

An aerial photograph of the Kemano T2 Project site. The image shows a large industrial complex with several large buildings, parking lots filled with vehicles, and a winding road. The site is surrounded by dense green forests and steep, rocky mountains. A green semi-transparent box is overlaid on the left side of the image, containing the Rio Tinto logo and project information.

RioTinto

Kemano T2 Project

The Kemano T2 Project received approval from Rio Tinto's board of directors in December 2017.

Completion of a second tunnel will ensure the long-term reliability of the power supply from the Kemano Powerhouse, which powers Rio Tinto's BC Works smelter in Kitimat.

Construction of the project is expected to be complete in 2020.

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Welcome

On behalf of Rio Tinto, I am pleased to welcome you to Kemano and the Kemano T2 Project.

The Kemano T2 Project has a long history of planning, so it is with great excitement that we announced earlier this year that construction was underway to complete the second tunnel.

Construction of the project involves carving a tunnel by Tunnel Boring Machine through the mountains, which is a highly-skilled and technical feat. What is equally, if not more impressive, is the rugged, yet pristine environment that surrounds the project site.



The challenging nature of the project site brings with it an incredible set of responsibilities. At Rio Tinto, our people's safety is our core value. This extends to the safety of our host communities and the environment.

Therefore, as general manager for the project, I have assembled a dedicated team who will successfully deliver a project, and will place safety for their fellow workers and the environment as their greatest value along the way. They will also respect the traditional territory of our First Nations partners at all times.

We have also established a commitment to ensure local businesses and workers benefit from the project, in particular through contracting and employment opportunities. As you tour Kemano, the project site, and visit the camps, I encourage you to meet the workers, as many of them are local and have intriguing stories to share about working in this beautiful part of the world.

The completion of a second tunnel will mark the beginning of a new era for Rio Tinto in British Columbia. With the recent completion and start up of the \$6 billion modernised smelter in Kitimat, the second tunnel will complement Rio Tinto's state of the art aluminium production business by delivering clean, renewable, and stable energy to power the BC Works smelter for decades to come.

The finished product will be a truly sustainable operation for BC Works, something we at Rio Tinto are deeply committed to.

Yours truly,

Benjamin Fullerton, general manager, Kemano T2 Project
Rio Tinto Projects, Growth & Innovation

About Rio Tinto

Rio Tinto is the largest mining and metals business operating in Canada today, with around 15,000 people working at over 35 sites and operations across the country. As pioneers in mining and metals, we produce materials essential to human progress, around the globe. Canada is home to the global headquarters for Rio Tinto's aluminum business and some of the cleanest, most energy efficient and sustainable aluminum smelting facilities in the world. We're Canada's biggest private producer of renewable hydroelectric energy with facilities in British Columbia and Quebec, and a global leader in cold climate renewable energy at our Diavik Diamond Mine.

Our operations in British Columbia span more than 500km from the smelter in Kitimat to our vast hydroelectric assets in the Nechako Reservoir.



Our operations in British Columbia span more than 400km from the smelter in Kitimat to our vast hydroelectric assets in the Nechako Reservoir.

BC Works

Rio Tinto has been operating in British Columbia for nearly 65 years. With our recent \$6 billion investment in the modernisation of the BC Works smelter in Kitimat, we have secured decades of economic prosperity in northwest British Columbia. With industry leading technology and four generations of employee expertise, as well as our hydropower facility at Kemano and the Nechako Reservoir, the Kitimat smelter produces aluminum with one of the lowest carbon footprints in the world.



History of Kemano and the original tunnel

The Kemano Second Tunnel Project (T2 Project) will sustain and further enhance Rio Tinto Aluminium's enviable Kemano asset, which is integral to the sustainable operation of the newly modernised \$6 billion BC Works aluminium smelter in Kitimat.

BC Works depends on the guaranteed availability of a stable supply of electricity that Kemano and the Nechako Reservoir provide, and is key to Rio Tinto's ability to produce aluminium with one of the lowest carbon footprints in the world.

To connect the powerhouse to the reservoir, a 16-kilometre tunnel was bored through Mt. Dubose in the 1950s. During the construction, more than 1,000 men worked around the clock tunneling through solid rock from both the east and the west, eventually breaking through in the middle and allowing east and west to exchange a handshake.

The tunnel is as wide as a two-lane highway and took 20 months to complete. It is unique in that it allows water to plunge 800 metres, or (2,600 feet) from the Tahtsa Lake intake through two penstocks to the Kemano powerhouse – creating a head that is 16 times the height of Niagara Falls.

To this day it remains the highest head at any power generation facility in North America, offering very cost efficient power production for a relatively low volume of water.



Historical construction photos
and the townsite of Kemano

Kemano T2 Project

A second tunnel has been part of Rio Tinto's long term planning for several decades. In fact, infrastructure for a potential future second tunnel was constructed as part of the original project.

Unlike other parts of Kemano's infrastructure that can be turned off, shut down, and repaired as necessary, the original tunnel cannot be turned off without shutting down Kemano and aluminium production in Kitimat.

The Kemano T2 Project is the second and final phase of a project that envisions the completion of a second 16km tunnel. The current and final phase includes the excavation of 7.6km of new tunnel, and the refurbishment of a 8.4km portion of the second tunnel that remained from the mid 1990s.

Phase 1 required a 50 per cent shutdown of Kemano in order to construct the interconnections between the previously excavated part of T2 and the existing T1 penstocks. This work could only be done before the modernised smelter was completed, therefore it was critical to make sure Phase 1 was completed by 2013.

The Kemano T2 Project will ensure the long-term, sustainable operation of Rio Tinto's aluminium business in B.C. The second tunnel will allow Rio Tinto to conduct repairs and maintenance on the existing tunnel without shutting down Kemano and Kitimat operations.



2018 - TBM that will complete the second tunnel arrives at Horetzky Landing



1988 - Partial completion of second tunnel by tunnel boring machine (TBM)

1951	Construction of the Kemano Powerhouse and original tunnel begins
1953	Construction crews meet in the middle of Mt. Dubose, completing the first tunnel
1958	Partial collapse in the Kemano tunnel
1961	Second partial collapse in the Kemano tunnel
1979	Proposal for Kemano Completion Project (KCP) announced
1988	Construction of KCP commences including partial completion of a second tunnel
1995	KCP cancelled by provincial government
2000	Village of Kemano demobilised with Kemano work camp remaining
2010/11	Detailed engineering studies including underwater submarine inspections on original tunnel
2011	Final Notice to Proceed on \$6 billion Kitimat Modernisation Project
2012	Regulatory approval for second tunnel project (Phase 1)
2013	First phase of second tunnel project completed (penstocks)
2015	Start up of modernised smelter in Kitimat
2016	Permitting and engineering for next phase of second tunnel project (Phase 2)
2017	Rio Tinto board of directors approves \$600 million funding for completion of the Kemano T2 Project (Phase 2)
2018	Rio Tinto announces selection of main contractor for the project, Frontier-Kemper Aecon
2018	Project construction starts

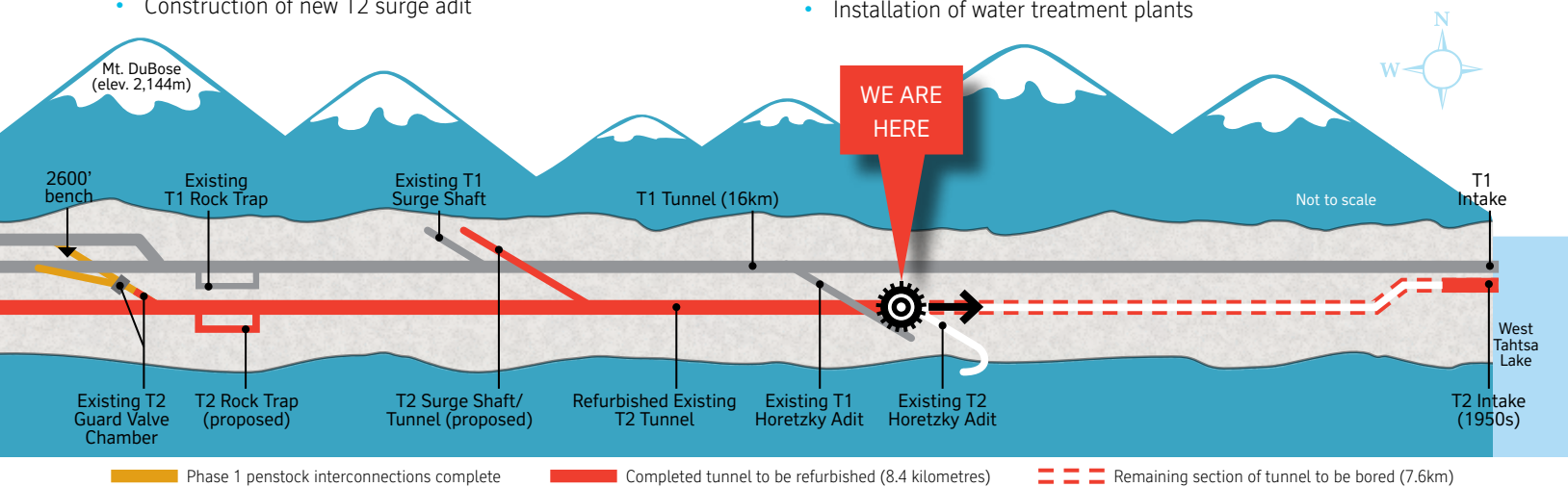
Project scope

The majority of the Kemano T2 Project involves excavating a new 7.6km portion of tunnel and refurbishing an existing 8.4km portion of the second tunnel to complete the 16km long tunnel to the existing penstocks.

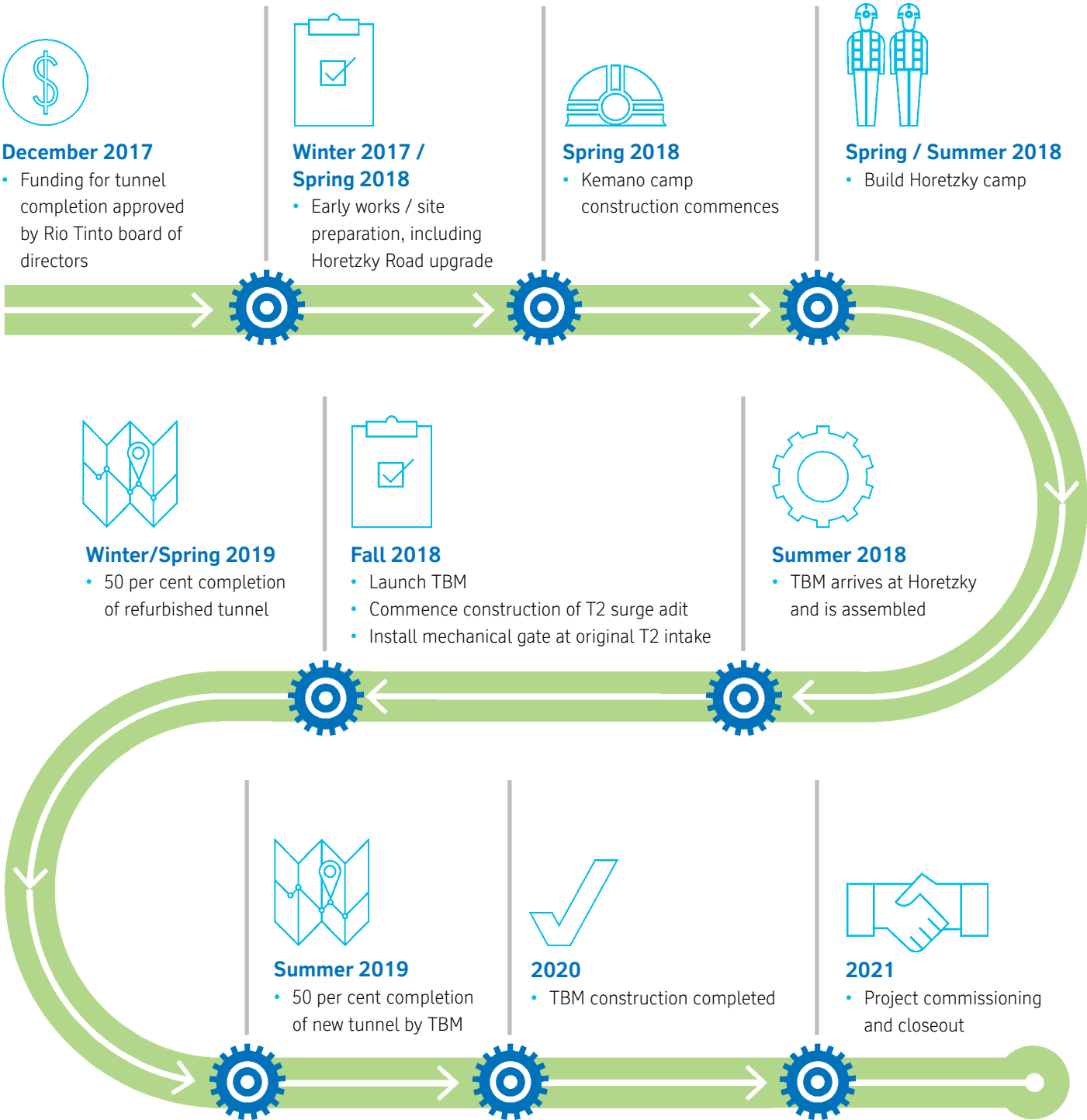
A mechanical gate will be installed at the existing T2 intake at Tahtsa Lake, which will also have a lower environmental footprint than building a new intake.

Ancillary infrastructure is also required to support project construction, including:

- Temporary worker camps at Kemano, Horetzky and Tahtsa Lake
- Upgraded road to Horetzky to support safe transport of equipment and crews
- Construction of new T2 surge adit
- New road to 2900 level bench area to support safe transport of equipment and crews
- Upgrades to Kemano Beach infrastructure
- Installation of water treatment plants



Schedule



Welcome to Kemano

Located 75km southeast of Kitimat, Kemano is only accessible by air or water.

The main project camp is being constructed at Kemano, where the majority of workers will be housed. Offices are also being constructed at Kemano to create a 'headquarters' for the project team and for our main contractor to oversee project construction.

Workers and project team members arrive to Kemano generally by a crew boat, which departs Kitimat on scheduled trips. Workers complete a fourteen days on/ seven days off shift.



History of Kemano

Beginning in 1952 and lasting until 2000, the Village of Kemano was home to approximately 280 people. It was a fully self-contained town featuring family homes, an apartment complex, grocery store, restaurant and lounge, post office, hair salon, medical clinic, elementary school, daycare and church. The town also boasted several recreational facilities including ski hill, Rod and Gun Club, giftshop, horses, curling rink, bowling alley, swimming pool, ball and soccer fields, and a sand green golf course.

Those who called Kemano home during these years recall it as a wonderful place to live and raise a family. There was a tremendous sense of community and looking out for one's neighbours.



Meet our main contractor and EPCM



Main contractor

Frontier-Kemper Aecon (FKA) was selected by Rio Tinto to deliver the majority of the construction scope. As main contractor, FKA is responsible for hiring and managing the various subcontractors and employees who will be required to construct the project.

FKA is a Joint Venture between Frontier-Kemper Constructors and Aecon, two widely respected companies in the field of construction management and civil engineering. Together, they have successfully executed several complex and technically-challenging mining and tunneling projects across the country and around the world.

Rio Tinto is working with FKA to ensure the maximum involvement of First Nations, and local and regional businesses and workforce in the project, subject to qualifications and availability. Projects in BC include the Waneta Hydroelectric Expansion Project (Trail), Seymour Capilano Twin Tunnel Project (North Vancouver), and the John Hart Powerhouse Replacement Project (Campbell River).



HATCH EPCM contractor

Rio Tinto has also engaged Hatch Ltd. in an Engineering, Procurement, Construction Management (EPCM) role to manage project delivery. The role of the EPCM contractor is to coordinate the design, procurement and construction work and ensure that the project is completed as required and on time.

Hatch has a long history working with Rio Tinto and on planning for the Kemano T2 Project, including executing feasibility studies and providing engineering services for Phase 1.





tl'ughus the TBM



The Cheslatta Carrier Nation and the Haisla Nation are participating with Rio Tinto on the Kemano T2 Project, including ensuring their cultures and traditions are respected as we undertake construction of the project.

In preparing for the project, Rio Tinto invited the Haisla Nation and Cheslatta Carrier Nation to assist in designing the cutterhead for the tunnel boring machine (TBM) and providing it with a name that reflects their culture.

Rio Tinto, together with our contractors and workers who will help build the Kemano T2 Project, shall respect the traditional territory of our First Nations neighbours, including their cultures and beliefs, as we work alongside the legendary tl'ughus.

The legend of tl'ughus

The mountains and landscape around the Nechako Reservoir used to be home to a legendary giant monster snake. The snake, known as 'tl'ughus', travelled from lake to lake by boring through the mountains, including Mount Dubose. The openings created by the snake allowed fish to pass from lakes on one side of the mountain to lakes on the other side. The Cheslatta Nation selected the name for the TBM – "tl'ughus" – as it shares many parallels with the Kemano T2 Project. Variations of the legend of "tl'ughus" are shared with Carrier communities across the region. The Haisla Nation also share a similar belief.



Rio Tinto's Jennifer Campeau with the TBM artwork contestants, including winner Ali-Anna (at right).

Designing the TBM cutterhead

Several students from the Haisla Community School participated in a contest to design the artwork that would eventually be placed on the TBM. Twenty-one submission were received, and the winning design was created by grade six student Ali-Anna Wilson. Ali-Anna's design portrays several important figures in Haisla tradition, including the raven, oolichan and the northern lights.

"Every night the chief went to his pond fishing for oolichans that he kept hidden from everyone else. One night the raven flew across his pond and the reflection of the fish caught his eye. The raven flew down and took the oolichan. When the moonlight shined on the oolichan's pretty colours, the northern lights started. The raven got scared and dropped the oolichan in the ocean outside Kitamaat Village. When the oolichan landed in the ocean it multiplied and people of the north kept fishing for oolichans."

- Ali-Anna Wilson

Avalanche control

Protecting our workers and the project site is our top priority. Project construction will occur between 2018 and 2020 – through two winter seasons where temperatures sit around minus -10 degrees Celsius and avalanches are common.

These missions involve avalanche technicians using helicopters to access areas of the mountain that present avalanche risk (built up snow, structural weakness in the snow pack). When they reach these locations they use explosives to generate a controlled release of the avalanche.

As part of the avalanche control program, Rio Tinto is installing a Gazex system – a powerful, remote-controlled avalanche control system – atop Horetzky Mountain to mitigate avalanche risk during project construction.

Leading the way to protect the environment

Mountain goats are a protected, sure-footed climber commonly seen on the cliffs and ice in and around the project site.

With mountain goats extremely sensitive to disturbances, and with tunnel construction potentially requiring up to 84-avalanche control missions, the environment team had to carefully consider how to protect the goats. It was important they did not become displaced, channelled into avalanche areas or experience heightened stress – each of which could prove fatal, particularly during the critical winter and rearing months.

Following the advice of a respected local wildlife biologist, the environment team has introduced a number of controls to safeguard the goats. These include: aerial occupancy surveys of goat locations each winter; environmental monitoring and avalanche technicians tracking mountain goat occupancy and nanny-kid ratios through a wildlife sightings program and frequent counts; and restricted avalanche control helicopter flight paths, which would be altered or delayed should goats be located within the planned helicopter flight path.

Although construction is only just underway, so far the program is working well, with government regulators saying Rio Tinto's monitoring controls are leading research into the interaction between avalanche control and mountain goats and helping to build the Province's scientific knowledge of mountain goat behaviour.





1 Early works – To ensure the site is ready for the launch of the TBM, several ‘early works’ activities were undertaken throughout 2017 and 2018, including installation of culverts while upgrading Horetzky Road, a critical link from Kemano to the tunnel boring activities.

2 Avalanche control – Gazex system – a powerful, remote-controlled avalanche control system – is being installed atop Horetzky Mountain to mitigate avalanche risk during project construction.

3 Safety first – All personnel, from management to day labourers, are required to undertake inductions when they arrive at site. Rio Tinto’s Graham Geeraert, provides an overview to the workers on health and safety protocols, environmental requirements, cultural awareness training, and more.

4 Inside the T2 Adit – The TBM will be launched from the existing T2 Adit at Horetzky Landing. Crews recently investigated the adit to develop the final tunnelling plan, which will be implemented in late 2018.

5 Protecting the environment – Mitigating our impact on the environment is a key focus during construction. As part of the Horetzky Road upgrade, exclusion fencing was installed to provide migratory access for coastal tailed frogs and western toads, at-risk and protected species in British Columbia.

6 Horetzky Landing – Horetzky Landing has been prepared to accommodate construction activities associated with tunnel boring. A temporary camp has also been constructed to house workers and the project team overseeing the work.

Project by the numbers

7.6

Length of
newly excavated
portion of
second tunnel
by TBM

300

Workforce at
peak construction

2020

Expected project
completion

8.4

Refurbished
portion (km)
of 1990s
second
tunnel

16

Length (km)
of completed
second
tunnel

190

Length in
metres of
the TBM

3

Number
of worker
camps

250,000

Volume (m³)
of rock to be
excavated

RioTinto

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