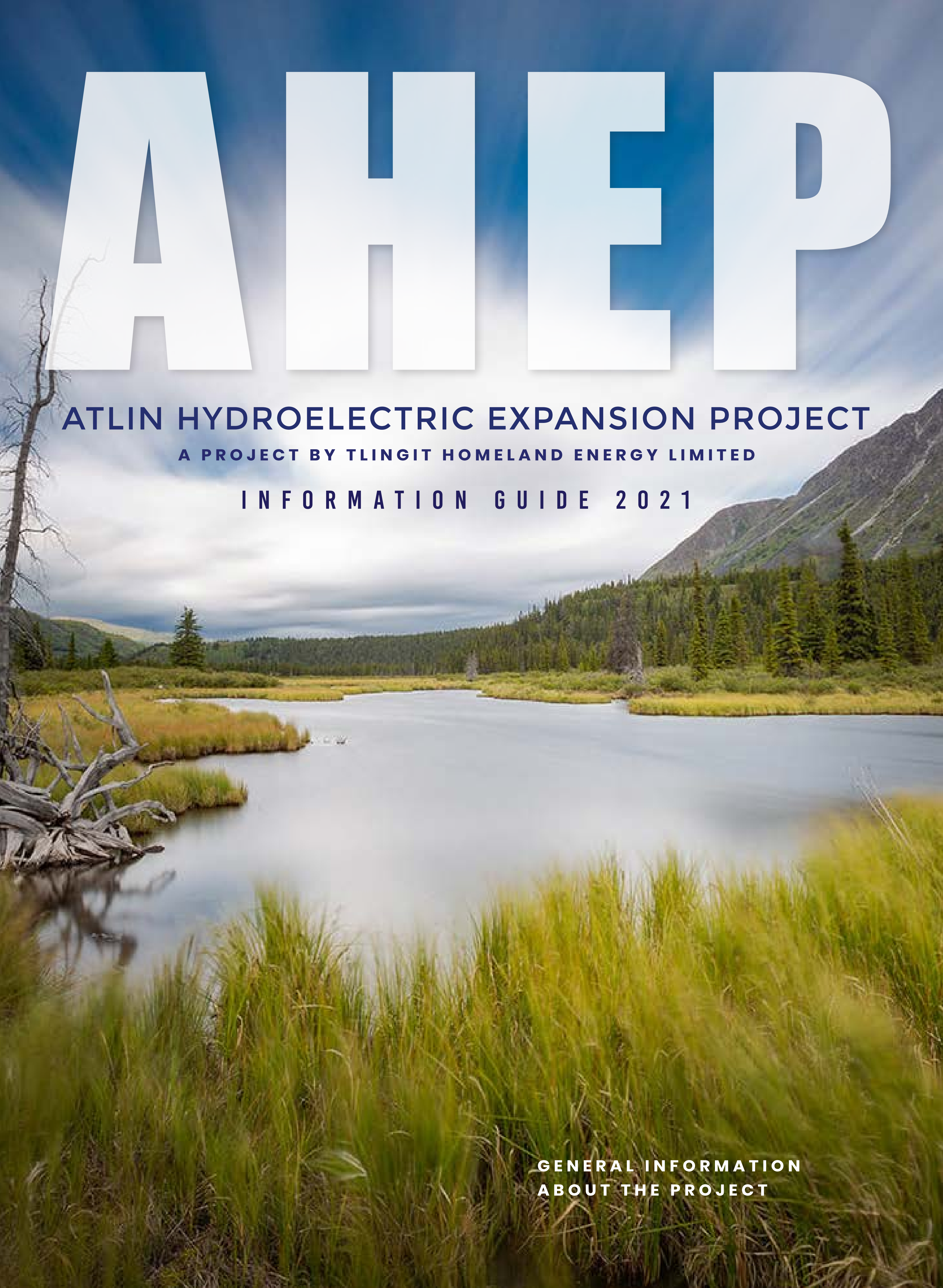
AHEP

ATLIN HYDROELECTRIC EXPANSION PROJECT

A PROJECT BY TLINGIT HOMELAND ENERGY LIMITED

INFORMATION GUIDE 2021



GENERAL INFORMATION ABOUT THE PROJECT

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Cover Photo by Manu Keggenhoff

The Atlin Hydro Expansion Project

Introduction

BC gets most of its power from large hydropower projects across the province. These range in size. The Columbia system, for example, includes two giant dams, the 2,480 MW Revelstoke Dam and the 1,805 MW Mica Dam, completed in the 1980s and 1970s, respectively. 1

By contrast, the existing hydropower facility on Pine Creek produces 2.1 MW. The proposed Atlin Hydro Expansion Project (AHEP) would increase this energy production by 8.5 MW, for a total of 10.6 MW. While the energy production of the proposed Project is hundreds of times less than these larger facilities, its design is complex, and its benefits to our community meaningful.

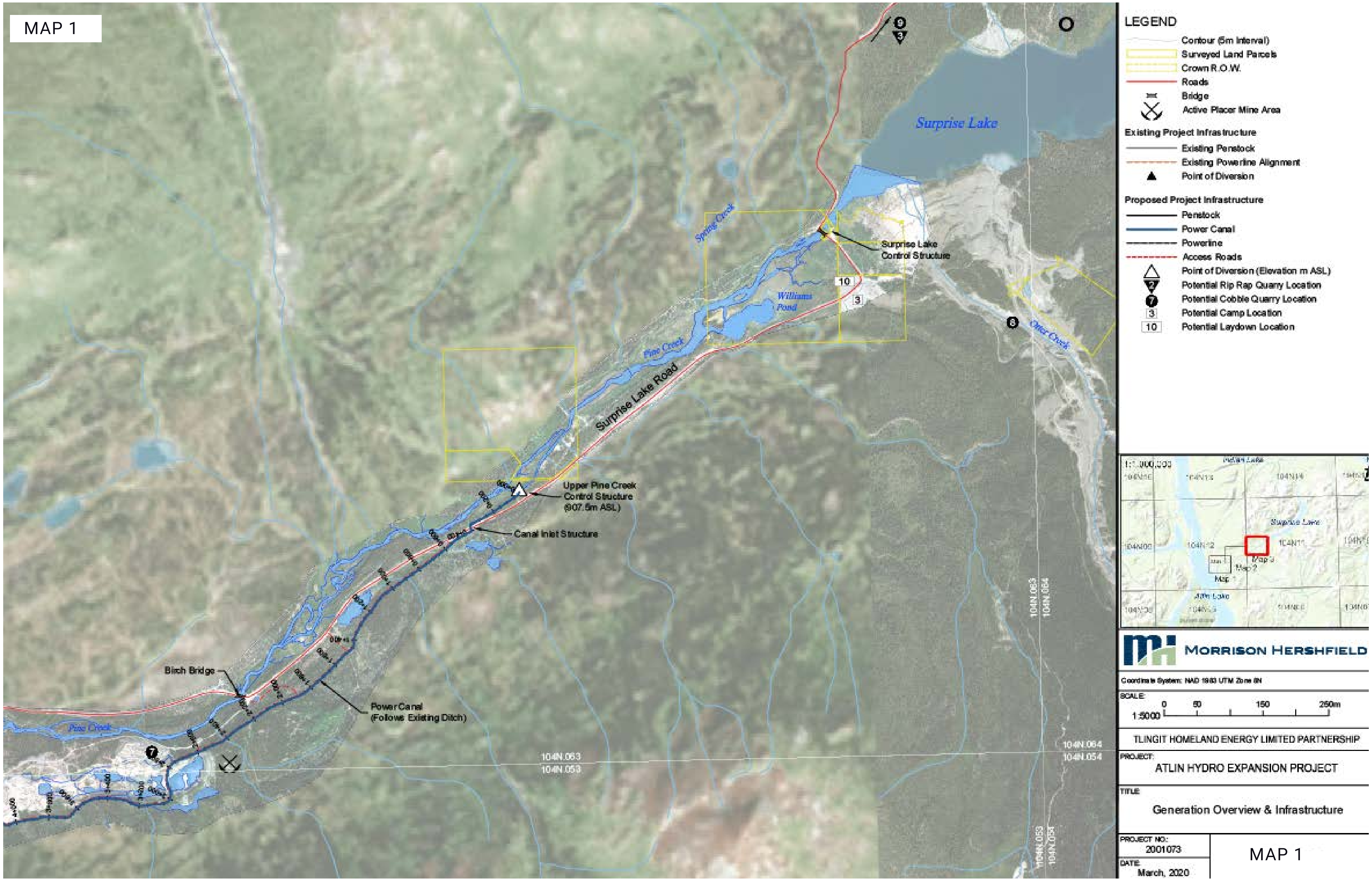
In studying the feasibility of this project, we enlisted many experts, such as engineers and biologists, and received important input from our community about your values and concerns. Through this magazine, we hope to effectively communicate the nuts and bolts of the proposed Atlin Hydro Expansion Project, its development phases, regulatory and review processes overseeing its proposed development, as well as the potential impacts and benefits to our community and environment. Further public engagement will take place and we look forward to these conversations.

What's involved in the Atlin Hydro Expansion Project? In order to generate this energy, the Atlin Hydro Expansion Project would use the existing infrastructure of the existing hydro facility (eg. reservoir, weir, tailrace) and build new infrastructure, as well. This new infrastructure includes two new powerhouses, two power canals, two penstocks, two weirs, powerlines, and two substations.

Put simply, water would be collected and held back in the Surprise Lake reservoir over the summer months, then be released in the winter months to generate power.

This energy would then be exported to the Yukon via a proposed 92 km transmission line along the Atlin Road. The Project would operate primarily in winter, from September to May.

Surprise Lake August 2020


MAP 1
Surprise Lake
Spring Creek
Surprise Lake Control Structure
Williams Pond
Pine Creek
Surprise Lake Road
Otter Creek
Upper Pine Creek Control Structure (907.5m ASL)
Canal Inlet Structure
Birch Bridge
Power Canal (Follows Existing Ditch)
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104N.063
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104N.064
104N.054
LEGEND
Contour (5m Interval)
Surveyed Land Parcels
Crown R.O.W.
Roads
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Existing Project Infrastructure
Existing Penstock
Existing Powerline Alignment
Point of Diversion
Proposed Project Infrastructure
Penstock
Power Canal
Powerline
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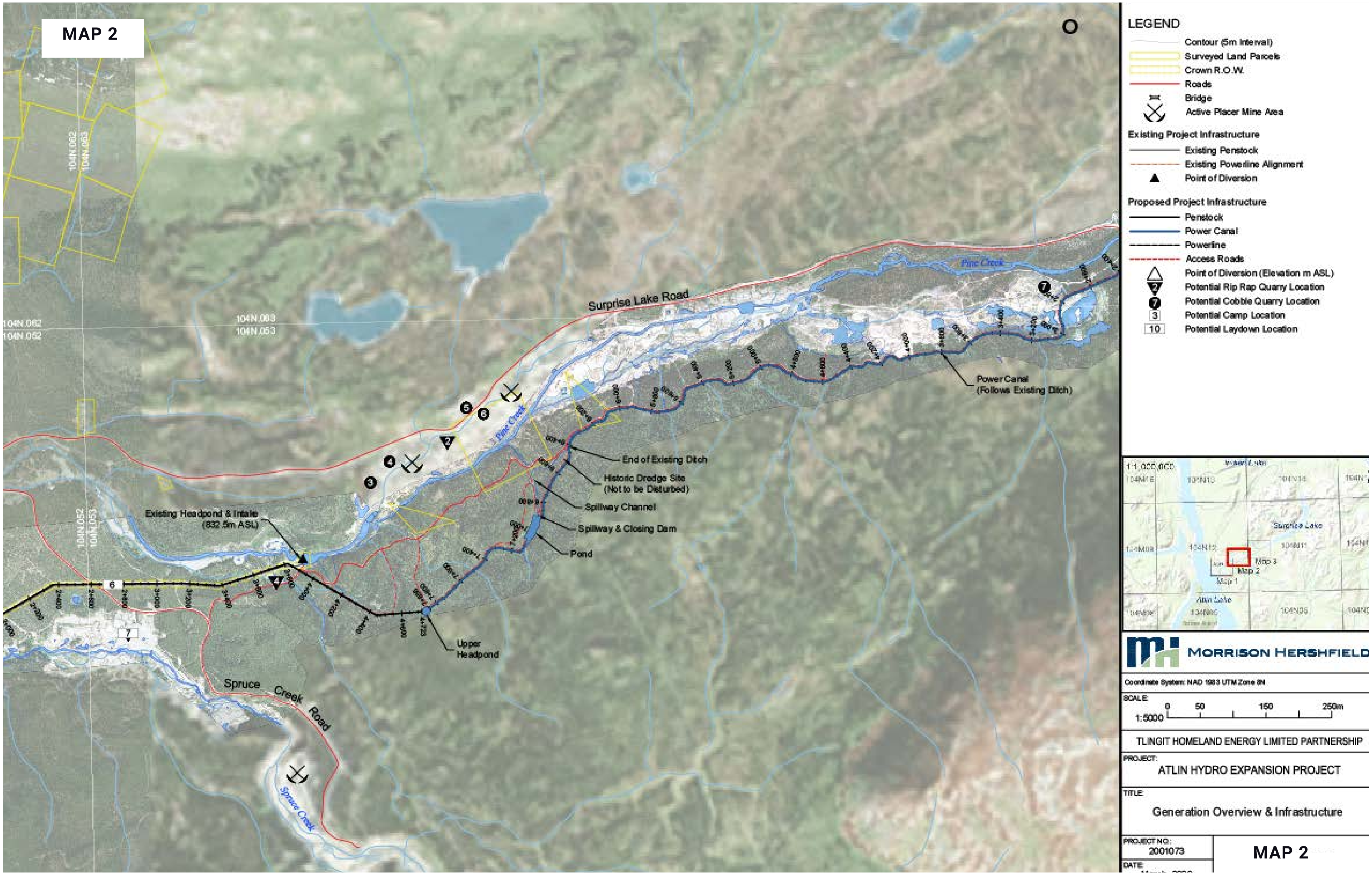
Point of Diversion (Elevation m ASL)
Potential Rip Rap Quarry Location
Potential Cobble Quarry Location
Potential Camp Location
Potential Laydown Location
Surprise Lake
Atlin Lake
MORRISON HERSHFIELD
Coordinate System: NAD 1983 UTM Zone 8N
SCALE:
1:5000
0 50 150 250m
TLINGIT HOMELAND ENERGY LIMITED PARTNERSHIP
PROJECT:
ATLIN HYDRO EXPANSION PROJECT
TITLE:
Generation Overview & Infrastructure
PROJECT NO.:
2001073
DATE:
March, 2020
MAP 1



MAP 2
LEGEND
Contour (5m Interval)
Surveyed Land Parcels
Crown R.O.W.
Roads
Bridge
Active Placer Mine Area
Existing Project Infrastructure
Existing Penstock
Existing Powerline Alignment
Point of Diversion
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Penstock
Power Canal
Powerline
Access Roads
Point of Diversion (Elevation m ASL)
Potential Rip Rap Quarry Location
Potential Cobble Quarry Location
Potential Camp Location
Potential Laydown Location
Surprise Lake Road
Pine Creek
Power Canal
(Follows Existing Ditch)
End of Existing Ditch
Historic Dredge Site
(Not to be Disturbed)
Spillway Channel
Spillway & Closing Dam
Pond
Existing Headpond & Intake
(832.5m ASL)
Upper
Headpond
Spruce Creek Road
Spruce Creek
104N.062
104N.052
104N.063
104N.053
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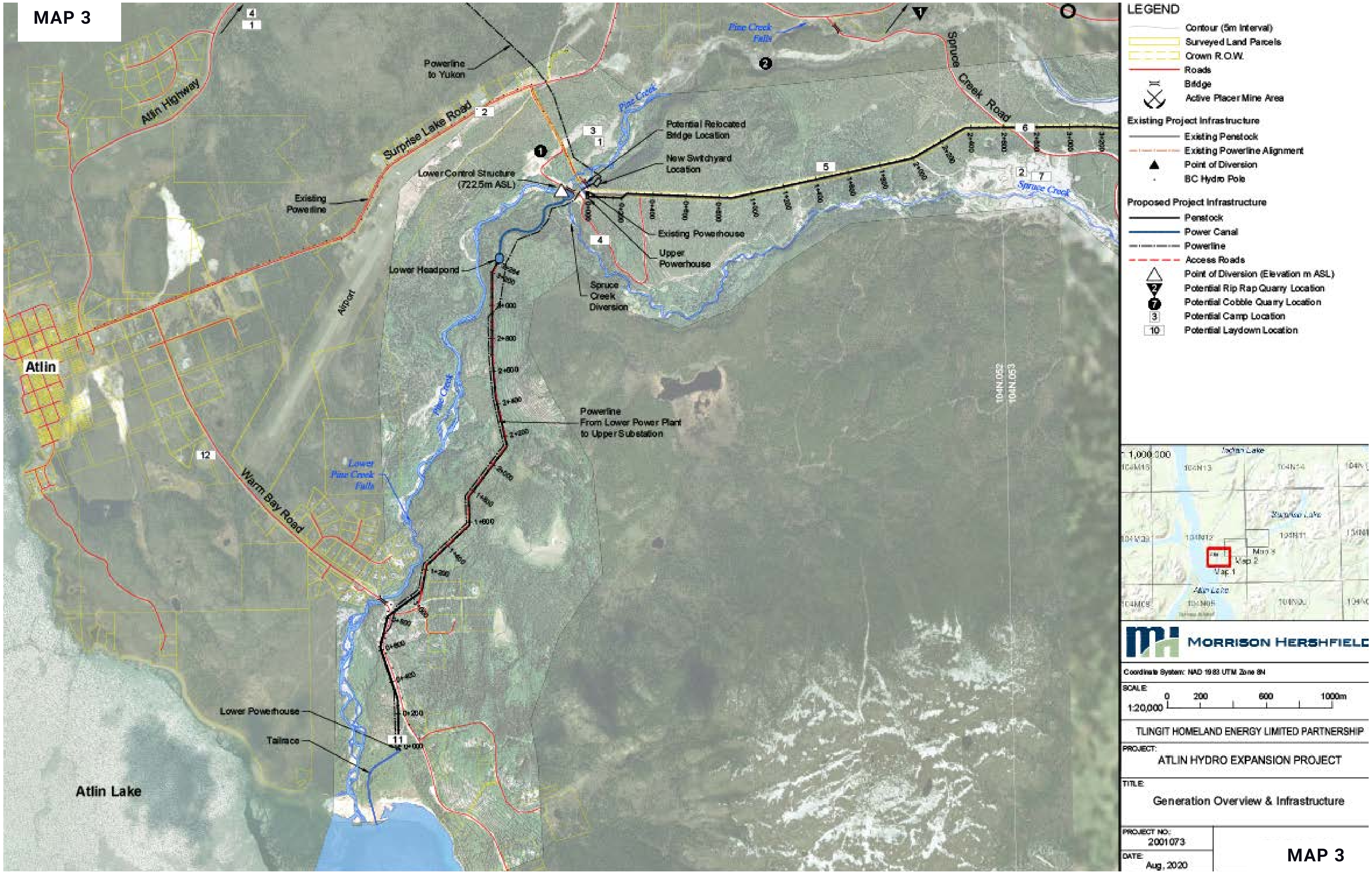
MAP 3
Powerline to Yukon
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Surprise Lake Road
Existing Powerline
Airport
Atlin
Warm Bay Road
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Pine Creek
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Upper Powerhouse
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Spruce Creek
Powerline From Lower Power Plant to Upper Substation
Lower Powerhouse
Tailrace
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104N.053
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BC Hydro Pole
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Powerline
Access Roads
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Potential Rip Rap Quarry Location
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MAP 3

What are the potential benefits and impacts of the Project?

In developing a design for the Project, we considered potential impacts to the environment (fish and wildlife, existing vegetation, water levels and flows) and to people (cultural and recreational uses of the areas surrounding the proposed facilities, nearby residents, as well as aesthetics).

We also considered the potential benefits of the Project. These include many benefits to our community, both locally and regionally. The Project would provide direct employment benefits during construction and operations, as well as long-term dividend benefits that would be reinvested in the community. Investments may take the form of new business investments; funding for training and various social and environmental programs; local entrepreneurial funding opportunities; and/or other investments approved by TRTFN.

In addition, the Project would provide a significant injection to the local tax base. No matter what investments are made, local employment would increase. The Atlin Hydro Expansion Project would also benefit the Yukon by helping to meet the Yukon's clean-energy shortfall. More broadly, the Project benefits the North through supporting our collective goal of reducing greenhouse gases – these emissions would be reduced by approximately 27,400 tonnes annually.

What is the history of the Project?

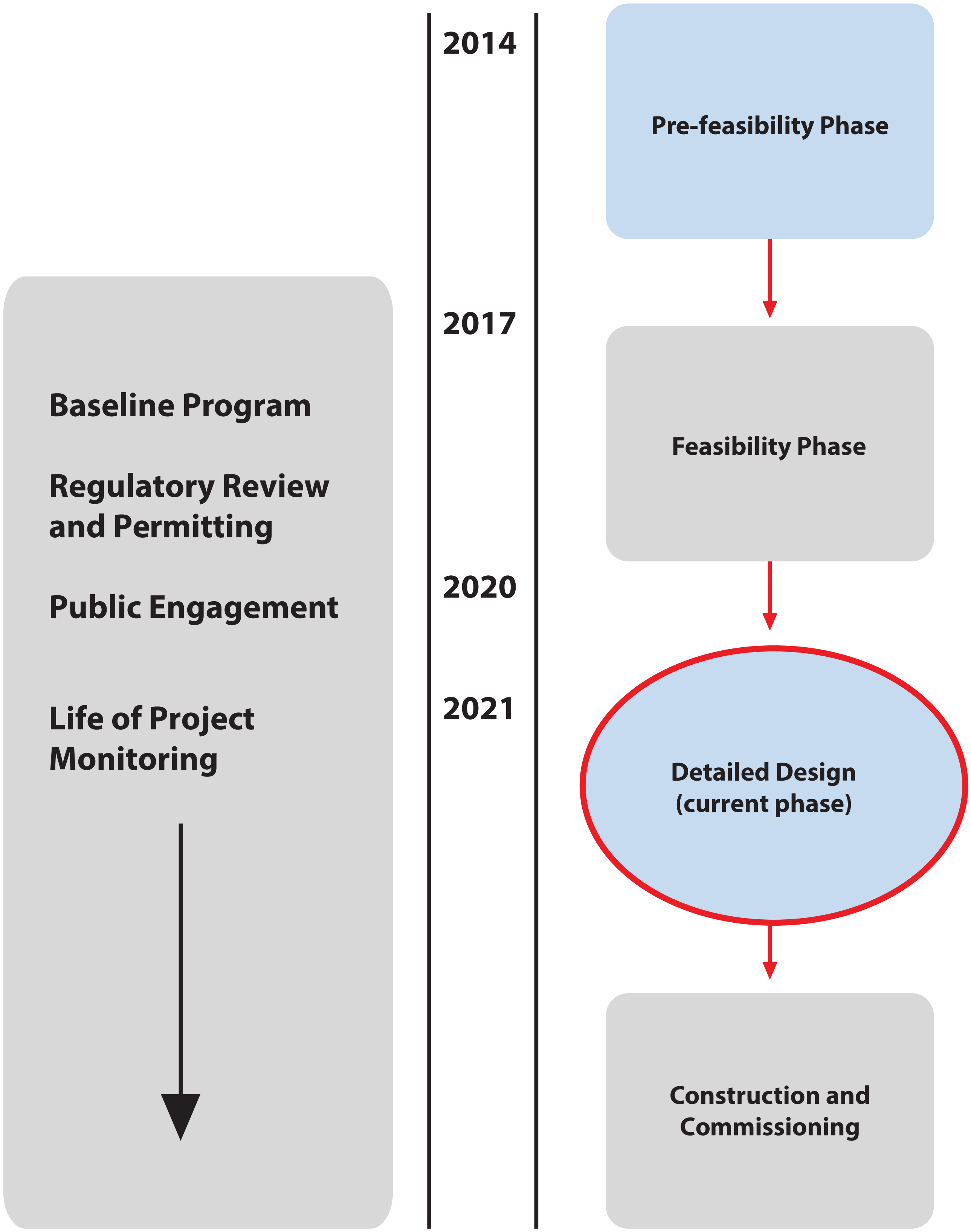
The idea for the Atlin Hydro Expansion Project (AHEP) came out of the success of the existing hydropower facility that provides energy to Atlin. This is a 2.1 MW facility owned and operated by Xeitl Limited Partnership (XLP), one of the Taku Group of Companies (see organization chart on page 58). A subsequent analysis of business development opportunities in the Atlin area showed that a hydro expansion project would offer the best long-term benefits for revenue generation and job creation.

The Taku Group of Companies saw that we could build on our success and experience in hydropower, not only to grow our business and provide more clean energy to our region, but to contribute to Canada's goal of Net Zero GHG emissions. So, in 2014, five years after the commissioning of the XLP facility, we established the company Tlingit Homeland Energy Limited (THEL) and began the first phase of work (pre-feasibility) on the AHEP concept.

In 2017, we formally began the feasibility phase, designing the infrastructure needed to maximize the power that could be produced on Pine Creek, while studying the potential environmental and economic impacts and benefits of the Project. Public engagement also occurred during this phase, which helped guide design, as well as an understanding of the potential impacts and benefits of the Project. These phases of development are outlined in the accompanying chart.

Performing seepage testing in the power canal during the feasibility study.

Project Development Phases



Regulatory Review

We are now in the detailed-design phase, when the Project is further refined with input from regulators, engineers and construction contractors. It is during this phase that the regulatory review and permitting process also occurs. This review process is undertaken by the Province of BC and the Taku River Tlingit First Nation (TRTFN) under their Wóoshtin yan too.aat Land and Resource Management and Shared Decision-Making Agreement (G2G Agreement). As well, for the project infrastructure located in Yukon, the Yukon Environmental and Socio-economic Assessment Board completes a review prior to permitting.

Based on the proposed activities and the size of the Project, THEL was required to develop a Clean Energy Development Plan (CEDP) to accompany all permit and license applications in BC. The requirements of this plan are outlined by BC's Major Projects division for Clean Energy Projects in their document, "Development Plan Information Requirements" (DPIR). THEL used the DPIR to identify the baseline studies necessary to complete the Clean Energy Development Plan. THEL undertook these studies from 2014 to present and continues to collect data that will be used in future monitoring programs, if the Project is approved.

This Clean Energy Development Plan forms the basis of the regulatory review in BC.

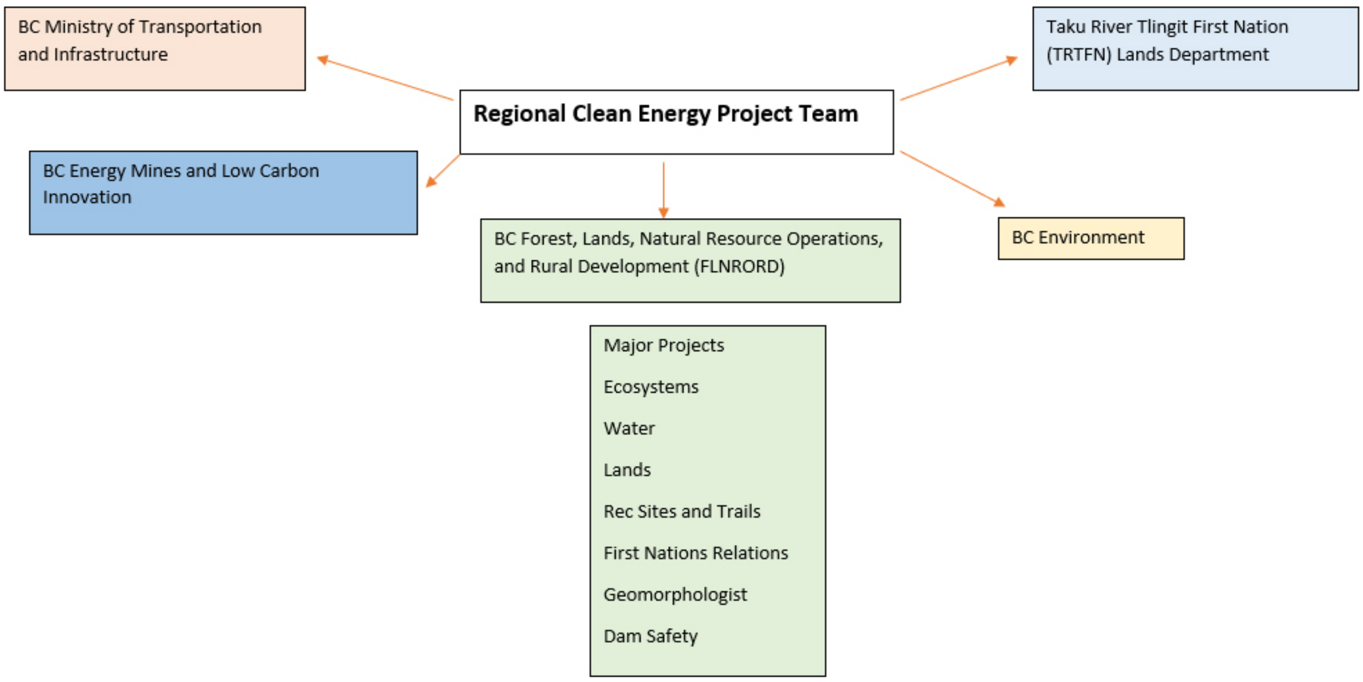
Hydrology Monitoring, Spruce Creek 2016

Who Reviews the Plan?

The Regional Clean Energy Project Team reviews the Plan. This team is comprised of representatives from various provincial section heads (for example, Ecosystems Branch, BC Recreation Sites and Trails, Lands, Mining, etc.), as well as the TRTFN Lands Department.

There are many provincial licenses and permits required for this Project, including for the use of Crown Land, a water license, use of the Highway right-of-way for the transmission line, and many smaller permits and authorizations, such as for cutting trees. All these licenses, permits and authorizations will be reviewed along with the Clean Energy Development Plan.

Federal authorizations are required for some activities, such as constructing works within a navigable water (Surprise Lake), and for altering and disrupting fish habitat on Pine Creek. These federal authorities will review these stand-alone applications, but may work cooperatively with the Regional Clean Energy Project Team.



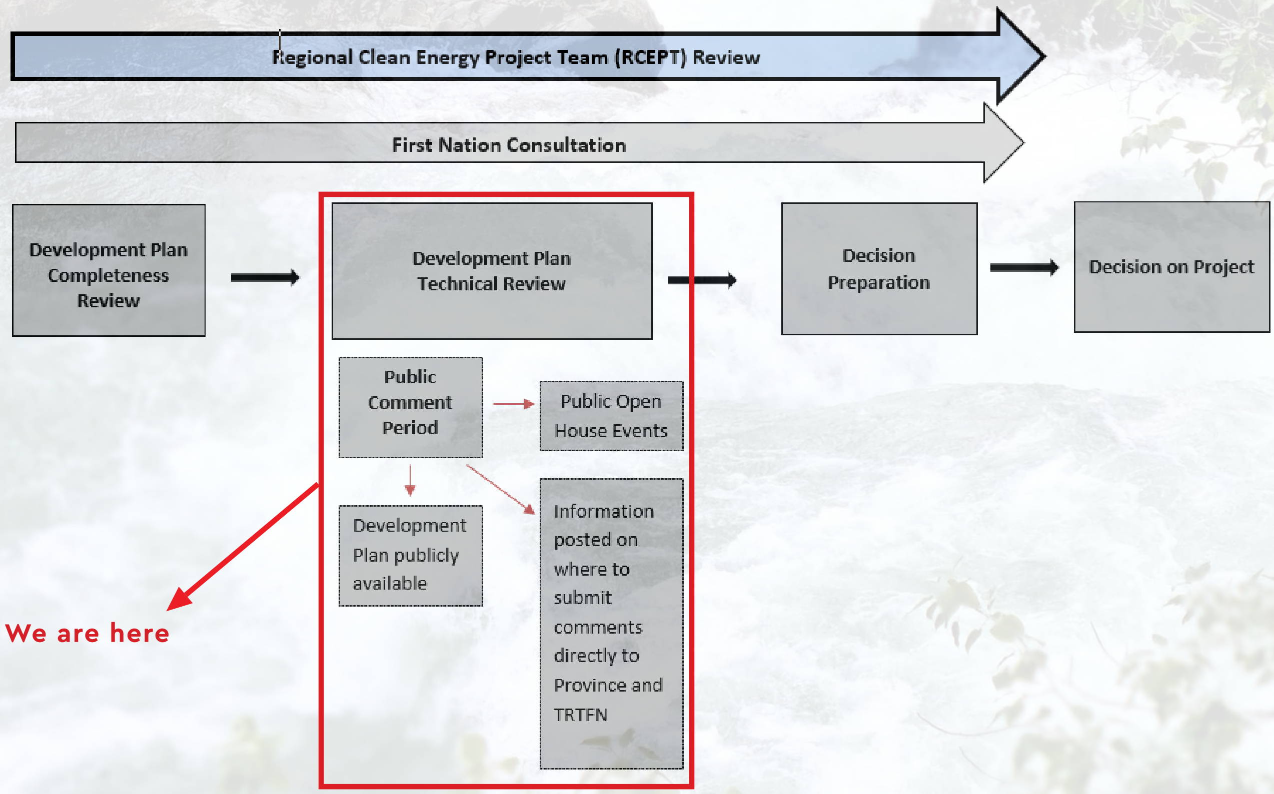
Where Are We in the Review Process?

THEL officially submitted its Clean Energy Development Plan in January 2021. The Regional Clean Energy Project Team recently determined that the Plan is complete and meets the specified information requirements. In other words, the Plan has undergone the Completeness Review and is now in the second stage of review: Technical Review.

This does not mean that the Plan has been approved, only that there is enough information to begin the formal review. During this Technical Review period, the Plan will become publicly available. Once the Clean Energy Development Plan is publicly available, information regarding where and how to make comments will be provided, and public open-house events will be hosted, following COVID-19 protocols.

The Clean Energy Development Plan will be available in hard copy at the Atlin Tlingit Economic Limited Partnership (ATELP) office during the Technical Review stage. At the same time it will be available online from both the Province's and THEL's websites. Advertisements will be posted at the TRTFN Government Office, the Post Office and Service BC when the Plan becomes publicly available and is open for public comment.

The Technical Review stage may take six months to complete, depending on whether additional information and what kind of information is requested by the review team. Once a decision has been made as to whether to allow the Project to proceed, then permits and licenses may be issued and pre-construction work can begin.



How the project works

The proposed Atlin Hydro Expansion Project, hereafter most often referred to as "the Project," involves the use of existing infrastructure (eg. the existing powerhouse, weir, penstock, etc.), as well as the construction of additional infrastructure. The following section provides an overview of infrastructure – both the existing and proposed components.

Later sections discuss the Project design in more detail, as well as the potential impacts of the Project on Surprise Lake, Pine Creek, fish and wildlife, residents, and other aspects. Before we dive in, we can wet our feet with a general overview of how hydropower works.

How does hydropower work?

Hydropower facilities include many components that are designed to harness the energy of moving water. Because the flow of rivers and creeks changes depending on the climate and the time of year, many hydropower designs involve regulating the release of this water. This way, energy can be captured throughout much of the year, rather than only during one season.

To accomplish this for our Project, we need a place to store the water (a reservoir), a structure to control the water's release, and a channel or pipe along which to move the water to a turbine (located in the powerhouse). In the powerhouse, the force of moving water turns the turbine, which generates electricity. Finally, we need a powerline to transport this electricity to a substation, where it can be made available to consumers via powerlines.

What's involved in the existing operation?

Currently, Xeitl Limited Partnership (XLP) uses Surprise Lake as the reservoir for the existing 2.1 MW hydropower facility. The structure to manage the water's release is a rockfill weir (located at the bridge at Surprise Lake). The weir is basically a barrier that helps to hold back the water at Surprise Lake. While water spills over the weir at some times of the year, a gated pipe below the surface further controls the water's release. The water then flows down Pine Creek where a **concrete dam** holds the water back in a **headpond**. From this headpond, the water flows into a **penstock**, a pipe that also has a mechanism for controlling the water's release.

Surveying of existing penstock.

Pelton turbine in existing powerhouse.

This headpond is called a "penstock **intake** headpond," because it is a headpond from which the penstock "takes in" water. The penstock then carries the water ~4 km down to the existing powerhouse where the moving water forces the turbine to turn, generating electricity. Finally, the water flows out of the powerhouse along a channel called a **tailrace**, back into Pine Creek. Energy generated at this powerhouse is transferred to the BC Hydro substation.

Maintenance work at the existing headpond and intake structure.

The existing hydropower facility affects water levels at Surprise Lake and flows in Pine Creek. A detailed discussion of water levels can be found in the sections titled "What Happens at Surprise Lake" and "What Happens at Pine Creek." The existing concrete dam is not discussed in detail in this magazine, as the proposed Project does not involve any changes to this structure.

Tailrace at existing powerhouse.

What's involved in the proposed operation?

To generate more energy from Pine Creek, which will offset winter burning of fossil fuels, more water must be available to feed two new powerhouses. This requires "holding back" more water at the reservoir at Surprise Lake and diverting (via canals and penstocks) more water from Pine Creek.

The following provides an overview of the new infrastructure (powerhouses, weirs, etc.) required to generate and export this energy to consumers. This overview will follow the same path the energy takes – from its start as water held back at Surprise Lake, through to the turbines and along powerlines to the Yukon.

Existing concrete dam.

Increased water storage on Surprise Lake

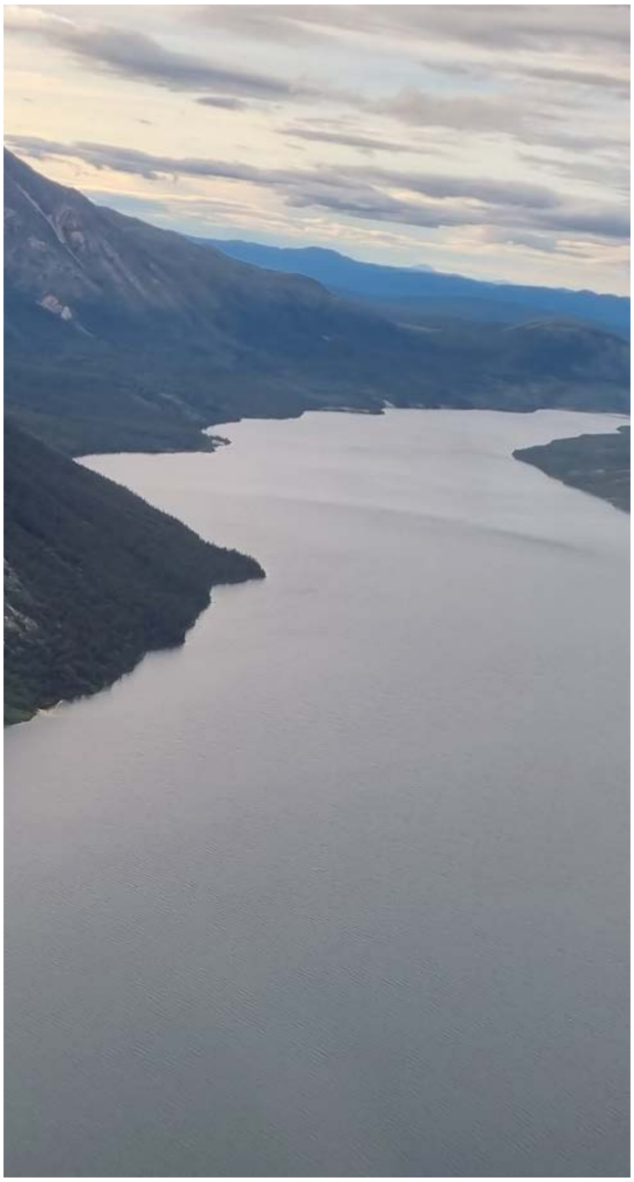
Storage range refers to the difference in water level at the reservoir, but more specifically the required range of water level for the hydropower facility to operate. **Full supply level** and **low supply level** are the terms used to refer to these operational levels. (These terms are sometimes confused with "average high water" and "average low water." We have included a discussion of these terms on the following page)

For the proposed Project, the storage range would increase from approximately 1.1 m to 2.0 m. By increasing our ability to store the water that currently spills over the existing weir, more energy can be captured for power production throughout the year.

To increase this storage range, we need the reservoir – Surprise Lake — to hold more water. To this end, we would raise the height of the existing rockfill weir by 0.7 m. (These levels are discussed in detail in the section titled "What Happens at Surprise Lake"). This would be the new full supply level. The low supply level (the lowest level the lake can be drawn down while still allowing water to flow through the gated pipe) would be lowered by 0.2 m. This lowering would be accomplished by removing some sediment from upstream and downstream of the weir.

This structure – the rockfill weir and gated pipe – is called the Surprise Lake Control Structure.

(As mentioned earlier, there are no proposed changes to the existing concrete dam downstream of the Surprise Lake Control Structure.)



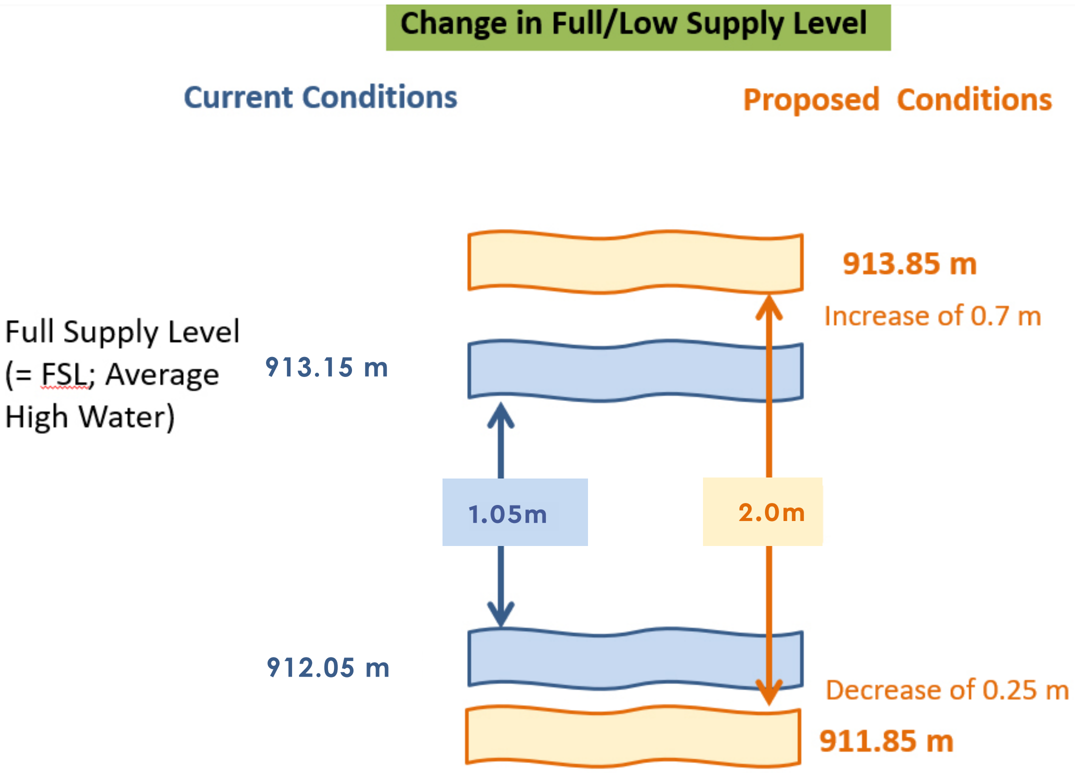
Surprise Lake July 2021

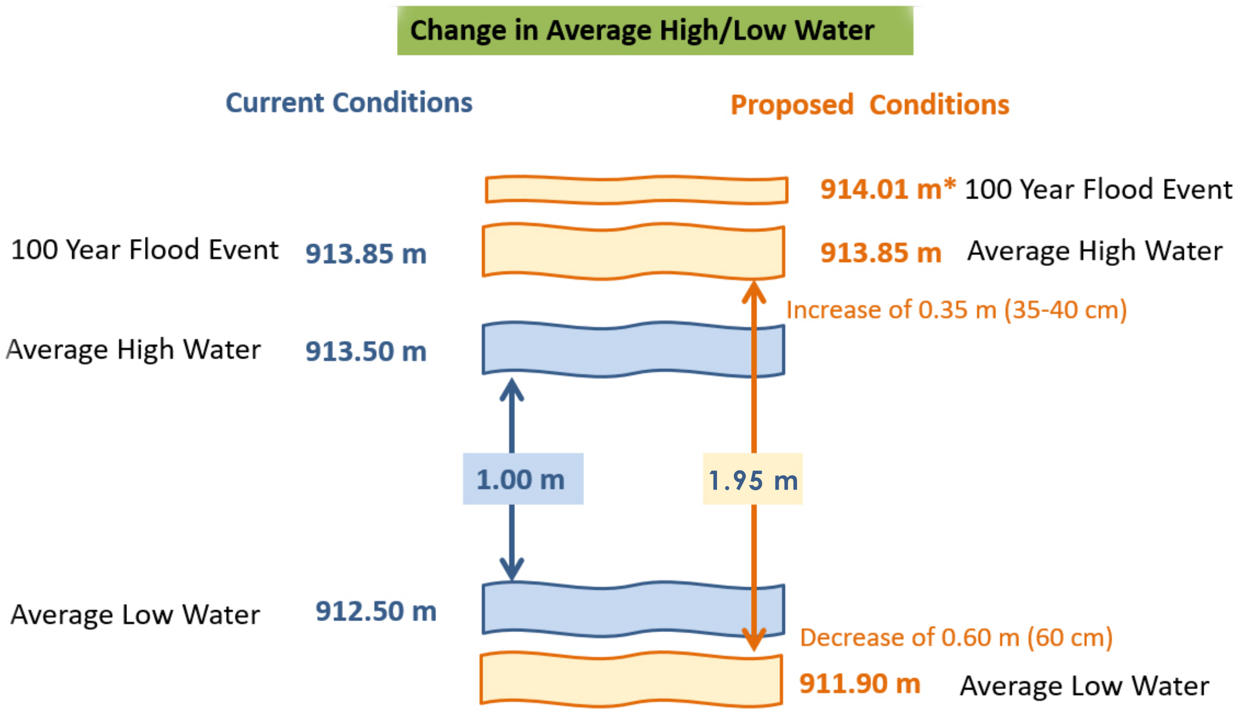
[1] The elevations discussed in relation to Surprise Lake and the Surprise Lake control structure are based on a local datum derived from elevation on top of the concrete wall at the low-level outlet intake (elevation of 913.75 m shown on Sigma Engineering as-built drawings). For consistency between the existing works and operating water levels, the engineers use this local datum. All elevations at the Surprise Lake control structure and Surprise Lake refer to this local datum, which is 0.37 m higher than geodetic datum.

What's the difference between Full/Low Supply Level & Average High/Low Water?

Low supply level is the level that that lake can be drawn down to, while full supply level refers to the water level elevation that corresponds to the weir crest height. However, high water and full supply level are not always the same.

At present, the full supply level (FSL) of 913.15 m (the weir height) is different than the high-water level of the lake, which actually averages 913.4 m and often reaches a level greater than ~913.5 m. However, under the proposed storage range, the FSL would closely correlate with the average high-water level, which is proposed to be managed at 913.85 m. Similarly, although Xeitl Limited Partnership is currently licensed to draw down the lake to 912.05 m, due to a hydraulic barrier created by the silt build-up on the lake bottom, the average low supply level (LSL) currently reached is approximately 912.5 m. For this reason, the proposed LSL requires excavating the outlet upstream and downstream of the Surprise Lake control structure (weir) to remove the hydraulic barrier.





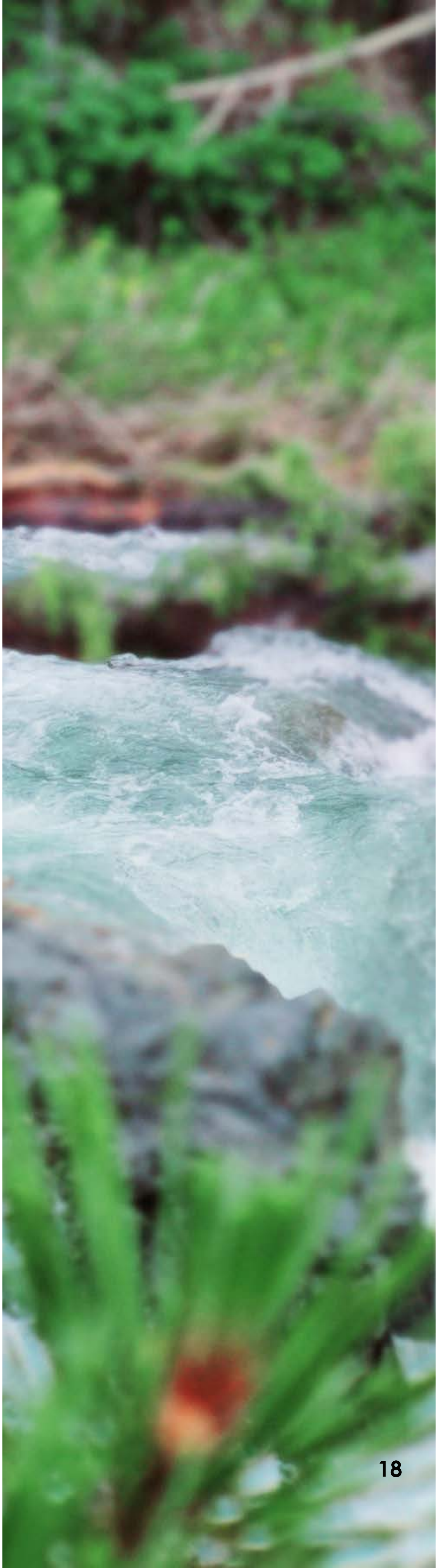
* The modeled flood happening about once every 100 years is at 914.2 m, however, THEL is proposing to manage flood levels at 914.01 m as a mitigation measure.

Changes to flow on Pine Creek

"Flow" refers to the volume of water per second (measured in cubic metres per second) that moves down the creek. To regulate flows on Pine Creek, water would be held back at Surprise Lake to the new full supply level. This means flows would be reduced in the summer to meet the needs of the existing and proposed facilities in later months. This would not affect all sections, or "reaches," of the creek equally. In general, flows in Upper Pine Creek would remain high, while flows in the middle and lower reaches would diminish as some of the water is captured and conveyed to powerhouses.

Mean Annual Discharge refers to the average flow for a period of time. The lowest flows proposed on Pine Creek would occur in the lower reach. These flows would be 10% of the Mean Annual Discharge (at approximately 0.4 m^3/s).

This flow is similar to the average winter flows in Pine Creek prior to the construction of the existing XLP facility. The critical difference is that the low flows in the lower reaches of Pine Creek (averaging 0.4 – 0.8 m^3/s) would occur year-round, rather than seasonally. However, spillage over the weir and high precipitation years may increase this flow substantially. A detailed description of flows in Pine Creek is provided on PAGE 32.



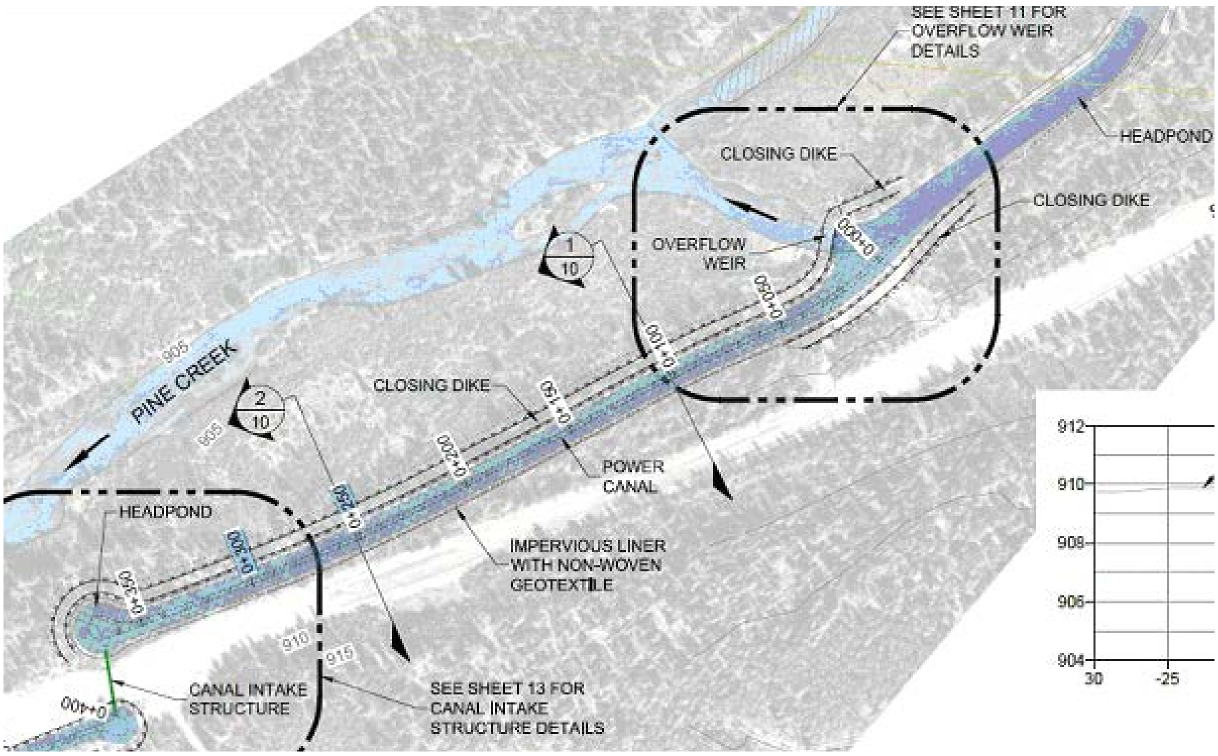
Construction of an upper powerhouse adjacent to existing facility (expansion)

An upper powerhouse would be constructed with a two **Francis turbines**. This powerhouse would be located beside or attached to the existing XLP powerhouse building. The two powerhouses would share the tailrace, which would be expanded to accommodate this additional facility. This upper powerhouse would be capable of producing ~5.7 MW of power.

Water for the upper powerhouse would be diverted from Pine Creek (with the flow at ~4.7 m^3/s) into the **upper power canal**. The location of the start of this power canal would be about 2.5 km downstream of Surprise Lake, at the same location as used in 1908 for an existing, historical mining ditch. To divert the water from the creek to this canal, a new **rockfill weir** would be constructed.

This weir would create a headpond for the power canal. The amount of water entering the upper power canal from this headpond would be controlled by a gated pipe under Surprise Lake Road. This proposed structure – the new rockfill weir, headpond and gated pipe – is called the Upper Pine Creek Control Structure.

The upper power canal would be approximately 8 km long, making use of an existing 6 km-long mining ditch, or flume, developed in the early 1900s, which terminates near the historic Dredge and Flume Site. The remaining ~2.0 km section of the power canal would be developed, avoiding the historic Dredge site.



Fesability level design of Upper Pine Creek Control Structure.

The canal would terminate at a penstock intake headpond, located at an elevation of about 176.5 m above the upper powerhouse.

From this headpond, water would be conveyed into the penstock. The first ~750 m of the penstock would drop ~70 m in elevation before running parallel to the existing penstock for the remaining ~4 km. In other words, the new penstock would be constructed within the footprint and clearing of the existing penstock right-of-way.

After cycling through the turbines to generate energy, the water would be released into the tailrace of both the upper powerhouse and existing powerhouse and returned to Pine Creek. The existing tailrace would be expanded to accommodate the additional volume of water.

Construction of a lower powerhouse below Warm Bay Road

A lower powerhouse would be constructed with a Francis turbine. This powerhouse would be located ~4 km downstream of the existing and proposed upper powerhouse.

Downstream of the upper powerhouse expanded tailrace, Spruce Creek merges with Pine Creek. Here, the water would be re-captured by another new rockfill weir, headpond and gated pipe on Pine Creek. This proposed structure is called the Lower Pine Creek Control Structure. This means that the water used for energy production in the upper powerhouse would be reused to generate energy in the lower powerhouse.

This rockfill weir would create a headpond on Pine Creek, from where water would be conveyed into a lower power canal. In addition to water from Pine Creek, the lower ~100 m of Spruce Creek would also be diverted into this headpond, so that all the water from Spruce Creek would enter this lower power canal. This ~600 m-long power canal would be located on the south side of Pine Creek. Combined, approximately 6 m^3/s of flow from Pine Creek and Spruce Creek would be diverted into this lower power canal, ending at a penstock intake headpond.

This penstock would run approximately 3.2 km to the lower powerhouse and would be located near Pine Creek. It would cross the Warm Bay Road at the Pine Creek Campground and travel ~600 m south, before entering the lower powerhouse.

The tailrace would move the water into Atlin Lake directly. This tailrace would act like an extension of the lake, with water rising and falling with natural lake levels, and the flow being slow. The tailrace would be approximately 500 m long, and ~17 m wide at high water, and would include fish habitat in its design at the outflow into Atlin Lake.

Pine Creek Beach, Atlin Lake, July 2020

Conceptual drawing of lower powerhouse and tailrace general location. Powerhouse is not to scale, and appears much larger than it would be in reality.

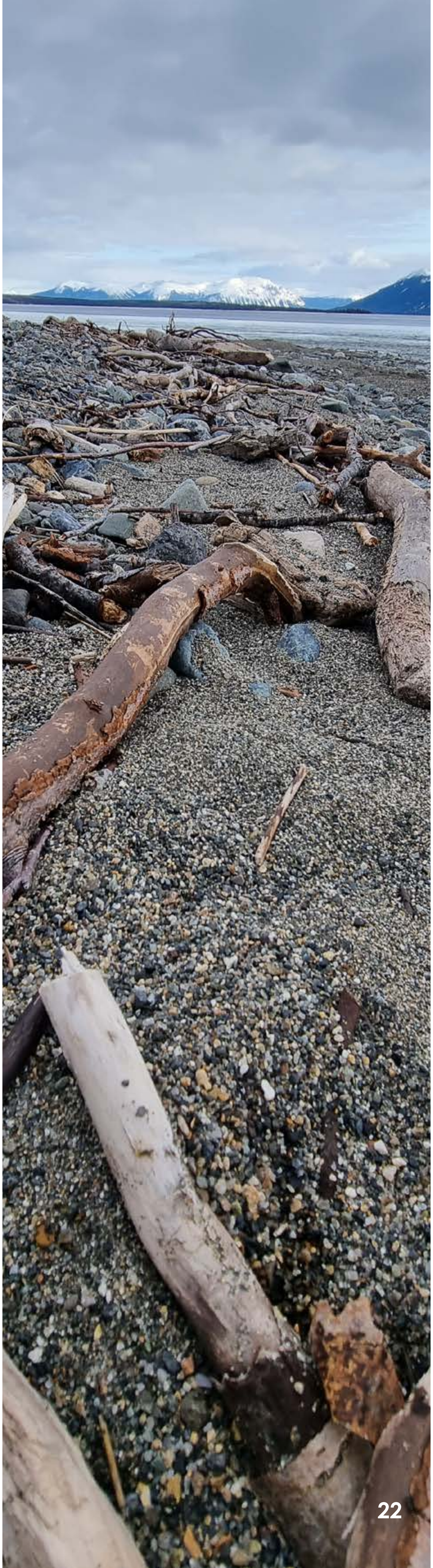
Construction of a 25 kV powerline.

A powerline would convey the energy generated from the lower powerhouse to a new substation. This substation would be located next to the upper powerhouse. As proposed, the powerline to this substation would generally follow the route of the penstock, except along a portion of Warm Bay Road, where it would be on the opposite side of the road to avoid BC Hydro distribution lines.

Construction of a 69 kV transmission line to export power to Yukon

Power would be exported to Yukon's grid via a 92 km 69 kV powerline. This line would originate from a new substation, constructed at the upper powerhouse, and travel northwest to Como Lake. From there, the powerline would travel along Atlin Road to Jakes Corner, where a second new substation would be located. Although the powerline would generally be located within the Atlin Road right-of-way, additional clearing would be required. This involves an average width of 7.5 m of additional clearing in BC, and an average width of 5 m in Yukon.

The design of the powerline generally includes 55 ft high western red cedar poles, with 3-strands of wire, but individual pole heights may vary (higher or shorter) to accommodate the terrain.



Pine Creek Beach Atlin Lake 2021

What Happens at SURPRISE LAKE

Surprise Lake is the headwaters of Pine Creek with a surface area of approximately 32 km2. The Surprise Lake watershed contains 11 major tributaries – Pine/Cup Creek, Otter Creek and Ruby Creek are the largest ones. The lake serves as the reservoir for the existing XLP hydropower operation and would continue to be used for this purpose for the proposed expanded facility. The following section outlines how the lake levels would change, and the potential impacts of these change on animals, the environment, and cultural areas.

Rockfill weir at Surprise Lake

How will the Project change the lake levels in Surprise Lake?

The height of the weir crest on Surprise Lake is currently 913.15 m above sea level (local datum), but the **average high water** on the lake is slightly higher, at 913.4 m above sea level (often 913.5 m). This means excess water spills over the weir. In this section, we will discuss

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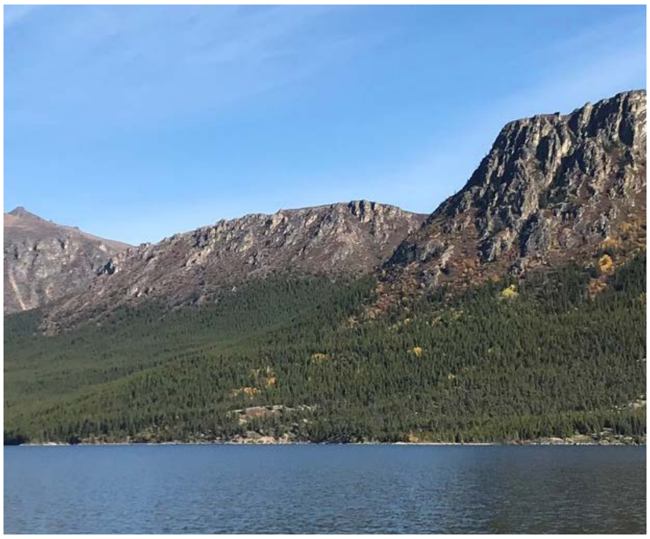

Surprise Lake August 2020

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average high/low water levels and full/low supply levels. For an explanation of these terms, see page 53.

Currently, the existing hydropower operation is permitted to a high-water level of 913.85 m, which was reached for the first time during the 2021 flooding event. The proposed Project would raise the weir crest height to this level (913.85 m), so that this permitted high-water level would become the new full supply level. The high water would not exceed 913.9 m. In other words, the new level of average high water would be 0.5 m higher than the current level of average high water (913.4 vs 913.9 m above sea level).

The existing hydropower operation is permitted to a low supply level of 912.05 m. However, due to the sediment upstream and downstream of the weir, which creates a "hydraulic barrier," the lowest average drawdown level achieved has been 912.5 m. The proposed Project would lower the permitted low supply level by 0.2 m, to 911.85 m. In practice, however, the average lowest drawdown would be ~912.0 m. In other words, the average lowest drawdown in Surprise Lake would be ~0.5 m lower than the current average low water.

Regulation of Surprise Lake would generally consist of a filling period (May to September) and a generation period (September to May). It is during this latter period that the facility "generates" electricity and drawdown occurs. During the generation period, the gated pipe at the Surprise Lake Control Structure is adjusted according to the water elevation in the lake, releasing a relatively consistent flow for power generation.

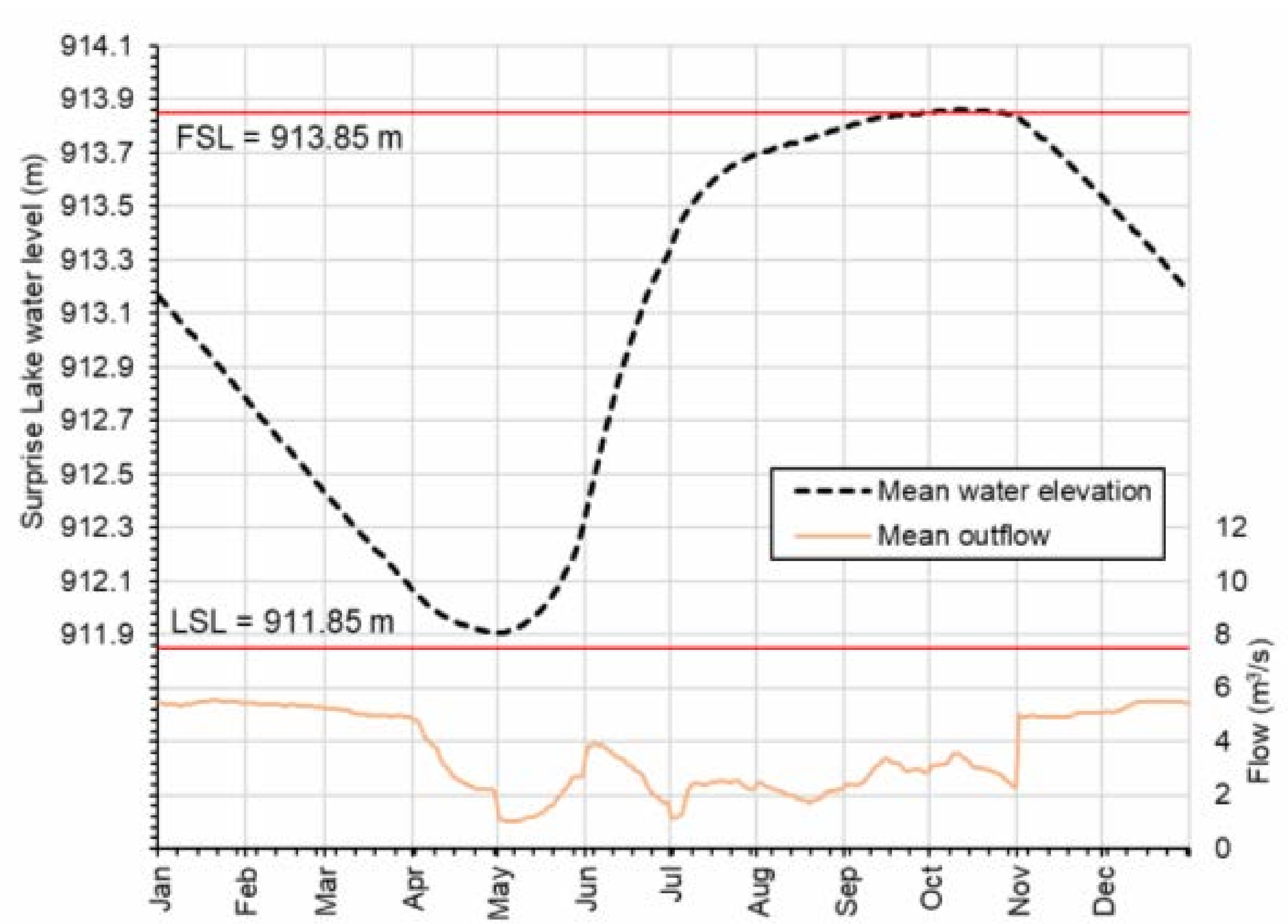
Comparison between existing Surprise Lake water levels and proposed levels (monthly average water levels, in metres above sea level, for existing and proposed)

	EXISTING	WITH PROJECT	DIFFERENCE
January	912.9	913.0	+0.1
February	912.7	912.6	-0.1
March	912.6	912.2	-0.4
April	912.5	912.0	-0.5
May	912.8	912.0	-0.8
June	913.4	912.9	-0.5
July	913.4	913.6	+0.2
August	913.4	913.7	+0.3
September	913.4	913.8	+0.4
October	913.4	913.9	+0.5
November	913.3	913.7	+0.4
December	913.1	913.4	+0.3
Mean	**913.1**	**913.1**	**0.0**

The maximum monthly average change in lake elevation with the proposed Project would be 0.5 m. Low water would be in April and May. The lake would fill over the summer months with high water occurring in October. Currently, high water (913.4 m) is reached about the third week of June. Under the proposed Project, this water level would not be reached until the second week of July, and the new high-water level (~913.8 m) would be reached in late September.

Based on this information, **inundation** (flooding over land) of low-lying areas would occur from mid-July into the winter, encompassing approximately 32 hectares (ha) of the lakeshore. Surprise Lake is steep-sided, so a lot of the inundation occurs at low-lying areas at the mouths of creeks, including Boulder, Ruby, Cracker, and Pine/Cup creeks.

Proposed monthly water elevations on Surprise Lake



Pine Cup Creek Beach Surprise Lake August 2020

WHAT ARE THE EFFECTS OF CHANGING LAKE LEVELS?[3]

Birds

Field studies and assessments undertaken by qualified professionals identified minimal impacts to birds during the birds' critical life stages. Shore-nesting birds typically complete nesting earlier than other species. While the lower lake level of the proposed Project may encourage birds to nest lower on the shoreline, the high-water level of the proposed Project is reached later in the season, giving the birds more time to complete this critical life stage.

In other words, the delay in high-water level reduces the potential that nests will be flooded. Further, shore-nesting birds are adapted to fluctuations in water levels and are expected to adapt to the increased storage range.

Other possible impacts may occur due to changes in the availability and nature of various bird habitat, including wetlands. However, the relatively small area of inundation and limited change in storage range, as well as the availability of surrounding habitat means that effects to bird populations on Surprise Lake would be negligible, though some level of displacement may occur. THEL would monitor for impacts to birds and develop adaptive management measures.

Shoreline, beaches and wetlands

With changes to water levels, erosion would increase for a period of time, as well as some tree kill. Dead trees may be removed in winter, if deemed necessary. However, dead trees can provide nesting opportunities for birds, so risk factors, aesthetics, and potential wildlife benefits would be considered prior to removal. Areas of higher use, such as the boat ramp, would be monitored, and mitigation employed to ensure the integrity and safety of these structures.

Several wetland areas would be inundated from mid-July onward. The boundaries and type of wetland are likely to change. For example, shrubbier wetlands may convert to those with more grasses and sedges. While the extent and magnitude of these changes are also expected to be minimal, THEL would monitor the changes to beaches and wetlands, and erosion more generally.

There are also several sandy beaches on Surprise Lake, including barrier beaches (such as Hemlock Creek Beach and Pine/Cup Beach) and the lagoons these beaches create. These

Boat launch – Early September (913.8)
Conceptualization of high water at boat launch.

[3] Field studies and assessments undertaken by qualified professionals identified minimal impacts from changing lake levels, as described in the Clean Energy Development Plan. The results of these assessments are broadly summarized here. The TRTFN Lands Department and the Province of BC will review the Plan and may have differing views on the significance of impacts.

beach formations would remain largely intact in the long term. Continued erosion and deposition (laying down of sediment – such as pebbles, sand etc. – by wind and flowing water) are predicted to continue to build and add to these landforms. Inundation would flood the lagoons and shrink the size of the beaches seasonally from mid-July onward. Over time, however, these beaches would likely grow and expand with continued erosion and deposition.

Wildlife

There would be minimal impacts to wildlife, such as moose and caribou, due to the small increase in water level and inundation. Movements of other wildlife, such as sheep, may be most affected at Pine/Cup Creek in the fall due to the increased level of average high water. This new level could move any existing crossing points along the beach or lagoon a short distance up the valley. Currently, THEL is monitoring wildlife movements across this area in cooperation with TRTFN Lands Department, via the use of wildlife game cameras.

Fish and fish habitat

Grayling are the primary species of interest in Surprise Lake, and the effect on grayling due to changes to water levels is expected to be neutral. Impacts to spawning habitat appear to be negligible, while there may be potential benefits to the increased availability of shallow nearshore water, which is used for rearing. The availability of this habitat may be a factor limiting the size of the grayling population in Surprise Lake, and this habitat would increase with inundation of some low-lying areas.

In terms of spawning habitat, the anticipated changes resulting from lower lake levels (compared to historic levels) is not expected to impact grayling productivity nor to result in a reduction of usable spawning habitat. There are no barriers to spawning channels created by low-water levels. Because grayling spawn during lower water from May to mid-June, existing channels would not be inundated at this time of year. Grayling are adaptable to a variety of spawning habitat conditions, so they are expected to be resilient to water-level changes in their spawning habitat. Nonetheless, THEL proposes to monitor grayling spawning during and after construction and to adapt the reservoir management strategy, if required.

Cultural areas

TRTFN Class A Cultural Sites are located at both Granite Creek and Pine/Cup Creek. Inundation would exceed XLP's currently permitted water level of 913.85 m by 5 cm a few days a year. As a result, the proposed high-water level does not substantively change the existing permitted land use at these sites. (That said, the existing hydropower operation does not typically reach the permitted maximum for high water. For a discussion on existing and proposed water levels, see page 23, "How will the Project change the lake levels in Surprise Lake.) No archaeological sites would be affected between these high- and low-water levels, and the beaches and landforms would remain largely intact.

Inundation of barrier beach at Cracker Creek by September. Beach is likely to exist at lower water elevations up until at least mid-July.

Comparison of water levels at Granite Creek beach at 913.35 m (slightly below current average high water) and 913.8 m, looking west from the creek channel.

Conceptualization of Granite Creak beach early July (913.35 m)

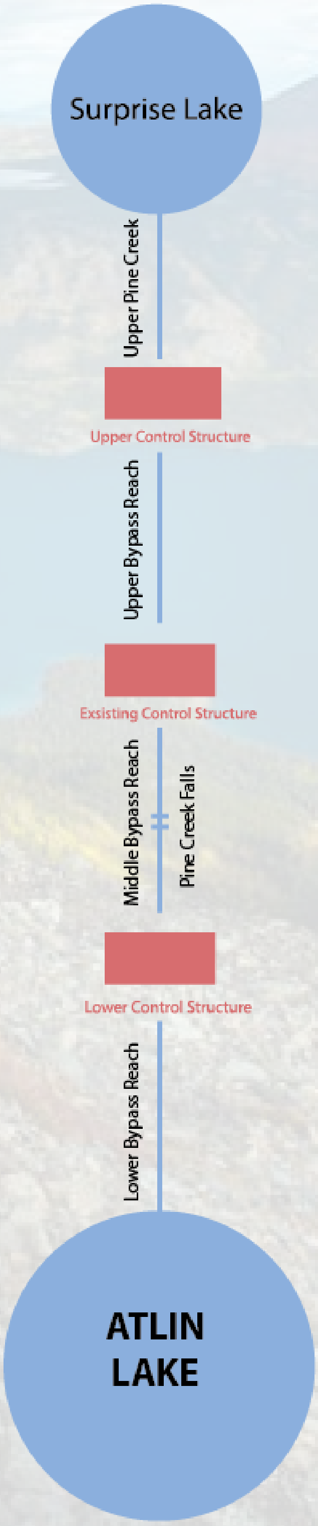
Conceptualization of Granite Creak beach early September (913.8 m)

What Happens at PINE CREEK

As described earlier, much of the design of a hydropower facility involves structures to regulate the flow of water – holding back or drawing down water at the reservoir, holding water in headponds, conveying water through canals or penstocks to a powerhouse, then finally along the tailrace back into the creek or lake. The following section describes the changes to the flow of water on Pine Creek, as well as the potential effects of these changes on fish and people.

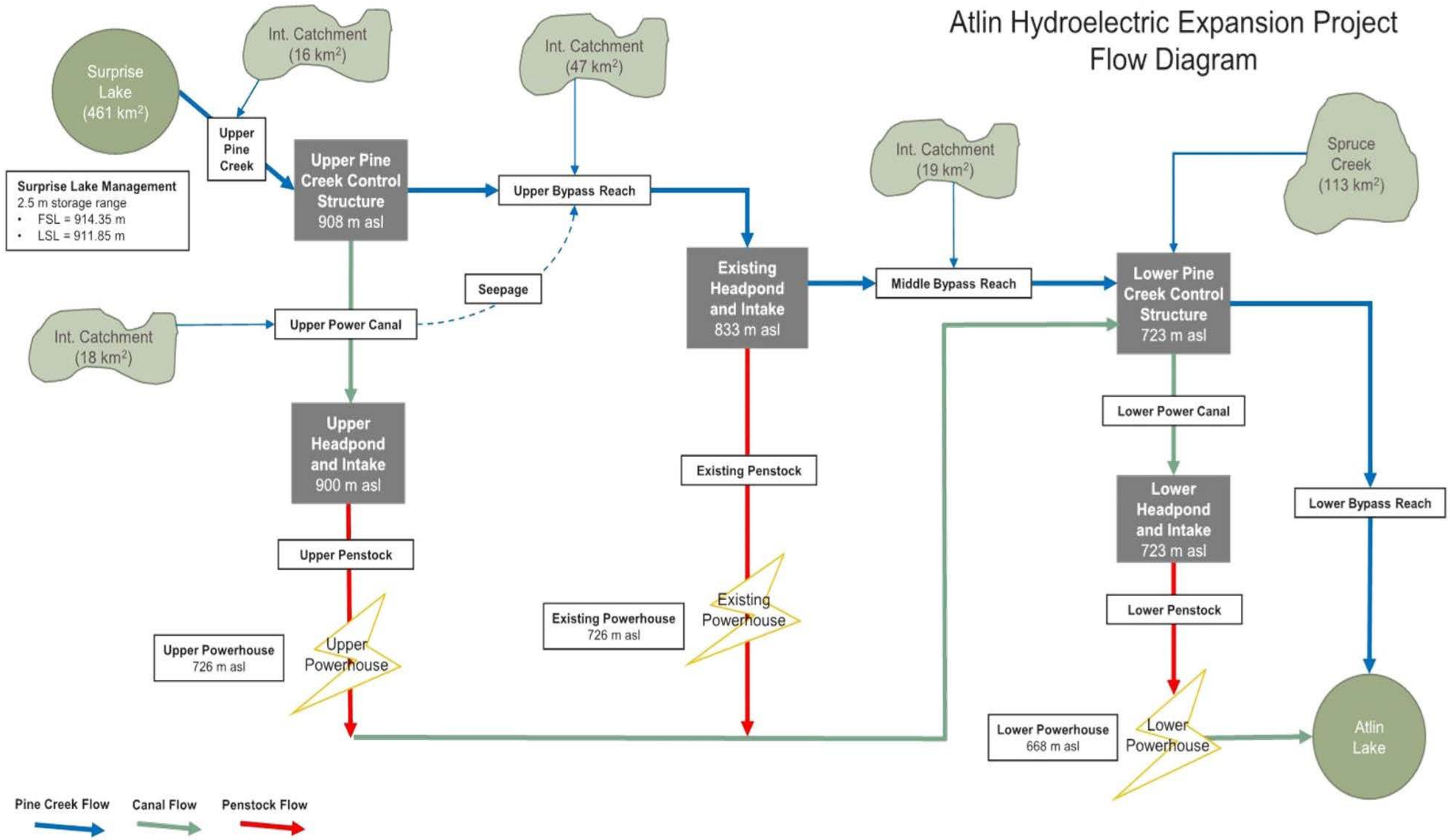
The proposed Project involves diverting more water from Pine Creek to feed two new powerhouses. As a result, there would be a total of three places where water is diverted from Pine Creek: at the existing concrete dam (where water is diverted to Xeitl's powerhouse), and at the proposed Upper and Lower Pine Creek control structures (where water would be diverted to the two new powerhouses).

The flows of different sections, or "reaches," of the creek are affected differently. If you imagine Pine Creek as a cucumber and cut it in three places, you will end up with four pieces of cucumber. Each cut represents a diversion point, while each piece represents a reach of Pine Creek. In the following pages, we will describe the impacts on the flows of these four reaches: Upper Pine Creek Reach, Upper Bypass Reach, Middle Bypass Reach and Lower Bypass Reach.



Reaches of Pine Creek

Atlin Hydroelectric Expansion Project Flow Diagram



What will happen to flows on Pine Creek?

In a natural system in our climate, creek flows are generally highest during the spring and summer months due to melting snow. The flows diminish in the fall, reaching their lowest flows during the winter freeze-up. Prior to construction of the existing project, the minimum seasonal flows in winter on Pine Creek were about 0.5 m^3/sec, while spring and summer seasonal flows averaged ~5 m^3/sec.

However, in a regulated system, flows are reversed — lower in summer and higher in winter. This happens because water is held back in a reservoir during the summer months to allow it to fill (in this case at Surprise Lake), then released in the winter to feed a powerhouse.

Flows on Pine Creek are currently higher in winter than they were before the development of the existing hydropower facility (with a January monthly peak averaging ~1.5 m^3/s, and a July monthly peak averaging 6.0 m^3/s), but they are still highest in summer. With the development of the proposed Project, more water would be held back for longer in the summer months, and more water would be released in the winter months to feed the two new powerhouses. The flows of the reaches of Pine Creek would be affected differently. Flows in the upper two reaches would be highest in winter, while flows in the lower two reaches would be marginally higher in summer.

The following chart provides the average January and July flows for each reach. The highest flows are in Upper Pine Creek Reach and the Upper Bypass Reach, since minimum flows must be maintained to feed the existing powerhouse, as well as to maintain minimum flows in Lower Pine Creek Reach.

	Upper Pine Creek (mean m^3/sec)	Upper Bypass (mean m^3/sec)	Middle Bypass (mean m^3/sec)	Lower Bypass (mean m^3/sec)
January	5.5	1.1	0.4	0.5
July	2.2	1.7	0.8	1.1
Lowest average	1.6	0.8	0.4	0.5

Minimum flows in the Middle Bypass Reach and Lower Bypass Reach of Pine Creek are proposed to be ~0.4 m^3/s throughout the year, but they will typically average 0.5 m^3/s in winter, and 0.8 m^3/s in summer, which is similar to minimum winter flows prior to construction of the existing project.

[4] The Surprise Lake Control Structure regulates the flow of water from the lake; it does not divert it here. At the concrete dam, water is captured in a penstock intake headpond – this is the diversion.

What will Pine Creek and Pine Creek Falls look like with these flows?

Pine Creek is visible from multiple viewpoints along Surprise Lake Road, various recreational sites (e.g. Powerhouse), trails, and the Warm Bay Road Bridge. Most of the recreational use along Pine Creek occurs in the Lower Bypass Reach, where flows will range from 0.5 – 0.8 m^3/s, which is 20% – 50% lower than existing low flows.

This will result in approximately a 20% reduction in the average wetted width of Pine Creek, as well as changes to the depth. Visually, the wetted width is more important to the perception of change in the overall appearance of the creek. The accompanying images illustrate the visual impacts of these changes in flow.

Pine Creek Falls is currently a designated viewpoint located on Surprise Lake Road. This viewpoint coincides with the terminus of the Crocus Trail, making it attractive to tourists and local residents. Flows over the falls currently average 4.0 m^3/s, with the lowest flows occurring early May at about 1.0 m^3/s. Under the proposed Project, the flow would be reduced in summer to approximately 0.5 m^3/s, or half of the lowest flows currently observed over the falls.

Visually, this reduction in flow will change the appearance of the falls. Project engineers estimate that 0.5 m3/s of water will maintain aesthetic flows over the falls, but THEL recognizes that this is subjective.

Image shows 0.8 m^3/s flow in Upper Pine Creek,which is HALF of what would be expected

Upper Bypass Reach when flow was 1.5 m^3/s, the midway between the January (1.1) and July (1.7) flows, and almost twice the 0.8 m^3/s lowest flow expected in April.

Conceptualization of Lower Bypass Reach from Warm Bay Road Bridge with 20% reduction in width.

Factors contributing to the appearance of a waterfall include the height of the fall, steepness of the vertical drop, the flow, the width and the number of cascades. Pine Creek Falls has four main cascades, with the steepest vertical drop being in the first cascade. As such, Pine Creek Falls will likely retain its attractive qualities due to the cascading geometry of the bedrock and canyon, which will continue to funnel water over the falls. In other words, the change in the visual quality of a waterfall is not directly proportional to the volume of water flowing over it.

To illustrate this varied impact of a change in flow, the images on the following page compares the appearance of Pine Creek Falls in May 2020 and June 2018. The difference of flow between these two images is significant, at 3.7 m^3/sec, though the resulting change in appearance may seem subtle for some. Similarly, the images below of Shannon Falls and Bridal Veil Falls demonstrate how even relatively low flows (~1.0 m^3/sec) can still have a dramatic appearance.

Shannon Falls, BC with flows of ~1.0 m^3/s and Bridal Veil Falls, BC with flows of a maximum of 1.0 m^3/s (Source: World Waterfall Database).

Pine Creek Falls in May 2020, with flows ~2 m³/s Photo Credit Christian Bucher

Pine Creek Falls in June 2018, with flows ~6 m³/s Photo Credit Christian Bucher

Will these flows affect fish in Pine Creek?

The most important reaches on Pine Creek in terms of their fisheries value are Upper Pine Creek Reach and, to a lesser extent, the Upper Bypass Reach. Grayling migrate between Spring Creek, a tributary in Upper Pine Creek, and Surprise Lake. With the proposed Project, small pools and other fish habitat would be maintained or re-created.

There is currently a fishway (a structure to enable fish to pass around a weir/dam, also called a fish ladder), which would be upgraded if required, to maintain fish passage between Pine Creek and Surprise Lake. Flows in both the Upper Pine Creek and Upper Bypass reaches would remain relatively high to maintain flows to the existing headpond, so fish passage between these reaches would be maintained, and impacts to habitat would be minimal. To sum up, biologists have determined that the productive capacity of these reaches for fisheries would be maintained.

The Middle Bypass Reach contains two barriers that prevent fish passage up Pine Creek from Atlin Lake: natural barrier of Pine Creek Falls, and the constructed dam at the existing headpond.

In the Lower Bypass Reach, the Lower Falls (a small cascade in a canyon visible from Pine Creek Trail), approximately 2.5 km upstream of Atlin Lake, also prevents fish from Atlin Lake from moving very far up the Creek. This means that fish found in the reaches between the two falls are those that have been swept downstream. For the fish that do enter Pine Creek from Atlin Lake, the lower year-round flows of 0.5 m3/sec to 0.8 m3/sec may discourage some use. However, the proposed tailrace from the lower powerhouse will create new habitat. This tailrace, located next to the creek, would be a large, slow-moving channel that rises and falls with the lake. The tailrace would incorporate fish habitat features into its construction, such as boulders and pools, and vegetation.

Although the fish population is not expected to be negatively impacted, fish habitat would be reduced by barriers to passage from the new weirs on Pine Creek, and the change in wetted width.

This means that habitat compensation measures would be required under a Department of Fisheries and Ocean's (DFO) fisheries authorization. For this Project, TRTFN requested that we develop compensation on the lower end of Otter Creek rather than Pine Creek. THEL will be proposing to develop spawning habitat in lower Otter Creek near its outflow at Surprise Lake, as part of a larger TRT-led restoration project.

In the earlier section titled "How the Project Works" (page 12), we provided an overview of the Atlin Hydro Expansion Project, including a description of the existing and proposed infrastructure (weirs, powerhouses, canals, etc.). The following three sections offer additional details on the design of this infrastructure, as well as the impact of their construction.

UPPER POWER
Canal, Penstock & Powerhouse

About 2.5 km downstream of Surprise Lake, water would be diverted from Pine Creek to enter the upper power canal. The canal itself travels through the northeast end of an active goldfield before joining and paralleling the old road on which the Dredge and Flume historic site is located. (Refer to Map 2 to view location of upper power canal and penstock.)

From here, the canal would be extended a couple of kilometres to a penstock intake headpond. The penstock would then drop ~70 m before paralleling the existing XLP penstock, where the water would be conveyed to the upper powerhouse.

Test pits program on proposed power canal.

The power canal would operate during the winter months from September to May. For this reason, the canal has been designed to ensure that an adequate ice cover can form, facilitating flow and reducing the potential for frazil ice (soft, amorphous ice that is formed by the accumulation of ice crystals in water that is too turbulent to freeze solid). Some water is expected to remain in the canal during the filling period, as is currently the case, from groundwater seepage and precipitation.

This remaining water would provide habitat value for amphibians and birds. Some access control along the canal dikes may be required to ensure the integrity of the canal and service road.

Most of this infrastructure would be in areas of existing development, as well as existing access routes, including Surprise Lake Road and the Dredge and Flume Road. However, new access and clearing would be required for the upper power canal's ~2.0 km extension and the first ~700 m of the penstock (before its route joins the existing right-of-way). During construction of the power canal, traffic would be impacted on Surprise Lake Road where a gated culvert would be installed, as well as on the Dredge and Flume Road.

An emergency spillway dam on this power canal would also be developed, where water would be released in a small drainage that crosses the Dredge and Flume Road. Temporary roadwork would also be expected where the penstock crosses Spruce Creek Road.

THEL proposes to limit any new clearing for the upper penstock to the 700 m of new alignment above the existing headpond, recognizing that the existing route is wide enough to accommodate both penstocks. Similarly, the site of the upper powerhouse is directly adjacent to the existing XLP powerhouse, and these two powerhouses would share an upgraded tailrace. By taking advantage of existing access and clearings, the overall footprint of the new infrastructure is minimized.

Construction of exsisting penstock pipe.

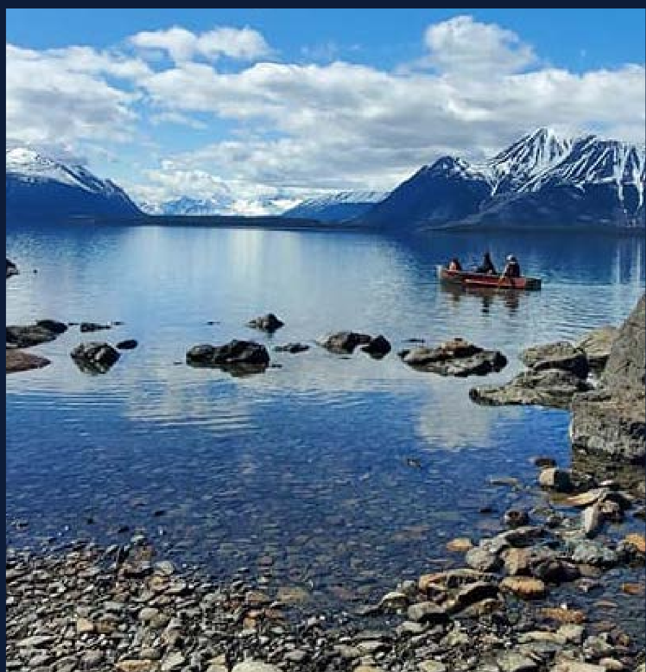
LOWER POWER
Canal, Penstock & Powerhouse

The lower power canal would be located downstream of the existing powerhouse on Pine Creek and the existing bridge to the powerhouse (Map 4). This lower power canal would travel about 600 m west, paralleling Pine Creek. Spruce Creek would be diverted into a headpond, capturing flows there to be conveyed down the canal to the penstock intake headpond.

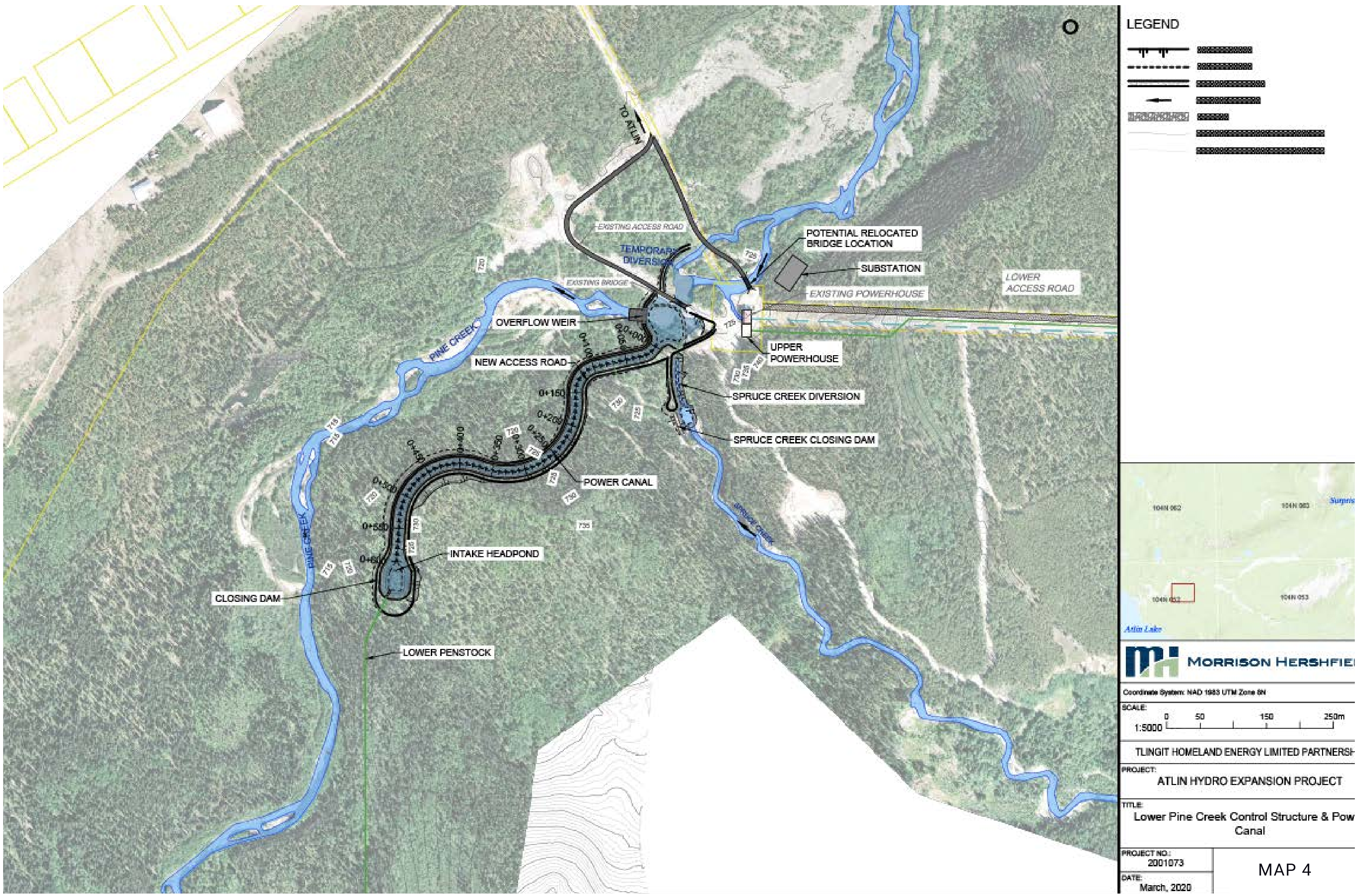
This penstock would traverse about 3.2 km, paralleling Pine Creek for most of its length. The penstock would cross Warm Bay Road at the campground, and then travel about 600 m alongside the road before angling toward the lower powerhouse. Also generally overlapping the penstock would be a 25 kV powerline, connecting the lower powerhouse with the substation. Once water has cycled through the lower powerhouse, it would be released into the 500 m-long tailrace, which swings back toward Pine Creek and terminates at Atlin Lake (Map 5).

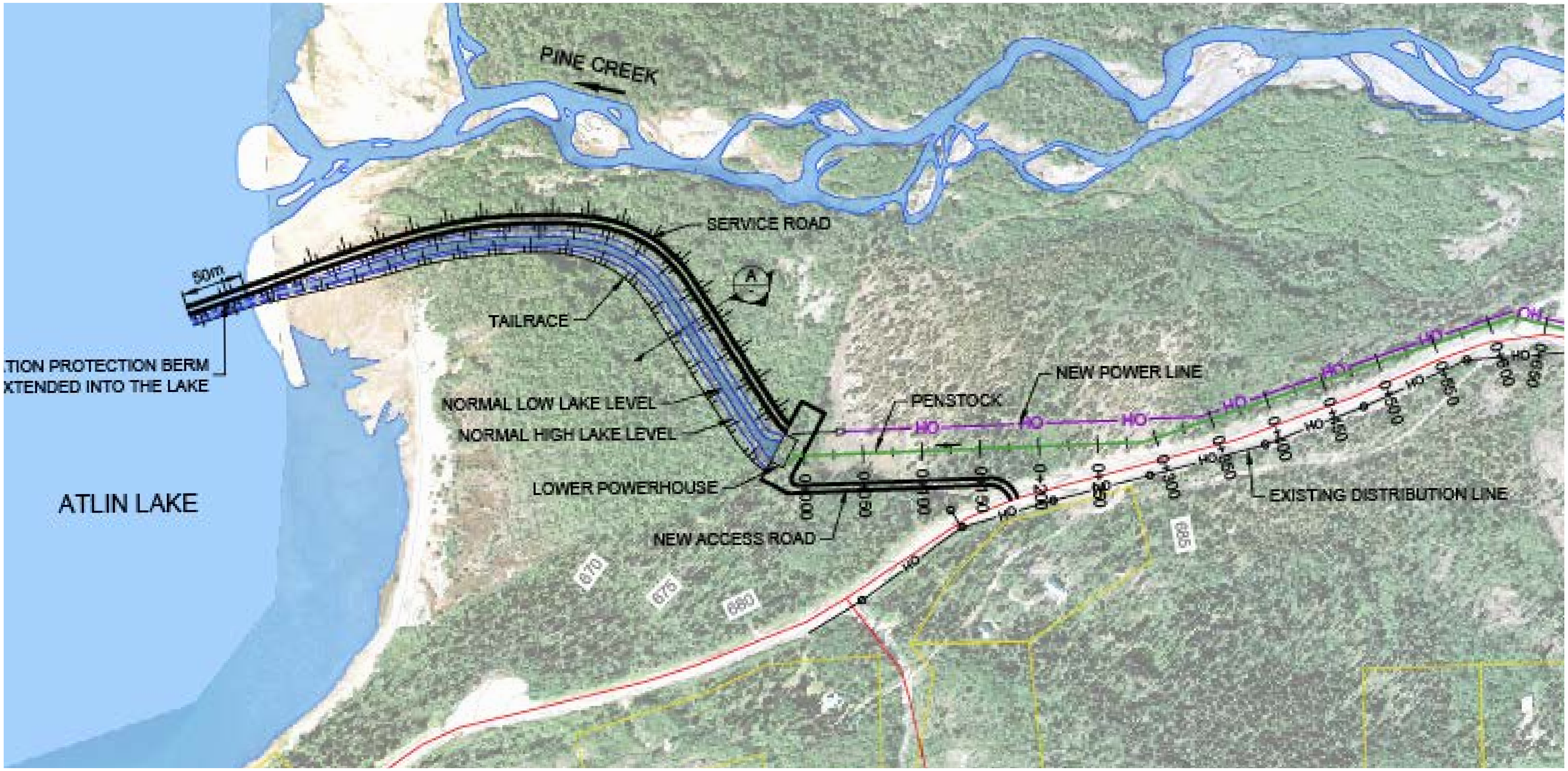
The lower power canal, penstock, powerhouse and powerline are in areas with several nearby recreational and residential uses. For this reason, these are generally the most conspicuous components of the project. Many of the comments and concerns about the project we have heard so far focus on the location of these components, and the potential impacts on residential and recreational users.

In terms of the lower power canal and penstock, the key impacts THEL identified relate to recreational trails and roads. Map 6 shows some of the land uses in the area, including residential properties and, notably, the Pine Creek Trail.



Atlin Lake


LEGEND
TO ATLIN
EXISTING ACCESS ROAD
TEMPORARY DIVERSION
EXISTING BRIDGE
POTENTIAL RELOCATED BRIDGE LOCATION
SUBSTATION
EXISTING POWERHOUSE
LOWER ACCESS ROAD
UPPER POWERHOUSE
OVERFLOW WEIR
NEW ACCESS ROAD
PINE CREEK
SPRUCE CREEK DIVERSION
SPRUCE CREEK CLOSING DAM
POWER CANAL
SPRUCE CREEK
INTAKE HEADPOND
CLOSING DAM
LOWER PENSTOCK
Atlin Lake
MORRISON HERSHFIE
Coordinate System: NAD 1983 UTM Zone 8N
SCALE: 1:5000
0 50 150 250m
TLINGIT HOMELAND ENERGY LIMITED PARTNERSH
PROJECT: ATLIN HYDRO EXPANSION PROJECT
TITLE: Lower Pine Creek Control Structure & Pow Canal
PROJECT NO.: 2001073
DATE: March, 2020
MAP 4



SCALE:
1:5000 0 50 150 250m

Lower penstock powerhouse, and tailrace

LEGEND

- Existing Land Parcels
- Existing Roads
- OH New Overhead Powerline
- OH Existing Overhead Powerline
- Lower Penstock
- Flow Direction

Lower Powerhouse and Tailrace

MAP 5

The lower power canal would be located and accessed west of the existing powerhouse, along a section that is sometimes referred to locally as Poor Man's Farm Road. Currently, to access Poor Man's Farm Road, Spruce Creek must be forded. With the proposed Project, Spruce Creek would be diverted through a culvert, so safe access to this road would be improved.

Both the lower power canal and the lower penstock would affect the Pine Creek Trail. This trail is approximately 3 km-long. It begins at a pull-out on Warm Bay Road on the south side of the Pine Creek bridge and ends at the existing powerhouse. This trail receives limited use when compared to other trails in the area but has been maintained in recent years by a group of local residents, including the Atlin Alpine Society. The proposed Project would mean the trail overlaps the penstock for an approximately 150 m section at the east end. As a result, the trail in this section would widen into a grassy right-of-way.

As well, the proposed lower power canal would cut off the Pine Creek Trail from its original exit point, at the Poor Man's Farm Road crossing of Spruce Creek near the existing powerhouse Currently, this road crossing is not always passable due to flows on Spruce Creek. As well, crossing Pine Creek near the powerhouse can also be impossible or unsafe due to high flows, so many trail users return the same way to Pine Creek Bridge on Warm Bay Road.

However, since the proposed Project would reduce flows in this Lower Bypass Reach to about 10% of the mean annual discharge (average flows in a period of time), the creek would likely be passable at this location, creating a new point of exit/entry, in addition to the culvert access over Poor Man's Farm Road. Further, to facilitate connectivity for trail users, while also enhancing the trail options in this area, a pedestrian access could be placed over the lower power canal at the terminus of the Pine Creek Trail. Lastly, the clearing for the 25 kV powerline route would also provide an additional trail that connects with the existing powerhouse.

Before crossing Warm Bay Road, the penstock route comes into proximity with residential properties on South Pine Drive. The penstock would be constructed largely in the cleared area between the road and the treeline along Warm Bay Road, before angling down to the lower powerhouse (Refer to Map 5 on page 41). Easily accessible sections of the penstock may be revegetated with edible berries to create harvesting opportunities, if deemed desirable by the local community.

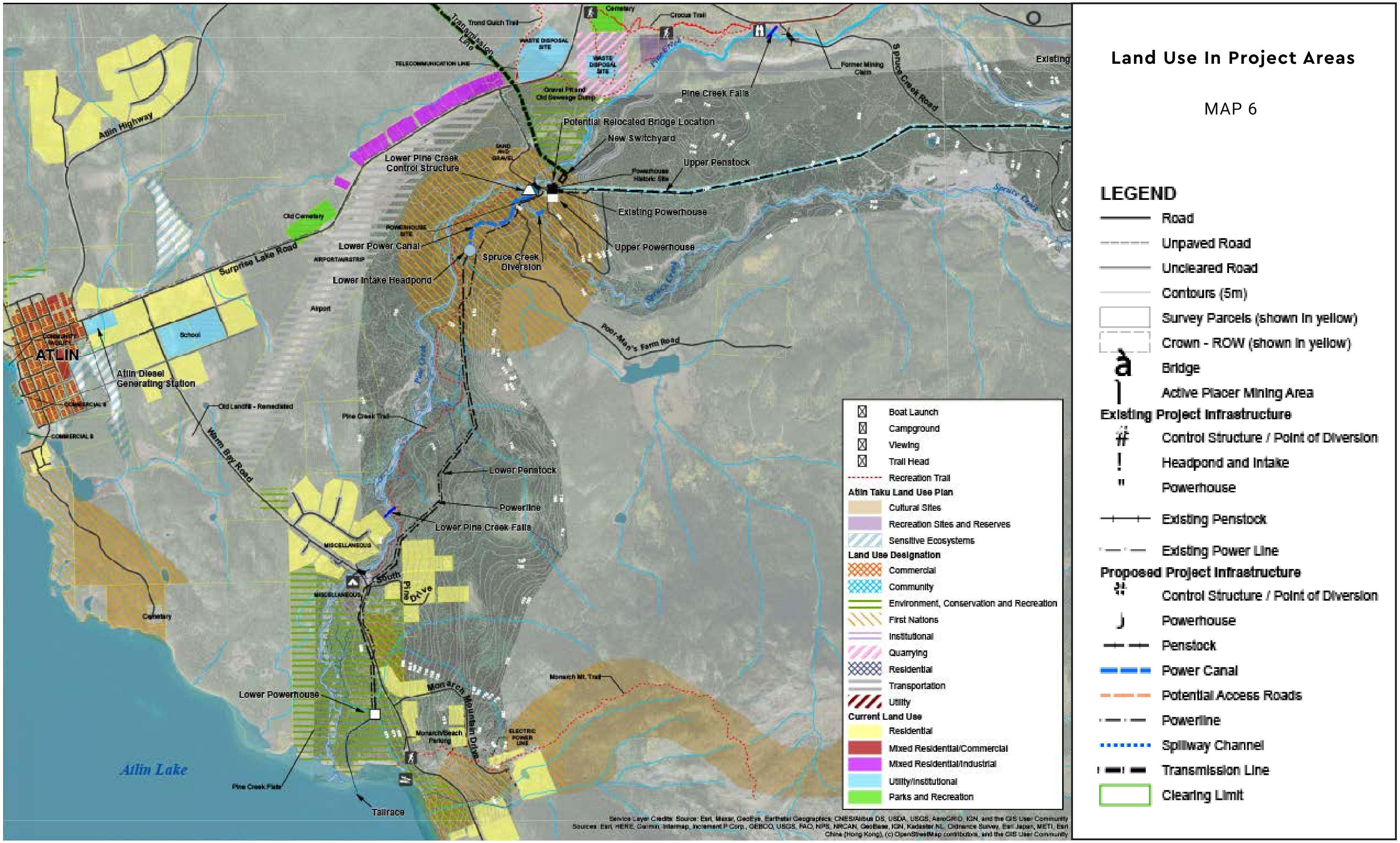
The proposed site for the lower powerhouse site is below the Warm Bay Road, about 200 m from the nearest residence, and about 300 m from the main beach at the Pine Creek beach trail.

The area is considered part of the Pine Creek flats, which includes a large delta floodplain primarily vegetated with willows. This floodplain is a result of the large volume of sediments that were historically, and continue to be, transported downstream from placer mining activities and erosion caused by flooding, as happened in June, 2021. Pine Creek flats, including an area on both the south and north sides of the Creek, was formerly zoned for the Use, Recreation, and Enjoyment of the Public (UREP). The Province removed this designation in June 2021. However, because THEL is locally owned, THEL considers the area to have high recreational value and potential, and the area is identified in the Atlin-Taku Land Use Plan as being important

Tlingit Youth at Pine Creek Flats

THEL identified two main concerns with the lower powerhouse and tailrace. The first was the potential for noise, which could affect nearby residences, particularly in winter months. The second was consistency with recreational use in the area, including possible impacts to Pine Creek beach.

With respect to noise, THEL's goal is to ensure that noise from this powerhouse would be largely imperceptible to nearby residences under normal weather conditions. Powerhouses generate noise via their machinery that includes, but is not limited to, generators, turbines and fans. Most important for this project is the ability to reduce sound levels outside of the powerhouse building. The primary method for this is through insulating materials in the building itself.


Land Use In Project Areas
MAP 6
LEGEND
Road
Unpaved Road
Uncleared Road
Contours (5m)
Survey Parcels (shown in yellow)
Crown - ROW (shown in yellow)
Bridge
Active Placer Mining Area
Existing Project Infrastructure
Control Structure / Point of Diversion
Headpond and Intake
Powerhouse
Existing Penstock
Existing Power Line
Proposed Project Infrastructure
Control Structure / Point of Diversion
Powerhouse
Penstock
Power Canal
Potential Access Roads
Powerline
Spillway Channel
Transmission Line
Clearing Limit
Boat Launch
Campground
Viewing
Trail Head
Recreation Trail
Atlin Taku Land Use Plan
Cultural Sites
Recreation Sites and Reserves
Sensitive Ecosystems
Land Use Designation
Commercial
Community
Environment, Conservation and Recreation
First Nations
Institutional
Quarrying
Residential
Transportation
Utility
Current Land Use
Residential
Mixed Residential/Commercial
Mixed Residential/Industrial
Utility/Institutional
Parks and Recreation
ATLIN
Atlin Lake
Atlin Highway
Surprise Lake Road
Warm Bay Road
Spruce Creek Road
Poor-Man's Farm Road
Monarch Mountain Drive
Pine Drive
Atlin Diesel Generating Station
Lower Pine Creek Control Structure
Lower Power Canal
Lower Intake Headpond
Spruce Creek Diversion
Potential Relocated Bridge Location
New Switchyard
Upper Penstock
Existing Powerhouse
Upper Powerhouse
Pine Creek Falls
Lower Penstock
Powerline
Lower Pine Creek Falls
Lower Powerhouse
Tailrace
Transmission Line
Existing

Studies of industrial noise sources in residential areas found façade insulation in buildings to have the most significant effect on noise levels and annoyance ratings (e.g., sound-insulated windows can reduce the sound by more than 30 decibel (dBA)) (European Union, 2017). Sound-damping in the building, especially with respect to ventilation, would likely be required for the lower powerhouse. So how loud is loud? A natural environment (e.g., birds, trees, wind) has an average daytime level of 40 dBA, and an average night-time level of 30 dBA. The figure below shows a comparison of common noise sources and their dBA levels. While the average ambient decibel level at the nearest residences on Warm Bay Road are not known at this time, it is expected to be similar and/or lower than the average night-time decibel level for a natural, quiet environment.

The nearest residences on Warm Bay Road are approximately 200 m away from the lower powerhouse. The distance that sound travels depend on acoustic design measures as well as the topography, the size of openings, the amount of vegetation, the prevailing winds, and other similar factors (Power Engineering, 2000). For that reason, the location and layout of the proposed lower powerhouse is as important to reducing the potential for noise to residences as the acoustic design measures.

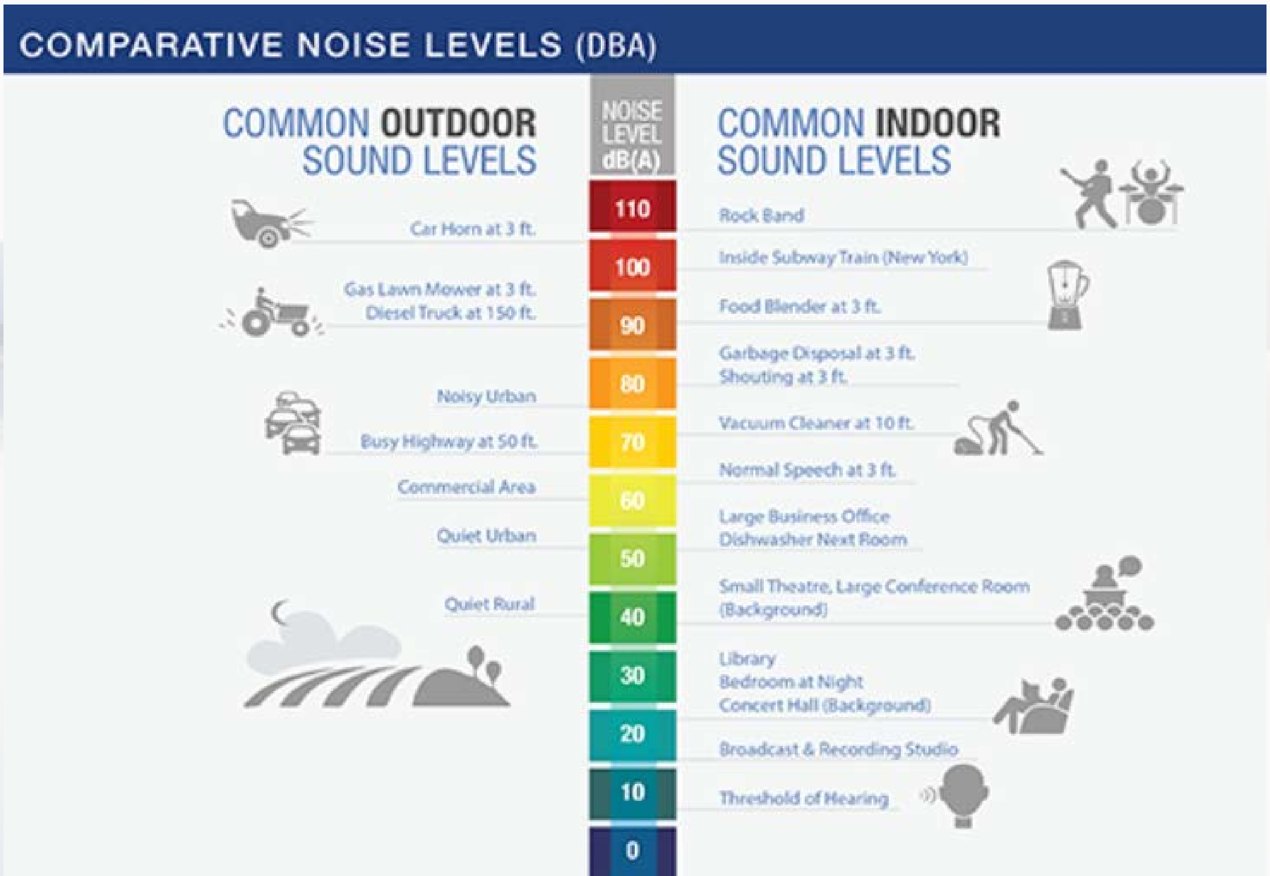



Photo from residence above Pine Creek.

The lower powerhouse is ideally situated in this regard, as it is located below the residences at the base of a hill on the Pine Creek flats, reducing the potential for sound to travel. The site is also surrounded by forest, which further reduce this potential.

The noise control system for the lower powerhouse will be determined during the current detailed design phase. However, it should be noted that the lower powerhouse would use Francis turbines, rather than the Pelton turbines used at the existing powerhouse. Because Francis turbines are submerged, and the tailrace is a low-flow channel, the potential noise associated with the turbines and flows from the tailrace are likely to be reduced.

Other systems still to be designed would include noise abatement measures in the building, e.g., an acoustic building envelope, acoustically treated ventilation system and acoustic doors.During the detailed design phase, the existing ambient noise levels at the nearest residences, as well as the location of the most sensitive noise receptors (not necessarily based on distance from the powerhouse) will be determined. This information will ensure the design reaches the target decibel level for these receptors through noise abatement – in other words, will ensure a quiet design.

Measures may include, for example, the direction the vents should face, additional sound-damping/insulation on a particular wall, and minimizing the size and shape of clearings. This would be designed by an acoustic engineer.

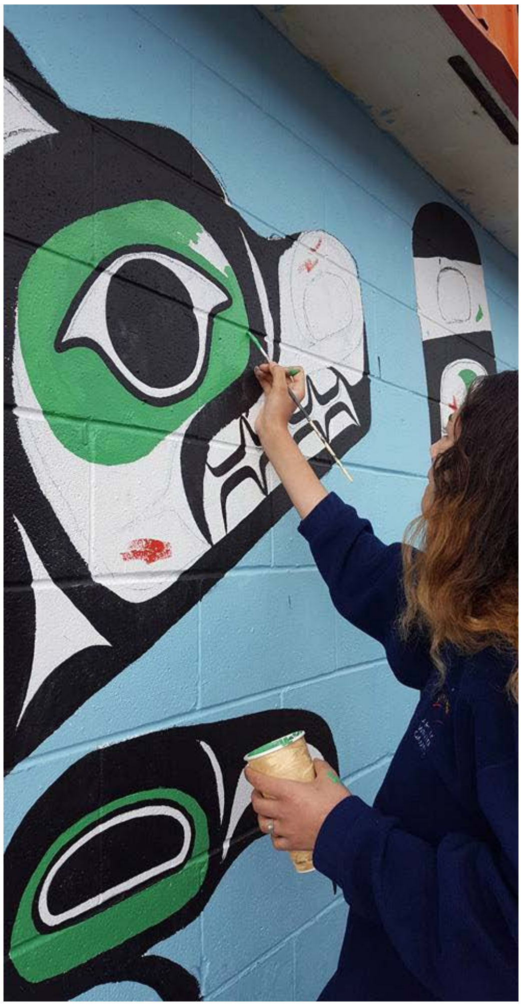
In terms of recreational values, THEL would like to enhance recreational opportunities in the area by providing alternative trails and trail network connections between Pine Creek beach, Monarch Mountain, the campground, and trails used on the north side of Pine Creek. Design, development and maintenance of this network would occur in consultation with the community and interested parties, and regular maintenance of the trails and signs would be completed by THEL.

THEL also proposes to develop a small public

Monarch Mountain Trail July 2021

parking area at the lower powerhouse, and to develop the tailrace service road into a wheelchair-accessible trail. This 500 m-long gravel route would have seating benches and interpretive signs, while a pedestrian overpass would be developed to maintain access to Pine Creek. As well, fish habitat would be developed within the tailrace, which may provide angling opportunities from the trail. The powerhouse itself may also be designed to have a pleasant façade, such as community mural art.

An example of mural art: Southeast Alaska Tlingit artist Patrick Price: https://coloroutsidelines.org/pages/murals-project



An example of mural art: Youth Mural project in Whitehorse Yukon.

The lower powerhouse would not only be designed to be quiet, but also discreet – it would not be visible from Pine Creek beach. As well, the powerhouse would generally not be operational during the summer months, the primary period of use at Pine Creek beach. THEL hopes that the accessibility of the service-road trail by people with mobility issues would be viewed positively. While the tailrace would be visible, the service-road trail would be designed to blend with the natural environment. The tailrace itself, being a slow-moving extension of the lake, is also likely to improve ice stability and safety at and near the mouth of Pine Creek.

Transmission Line

The AHEP will export 100% of the power to the Yukon via a 92 km-long powerline that parallels the Atlin Road for most of its length. The powerline would begin at the substation located next to the upper powerhouse on Pine Creek and would terminate at a substation located at Jake's Corner. The largest section of the line outside of the Atlin Road right-of-way is between Surprise Lake Road (near the upper powerhouse) and Como Lake, where ~2.0 km of new linear corridor would be developed across the valley to connect with the Atlin Road south of the Atlin Landfill at Como Lake.

Although the line would be placed primarily within the right-of-way, additional clearing within the right-of-way would be required. On average, the width of this additional clearing extends 7.5 m from the existing cleared right-of-way on the BC side of the border, and about 5 m on the Yukon side. Locating the line within the right-of-way reduces the visual and environmental impact of a new linear corridor and minimizes or eliminates overlap with other land uses, such as private properties and settlement land in Yukon. Generally, the line has been proposed at this stage of development on the east side of the Atlin Road.

This avoids visual impacts to viewscapes and limits overlap with private properties. However, during the regulatory review process and detailed design phase, refining of the route may occur to address site-specific concerns, such as potential impacts to recreational use at White Mountain.

Other key considerations for the powerline relate to limiting impacts to riparian areas (areas near water) and wildlife habitat. Examples of measures to limit this impact are locating the powerline within the right-of-way, spanning riparian areas (rather than erecting poles within these areas) and undertaking only minimal hand clearing where necessary. This clearing would be undertaken in winter so the vegetative mat would not be removed, further retaining wildlife habitat features and vegetation.

Transmission Line Pole.

Benefits of the Projects

The North is experiencing the dramatic effects of climate change, from extreme weather events to landslides and shrinking glaciers, and the need for action has never been more urgent. The AHEP will provide clean energy to our region, reducing GHG emissions by 27,500 tonnes annually, or 27 kilotonnes. At present, there is ~13 MW winter-energy shortfall in southern Yukon, which requires that the LNG facility and/or diesel generators are turned on in the winter months.

The proposed Project would provide 65% of the winter energy shortfall. Further, Yukon's climate change action plan requires that GHG emissions be reduced by 30% below 2010 levels by 2030, equivalent to 263 kilotonnes per year. As such, the Project would account for 10% of that goal.

In addition to the environmental benefit, the AHEP would provide direct employment during construction and operations, as well as long-term dividend benefits that would be reinvested in the Atlin community. The Project would signal the evolution of the Taku Group of Companies into an important regional energy company with long-term capacity development and employment opportunities. The equivalent of an estimated 176 full-time employment positions over a 3–4-year period would be created, and another approximately 6–8 full-time employment positions for operations and maintenance over the life span of the project. Employment positions may include hydro plant operators, transmission line operators, environmental monitor and safety officers, trades, computer technicians, and management positions.

The AHEP would provide dividends to be reinvested back to the community and community programs. Reinvestment of resource revenues reduces economic leakage in the region, the process whereby money is leaked out of the local economy. Economic leakage is common, for example, when companies from outside the area take their profits earned here and spend them

Atlin School field trip to the existing concrete wier.

or invest them elsewhere. Re-investment in the community is required by TRTFN corporations to ensure benefits accrue to the community, bringing in substantive long-term increases to direct and indirect employment, economic opportunities, and education skills and training benefits.

The Project would continue to diversify the economic base of the Atlin community, providing varied employment opportunities and room for advancement. Intangible benefits to First Nations' health and well-being are likely to result over the long-term due to the influence of local ownership, economic independence and control over resources.

When members of our community benefit – e.g., through direct or indirect employment opportunities that keep people and their families here in Atlin or from the benefits of long-term investment in social programs – then we all benefit. It's that simple!

Did you know? The existing hydro project has provided these benefits to Atlin:

Reduction of greenhouse gases (4500 tonnes/year or 54,000 tonnes in 12 years).

16 million litres (350 B-train tankers) of diesel not burned to generate electricity.

Enhanced grayling migration at Surprise Lake.

Employment for the last 12 years for four local residents involved with hydro operations and maintenance.

Investment in skills training and education programs for local residents.

Investment in business growth (equipment, trucks, capacity) creating more employment.

Investment in the hydro expansion project development stages.

Knowledge and experience to become leaders in renewable energy in the north.

What's Next?

The Project is currently in the detailed design phase of development. This means that the engineering is advancing beyond the preliminary design of the feasibility phase, toward refining the design with detailed construction plans, specifications, and cost estimates as outcomes.

This phase partially overlaps the regulatory and public review period of the Project, but detailed design will not be finalized until after completion of the review period, and amendments and changes to the design may be required.

As described previously in the section titled "Regulatory Review Process" (page 09), the Project has just entered the Technical Review stage. The public will be notified of where to access the Plan and where and how to provide comments in the near future.

Additionally, THEL will be hosting open houses with information booths over the summer and fall, so the public can view key components of the Project proposal and expected effects and mitigation.

Please stay tuned for notices of the dates for these open houses. As well, THEL's Community Outreach Coordinator, Caitlin O'Shea, will be available at the Tutan Hit Centre in the near future to speak to any and all interested people in the coming months.

For more information on the status of the Project and to find updates, please visit our website at www.thelp.ca or visit our Facebook page.

Glossary

Control structure: A structure that is used to control the natural flow of water, including dams, weirs, and diversions.

Francis Turbine: A type of reaction turbine: reacts to pressure/mass of water, requiring a high volume of water but moving at low velocity.

Frazil ice: Slushie-like ice that forms through the accumulation of ice crystals in water that is too turbulent to freeze solid.

Full Supply Level (FSL): The normal maximum operating water level of the storage reservoir when not affected by flooding or high water – the FSL corresponds to what is considered 100% capacity.

Headpond: A pond where water is collected and regulated at the point of intake.

Intake: A controlled location or point where water enters a pipe, culvert, canal, etc., for conveyance.

Inundation: Flooding over land.

Low Supply Level (LSL): The normal minimum operating water level of the storage reservoir.

Mean Annual Discharge (MAD): The mean annual discharge is the average flow of water for a period of time. It is calculated by dividing the sum of all the daily flows by the number of daily flows recorded for the year.

Pelton Turbine: A type of impulse turbine: a wheel-like turbine requiring low volume flow, but at high-velocity. (eg. via high head).

Penstock: The enclosed pipe used to convey water to the turbines.

Power canal: The canals used to convey water to the penstock. These canals reduce the length of penstock required.

Rockfill weir: A control structure constructed with an impervious liner, e.g. sheet pile, and a gently sloping bank downstream consisting of packed boulders. (This is what currently exists at Surprise Lake.)

Storage Range: The difference in height between the highest and lowest water level of the reservoir required for the hydropower facility to operate (full supply level/low supply level).

Substation: Equipment reducing the high voltage of electrical power transmission to make it suitable for supply to consumers.

Tailrace: The water channel below a powerhouse, where water used by the turbines is released back into the system (e.g., river or lake).

Weir: A low dam built across a creek that is used to raise the water level upstream, e.g. the control structure at Surprise Lake is a weir to raise the water level in Surprise Lake.

Abbreviations

ABBREVIATIONS

AHEP – Atlin Hydro Expansion Project

THEL – Tlingit Homeland Energy Limited

XLP – Xeitl Limited Partnership

ATELP – Atlin Tlingit Economic Limited Partnership

TRTFN – Taku River Tlingit First Nation

MW – Megawatts

m3/s – Cublic Meters per second

Meet Our Team

Peter Kirby

President and CEO

Wáa sá i yatee.
Dleit kaa x'éináx Peter Kirby yéi xat duwasáakw. Ltaadooteen Lingít yóo xat duwasáakw. Terrace-x' kuxwdzitee. Ax tlaa, Anna Williams, yéi duwasáakw, Lingit x'einax Kinxkhashee yéi duwasáakw. Ax léelk'w, Elizabeth Nyman yéi duwasáakw. Lingit x'einax Seidayaa yéi duwasáakw. Yaniyadi naax xat sitee. Ax éesh George Franklin Kirby yéi duwasáakw. German, English ka Scottish áwé. Atlin-x' yéi xat yatee.

Hello
I am called Peter Kirby in English. my Tlingit name is Ltaadooteen. I was born in Terrace. My Mother is Anna Williams. Her Lingit name is Kinxkhashee. My grandmother's name is Elizabeth Nyman. Her Lingit name is Seidayaa. My Father's name is George Franklin Kirby. He is German, English, and Scottish. I live in Atlin.

I have lived in Atlin since 1998 serving TRTFN in various capacities including President & CEO of the Taku Group of Companies. Since the early 2000's, the corporate group has grown from three employees to include several companies and many more seasonal and full time employees. The Taku Group of Companies contributes in excess of $1M annually into the local economy. This has come about as a result of an incredible team of dedicated staff that includes: Stuart Simpson, Stephanie Routley, Caitin O'Shea, Jose Chill, Cyan Kim, Lars Johansson, Franclin Anto, Linda McGill, Darlene McGill, TJ Esquiro, and Eddy Feldman. TJ, Dave Parisien, and Eddy have kept our existing hydro project operating with 98% reliability for over a decade. The consistency and reliability of our whole team is nothing short of amazing. Atlin is blessed to have these talented and dedicated people working so reliably and consistently to build our local economy, to provide opportunity, and to do so with minds attuned to sustainability and long term benefits to our entire community.

The proposed hydro project provides opportunity for multigenerational sustainable growth like no other project. It provides opportunity for socio-economic reconciliation. TRTFN, and Atlin, will benefit from a decades long Energy Purchase Agreement and beyond when the next generation negotiates another Energy Purchase Agreement. Our staff listed above shows one way revenues are distributed throughout our community, through wages.

Other ways revenues from hydro projects help our community include provincial taxes and fees, as well as consultants, engineers, and many others who visit Atlin to work for The Taku Group of Companies who stay in local hotels, eat locally, purchase fuel locally, and often return for social visits. Additional investments from our existing hydro project have increased employment opportunities as Stuart outlines below. With the expansion project we can and will do more because it will provide more opportunity, for generations to come. THEL is proposing the project described in this guide, and the governments of BC and TRT will decide whether our proposed project will be approved. They will do that after consultation with citizens. In this guide, you have read what is proposed with discussion of impacts and benefits.

I am hopeful each of you will consider the full extent of the information with a mind to how we, and future generations, will sustain ourselves in Atlin and how we can not only sustain ourselves and future generations with this project, but we can also contribute to the reduction of Green House Gas emissions that will benefit the entire planet. TRTFN and Atlin can prosper while also making the world a better place to come.

Stuart Simpson
Senior Project Manager

Hi, my name is Stuart Simpson, and I have lived in Atlin since 1989. My children are TRTFN citizens, and I care greatly about Atlin. For most of the last 32 years I have been focused on economic development for our community, something I am very passionate about. I got into the field of economic development to help TRTFN and Atlin to become a healthier community, socially and economically. The socioeconomic fabric of a community is the basis for the health and well-being of a community and the people who live here.

The Taku Group of Companies were created for the purpose of economic development, including starting business ventures that create meaningful employment and create a source of revenues for the TRTFN to invest in business expansion, training, education and other goals the TRTFN may have in the future. The Group of Companies have grown over time, and now have 12 full time employees and over 50 seasonal employees some years.

In 2001 we started developing the first Atlin Hydro Project which led to the construction of the 2.1 MW hydro plant on Pine Creek owned by Xeitl Limited Partnership (XLP), which has successfully powered Atlin with clean energy since 2009. Not including the benefits during construction, that project has provided substantial benefits to the Atlin community and the TRTFN over the long term, in the form of profits (dividend benefits) that have been invested in TRTFN environmental goals, training programs, purchase of additional equipment and trucks in the corporate group, and the ability to create many jobs as a result.

I am often asked questions like "Why was the first hydro project built? Why are you doing this expansion project? How will Atlin benefit? Why does Atlin need this project if the power is all going to the Yukon? Why do you feel so strongly that this is a good project for Atlin?" The answer to all the questions is the same for me: It's for the economic benefits to Atlin.

We need to slow the economic leakage and bring more money and jobs into Atlin. One of the best ways to do this is to export something, preferably from a natural local resource that is sustainable. By using a natural clean energy resource as simple as water flowing down a creek, we can create electricity that can be exported, bringing significant amounts of money into Atlin over many generations. The fact that these projects are owned by a local entity means that all the profits generated from the projects stay in Atlin, rather than being taken by an outside owner to somewhere else.

This means Atlin benefits when the profits are invested in further development, creating more jobs, more training, and a healthier community as a result. I have seen this over the last 12 years from the existing hydro project, and I get pretty excited when I think about the even larger level of benefits that the Expansion Project could bring to Atlin through Tlingit Homeland Energy Limited Partnership (THELP).

Stephanie Routley

Environmental Permitting Coordinator

Stephanie Routley is the environmental permitting coordinator for THEL. She has been involved in the development of the Atlin Hydro Expansion Project since 2017, through the feasibility phase to the current detailed-design phase. During this time, she has coordinated baseline studies, public engagement, the development of permit applications, and the Clean Energy Development Plan, a project proposal and environmental and socio-economic assessment.

Stephanie will continue to engage with regulators and First Nation authorities as the Atlin Hydro Expansion Project advances through the permitting process. She looks forward to working with THEL's community outreach coordinator to engage with First Nations, the public and stakeholders during the review process, with the goal of making the final design of the Project and its construction one of which the community can be proud

"For me, the most exciting part of this Project is its contribution to the economic resilience of our community in an uncertain future—to be able to do that with a renewable resource while reducing our region's carbon footprint feels pretty good."

Caitlin Rose

Community Outreach Coordinator

Caitlin O'Shea joined the THEL Team this past November as the community outreach coordinator.

Caitlin lives in Atlin full time and is involved in many different levels of community as a Mother, Lingit Language Student/Teacher, as well as her position with THEL.

Caitlin is excited to be able to bring to the Taku River Tlingit First Nation citizens, shareholders and public the information they need to participate in the review of the proposed Atlin Hydro Expansion Project, and to understand its impacts and benefits to their home, community and livelihoods.

Caitlin looks forward to creating public display booths and open houses for all to feel informed and involved, and to the many connections that will be built through the upcoming public consultation and engagement process.

"It is extremely valuable to our team to work cooperatively within the community of TRTFN, Atlin, CTFN and Yukon. Your input is valuable and important to the work that we are doing."

TAKU Group of Companies Board

Caitlin O'Shea

Watsait

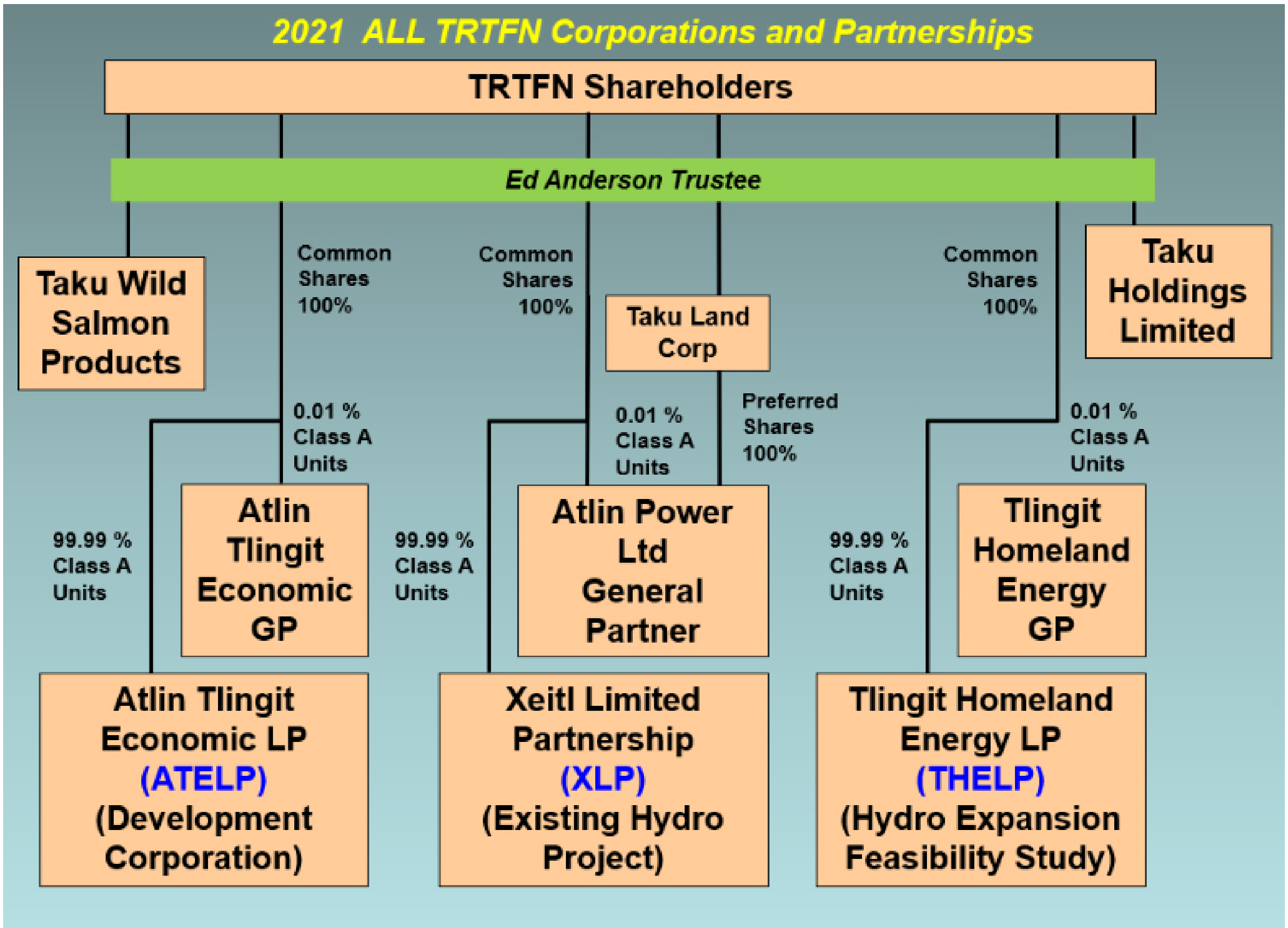
(Bryan Jack)

Yaandeteen

(George Esquiro)

Ltaadooteen

(Peter Kirby)



Atlin Hydroelectric Expansion Project

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