



Minton Lake Dam Rehabilitation

2021 Canadian Consulting Engineering Awards

HATCH

Project Name: Minton Lake Dam Rehabilitation

Location of Project:

City: **Williams Lake**
Province: **British Columbia**
Country: **Canada**

Category: **E. Natural Resources, Mining, Industry & Energy**

Entering Firm

Firm Name: **Hatch Ltd**
Street Address: **1066 West Hastings Street, Suite 400**
City: **Vancouver**
Province: **British Columbia**
Postal Code: **V6E 3X2**

Completed By: **Nikou Jalayeri**

CONTACTS INFORMATION

Contact #1 (Communications/Marketing/Public Relations)

Name: **Lisa Novich**
Phone: **360-682-7288**
Email: **lisa.novich@hatch.com**

Member of Association of Consulting Engineering Companies? **Yes**

Contact #2 (Management/Administration)

Name: **Rajib Ahsan**
Phone: **778-655-5807**
Email: **rajib.ahsan@hatch.com**

Contact #3 (Project Engineer)

Name: **Nikou Jalayeri**
Phone: **604-689-5767**
Email: **nikou.jalayeri@hatch.com**
P.Eng: **Yes**

Project Summary:

BC Ministry of Forests and Natural Resources (FLNR) owned the Minton Lake Dam which had significant deficiencies. They hired Hatch to do preliminary and final design as well as on-site construction inspection services. Hatch needed to make sure the reservoir stayed operational and access to the dam was maintained. Hatch devised a design plan that minimized environmental impact, protected the downstream communities, used local sources of materials where possible, and improved ease of maintenance.



Grading of the approach to the new dam, looking upstream

Project highlights

Innovation

Minton Lake Dam was constructed in 1941. Recent studies identified multiple safety deficiencies in the existing dam and ancillary structures. BC Wildfire Service (BCWS) and FLNRO collaborated with Hatch to develop a replacement option that would ensure the reservoir would continue to have available water during the fire season (April/May to September). Water from the reservoir is used as an emergency water source to provide water supply to the air tanker base and mixing with fire retardant foam for aerial water bombers.

The team decided to build a new earthfill embankment 35m downstream of the old dam. The old dam was the cofferdam for the new construction. In July 2022, when the new structure was completed, the old dam was breached. The reservoir returned to regulation level very quickly.

Hatch demonstrated that rehabilitation of the old dam would affect the water needed by BCWS and the longevity and safe operation of a rehabilitated dam would not be acceptable which indicated the need for the construction of new dam. Bedrock at the Minton Lake site was found very low but the dam site was underlain by a dense glacial till which was considered suitable for earthen dams and structures not sensitive to settlement. These conditions led Hatch to select a rockfill lined spillway with cutoff wall. The location was chosen to allow for the new dam to be constructed as close to the existing structure as possible. This minimized the size of the construction area and reduced the amount of additional impoundment required and facilitated care of water during construction. The new structure was designed to safely pass water through its overflow emergency spillway during the freshet season without a requirement of manual gate operation which avoids any chance of dam failure by un-intentional overtopping.



Old Minton Lake dam spillway

The new crest centerline was oriented roughly parallel to the longitudinal axis of the existing dam, across Minton Creek, on an approximate northeast to southwest alignment maintaining the relatively similar approach as the old dam. The complex construction season was exacerbated by sub-zero temperatures from November to April. The placement of impervious materials in the dam was scheduled carefully because the cost of moisture adjustment is prohibitive during cold temperature and during snow/rainfall.

The new Minton Lake Dam was successfully constructed prior to the spring freshet 2020 which allowed for the high flows that were observed through the region that year to pass through safely.



Old Minton Lake dam

Complexity

The design and construction schedule was developed for the new dam to be commissioned in a timely manner for safety of the community downstream of the dam as well as to protect the reservoir for BCWS use.

Fire season in this area is from early spring to mid fall and sub-zero temperatures occur from mid fall to early spring. Bird nesting season, fish spawning, sensitive wetland habitat and proximity to population immediately downstream made the construction challenging. As the dam serves an essential service to this region, a replacement option would have to meet the most recent safety guidelines and be designed, approved, and constructed on a fast-tracked schedule.

The absence of reachable bedrock could have created a condition where conventional concrete spillways were not suitable without rigorous foundation preparation including deep foundations. Instead, Hatch selected a cost-effective method of utilizing the existing glacial till foundation to host the overflow spillway with a central cutoff wall and used conventional riprap for erosion protection. Since the glacial till contained boulders and cobbles, Hatch proposed foundation replacement to allow sheetpile driving. An easily accessible manhole style chamber was designed to provide a means for ease of operation and maintenance of the low level outlet.

The selection of the preferred option required the weighing of many criteria and became complicated for Hatch, the Client, and the Client's consultant so Hatch developed a multi-criteria assessment analysis tool to evaluate and rank the proposed options. With this tool, the Client could confidently select the preferred option.



Sheetpile installation

Social and/or Economic Benefits

This dam was originally built using unknown construction methods by local ranchers and before dam safety guidelines were in place. Prior to this project, the community downstream was at risk of flooding caused by an unexpected dam failure. In addition, BCWS was at risk of losing their source of water for fighting wildfires.

The new Minton Lake Dam was designed and constructed to meet the BC Dam Safety Guidelines and the design was approved by the local Dam Safety Officer. The new structure was designed to meet its intended use for the BCWS which requires the reservoir levels to be maintained during the wildfire season. The new structure also provides a safe structure for the downstream community.

The original reservoir water level was maintained following the construction which allowed the local use and land impoundment to be maintained. The new dam is considered safe for the public since no elevated structure was constructed or concentrated water flow was created which could endanger the public. In addition, the new structure is designed to safely pass water through its overflow emergency spillway during the freshet season without a requirement of manual gate operation. The removal of the manual gate operation requirement avoids any potential unintentional overtopping of the structure should no staff be on site during the emergency. Overtopping could cause dam failure.



Grading of the till layer of the new Minton Lake dam



Placement of filter material, looking downstream. Inlet of the low level outlet



Sheetpile installation completed, preparation for riprap placement

Environmental Benefits

The location of the new dam was selected to minimize the disturbance to the environment during construction. In addition, under the assumption of potential presence of fish, the riprap spillway was designed to prevent stranding and to provide vegetative cover and slow velocity. This design provides a more fish and wildlife friendly condition because it reduces the risk of injury and predation.

The design of the new dam is considered sustainable. The earthen structures used the glacial till produced during excavation as the main water barrier element with minimal cutoff wall use. All the other construction materials were produced locally through the pits or quarries and were considered environmentally suitable and sustainable. Future maintenance will require use of similarly local material and common methodology so that it can be done by local construction companies and will not require the mobilization of specialty contractors.

The additional land impoundment was limited to the immediate area, just 35m downstream of the existing dam. The new dam was designed to minimize the impact on the environment with consideration on keeping the reservoir levels similar in order to avoid addition overland flooding.



View of old Minton Lake dam which was used as a coffer dam during construction of the new dam



Grading of the riprap layer, outlet of the Low level outlet

Meeting Client's Needs

The process of selection of the preferred dam option was carried out with the Ministry of FLNRORD

Hatch developed and used a multi-criteria assessment matrix as a tool to evaluate and rank the proposed options to assist with selection of the preferred option. With this tool, project team and the client were able to select their preferred option. The client could comfortably weight and rank various options such as cost, safety and durability, environmental and social impacts, ease of operation and maintenance, source of local construction materials, public access, and safety among others.

Hatch provided professional services and support to FLNR throughout the option selection, design, and construction services of the Minton Lake Dam. Hatch's project team acted as owners and worked with FLNR to ensure the new Minton Lake Dam met its intended use and the requirements of the dam safety guidelines.



New Minton Lake Dam, looking downstream



Grading of the riprap layer



Breach of the old dam



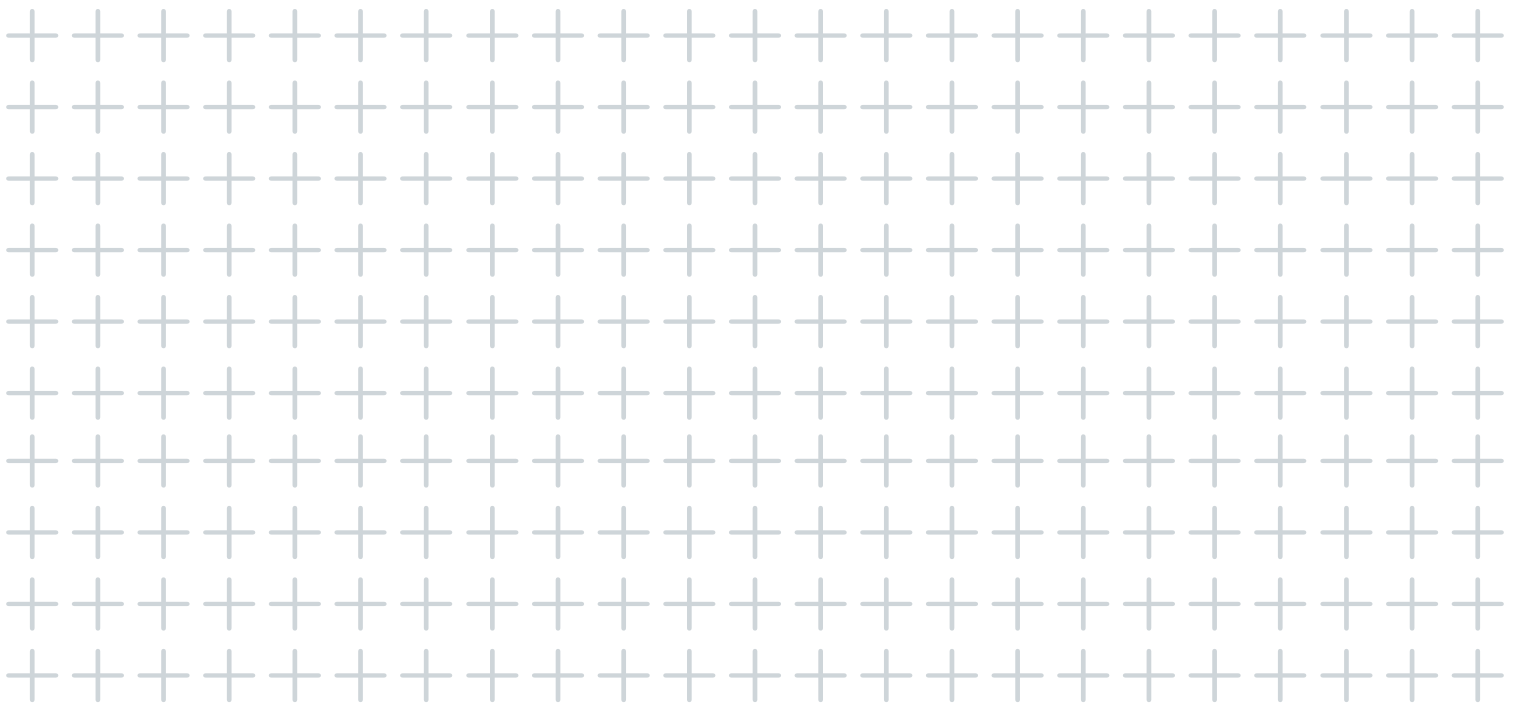
New Minton Lake Dam spillway, looking downstream



New Minton Lake Dam, looking upstream



Clearing the area at the location of the foundation of the new dam, looking upstream / the old Minton Lake dam is being used as a coffer dam



Appendix A

Client's consent approval

HATCH



Suite 400, 1066 West Hastings Street
Vancouver, British Columbia, Canada V6E 3X2
Tel: +1 (604) 689 5767 www.hatch.com

March 2nd, 2021

Gilles Clement-Reynier

BC Wildfire Service
Ministry of Forests, Lands, Natural Resources
Victoria, BC

RE: Request for Approval of Inclusion of Request for Approval of Submission of Hatch Work at Minton Lake

Dear Gilles,

Every year the Canadian Consulting Engineer magazine provides a platform for consulting engineering firms to showcase their work. Member companies submit synopses of significant and/or interesting projects and winners are published in a special edition of the magazine. Over the years, Hatch has had numerous project awards through this contest and this year we would like to submit our work at Minton Lake Dam.

I have attached the write-up we would like to submit. Would you please review it and if it is acceptable to you, please give us your permission to submit by signing the statement below.

Sincerely,

A handwritten signature in black ink, appearing to read "Nikou Jalayeri".

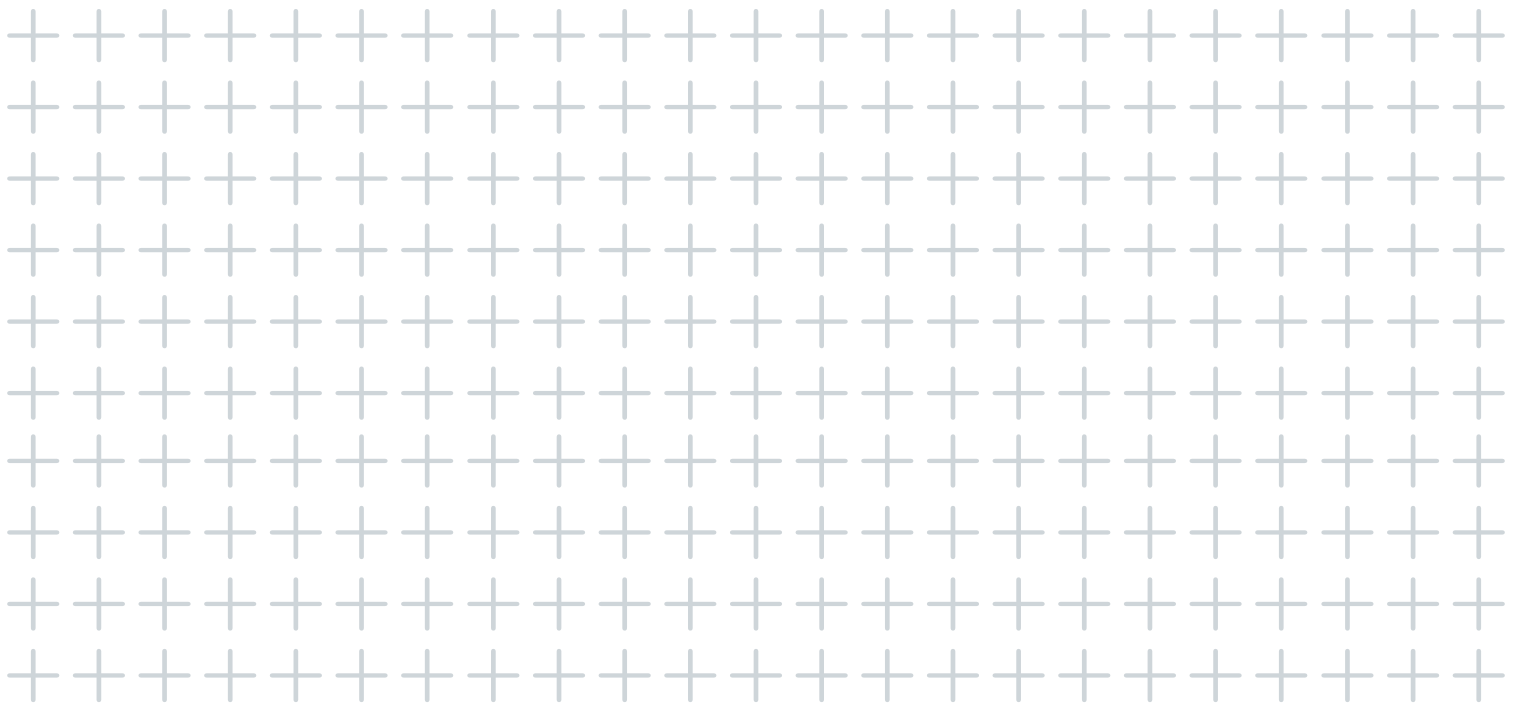
Nikou Jalayeri

To Whom it May Concern:

I have reviewed Hatch's proposed submission for CCE Magazine. I have reviewed their writeup and they have my permission to use this project.

Gilles Clement-Reynier, Senior Engineering Specialist

Signature:  Date March 2nd 2021.

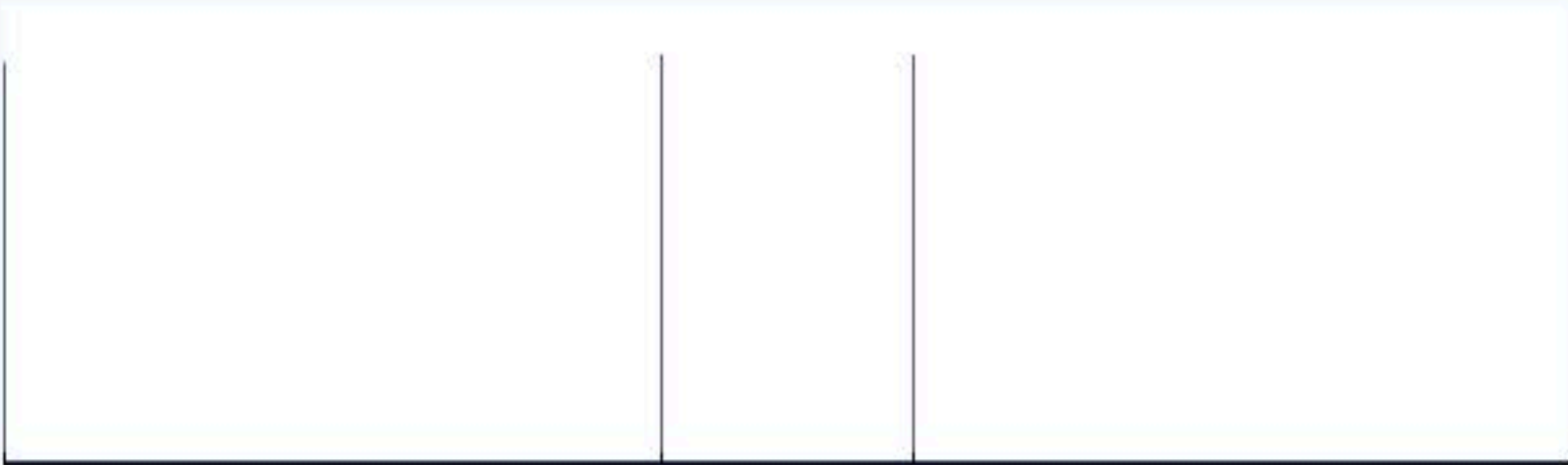


Appendix B

Payment receipt

HATCH

To: Novich, Lisa <lisa.novich@hatch.com>
Subject: Your Annex Business Media receipt [#1504-5996]



Receipt from Annex Business Media

Receipt #1504-5996

AMOUNT PAID	DATE PAID	PAYMENT METHOD
C\$393.75	February 26, 2021	<input type="checkbox"/> 7312

SUMMARY

Payment to Annex Business Media	C\$393.75
Amount charged	C\$393.75

If you have any questions, contact us at sbradshaw@annexbusinessmedia.com or call at [+1 800 265 2827](tel:+18002652827).

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