Fish and Fish Habitat and the Tenas Coal Project: Current status and potential impacts to Wet'suwet'en interests

Prepared for the Office of the Wet'suwet'en by:
Kyla Warren

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Skeena Fisheries Commission
3135 Barnes Crescent
Kispiox, BC

V0J 1Y4

CONTENTS

1. INTRODUCTION

BACKGROUND AND CONTEXT

Telkwa Coal Ltd. ("TCL") is proposing to develop the Tenas Coal Project ("the Project") in the area between Tenas Creek and Goathorn Creek (the main "Project area"), tributaries to the Telkwa River in the Wet'suwet'en Yintah. The project includes an open pit, a coal processing facility, four containment ponds, a camp, and other infrastructure in the Project area, as well as a rail loadout facility on the shoreline of the Bulkley River and a haul road that connects the rail loadout to the Project area.

In February 2022, TCL provided a description of the project design, project activities, environmental setting, and projected project impacts in Application for an Environmental Assessment Certificate (the "Application") to the BC Environmental Assessment Office (Telkwa Coal, Ltd., 2022). Skeena Fisheries Commission was contracted by the Office of the Wet'suwet'en Natural Resource Department (OWNRD) to review the Application and provide expert technical advice on potential impacts to Wet'suwet'en rights and interests if the Project were to be approved.

OBJECTIVES

The objective of this report is to provide decision makers and representatives of the Wet'suwet'en Nation with reliable, impartial advice about potential impacts, risks, and uncertainties associated with the Project. It will not contain advice on whether the project should be supported. It is expected that Wet'suwet'en decision makers will use this report to inform their decision-making process, in which risks and potential benefits will be evaluated through their own value systems, laws, and understanding to make informed decisions.

This report was written by Kyla Warren (EA and Habitat Biologist for Skeena Fisheries Commission) and provides my best professional opinions on potential impacts to fish and fish habitat as they relate to Wet'suwet'en rights and interests, as well as a high level critique of the Application. It is based on a thorough review of the relevant sections of the Application, my professional knowledge and experience, and a review of all relevant historical documents that have been provided by the Office of the Wet'suwet'en. Many of the statements of potential impacts are based around probabilities: it is not always possible to definitively predict impacts or to give an exact probability of their occurrence, and I have tried to indicate when impacts are highly likely, likely, possible, or unlikely to occur in order to give an indication of the level of uncertainty.

This report focuses on potential impacts to fish and fish habitat. A second report, authored by Allison Oliver, focuses on potential impacts to water quality and quantity (the "Water Quality Final Report") and should be referenced for details on those topics. This Final Report is relatively technical in nature, an additional, separate plain language document will be submitted summarizing this report that will be appropriate for a less technical audience such as community leadership.

APPROACH

There is much overlap between this impact assessment and the environmental assessment contained in the Application. Both assessments will describe the current environment in the Project area and expected impacts to that environment from Project-related activities and use most of the same data sources (see Data Sources section below). For the purpose of this report, it will be assumed that the Project Description provided in the Application is accurate. It will also be assumed that components such as the hydrological modelling and the engineering reports are accurate, as I do not have the knowledge needed to assess their accuracy.

Data on fish and fish habitat provided by OWNRD was reviewed, as were relevant sections of the water quality data provided and the Water Quality Final Report. The result was a mix of historical and modern data of varying methodologies and quantities throughout the study area, requiring an iterative, flexible approach that combined both quantitative and qualitative data as needed. Where available, data describing the current status of fish habitat in each waterbody was assessed to gain an understanding of the current status of the environment, as well as any existing habitat pressures or disruptions. Where available, data describing the fish populations and usage of that data was used to identify key species, which were primarily salmon, trout, and char species. The known habitat preferences of the key species of from each waterbody were compared qualitatively with current conditions, and ranked as "poor", "good", or "excellent" habitat or as no habitat (when survival would be unlikely).

Using a combination of professional knowledge and the modelling conducted by TCL in the Application, potential impacts from Project activities were identified. Impacts were compared to current condition and key species preferences to determine whether these impacts would cause the environment as experienced by that species to degrade, improve, or remain unchanged. That change, and a qualitative description of the risk of that change ("very unlikely", "unlikely", "likely", or "very likely") is presented.

The BCEAO process usually treats proposed projects as a disruptor to an existing baseline: the current status of the environment is described and is assumed to be unchanging unless the project is built. This impact assessment report instead sees the current status of the environment as a point on a long timescale of ongoing impacts, with true “baseline” having been disrupted at the arrival of settlers to Wet’suwet’en territory. Historical impacts and trends in the environment will be noted, especially where Wet’suwet’en rights have likely already been diminished by these impacts. Nor does this impact report assume that the environment is static without the Project’s possible impacts: trends such as climate change will likely to continue to affect the area, and the future contains a range of other possibilities from alternate land uses to restoration of damaged fish habitat. While such future settings are difficult to predict with currently-available data sources, these will be noted where applicable.

DATA SOURCES

This report was compiled using the following data sources provided by the Office of the Wet’suwet’en:

- Bustard, D. 1983. 1982 Investigations of Adult Coho Salmon in the Telkwa River. Smithers, BC: Produced by Dave Bustard and Associates for Crowsnest Resources Ltd.
- Bustard, D. 1983. 1982 Investigations of adult pink salmon in the Telkwa River. For READ Environmental & Planning Associates Ltd.
- Bustard, D. 1984. Assessment of Benthic Invertebrate and Juvenile Fish Populations in Goathorn and Tenas Creeks and the Lower Telkwa River, 1983.
- Bustard, D. 1985. Telkwa Coal Project Aquatic Resource Assessment. Prepared by D. Bustard and Associates for the Telkwa Coal Project: Smithers, BC.
- Bustard, D. 1998. Telkwa Coal Project Aquatic Resources Inventory. Prepared for Telkwa Coal Ltd. by Dave Bustard & Associates: Smithers, BC.
- Triton. 1997. 1996 Reconnaissance Level Fish and Fish Habitat Inventory in Working Unit 13 (Telkwa River Watershed). Prepared by Triton Environmental Consultants Ltd. for Pacific Inland Resources Ltd. and BC Ministry of Environment, Lands and Parks: Terrace, BC.
- BC MOE. 2018. HabitatWizard. British Columbia Ministry of Environment and Climate Change Strategy Habitat Wizard website. <http://www.env.gov.bc.ca/habwiz/>. Accessed May 2022.
- Environmental Resources Management (ERM). 2020. Telkwa Project Baseline Report: 2017-2020. Prepared for Telkwa Coal Ltd.
- DWB Consulting Services Ltd. 2020. Stream Assessment Report: Feasibility Road Design Phase 2 Telkwa Metallurgical Coal Project. Prepared for Allegiance Coal Ltd. Prince George, BC.
- Telkwa Coal, Ltd. 2022. BC EAO EAC Application - Tenas Project. Prepared for the BC Environmental Assessment Office.

While summarizing data for this assessment, a differentiation will be made between “historical” data, which provides useful data on long term trends but may not accurate describe the current environment, and “modern” data, which provides information on the current environment. For the purposes of this report, 15 years was used as a cut off: data collected 15 or more years before the submission of the Application, or April 2007, was considered historical and any data collected since then was considered modern.

2. KEY AREAS

Goathorn Creek and Tributaries

Goathorn Creek a moderate sized shallow creek, with a mean width of 16.8 m (Telkwa Coal, Ltd., 2022). It flows from south to north to the east side of the Project area before flowing into the lower Telkwa River (Figure 1). It is crossed by the haul road, approximately 1 km from the main Project footprint.

The lower 15 km are available to anadromous fish, but upstream access is blocked by a series of falls and cascades upstream of the mine site and no fish have been captured upstream of the obstacle (Bustard D. , 1998). Most habitat information available regarding this waterbody was taken from studies conducted in the 1980s and 1990s, and has not been groundtruthed since (Bustard D. , 1984) (Triton, 1997) (Bustard D. , 1998).

The spawning and rearing habitat for salmon is good, but there may be a lack of deep pools for overwintering. Spawning gravels appropriate for salmonids are located in isolated pockets rather than large spawning areas (Bustard D. , 1998). The water velocity in much of the creek is relatively fast, with a lack of side channels and other protected, lower flow areas. This habitat configuration is usually good for species like steelhead, rainbow trout, and char, but is less suited for species like coho and Chinook salmon who preferentially rear in low velocity areas. Historically, extensive anchor ice and low winter flows likely limited habitat in the winter by severely limiting the area of water in which fish could survive (Bustard D. , 1998).

Steelhead are the predominant species in the lower reaches of Goathorn (Bustard D. , 1998). Historically, bull trout and Dolly Varden were both found in the mid reaches, with a substantial population of bull trout identified in Reach 2. In modern sampling, bull trout were not identified, however, char were not identified to species using reliable methods like genetic testing (Telkwa Coal, Ltd., 2022). Coho salmon were also identified, primarily in the lower reaches, but were not found in high densities (Telkwa Coal, Ltd., 2022). Pink salmon were only captured historically, and only near the confluence with the Telkwa River (Bustard D. , 1998).

The drainage area Goathorn Creek has been extensively logged, and historically Goathorn Creek showed evidence of disturbance in the form of large log jams, bed material aggradation, and channel widening, as well as beaver activity (Bustard D. , 1998). Some of the log jams have been sufficiently substantial that they likely would prevent fish access to parts of the creek (Bustard D. , 1998). Gravel roads, clearcuts, farms, and road crossings are common in the east portion of the Goathorn Creek watershed. Due to this long history of land use changes and disturbance, for the purpose of this report Goathorn Creek watershed will be considered moderately impacted pre-Project development, as the impacts are likely to have at times significantly decreased the productive capacity of the creek.

Goathorn Creek has 27 tributaries. Several, including Tenas Creek, Four Creek, Cabinet Creek, and Webster Creek have been given settler names, others have not. Four Creek, Cabinet Creek, and Webster Creek are all fish bearing, supporting small populations of Dolly Varden and/or Bull Trout (Bustard D. , 1998). They are high velocity with moderate to low quality fish habitat.

Four Creek is also fish-bearing. An impassible culvert limits anadromous fish to the lower 600 m of the stream, although good habitat and Dolly Varden were found upstream (Bustard D. , 1998), and anadromous fish like steelhead may have used this habitat prior to the building of the road and the installation of the culvert. In 1997, steelhead juveniles were found rearing in the lower 600 m of Four Creek, but in 2018 none were found during sampling (Bustard D. , 1998) (Telkwa Coal, Ltd., 2022). For this reason, Four Creek should be considered highly impacted pre-Project, as entire species have been likely extirpated from the majority of the stream due to the barrier. The Dolly Varden in upper Four Creek are a separate breeding population from those downstream, as movement between the two areas is prevented by the culvert.

Tenas Creek and Tributaries

Tenas Creek is a tributary of Goathorn Creek and drains approximately 1/3 of the total Goathorn Creek watershed (Bustard D. , 1998). It runs south-west to north-east along the west side of the project, located directly adjacent to the Project footprint. It enters Goathorn Creek approximately 1.25 km upstream of the confluence of Goathorn Creek and the Tekwa River.

Tenas Creek is relatively small and of moderately steep gradient. The channel widths range from 3.4 m (upstream of the Project area) to 15 m (downstream of the project area) (Telkwa Coal, Ltd., 2022). There are a series of chutes approximately 6.5 km upstream of the confluence with Goathorn Creek which likely deter anadromous fish, but non-anadromous fish are found at least 12 km upstream from the mouth (Bustard D. , 1998).

The lower 9 km, which includes the reaches nearest the mine site, are good quality fish habitat with good spawning and rearing areas. These reaches are particularly well-suited to steelhead spawning and rearing due to the presence of pools, large woody debris, and gravel areas, as well as lower water velocities than Goathorn Creek (Bustard D. , 1998). Overwintering habitat may be somewhat limited due to the shallow depths of the creek and the observations of significant anchor ice in the area, and fish may move into the Telkwa River to overwinter (Bustard D. , 1998). Whether this is still the case or if milder winters due to climate change have increased the availability of overwintering habitat is unknown.

Historically, steelhead have been the dominant fish species in Tenas Creek, comprising approximately 90% of the catch in the downstream 6.5 km reaches (Bustard D. , 1984) (Bustard D. , 1998). In 1983, the density of juveniles was used to estimate the predicted number of adult steelhead produced by the Project area as 387 fish (Bustard D. , 1984). While these numbers are extremely speculative, it does provide context for potential project impacts.

Both Dolly Varden and Bull Trout were historically observed using the upstream portions of Tenas Creek for spawning (Bustard D. , 1998).

According to historical reports, the lower portion of Tenas Creek is sometimes used as spawning grounds by pink salmon, with 58 observed in 1983, but none located in other years (Bustard D. , 1983). It is unknown whether it is currently used by pink salmon as either spawning or rearing habitat.

The watershed of Tenas Creek has been heavily logged. While some unlogged areas may be present in the headwaters of Tenas Creek, the downstream reaches appear to have been almost entirely logged and are crossed by a number of logging roads and a transmission line. Both logging and roads have been shown to damage stream health and fish habitat quality by causing erosion, decreasing canopy cover and woody debris additions, and destabilizing hydrologic flows. The banks of Tenas Creek are steep, made of fine sediment, and erosion-prone (Bustard D. , 1998). There is likely significant natural erosion, which would be exacerbated by logging in the riparian area. There are observations of logging cut blocks extending to the top of the banks with no set-back, which would likely cause further destabilization and erosion (Bustard D. , 1998). Tenas Creek is currently moderately impacted, with extensive logging in the area likely causing significant changes to habitat quality.

Tenas Creek has 38 tributaries, although many are not accessible to fish. All tributaries entering Tenas Creek from the east near the project area are non-fish bearing as the reach immediately upstream of the tributary mouth is of very high gradient and forms a fish barrier. This includes all Tenas Creek tributaries that are within the project footprint (Telkwa Coal, Ltd., 2022). While a small number of tributaries on the west side of Tenas Creek and in the headwaters are likely fish bearing, they are small and high gradient and likely only support small numbers of char (Bustard D. , Aquatic Resource Baseline Studies: Telkwa Coal Project 1997, 1998).

Telkwa River

The Telka River is a large river (approximately 44 m in width), and one of the largest of the tributaries to the upper Bulkley River. It runs west to east and receives water from Tenas Creek and Goathorn Creek. The approximately 8 km of the Telkwa River between the Goathorn confluence and the Bulkley River confluence are of greatest importance to the project, as this is the area that could be impacted by changes to the water quality or quantity of its tributaries as a result of the Project.

This portion of the Telkwa River contains good spawning, rearing, and overwintering habitat (Telkwa Coal, Ltd., 2022). It has abundant cover in the form of boulders and large woody debris, extensive areas of gravel appropriate for spawning, and deep water for overwintering. In addition to supporting the fish that spawn and rear in the Telkwa River, it may also be important as overwintering habitat for salmon rearing in the other creeks in the project area. It contains backchannel areas and fisheries sensitive zones that may be critical rearing areas for species such as coho and Chinook salmon (Telkwa Coal, Ltd., 2022). The back channels in this reach are extensive, and in 1984 there was an estimated 18 km of back-channel habitat downstream of the Goathorn confluence.

The Telkwa River is known for its steelhead population, and juvenile steelhead were common throughout these reaches and side channels, although not seen in the densities found in 1997 when they comprised 70% of the overall catch (Bustard D. , Aquatic Resource Baseline Studies: Telkwa Coal Project 1997, 1998) (Telkwa Coal, Ltd., 2022). Coho salmon were also frequently captured, mostly in side-channel areas (Telkwa Coal, Ltd., 2022). Char and Mountain Whitefish were also captured in modern sampling (Telkwa Coal, Ltd., 2022). Juvenile Chinook were captured in 1997 but not in modern sampling, although modern sampling was less intensive than the sampling carried out in 1997 (Bustard D. , 1998) (Telkwa Coal, Ltd., 2022).

Steelhead and char likely do not spawn in large numbers in this part of the Telkwa River, as they prefer smaller, and higher gradient streams such as Tenas Creek and Goathorn Creek. Pink salmon are known to spawn in the Telkwa River, although possibly only in years of high returns (Bustard D. , 1998). Coho salmon are known to spawn in the Telkwa River, but primarily farther upstream than the Project area

(Bustard D. , 1998). The spawning survey conducted by Telkwa Coal did not observe any spawning salmon in the area (Telkwa Coal, Ltd., 2022).

In addition to extensive logging and road construction, this part of the Telkwa River runs directly adjacent to the Village of Telkwa. In many areas, vegetation has been cleared to the water, and there are areas of riprap and other erosion control measures that impact the riparian area. This reach has been moderately impacted, as these measures have likely had significant impacts on the ability of fish to rear in the valuable off-channel habitats of the Telkwa River, but it nevertheless retains good habitat quality.

Hubert Creek and Road-Adjacent Tributaries

Helps and Hubert Creeks are small tributaries of the Bulkley River. They are approximately 6 km or more from the mine site, but the haul road to the rail loadout crosses both creeks and some of their tributaries. There is some confusion over naming of the two creeks, with some maps listing Helps Creek as a tributary to Hubert Creek, some listing Hubert Creek as a tributary to Helps Creek, and some only listing Helps Creek. The Application does not mention Hubert Creek: it refers to the main channel as Helps Creek and Hubert Creek as an unnamed tributary. For the purposes of this report, the main channel will be referred to as Hubert Creek, and its largest tributary to the north will be referred to as Helps Creek.

At the proposed road crossing, Helps Creek is small (average width was 5.6 m) and low gradient (Telkwa Coal, Ltd., 2022). When surveyed in August 2018, the Creek had very low flow and several dewetted portions of channel. However, this may not be typical for summer flows at Helps Creek, as 2018 was an unusually dry year with record low water levels in some areas. When wetted, the channel likely provides good quality habitat for spawning and rearing, as there is ample gravel appropriate for spawning and cover in the form of woody debris and overhanging vegetation. This portion of Helps Creek may be too shallow to provide overwintering habitat, which would require fish to move downstream to either Helps Lake or Hubert Creek to overwinter.

A more extensive survey of Helps and Hubert Creeks in 1986 indicated that Hubert Creek can be divided into two primary sections: a low gradient, deeper lower reach with fine sediments and a moderate gradient upper reach that is shallow with primarily gravel and cobble sediments, with Helps Lake forming the reachbreak (Bustard D. , 1986). The theory proposed in the survey report is that the upper reach and Helps Creek provided spawning areas but not overwintering areas due to low flow, and that the lower reach provided good rearing and overwintering areas, but were not good spawning areas, and fish would move up and downstream in order to carry out their life cycle. Following this theory, the upper reach of Hubert and Helps Creek should not be discounted as habitat despite low flows, as they still provided critical seasonal habitat for spawning char, trout, and potentially steelhead.

While no modern sampling of these creeks and their tributaries has taken place, historical sampling found cutthroat and Dolly Varden in the headwaters, and coho salmon, Chinook salmon, and steelhead rearing in lower reaches (Bustard D. , 1986). Several of the network of tributaries to Helps and Hubert Creek have been surveyed, and most were unlikely to be fish bearing, but a few were likely fish-bearing, including the largest unnamed Helps Creek tributary.

Comparing historical and modern surveys of these creeks is difficult due to the extent of anthropogenic impacts on the area. In 1986, it was noted that a 2 km section of Helps Creek had been redirected around a hay field (Bustard D. , 1986). The maps included in that report and modern satellite images show that upper Helps Creek has changed its course once again, and again there is a hay field overlaying it's previous course, suggesting that it may have been deliberately re-routed again since 1986. The watershed of the two creeks is almost entirely anthropologically altered: by heavy logging in the headwaters and agricultural land in the downstream reaches. These activities may contribute to the dewatering and poor overwintering habitat identified in the upper reach, and the fine sediment that limits spawning in the lower reach. As habitat has been altered or destroyed to the point where critical habitat has been lost, these creeks should be considered severely impacted.

Bulkley River

The Bulkley River is the largest watercourse in the vicinity of the Project. It receives water from the minesite through the Telkwa River, and is directly adjacent to the proposed rail loadout, which would be built upstream of the Helps Creek confluence on the bank of the river.

The Bulkley River is large, deep, and low gradient. Gravel bars provide excellent spawning habitat, and cobble and boulder substrates provide rearing habitat for fish. It lacks the braids and side channels that make the Telkwa River so high value as rearing habitat, but juvenile fish rear at the margins of the mainstem and in the few side channels that exist. It is also likely that juvenile fish move into the small, low velocity tributaries to rear, such as Helps Creek.

There is a large gravel bank on the shore adjacent to the rail loadout. This type of habitat is ideal for Chinook spawning, and there are reports of Chinook spawning in the area. There is likely also be spawning areas suitable for sockeye, coho, pink, or chum salmon, as all these species are found rearing in the area.

The Bulkley River is a major corridor in the region, as both Highway 16 and the railway run alongside it. As a result, much human development in the area is also adjacent to the river, including towns, residential areas, and farmland. The reach between the rail loadout and the Telkwa River is heavily agricultural with most of the riparian area cleared, in some places cleared to the water edge. The village of Telkwa is also located in this reach, with potential impacts from clearing, pollution run-off, fertilizer run-off, and canopy removal. The small tributaries and side channel habitat that likely provide rearing habitat for juvenile coho, Chinook, and steelhead will have been impacted and may have been destroyed or blocked altogether, removing a crucial link from the chain of habitats required by salmon lifecycles. Due to the extent of human use of the riparian zone in this area and the long history of development that pre-dates any fish habitat protections, this reach is likely currently severely impacted as critical habitat has likely been destroyed or seriously altered.

FFig

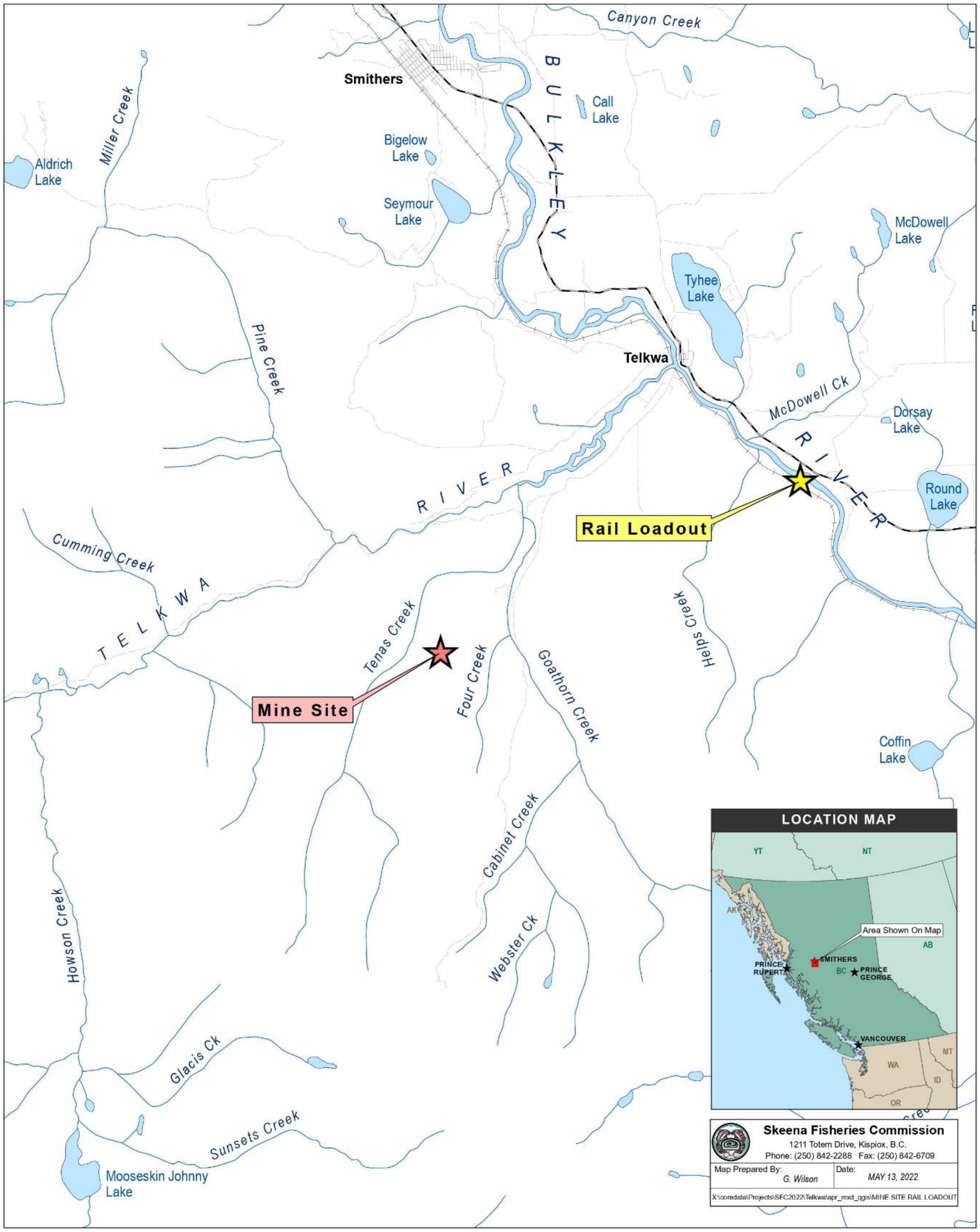

Figure 1. Key areas of the Tenas Coal Project including the minesite and rail loadout

3. DATA GAPS

Context

Prior to the submission of the Application, all available baseline data provided by TC was reviewed and data gaps identified by this author in the Telkwa Coal Data Summary Memo – Fish and Fish Habitat (the Data Summery Memo). At the time, only the 2017 baseline data was available. However, the Application included data from 2018 fish and fish habitat sampling and an extended baseline. In this section, these data gaps will be revisited to review whether they have been satisfactorily handled for the Application.

Out of Date Data

The data used to support the conclusions of the Application fell into two categories: "historical" data collected between 1970 and 1997, and "modern" data collected primarily from 2017-2020. Historical data has value to the assessment process as it provides information on trends over time, but it should not be used to make assumptions as to the current state of the environment without supporting modern data. Factors such as climate change, fish population declines, and logging are likely to have impacted the area, making it inappropriate to use historical data to describe the current environment.

As noted in the Data Summary Memo, much of the detailed data was collected from 1982-1986, and even within that period changes to the state of some of the waterbodies were noted. The modern data collection was very minimal, as only nine sites in the Project area were sampled and those did not include the areas identified as the primary steelhead and bull trout spawning areas in Tenas Creek and Goathorn Creek in the 1980's. Two sites were sampled in 2018 Four Creek, which were not included in the data available for the Data Summary memo, but were only once in 2018, rather than the two years usually recommended as the minimum sample number. As a result, it's not clear if the lack of some species in the modern sampling that were present in the historical sampling is a sign of their extirpation or merely a sign of insufficient sampling. A second year of sampling in 2018 was added to the data available in the Data Summary memo for the other seven sites, which partially addresses issues identified there, but the number of sites and amount of sampling is still very low for the size of the Project and its potential impacts.

This data gap has only partly been addressed since the Data Summary Memo and is still a large source of uncertainty when assessing potential risks and impacts.

Steelhead

The historical reports highlight the importance of the area as spawning and rearing habitat for steelhead, stating "the studies suggest that Tenas and lower Goathorn Creek are the most productive steelhead tributaries in the Telkwa system" (Bustard D. , 1998). The Application does not differentiate between steelhead and rainbow trout, nor does it attempt to address the value of this area to steelhead. It does not address the uncertainty about whether steelhead still spawn in the area or where they spawn.

This data gap has not been addressed in any way since the Data Summary Memo and is a particularly significant gap given the importance of steelhead to the Wet'suwet'en and the importance of the Project area to steelhead historically.

Spawning Locations

The baseline data available during the review for the Data Summary Memo included only a single coho spawning survey in 2017. Additional coho and Chinook spawning surveys were attempted in 2018.

However, no spawners or spawning locations were identified, and no modern spawning surveys were attempted for steelhead, pink salmon, Dolly Varden, or bull trout despite previous accounts of these species spawning in the study area and juveniles found in the area. The survey also did not include the potential spawning habitat adjacent to the rail loadout.

Dolly Varden habitat within Four Creek is estimated in the Application, but there are no estimates for any other species or waterbodies.

This data gap has only been partly addressed; the location of spawning areas relative to the Project is still unknown for most species. Therefore, outside of the risks to Dolly Varden due to impacts to Four Creek, risks to spawning habitat is not known.

Species Presence

The Data Summary Memo noted uncertainty about the presence of Chinook salmon, pink salmon, and bull trout in Goathorn Creek, as they were historically present but were not captured in the 2017 surveys. The additional 2018 survey added an additional year of survey to Goathorn Creek, but still only at the one site which was not located near the area used by bull trout historically.

So, while additional sampling took place, it was not well-designed to address the issue of species presence in Goathorn Creek and this data gap has not been addressed.

Small Tributaries

The Data Summary Memo noted that no sampling had taken place in any of the tributaries feeding the main waterbodies in the Project area. The 2018 sampling included surveys in Four Creek, and the Application adds the additional information that the other tributaries have been determined to be non-fish bearing due to an unsuitably high gradient.

While these tributaries may still have value to fish by providing aquatic organism for food or temperature refugia downstream, their value as direct fish habitat has been adequately described and this data gap has been addressed.

Haul Road and Load Out

An important gap noted in the Data Summary Memo was the lack of sampling on Hubert Creek, Helps Creek, and other tributaries crossed by the haul road, and the lack of sampling near the rail loadout facility. The Application included a survey of all tributaries crossed by the haul road and their habitat value that was not available for the Data Summary Memo. This survey comprehensively describes all tributaries using industry standard methods but was carried out in August in an unusually dry year. The assessment noted that almost all the crossings were dry, but that may not be representative of habitat in a year with normal precipitation. Also, Goathorn Creek was not assessed during this survey despite the planned haul road crossing, and no other modern sampling for fish and fish habitat was conducted in that area either.

Likewise, there has still been no modern fish, fish habitat, or spawning surveys of the area of the Bulkley River adjacent to the rail loadout, or any attempt to identify the habitat value of Hubert Creek or Helps Creek downstream of the area immediately adjacent to the crossings.

Due to these flaws in sampling methodology and unsampled areas, this data gap has been only partially addressed. This data gap makes it particularly difficult to estimate impacts to Wet'suwet'en rights and interests.

Fisheries Sensitive Zones

Fisheries Sensitive Zone (FSZ) are areas or side channel, off channel, wetland, or other habitat that does not create a channelized flow as a stream does, but still provides fish habitat. These can be incredibly important areas for fish species, particularly for providing shelter for rearing juvenile fish during freshet.

FSZs were not identified during the baseline surveys. While the morphology of the Project area may not permit the creation of FSZs, historical surveys have identified them in the form of wetlands and ponding water in the Hubert and Helps Creek watershed. While this area was surveyed, it was only surveyed during August. Many FSZs are ephemeral and would have been dry in August and not detected on the survey. Therefore, this data gap has not been addressed.

4. PRIMARY PROJECT IMPACTS

Surface Water Quantity During Operations

The project will involve changes to the water quantity of rivers and streams in the project area, including Tenas Creek, Four Creek, Goathorn Creek, and Telkwa River. This will occur due to water removal from the system for project operations, containment of potentially contaminated water in control and maintenance ponds, and diversion channels that will route surface water around the project site.

The removal of water can impact fish through multiple pathways including decreased habitat quantity, increased likelihood of drought and channel dewatering, increases in contaminant concentration from decreased dilution, increases in water temperature, accumulation of fine sediments due to decreased freshet flooding, dewatering of redds in winter, and decreased depth of ponds for overwintering.

The greatest decreases in water quantity will likely occur in Four Creek, which will experience decreases in water discharge by up to 34.4%. This is highly likely to substantially decrease the available wetted area for fish habitat. While Four Creek contains good quality fish habitat, a perched culvert at the existing crossing of Coalmine Road near the creek mouth prevents salmon and steelhead from migrating upstream beyond 600 m from the mouth. Upstream of the culvert, only Dolly Varden have been found. The area upstream of the culvert is reported to have limited overwintering habitat as there are few pools deep enough to not freeze to the substrate. There is a high likelihood that the substantial water quantity decreases for Four Creek will decrease or completely remove the available overwintering habitat, extirpating the resident Dolly Varden populations. As the culvert prevents fish from moving upstream from elsewhere in the system, this extirpation would likely be permanent.

Water quantity in Tenas Creek will also likely decrease due to the Project, as the Project includes a diversion channel that will divert surface flows from 7% of the Tenas Creek catchment to Goathorn

Creek. Water flows are predicted to decrease by 5-10%, with the greatest reductions on the downstream end near the confluence with Goathorn Creek and during low flow periods in April and August. Unlike with Four Creek, it is unlikely that the impacts will be so severe as to prevent the use of the habitat by fish. However, overwintering habitat has also been found to be limited in Tenas Creek, with much of the creek freezing to the substrate in winter according to historical records. Decreased surface water flows may further reduce the already-limited amount of overwintering habitat and cause redds to freeze, killing eggs. Unlike with Four Creek, Tenas Creek is still functionally connected to Goathorn Creek and the Telkwa River so re-colonization would be possible in the event of a winter kill. However, frequent winter kills can act as a "population sink", where fish migrate into an area with good summer rearing habitat but are killed during the winter, resulting in an overall and persistent decrease in population. As the environmental flow needs have not been determined for Tenas Creek, it is unclear what impacts the 10% reductions predicted during the lowest flow period of August will have on the ability of fish to use the creek for rearing. It will likely still provide rearing habitat, however there may be issues related to stranding, high temperatures, or stagnant water decreasing habitat quality.

Due to the diversion of Tenas Creek flows to Goathorn Creek, the reach of Goathorn Creek between the Four Creek confluence and the Tenas Creek confluence will likely experience moderate increases in discharge of less than 5%. Downstream of the Tenas Creek confluence, the decrease in Tenas Creek flows will result in a total loss of 0-3% of the total discharge of Goathorn Creek. This fairly minor decrease in water flow is unlikely to have strong impacts to fish habitat, although it may have an impact during drought years as the impacts of droughts on the system are not known. Historical habitat surveys record high flooding in Goathorn Creek, with spring floods during freshet potentially damaging steelhead spawning areas. The water management ponds and water control structures installed as part of the project may moderate these floods and have a positive impact on fish habitat in Goathorn Creek, although they are only built to manage a 1-in-10 year flood and will not be able to manage large floods.

The impacts on water quantity to Telkwa River are minimal and unlikely to have significant impact on fish habitat.

Groundwater Withdrawal During Operations

The Project is predicted to have impacts to groundwater, as the construction of the underground pit will disrupt the groundwater table and divert groundwater from its normal pathways into the pit and containment pond system. There is also the potential for water to seep from the Project's water management system into the groundwater of the surrounding environment, particularly as the infrastructure ages. This water may contain contaminants from the Project operation.

The primary function of groundwater to fish habitat is in providing water quantity. Potential impacts from water quantity changes on fish habitat is described above.

The secondary function of groundwater to fish habitat is to provide temperature refugia to permit behavioural thermoregulation. As it is usually cooler than surface water in the summer and warmer in the winter, areas of groundwater upwelling protect rearing salmonids from high water temperatures in the summer and enhance the growth of eggs over the winter and protect from freezing. Many salmonids, including Chinook salmon, coho salmon, steelhead, and bull trout, preferentially spawn in areas of groundwater upwelling.

Many of the changes to the flows described above are due to changes to groundwater flow. As with total flow, it is expected that Four Creek will be heavily impacted, Tenas Creek and Goathorn Creek moderately impacted, with low impacts to Telkwa Creek, and that during project operations the flow of groundwater will be reduced. The reduction in groundwater flows will be highest in the portions of the streams adjacent to the open pit. In Tenas Creek, groundwater flows may decrease by up to 6% in some areas. In Goathorn Creek, the groundwater flows will decrease by approximately 3% adjacent to the pit.

These moderate changes will not likely prevent fish from using these waterbodies. It is likely that they will degrade the habitat somewhat, potentially decreasing the amount of high-quality spawning habitat or reducing the carrying capacity of the waterbodies in low water or drought years.

Changes to Water Quality During Operations

The Project will likely impact water quality in Tenas Creek, Goathorn Creek, and Four Creek both during operations and post-closure. For a detailed description of the impacts, please see associated Water Quality Impact Report.

The contaminants of most concern in the context of fish habitat and this Project are selenium, heavy metals (particularly copper, cadmium, and aluminum), and sediment.

Selenium causes severe health impacts through multiple pathways. It can cause alterations in the liver, kidney, and heart that can result in mortality or morbidity. Sublethal levels of selenium can cause impacts to fish populations through reproductive failure: selenium can cause ovarian disruption, rupturing of egg follicles, decreases in the production of viable eggs, and deformities and abnormalities in developing eggs. Reproductive failure is often not observable from adult fish, who appear healthy, but can have serious impacts on a population level. Selenium bioaccumulates (builds up over time) in fish.

Heavy metals are another contaminate of concern due to the potential for water quality guideline exceedances of several heavy metals and their potential impact to fish.

- Aluminum is already elevated in the environment either due to the natural geology, or to previous impacts from mining and other development in the watershed. However, the Project is expected to elevate it further. Aluminum disrupts gill function, causing irritation to gills and increased ventilation rates at low concentrations, and asphyxiation and disruptions to ion regulation at higher concentrations, where it can be fatal.
- Cadmium concentrations may exceed guidelines due to the Project. Cadmium's sublethal effects in fish include decreased appetite, decreased growth, and reproductive damage through inhibited egg maturation and development. It may cause negative impacts when combined with zinc, which also may exceed guidelines in the Project area as a result of Project activities. At higher levels, it is lethal.
- Copper exposure at levels exceeding guidelines can result in sublethal effects such as decreased growth, decreased immune system function, damage to sensory organs (olfactory receptors and lateral line cells), and damage to liver, kidneys, and gills, among other effects. Damage to olfactory receptors are linked to difficulties feeding, difficulties homing to natal streams, and reduced predator avoidance. As with other heavy metals, high concentrations can be lethal to fish.

All three heavy metals persist in the environment indefinitely and can bioaccumulate (build up over time) in fish.

Sediment does not impact fish through chemical means, its impacts are primarily physical. While in the water column it can damage gills and prevent fish from locating prey effectively. Settling sediment damages the environment, filling interstitial spaces between rocks that are used by juvenile fish to hide from predators and locate prey and can smother eggs located in gravel redds. Excessive amounts of sediment can destroy spawning habitat for fish.

Habitat Destruction During Construction

The project infrastructure largely avoids the destruction of major waterbodies. There are several tributaries to Tenas Creek and Goathorn Creek that will be directly altered or destroyed by the project. However, most of these tributaries are steep with little to no value as fish habitat (Telkwa Coal, Ltd., 2022).

Despite the lack of good fish habitat, it is possible that these tributaries provide food for rearing fish in Tenas and Goathorn Creeks in the form of aquatic organisms that drift downstream, or that the groundwater from the streams provides temperature-regulating services to that downstream fish habitat. Tenas Coal did not survey the aquatic invertebrate population or the temperature and discharge from these streams so those impacts cannot be estimated.

Haul Road Impacts During Construction and Operations

The haul road that is planned to connect the mine site to the rail loadout and be used for hauling the produced coal to the rail loop. Part of the haul road will follow an existing Forest Service Road and be constructed through upgrades to that road, but some of the haul road will be new construction (Telkwa Coal, Ltd., 2022). The Application provides little clear information on the haul road, its route, the existing FSR, its crossings, or the traffic on the road and therefore impacts from the road are difficult to determine. There was a limited survey conducted in 1983, and another in 2018. The 2018 survey indicates that some of the water bodies crossed by the road were surveyed but does not state that all of them were. It is unclear if some water bodies crossed by the road have not been surveyed. The large wetland adjacent to Hubert Creek was not surveyed.

Most of the haul road route is low gradient, once it descends from the Goathorn Creek drainage. Historical data collected in the 1980s indicates that waterbodies in the area such as Hubert Creek and Helps Creek are good quality fish habitat, with steelhead, coho salmon, Chinook salmon, cutthroat trout, and Dolly Varden present rearing and potentially spawning (Bustard D. , Fisheries Studies in Hubert Creek near Telkwa, 1986). In a 1983 survey, it is noted that clearing for agricultural and forestry purposes has been carried out throughout the area including riparian zones. The 2018 survey finds the streams in the area to be heavily impacted, as many are dry or comprised of isolated pools, and little good fish habitat is noted (Telkwa Coal, Ltd., 2022). Dolly Varden and other un-identified salmonids are still observed in isolated ponds in a dry section of Helps Creek. The road crossings are located far upstream on both creeks, while most historical fish habitat appears to be approximately a kilometer or more downstream.

The August 2018 survey notes that many of the streams crossed by the haul road do not contain water, however, 2018 was an unusually dry year during which the Kitwanga Salmon Enumeration Facility recorded its lowest ever water levels. It is unlikely that the water levels observed in 2018 are typical for these streams, which may be wetted permanently in a normal year.

Impacts to fish and fish habitat from roads such as haul roads can occur through multiple pathways: culverts and bridges can encroach on fish habitat from undersized footings, improperly sized or installed culverts can prevent fish passage, the construction of roads often requires the removal of riparian vegetation which can exacerbate high water temperatures and lack of canopy cover, and dust (sometimes containing trace heavy metals), herbicides and dust suppressant chemicals can enter waterways during the use and maintenance of roadways. Dust and chemical impacts are localized, and likely will primarily impact the habitat near the road crossings to a distance of up to 2 km. The construction of roads can impede overland water flow and cause a decrease in water levels in nearby streams, or can increase the drainage of adjacent wetlands and cause them to become dry.

Telkwa Coal has stated that it will only install clear span bridges on any fish-bearing waterbodies, and install culverts on all non-fish bearing waterbodies as culverts can impede fish passage. For this reason, it is important for good data to determine which streams are fish-bearing and which aren't.

Sedimentation from roadways and road construction is a persistent issue that can occur both during construction and for the life of the roadway as unstabilized soils erode. Major erosion can mobilize large amounts of sediment and could cause impacts to the entire stream from the road crossing to the confluence with the Bulkley River. Erosion can largely be prevented by careful road planning, construction, and maintenance, but nevertheless often occurs during road construction projects.

Beneficial impacts from the haul road could include the removal and replacement of undersized or improperly designed culverts from the existing Forest Service Road with more appropriate structures.

To estimate risks and impacts from the haul road, information on the crossing structures to be installed, the predicted traffic on the haul road, sediment control plans, and the road maintenance plans would be required. These were not provided by Telkwa Coal. Therefore, specific estimates cannot be made.

Accidents – Containment Pond Breach During Operations or Closure

Accidents are a serious concern for large construction projects, but also one of the hardest risks to estimate as they are not planned and are not likely to occur. However, given the potentially catastrophic results of a major accident like a containment pond breach, the potential impacts must be considered despite the unlikeliness.

Containment pond breaches occur when the dams containing wetted mine tailings, effluent, or other mine products breach or collapse, releasing the contents of the enclosed area into the environment. The Mt. Polley Mine Tailings Dam Failure of 2014 was one such event, when one of the earthen dams of the tailings pond collapsed and released tailings into the Quesnel River watershed.

The Project includes four ponds with potential for a breach: a control pond used for settling sediment and potentially treating water collected from the mine site, and three management ponds (North, West, and East) that will contain wetted potentially acid-producing materials from the mine. All four ponds will be created through the use of earthen dams.

It is beyond the scope of this report to evaluate the engineering designs and geotechnical investigations that would allow for an estimation of their sufficiency. In general, most mines do not experience such breaches, although they have and do occur.

If the control pond were to experience a breach, it would likely release the contained water and sediment downstream through the unnamed Goathorn Creek tributary into Goathorn Creek, and the Telkwa River (Telkwa Coal, Ltd., 2022). As the water within the control pond is relatively low in contaminates, the primary impact would be from the flood itself and the resulting sedimentation. The likely results include fish mortality and severe destruction of fish habitat to Goathorn Creek and potentially the Telkwa River. Habitat restoration may be possible, but restoration and repopulation would likely take decade.

If the larger management ponds were to experience a breach, the likely path of the breach would be through Four Creek and Goathorn Creek, into the Telkwa River, although there is a possibility for a breach into Tenas Creek as well as well as a chain reaction breach of the control pond. All nearby fish habitat would be eliminated, and most or all fish in the area would be killed. It would likely cause a large sedimentation event in much of the Upper Bulkley River that would have significant impacts to fish habitat, particularly through sedimentation of spawning grounds. Full restoration is unlikely to be possible.

Accidents – Rail Loadout Spill During Construction of Operations

The rail loadout will be used to transfer processed coal from trucks to railcars for shipping, and equipment and other mine materials from railcars to trucks. While the rail infrastructure will not be built over top of any fish habitat, it is directly adjacent to the Bulkley River and there is the potential for any spills that occur at the rail loadout to enter the river.

The primary substances of concern for fish habitat are the processed coal and fuel (such as diesel or gasoline).

While the impact of a coal spill would be largely localized, fuels like gasoline or diesel are highly mobile in moving water and would spread downstream quickly, with no possibility of containment. Fuels have both lethal and sublethal impacts to fish and can cause ecosystem-level changes through toxic effects to other species. In fish, fuels are known to block respiration, cause lesions on gills, decrease immune system function, and damage reproduction and endocrine function. Fuel spills are often lethal to fish, primarily due to suffocation, and may be particularly damaging to young juveniles and eggs.

The distance at which these effects would occur is dependent on the amount of fuel spilled and the discharge level of the river at the time, as the volume of the Bulkley River will cause it to be diluted. Over time, small or moderate fuel spills will be sequestered in sediments and diluted by water, and so impacts are likely to be moderate in length, measured in years to decades.

Due to the flow of the Bulkley River, liquid substances that enter the river will be rapidly moved from the spill site and spread throughout the river. Containment or restoration are very unlikely to be effective in this environment.

Post-Operation State

At the end of Year 21, the Project is scheduled to enter its Decommissioning Phase where the mine is shut down, the environment in the project area partially restored, and the Project will enter its long term maintenance state. It is important to understand that while most of the activities associated with the Project will cease, that does not mean that impacts will cease and there will be permanent changes to the environment from the Project.

Long term water management in a mining project is one of the most important and difficult parts of many mine reclamation phases. Acid generating mine wastes will retain their acid generating potential and must be managed in perpetuity. Potentially Acid Generating (PAG) wastes will be managed by submersion in the three management ponds and then topped by 2 m of topsoil and non-PAG waste. If PAG wastes are submerged in water, the acid-generating potential is minimized, but the site must be monitored to ensure that the PAG wastes remain submerged by maintaining water management structures. While submersion largely minimizes sulphuric acid production, it does not prevent other contaminates from leaching from the waste into the environment. The ponds will be lined with a liner to minimize leaching into the groundwater, but liners develop leaks over time and this will not fully prevent heavy metals and other contaminants from leaching into the groundwater post-closure (please see the Water Quality Impact Report for details on post-closure water quality issues).

The mine site is located near steelhead and coho spawning areas of Tenas Creek, Goathorn Creek, and upstream of Telkwa Creek. Fish eggs are particularly sensitive to waterborne contaminants including heavy metals. Acute toxicity causing direct mortality is unlikely to be widespread from this project, even as contaminate levels rise post-closure. However, as the levels of several contaminants (including aluminum, cadmium, iron, and selenium) are predicted to exceed guidelines for the protection of aquatic life post-closure in all waterbodies modelled, including downstream portions of the Telkwa River, there is the high potential for impacts to fish in the form of sublethal health impacts or population decreases on the species they depend upon for food while rearing.

Contamination by heavy metals and selenium are expected to increase in Tenas and Goathorn Creeks over time, peaking in approximately 100 years (see Water Quality report for details) and potentially continuing for several centuries. Tenas Coal has not suggested mitigation for this period and expects to cease its post-closure monitoring after 25 years. Health impacts to fish in the Project area are expected occur primarily after post-closure monitoring ceases and will not to be easily mitigated. These impacts will likely negatively impact any attempts to restore habitat or recover fish populations in this area.

Post-closure conditions will also result in permanent alterations to water quantity. Tenas Creek is expected to experience a reduction in flows of up to 10% during low flow periods. Four Creek will experience more extreme flows: increases of 30% overall, but a decrease of 25% during winter low flows.

Climate Change

Climate change is a key source of uncertainty for identifying Project impacts. Models of water quality, quantity, and structural engineering, as well as knowledge of habitat use patterns for fish rely on past sampling. The Application relies heavily on older fish sampling studies dating to the 1980s and 1990s. Climate change has impacted the Project area and will have even more extensive impacts going forward.

Extreme events, such as unusually wet or dry years, unusual heat waves, and floods, are likely to become more common in the future. The water quality and quantity modelling undertaken by Tenas Coal includes modelling for multiple wet years or multiple dry years in a row but does not model for more extreme events. It is unclear if the predictions would remain accurate for multiple extreme flood years, or for serious and ongoing drought that might require additional water removal for Project activities.

As climate change affects the Project area, fish habitat use may change as well. Some previously-important streams may become too warm for fish use, or may run dry during low flow periods. Other areas, buffered by cool groundwater, may increase in importance. Forest fires may impact catchments and riparian zones and further change ecosystem functions.

IMPACTS TO KEY SPECIES

Impacts to Coho

Coho salmon in the project area belong to the Middle Skeena Conservation Unit, and the Telkwa River is an indicator stream for this unit. The spawner surveys for the Telkwa River are patchy, and there does not seem to be a strong trend line for the population, but the last two years have shown low spawner returns.

Within the Project area, coho salmon are found in the larger streams: Goathorn Creek, Telkwa River, Bulkley River, and historically were found in Helps and Hubert Creeks. Goathorn Creek and Telkwa River were historical coho spawning areas, but it is unknown whether those are still active spawning grounds, and if they are active, it is unknown how many spawners use the area. Identifying risks to coho populations without data on spawning areas and escapement numbers is difficult. The presence of juvenile coho in Goathorn Creek does provide some evidence that spawning still occurs but given the low densities of juvenile coho and the overall marginal habitat quality for coho spawning, the number of spawners seems potentially low. Hubert and Helps Creeks are entirely unknown, while they were historically good quality coho rearing areas with high densities of juvenile coho, those reports date to 1983 and the ecosystem may have changed considerably in the previous 39 years.

Goathorn Creek and Telkwa River are likely to experience low to negligible impacts from water quantity changes and destruction of habitat. Goathorn Creek will be crossed by a clearspan bridge for the haul road and may experience some sedimentation due to dust from vehicle traffic from the road. The effects on coho salmon from these impact pathways is likely to be fairly minimal. A dam breach is unlikely, and the reaches of the Telkwa River downstream of the Project area are not the primary spawning regions (which are believed to be further upstream), and Goathorn Creek is not a high value spawning area.

Water quality changes to Goathorn Creek are expected and are likely to exceed guidelines for several contaminate types. As a result, coho spawning and rearing in Goathorn Creek may experience sublethal impacts such as decreased growth rate, lower health, and reproductive failure.

The primary risks to coho salmon are impacts from the road on Hubert and Helps Creeks, and through changes to water quality, particularly post-closure. The road is located farther upstream on Hubert and Helps Creek than coho were found in 1983 but may contribute sediment and dust that will further exacerbate the sedimentation and infilling of those streams.

Coho are widespread within the Skeena Watershed, and on a watershed or even CU level, the Project Area is not particularly important habitat. However, on a local level, a loss or reduction of coho population size could occur, and from the perspective of cumulative effects, this would contribute to the slow disappearance of the small, groundwater fed streams and side channels that coho preferentially rear in, which are often impacted by agriculture and forestry.

Helps and Hubert Creeks in particular are candidates for potential restoration of coho salmon habitat, and both lower Goathorn and the Telkwa River would be good candidates for building off channel habitat that benefits rearing coho juveniles. The Project offers both potential for funding for such work through the Offsetting Plan, but also may impede the ability for the Wet'suwet'en Nation to carry out this work on their own.

Impacts to Bull Trout

The presence and abundance of bull trout in the Project area is unclear. Bull trout are not mentioned in the earliest reports included in the baseline, collected in 1983 and 1984, but surveys conducted in 1997 and 1998 found bull trout in low densities in both Tenas and Goathorn Creeks, with spawning areas identified in Goathorn Creek near the proposed haul road crossing. The modern baseline surveys from 2017 and 2018 did not capture any bull trout. Bull trout and Dolly Varden are similar in appearance and can be difficult to differentiate as juveniles. It is possible that some of the Dolly Varden captured in 2017 and 2018 were instead bull trout.

As a blue listed species, the potential presence of bull trout spawning and rearing habitat in the Project area is important to note. The 1998 location of the bull trout redds where the majority of the juvenile bull trout were found was not surveyed in 2017 or 2018, despite its location near the Goathorn bridge haul road crossing. If this area is still used by bull trout for spawning and rearing, there could be impacts from dust and erosion from the road crossing as eggs are quite sensitive to smothering by sediment.

This particular area may also experience exceedances of WQ guidelines of iron, aluminum, and cadmium during the project operations and post-closure, as it is close to the confluence with the unnamed tributary through which the Control Pond effluent will be released. These exceedances are not expected to cause direct mortality but may result in sublethal impacts to health or reproduction and associated population-level impacts.

Bull trout populations and spawning locations in the upper Bulkley area are not well known, nor is the current status of bull trout in the Project area known. Without this information it is difficult to put these impacts into context. It seems likely that due to the low densities observed in the 1990s, that the area may or may not be important locally but is not likely to be important on a watershed-level scale. That does not rule out the possibility that this area was important historically or has potential as a future site for population recovery.

Impacts to Steelhead

Both historical records and the modern sampling carried out by Tenas Coal confirm that the Project area is very important habitat for steelhead. High densities of juvenile steelhead/rainbow trout (*Oncorhynchus mykiss*) were captured consistently throughout the Project area in all sampling carried out between 1983 and 2018 (Telkwa Coal, Ltd., 2022). Steelhead juveniles cannot be differentiated from rainbow trout juveniles in the field, so it cannot be conclusively determined whether the *O. mykiss* fish captured are rainbow trout or steelhead. However, in his 1984 sampling report David Bustard argues that based on the known distributions and densities of adult rainbow trout and steelhead in the area, as well as the lack of any *O. mykiss* individuals larger than a steelhead smolt (approximately 250 mm), it is likely that the majority are steelhead and not rainbow trout (Bustard D. , 1984). This argument is compelling and well-reasoned, so for the purposes of this report I will assume that the majority of the *O. mykiss* captured were steelhead.

In both historical and modern sampling, steelhead are the most common species captured in the Project area and are found in particularly high densities in Tenas Creek and the lower reaches of Goathorn Creek, below the haul road bridge crossing. In 1983, the density of juveniles was used to estimate the predicted number of adult steelhead produced by the Project area (Table 1). While these numbers are extremely speculative, it does provide context for potential project impacts.

Table 1: Estimated steelhead smolt and adult production from the Project area in 1983.

Waterbody	Smolt Production (#)	Adult Production (#)
Goathorn Creek	1097	165
Tenas Creek	2580	387
Lower Telkwa below Project site	2184	328

From: Bustard, D. 1984. Assessment of Benthic Invertebrate and Juvenile Fish Populations in Goathorn and Tenas Creeks and the Lower Telkwa River, 1983.

The estimated steelhead returns to the Skeena system in 2021 were 5,461 spawners total. These numbers are not directly comparable: it is to be expected that the population declines that have impacted Skeena steelhead since 1983 have also decreased the number of steelhead produced by the Project area. It does, however, put the habitat potential for the production of 880 adult steelhead into context.

Tenas Creek has the highest densities of juvenile steelhead in the Project area and may be the spawning grounds from which some of the other steelhead rearing in the Project Area originate. Tenas Creek will be heavily impacted due to changes in water quality, primarily through high levels of selenium and heavy metals. This may cause mortality or health impacts to rearing steelhead, and particularly may impact eggs due to their sensitivity. Water quantity is also predicted to decrease, and as overwintering habitat is likely a limiting factor to productivity in Tenas Creek, it is possible that decreased availability of deep pools for overwintering will decrease the carrying capacity of the creek and result in decreased steelhead survival.

As the receiving environment for Project wastewater output, Goathorn Creek will likely experience the greatest water quality impacts. Increased concentrations of selenium, sediment, heavy, metals, and other contaminates will degrade the habitat quality of Goathorn Creek, and potentially cause population-level effects through sublethal toxicity that may decrease the growth, health, and reproductive success of steelhead rearing and spawning there.

The current production of steelhead from the Project area is unknown. Historically, it was likely of a similar value to other streams known as being particularly important for steelhead production. A 1997 study stated that “the studies suggest that Tenas and lower Goathorn Creek are the most productive steelhead tributaries in the Telkwa system” (Triton, 1997). For this reason, impacts from the Project on steelhead may be significant on a population-level rather than solely local-level. On a local level, the Project area may produce many of the adult steelhead captured in the Telkwa area. The impacts from the project will be permanent (measured in centuries), difficult to mitigate, and will likely prevent full restoration of the lost and damaged steelhead habitat.

Impacts to Other Fish Species

Other species in the area that may be impacted include Dolly Varden, Chinook salmon, and pink salmon.

Dolly Varden are found throughout the area, in every named waterbody sampled. While they are not found in high densities anywhere in the Project area, they are nevertheless present in small, resident populations. Likely, the biggest impact to Dolly Varden from the Project would be the impacts to Four Creek. As water diversions would decrease the water volume of the stream substantially, it could destroy all available overwintering habitat for the resident population while a hanging culvert downstream would prevent them from moving to other overwintering habitat. It is possible that as a result of Project activities, this population would be wiped out and Four Creek would become non-fish bearing.

Chinook salmon are mostly limited to the large rivers in the Project area, the Telkwa River and the Bulkley River. Due to their size and distance, these rivers are for the most part buffered from impacts from the Project. Chinook spawning areas adjacent to the rail loadout may experience minor sedimentation from coal and vehicle dust, or moderate sedimentation in the case of erosion or poor sediment control during construction. Chinook spawning and rearing habitat would also be at risk in the case of a major accident: either a dam breach or a major fuel spill would destroy or contaminate habitat in the lower Telkwa and the Bulkley River, respectively.

Pink salmon are found in low numbers in Goathorn Creek, the lower Telkwa River, and the Bulkley River near the rail loadout. The pink salmon in the project area belong to the Middle Upper Skeena (even) and Middle Upper Skeena (odd) conservation units. The pink salmon in Goathorn Creek may be impacted by changes in water quality, however due to the low density of pink salmon juveniles both historically and in modern sampling, it seems unlikely that there would be population-level impacts to the Middle Upper Skeena CUs as a result of the project. It would, however, contribute to the cumulative impact of the gradual decline in availability of habitat for pink salmon in the Skeena.

5. CONCERNS WITH APPLICATION

While this report will not provide a full critique of the Application. Instead, it is a high level summary of major concerns. It is hoped that in combination with the different approaches to impact assessment described in the Approach section, these concerns will explain the difference in conclusions between this report and the Applications statement of impacts.

Predicted Futures vs. Risks

There are two main ways to categorize future impacts: predicting future conditions and characterizing risks. The Application uses the predicting future conditions approach: TC predicts the most likely (in their view) future condition for the environment and summarizes how it differs from the present. As stated in the Application, the likelihood of an impact is only considered if it is viewed to be likely “while considering that the mitigation will be successful”, with the assumption that all mitigations will be fully successful despite the frequency at which mitigations occur in real life situations. For example, as it is unlikely to be an accident such as a fuel spill if all mitigation measures and best management practices are followed perfectly, fuel spills are not included as impacts to fish and fish habitat in the Application and the impact from fuel spills is assumed to be zero.

This assessment uses the methodology of characterizing risks. Using this methodology, both the risk and its likelihood are described with the understanding that some impacts that are characterized may not occur. For example, while a large fuel spill is unlikely, it can and does occur in similar projects and so the risk of a spill occurring is considered as a potential future impact.

This risk-based approach was intended to recognize the role of value systems and risk acceptance in impact assessment. Risk tolerance and the comfort level of various risks are different for different decision makers. The risk tolerance of TC, who has legal obligations but no emotional or cultural connection with the Project area, may be higher than that of Wet'suwet'en leadership, who may have deep emotional and cultural connections and also obligations under Wet'suwet'en law. A risk-based approach allows Wet'suwet'en leadership to interpret risks according to their own perspectives and risk tolerances.

Definition of Significance

The impact characterization and definitions of significance used in the Application are in line with industry norms and Canadian law. However, in my opinion they are not in line with Wet'suwet'en understandings of the world and are not conducive for protecting Wet'suwet'en rights and interests.

In general, definitions used in the Application require a high bar of change to be considered in the assessment. For example, the definition of a change in fish habitat used in the Application requires the habitat to be "*permanently altered, destroyed, disturbed, or made inaccessible to fish*". This means that *temporary* habitat damage is not considered an impact, with "permanent" being defined as "in perpetuity" and contrasted with impacts that can last for years but may eventually return to baseline. However, damage to habitat that lasts only a few months, or a few years, can decrease the number of fish in one or more year-classes, which can then decrease the availability of fish for Wet'suwet'en fishers. Therefore, for this report, I have instead considered any habitat alteration or destruction that will decrease the ability of fish to use a habitat for a full stage of their lifecyle (such as a spawning period, or an overwintering period) to be an impact.

The definition of significance for changes to fish habitat is and adverse effect "*that is Moderate to High in Magnitude, a Geographic Extent that is Local or greater, a Duration of Medium to Long-term, is Continuous, not Fully Reversible, and Moderate to High in Context.*" (Telkwa Coal, Ltd., 2022). Using the definitions provided, that would mean that impacts would not be significant if they only occur within the project footprint, or occur in an area with "low sensitivity", occur for less than six months, occur several times but is not continuous, at any point diminishes to baseline conditions, or occur in an area of high resilience due to "*a lack of historic…natural disturbance*".

For example, while sedimentation and erosion are anticipated during construction, it is assumed that they will return to baseline levels after construction and therefore the sedimentation is not significant, even if it causes changes to the ability of fish to use habitat or the productivity of systems during this period.

In addition, where Best Management Practices have been identified by the BC Government, any activity that follows those practices is assumed to have no impact. This is a legal and industry standard intended to assist proponents in project applications by not requiring them to account for small impacts from common works like bridge and culvert installation, sediment and erosion control, fuel management, and clearing riparian areas. These impacts are often small in isolation, but from the perspective of an entire large project, or multiple projects in one area, the overall impact can be noticeable. Unlike the Application, this assessment takes a more holistic view, considering the impact of these works in aggregation despite best management practices.

Offsetting Plan

One primary reason why the Application states that there will be no significant impacts to fish and fish habitat is the consideration of the offsetting plan. The *Fisheries Act* requires that all harmful alteration, damage, and destruction (HADD) of fish habitat be offset by the construction or restoration of habitat of equal or high productivity so that there is a net increase. If a project constructs such habitat, under an Environmental Assessment it is considered to have no significant impacts of fish and fish habitat.

TC proposes to construct an off-channel pond and channel complex on lower Goathorn Creek. The Offsetting Memo included in the Application gives a high-level overview of what possible projects could entail, but does not specify design, location, or size. Nor does it give measurable definitions of "productivity" to be replaced – generally size is used as a proxy with a larger area assumed to produce more fish. This style of offsetting plan, with few if any details, is industry standard for EAs. The details are usually worked out in permitting, and since it is legally required to offset all HADDs to fish habitat, it is generally assumed that HADDs cannot then be the cause of impacts to fish habitat.

However, offsetting projects are known to have a high likelihood of failure. A paper assessing the success of 16 such projects carried out by proponents found that only 12% achieved a net gain in productivity and 63% resulted in a net loss (Quigley, 2006). The presence of an offsetting plan should not be taken as a guarantee of no net loss of productivity, and the Offsetting Memo included in the Application does not have sufficient detail to assess the likelihood of success of the offsetting activities.

As there is little information on which to evaluate the offsetting plan, and no guarantee of it succeeding, the offsetting plan was not considered while describing potential Project Impacts

Cumulative Impacts

Following the EAO's assessment process, cumulative impacts are only considered when a significant residual impact has already been identified. TC considers the best management practices, mitigation and offsetting sufficient to manage residual impacts, and therefore does not see any potential for cumulative impacts.

However, this approach to estimating cumulative impacts overlooks the effects of impacts that may not be significant on their own, but in combination with other impacts become significant. As described in Section 2 – Key Areas, the Project area is already moderately to severely impacted by many anthropogenetic pressures including past mining, logging, agriculture, and urban development. This is in addition to larger scale impacts from climate change and overall fish population declines.

The environment and Wet'suwet'en rights and interests are already under strain from these factors, so regardless of whether TCL feels that the Project is going to have a significant impact on its own, its contribution to these ongoing threats and pressures should be considered. As detailed in the Section 4 – Potential Impacts, there are several impacts that are likely to contribute to the ongoing cumulative impacts and environmental declines in the region.

Restoration Plan

The temporal boundaries for the Application begin at construction and continue for 50 years post-closure, at which point TCL intends to consider their responsibility to the site complete. However, the Wet'suwet'en cannot walk away from this area or this project, their interest extends for an unlimited amount of time in the future.

The Project is expected to continue influencing the environment for a much longer period of time than 50 years. The impacts on water quality are relatively minor during Operations but are expected to increase over time due to seepage from the containment ponds, and to peak in 100 years and exceed guidelines for longer. While this time period is not contained within the temporal boundaries of the Fish and Fish Habitat VC, and therefore not included in the impact statement, the impact on future generations of Wet'suwet'en is important, and included in this Assessment.

Restoration plans for mine sites often do not adequately restore the environment to its original condition. While they may *look* similar to the previous environment and be physically stable, they often lack the ecological conditions and relationships to *function* as the environment did previous to the project. Restoration often includes achieving physical stability, recovering with soil, replanting vegetation, and little else. Issues with decreased biodiversity, low species abundance, and lack of key species sometimes extend for decades after closure.

The restoration plan is lacking in specifics or measurable objectives and indicators that would allow TCL to be held accountable for restoring habitat, nor are there proposals that TCL will retain their responsibility to the project until it meets those objectives.

6. REFERENCES

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