g) was caught in Tatelkuz Lake during sampling in July 2013. Based on size and age at maturity from other studies it is not clear if this is a juvenile or mature specimen. No Burbot have been captured in Davidson and Turtle Creeks and Creek 661.

Several other species were also observed in the Project area. Slimy Sculpin and Longnose Dace were captured in Chedakuz Creek. Snake Lake, a headwater lake in the Tatelkuz Lake Tributaries Watershed, contained only Lake Chub. Brassy Minnow, a provincially blue-listed species, and Longnose Dace are present in Tatelkuz Lake. None of these species, as well as Largescale Sucker and Northern Pikeminnow were detected in the remaining lakes and streams in the LSA and RSA.

## 3.5 Limitations to Fish Productivity

### 3.5.1 Kokanee

Kokanee only use the streams in the Project area for spawning, and when the fry emerge, they quickly migrate to their resident lakes. There is abundant kokanee spawning habitat in lower Davidson Creek, lower Creek 661, and in Chedakuz Creek above and below Tatelkuz Lake. The limiting factor on kokanee productivity in the RSA is likely the availability of habitat, including food supply and nutrient levels in their resident lakes (i.e., Tatelkuz and Kuyakuz). In addition, water temperature in Davidson Creek is below the optimal temperature range for kokanee spawning and egg incubation too. The basis of the compensation plan is total habitat area and not an assumption of habitat productivity or water temperature being limiting factors.

### 3.5.2 Rainbow Trout

Unlike kokanee, Rainbow Trout fry and juveniles spend at least one year rearing in Davidson Creek or Creek 661 before moving downstream to mature in Chedakuz Creek or Tatelkuz and Kuyakuz lakes. The productivity of fish populations is most often limited by the survival of the youngest life stages, hence Rainbow Trout productivity in the Project area is most likely limited by habitat availability in their natal streams. The availability and suitability of overwintering habitat is likely a physical feature limiting Rainbow Trout productivity in Davidson Creek and Creek 661. This is consistent with research in other BC watersheds where the factor limiting salmonid densities is most often attributed to the availability of adequate overwintering habitat rather than to the amount of summer rearing habitat (Bustard and Narver 1975). Sub-optimal annual water temperatures also limit production in the system, affecting population numbers. The basis of the compensation plan is total habitat area and not an assumption of individual habitat type or water temperature being limiting factors.

# 4. Fish and Fish Habitat Effects Assessment Summary

Fish and Fish Habitat was selected as a VC for consideration in the effects assessment (Section 5.3.1 of the Application/EIS). The potential effects of the Project on fish and fish habitat are described in detail in the Application/EIS (Section 5.3.8, New Gold 2014). The EA considered both direct and indirect effects, including:

- Direct loss of fish and fish habitat under the mine site footprint;
- Indirect reduction in growth, survival and recruitment of fish due to isolation of fish populations upstream of the mine site footprint;
- Indirect reduction in growth, survival and recruitment of fish and indirect reduction in habitat quality and quantity downstream of the mine site due to flow changes;
- Indirect reduction in growth, survival and recruitment of fish due to changes in downstream water quality, temperature, and suspended solid concentrations due to working in or around water;
- Direct mortality of fish due to instream work during Construction, spills during Operations, or blasting in the mine site; and
- Loss of riparian vegetation associated with the construction of mine components or linear stream crossings.

The effects assessments for Fish and Fish Habitat were used as a basis to identify those effects that could constitute HADD, or cause death of fish, as well as to identify further mitigation measures, where appropriate. Rainbow Trout and kokanee were selected as the key indicator species to evaluate potential effects to fish and fish habitat. Potential effects on fish from Construction, Operations, and Closure of the mine site were identified based on guidance from the DFO Pathways of Effects (DFO 2014).

This Compensation Plan identifies multiple direct and indirect potential effects on fish and fish habitat. However, only the effect of loss of fish habitat directly beneath areas subject to Schedule 2 amendment (i.e., TSF, ECP, the low-grade and high-grade ore stockpiles, and the upper overburden stockpile) will be carried forward to the quantitative habitat loss assessment (Section 5 Habitat Loss Assessment) and will be included in the compensation assessment (Section 6 Compensation Measures). Offsetting for all other effects to fish and fish habitat, including those identified in Section 4.5 Summary of Fish and Fish Habitat Residual Effects. related to instream habitat losses not subject to Schedule 2 amendment, upstream habitat isolation, downstream changes in flow, water quality alteration, or direct mortality, will be addressed in the *Fisheries Act* (1996) application for Authorization Offsetting Plan.

A summary of anticipated potential effects specific to the placement of deleterious substances, which is subject to Schedule 2 amendment, is presented in the following sections.

## 4.1 Potential Effects of the Deposit of Deleterious Substances at the Mine Site

The mine site components associated with the placement of deleterious substances are located in the Davidson Creek and Creek 661 watersheds. Other watersheds in the mine site aquatic LSA, including

Turtle Creek, Tatelkuz Lake and tributaries, Chedakuz Creek, and Creek 705, will not be directly affected by the placement of deleterious substances. The affected watersheds include:

### 4.1.1 Davidson Creek Watershed

The majority of the deleterious substance placement will occur in the Davidson Creek Watershed. Potential effects of deleterious substance placement on fish and fish habitat, prior to mitigation, include:

- Davidson Creek in the upper and middle reaches: TSF C and TSF D includes portions of Reaches 8, 9, 10, and 11 of the Davidson Creek mainstem. The ECP is located in Reach 7.1. These stream segments will be infilled for tailings placement or used for seepage management.
- Portions of Davidson Creek tributaries including Creek 668328 (portions of Reaches 1 and 2), Creek 636713 (portions of Reaches 1 to 4) and Creek 704454 (Reaches 1 to 4) will be infilled for tailings placement.
- Portions of Reaches 4 to 7 of Creek 704454 and its unnamed tributaries are within the footprints of the stockpile areas. These streams will be dammed, diverted, or dewatered and eventually covered with fill as foundations.
- Upstream habitat in the upper reaches of Creek 668328, Creek 636713, Creek 704454, Davidson Creek, and unnamed tributaries, as well as Lake 16 will be isolated from downstream habitat in the watershed. However, Lake 16 is already isolated from upstream fish passage by a barrier located in Reach 11.
- Placement of deleterious substances has the potential to result in direct fish mortality.

Rainbow Trout are the only species that have been identified in the stream habitat subject to Schedule 2 amendment. Kokanee are seasonally present in the lower reaches of Davidson Creek and will therefore not be directly affected by placement of deleterious substances.

### 4.1.2 Creek 661 Watershed

Placement of deleterious substances in the Creek 661 will be limited to the headwater reaches that are located in TSF C. Potential unmitigated effects of deleterious substance placement on fish and fish habitat include:

- Portions of Reaches 5 and 6 of Creek 505659 and an unnamed tributary will be infilled for tailings placement in TSF C.
- Loss of streamside riparian vegetation adjacent to the instream areas lost due to deleterious substance placement.
- Placement of deleterious substances has the potential to result in direct fish mortality.

Rainbow Trout are the only species that have been identified in the stream habitat subject to Schedule 2 amendment. Kokanee are seasonally present in the lower reaches of Creek 661 and will therefore not be directly affected by placement of deleterious substances.

## 4.2 Summary of Avoidance and Mitigation Measures

The Project design, Aquatic Resources Management Plan (Section 12.2.1.18.4.2 of the Application/EIS), Fish Salvage Plan (Section 12.2.1.18.4.21 of the Application/EIS), and Fish and Fish Habitat sections of the EA (Sections 5.3.8 and 5.3.9 of the Application/EIS) include avoidance and mitigation measures to eliminate or minimize the potential effects to fish. The TSF also underwent a formal alternative assessment process, which included quantitative consideration of environmental factors (Appendix 2.5A of the Application/EIS).

Avoidance and mitigation measures have been a key part of the planning and design process of the Project since the early mine planning stages, including the following design principles:

- Early identification and avoidance of key sensitive areas in the Project area;
- Clustering, which refers to locating facilities to minimize the spatial extent of the Project footprint. The TSF, open pit, waste rock dumps, stockpiles, and all other mine site facilities are clustered as closely together as possible in the headwaters of Davidson Creek and Creek 661;
- Minimizing the number of watersheds potentially affected by locating the TSF and all mine site facilities within the Davidson Creek and Creek 661 watersheds;
- Avoidance of the Blackwater River Watershed, a designated Heritage River with important natural, cultural and recreational values; and
- Avoidance of direct footprint effects to kokanee habitat.

### 4.2.1 Mitigation Measures

'Mitigation by design' is a key part of the mine planning process and the following is a summary of some key mitigation measures and design features that have been incorporated into the mine plan and design:

*Construction Phase*

- Constructing mine infrastructure using a staged approach, with TSF C built earlier and TSF D built later, as needed. This approach will simplify water management and reduce potential effects during construction;
- Locating the mine and processing components upslope of the environmental control dam to manage TSS and other water chemistry parameters;
- Developing a Sediment and Erosion Control Management Plan, which will limit release of suspended solids;
- Using Best Management Practices (BMPs) and an adaptive management approach to minimize the volume and maintain quality of contact water;
- Constructing the central and southern surface water diversions to route water around the TSF and minimize site contact water volume;
- Phasing sediment control to match the main construction activities: 1) land clearing and grading; 2) TSF construction; 3) open pit development;
- Timing of instream work in fish-bearing streams to occur during the 'Reduced Risk Timing Windows' where possible;
- Salvaging fish from watercourses prior to the start of instream works;
- Using existing disturbed areas and corridors for infrastructure to the extent possible; and
- Using clear-span bridges or open-bottom culverts for crossings of fish-bearing streams.

*Operations and Closure Phases*

- Constructing mine infrastructure using a staged approach, with TSF C built earlier and TSF D built later, as needed. This approach will simplify water management and minimize the potential effect on downstream flows in Davidson Creek during operations;
- Minimizing water use by recycling water in the TSF for use in the mill and by capturing, collecting and pumping seepage back to the TSF. This minimizes potential disturbances to the aquatic environment from water withdrawals and releases;
- Treating and releasing water to Davidson Creek to minimize the amount of flow augmentation needed from Tatelkuz Lake via the FWSS;
- Constructing northern surface water diversions to route water around the TSF and minimize site contact water volume;
- Constructing seepage interception trenches and the environmental control dam downstream of the TSF D dam. These will collect seepage from the TSF and route it to the environmental control dam and back to the TSF via pumping;
- Mitigating direct mortality of fish by the FWSS by using appropriately-sized screens per DFO guidelines at end of pipe; extending intake pipes out into lake to prevent entrainment of sediment and aquatic organisms; regularly removing and cleaning fish screens; and
- Following new DFO guidelines for the use of explosives (i.e., 50 kPa criterion) in or near fish-bearing waters as required.

*Post-Closure Phase*

- Operating the FWSS and other water management infrastructure in the Davidson Creek Watershed, until the monitoring demonstrates that treated water can be discharged to Davidson Creek; and
- Allowing run-off and seepage from reclaimed areas to flow in the Creek 661 Watershed only if it meets site-specific water quality objectives.

## 4.3 Construction Environmental Management Program

A Project-wide environmental management program will be implemented during all Project phases. This program will describe (among other things), environmental protection measures and best management practices to minimize potential impacts to the aquatic environment. A Construction Environmental Management Plan is required by BC EAC M19-01 condition #13 and has been submitted with the joint *Mines Act* (1996) and *Environmental Management Act* (2003) permits application. The Construction Environmental Management Plan (CEMP) required by M19-01 condition #13 was approved for implementation in a letter received by BW Gold from the BC Environmental Assessment Office on August 31, 2022.

## 4.4 Pre-Disturbance Fish Salvage

BW Gold proposes to conduct fish salvage and relocation in affected streams within upper and middle Davidson Creek and within headwaters of Creek 661. Affected streams in the Davidson Creek Watershed will include the upper and middle sections of the mainstem, Creek 688328, Creek 704454 and various tributary streams (Section 5.2 Quantification of Habitat Loss). Affected streams in Creek 661 Watershed will include Creek 505659, Creek 146920, and various tributary streams.

In accordance with federal EA Condition # 3.2.1, a fish salvage and relocation plan will be developed prior to construction. The plan will be developed in consultation with Indigenous Nations, DFO, and any other relevant authorities and implemented prior to conducting any activity requiring the removal of fish habitat. Salvage and relocation will be conducted by a team comprised of qualified individuals, including a Registered Professional Biologist, who have experience in all aspects of the proposed work. The current iteration of the Fish Salvage Plan is included in Appendix A, although it should be noted that updates are expected as detailed construction staging information becomes available.

The fish salvage and relocation plan will specify non-lethal techniques that include backpack electrofishing, minnow trapping, and beach seining, as applicable for the habitat being salvaged. The plan will be refined and finalized, after a site reconnaissance conducted by the lead biologist and team members prior to conducting the salvage. The main fish collection method will use multiple-pass electrofishing with blocking nets in 100 m sections until no more fish are captured. Minnow traps will then be placed within each section and fished over a 24-hr period to catch any residual fish that were not collected during electrofishing. Other methods, such as beach seining may also be used to best suit the channel size, substrate and specific habitat identified for salvage.

Fish salvage efforts will be staged according to the construction schedule and will be subject to approval by the BC Ministry of Water, Land and Resource Stewardship (BC WLRS), formerly FLNRO, and DFO and will be subject to the conditions of those approvals.

## 4.5 Summary of Fish and Fish Habitat Residual Effects

Based on the implementation of avoidance and mitigation measures and knowledge of the fish habitat in the Project area, the only residual effects that are anticipated to remain after the implementation of avoidance and mitigation measures are related to direct loss of fish habitat, upstream fish habitat isolation, and downstream flow alterations from the mine site footprint.

The following effects from deleterious substance placement were identified and will be carried through to the residual habitat loss section of this Compensation Plan:

- Direct habitat loss
  - Loss of instream habitat in Davidson Creek and Creek 661 watersheds beneath the footprint of the TSF (not including instream habitat beneath the footprints of the Main Dam C and D dam embankments), the ECP (not including instream habitat beneath the footprint of the Environmental Control Dam), the low-grade and high-grade ore stockpiles, and the upper overburden stockpile.
  - Loss of streamside riparian vegetation adjacent to the instream areas lost due to deleterious substance placement.

In addition, the following effects from deleterious substance placement were identified and will be carried through to an assessment of HADD or death of fish in the *Fisheries Act* Authorization application:

- Habitat Isolation

  - Habitat isolation in the upper headwaters of Davidson Creek (Reaches 11 and 12) and tributaries (including upper reaches of Creek 668328, Creek 636713 and Creek 704454) and Lake 16.
- Downstream Flow Changes
  - Flow reductions and loss of habitat in Creek 661 and tributaries (Creek 505659 and Creek 146920) downstream and under the footprint of the mine site infrastructure.
  - Flow alterations in Davidson Creek (Reaches 1 to 6).

# 5. Habitat Loss Assessment

The purpose of this section is to present an assessment of the habitat losses subject to Schedule 2 amendment of the MDMER (2002) associated with the deposition of a deleterious substance. The losses of fish habitat in these portions of the streams into which mine waste or deleterious substances (e.g., tailings, waste rock) are proposed to be deposited will be compensated for, as described in Section 6 Compensation Measures of this document.

Avoidance and mitigation measures will be implemented to reduce the overall Project effects on fisheries. However, the placement of tailings and rock into the areas subject Schedule 2 amendment (i.e., the TSF, ECP, the low-grade and high-grade ore stockpiles, and the upper overburden stockpile) will result in an unavoidable permanent loss of fish habitat in the affected upper reaches of Davidson Creek and headwater tributaries (Davidson Creek Watershed); and in the upper reaches and tributaries of Creek 505659 in the Creek 661 Watershed. The location of these stream segments is shown on Figure 5-2.

To inform regulatory decisions, a quantification of the areal extent and suitability-adjusted estimate of habitat loss are presented here. Bradford et al. (2014) outlined that a decision-support framework should be informed by:

- The nature of the impact of the Project on fish and fish habitat, assessed by temporal and spatial scales and intensity; and
- The type of fish habitat or species that will be exposed to the Project's impacts. Some form of classification scheme utilizing habitats and potential species could be used to reflect regional priorities.

Where residual loss of fish habitat will occur, these impacts should be counterbalanced by gains through compensation (described in Section 6 Compensation Measures). Methods to quantify lost productivity are important because they are an improvement on qualitative or judgment-based approached (Bradford et al. 2014). In addition, quantification of residual habitat loss provides a comparable account of habitat losses and gains.

The assessment of habitat loss outlined in this section benefits from a thorough understanding of fish and fish habitat in the area, based on substantial baseline data collection (summarized in Section 3 Description of Fish and Fish Habitat of this report). There is sufficient information on the availability and use of affected fish habitat to inform a robust assessment of habitat loss.

This assessment of residual habitat loss focuses on impacts to the only species encountered in the affected upper reaches of Davidson Creek and Creek 661 – Rainbow Trout. Rainbow Trout are also largely the focus of the compensation plan, providing a direct counterbalance between losses and gains to fish communities in the area.

## 5.1 Methods for Quantification of Habitat Loss

As outlined by DFO (2013c), development of common spatial units or 'estimates of equivalency' is required between the consequences of habitat loss and the compensation benefits. The assessment of habitat loss from the proposed placement of deleterious substances was completed using three methods:

1. Calculation of the areal extent (surface area) of affected instream habitat (in m2) using stream channel measurements collected during baseline field programs, and spatial analysis using GIS software;
2. Habitat Evaluation Procedure (HEP) to calculate Habitat Units (HU), a metric that integrates habitat quality with quantity (equivalent to m2 of 'usable' in-stream habitat); and
3. Calculation of the riparian habitat (in m2) using stream buffers applied to stream segments, based on fish-bearing status assessed during baseline field programs.

### 5.1.1 Instream Habitat Area

Calculation of habitat area is required as a first step for the HEP method and provides a straight-forward measure of habitat loss. However, it does not incorporate an index of suitability related to habitat quality.

Site-specific baseline information was used as the foundation of the quantification of habitat losses. As outlined in the baseline reports (Appendix 5.1.2.6A&B of the Application/EIS), stream channel measurements and spatial analysis using GIS were used to quantify total habitat. This GIS spatial information was then overlaid on the mine site footprint over the BC standard 1:20,000 scale Freshwater Atlas stream and water body network coverage.

As described in the Instream Flow Study for the Project (Appendix 5.1.2.6D of the Application/EIS*),* each stream segment and affected water body was delineated and categorized by the Freshwater Atlas code, stream order, stream classification, type of impact, and fish presence/absence data. Stream segment lengths were measured using GIS software, and total instream habitat area for each stream segment was determined using the length multiplied by average channel measurements from field data. Surface water areas for water bodies and lakes were derived using GIS software and verified using shoreline perimeter data collected during baseline bathymetric surveys.

Stream segments affected by the placement of a deleterious substance were identified by mapping those watercourses within the footprints of the areas subject to Schedule 2 amendment (i.e., TSF, ECP, the low-grade and high-grade ore stockpiles, and the upper overburden stockpile). Stream segments located elsewhere on the site (i.e., beneath the dam embankments or other site infrastructure or isolated upstream of these) were analyzed separately for the *Fisheries Act* (1996) application for Authorization. Habitat loss mapping for this areal analysis was conducted using mine component arrangement polygons for the end of Year 18, because this phase represents the maximum footprint of all mine site facilities over the life of the Project.

These results provided the areal extent of habitat affected and formed the basis of the HEP evaluation.

### 5.1.2 Habitat Evaluation Procedure

#### *5.1.2.1 Overview of HEP*

The Habitat Evaluation Procedure (HEP) methodology was originally developed by the U.S. Fish and Wildlife Service and has been widely used across North America as a reliable model for quantifying habitat loss. HEP is a valuable method to quantify biologically-relevant habitat loss or gain, by taking into account the habitat preferences and requirements of a species at varying life stages. This method of habitat quantification facilitates an effective comparison with different potential compensation opportunities, regardless of habitat type.

HEP provides an objective method to characterize the quality of habitat, and it also standardizes the habitat quality ratings relative to other habitats that have different physical characteristics (e.g., lake versus streams). This allows affected habitat to be standardized and evaluated as a single unit. Considering the importance of maintaining fish communities in these systems, it is important to understand the suitability of the lost habitat and relate this to the habitat gains that are proposed through compensation plans.

The HEP evaluation (USFWS 1980) is generally used when there is a direct loss of habitat, and a value of this habitat is required for assessing impacts. The HEP is based on the concept that habitat value for a selected species/life stage can be described by a Habitat Suitability Index (HSI). An HSI is a habitat quality rating that is assigned on a scale of 0 (no value) to 1 (optimum value) for a given species/life stage of interest (USFWS 1980). HSI models use a combination of quantitative and qualitative information, synthesized from published literature and site-specific professional observations, to describe how different habitat variables influence habitat quality for each species/life stage of interest.

The HEP derives a dimensionless Habitat Unit (HU) by multiplying affected area ($m^2$) by a habitat- and species/life stage-specific HSI value. The HEP allows standardization of habitat quality ratings relative to other habitats, such as lakes and streams, even if they have different physical characteristics. This ultimately allows the habitats to be evaluated as a single group for habitat accounting (gains versus losses). Additional assumptions of the HEP include:

- An area of interest typically possesses different habitat types and classes;
- That each habitat type/class has a measurable area;
- Each habitat type/class may have a different suitability for each species and life-stage of animal that utilizes that area; and
- HSI models assume that there is a positive relationship between the suitability index and habitat carrying capacity (USFWS 1981).

#### *5.1.2.2 Project-Specific Implementation of HEP*

The Instream Flow Study (Appendix 5.1.2.6D of the Application/EIS), as well as Annex C of the Fisheries Mitigation and Offsetting Plan that was previously submitted (Appendix 5.1.2.6C of the Application/EIS), describes the process for establishing HSI models for this Project. The original methodology and subsequent modifications are described in detailed in the technical memorandum *Habitat Evaluation Procedure (HEP) for Blackwater Project – Fisheries Compensation Plan* (Palmer 2020), provided in Appendix B.

AMEC et al. (2014) developed a habitat classification system to support the use of HSI models for Rainbow Trout. Seven mesohabitat types were identified during baseline assessment in the Project footprint. Each of the seven habitat types were then further categorized into more-detailed habitat classes by AMEC et al. (2014).

Identified stream habitat types included the four following mesohabitats: cascades, riffles, glides, and pools. Three additional habitat types were utilized to describe the remaining diversity of fish habitat "not represented by the four mesohabitat types" (AMEC et al. 2014). A "tributary" type was used to describe small first-, second-, and third-order tributaries to mainstem creeks; an "other" type that describes habitats afforded by off-channel areas such as back-flooded beaver dams, and wetlands; and a "lake" category that describes different lake habitats (AMEC et al. 2014).

The type/class categorization resulted in the identification of 19 discrete habitat classes in the Project area. Subsequent assessment of potential off-site compensation options necessitated defining two additional habitat classes to better describe existing conditions, resulting in a total of 21 unique habitat classes. Detailed descriptions of the habitat types and classes are provided in Appendix B.

Five life stages of Rainbow Trout were considered for inclusion in the HEP:

1. Spawning and Egg Incubation;
2. Fry Summer Rearing;
3. Juvenile Summer Rearing;
4. Adult Summer Foraging; and
5. Overwintering.

For each of the 21 habitat classes, specific HSI values were established for each of the five life stages of Rainbow Trout, based on the system developed by AMEC et al. (2014) and using guidance from Raleigh et al. (1984). Briefly, a five-point habitat suitability rating system was used, ranging from 0 to 1. Shifts in habitat suitability were represented by increments of 0.25, as shown in Table 5-1. It is important to note that the HSI model was not given any *a priori* weighting for particular habitat type or life stage of fish. For example, spawning habitat was not given any more importance than overwintering habitat.

***Table 5-1. Habitat Suitability Ratings and Definitions***

| Habitat Suitability Rating | Definition |
|---|---|
| 0 | Unsuitable |
| 0.25 | Below Average Quality |
| 0.50 | Average Quality |
| 0.75 | Above-average Quality |
| 1.0 | Optimal Quality |

*Source: AMEC et al. 2014*

HU values were calculated by multiplying the species- and life-stage-specific HSI values by the length and width (i.e., the area) of a given channel unit, as shown in Equation 1.

***Equation 1***

$$HU_{u_i,sp_j,ls_k} = HSI_{u_i,sp_j,ls_k} * L_{u_i} * W_{u_i}$$

Where:
HU = Habitat unit
HSI = Habitat Suitability Index
L = Unit Length
W = Unit Bankfull Width
$u_i$ = Habitat mapping mesohabitat unit $i$
$sp_j$= species $j$
$ls_k$= life-stage $k$

### 5.1.3 Riparian Habitat Area

In the Fisheries Mitigation and Offsetting Plan (Appendix 5.1.2.6C of the Application/EIS) a food and nutrient Habitat Suitability Index (HSI) value was assigned to address riparian inputs. However, in discussion with DFO, it was agreed that a more straightforward approach to riparian habitat accounting should be applied to both losses and gains. Per DFO, this would provide a more transparent accounting system for each of the Project impacts (losses) and Offsetting Plans (gains).

The functional riparian zone around water bodies (i.e., streams, ponds, and lakes) was applied to be consistent with guidance from DFO, as 15 m from bankfull channel limits, for all confirmed fish-bearing water bodies. For water bodies that were non-fish bearing, or had “unconfirmed” fish-bearing status, the applied riparian buffer was 5 m from the bankfull channel limits. Accordingly, the total riparian width was 30 m or 10 m along streams, and 15 m or 5 m around the shoreline of lakes and ponds (buffer applied to perimeter, dependant on fish-bearing status). For water bodies with no available fish presence information (typically small, headwater, first- and second-order streams), a default “unconfirmed” fish-bearing status was applied, with a 5 m riparian buffer conservatively applied to both sides of the stream.

Drainage features that were not classified as streams and were assigned no fish habitat value in the EA (e.g., NCDs[4] and terrain features with no visible channel[5] [NVC]) were excluded from the riparian buffer calculations. This was because, by definition, NCDs and NVCs do not have continuous channels that connect to fish-bearing streams downstream. Therefore, riparian inputs adjacent to NCDs and NVCs do not contribute to fish-bearing streams downstream.

As per definitions provided in the Fish and Aquatic Resources Baseline Reports (Appendix 5.1.2.6A&B of the Application/EIS), water bodies were assigned the following ‘fish-bearing statuses’ based on field data:

- “Confirmed” indicates that the water body was surveyed for fish and fish habitat and that fish were captured;
- “Unconfirmed” indicates that the stream was surveyed for fish and fish habitat but no fish were captured; and

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[4] *A non-classified drainage is a watercourse that does not meet any of the following criteria:*
- *a continuous channel bed of at least 100 m in length, or,*
- *a continuous channel bed of less than 100 m in length, where:*
    - *the continuous channel bed is known to contain fish,*
    - *the continuous channel bed flows directly into a fish stream or a lake known to contain fish, or the continuous channel bed flows directly into a domestic water intake. (BC MOF 1998)*

[5] *No visible channel indicates a complete absence of scoured channel definition. These features are typically found in the bottom of dry draws or depressions, consisting entirely of terrestrial, upland vegetation.*

- Non-fishing bearing water bodies were classified as either S5 (>3 m wide) or S6 (<3 m wide), with non-fish bearing status based on lack of connectivity, the presence of downstream barriers, or reach gradients of >20% (BC MOF 1995 and 1998).

In most cases, "unconfirmed" fish-bearing status was due to the low density of juvenile Rainbow Trout in headwater streams in the mine site LSA compared to BC provincial standards (Keeley et al. 1996; Koning and Keeley 1997). The application of these riparian zone widths is the buffer widths is consistent with the. Riparian Management Area Guidebook (BC MOF1995)). The Land Development Guidelines for the Protection of Aquatic Habitat (DFO 1993) identify a 15 m buffer (referred to as "leave-strips") as appropriate for fish-bearing water bodies.

In BC, the *Forest and Ranges Practices Act* (*FRPA*) and the Riparian Areas Regulations (RAR) (formed under the BC *Fish Protection Act*), are commonly-used standards for determining riparian buffers. Under the *FRPA*, which sets the requirements for tree harvesting, road building and grazing, the Riparian Management Area (RMA) for streams is based on fish presence and stream width. The RMA consists of the Riparian Reserve Zone (RRZ), which is immediately adjacent to both sides of the stream, and beyond that, a Riparian Management Zone (RMZ). In general, harvesting within the RRZ is not permitted and there are restrictions on harvesting within the RMZ. The RRZ for non-fish bearing reaches is zero. Under the RAR, which relates to development near aquatic habitats, the riparian "zone of sensitivity" ranges from 5 m to 30 m depending on channel type and the nature of large woody debris.

Considering these legislative standards, and that water bodies with unconfirmed fish bearing status have potential to support fish (albeit at low densities and perhaps only seasonally), the 10 m riparian zone width (5 m buffer on each side) was chosen. The same buffer was applied to non-fish bearing water bodies, to account for the value of the riparian vegetation to downstream fish habitat.

Within areas subject to Schedule 2 amendment, the riparian area for fish-bearing water bodies was identified by applying the 15 m riparian buffer on both sides of a watercourse (i.e., 30 m total riparian zone width). Where water bodies were unconfirmed or non-fish bearing, the 5 m buffer (i.e., 10 m riparian zone width) was applied to account for the potential for fish utilization (in the case of unconfirmed), and potential riparian contributions to downstream reaches.

## 5.2 Quantification of Habitat Loss

This section presents a quantification of fish habitat loss in the areas subject to Schedule 2 amendment. Habitat loss was quantified both by surface area (in $m^2$) to provide context and transparency for the habitat calculations, as well as HU. HU will form the basis of the compensation calculations, as they provide an inherent measure of habitat suitability as well as habitat quantity. Riparian losses (and gains) are presented in area impacted (gained; $m^2$).

A summary of affected watercourses and their locations is provided in Table 5-2. Habitat losses, including instream habitat area in $m^2$, habitat units by Rainbow Trout life stage, and riparian area (in $m^2$), are summarized in Table 5-3, with detailed HEP data presented in Appendix C. A detailed breakdown of the stream segments lost is provided in Table 5-4. Figure 5-1 and Figure 5-2 show the distribution of water bodies that will be permanently lost.

Most of the affected habitat is located in the upper reaches of Davidson Creek and its headwater tributaries. The remaining habitat is in the upper reaches of the Creek 661 Watershed, namely Creek 505659 and a tributary stream.

Davidson Creek supports habitat for all life stages of Rainbow Trout, except for adult summer foraging. Adult Rainbow Trout only use habitat in Davidson Creek and Creek 661 watersheds primarily to spawn, not to forage. Adults typically return to Tatelkuz Lake in late-June immediately after spawning; therefore, no adult summer foraging habitat value was calculated.

In the Davidson Creek Watershed, a total of 56,592 $m^2$ of instream habitat will be lost (Table 5-3). A total of 57,768 Rainbow Trout HU will be lost, comprising 16,678 spawning and egg incubation HU, 16,325 fry summer rearing HU, 17,272 juvenile summer rearing HU, and 7,492 overwintering HU. A total of 502,849 $m^2$ of riparian area will also be lost.

In the Creek 661 Watershed, a total of 1,181 $m^2$ of instream habitat will be lost (Table 5-3). This habitat supports 327 HU of juvenile summer rearing habitat. No other life stages are supported by this habitat. A total of 12,041 $m^2$ of riparian area will also be lost.

### *Table 5-2 Locations of Watercourses Subject to Schedule 2 Amendment*

| Watershed | Stream Name | Unique Identifier (WFID)1 | Coordinates (UTM Zone 10 N) | | | |
|---|---|---|---|---|---|---|
| | | | Upstream Extent | | Downstream Extent | |
| | | | Easting | Northing | Easting | Northing |
| Davidson Creek | Davidson Creek Mainstem (upper) | 700, 710, 711, 3813, 3820 | 371791 | 5894999 | 375848 | 5897508 |
| | Davidson Creek Mainstem (middle) | 720, 732, 3811 | 376027 | 5897703 | 376276 | 5897703 |
| | Davidson Creek Mainstem (lower) | 841, 852 | 377129 | 5898419 | 377532 | 5898419 |
| | Unnamed Tributary to Davidson Creek | 1910 | 375615 | 5896370 | 375432 | 5896370 |
| | Unnamed Tributary to Davidson Creek | 1930 | 373798 | 5897105 | 375080 | 5897105 |
| | Unnamed Tributary to Davidson Creek | 1971 | 372673 | 5895176 | 372718 | 5895176 |
| | Unnamed Tributary to Davidson Creek | 1991 | 372294 | 5895901 | 372633 | 5895901 |
| | Unnamed Tributary to Davidson Creek | 1522 | 376754 | 5896880 | 376883 | 5896880 |
| | Creek 704454 Mainstem (upper) | 1710, 1711, 1782, 3380, 3381, 3890 | 373845 | 5892328 | 374519 | 5892328 |
| | Creek 704454 Mainstem (middle) | 1733, 1740, 1750, 1771 | 375707 | 5895668 | 376022 | 5895668 |
| | Creek 704454 Mainstem (lower) | 1731 | 376165 | 5897548 | 376154 | 5897548 |
| | Unnamed Tributary to Creek 704454 | 1790, 3400, 3401, 3410 | 374733 | 5893299 | 374472 | 5893299 |
| | Unnamed Tributary to Creek 704454 | 1881, 3390, 3391, | 374597 | 5892726 | 374172 | 5892726 |
| | Unnamed Tributary to Creek 704454 | 1850, 1860 | 373823 | 5893144 | 373853 | 5893144 |
| | Unnamed Tributary to Creek 704454 | 1870, 3460, 3470 | 373730 | 5892959 | 373827 | 5892959 |
| | Unnamed Tributary to Creek 704454 | 1811, 1812, 1840 | 373102 | 5893985 | 374062 | 5893985 |
| | Creek 668328 Mainstem | 1572, 1591 | 373760 | 5898177 | 376188 | 5898177 |
| | Unnamed Tributary to Creek 668328 | 1601 | 375024 | 5897943 | 375106 | 5897943 |
| | Creek 636713 Mainstem (upper) | 1340, 1361, 1392, 1399, 1400, 1409 | 374563 | 5899157 | 376116 | 5899157 |
| | Creek 636713 Mainstem (lower) | 1411, 1420 | 377253 | 5898491 | 377290 | 5898491 |
| | Unnamed Tributary to Creek 636713 | 1481, 1482, 1490, 1499 | 373805 | 5899167 | 375097 | 5899167 |
| | Unnamed Tributary to Creek 636713 | 1439 | 375916 | 5898628 | 375976 | 5898628 |
| Creek 661 | Creek 505659 Mainstem | 2780, 3431, 3870 | 376256 | 5895468 | 376552 | 5895468 |
| | Creek 505659 Tributaries | 2960 | 375978 | 5895712 | 376427 | 5895712 |

*Notes:*

*1. The Water Feature Identifier (WFID) is a unique number assigned to identify a water feature (including streams, ponds, and lakes)*

*Table 5-3. Summary of Instream Area and Habitat Units Subject to Schedule 2 Amendment*

| Watershed | Stream | Length (m) | Instream Habitat Area ($m^2$) | Rainbow Trout Habitat by Life Stage (HU) | | | | | Total Habitat Units (HU) | Riparian Area ($m^2$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spawning / Egg Incubation | Fry Summer Rearing | Juvenile Summer Rearing | Adult Summer Foraging | Over-wintering | | |
| Davidson Creek | Davidson Creek Mainstem | 6,743 | 22,148 | 13,538 | 7,887 | 5,164 | 0 | 3,864 | 30,453 | 202,293 |
| | Davidson Creek Tributaries | 3,366 | 2,983 | 0 | 0 | 746 | 0 | 0 | 746 | 27,790 |
| | Creek 704454 Mainstem | 4,775 | 13,070 | 1,334 | 4,601 | 5,714 | 0 | 2,041 | 13,690 | 101,093 |
| | Creek 704454 Tributaries | 5,684 | 7,928 | 0 | 0 | 2,125 | 0 | 0 | 2,125 | 56,837 |
| | Creek 668328 Mainstem | 2,573 | 6,443 | 1,806 | 3,837 | 2,097 | 0 | 1,587 | 9,328 | 77,180 |
| | Creek 668328 Tributaries[1] | 109 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Creek 636713 Mainstem | 2,280 | 2,575 | 0 | 0 | 1,066 | 0 | 0 | 1,066 | 22,797 |
| | Creek 636713 Tributaries | 1,486 | 1,445 | 0 | 0 | 361 | 0 | 0 | 361 | 14,859 |
| **Davidson Creek Watershed Subtotal** | | 27,015 | 56,592 | 16,678 | 16,325 | 17,272 | 0 | 7,492 | 57,768 | 502,849 |
| Creek 661 | Creek 505659 Mainstem | 585 | 432 | 0 | 0 | 140 | 0 | 0 | 140 | 5,851 |
| | Creek 505659 Tributaries | 619 | 749 | 0 | 0 | 187 | 0 | 0 | 187 | 6,190 |
| **Creek 661 Watershed Subtotal** | | 1,204 | 1,181 | 0 | 0 | 327 | 0 | 0 | 327 | 12,041 |
| **Totals** | | 28,219 | 57,773 | 16,678 | 16,325 | 17,600 | 0 | 7,492 | 58,096 | 514,890 |

*Notes:*

*1. Creek 668328 Tributaries affected by the placement of deleterious substances include only two non-visible channel segments that offer no fish habitat value.*

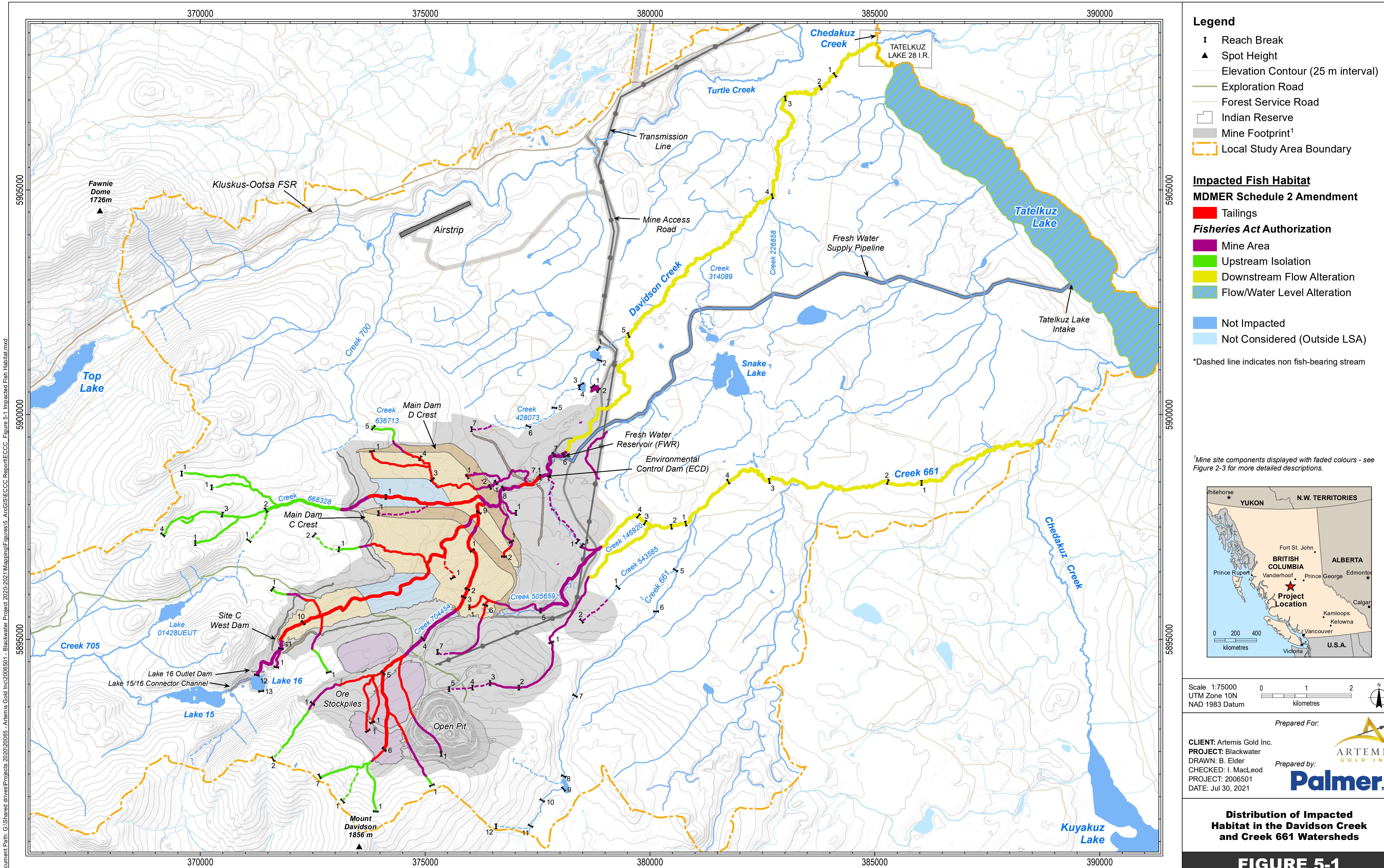
*Table 5-4. Detailed List of Stream Segments, Habitat Area, HU, and Riparian Area Subject to Schedule 2 Amendment*

| Watershed | Section | Reach[1] | Fish-Bearing Status | Unique Identifier (WFID)[2] | Stream Class[3] | Length (m)[4] | Instream Area ($m^2$) | Rainbow Trout Habitat Units by Life Stage (HU) | | | | | Total Habitat Units (HU) | Riparian Area ($m^2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Spawning / Egg Incubation | Fry Summer Rearing | Juvenile Summer Rearing | Adult Summer Foraging | Over-wintering | | |
| Davidson Creek | Davidson Creek Mainstem | 8 | Confirmed Fish-Bearing | 841 | S3 | 74 | 518 | 152 | 306 | 191 | - | 170 | 818 | 2,225 |
| Davidson Creek | Davidson Creek Mainstem | 8 | Confirmed Fish-Bearing | 852 | S3 | 420 | 2,935 | 860 | 1,731 | 1,079 | - | 964 | 4,633 | 12,598 |
| Davidson Creek | Davidson Creek Mainstem | 9 | Confirmed Fish-Bearing | 732 | S3 | 295 | 1,612 | 450 | 959 | 599 | - | 533 | 2,540 | 8,857 |
| Davidson Creek | Davidson Creek Mainstem | 10 | Confirmed Fish-Bearing | 700 | S3 | 2,714 | 8,054 | 6,172 | 2,272 | 1,299 | - | 974 | 10,716 | 81,410 |
| Davidson Creek | Davidson Creek Mainstem | 10 | Confirmed Fish-Bearing | 720 | S3 | 58 | 172 | 131 | 48 | 28 | - | 21 | 228 | 1,734 |
| Davidson Creek | Davidson Creek Mainstem | 10 | Confirmed Fish-Bearing | 3811 | S3 | 156 | 463 | 355 | 131 | 75 | - | 56 | 617 | 4,685 |
| Davidson Creek | Davidson Creek Mainstem | 10 | Confirmed Fish-Bearing | 3813 | S3 | 2,286 | 6,784 | 5,198 | 1,913 | 1,094 | - | 820 | 9,026 | 68,566 |
| Davidson Creek | Davidson Creek Mainstem | 10 | Confirmed Fish-Bearing | 3820 | S3 | 97 | 286 | 220 | 81 | 46 | - | 35 | 381 | 2,895 |
| Davidson Creek | Davidson Creek Mainstem | 11 | Confirmed Fish-Bearing | 710 | S4 | 279 | 573 | - | 194 | 327 | - | 126 | 647 | 8,375 |
| Davidson Creek | Davidson Creek Mainstem | 11 | Confirmed Fish-Bearing | 711 | S4 | 365 | 749 | - | 253 | 428 | - | 165 | 846 | 10,948 |
| Davidson Creek | Davidson Creek Tributary | 2 | No Data (Default Unconfirmed Fish-Bearing) | 1522 | - | 225 | 169 | - | - | 42 | - | - | 42 | 2,254 |
| Davidson Creek | Davidson Creek Tributary | 1 | Non-Fish-Bearing | 1910 | NVC | 587 | - | - | - | - | - | - | - | - |
| Davidson Creek | Davidson Creek Tributary | 1 | Unconfirmed Fish-Bearing | 1921 | S4 | 24 | 23 | - | - | 6 | - | - | 6 | 235 |
| Davidson Creek | Davidson Creek Tributary | 1 | Unconfirmed Fish-Bearing | 1930 | S4 | 1,522 | 1,461 | - | - | 365 | - | - | 365 | 15,223 |
| Davidson Creek | Davidson Creek Tributary | 1 | Unconfirmed Fish-Bearing | 1971 | S4 | 371 | 579 | - | - | 145 | - | - | 145 | 3,712 |
| Davidson Creek | Davidson Creek Tributary | 1 | Unconfirmed Fish-Bearing | 1991 | S4 | 637 | 751 | - | - | 188 | - | - | 188 | 6,365 |
| Davidson Creek | Creek 636713 Mainstem | 1 | Unconfirmed Fish-Bearing | 1411 | S3 | 15 | 23 | - | - | 11 | - | - | 11 | 149 |
| Davidson Creek | Creek 636713 Mainstem | 1 | Unconfirmed Fish-Bearing | 1420 | S3 | 47 | 72 | - | - | 36 | - | - | 36 | 469 |
| Davidson Creek | Creek 636713 Mainstem | 3 | Unconfirmed Fish-Bearing | 1392 | S4 | 1,198 | 1,593 | - | - | 797 | - | - | 797 | 11,979 |
| Davidson Creek | Creek 636713 Mainstem | 4 | Unconfirmed Fish-Bearing | 1340 | S4 | 261 | 117 | - | - | 29 | - | - | 29 | 2,610 |
| Davidson Creek | Creek 636713 Mainstem | 4 | Unconfirmed Fish-Bearing | 1400 | S4 | 85 | 38 | - | - | 10 | - | - | 10 | 846 |
| Davidson Creek | Creek 636713 Mainstem | 4 | Unconfirmed Fish-Bearing | 1399 | S4 | 195 | 260 | - | - | 65 | - | - | 65 | 1,953 |
| Davidson Creek | Creek 636713 Mainstem | 4 | Unconfirmed Fish-Bearing | 1409 | S4 | 84 | 35 | - | - | 9 | - | - | 9 | 841 |
| Davidson Creek | Creek 636713 Mainstem | 4 | Unconfirmed Fish-Bearing | 1499 | S4 | 34 | 14 | - | - | 4 | - | - | 4 | 338 |
| Davidson Creek | Creek 636713 Mainstem | 5 | Unconfirmed Fish-Bearing | 1361 | S4 | 361 | 423 | - | - | 106 | - | - | 106 | 3,613 |
| Davidson Creek | Creek 636713 Tributary | 1 | No Data (Default Unconfirmed Fish-Bearing) | 1439 | - | 63 | 51 | - | - | 13 | - | - | 13 | 635 |
| Davidson Creek | Creek 636713 Tributary | 1 | Unconfirmed Fish-Bearing | 1481 | S4 | 1,221 | 1,196 | - | - | 299 | - | - | 299 | 12,206 |
| Davidson Creek | Creek 636713 Tributary | 1 | Unconfirmed Fish-Bearing | 1490 | S4 | 202 | 198 | - | - | 49 | - | - | 49 | 2,019 |
| Davidson Creek | Creek 688328 Mainstem | 1 | Confirmed Fish-Bearing | 1572 | S3 | 2,202 | 5,764 | 1,581 | 3,454 | 1,927 | - | 1,441 | 8,403 | 66,074 |
| Davidson Creek | Creek 688328 Mainstem | 2 | Confirmed Fish-Bearing | 1591 | S3 | 370 | 679 | 225 | 383 | 170 | - | 146 | 925 | 11,106 |
| Davidson Creek | Creek 688328 Tributary | 1 | Non-Fish-Bearing | 1601 | NVC | 109 | - | - | - | - | - | - | - | - |
| Davidson Creek | Creek 704454 Mainstem | 1 | Confirmed Fish-Bearing | 1731 | S3 | 235 | 931 | 28 | 435 | 649 | - | 226 | 1,338 | 7,060 |
| Davidson Creek | Creek 704454 Mainstem | 1 | Confirmed Fish-Bearing | 1733 | S3 | 378 | 1,493 | 45 | 698 | 1,041 | - | 362 | 2,146 | 11,325 |

| Watershed | Section | Reach[1] | Fish-Bearing Status | Unique Identifier (WFID)[2] | Stream Class[3] | Length (m)[4] | Instream Area ($m^2$) | Rainbow Trout Habitat Units by Life Stage (HU) | | | | | Total Habitat Units (HU) | Riparian Area ($m^2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Spawning / Egg Incubation | Fry Summer Rearing | Juvenile Summer Rearing | Adult Summer Foraging | Over-wintering | | |
| Davidson Creek | Creek 704454 Mainstem | 2 | Confirmed Fish-Bearing | 1740 | S3 | 960 | 3,158 | 463 | 1,263 | 674 | - | 498 | 2,899 | 28,789 |
| Davidson Creek | Creek 704454 Mainstem | 3 | Confirmed Fish-Bearing | 1750 | S3 | 195 | 667 | 155 | 398 | 189 | - | 152 | 895 | 5,837 |
| Davidson Creek | Creek 704454 Mainstem | 4 | Confirmed Fish-Bearing | 1771 | S3 | 315 | 861 | - | 340 | 587 | - | 203 | 1,129 | 9,451 |
| Davidson Creek | Creek 704454 Mainstem | 5 | Confirmed Fish-Bearing | 1782 | S3 | 585 | 2,399 | 643 | 1,467 | 793 | - | 600 | 3,503 | 17,554 |
| Davidson Creek | Creek 704454 Mainstem | 6 | Unconfirmed Fish-Bearing | 1710 | S3 | 380 | 642 | - | - | 321 | - | - | 321 | 3,798 |
| Davidson Creek | Creek 704454 Mainstem | 6 | Unconfirmed Fish-Bearing | 1711 | S3 | 556 | 940 | - | - | 470 | - | - | 470 | 5,562 |
| Davidson Creek | Creek 704454 Mainstem | 6 | Unconfirmed Fish-Bearing | 3890 | S3 | 260 | 439 | - | - | 220 | - | - | 220 | 2,601 |
| Davidson Creek | Creek 704454 Mainstem | 6 | Unconfirmed Fish-Bearing | 3380 | S3 | 585 | 988 | - | - | 494 | - | - | 494 | 5,846 |
| Davidson Creek | Creek 704454 Mainstem | 6 | Unconfirmed Fish-Bearing | 3381 | S3 | 327 | 553 | - | - | 276 | - | - | 276 | 3,270 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 3410 | S4 | 58 | 67 | - | - | 17 | - | - | 17 | 575 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 1790 | S4 | 868 | 1,015 | - | - | 254 | - | - | 254 | 8,679 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 3400 | S4 | 52 | 61 | - | - | 15 | - | - | 15 | 521 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 3401 | S4 | 387 | 453 | - | - | 113 | - | - | 113 | 3,872 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 1840 | S4 | 255 | 571 | - | - | 286 | - | - | 286 | 2,551 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 1811 | S4 | 450 | 482 | - | - | 120 | - | - | 120 | 4,501 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 1812 | S4 | 323 | 346 | - | - | 86 | - | - | 86 | 3,232 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 1850 | S4 | 182 | 259 | - | - | 65 | - | - | 65 | 1,824 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 1860 | S4 | 924 | 1,311 | - | - | 328 | - | - | 328 | 9,235 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 3470 | S3 | 126 | 238 | - | - | 59 | - | - | 59 | 1,257 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 1870 | S3 | 1,064 | 2,012 | - | - | 503 | - | - | 503 | 10,644 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 3460 | S3 | 195 | 369 | - | - | 92 | - | - | 92 | 1,950 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 3390 | S4 | 478 | 444 | - | - | 111 | - | - | 111 | 4,777 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 3391 | S4 | 137 | 127 | - | - | 32 | - | - | 32 | 1,366 |
| Davidson Creek | Creek 704454 Tributary | 1 | Unconfirmed Fish-Bearing | 1881 | S4 | 185 | 172 | - | - | 43 | - | - | 43 | 1,853 |
| Creek 661 | Creek 505659 Mainstem | 6 | Unconfirmed Fish-Bearing | 3870 | S4 | 133 | 129 | - | - | 64 | - | - | 64 | 1,329 |
| Creek 661 | Creek 505659 Mainstem | 7 | Unconfirmed Fish-Bearing | 2780 | S4 | 172 | 115 | - | - | 29 | - | - | 29 | 1,717 |
| Creek 661 | Creek 505659 Mainstem | 7 | Unconfirmed Fish-Bearing | 3431 | S4 | 281 | 188 | - | - | 47 | - | - | 47 | 2,805 |
| Creek 661 | Creek 505659 Tributary | 1 | No Data (Default Unconfirmed Fish-Bearing) | 2960 | - | 619 | 749 | - | - | 187 | - | - | 187 | 6,190 |
| **Totals** | | | | | | **28,219** | **57,773** | **16,678** | **16,325** | **17,600** | **-** | **7,492** | **58,096** | **514,890** |

*Notes:*

1. *Reach numbers are based on the Reach Breaks defined in Appendix 5.1.2.6A of the Application/EIS (New Gold 2014)*
2. *The Water Feature Identifier (WFID) is a unique number assigned to identify a water feature segment (including streams, ponds, and lakes)*
3. *Stream Class ratings are based on those assigned in Appendix 5.1.2.6A of the Application/EIS (New Gold 2014) following the BC Forest Practices Code classification system. S3 streams are fish-bearing with a channel width of 1.5 ≥ 5 m. S4 streams are fish-bearing with a channel width < 1.5 m. NVC refers to non-visible channels that do not support fish habitat. A dash "-" indicates that no stream classification was assigned in the EA dataset.*
4. *Channel length rounded to the nearest metre*




**Distribution of Impacted Habitat in the Davidson Creek and Creek 661 Watersheds**

**FIGURE 5-1**

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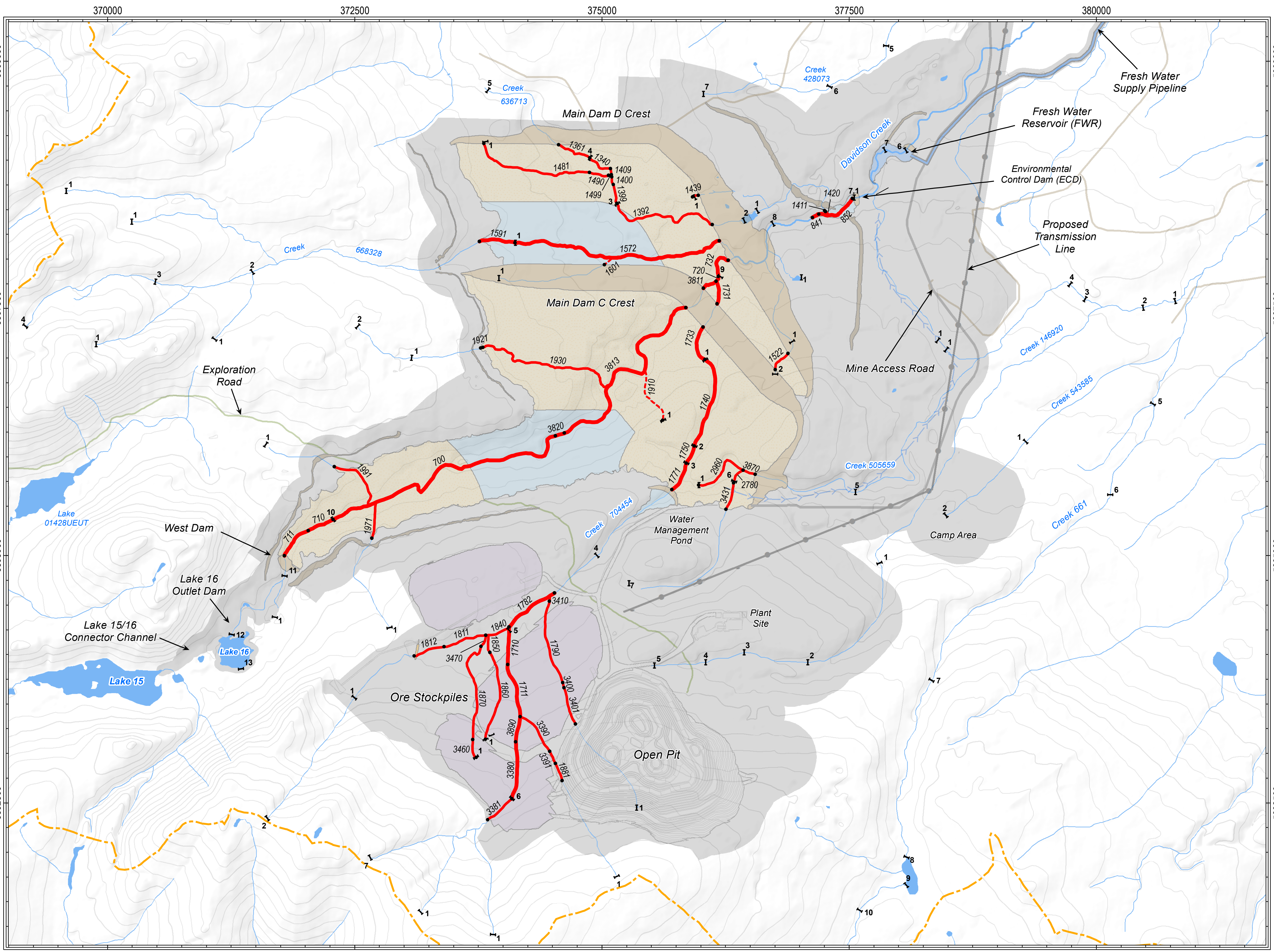



## Legend

- Impacted Fish Habitat (Schedule 2)*
- Non Fish-bearing Stream (Schedule 2)
- Reach Break
- Segment Break
- Elevation Contour (25 m interval)
- Exploration Road
- Forest Service Road
- Waterbody
- Mine Footprint
- Local Study Area Boundary

* Segment number refers to unique Water Feature Identifier (WFID).

*Mine site components displayed with faded colours - see Figure 2-3 for more detailed descriptions.

Whitehorse, YUKON, N.W. TERRITORIES, Fort St. John, BRITISH COLUMBIA, ALBERTA, Prince Rupert, Vanderhoof, Prince George, Edmonton, Project Location, Calgary, Kamloops, Kelowna, Vancouver, Victoria, U.S.A., 0 200 400 kilometres

Scale 1:38000
UTM Zone 10N
NAD 1983 Datum
0 0.5 1 kilometres

Prepared For:

**CLIENT:** Artemis Gold Inc.
**PROJECT:** Blackwater
DRAWN: B. Elder
CHECKED: I. MacLeod
PROJECT: 2006501
DATE: Jul 29, 2021

Prepared by:

**Distribution of Schedule 2 Impacted Habitat in the Blackwater LSA**

**FIGURE 5-2**



Document Path: G:\Shared drives\Projects 2020\20065 - Artemis Gold Inc\2006501 - Blackwater Project 2020-2021\Mapping\Figures\5_ArcGIS\ECCC Report\ECCC_Figure 5-2 Impacted Fish Habitat (Schedule 2).mxd

# 6. Compensation Measures

BW Gold has designed the Project, to the extent possible, to avoid HADD and death of fish through project design, refinement and mitigation. Despite these efforts, residual habitat loss subject to Schedule 2 amendment (as described in Section 5 Habitat Loss Assessment) is unavoidable. Compensation measures are necessary to counterbalance the resulting unavoidable habitat loss.

This Compensation Plan has been prepared in accordance with DFO's Measures to Protect Fish and Fish Habitat (DFO 2019a), DFO's Fish and Fish Habitat Protection Policy Statement (DFO 2019b), and DFO's Policy for Applying Measures to Offset Adverse Effects on Fish and Fish habitat Under the *Fisheries Act* (DFO 2019c). It also aligns with provincial fisheries management objectives and prioritizes measures that address existing limitations on fisheries productivity within and beyond the Project area. The Plan was updated based on comments received from Indigenous Nations, after field reconnaissance visits, community meetings and technical workshops.

Two provincial fisheries management objectives were used to guide development of potential compensation measures:

1. Protect and increase freshwater fish stocks; and
2. Rehabilitate habitat used by freshwater fish.

The proposed compensation measures focused on the development of habitat gains for Rainbow Trout, as this is the only fish species identified in the upper reaches of the Davidson Creek and Creek 661 watersheds. Rainbow Trout is an important recreational fish species in BC and is culturally important to Indigenous people. The proposed compensation measures are biologically relevant and provide the greatest likelihood of counterbalancing losses in the long term.

An overview of each of the proposed compensation measures is provided in the following subsections. Overview aerial photography is provided for the compensation sites in Appendix D. Detailed Design Drawings for the proposed habitat compensation measures are presented in Appendix E. Riparian vegetation planting plans for each compensation measure are provided in Appendix F1 to F5. General and site-specific considerations for mitigating adverse effects during the implementation of each compensation measure are provided in a CEMP in Appendix G. An Effectiveness Monitoring Plan is provided in Appendix H to detail the approach to monitoring the successful implementation of the compensation measures.

## 6.1 Compensation Alternatives

Since the initiation of Project baseline aquatic studies in 2011, more than 35 candidate opportunities for fish habitat compensation have been identified through a comprehensive and systematic review of undisturbed and previously impacted aquatic ecosystems in the region encompassing the Project. The Conceptual Fisheries Mitigation and Offsetting Plan (AMEC 2014a, Appendix 5.1.2.6C of the Application/EIS) documents a comprehensive identification and evaluation of 19 on-site[6] and 12 off-site

[6] *Offsetting measures within the LSA are considered "on-site", whereas those outside of the LSA boundaries are considered "off-site".*

compensation options, and describes options determined most likely to provide direct benefits to the fisheries affected by the Project, and to the people relying on these areas for fishing. Additional compensation candidate projects were identified since the submission of the Application/EIS, including six options proposed by the Carrier Sekani First Nations (Palmer 2017), and one option proposed by the Ulkatcho First Nation. Other options, including ranchland stream restoration in the Vanderhoof agricultural district, and overwintering ponds, were identified in 2016 and 2017 through consultation with the Nechako Environment and Water Stewardship Society (NEWSS). Evaluation of offsetting options to be carried forward to detailed design considered DFO's hierarchy of preferences, feedback from Indigenous Nations, technical feasibility, biological relevance, certainty in success (risk of failure), and relative cost.

## 6.2 Selection of Compensation Measures for the MDMER Schedule 2 Compensation Plan

### 6.2.1 Mathews Creek and Additional Offsetting

Six compensation measures were selected for inclusion in the MDMER (2002) Schedule 2 Compensation Plan out of the many potential compensation measures considered for overall Project compensation. Two of the compensation measures are situated approximately 16 km southwest of the mine site in the Mathews Creek Watershed (Figure 6-1**;** Design drawings provided in Appendix E). These two associated measures are:

1. Mathews Creek channel restoration/enhancement; and
2. Mathews Creek off-channel pond creation.

Mathews Creek drains into Laidman Lake, which is located in the Fawnie Creek Watershed. The Fawnie Creek Watershed contains portions of the Blackwater LSA, including Creek 705 and Lakes 14 and 15, and drains into the Entiako River.

Based on the potential need for additional offsetting sites identified through consultations with ECCC, DFO and Indigenous nations that occurred throughout Q3 and Q4, 2021 and Q1 and Q2 2022, additional fish habitat and riparian offsetting opportunities at Mathews Creek, Chedakuz Creek in the area of Dykam Ranch and Ormond Creek (Planting plan presented in Appendix F5) were identified and explored in 2022 and have been added to the plan. These four new offsetting measures, are:

1. Mid-Mathews off-channel pond creation;
2. Chedakuz Creek (Dykam Ranch) channel restoration/enhancement;
3. Chedakuz Creek (Dykam Ranch) off-channel pond creation; and
4. Ormond Creek riparian restoration.

### 6.2.2 Mid-Mathews Ponds

Mid-Mathews Ponds were originally identified as a potential compensation measure during the conceptual planning stage for the overall Blackwater Project offsetting. The pond designs were advanced to a preliminary design stage, but were set aside as potential contingency options and not fully incorporated into past iterations of the FHCP. Following feedback from regulators and Indigenous Nations, indicating that additional instream area was required, these designs were revisited, presented to the Nations, and included in the FHCP. Similar to the Mathews Ranch Ponds, the Mid-Mathews Ponds are located in a historically altered floodplain that was used for agricultural purposes. Creation of these ponds will increase the available habitat for the resident fish community as well as providing habitat for waterbirds and other wildlife (described further in Section 6.4.2 Mathews Creek and Mid-Mathews Creek Off-Channel Ponds, and Section 6.4.7 Fish Compensation Interaction with Mathews Creek and Chedakuz Creek (Dykam Ranch) Wetland Offsetting).

Sites for off-channel overwintering ponds must be situated in low-lying areas adjacent to watercourses in order to avoid unnecessary and impactful earthworks/grading and ensure pond bottoms are excavated below the water table. Mid-Mathews Ponds are situated adjacent to segments of Mathews Creek that exhibit relatively stable channel morphology. Mathews Creek, near the proposed ponds, has a low gradient (<0.5%), modest flow velocities and no excessive erosion and/or deposition or rapid planform adjustment. The ponds are positioned in an ideal refuge area for migrating and overwintering fish species as Mathews Creek bed elevation drops approximately 75 m over 5 km (approximately 1.5%) as it flows toward Laidman Lake. Additionally, Mid-Mathews Ponds benefit from a history of anthropogenic disturbance (e.g., land/vegetation clearing and localized ditching to optimize the land for agriculture/ranching), such that proposed excavations necessitate little to no impact to natural ecosystems.

### 6.2.3 Chedakuz Creek (Dykam Ranch)

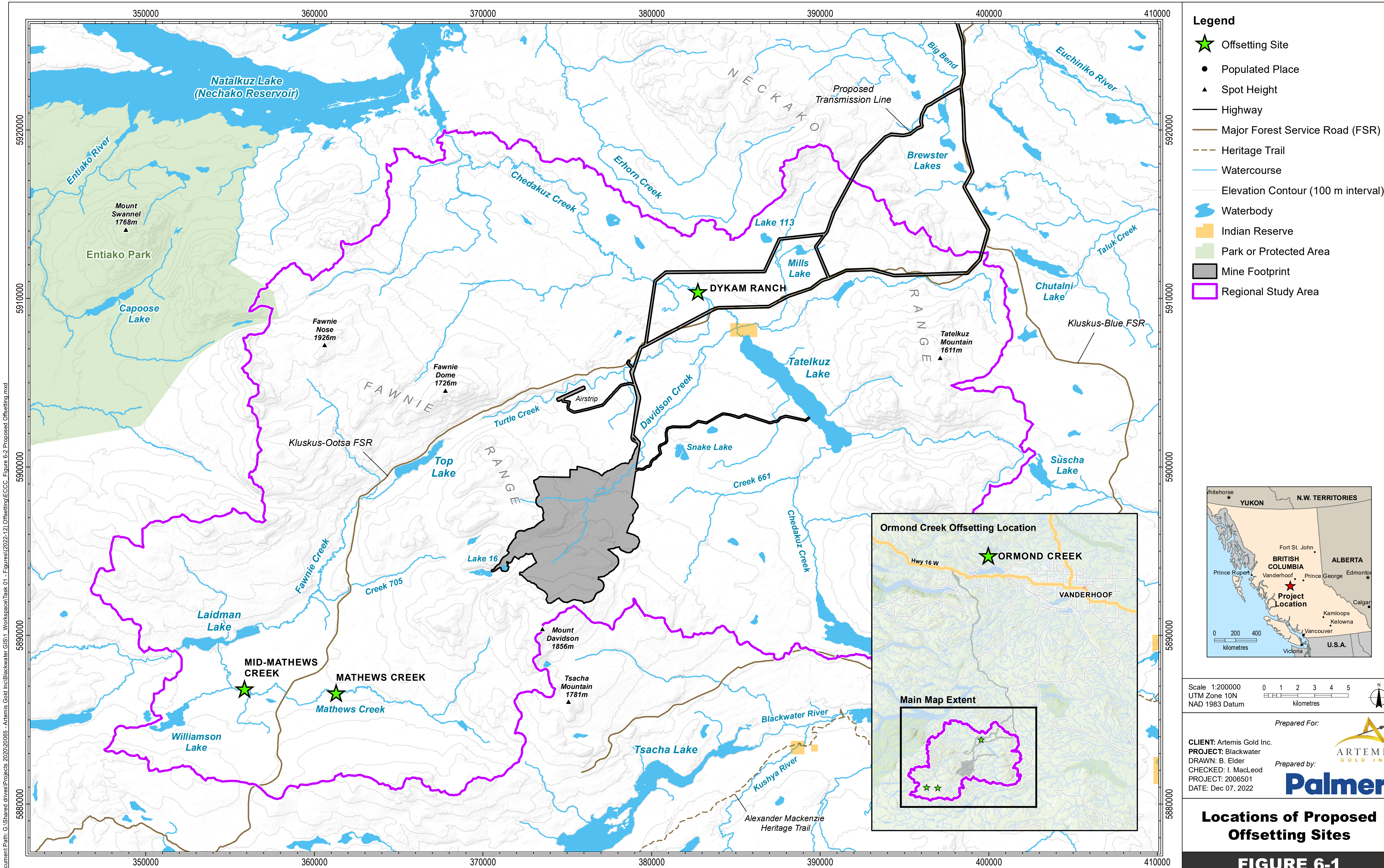
At the request of Lhoosk'uz Dené and Ulkatcho First Nations, during the 2021 fall moose surveys ERM personnel identified a number of other potential wetland/fisheries offsetting sites, one of which is known as Dykam Ranch (Design drawings provided in Appendix E). Dykam Ranch is located along Chedakuz Creek, northwest and downstream of Tatelkuz Lake. The Dykam Ranch contains a portion of an extensive wetland complex that is bisected by the Kluskus Forest Service Road (FSR). The Vanderhoof Land and Resource Management Plan (Government of BC, 1997) indicates that Dykam Ranch is within the Chedakuz Resource Management Zone 16, in which they report:

> This area is home to large moose and deer populations, along with birds, small mammals, grizzly and black bear. The vegetation is an unusually diverse mixture of species and stand ages for the Nechako Plateau, situated along numerous creeks and swamps. This combination provides excellent ungulate habitat, and probably the best moose winter range in the Vanderhoof Forest District.

Consequently, the Dykam Ranch fish offsetting restoration activities provide an opportunity to enhance ecosystems that are adjacent to critical winter range for moose and mule deer and serves as important habitat for grizzly and black bear. Benefits to Kokanee achieved through offsetting will also serve grizzly bear populations. The area also contains a system of natural wetlands and meadows that create a corridor of important wildlife habitat between the Blackwater River valley and the Knewstubb Reservoir. Furthermore, Dykam Ranch is owned by a proactive landowner with the desire to create a long-term positive environmental legacy on the land that is part of such an important and diverse ecosystem.

### 6.2.4 Ormond Creek

Ormond Creek is an area that was impacted by the Shovel Lake Wildfire. This area was proposed for inclusion as a riparian offsetting area by the Carrier Sekani First Nations in Dec 2021 due the widespread effects of the fires in the region and the positive benefits that could be achieved for aquatic life through riparian restoration. The Ormond Creek site consists of two potential restoration areas: Restoration Area 1 and Area 2 (Appendix F4). Field crews documented observations of riparian disturbance to identify restoration needs, potentials, and collect initial baseline data. Survey methods were increasingly systematized in specific management areas such as Ormond Creek to measure live and dead standing timber in burn areas. Restoration Area 1 is focused on the upper portion of Ormond Creek, starting at the outlet of Ormond Lake, and extending roughly 6 km downstream towards Fraser Lake. Restoration Area 2 is focused on a short (roughly 0.9 km) portion of the Ormond Creek that joins Oona Lake to the northwest corner of Ormond Lake.




**Locations of Proposed Offsetting Sites**

**FIGURE 6-1**

## 6.3 Compensation Sites Existing Conditions

### 6.3.1 Fish Habitat Assessment and Background Information Review Methods

Mathews Creek was first identified as a compensation opportunity in 2012, and field studies to characterise the existing habitat conditions and fish community were conducted in 2013, 2016, 2017, 2020, and 2021. Field data collection included fish habitat assessment, aerial photograph interpretation, aerial photograph and digital elevation mapping using an Unmanned Aerial Vehicle (UAV; drone), water chemistry sampling, and fish sampling. Baseline streamflow monitoring was initiated to document flow, water quality and stream temperatures. Geomorphic channel surveys were completed at key sites to support the design of habitat compensation efforts. Fish habitat assessments were conducted using the *Fish Habitat Assessment Procedures* (Johnston and Slaney 1996), the *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory* (RIC 2001), or a HEP-specific field data sheet, described in Appendix B. Background review of publicly available information accessed from the BC Fisheries Information Summary System (FISS), local knowledge, and regional fish habitat data provided by NEWSS, was also completed to help inform the field program objectives and restoration approach.

In October 2020, Palmer completed a drone flight of the Mathews Creek valley and visually assessed portions of the restoration area on foot to determine if disturbance indicators had changed since the 2016/2017 UAV flight and field assessment. The 2020 drone imagery was compared to 2016 and 2017 drone imagery to document any recent ecological or morphological changes along Mathews Creek, as described in Appendix B.

### 6.3.2 Mathews Creek History

The Nechako Plateau has undergone extensive historical disturbance in association with farming and cattle ranching (NEWSS 2016; W. Salewski, pers. Comm.). An influx of people to the region throughout the 20th century was driven by readily available land and government policies to encourage settlement and land-clearing.

Arranging leases and establishing ownership of parcels of government-owned land were historically contingent on requirements to clear a percentage of the land within a parcel. Clearing and seeding of up to 80% of a parcel of land over a 20-year period was required for the land occupant to obtain title to the land (NEWSS 2016; W. Salewski, pers. Comm.).

Over time, grazing by cattle "can affect the riparian environment by changing, reducing, or eliminating vegetation, and/or entire riparian areas through channel widening, channel aggrading, or lowering of the water table" (Platts 1991). In areas of intense grazing, stream channels contain more fine sediment, streambanks are more unstable and are less undercut compared to streams in ungrazed areas (Armour 1977; Behnke and Zarn 1976; Platts 1983).

Historical policy of mandating land clearing for farming and ranching led to widespread loss of aquatic habitat, including small streams, riparian areas, and wetlands. Ongoing farming and ranching activity has prevented the reestablishment of sensitive streamside areas throughout the Nechako Valley (W. Salewski, pers. Comm.). One section of watercourse where impacts of decades of cattle ranching on aquatic habitat persist is a mid-elevation reach of Mathews Creek, which drains the southwestern flank of Mount Davidson (Figure 6-1).

Mathews Creek was first visited by European settlers shortly after World War II (late 1940s), when a float plane pilot working in the area spotted and landed on Laidman Lake (Laidman Lake Lodge 2013). Since then, human activity in the Mathews Creek Watershed has altered its natural condition. Anthropogenic influences largely stem from agricultural activity, forest harvesting, mineral exploration and recreational fishing (Palmer 2013).

In Mathews Creek, extensive impacts are the result of several decades of agricultural land use (Palmer 2013). The property is overlapped by a Range Tenure (RAN075042, retired in 2012), and displays evidence of past use of agronomic production, and cattle grazing. Historical aerial photographs reveal that construction of the Mathews Creek Ranch and land clearing in support of cattle ranching began between 1964 and 1975. Use of the floodplain for hay harvesting likely began in 1975 and continued until 1991, during which period drainage ditches were excavated along the valley bottom and in toe-slope positions. The drainage ditches increased the efficiency of land drainage, particularly in the spring, maximizing accessibility for cattle grazing. The ditching has also lowered the groundwater table within the valley bottom alluvium, altering the natural soil moisture regimes and transforming areas of wet meadow and riparian fens into drier meadow ecosystems. Extensive cattle trampling of the floodplain and channel banks, where deterrent fences were absent or unmaintained, destabilized channel banks and has increased local and downstream sedimentation. BW Gold bought the property in 2013, which resulted in the removal of grazing and livestock pressure on the land.

Non-agricultural anthropogenic disturbances have contributed less to impacts to the aquatic and riparian ecosystems of Mathews Creek and its tributaries (Palmer 2013). Extensive clear-cut forestry has occurred in the watershed, including on the lower valley sides adjacent to Mathews Creek between 1975 and 1991. This has mainly altered woody debris supply to intermittent headwater tributaries and has potentially increased stream temperatures and decreased hydrological response time slightly. Also, a number of bridges and culverts were constructed across Mathews Creek and its tributaries to provide forestry road access.

### 6.3.3 Mathews Creek Existing Conditions

Mathews Creek Watershed is approximately 180 km$^2$ and located in the Nechako Plateau of central British Columbia. Mathews Creek originates near treeline on the southwest flank of Mount Davidson (1,862 masl) and flows generally westward and northwestward through open and forested valleys to its mouth at Laidman Lake (~1,000 masl), which defines its confluence with Fawnie Creek. Fawnie Creek flows northwestward through a series of narrow lakes before entering Entiako River, which flows northeastward to Natalkuz Lake, part of the Nechako Reservoir. Nechako River continues eastward to Prince George, where it joins Fraser River and flows southward to its mouth in Georgia Strait in Vancouver.

Mathews Creek Watershed is situated within a region of gently rolling to hilly terrain, with more subdued topography than exists in the Coast Mountains about 100 km to the west. A clayey to sandy till dominates the surficial geology within the watershed (Plouffe et al. 2004). Glaciofluvial sand and gravel is widespread along the lower valley sides adjacent to Mathews Creek and along the headwater tributary containing a small lake. Modern alluvial deposits fill most valley bottom areas, largely derived from upstream glaciofluvial deposits exposed in cut-banks. In the vicinity of the compensation measures, the level floodplain is composed of fine sand, interbedded with silt and organic material.

At the farthest downstream extent of Mathews Creek, the channel exhibits an unconfined, sinuous pattern as it flows across the gentle alluvial fan-delta to its mouth at Laidman Lake. It is relatively wide and shallow, with well-defined pool-riffle morphology and a gravel bed. Only a small deposit of sediment extends into Laidman Lake at its mouth, indicating that sediment transport rates are modest (Palmer 2013).

Between Mathews Creek Ranch and Laidman Lake, Mathews Creek flows through a boulder-dominated canyon near Laidman Lake, and a broad, valley-bottom meadow closer to the ranch (Palmer 2013). The canyon reach is in a relatively narrow and deep valley incised into adjacent glaciofluvial and till deposits. It is relatively wide and shallow, with a complex of pool-riffle-run habitat. Cobbles and boulders, derived mainly from several high, unstable cut-banks along the reach, dominate the bed and protrude above the water surface during low to moderate flows. Large woody debris extends into the channel along some portions of the banks, derived from fallen coniferous trees that line both sides of the channel. The valley-bottom meadow reach is partly confined with an irregular meander pattern. The low gradient and local abundance of beaver dams (approximately 12 along its upstream end) minimize flow velocities and maintain a deep channel dominated by run and pool habitats. Channel substrates are mostly sand with minor amounts of gravel. In-stream large woody debris is uncommon, as the channel is bound by mostly open herb meadows, some of which continue to be cleared for hay harvesting.

In the immediate vicinity of the compensation measures, the Mathews Creek channel exhibits an unconfined, tortuous meander pattern as it flows across a very broad, level valley bottom, within which past agricultural activity has been most intense of all reaches. Its gradient is low (~0.1%), and riffles are rare to non-existent. In-stream habitats are dominated by long runs (approx. 58% of channel, on average), with small pools situated at the apices of sharp meanders (approx. 42% of channel, on average). Most drops in water elevation along the reach occur in association with the numerous observed beaver dams. Bed material is dominantly sand, with fine gravels exposed along local flow constrictions formed by collapsed banks, where velocities are higher. Little in-stream large woody debris was identified where agricultural land use predominates and natural, shrubby riparian vegetation has been removed or trampled by cattle. Moderate to abundant fish cover is provided by deep pools and in-stream vegetation, with isolated accumulations of small woody debris and collapsing, undercut banks also noted. Deep pools may provide overwintering habitat depending on local groundwater inputs and winter temperatures. However, the lack of gravel substrate indicates that Rainbow Trout spawning is unlikely supported along this reach.

Immediately upstream of the former Mathews Creek Ranch and the proposed compensation area, the broad, gentle valley bottom is dominated by a mosaic of shrubs and herb fens, with black spruce scattered along the tops of banks providing some forested canopy cover (Palmer 2013). Functional large woody debris is common. Overhanging vegetation is abundant, with boulders, in-stream vegetation and woody debris providing additional cover.

Farther upstream in the headwater reaches, the gradient of Mathews Creek increases, instream habitat includes a complex assemblage of riffles, run, and pools, cover for fish is dominated by overhanging vegetation and undercut banks, and land cover is dominated by forest (Palmer 2013).

Water chemistry sampling indicated that water quality in Mathews Creek is suitable to support aquatic life (Palmer 2013). Parameters measured *in-situ* (i.e., dissolved oxygen, pH, conductivity, water temperature) were all within Canadian Council of Ministers of the Environment (CCME) and provincial guidelines. Nutrient concentrations both upstream and downstream of the compensation areas were low, indicating that agricultural land use in the middle and upper reaches of the watershed are not contributing to increased nitrogen levels in Mathews Creek. No pesticides or herbicides were detected in the water quality samples. Some guideline exceedances for total iron and total copper were detected downstream of the compensation area.

Streamflow in Mathews Creek has been measured by Knight Piésold at station H12, located at the FSR approximately 3 km downstream of the proposed compensation work area. Hydrometric instrumentation is removed from the channel during winter months to avoid damage caused by ice; therefore, only seasonal measurements are available. The hydrograph from Mathews Creek indicates that peak flows typically occur in May and are due to runoff generated as a part of spring freshet (Figure 6-2). Following peak flows in the spring, flows recede to low flow conditions that exist throughout summer months. Additionally, the impacts of summertime rainstorms are evident through the presence of secondary streamflow peaks that occur throughout the summer.

Beaver dams regulate water levels along much of the creek and maintain upstream deep impoundments during periods of low discharge. Although observed data are not present during the winter, groundwater-dominated low flows likely persist throughout the winter months until temperatures rise and snow begins to melt in the spring.

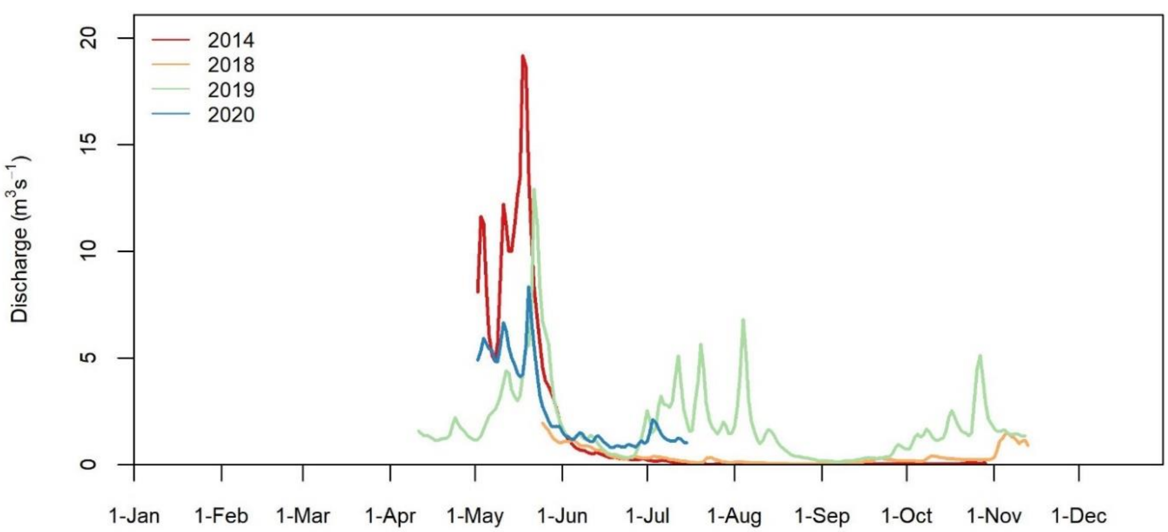



***Figure 6-2. Daily Streamflow Recorded at Hydrometric Station H12 in Mathews Creek.***

Burbot (*Lota lota*), Brassy Minnow (*Hybognathus hankinsoni*), Slimy Sculpin (*Cottus cognatus*), Longnose Dace (*Rhinichthys cataractae*), Rainbow Trout, and White Sucker (*Catostomus commersonii*) were captured in Mathews Creek during fisheries sampling (electrofishing and minnow trapping) in the fall of

2013 (Palmer 2013). Longnose Dace, Lake Chub (*Couesius plumbeus*), and Rainbow Trout were captured in the lower section of Mathews Creek, near the Kluskus FSR crossing during fish sampling efforts (electrofishing and minnow trapping) conducted in early October 2016 (Palmer 2013).

Rainbow Trout and Burbot were the most dominant species captured in Mathews Creek, with low abundances of White Sucker, Longnose Dace, Brassy Minnow, and Slimy Sculpin also present throughout the watershed. Fish sampling conducted in 2013 found that catch per unit effort (CPUE) for all fish was highest downstream of the compensation area (3.42 individuals/100s electrofishing), lowest in the immediate vicinity of the compensation area (0.49 individuals/100s electrofishing), and intermediate in adjacent reaches (1.30 [downstream reach] and 0.83 [upstream reach] individuals/100s electrofishing, respectively; Palmer 2013).

Anthropogenic changes along Mathews Creek have affected local, upstream and downstream habitat productive capacities. Fish utilization near the Mathews Creek Ranch is likely reduced from its natural condition due to a lack of habitat structural complexity (e.g., riparian vegetation, large woody debris and stable, undercut banks) that provides fish cover and substrate for periphyton and benthic invertebrates, and from locally high suspended sediment concentrations from the erosion of trampled and collapsed banks. Fine substrates have been associated with reductions in benthic invertebrate and periphyton abundance and diversity (Wood and Armitage 1997), and lower salmonid growth and survival rates (Suttle et al. 2004).

The current sparse riparian canopy also increases predation from birds and mammals and raises water temperatures through reduced shading. Allochthonous inputs including nutrients and food from riparian vegetation have been reduced along and thus downstream of the reach. Large woody debris disbursement, which provides organic carbon, fish protective cover, benthic invertebrate habitat and the facilitation and maintenance of complex stream features (e.g., scour pools, undercut banks), is largely absent.

The aquatic impacts to fish habitat can be generally grouped into four categories:

1. Cattle trampled banks and bed;
2. Dilapidated bridge crossings;
3. Exposed channel banks; and
4. Flow obstructions/impediments.

### 6.3.4 Chedakuz Creek (Dykam Ranch) Existing Conditions

The Chedakuz Creek Watershed is situated along the northern flank of the Fawnie Ridge and flows from upstream of Kuyakuz Lake to the Nechako Reservoir (AMEC 2013). Located within the RSA, Chedakuz Creek includes lower, middle, and upper portions. Lower Chedakuz Creek meanders northwest for approximately 53 km from Tatelkuz Lake to the Nechako Reservoir. Middle Chedakuz Creek flows north approximately 12 km from the outlet of Kuyakuz Lake to Tatelkuz Lake. The upstream-most section of Chedakuz Creek is the main tributary to Kuyakuz Lake. More specific to the RSA, middle Chedakuz Creek is limited to the length between its confluence with Creek 661 and Tatelkuz Lake, and lower Chedakuz Creek is defined from the outlet of Tatelkuz Lake to the confluence with Turtle Creek.

#### *6.3.4.1 Chedakuz Creek Mainstem*

Immediately upstream of the inlet to Kuyakuz Lake, upper Chedakuz Creek is characterized by low-gradient riffle-pool habitat with abundant gravel substrate. Conditions there provide suitable spawning habitat, good quality rearing and migration habitat, and fair overwintering habitat (AMEC 2013). Major tributaries within the upper watershed provide high quality habitat, however, these headwater tributaries present fish passage barriers due to steep gradients, beaver dams, cascades and a culvert obstruction (AMEC 2013).

In closer proximity to compensation measures, lower Chedakuz Creek is a low-gradient stream with good quality spawning and rearing fish habitat (AMEC 2015). Typical of a medium-sized river, the portion directly downstream of Tatelkuz Lake has abundant gravels, deep pools, and instream vegetation (AMEC 2015). The average bankfull width in this section is approximately 14 m and has alternating patterns of glide, riffle, and pool habitat. Off-channel habitat is also prevalent in lower Chedakuz Creek (AMEC 2014b).

Water quality in lower Chedakuz Creek is generally suitable to support aquatic life (Palmer 2022c). In situ measurements for temperature and dissolved oxygen averaged 11.4°C and 7.57 mg/L, respectively. Values for conductivity (average 136.5 µS/cm) and total dissolved solids (average 121.3 mg/L) were relatively low. Water pH was within CCME and provincial guidelines for aquatic life (ranging from 7.41 to 7.98).

Streamflow in Chedakuz Creek has been measured by Knight Piésold at station H5 (Figure 6-3), located at the Kluskus FSR creek crossing. During the winter months (December to April), hydrometric instrumentation is removed to avoid damage to the instruments caused by ice. However, winter streamflow has been estimated by Knight Piésold using linear interpolation between discrete winter measurements. The hydrograph of Chedakuz Creek at the H5 station indicates that peak flows typically occur within May and are due to runoff generated as a part of spring freshet. Streamflow generally recedes following peak flows, with an increase in flow occurring within July, before reaching summer low flow conditions. Secondary streamflow peaks during July are likely caused by summer rainstorms. During low flow months, such as summer and winter months, Chedakuz Creek is likely supplied by outflow from Tatelkuz Lake and groundwater flow, until snowmelt occurs in the following spring.

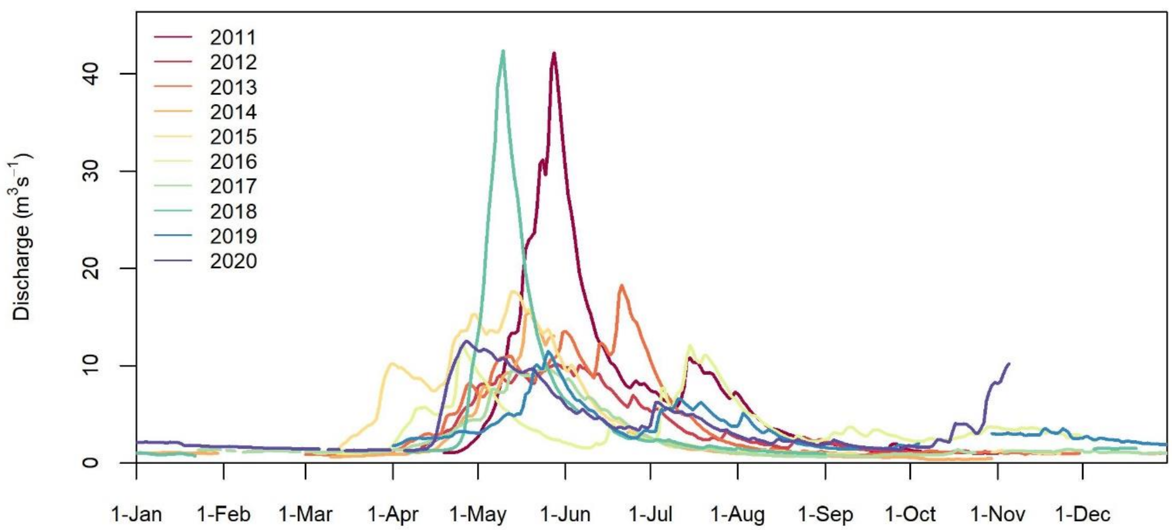



***Figure 6-3. Daily Streamflow Recorded at Hydrometric Station H5 in Chedakuz Creek.***

Longnose Sucker, Rainbow Trout, kokanee, Slimy Sculpin, and Longnose Dace were captured in Chedakuz Creek during baseline fisheries sampling (AMEC 2014b). Rainbow Trout were captured in lower Chedakuz Creek, near Dykam Ranch during fish sampling efforts (minnow trapping) conducted in September 2022 (Palmer 2022c). CPUE for all sites samples was highest at Site 13 (8.17 fish/trap hours) in comparison to lower catch at Site 10 (1.27 fish/trap hour), Site 13 (0.54 fish/trap hour) and Site 13 (0.53 fish/trap hour; Palmer 2013). The only fish species captured in upper Chedakuz Creek was Rainbow Trout (AMEC 2013).

Anthropogenic changes in the Chedakuz Creek Watershed, including decades of timber harvesting, road construction, and agricultural activities, have affected local, upstream and downstream habitat productive capacities. Fish utilization in Chedakuz Creek near the Dykam Ranch is likely reduced from its natural condition due to a lack of habitat structural complexity (e.g., riparian vegetation, large woody debris and stable, undercut banks) that provides fish cover and substrate for periphyton and benthic invertebrates, and from locally high suspended sediment concentrations from the erosion of trampled and collapsed banks. Fine substrates have been associated with reductions in benthic invertebrate and periphyton abundance and diversity (Wood and Armitage 1997), and lower salmonid growth and survival rates (Suttle et al. 2004).

The current sparse riparian canopy also increases predation from birds and mammals and raises water temperatures through reduced shading. Decreased nutrient and food input from riparian vegetation loss have been reduced along and thus downstream of the reach. Large woody debris disbursement, which provides organic carbon, fish protective cover, benthic invertebrate habitat and the facilitation and maintenance of complex stream features (e.g., scour pools, undercut banks), is largely absent.

The aquatic impacts to fish habitat can be generally grouped into four categories:

1. Cattle trampled banks and bed;
2. Dilapidated culvert crossings;
3. Exposed channel banks; and
4. Riparian vegetation loss.

#### 6.3.4.2 Lower Chedakuz Creek Tributaries

Two tributaries to lower Chedakuz Creek were assessed for habitat offsetting suitability in the area of Dykam Ranch: Tributary 1 and Tributary 2 in 2022 (Palmer 2022b, 2022c). Both tributaries flow southwest into the mainstem of Chedakuz Creek.

Tributary 1 has an average bankfull width and depth of 2.33 m and 0.48 m, respectively. Stream substrate is predominantly fines with subdominant gravels and cobbles. Impacts from cattle grazing were observed throughout the entire length of the tributary. Tributary 1 has a moderate to steep gradient (4.1%) and forks into an east and west branch. Riparian vegetation is a mix of shrubs and grasses with hardwood scattered along the tops of banks providing limited forested canopy cover. Overhanging vegetation is abundant, with small woody debris providing additional instream cover (Palmer 2022c).

Tributary 2 has an average bankfull width and depth of 2.95 m and 0.24 m, respectively. Stream substrate is dominated by fines with subdominant gravels. Riparian vegetation is mainly comprised of shrubs with grasses and coniferous trees. The stream has a moderate to steep gradient (4.5%). Overhanging vegetation is abundant with small woody debris providing additional instream cover (Palmer 2022c).

Juvenile Rainbow Trout were captured in both Chedakuz Creek tributaries during fish inventory sampling in 2022 (Palmer 2022c). In Tributary 1, CPUE was highest upstream from the road crossing (7.30 fish/100s electrofishing) in comparison to downstream from the road crossing (5.70 fish/100s electrofishing) and upstream in the west branch (2.97 fish/100s electrofishing). Although no fish were captured in the east branch of Tributary 1, fish were observed in this area during reconnaissance. In Tributary 2, CPUE downstream of the road crossing was 1.59 fish/100s electrofishing; no fish were caught upstream of the road crossing (Palmer 2022c).

Water quality sampling results for Tributaries 1 and 2 are generally suitable to support aquatic life (Palmer 2022c). In situ measurements for temperature and dissolved oxygen averaged 8.7°C and 7.16 mg/L, respectively. Values for conductivity (average 159.2 µS/cm) and total dissolved solids (average 143.8 mg/L) were low. Water pH was within or slightly above CCME and provincial guidelines for aquatic life (ranging from 7.95 to 9.75).

Anthropogenic changes in the Chedakuz Creek Watershed, including decades of timber harvesting, road construction, and agricultural activities, have affected local, upstream and downstream habitat productive capacities. Fish utilization near the Dykam Ranch is likely reduced from its natural condition due to a lack of habitat structural complexity (e.g., riparian vegetation, large woody debris and stable, undercut banks) that provides fish cover and substrate for periphyton and benthic invertebrates, and from locally high suspended sediment concentrations from the erosion of trampled and collapsed banks. Fine substrates have been associated with reductions in benthic invertebrate and periphyton abundance and diversity (Wood and Armitage 1997), and lower salmonid growth and survival rates (Suttle et al. 2004).

The current sparse riparian canopy also increases predation from birds and mammals and raises water temperatures through reduced shading. Nutrient and food inputs from riparian vegetation loss have been reduced along and thus downstream of the reach. Large woody debris disbursement, which provides organic carbon, fish protective cover, benthic invertebrate habitat and the facilitation and maintenance of complex stream features (e.g., scour pools, undercut banks), is largely absent.

The aquatic impacts to fish habitat can be generally grouped into four categories:

1. Cattle trampled banks and bed;
2. Access road crossings;
3. Exposed channel banks; and
4. Riparian vegetation loss.

### 6.3.5 Ormond Creek Existing Conditions

The Ormond Lake Watershed is 58.1 km$^2$ in size and is located north of Fraser Lake, central British Columbia. Water flows from Ormond Lake into Ormond Creek then drains towards the south, where it meets with Fraser Lake. Fraser Lake drains into the Nechako River and continues eastward to Prince George, where it joins the Fraser River.

The Ormond Lake Watershed exists within the Stuart Dry Warm Sub-boreal Spruce biogeoclimatic zone (SBSdw3). The watershed is characterized by gently rolling hills and has an elevation range of 676 m and 1382 m. Upland forests are dominated by hybrid White Spruce and Subalpine Fir. Lodgepole Pine, Trembling Aspen and Paper Birch are common pioneer species, indicating moist, rich, riparian zones. Alluvial forests with Black Cottonwood have a limited distribution surrounding riparian areas and on river floodplains. Wetlands are commonly located in abandoned river oxbows and postglacial depressions, occupying 0.6 km$^2$ of the watershed.

Lake area occupies 4.8 km$^2$ and streams cover a distance of 114 km. Fish species including Longnose Sucker, Rainbow Trout, Peamouth Chub, Burbot, and Lake Whitefish have been captured from Ormond Lake while Rainbow Trout, Chinook Salmon and Sockeye Salmon have been captured from Ormond Creek (BC MOE 2022). Ormond Creek joins with Fraser Lake, which has a well known and diverse assemblage of fish species, including Rainbow Trout, Bull Trout, Lake Trout, Dolly Varden, Mountain Whitefish, kokanee, Sockeye Salmon, Chinook Salmon, Prickly Sculpin, Burbot, Carp, Peamouth Chub, Largescale Sucker, Northern Pikeminnow, Redside Shiner, Longnose Dace, and Nechako White Sturgeon (BC MOE 2022).

Although sub-boreal landscapes are typically shaped by fire, fire regimes in the area have been disturbed through anthropogenic interactions including industrial scale forestry practices. Climate change, wildfire suppression, fuel accumulation due to mountain pine beetle outbreaks, and forest management practices have resulted in increased fire intensities and degraded ecosystem function.

Between July and September 2018, the Shovel Lake Wildfire burned 92,412 hectares of land, located directly north of Fraser Lake. The Ormond Creek riparian area was highly impacted by the 2018 Shovel Lake Wildfire. A severe burn area extends for approximately 2.4 km south-west of the Ormand Creek confluence with Ormand Lake. A stream restoration feasibility assessment completed by EcoLogic (2022) indicated that all trees had been killed within the 0.02 hectare (ha) test plots assessed along the Ormond Creek riparian zone, although some live trees including cottonwood, willow and Sitka Alder filled in patchy sections to occupy sections of approximately 5 to 15 m of the stream shoreline. The burn was more severe (i.e., no live large trees) on the eastern bank where the plots were established.

According to the Shovel Lake Wildfire Ecosystem Restoration Plan (Daust and Price 2019), Ormond Creek is an area with high watershed sensitivity and heightened value for fish reproduction, including both rearing and spawning habitat It also serves as a culturally important area to the Nak'azli Whut'en. These values make the Ormond Creek Watershed a restoration priority.

Equivalent clearcut areas (ECA) represent the hydrological equivalency between a watershed and a recent clearcut. Following the Shovel Lake Wildfire, the Ormond Lake Watershed had an equivalent clearcut area (ECA) of 76%. The high-risk rating for ECA is >48% clear land. The Ormond Lake Watershed is of particular concern, as it is an area of high fisheries productivity and sensitivity.

The Ormond Lake Watershed is free of road disturbance in much of the area surrounding Ormond Lake, providing a large enough area to support female grizzly bear foraging. Road density in the watershed is 1.5 $km/km^2$. Retaining riparian structure around Ormond Lake and Ormond Creek is also key to providing habitat for furbearing animals and moose. The Ormond Lake Watershed supports cultural values and services by providing food, medicinal plants and fishing opportunities. The cultural camp near Ormond Lake is used often and the area also has high archaeological potential.

## 6.4 Detailed Description of Habitat Compensation Measures

The three proposed compensation project areas are described in detail in the following sections. Calculations of habitat gains are provided in areal extent (i.e., in square metres) and in HU for relevant life stages of Rainbow Trout. The proposed compensation projects are located on land owned by BW Gold and on adjacent Crown Land (Mathews Creek and Ormond Creek), or on private land (Chedakuz Creek [Dykam]).

### 6.4.1 Mathews Creek Restoration and Enhancement

Stream restoration and enhancement is proposed along 4.9 km of Mathews Creek in multiple reaches where degraded habitat has been identified (Appendix E, Sheets 1824-3-1-003 to 1824-3-1-006). Mathews Creek is part of the Nechako River Watershed, and has been impacted by past agricultural practices, particularly land clearing and cattle grazing. Mathews Creek was selected as a compensation site because it is in close proximity to watersheds and water bodies being affected by the Project and it is within the territories of the Indigenous Nations (LDN and UFN) where the majority of stream impacts are occurring. Further, there are ecosystem-level gains to come from multiple forms of offsetting happening within the Mathews Creek wetland complex as well (e.g., bats, wetlands, and fish).

The impacts of agricultural activity, in particular cattle trampling of riparian and instream habitat, is primarily concentrated along the north bank, thus most of the proposed restoration/enhancement occurs along the north bank. Common issues and proposed restoration techniques are summarized in Table 6-1. Restoration of natural channel dimensions is proposed for the upstream segments near the Mathews Creek Ranch buildings, where exposed banks and channel over-widening are observed. Cattle trampling becomes more localized further downstream of ranch buildings.

The local rise in the groundwater table in recent years, associated with beaver activity in downstream segments, poses construction challenges (e.g., soft ground, dewatering). However, proposed restoration/enhancement treatments requiring heavy machinery (e.g., excavators) is limited to upstream (drier) segments and downstream segments that are above the groundwater table. Riparian plantings (see Appendix F1) are proposed for the majority of segments to improve bank stability and shade, provide allochthonous inputs (e.g., leaf litter, terrestrial insects), and increase overhanging cover for fish. Four failing cattle and small vehicle crossings and farm machinery debris are proposed to be removed.

The Surface Erosion Prevention and Sediment Control Plan (SEPSCP) for the Mine Site contains specific mitigation measures to minimize temporary impacts to Mathews Creek that could be caused by initial flow diversion, dewatering of the instream work areas, and general construction activities (ERM 2022). The mitigations from the Mine Site CEMP should also be implemented during construction and soil salvage activities. Mitigations include soil salvage being conducted under frozen conditions, removing snow prior to salvaging, the usage of swamp mats or pads, and low-ground pressure or tracked equipment to reduce compaction. The SEPSCP and the CEMP should be periodically updated to reflect learnings from operations and site conditions proposed encountered for the Mathews Creek offsetting sites.

Bed material in the area of proposed works is naturally dominated by sands. Therefore, placement of gravel materials on the streambed to support spawning habitat is not proposed, due to the expected infilling of interstitial spaces by fine sand and silt, which would limit suitability to support spawning habitat.

BW Gold owns (fee-simple) the majority of the land along the section of Mathews Creek to be restored and enhanced, although some portions of the compensation habitat are located on the adjacent Crown Land. To date, BW Gold (and the previous owners, New Gold) have excluded cattle from the property and engaged in discussions with provincial range officers to explore options for permanent cattle exclusion and off-channel watering within the adjacent Crown Land areas. The removal of agricultural pressures has begun to reverse erosion, rutting, nutrient loading, and soil compaction impacts (Robotham et al. 2021). Areas of the wetland complex surrounding Mathews Creek, west of the second off-channel pond have been observed to be recovering, likely due to the absence of cattle browsing pressures and the reintroduction of beavers onto the landscape.

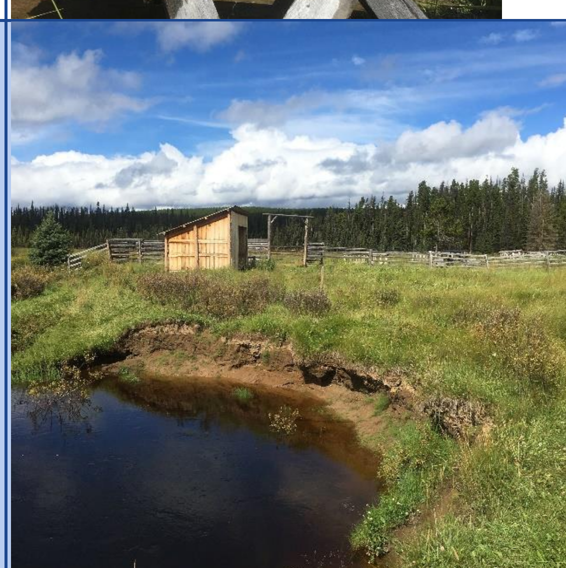
Riparian plantings are proposed where land adjacent to the stream is bare of vegetation or has minimal vegetation cover. Once fully established, the riparian plantings will improve bank stability and shade, provide aquatic food sources, and increase overhanging cover extending up to 15 m from the stream bank. The generally bare riparian areas are proposed to be enhanced with a combination of native seed mix and native shrub plantings whereas the areas with sparse shrub cover are only proposed to be seeded. If any species is not locally available then a suitable locally native alternative will be used as determined by a Qualified Professional Botanist. During planting, any existing invasive species will be identified and this information will be added as part of monitoring data collection and management recommendations (Section 8 of Appendix F1).

Densely vegetated areas, areas with standing water, and small tributaries are proposed to be retained and protected. The plant selection (Appendix F1) was based on field reconnaissance, aerial photograph interpretation, multiple years of drone imagery, common vegetation community summaries described in BC's Wetland Identification Guide (Mackenzie and Moran 2004) and BC's Biodiversity Atlas (Austin and

Eriksson 2009), restoration papers, and guidance documents. All species proposed to be planted are native to the region.

The riparian planting prescriptions (e.g., plant selection, planting densities, seeding techniques and rates, and seeding mixes) described in Appendix F1 are based on vegetation surveys performed in the 2022 field season, and will depend on the availability of plants/seeds, and site conditions during implementation (i.e., there will be some degree of 'field-fitting'). The primary purpose of the 2022 vegetation surveys was to fully characterize and evaluate existing conditions, and thereby allow for refinement of the planting prescriptions. These prescriptions provide site-specific treatments (e.g., cutting, tilling, or otherwise removing the pressure from agronomic species to compete with native plants) based on the survey results and guidance of qualified plant ecologists. Other updates to planting or revegetation measures (e.g., species selection, planting densities) are presented, including plant protection measures (e.g., livestock exclusion, browse protection).

***Table 6-1. Common Geomorphological and Aquatic Habitat Impacts along Mathews Creek and Proposed Restoration Techniques***

| Aquatic Impact | Description | Example Photo | Restoration Objectives | Proposed Restoration and Enhancement Techniques |
|---|---|---|---|---|
| Cattle Trampled Banks and Bed | Cattle have trampled channel banks and bed while grazing and watering, which has led to a lack of a defined channel, over-widening, fine sediment input, and/or lack of riparian vegetation. |  | Restore and maintain a channel with a natural shape, dimensions, and bed material, such that water flow and sediment transport are in a natural balance; and<br>Exclude livestock from property | Reconstruction of natural bankfull channel, using a combination of earth fill and strategic woody debris placement (to promote channel-edge sedimentation);<br>Brush layers;<br>Riparian plantings (e.g., live stakes and potted plants);<br>Targeted/careful excavation of anomalous in-stream accumulations of fine sediment; and<br>Localized placement of boulders on channel bed. |
| Dilapidated Bridge Crossings | Small machinery and livestock historically crossed Mathews Creek at haphazard wooden crossings, which has degraded the channel banks and bed and negatively impacted fish passage. |  | Maintain opportunities for small machinery and pedestrians to cross Mathews Creek at one managed/controlled location; and<br>Remove dilapidated crossings. | Restrict crossing to one existing wooden crossing near the Mathews Creek Ranch buildings (i.e., upstream extent of works)<br>Re-sculpt the channel banks immediately upstream/downstream of the removed crossings; and<br>Plant natural riparian and brush layers immediately upstream/downstream of the crossings. |
| Exposed Channel Banks | Hydraulic erosion and/or lack of bank or riparian vegetation has led to exposed and commonly over-steepened channel banks, resulting in channel instability (rapid bank erosion, bank slumping) and increased inputs of fine sediment into the channel. |  | Restore natural meander migration rates through re-establishment of riparian vegetation on re-graded banks. | Re-grade banks to a gentler side slope, to allow bank/riparian vegetation to re-establish;<br>Plant natural brush layers;<br>Plant natural riparian vegetation via seeding and live stakes in all areas of disturbance; and<br>Proactively accommodate meander migration trend, where possible, with wider riparian buffer or low-use set-back area. |
| Flow Obstructions/ Impediments | Natural (e.g., beaver) and anthropogenic woody debris jams (small and large), and anthropogenic materials (e.g., failed crossing structures) has caused upstream impoundment, excess sedimentation, and fish passage issues. |  | Remove in-stream obstructions that are unnatural and impede or prevent fish passage or cause extensive and/or prolonged backwatering (habitat impact). | Remove unnatural flow impediments. |

### 6.4.2 Mathews Creek and Mid-Mathews Creek Off-Channel Ponds

The limited availability of overwintering habitat has been identified in the baseline studies as a potential limited habitat type for fish in the Project area (as described in Section 3.4.1.1 Rainbow Trout). To compensate for lost habitat in the Project area, BW Gold proposes to construct five off-channel ponds in the Mathews Creek Watershed to provide overwintering habitat for Rainbow Trout, as well as habitat for other trout life stages (Appendix E, Sheets 1824-3-1-008 to 1824-3-1-011). The basis of the compensation plan is total habitat area and not an assumption of individual habitat type being the lone limiting factor.

Three ponds (Mathews Ranch Ponds #1, #2, and #3) are located adjacent to the Mathews Creek stream restoration area, and two ponds (Mid-Mathews Ponds #1 and #2) are located adjacent to Mathews Creek approximately 5.5 km to the northwest of Mathews Ranch. Locations and physical characteristics of each of the ponds have been specifically designed to maximize the quality of overwintering refuge provided by the ponds by targeting areas of naturally high groundwater table and through-flow for minimizing winter ice cover thickness, maximizing dissolved oxygen, and incorporating deep water (i.e., greater than 2 m), cobble/boulder substrates, and overhead cover.

The ponds have irregular shapes, contain peninsulas and islands and are strategically positioned to increase habitat diversity. Each proposed pond is positioned and shaped such that it minimizes the risk of sedimentation (infilling) and avulsion (channel cut-off) during floods. The connector channel is positioned to meet the main creek in a natural scour, such as a pool along a relatively stable meander, to reduce the potential for sedimentation and isolation. While subsurface materials contain deep peat in areas (up to 3.5 m), adjacent to Mathews Creek the peat layer grades to 20 cm. Excavated peat will be used for reclamation of disturbed areas, including access roads required for restoration activities.

Large woody debris (anchored with boulders) will be positioned along the shoreline of the ponds. The ponds contain shallow water (0 to 1 m depth) 'shoals' lined with cobble, and deeper (1 to 5 m depth) areas. The pond designs were guided, through consultation with DFO during development of the conceptual offsetting plan, by those successfully implemented at the nearby Mount Milligan Project to address limitations in Rainbow Trout overwintering habitat.

A 'leaky bank' is proposed to separate the pond and adjacent channel along a segment of an up-valley portion of pond shoreline at Mathews Ranch Pond #1 and Pond #2 and Mid-Mathews Pond #1 and #2. The leaky bank is composed of coarse gravels that allow for some throughflow of water from Mathews Creek into the pond. The morphology and stone gradation of the leaky bank has been designed to allow 0.4 to 0.8 L/s of throughflow, which will provide benefits to the pond but maintain sufficient flows in Mathews Creek (baseflow is greater than 100 L/s). Incorporating a leaky bank into the design of two overwintering ponds aligns with the objectives and approaches of overwintering habitat creation outlined in the *Fish Habitat Rehabilitation Procedures* (BC MOELP 1997).

The leaky bank has several key functions:

- to improve dissolved oxygen within the off-channel pond by encouraging through-flow of surface water (a small hydraulic gradient maintained through the leaky bank will drive slow water movement);
- to discourage fine sediment accumulation within the pond and its connector channel through periodic flushing; and

- to limit meander migration that could lead to channel avulsions. An area akin to a 'forebay' in a stormwater management pond is proposed on the downstream side of the leaky bank to help induce deposition of fine sediment that enters the pond through periodic overbank flow during floods. The local channel geometry and near-surface groundwater table at Pond #3 precludes the use of a leaky bank. Furthermore, due to the high groundwater table throughout the Mathews Creek valley, groundwater interceptor channels to concentrate groundwater discharge into the ponds are not required.

Riparian plantings (see Appendix F1 and Appendix F3 for species lists) are proposed along the periphery of all ponds to ensure full riparian benefits to in-pond aquatic habitat. The proposed plantings include a native seed mix and shrub plantings around the periphery of the pond and aquatic (emergent) plantings in the gentle, shallow shoreline area. The plant selection was based on field reconnaissance, multiple years of drone imagery, common vegetation community summaries described in BC's Wetland Identification Guide (Mackenzie and Moran 2004) and BC's Biodiversity Atlas (Austin and Eriksson 2009), restoration papers, and guidance documents. All species proposed to be planted are native to the region.

Furthermore, ponds proposed in the Mathews Creek Ranch area will be incorporated into proposed valley bottom wetland restoration complexes designed by BW Gold's consultants. A gentle, shallow shoreline was incorporated into the Mathews Creek ponds to support transitional emergent vegetation growth in surrounding wetland restoration areas.

### 6.4.3 Chedakuz Creek (Dykam Ranch) Restoration and Enhancement

A component of the Compensation Plan is the restoration and enhancement of fish habitat in Chedakuz Creek in the area of Dykam Ranch. Portions of the creek bank have been degraded by past agricultural practices, primarily cattle grazing. The impacts of agricultural activity, including cattle grazing on riparian vegetation and trampling of stream banks, occurs along the north bank in four discrete sections.

Bank restoration is proposed along these four discrete sections, totalling 400 m of channel length. The nature of the proposed impacts and proposed restoration techniques are similar to those identified in Table 6-1 (specifically, the rows titled 'Cattle Trampled Banks and Bed' and 'Exposed Channel Banks'). The restoration plan involves exclusion of cattle within the riparian area, riparian plantings, regrading of banks, and installation of woody debris structures and boulder clusters, as shown in Appendix E.

Cattle exclusion will be accomplished by installing a barbed wire fence along the margin of the riparian area. This fence will delineate the upland cattle grazing area required for ranch operation and prevent cattle from entering the riparian areas. The fencing will be regularly inspected to ensure functionality and repairs will be made as needed.

Riparian plantings are proposed to naturalize banks, create overhanging habitat and shade, provide allochthonous inputs (e.g., leaf litter, terrestrial insects), and increase overhanging cover for fish. Riparian plantings are proposed between the fence line and the stream edge in field-identified locations where riparian vegetation is sparse, as shown in the riparian planting polygons presented in Appendix E and Appendix F4. The details of the riparian planting prescriptions, including plant species lists, planting methods, densities, and seeding rates are presented in Appendix F4.

Bank enhancement will be accomplished by regrading banks using native material and installing brush layers. Brush layering will be constructed in two 0.5 m 'lifts' by laying a continuous layer of cut native willow stakes into the banks at an angle of 10° from horizontal. The stakes will be partially buried to allow for root establishment, with the growing tips protruding from the bank.

Habitat complexity will be increased by installing large woody debris, root wads, and boulder clusters. Large woody debris and root wads will be installed by securely inserting large logs (minimum diameter 300 mm) with or without attached rootwads into the channel bank. Logs will be positioned so that they are angled upstream into the direction of flow, then secured into the bank with a combination of anchor boulders, logs, and backfilled and compacted native earth fill. Boulders will be placed in the channel in clusters of two or three. Each boulder will be partially embedded into the channel, sized to minimize likelihood of displacement, and located in erosional zones to avoid sediment burial.

### 6.4.4 Chedakuz Creek Tributaries (Dykam Ranch) Restoration and Enhancement

Two unnamed tributaries of Chedakuz on the Dykam Ranch property will be restored and enhanced. Tributary 1 and Tributary 2 have been impacted by cattle grazing, leading to overwide channels, undefined banks and riparian vegetation loss. Additionally, each tributary is crossed by access roads and trails that lack functioning crossing structures and lead to seasonal blockage of fish passage.

Due to the small size of these creeks and the anticipated logistical difficulties associated with significant instream construction, restoration of these two tributaries will be accomplished by exclusion of cattle to eliminate the stressor on the aquatic environment, riparian planting to supplement recovery of the native ecosystem, redefine channel cross-sections, and installation of open-bottom crossing structures to eliminate instream ford crossings, minimize sedimentation and the restore seasonal fish passage.

Cattle exclusion will be accomplished by installing a barbed wire fence along the margin of the riparian area from the confluence of each tributary with Chedakuz Creek to the northern boundary of the ranch property. This fence will delineate the upland cattle grazing area required for ranch operation and prevent cattle from entering the riparian areas. The fencing will be regularly inspected to ensure functionality and repairs will be made as needed.

Riparian plantings are proposed to improve bank stability and shade, provide allochthonous inputs (e.g., leaf litter, terrestrial insects), and increase overhanging cover for fish. Riparian plantings are proposed between the fence line and the stream edge in field-identified patchy locations where riparian vegetation is sparse, as shown in the riparian planting polygons presented in Appendix E and Appendix F4. These plantings will occur in the farthest downstream sections of the tributaries, spanning approximately 397 m of Tributary 1 and 250 m of Tributary 2. The details of the riparian planting prescriptions, including plant species lists, planting methods, densities, and seeding rates are presented in Appendix F.

Installation of open-bottom culverts is proposed at five locations on the two unnamed tributaries and at one additional location on the Dykam Ranch access road. Crossings will allow for the safe passage of machinery and livestock across the channel while minimizing the instream disturbance associated with ford (bed-level) crossings. Clear-span open bottom culverts will be installed at these five locations to avoid any instream footprint. Crossing sites have been selected based on geomorphic, ecological, and agricultural considerations. Crossings are not positioned near sharp meander bends to minimize the likelihood of future bank erosion or instability. Riparian clearing will not be required at the five crossing sites due to their locations along existing access corridors that lack riparian vegetation.

### 6.4.5 Chedakuz Creek (Dykam Ranch) Off-Channel Ponds

The limited availability of overwintering habitat has been identified in the baseline studies as a potential limited habitat type for fish in the Project area (as described in Section 3.4.1.1 Rainbow Trout). To compensate for this lost habitat in the Project area, BW Gold proposes to construct three off-channel ponds in the Chedakuz Creek Watershed to provide overwintering habitat for Rainbow Trout, as well as habitat for other trout life stages. Three ponds (Dykam Ranch Pond #1 (Site 6), #2 (Site 11a), and #3 (Site 11b)) are located on the Dykam Ranch property, near the Chedakuz Creek stream restoration areas described in Section 6.4.3.

Locations and physical characteristics of each of the ponds have been designed to maximize the quality of overwintering refuge provided by the ponds by targeting areas of naturally high groundwater table and through-flow for minimizing winter ice cover thickness, promote dissolved oxygen, and incorporating deep water (i.e., greater than 2 m), cobble/boulder substrates, and overhead cover.

The ponds have irregular shapes and are strategically positioned to increase habitat diversity. Each proposed pond is positioned and shaped such that it minimizes the risk of sedimentation (infilling) and avulsion (channel cut-off) during floods. The connector channel for each pond is positioned to meet the main creek in a natural scour area, such as a pool along a relatively stable meander, to reduce the potential for sedimentation and isolation. While subsurface materials contain peat in the swampy areas adjacent to Chedakuz Creek in the area of Dykam Ranch, the peat layer is not deep in the proposed pond locations (0 to 20 cm). Excavated peat will be used for reclamation of disturbed areas, including access roads required for restoration activities.

Large woody debris (either coniferous trees or rootwads) will be positioned along the shoreline of the ponds and anchored with boulders. The ponds contain shallow water (0 to 1 m depth) ‘shoals’ lined with cobble and deeper (1 to 5 m depth) areas.

Riparian plantings (see Appendix F4 for species list) are proposed along the periphery of all ponds to ensure full riparian benefits to in-pond aquatic habitat. The proposed plantings include a native seed mix and shrub plantings around the periphery of the pond and aquatic (emergent) plantings in the gentle, shallow shoreline area. The plant selection was based on field reconnaissance, multiple years of drone imagery, common vegetation community summaries described in BC’s Wetland Identification Guide (Mackenzie and Moran 2004) and BC’s Biodiversity Atlas (Austin and Eriksson 2009), restoration papers, and guidance documents. All species proposed to be planted are native to the region.

### 6.4.6 Ormond Creek Riparian Offsetting

The Ormond Creek riparian restoration compensation measure aims to restore the vegetation community affected by wildfire and mountain pine beetle infestation. The site consists of two potential restoration areas: Restoration Area 1 and Area 2. Restoration Area 1 is focused on the upper portion of Ormond Creek, starting at the outlet of Ormond Lake, and extending roughly 6 km downstream towards Fraser Lake. Restoration Area 2 is focused on a short (roughly 0.9 km) portion of the Ormond Creek that joins Oona Lake to the northwest corner of Ormond Lake. The framework for the Ormond Creek restoration measure follows on restoration recommendations for the broader Shovel Lake wildfire area (Daust and Price 2019). The portion of Ormond Creek riparian planting area to be used for the FHCP includes 25.3 ha in Area 1 and 58.4 ha in Area 2 (Appendix F5).

The focus of the restoration is to diversify the riparian area's supply of standing tree types and large woody debris and to include planting in areas where regeneration is limited or where exposed soil occurs. Removal of excess hanging trees along steep slopes of side stream ravines is proposed to reduce log jams that may occur with increasing floods. It is proposed that the large woody debris remain in the treatment area but be cut and dispersed to densify the wood pieces pressed to the ground. Diversifying standing dead wood in places where there is no (or limited) living canopy, but standing dead trees, is proposed by cutting to leave different sized standing pieces while leaving the cut pieces to form the large woody debris base. Increasing dispersion to the large woody debris spread and density is recommended to provide habitat for small mammals, amphibians, and invertebrates in recognition of their linkages via nutrient and food supplies to fish in-stream. Planting within the treatment area is recommended from review of general guidelines in Ministry of Forests (2002) with adaptations from Daust and Price (2019) and details from Meidinger and Pojar (1991) to recommend planting with patches of deciduous shrubs (alder), 43% white spruce, 35% lodgepole pine, and 22% Douglas-fir. It is recommended that seedlings are sourced locally, such as those that are patchily located in the riparian areas at high densities for thinning and transplant.

### 6.4.7 Fish Compensation Interaction with Mathews Creek and Chedakuz Creek (Dykam Ranch) Wetland Offsetting

The fisheries compensation measures in the Mathews Creek and Chedakuz Creek (Dykam Ranch) watersheds are located adjacent to the proposed Mathews Creek Ranch and Dykam Ranch Wetland Restoration Projects. The Project's Wetland Management and Offsetting Plan (WMOP; ERM 2022) lays out the strategy to manage impacts to wetlands and to provide a plan to offset the loss of wetland and wetland functions caused by the Project. The WMOP is required to meet the Decision Statement Condition 5.3 and the EA Certificate Condition 24. The co-location of the fisheries compensation measures and the wetland offsetting and enhancement measures will lead to ecosystem-wide synergistic gains.

#### *6.4.7.1 Ecosystem Approach*

In terms of offsetting lost or altered wetlands, the updated WMOP takes a holistic ecosystem approach to offsetting, whereby the wetland restoration effort focuses on creating the environmental conditions conducive to the recovery of wetlands as well as surrounding habitat areas, including riparian zones and open water. Maintaining the interconnectivity of habitat types promotes the health of the ecosystem and maximizes functionality. Ecosystem restoration strategies are aimed at places of disturbance where ecosystem functions, habitats, and communities have been reduced, lost, or are threatened.

An ecosystem includes all of the living organisms (plants and animals) and the environment in which they live and interact. Ecosystem functions are empowered by the metabolism and ecological activities of organisms as they occupy their niches and modify their environments to promote balanced living conditions.

Restoring ecosystem functions includes a whole-system and eco-mechanistic understanding of pathways for nutrient and energy flow. These pathways are sustained and interconnected into the broader landscape by interactions of organisms with each other and their environment, including the migrations and activities of wildlife moving seasonally between habitat patches. Habitats are “the place where [an animal] lives” (Morrison et al. 2012, p. 3) and “the range of environments or communities over which a species occurs” (Whittaker et al. 1973, p. 328). Communities are formed within habitats by interactions of different species, their trophic dynamics, mutualisms, and by species interactions.

Prioritizing the restoration of ecosystem function over attempting to return to pre-disturbance conditions can result in ecosystem benefits manifested over a shorter timeframe. Many goals, such as restoring the hydrology to a former wetland area by filling anthropogenic drainage features (e.g., ditches) can help restore a number of ecosystem functions and improve habitat for local species, even if the ecosystem restored is not exactly the same as its historical reference. For example, a well-vegetated wetland system can filter groundwater supplies and reduce direct nutrient loads into streams.

Greater understanding into the larger scales and extents of aquatic, wetland, riparian and upland functions has led researchers to place a stronger emphasis on restoring ecological networks across watersheds (e.g., Graziano et al. 2022; Welsh 2011). It follows that ecosystem pathways connect the flow of material (e.g., trophic systems) and energy (e.g., stream temperature regulation) resources that feeds into the recovery and productivity of fish in streams (Walther et al. 2022; Welsh 2011). Hence, the WMOP does not limit its prescriptions to the immediate narrow perimeter of a single realm but considers how restoring functions in a discrete realm contribute to broader functional enhancement. This approach is experimentally supported for the benefits it confers to fish habitat, biomass, and recovery (Whitney et al. 2020).

#### *6.4.7.2 Wetland Offsetting Measures*

Wetland offsetting at the Mathews Creek Ranch will focus efforts on restoration. A large natural wetland complex exists at Mathews Creek that has been significantly degraded through years of agricultural use. Wetland disturbance along the middle reaches of Mathews Creek have resulted in lowered water tables, altered wetland vegetation, soil rutting, and erosion of riparian areas.

Wetland offsetting measures at the Dykam Ranch property will include conservation and enhancement of existing high-quality wetland area as described above in this plan with reference to the Vanderhoof Land and Resource Management Plan (Government of BC 1997). Planned enhancement includes installation and maintenance of cattle exclusion fencing to keep livestock out of the wetland area (in addition to fencing around fish habitat compensation measures), invasive plant monitoring, tree gridling to improve structural complexity and wildlife habitat, additional site surveys to identify other wetland enhancement opportunities, and inclusion in the wetland monitoring program.

#### *6.4.7.3 Interaction between Fish Compensation Measures and Wetland Offsetting*

Wetland restoration and fish habitat creation, restoration, and enhancement are mutually beneficial when considering the ecological synergies of complex ecosystems. As described in the WMOP, contiguous fish compensation and wetland offsetting projects in this watershed, when considered together, are anticipated to:

- Restore water quality functions in wetlands altered by human activities.
  - Removal and continued exclusion of livestock from floodplain wetlands will eliminate nutrient loading from animal waste, reduce erosion and sedimentation in watercourses and associated wetland, and improve the thermal regulation function of wetlands.
- Restore riparian vegetation.
  - Evaluation of the current riparian vegetation community and implementation of a planting strategy will expedite natural succession and achieve a function riparian ecosystem.
- Improve fish habitat, water quality, and thermal regulation in watercourses.
  - Fish habitat creation, restoration, and enhancement and wetland restoration and enhancement will result in improved fish habitat and water quality parameters.
- Increase shallow-water and marsh habitat along watercourses to support wildlife use.
  - Creation of open-water ponds and marsh habitats in restored wetlands will provide habitat for a wide variety of wildlife species, including waterfowl and moose.

In addition, the conservation of the Mathews Creek Ranch site will contribute to maintaining connectivity of habitat types on the landscape in an area where caribou movement has been documented, and caribou conservation efforts are being undertaken by others (personal communication with Keefer Ecological Services). A similar situation exists with conservation of Chedakuz Creek (Dykam Ranch), in terms of maintaining connectivity of habitat types on the landscape, as discussed in the WMOP.

The creation of shallow open water ponds (and associated fringe wetland ecosystems that are expected to develop over time) in the Mathews Creek and Chedakuz Creek Watersheds will increase the water holding capacity of the associated wetland complexes, improving hydraulic functionality of the wetland complexes while protecting downstream receptors from flooding and sedimentation (Juszczak et al. 2007). These ponds will provide habitat for waterbirds, particularly foraging habitat for dabbling ducks and shorebirds. Shallow ponds are also ideal breeding season habitat for Lesser Yellowlegs, a shorebird species of conservation concern which is known to occur in the Project area; Lesser Yellowlegs are Blue Listed in BC (Special Concern), and federally listed as Threatened by the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC; BC CDC 2022, Government of Canada 2021). Depending on the precise habitat results, these ponds may also provide breeding habitat for Horned Grebes (Special Concern on Schedule 1 of the Species at Risk Act; Government of Canada 2022), which have been recorded breeding in the Project area in very low numbers. Horned Grebes breed in shallow waterbodies within emergent vegetation areas, which are likely to develop in the wetland ecosystems of the MCR offsetting site.

There are synergistic properties and holistic ecosystem-level gains to come from multiple forms of offsetting happening within the same Mathews Creek and Chedakuz Creek wetland complexes (e.g., bats, wetlands, and fish). Considerable opportunity for restoration activities exists because there has been intensive agriculture and livestock grazing, active dewatering through the creation of drainage ditches lowering the water table in the wetland, and evidence of beaver trapping in the area for the last 50+ years.

The co-location of the Mathews Creek and Chedakuz Creek fisheries compensation and wetland offsetting projects will lead to efficiencies in baseline condition assessment, monitoring, and adaptive management. Surveys to evaluate existing conditions and monitor success will be carried out concurrently and adaptive management decisions can be made at an ecosystem-level to ensure overall success of both works.

Although the fisheries compensation and the wetland offsetting projects have similar ecosystem benefits, the accounting process must be accurate to avoid double-counting potential gains. Therefore, the specific areas of the fisheries compensation measures (i.e., the Mathews Creek channel restoration/enhancement, pond creation, and riparian planting areas identified in the design drawings) have been excluded from the wetland offsetting area calculations.

### 6.4.8 Land Tenure and Long-term Preservation of Compensation Measures

#### *6.4.8.1 Mathews Creek*

The Mathews Creek Ranch (MCR) habitat compensation area consists of areas both on land owned by BW Gold and on Crown land which is also a range tenure area.

BW Gold has secured the majority of the MCR through fee-simple ownership, which provides the highest form of land and access rights. As such, this ensures long term securement of the Mathews Creek property. While neither BW Gold or Artemis is contemplating the sale of the lands that they own or control, if BW were to sell all or a portion of this land required for the Fish Offset Programs on the MCR Property in the future, BW Gold would have a Statutory Right of Way (SROW) and restrictive covenant on the land and would enter into a license agreement with the new landowner that would provide the necessary ongoing protections referenced below.

A large natural wetland complex exists at the Mathews Creek offsetting site. However, it has been substantially degraded through years of agricultural use. The property is overlapped by a Range Tenure (RAN075042, retired in 2012), and displays evidence of past use of agronomic production, and cattle grazing. BW Gold bought the property in 2013, which resulted in the removal of grazing and livestock pressure on the land. For the portions of the compensation areas on private land owned by BW Gold, BW Gold will not have cattle on the property.

If BW Gold were to sell the land in the future, protections will be in place for the compensation areas on Mathew Creek. Currently, BW Gold is in the process of registering the SROW and restrictive covenant on the MCR. A SROW is similar to an easement which can be granted to a governmental agency or certain special classes of companies, including mining companies. Since the SROW and restrictive covenant would be registered on the title of the land, long-term access to the land and protection of the land for the purposes of the MCR habitat compensation area is secured. The SROW runs with the property, such that if the property was to be sold, the SROW would remain in force.

The SROW will give BW Gold the above-noted rights, but it will also impose certain standards on the owner (including BW Gold, as landowner) as to how the landowner performs work on the land and responsibility for damage that may be caused to the land. The SROW will also require the landowner to act reasonably and with due consideration for the interest of any future landowner. Furthermore, the SROW will not grant exclusivity of possession, which means that it will not prevent a future landowner from accessing or using the land, so long as the access or use is consistent with the terms of the SROW. Ultimately both parties (BW Gold and a future landowner, if there was to be one) to the SROW must respect the intended use of the SROW and the terms of the agreement.

The restrictive covenant proposed for MCR provides that upon the completion of planned restoration works and post-effectiveness monitoring requirements required by the fish offsetting plans at MCR, the landowner would covenant and agree that it will not use or permit the Lands, be used in any way that has the potential to:

1. Cause degradation, damage or destruction of any kind to any existing functioning ecosystems and all of their valued components, fish offsetting areas located on the Lands; or
2. Impair the functioning of any existing functioning ecosystems and all of their valued components, as well as fish offsetting or conservation areas located on the Lands in any way.

The restrictive covenant further provides that the landowner agrees that any lease, license, occupancy agreement or other agreement whereby the landowner permits all or any part of the Lands to be used or occupied by any third party shall expressly include a provision prohibiting any such tenant, licensee, occupant or other user of the Lands from using the Lands except in compliance with the above requirements. The restrictive covenant also runs with the property, such that if the property was to be sold, the SROW would remain in force.

The points below summarize the various rights that the SROW will provide:

- **SROW and Restrictive Covenant Binds the Lands for the Term**:
  - The SROW and restrictive covenant, and all the rights and obligations contained therein, will run with, and bind the land for an initial term of 99 years. Accordingly, if a landowner were to sell the lands, the SROW and restrictive covenant would continue to bind the lands. This ensures that BW would maintain the same rights under the SROW and restrictive covenant with any new landowner.
  - The SROW and restrictive covenant agreement will be registered against the lands at the Land Title Office. This registration will remain on the lands for the duration of 99 years, regardless of ownership. Potential buyers can read the SROW and restrictive covenant by obtaining it at the Land Title Office.
- **Remedies for Breach by the Landowner**: If a future landowner were to breach the terms of the SROW and restrictive covenant agreement (or any future license agreement with a new landowner), BW Gold would have legal and equitable remedies to rely on.
  - Equitable remedies would allow BW Gold to enforce its rights under the agreement, and may include, but are not limited to, specific performance, injunction and declaratory relief, or any combination thereof.
    - *Specific performance* – This is an equitable remedy whereby a court, at its discretion, compels a party to perform its contractual obligations.
    - *Injunction* – This is an equitable remedy which is granted only at the discretion of a court, whereby a court order will either forbid a certain behavior or action or require performance of a certain action or behavior.
    - *Declaratory relief* – This remedy comes in the form of a judgment from a court that defines the rights of the parties regarding the legal question that was presented to the court. They do not order a party to take any action, but rather state whether the parties may seek or are entitled to relief.

For the portions of the compensation areas on Crown land, BW Gold has been working with BC MoF on protective measures that could be implemented as discussed below.

BC MoF informed BW Gold that in order for a given party to obtain a new range tenure, a potential tenure holder would need to own or lease associated lands within 10 km of the range tenure. All nearby cattle operations currently have their own range tenures. BC MoF has confirmed that at this time, there is no possibility of a potential range tenure in the area of the compensation works.

As a further backstop, BC MoF has placed a Map Notation (MN6167) over the Crown land area containing the Mathews Creek compensation measures. Map Notation 6167 indicates a land tenure conflict when future land status reports are accessed for the area and would identify the compensation area as an area that is undergoing watershed and riparian restoration. The Map Notation will indicate: “Artemis Gold - proposed wetland and fish habitat compensation work. Not conducive to future Range Licence’s”, or similar. A note to file will also be added to indicate that it is not in the best interests of the area to have cattle on these tenures/incompatible use. The purpose of the Map Notation is to give the district statutory decision maker an indication of the status of this area as an ecosystem restoration/conservation zone when a forestry\Range application is applied for within this area.

These measures will alert ministry staff of the fish and wetland restoration land use at MCR ranch, and prevent issuance of authorizations with competing interests (e.g., grazing tenure in an area that has active restoration). Further, BC MoF confirmed that the map notation includes the whole past range tenure and not just the MCR, so the securement of land will include a large area surrounding the MCR offsetting site. A copy of the map notation along with related maps identifying the spatial area it covers are provided in Appendix I. The combination of BW Gold owning the private lands in the area, and continued collaboration with BC MOF, additional protection of the lands is achieved, thereby, avoiding future degradation from ranching and agricultural activity.

#### *6.4.8.2 Chedakuz Creek (Dykam Ranch)*

Similar to Mathews Creek, BW Gold is working with the owners of the Dykam Ranch to establish a set of agreements which include a SROW and restrictive covenant agreement (as described in Section 6.4.8.1 above), and a separate license agreement. The licence agreement supplements the SROW and restrictive covenant and constitutes an unregistered version of the SROW and restrictive covenant agreement.
The license agreement provides BW Gold with a contractual right to access to the land for the purposes set out in the licensing agreement. The terms included in the license agreement will be the same as the terms provided for in the SROW and restrictive covenant agreement. Therefore, BW Gold will have the same rights and obligations with respect to the land under both agreements. The license agreement is meant to supplement the SROW and restrictive covenant and provide additional land security, such that if there was any challenge to the SROW or restrictive covenant, the license agreement would provide the same rights and obligations as the SROW and license agreement.

Originally, the SROW for the Dykam Ranch offsetting site was being negotiated at a 25-year limit term with the current property owner. However, based on input from key stakeholders, including Indigenous groups, a 99-year SROW duration has been negotiated to better correspond with the phases of the Project, namely 2-year Construction phase; 23-year Operations phase; 24 to 45-year Closure phase; and 46-year Post-closure phase. Based on this approach, the 99-year SROW at the Dykam Ranch offsetting site will extend beyond the mining operations and reclamation to the point of recovery of the Mine Site to more natural conditions.

The license agreement, unlike the SROW, will not be registered. Accordingly, if the landowner sells the property, then they must ensure that the purchaser agrees to assume all obligations under the license agreement. There is will be a provision in the license agreement whereby the landowner agrees that they will not sell, transfer, or dispose of the land unless the purchaser executes an agreement to be bound by the terms of the license agreement and perform the obligations thereunder.

As previously noted, the rights and remedies for the landowner's breach of any of either the SROW and restrictive covenant agreement or the license agreement are set out in Section 6.4.8.1 above (Remedies for Breach by the Landowner).

## 6.5 Quantification of Habitat Compensation Gains

### 6.5.1 Instream Habitat Area

Calculation of affected habitat area is required as a first step for the HEP method and provides a straight-forward measure of habitat loss. However, it does not incorporate an index of suitability related to habitat quality.

For the Mathews Creek and Chedakuz Creek (Dykam Ranch) restoration and enhancement work, stream channel measurements and spatial analysis using GIS and AutoCAD were used to quantify total existing habitat. Changes to instream area (i.e., by narrowing channel sections as part of restoration of cattle-trampled areas) were assessed from the detailed design drawings (Appendix E) and incorporated into the GIS-based area calculation process. For Mathews Creek and Tributaries 1 and 2 to Chedakuz Creek, restoration measures are applied throughout the entire channel and the entire channel area is included in the habitat accounting. For Chedakuz Creek, bank stabilization and instream enhancements are focused on the north side of the channel, so one half of the channel area in the restoration area is included in the habitat accounting.

For the planned Mathews Creek and Chedakuz Creek off-channel ponds, no pre-existing habitat can be mapped. Instream habitat area was calculated from the detailed design drawings using AutoCAD.

### 6.5.2 Habitat Evaluation Procedure

A detailed description of the HEP approach to quantification of habitat compensation gains is provided in the technical memorandum *Habitat Evaluation Procedure (HEP) for Blackwater Project – Fisheries Compensation Plan* (Palmer 2020), provided in Appendix B. An overview of the HEP process is provided in Section 5.1.2.1 Overview of HEP. Detailed calculations used to calculate HEP values for each compensation measure are presented in Appendix J.

HU were calculated for Rainbow Trout life stages in a consistent manner to describe habitats in the Project area that will be located beneath the TIAs, as well as for habitats that will be constructed and/or enhanced through implementation of compensation measures. However, assessment and calculation methods varied slightly to account for site-specific differences in data availability and habitat quality. A description of the compensation-specific methodology is provided here.

#### *6.5.2.1 Desktop- and Field-based Assessments of Habitat*

Habitat in the Mathews Creek and Chedakuz Creek Watersheds, where instream work is proposed, was evaluated using both field surveys and desktop-based analysis of high-quality aerial imagery, digital elevation models, and GIS-based maps.

*Mathews Creek*

Initial desktop HEP habitat mapping of existing conditions in Mathews Creek was prepared in 2017, using the open-source program QGIS (version 2.18.12, 2020), and high-resolution aerial photography to delineate and measure existing stream habitats into types. Most habitat parameters such as habitat type and class, substrates, cover, and canopy closure, etc. were estimated from 'zooming in' on the aerial photography, while parameters such as average wetted width were enumerated by measuring distances in QGIS. These assessments were confirmed by ground-truthing surveys conducted in 2017, 2020, and 2021.

Palmer field crews conducted multiple site assessments that included physical habitat mapping of stream reaches selected for potential compensation measures to describe pre-restoration habitat conditions and support that assessment of existing HU. Ground-truthing surveys assessed existing habitat conditions and the results were subsequently used to re-evaluate the desktop generated results. Parameter values were adjusted for all units based on the ground-truthing results.

In the summer and autumn of 2017, a drone survey was completed of the Mathews Creek restoration area. In addition, a ground-based HEP survey was completed on two portions of Mathews Creek. Due to flooding and accessibility issues, the entire portion of the creek was not surveyed. In autumn 2020, a drone survey was completed over the entire restoration area and an orthomosaic image and a digital elevation model were generated. Portions of the restoration area were visually assessed on foot to determine if disturbance indicators had changed since the 2017 assessment.

Datasets from 2017 and 2020 were qualitatively and quantitatively compared to identify any differences. First, the two sets of aerial drone imagery were overlaid and a visual assessment of changes to channel morphology was conducted by an experienced fluvial geomorphologist. Differences in channel pattern, riparian vegetation, anthropogenic or natural disturbance, and canopy closure were noted, and their locations were recorded.

Next, a desktop HEP analysis was conducted. This involved overlaying the reach breaks identified in 2017 on to the 2020 orthomosaic imagery. Parameters that could be measured using the imagery (wetted width, bankfull channel width, channel thread (e.g., single, multiple), instream cover for fish, riparian vegetation presence and category, canopy closure over the stream channel, off-stream habitat presence, and disturbance indicators) were recorded. Bankfull width was measured using cross sections of the digital elevation model to identify bank edges. Five measurements of bankfull and wetted width were taken and were averaged for each reach. These digitally measured values were compared with ground-verified measurements.

Overall, the qualitative and quantitative comparisons between the 2017 and 2020 datasets indicate that the assessed reaches of Mathews Creek have remained largely unchanged. No evidence of significant channel morphology change was found. Differences in beaver dam locations and off-channel habitat extent were identified when comparing the 2017 and 2020 datasets. Off-channel habitat identified in the 2020 imagery was likely present during the 2017 assessment, but not identified due to lower image resolution collected in 2017. Quantitative assessment of channel conditions showed some variation in channel measurements, but these are within the typical level of variability expected with in-channel measurements. Riparian vegetation, instream cover, and disturbance indicators identified in the 2017 HEP ground survey generally matched the 2020 desktop analysis.

Following comments from First Nation reviewers and regulators and subsequent to the refinement of the Mathews Creek and Ponds Planting Plan (Appendix F1), the HU calculations for Mathews Creek and Ponds were reviewed and updated. All aspects of the predicted conditions, including dominant plant communities, instream cover, and habitat type/class associations, were critically examined and revised. This review resulted in the lower HU gain values presented in this version of this Fish Habitat Compensation Plan.

*Chedakuz Creek (Dykam Ranch)*

Assessment of impaired habitat in the Chedakuz Creek (Dykam Ranch) Watershed was first conducted in May 2022 during a reconnaissance site visit by a crew of fisheries biologists. Subsequent site visits by fluvial geomorphologists and fisheries biologists conducted in September 2022 involved HEP habitat mapping, drone orthoimaging, and photo documentation of proposed restoration and enhancement areas in the Chedakuz Creek mainstem and tributaries.

Ground-truthing surveys assessed existing habitat conditions and evaluated the suitability of identified sites for long-term stabilization and restoration. Palmer field crews conducted multiple site assessments that included physical habitat mapping of stream reaches selected for potential compensation measures to describe pre-restoration habitat conditions and support that assessment of existing and predicted HU.

#### *6.5.2.2 Index of Alteration*

Conditions in the Mathews Creek and Chedakuz Creek Watershed are severely degraded/altered, with trampled/unstable banks, excessive sedimentation, lack of coarse substrates, and lack of riparian vegetation (Palmer 2013, 2022). Therefore, quantification of the habitat value for existing stream habitats required an additional index to reflect the degraded conditions that would not be captured in the original HEP model.

Palmer developed an Index of Alteration (IA) that describes the relative level of habitat alteration in stream habitats used by Rainbow Trout. The IA assessment considers five habitat parameters: 1) riparian vegetation; 2) riparian stream banks; 3) stream channel stability; 4) stream substrate; and 5) cover. Within the five habitat parameters, 14 distinct variables were developed for scoring in order for the HEP to be applied to both existing and future restored conditions in each stream reach of interest.

These 14 variables within the five habitat parameters were scored for each identified stream unit based on the results of the field and desktop assessments. The IA is the mean score and was multiplied by each unaltered HSI value for each affected life stage of Rainbow Trout to determine the degraded habitat unit value. The IA was calculated as the sum of the habitat parameters divided by 5 (Equation 2). A detailed description of the IA habitat parameters and variables and their calculation is available in Appendix J.

***Equation 2***

$$IA_{u_i} = (RV_{u_i} + RB_{u_i} + CC_{u_i} + S_{u_i} + C_{u_i})/5$$

Where:

RV = Riparian Vegetation score

RB = Riparian Bank score

CC = Channel Condition score

S = Substrate score

C = Cover score

*6.5.2.3 Evaluation of Future Conditions*

Future habitat conditions for the Mathews Creek and Chedakuz Creek channels and off-channel ponds, based on existing baseline conditions determined during field stream surveys conducted in 2021 and 2022, were predicted by qualified fisheries biologists. The desktop HEP habitat mapping process was repeated while considering habitat conditions after implementation of restoration measures. This desktop HEP method relied on the high-quality orthomosaic mapping and detailed design drawings that incorporate the suite of proposed restoration prescriptions.

For each habitat segment, professional judgement was used to predict changes to the existing habitat (e.g., depth, width, spawning quality, canopy closure, etc.) that are expected post-restoration. These predicted changes were evaluated using the same process as was used to assess existing conditions, and this formed the basis for the HEP assessment of habitat gains.

*6.5.2.4 HEP Assessment*

HEP analysis was completed for the Mathews Creek, Chedakuz Creek, and Chedakuz Creek Tributaries instream restoration/enhancement and the Mathews Creek and Chedakuz Creek off-channel pond construction. As previously described, Rainbow Trout was selected as the evaluation species for all compensation measures, since it is the only salmonid species historically captured in Mathews Creek and it is the only species that will be directly impacted by the loss of habitat under the tailings and waste rock areas.

Habitat gains (in HU) were calculated for the five life stages of Rainbow Trout that were included in the mine site losses HEP. Habitat gains in existing streams (Mathews Creek, Chedakuz Creek, and its tributaries) were calculated by comparing pre-restoration habitat conditions to expected restored conditions to determine the net gain of HU achieved from implementation of restoration treatments. For all of the off-channel ponds, none of the proposed features have been built to date; thus, only the future restored conditions analyses are applicable. Therefore, only the habitat gains resulting from the construction of new habitat were assessed.

The habitat value of each habitat component was calculated by multiplying the HSI of the species and life-stages of interest by the length of the unit, the bankfull width (or the total wetted area for the off-channel ponds), and the IA described above. The formula for this calculation is presented in Equation 3.

The total habitat value of each habitat component was calculated by summing the combined HU for each life stage in each mesohabitat (Equation 4). For habitats that are newly constructed (i.e., the off-channel ponds), the $HU_{reach}$ is the net habitat gain.

Where the restoration is an improvement to existing degraded habitat (i.e., existing channel restoration/enhancement), the gains are calculated by the difference between restored and existing conditions (Equation 5).

***Equation 3***

$$HU_{u_i,sp_j,ls_k} = HSI_{u_i,sp_j,ls_k} * L_{u_i} * W_{u_i} * IA_{u_i}$$

Where:

HU = Habitat unit
HSI = Habitat Suitability Index
L = Unit Length
W = Unit Bankfull Width
IA = Index of Alteration
$u_i$ = Habitat mapping mesohabitat unit $i$
$sp_j$ = species $j$
$ls_k$ = life-stage $k$

***Equation 4***

$$HU_{reach} = \sum_{i=1}^{n} HU_{u_i} \sum_{j,k} HU_{u_i,sp_j,ls_k}$$

Where:

$n$ = the total number of mesohabitat units in the reach

***Equation 5***

$$HU_{gains} = HU_{restored} - HU_{existing}$$

### 6.5.3 Riparian Habitat Area

Along the margins of all the instream compensation measures, riparian plantings are proposed where land adjacent to the stream is bare or has minimal vegetation cover. Riparian plantings for all instream measures are shown as polygon areas in the associated design drawings. Additional information on the riparian plantings can be found in Sections 6.4.1, 6.4.3, and 6.4.4, as well as Appendix F (1-5). The total areas of the proposed riparian plantings were calculated in GIS based on mapped polygons.

For the proposed off-channel ponds, the riparian area gains were calculated in AutoCAD as the sum of the area of the gentle, shallow shoreline and the area of proposed riparian plantings that extends approximately 10 m beyond the periphery of the ponds. Further details on the gentle, shallow shoreline and riparian plantings can be found in Section 6.4.2 Mathews Creek Off-Channel Ponds and Section 6.4.5 Chedakuz

Creek (Dykam Ranch) Off-Channel Ponds and Appendix F. Vegetation restoration beyond the 10 m periphery of the ponds is included in the WMOP (ERM 2022).

Ormond Creek riparian restoration, including planting and large woody debris management, will encompass an area of 1,669,000 m$^2$. This value includes the 'high restoration potential' mapped polygon areas identified in Restoration Areas 1 and 2 in Tier 1 and 2 mapped areas. Of this area, 838,000 m$^2$ will be applied to this Compensation Plan, while the remainder 831,000 m$^2$ will be carried forward to the *Fisheries Act* Authorization application Offsetting Plan (Appendix F5).

## 6.6 Habitat Gains from Proposed Compensation Measures

HEP calculations show that the proposed restoration and enhancement of 4.9 km Mathews Creek will result in a gain of 11,915 instream HU for all Rainbow Trout life stages, due to improved channel hydraulics, bed substrates, and cover. Of this gain, 1,432 HU would be fry summer rearing, 4,041 HU will be juvenile summer rearing, 3,546 HU will be adult foraging, and 2,896 HU will be overwintering. No spawning habitat will be created or affected by the proposed works. In Mathews Creek, restoration measures will be applied to 33,550 m$^2$ of channel area. The proposed narrowing of sections of channel, as a means of restoring more functional habitat in areas over-widened by cattle trampling, will result in a net reduction of 2,192 m$^2$ of wetted area and a total instream area of 31,358 m$^2$. This overall decrease in stream area is balanced by the gain in habitat quality assessed with HEP, since a reduction in stream area is required to improve the overall habitat quality of Mathews Creek. Riparian vegetation will be restored/enhanced in sections with limited riparian vegetation such that instream aquatic biota receive the full benefit of riparian habitat. As such, the riparian habitat gain will be 48,467 m$^2$.

The three Mathews Creek off-channel ponds will result in the gain of 27,924 m$^2$ of pond habitat area. The habitat provided by the ponds is expected to support Rainbow Trout fry rearing, juvenile rearing, adult foraging, and overwintering. Overall, the ponds are expected to provide 63,780 Rainbow Trout HU, comprising 4,906 HU of fry rearing, 19,625 HU of juvenile rearing, 19,625 HU of adult foraging, and 19,625 HU of overwintering. Riparian vegetation will be restored/enhanced in sections of the pond shorelines with limited riparian vegetation such that in-pond aquatic biota receive the full benefit of riparian habitat. As such, riparian habitat gain will be 27,705 m$^2$.

The two Mid-Mathews Creek off-channel ponds will result in the gain of 27,072 m$^2$ of pond habitat area. The habitat provided by the ponds is expected to support Rainbow Trout fry rearing, juvenile rearing, adult foraging, and overwintering. Overall, the ponds are expected to provide 70,632 Rainbow Trout HU, comprising 5,433 HU of fry rearing, 21,733 HU of juvenile rearing, 21,733 HU of adult foraging, and 21,733 HU of overwintering. Riparian vegetation will be restored/enhanced in sections of the pond shorelines with limited riparian vegetation such that in-pond aquatic biota receive the full benefit of riparian habitat. As such, riparian habitat gain will be 14,640 m$^2$.

Restoration and bank stabilization of sections of the north bank of Chedakuz Creek totalling 401 m in length, will result in the enhancement of 2,993 m$^2$ of instream area. The calculation of restored/enhanced instream area assumes that since the work is occurring along only the north bank, half of the channel will be positively affected. Therefore, only half of the bankfull channel width was used to calculate enhancement areas and HU gains. The habitat enhanced by this measure supports all life stages of Rainbow Trout, as well as kokanee and other fish species, although only Rainbow Trout HU are calculated to maintain consistency of comparison. The habitat provided in this portion of Chedakuz Creek is expected to support Rainbow Trout spawning, fry rearing, juvenile rearing, adult foraging, and overwintering. Overall, the works are expected to provide 1,047 Rainbow Trout HU, comprising 510 HU of spawning, 338 HU of fry rearing, 77 HU of juvenile rearing, 77 HU of adult foraging, and 45 HU of overwintering. Riparian vegetation will be restored/enhanced in sections with limited riparian vegetation such that instream aquatic biota receive the full benefit of riparian habitat. As such, the riparian habitat gain will be 35,479 $m^2$.

Tributaries 1 and 2 of Chedakuz Creek will be enhanced by cattle exclusion and riparian restoration. Cattle exclusion will occur over the full length of 763 m (1,236 $m^2$ instream) and Tributary 1 and 799 m (1,897 $m^2$ instream area) between the Dykam Ranch property line and Chedakuz Creek. Fish passage will also be improved in these two tributaries following the installation of channel-spanning open-bottom crossings at existing ford crossing locations that are seasonal barriers to fish passage. These two tributaries support multiple Rainbow Trout life stages, including spawning and fry rearing, although the HEP classification system assigns only juvenile rearing value to streams with the ‘Tributary’ classification. This is an acknowledged limitation of the project-specific HEP accounting system. No adjustment to the calculation is proposed to maintain consistency with the Project’s loss calculation and to avoid potentially overstating the habitat value gained with this measure. Accordingly, the tributary enhancement works are expected to result in the gain of 85 juvenile rearing HU in Tributary 1 and 125 juvenile rearing HU in Tributary 2, which is in alignment with the lower magnitude of proposed restoration measures. Riparian vegetation will be restored/enhanced in sections with limited riparian vegetation such that instream aquatic biota receive the full benefit of riparian habitat. As such, the riparian habitat gain will be 17,999 $m^2$ in Tributary 1 and 16,779 in Tributary 2.

The three Chedakuz Creek (Dykam Ranch) off-channel ponds will result in the gain of 11,575 $m^2$ of pond habitat area. The habitat provided by the ponds is expected to support Rainbow Trout fry rearing, juvenile rearing, adult foraging, and overwintering. Overall, the ponds are expected to provide 26,374 Rainbow Trout HU, comprising 2,029 HU of fry rearing, 8,115 HU of juvenile rearing, 8,115 HU of adult foraging, and 8,115 HU of overwintering. Riparian vegetation will be restored/enhanced in sections of the pond shorelines with limited riparian vegetation such that in-pond aquatic biota receive the full benefit of riparian habitat. As such, riparian habitat gain will be 4,300 $m^2$.

A total of 838,000 $m^2$ of Ormond Creek riparian restoration area will be applied to this Fish Habitat Compensation Plan, while the remainder 831,000 $m^2$ will be carried forward to the *Fisheries Act* Authorization application Offsetting Plan. No instream work or Rainbow Trout HU calculation is associated with this compensation measure.

Table 6-2 provides a detailed breakdown of the instream and riparian area and Rainbow Trout life-stage-specific HU gained by the construction of each of the compensation measures. Overall, the proposed compensation measures will result in the net restoration/creation of 104,060 $m^2$ of habitat area, 173,958 HU, and 1,003,369 $m^2$ of riparian area.

*Table 6-2. Habitat Gains from Compensation Measures – Length, Area, Habitat Units by Life Stage, and Riparian Area*

| Offsetting Measure | Length (m)[1] | Existing Area ($m^2$) | Restored/Created Area ($m^2$) | Area Gain ($m^2$) | Rainbow Trout Habitat Units | | | | | HU Totals | Riparian Area ($m^2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Spawning / Egg Incubation | Fry Summer Rearing | Juvenile Summer Rearing | Adult Summer Foraging | Over-wintering | | |
| Mathews Creek Restoration and Enhancement | 4,933 | 33,550 | 31,358 | -2,192[2] | 0 | 1,432 | 4,041 | 3,546 | 2,896 | 11,915 | 48,467 |
| Mathews Creek Pond 1 | 106 | 0 | 7,409 | 7,409 | 0 | 1,302 | 5,207 | 5,207 | 5,207 | 16,923 | 9,850 |
| Mathews Creek Pond 2 | 90 | 0 | 7,500 | 7,500 | 0 | 1,318 | 5,271 | 5,271 | 5,271 | 17,130 | 6,750 |
| Mathews Creek Pond 3 | 148 | 0 | 13,015 | 13,015 | 0 | 2,287 | 9,147 | 9,147 | 9,147 | 29,727 | 11,105 |
| Mid-Mathews Pond 1 | 213 | 0 | 13,578 | 13,578 | 0 | 2,725 | 10,900 | 10,900 | 10,900 | 35,425 | 8,760 |
| Mid-Mathews Pond 2 | 211 | 0 | 13,494 | 13,494 | 0 | 2,708 | 10,833 | 10,833 | 10,833 | 35,207 | 5,880 |
| Chedakuz Creek Mainstem | 401 | 2,993 | 2,993 | 0[3] | 510 | 338 | 77 | 77 | 45 | 1,047 | 35,479 |
| Chedakuz Creek Tributary 1 | 389 | 1,236 | 1,236 | 0[3] | 0 | 0 | 85 | 0 | 0 | 85 | 17,999 |
| Chedakuz Creek Tributary 2 | 250 | 1,897 | 1,897 | 0[3] | 0 | 0 | 125 | 0 | 0 | 125 | 16,779 |
| Dykam Ranch Pond 1 (Site 6) | 118 | 0 | 4,200 | 4,200 | 0 | 656 | 2,625 | 2,625 | 2,625 | 8,531 | 1,530 |
| Dykam Ranch Pond 2 (Site 11a) | 97 | 0 | 2,790 | 2,790 | 0 | 541 | 2,162 | 2,162 | 2,162 | 7,027 | 1,282 |
| Dykam Ranch Pond 3 (Site 11b) | 98 | 0 | 4,590 | 4,590 | 0 | 832 | 3,328 | 3,328 | 3,328 | 10,816 | 1,488 |
| Ormond Creek Riparian Restoration | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 838,000 |
| **Totals** | **7,054** | **39,676** | **104,060** | **64,384** | **510** | **14,139** | **53,801** | **53,096** | **52,414** | **173,958** | **1,003,369** |

*Notes:*

1. *Length values for the eight ponds represent the length of longest axis of the pond.*
2. *The loss of area in the Mathews Creek channel is the result of narrowing the over-widened existing banks that have been trampled by cattle. The decrease in instream area is balanced by the increase in habitat quality, demonstrated by the net gain of habitat units.*
3. *The instream area is expected to remain constant following restoration and enhancement works.*

## 6.7 Habitat Balance

A habitat balance has been prepared to summarize the predicted impacts to fish habitat from the losses of instream habitat requiring MDMER (2002) Schedule 2 amendment and the potential gains from proposed fish habitat compensation measures (Table 6-3).

A total of 57,773 $m^2$ of instream area will be lost in areas subject to Schedule 2 amendment in Davidson Creek and Creek 661. This will be compensated for at an approximately 1.80:1 ratio by the gain and restoration of 104,060 $m^2$ of instream area in the Chedakuz Creek and Mathews Creek Watersheds.

A total of 58,096 Rainbow Trout HU will be lost in areas subject to Schedule 2 amendment in Davidson Creek and Creek 661. This will be compensated for at an approximately 2.99:1 ratio by the gain of 173,958 Rainbow Trout HU in the Chedakuz Creek and Mathews Creek Watersheds.

The compensation measures create and restore habitats that support Rainbow Trout life stages, including those life stages affected by the deleterious deposit, while also addressing potential bottlenecks in Rainbow Trout habitat availability in the Chedakuz Creek and Mathews Creek Watersheds. The proposed compensation plan includes the creation of off-channel ponds that will provide overwintering habitat, as well as habitat for all life stages during all seasons. Furthermore, as described in Section 6.8 Compensation Timeline, time-lag in compensating for impacts can be minimized by initiating compensation measures before losses occur.

Much of the habitat that will be permanently destroyed or altered supports fry summer rearing and adult spawning (egg incubation) for Rainbow Trout in the upper Davidson Creek Watershed. However, these habitats are more limited in quantity and quality compared to the habitats in the lower watershed due to the smaller habitat and lower habitat diversity. This comparison is supported by the lower densities of all Rainbow Trout life stages in the upper watershed. As such, the upper headwater tributaries in Davidson Creek Watershed likely contribute less to the annual recruitment and productivity of the Rainbow Trout population in Davison Creek compared to habitat in the affected lower reach. No other fish species have been identified in the affected portions of Davidson Creek and Creek 661, so only Rainbow Trout will be directly impacted.

The compensation plan provides additional benefits to fisheries productivity. The compensation habitats are located in watersheds that support a variety of fish species, including Burbot, Brassy Minnow (Blue-listed species; Section 3.4.1 Fish Community), Slimy Sculpin, Longnose Dace, and White Sucker. Although the HEP analysis focuses solely on Rainbow Trout, the positive effects of the compensation measures are expected to improve productivity of the other fish species present in Mathews Creek and Chedakuz Creek, since they will also benefit from the creation of new habitat and the restoration and enhancement of existing degraded habitat.

Riparian vegetation, and the habitat it supports, helps to maintain the productivity of adjacent and downstream fish habitat. Riparian habitat provides shading for cover, moderates fluctuations in water temperature, contributes allochthonous inputs, stabilizes banks and helps maintain overall channel morphology. Riparian habitat also has indirect value to fish habitat productivity by protecting water quality, temperature and stream hydrology. In recognition of these important ecological functions, riparian habitat restoration, creation or enhancement is integrated into all proposed in-stream habitat compensation opportunities.

The inclusion of additional compensation measures in the Mathews Creek, Chedakuz Creek and Ormond Creek Watersheds following the incorporation of feedback from First Nation reviewers has significantly increased the amount of proposed riparian planting. The compensation ratio is approximately 1.95:1 for the gain:loss of riparian habitat, based on area-for-area accounting, which, unlike habitat units for instream habitat, does not incorporate the quality of the habitat.

Based on these factors, the proposed instream habitat area compensation ratio of approximately 1.80:1 (ratio of area gained/restored to losses), the habitat unit compensation ratio of approximately 2.99:1 (ratio of HU gained to HU lost) and the riparian area ratio of approximately 1.95:1 (ratio of area gained to area lost) is considered appropriate to counterbalance the effects of habitat loss.

### *Table 6-3. Habitat Balance*

| **Losses** | | | | **Gains** | | | |
|---|---|---|---|---|---|---|---|
| **Impacted Stream** | **Instream Habitat Area ($m^2$)** | **Total Habitat Units (HU)** | **Riparian Area ($m^2$)** | **Impacted Stream** | **Instream Habitat Area ($m^2$)** | **Total Habitat Units (HU)** | **Riparian Area ($m^2$)** |
| Davidson Creek Mainstem | 22,148 | 30,453 | 202,293 | Mathews Creek Restoration and Enhancement | 31,358 | 11,915 | 48,467 |
| Davidson Creek Tributaries | 2,983 | 746 | 27,790 | Mathews Creek Pond 1 | 7,409 | 16,923 | 9,850 |
| Creek 704454 Mainstem | 13,070 | 13,690 | 101,093 | Mathews Creek Pond 2 | 7,500 | 17,130 | 6,750 |
| Creek 704454 Tributaries | 7,928 | 2,125 | 56,837 | Mathews Creek Pond 3 | 13,015 | 29,727 | 11,105 |
| Creek 668328 Mainstem | 6,443 | 9,328 | 77,180 | Mid-Mathews Pond 1 | 13,578 | 35,425 | 8,760 |
| Creek 668328 Tributaries | 0 | 0 | 0 | Mid-Mathews Pond 2 | 13,494 | 35,207 | 5,880 |
| Creek 636713 Mainstem | 2,575 | 1,066 | 22,797 | Chedakuz Creek Mainstem | 2,993 | 1,047 | 35,479 |
| Creek 636713 Tributaries | 1,445 | 361 | 14,859 | Chedakuz Creek Tributary 1 | 1,236 | 85 | 17,999 |
| Creek 505659 Mainstem | 432 | 140 | 5,851 | Chedakuz Creek Tributary 2 | 1,897 | 125 | 16,779 |
| Creek 505659 Tributaries | 749 | 187 | 6,190 | Dykam Ranch Pond 1 (Site 6) | 4,200 | 8,531 | 1,530 |
| | | | | Dykam Ranch Pond 2 (Site 11a) | 2,785 | 7,027 | 1,282 |
| | | | | Dykam Ranch Pond 3 (Site 11b) | 4,590 | 10,816 | 1,488 |
| | | | | Ormond Creek Riparian Restoration | 0 | 0 | 838,000 |
| **Total Losses** | **57,773** | **58,096** | **514,890** | **Total Gains** | **104,060** | **173,958** | **1,003,369** |

## 6.8 Compensation Timeline

The timing of proposed habitat compensation relative to predicted impacts is an important consideration, given its potential for a time lag between loss of habitat and the establishment of functioning compensation habitats. The Construction Schedule can be found in Appendix K.

The impacts associated with the works requiring the Schedule 2 amendment will commence during mine construction and continue over the life of the mine. As such, BW Gold proposes to commence implementation of the compensation measures on Mathews Creek during construction, before the impacts commence. Timing to implement will depend on timing of the Schedule 2 listing, Project permit timing more generally, and Project financing, and will also conform to fisheries timing window restrictions. Since the proposed compensation measures are located partially on land owned by BW Gold and partially on some adjacent Crown Land, implementation can begin rapidly following a decision to proceed.

Compensation measure construction will begin following designation of the fish habitat in Davidson Creek as a Tailings Impoundment Area by the federal government. Pond construction will begin in the first winter after designation. Pond construction will occur in winter to facilitate more efficient operation of heavy machinery in the floodplain areas. Ponds will be constructed each year, similar to the construction schedule used for construction of overwintering ponds for the Mount Milligan Project (B. Horne, Stantec, pers. comm.). Stream restoration and enhancement activities will take place during the final construction year, 2026. The compensation habitat will provide nearly the full value in habitat units described in Section 6.5 Quantification of Habitat Compensation Gains within 1 to 2-years after completion due to stabilization and establishment of periphyton and benthic invertebrate communities. Full compensation value will be realized as the planted vegetation community matures over time.

During this time, the mine will be under construction and Schedule 2 impacts will be limited to the effects of the overburden storage area. Tailings deposition and use of Schedule 2 stockpile areas is not scheduled to occur until Year 1 of mine operations (Knight Piésold 2021b; ERM 2020). Uncertainty related to when exactly the full value of the compensation measures will be realized is accounted for by the greater than 1:1 habitat balance of 1.80:1 (area gains:losses). This ratio provides additional confidence that compensation will “counterbalance particular adverse effects on fish and fish habitat resulting from particular works, undertakings or activities” as described in the DFO Applicant’s Guide (DFO 2020). There are therefore no additional measures necessary to account for time lag between impacts and offsetting.

## 6.9 Potential Effects and Mitigations Associated with Implementation of Compensation Measures

Implementation of compensation measures in Mathews Creek, Chedakuz Creek, and Ormond Creek Watersheds has the potential to result in temporary, localized adverse effects to fish and fish habitat. Potential effects of the project to fish and fish habitat could include:

- Fish injury or mortality as a result of crushing/smothering by equipment or materials, fish stranding due to dewatering, or introduction of deleterious substances into fish habitat. Deleterious substances could include suspended sediment from increased erosion due to vegetation removal and soil stockpiling, or hazardous materials such as hydrocarbons from spills or leaking equipment and containers.

- Changes to fish habitat due to altered stream flows caused by velocity and discharge changes during flow diversion around isolated areas with pumps or constructed diversion channels. Alteration of stream flows could cause scour or deposition of sediments and change channel morphology.

Palmer has developed a CEMP which describes mitigation measures to reduce or avoid adverse effects during implementation of the compensation plan (Appendix G). Potential, unmitigated, adverse effects associated with implementation of compensation measures are listed in Table 6-4 below with associated mitigation measures summarized from the CEMP. Residual adverse effects to the environment are not anticipated after implementation of mitigation measures, and the project will have an overall positive effect on aquatic habitat in Mathews Creek.

***Table 6-4. Potential Effects and Mitigations Associated with Implementation of Compensation Measures***

| Potential Effects | | CEMP Key Mitigation Summary |
|---|---|---|
| Vegetation | Invasive species introduction. | • Remove invasive species currently present.<br>• Clean all equipment and materials before arrival at site.<br>• Re-vegetate after construction with native species only. |
| Fish and Fish Habitat | Fish injury or mortality. | • Work in-stream only during the regional Reduced Risk Work Window for fish.<br>• Conduct fish salvage in advance of construction and maintain isolation of salvaged areas from the main streamflow for the duration of the work.<br>• Follow DFO guidance for screening on pump intakes. |
| | Altered stream flows changing downstream habitat. | • Maintain downstream flows with diversion pumps.<br>• Control pump discharge to dissipate water velocity.<br>• Prevent channel erosion with splash pad or similar measures<br>• Develop a contingency plan for pump failure.<br>• Prevent sediment-laden water from entering the aquatic environment. |
| Wildlife | Bird nest disturbance during vegetation clearing. | • Adhere to breeding bird timing windows<br>• Conduct a pre-clearing bird nest survey.<br>• Apply no-go buffers for any nests which are present. |
| | Human-wildlife conflict. | • Maintain the site free of wildlife attractants<br>• Discourage wildlife from inhabiting work areas.<br>• Utilize wildlife-proof waste containers.<br>• Prevent staff from interacting with wildlife.<br>• Prohibit hunting or fishing at site. |
| | Disturbance of reptiles and amphibians during project construction. | • Conduct a pre-construction reptile and amphibian salvage, install exclusion fencing, and monitor for effectiveness of the salvage and fencing. |
| Surface Water Quality | Erosion and mobilization of sediment into the receiving environment. | • The Contractor will develop and implement an Erosion and Sediment Control Plan (ESCP) including a detailed description of measures for erosion and sediment control. |

| Potential Effects | | CEMP Key Mitigation Summary |
|---|---|---|
| | | • Project-specific measures outlined in engineering drawings include the following:<br>■ Conduct pond excavation in winter when groundwater levels are low and soils are frozen.<br>■ Excavated materials from ponds will be stored at least 15 m from pond edge unless being used for revegetation.<br>■ Install rig matting on soft or wet ground.<br>■ Complete all in-stream works in isolation from stream flows.<br>■ Treat sediment-laden water with Siltsoxx or similar.<br>■ Cover exposed soil with biodegradable erosion control blankets.<br>■ Install fibre rolls or sediment control fencing where appropriate.<br>■ Place stockpiled materials at least 15 m from the top of bank<br>■ Re-establish in-stream flows in a controlled manner to minimize sedimentation.<br>• Water quality monitoring for turbidity and other parameters as per regulatory requirements or permit conditions (as applicable) will be conducted on site by a qualified environmental professional (QEP).<br>• Work will be stopped if turbidity or total suspended solids (TSS) levels are above guidelines work will be stopped and ESC measures will be adjusted as needed. |
| | Hazardous material (e.g., hydrocarbons) release into the receiving environment. | • The Contractor will develop and implement a Spill Prevention and Emergency Response Plan (SP&ERP) to prevent spills and other accidents or malfunctions.<br>• Water quality monitoring for hydrocarbons and other parameters as per regulatory requirements or permit conditions (as applicable) will be conducted on site by a QEP.<br>• In the event that a hazardous materials release is observed in the receiving environment, implement spill response protocols as described in the SP&ERP and report to Emergency Management BC's spill reporting line if appropriate. |

## 6.10 Monitoring. Adaptive Management, and Contingency Measures

In accordance with DFO's guidelines (Smokorowski et al. 2015), three main types of monitoring will be conducted to ensure the success of this Offsetting Plan: *compliance monitoring, functional monitoring* and *effectiveness monitoring*. Adaptive management is the process of promptly responding to and alleviating any identified deficiencies or failures in compensation works, based on the results of monitoring.

### 6.10.1 Monitoring

*Compliance* monitoring will involve monitoring by a qualified environmental professional (QEP) during construction to ensure that environmental protection measures and best management practices detailed in the CEMP (Appendix G) are implemented as required and that habitat features are constructed in accordance with the MDMER (2002) Schedule 2 amendment Compensation Plan and compensation design drawings. *Functional* monitoring will involve post-construction inspection and multiple follow-up evaluations to ensure morphological stability of the channel/ponds and the functionality of the constructed fish habitat, based on a qualitative and quantitative monitoring program. *Effectiveness monitoring* is the most rigorous, science-based monitoring, with the purpose of ensuring that compensation measures are functioning as designed using Before-After-Control-Impact (BACI) design or Control-Impact (CI) methods to assess habitat use by fish.

The Effectiveness Monitoring Plan (Appendix H) describes the site-specific monitoring plans. However, consultation with ECCC, DFO, and other relevant stakeholders or regulators may be conducted to refine the key indicators for monitoring and the criteria for evaluating ‘ecological functionality’.

In addition to the aforementioned monitoring efforts, construction monitoring in accordance with the CEMP will also be implemented to minimize risks to fish and fish habitat during construction of the compensation works. A QEP will monitor the in-water work to document compliance with environmental protection measures and inspect and report on erosion and sediment control measures. Field inspections will be conducted periodically before, during, and after construction to document and photograph site conditions associated with compensation works. Additionally, qualified professionals with experience in the supervision of channel restoration projects (e.g., fluvial geomorphologist, habitat restoration specialist) and riparian habitat restoration will visit the sites at critical times during construction to ensure all elements of the compensation works are completed according to design specifications, and to assist with field-fit modifications, where required. Key elements of construction requiring environmental supervision include, but are not limited to, the following:

- Implementation of functional erosion and sediment control measures, including flow by-pass measures;
- Removal of existing vegetation within, and protection of vegetation in close proximity to, the works area and access route;
- Establishment of key profile (elevation) points and channel dimensions;
- Installation of habitat cover features (e.g., root wads, boulders, brush layers, live stakes; species list in Appendix F); and
- Construction of transitions to the upstream and downstream tie-in points.

### 6.10.2 Adaptive Management

An adaptive management approach will be adopted in order to periodically identify the need for any further mitigation, remedial measures, or contingency compensation measures. The monitoring program is designed to include various metrics for assessing fisheries productivity and habitat structural integrity and quality. For example, monitoring will include measurements of channel morphology and fish habitat features, monitoring of water quality, sampling of fish communities, and riparian vegetation assessments. Maintenance (on an as-needed basis) may include selective irrigation, removal of invasive species (Appendix F), documentation and replacement of unsuccessful plantings, stabilization of erosion sites, and mitigation of wildlife intrusion or damage. The monitoring program will be concluded when habitat compensation sites have reached the defined success criteria, and thus, when the goal of counterbalancing habitat loss has been achieved.

### 6.10.3 Contingency Compensation Measures

#### *6.10.3.1 Nation-led Initiatives*

As described in Section 1.4.3 Instream Riparian Areas, LDN and UFN have expressed an interest in incorporating Nation-led initiatives into the FHCP and/or the *Fisheries Act* Authorization application for the Blackwater Project. Since specifics of viable Nation-led initiatives have not been brought forward during development of this iteration of the FHCP, these have been incorporated into this plan as contingency measures only. If effectiveness monitoring should show that the FHCP is not performing as planned and contingency measures need to be considered, BW Gold will consult with LDN and UFN at that time on Nation-led initiatives with a view to bringing forward the additional detail required to support a viable compensation measure. As at writing of this iteration of the FHCP, BW Gold has heard that the Nations are interested in:

- A fish passage project on the Dean River;
- Restoration of fire/mountain pine beetle/logging-disturbed areas in LDN territory; and
- Restoration of wetland/riverine hydrologic function and connectivity in logged watersheds.

BW Gold will prioritize engagement with LDN and UFN on these and other Nation-led initiatives as part of the Fisheries Act Authorization Application – Fish Offsetting Plan and as contingency measures required as part of this plan, should contingency offsets be required. BW Gold is committed to continuing to explore Nation-led initiatives with LDN, UFN and DFO for the Fisheries Act Authorization application, provided that those initiatives meet DFO's satisfaction to be considered as offsets and BW Gold's requirements.

#### *6.10.3.2 Additional Off-channel Ponds*

Within the Creek 661 Watershed, two additional overwintering pond candidate sites have been identified and are located:

- Adjacent to the main branch of Creek 661, approximately 3 km upstream of the proposed Creek 661 Overwintering Pond described in the Fisheries Act Authorization Application; and
- Adjacent to a tributary of Creek 661 that joins with the main branch of Creek 661 approximately 5 km downstream of the proposed Creek 661 Overwintering Pond.

Another option for two or more off-channel ponds is the Turtle Creek Watershed. Potential candidate locations include:

- Low gradient areas located on immediately east and west of the site access road,

These sites have good access from existing exploration and/or forestry roads, require few tree removals, and have a naturally high groundwater table. Proposed ponds at these sites would be deep (>2 m) and would incorporate cobble/boulder substrates and overhead cover (riparian vegetation, rootwads), similar to the creation of overwintering ponds proposed in Section 6.4 of this plan. The ponds would have irregular shapes and will be positioned such that they minimize the risk of sedimentation (infilling) and avulsion (channel cut-off) during floods.

#### *6.10.3.3 Murray Creek Restoration and Enhancement*

Additional ranchland stream reaches have been identified in the vicinity of the Murray Creek restoration/enhancement areas described in the *Fisheries Act* Authorization Application, as opportunities for restoration and enhancement. Similar to other stream restoration measures described above, agricultural activity has led to cattle trampled banks and bed, farm machinery crossings, exposed channel bank, and lack of riparian vegetation, which has negatively impacted fish habitat. Restoring additional portions of Murray Creek would involve localized restoration of natural channel dimensions, riparian plantings, cattle exclusion fencing, 'off-channel' watering, localized placement of boulders and gravels, restricted machinery sites, and removal of unnatural flow impediments.

## 6.11 Cost Estimate

Construction costs for Mathews Creek[7], Chedakuz Creek and Unnamed Tributaries[8] restoration/enhancement and off-channel ponds, and riparian planting in these areas as well as Ormond Creek are presented in Table 6-5. Detailed cost breakdowns and assumptions are used for the cost estimates are provided in Appendix L. The total cost to construct the proposed compensation measures include construction contingency and 10% maintenance allowance. Costing for detailed design (Mathews Creek and Ponds) have a lower construction contingency (15%) compared to Chedakuz Creek and Mid-Mathews Creek conceptual designs (30%). In addition, 2.64% per annum inflation protection has been incorporated, based on the proposed construction schedule (Appendix K) from 2023 to 2026. The 2.64% per annum inflation protection is based on the 40-year average rate of inflation for Canada according to World Bank data. In addition, a discount is included, representing the interest earned on the collateral associated with the financial security (Table 6-5). The discount rate was calculated from long-term average (22-years) 3-month Canadian treasury bill rates obtained from the Bank of Canada. Land purchase and lease rates have been included for Mathews Creek. Construction periods are limited to 'least risk timing windows' for Rainbow Creek and kokanee which allows for works completed in mid-summer and winter months. Costs do not include local expertise advantages to ensure conservative estimates. Local expertise will be targeted during the tendering phase following permit approvals.

The estimated cost presented in Table 6-5 provides costing for construction, maintenance, and monitoring of the compensation. A bond will be provided for all cost outlined below. Once construction is complete and documentation (As-builts) is submitted the amount indicated for construction will be un-bonded. The remainder of the bond will remain intact until the 10-year monitoring period is complete and/or authorization conditions are met.

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*[7] Mathews Creek and off-channel detailed design drafting, engineering oversight and costing were provided by Onsite Engineering Ltd.*

*[8] Palmer developed conceptual designs for Chedakuz Creek restoration, off-channel ponds and Mid Mathews Creek off-channel ponds and Rough Order Magnitude (ROM) costs based on Onsite Engineering Ltd. rates and template.*

### *Table 6-5 Estimated Construction Costs for the Proposed Compensation Measures*

| Compensation Measure | Design Phase | Subtotal | Construction Contingency | Maintenance" | Land Purchase/Lease ($1000/year)° | Totals |
|---|---|---|---|---|---|---|
| Mathews Creek | Detailed Design* | $4,861,000 | $588,000 | $392,000 | $13,000 | $5,854,000 |
| Mid-Mathews Creek | 30% Design** | $1,985,000 | $454,000 | $152,000 | - | $2,591,000 |
| Dykam Ranch | 30% Design** | $2,842,000 | $578,000 | $193,000 | - | $3,613,000 |
| Ormond Creek | Riparian Planting*** | $1,158,000 | - | $116,000 | - | $1,274,000 |
| | | | | | **Subtotal (Excl. Inflation Protection)** | **$13,332,000** |
| | | | | | Inflation Protection (2.64% per annum) | $974,000 |
| | | | | | Estimated Interest Earned by LoC (1.83% per annum) | (-) $616,000 |
| | | | | | **Total (Inc. Inflation Protection)** | **$13,690,000** |

Notes:

1. *Costs rounded to the nearest '000*
2. *Availability of Local Expertise: All mob and demob costs are assumed to originate from Vanderhoof, BC. Local expertise and resources will be targeted during tendering process.*
3. *Seasonal adjustment: Bank and in-channel works are restricted to the 'least risk timing window' for Rainbow Trout and Kokanee. Off-Channel construction will occur during winter months. Where possible winter months and low flow (late summer to late winter) have been targeted for construction activities.*
4. *Inflation Protection: 2.64% per annum for proposed construction schedule (2023 to 2026) in Appendix K based on 40-year average rate of inflation for Canada based on World Bank data to estimate an inflation rate of 2.64%.*
5. *Estimated interest earned on letter of credit (1.83%) deducted from per annum inflation total based on long-term (22-years) 3-month Canadian treasury bill rates obtained from the bank of Canada. The 22-year timeframe for long-term average was used because this is the furthest extent of Bank of Canada data for 3-month T-bill rates.*
6. *15% contingency applied to detailed design Engineering Construction Costs (ECE) subtotal*
7. *** 30% contingency applied to 30% designs ECE subtotal*
8. **** Costs provided by Ecologic Consulting LTD for 30% designs. Ecologic Consulting Ltd. Provided riparian planting costs for Dykam Ranch, Mid-Mathews and Mathews Creek ECE.*
9. *Ormond Creek riparian planting compensation includes 50% of the total area to be restored and the pilot program. The remaining 50% will be applied to the Fisheries Act Authorization application.*
10. *" 10% of ECE total (inc. contingency)*
11. *No contingency included for Riparian Planting*

# 7. Certification

This report was prepared, reviewed, and approved by the undersigned:

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