



Chaudière Falls Hydroelectric Redevelopment Project

Canadian Consulting Engineering Awards

HATCH



Project objectives, solutions, and achievements

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The Chaudière Hydroelectric Redevelopment Project entailed the retirement of two existing hydroelectric generating stations (GS) on Chaudière Island in the Ottawa River in Ottawa, Ontario, and the development of a new larger facility.

Hatch was involved in all aspects of the project, from planning, procurement, environmental permitting and approval through to engineering and construction management. The team consistently exceeded our client's expectations. An initial design that had been optimized by Hatch made it possible to boost annual energy-production estimates and improve site accessibility in line with Energy Ottawa's vision for the site. Changes to the overall execution approach helped reduce the project's development costs, enabling it to be delivered close to the baseline project schedule. In addition, design changes were implemented to reduce fish and eel mortality, enhance fish spawning, and facilitate environmental data collection. These actions greatly reduced the environmental footprint of the new facility and will provide a platform for data collection and research going forward.



Innovation

The Chaudière project houses the largest-capacity EcoBulb turbines installed anywhere in the world. The EcoBulb is a proprietary turbine design utilizing permanent magnets developed by Andritz Hydro.

Designing the overall project while working with vendors to address client, utility, and design questions associated with the electrical and mechanical components of the scope was challenging, given that certain aspects of the system or components were first-in-kind.

Energy Ottawa's idea of providing unfettered public access to the site and Chaudière Falls itself required a complete design change at the start of the concept phase. Initially, the site development had an above-ground powerhouse. However, this was reworked to align with the client's vision. The facility is now below grade and, combined with the newly constructed park, showcases the sweeping vista of the natural falls. Achieving this, however, along with the other project requirements, was a design challenge for the team.

The environmental constraints and land-use requirements imposed on the project were significant. Limits on fish and American eel mortality forced the design team to develop both a protection system to prevent entrainment and a bypass system to allow both upstream and downstream migration. The downstream eel-migration system is a first-of-its-kind in Canada. Trash racks covering 480 square metres of flow area upstream of the facility are changed twice a year. The narrow-gauge racks are used during the eel-migration period.

Construction Management

On behalf of the owner, the Hatch project team provided construction management services on-site for the duration of the construction phase. The services included contractor management and extended to coordinating the supply contractors and their scope of work regarding delivery and ongoing construction works.

The progress of the construction work was monitored to ensure it conformed to specifications. All non-conformities that were identified were tracked through a non-conformance register (NCR) process until a resolution was reached. Hatch set up and managed the project's change-order process, including the monitoring of work, the process for payment approvals, and the issuing of certificates to Energy Ottawa for payment. At completion, Hatch was responsible for awarding substantial completion status, working with the contractor to develop the deficiency lists and closing out the project from both a technical and financial perspective.

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Figure 1: Powerhouse construction starting following excavation



Contribution to Social and Economic Quality of Life

Hatch led the permitting and approval component of the project and lent support to Energy Ottawa as it spearheaded the community-engagement aspect. The new generating station now includes a new pedestrian access bridge and walkway, several lookout platforms, and a public-use area with landscaping that recognizes the Aboriginal cultural heritage and industrial aspect of the site.

First Nation Support

Energy Ottawa led the process of open discussions with the local First Nation communities. These discussions led to various design changes to the overall project layout. The project team developed a thorough understanding of the First Nation's key values and their traditional decision-making processes. The ideas brought forward were incorporated into the project and Energy Ottawa ultimately received the requisite First Nation support.

Public Access to the Site

The project features multiple safe-viewing platforms and greater public access and a defined pedestrian corridor on the roof of the new hydro facility. A new bridge stretches across the intake canal and is open for

pedestrian and cyclist traffic and to provide direct access to the falls. For the first time in more than a century, Chaudière Falls is open to the public.

Safety Compliance

The general contractor managed the overall site safety program. Hatch's role was to ensure contractor compliance programs met the client's specific requirements. There were no LTIs on the project with over 600,000 hours worked.

The project development provides strong evidence that projects, if executed correctly can result in a win-win result for the Owner and Community at large.



Complexity

During the permitting and approval phase, design changes required to address newly imposed environmental requirements. Ideally, these requirements would have been identified before the design phase work began; however, project schedule constraints required that the design and approval work happens concurrently. As project conditions changed, excellent communication between the Hatch Energy Ottawa team and the agency teams allowed the design work to be fast-tracked with minimal rework.

The spring flood

Complexity was not limited to design. The spring of 2017 was extremely wet. The high flows brought new and unexpected challenges to the Chaudière project team. Flood water started to lap at the crest of the downstream rock plug that was protecting and maintaining a dry construction site. Planning, coupled with excellent site coordination between the contractor, Energy Ottawa and Hatch, limited the negative impact of this extreme flood event on the overall progress of the project.

The dissolution zone

The geology of the Chaudière project site is challenging. Although field investigations were undertaken in the design stage, one specific feature, locally referred to as the “fault zone”, traversed obliquely across the intake channel and extended through the project site and into the Ottawa River. As the intake channel excavation progressed, it became apparent that the “fault”, correctly known as a dissolution zone, directly linked the Ottawa River to the dewatered project site. This dissolution zone, although not more than three-metre-wide, required careful and staged construction to limit the potential impact.

Environmental Benefits

Reducing the environmental footprint of the project and ensuring environmental sustainability with the operating facility were all aspects of the client's stated vision for the site.

Reduced environmental footprint

Design changes were implemented to reduce fish and eel mortality, to enhance the environmental footprint of the facilities, and to provide a platform for data collection and ongoing research.

In a parallel process, Hatch worked with the permitting and approval agencies of three levels of government to define their requirements and secure the project approval. A detailed permitting-and-approval-tracking register was prepared and maintained.

Limits on fish and American eel mortality forced the design team to develop both a protection system to prevent entrainment and a bypass system to allow both upstream and downstream migration. The downstream eel-migration system is a first-of-its-kind in Canada and diverts eel from the intake channel into bypass pipes that discharge into the tailrace. The upstream bypass, to be optimized over the next five years, will attract and provide safe passage along an eel ladder already incorporated into the facility.

The tailrace design was modified so that spawning beds could be developed thereby improving the natural spawning conditions in the Ottawa River.

Outdoor equipment and lighting required for the facility operation was designed and selected to minimize the noise and impact on the overall area. The island and the adjacent lands are part of a future mixed-use development.

Meeting Client's Needs

Energy Ottawa retained Hatch through an Engineering Procurement and Construction Management (EPCM) agreement to coordinate all design, procurement and construction work related to the Chaudière Falls Hydroelectric Redevelopment Project. Energy Ottawa required Hatch to plan, design and execute the project, such that it could be constructed safely in the short time available prior to the onset of the Power Purchase Agreement. In addition, the design needed to adapt to address specific agency requirements throughout the permitting and design period.

The client's needs are summarized as follows:

1. Design and manage construction within budget
2. Meet schedule requirements
3. Improve public access
4. Minimize the environmental footprint
5. Execute Safely

The team consistently exceeded our client's expectations. An initial design that had been optimized by Hatch made it possible to boost annual energy-production estimates (#1) and improve site accessibility (#3). Changes to the overall execution approach helped reduce the project's development costs (#1), enabling it to be delivered close to the baseline project schedule (#2). In addition, design changes were implemented to reduce fish and eel mortality, enhance fish spawning, and facilitate environmental data collection (#4). These actions greatly reduced the environmental footprint of the new facility and will provide a platform for data collection and research going forward (#4). The project commissioning was marginally behind schedule due to site conditions and extremely high flow condition experienced during construction (#5). All the construction was completed while meeting safety objectives (#5).

The success of the Chaudière project is highlighted in the excerpts below. The Energy Ottawa-Hatch team delivered a complex engineering assignment and construction project within budget, and the infrastructure will remain a lasting legacy for generations to come.

“While undertaking the Chaudière Falls expansion project, one of our primary goals was to create a beautiful public space that can be enjoyed by residents and visitors of the National Capital Region. The opening of Chaudière Falls has been a collaborative process, executed with great care, trust and thoughtfulness on behalf of all parties. We are excited to share it with you today.”

**Bryce Conrad, President and CEO
Hydro Ottawa Group of Companies**

“Hydro Ottawa’s Chaudière Falls expansion is a perfect example of Ottawa’s leadership, and it represents an important infrastructure expansion for this community. I applaud Hydro Ottawa for their vision, and look forward to benefits our community receives from this project. Congratulations to Hydro Ottawa for project completion and for their continued leadership towards a clean and affordable electricity system.

**Bob Chiarelli,
Ontario Minister of Infrastructure and MPP for Ottawa West-Nepean**

“The Chaudière Falls are one of the region’s most impressive and beautiful natural landmarks, and an important part of First Nations culture. Thanks to Hydro Ottawa, the public will be able to experience these historically significant falls for the very first time, and for many generations to come, as an important legacy of Canada’s 150th anniversary.”

**Jim Watson,
Major of Ottawa**

