# HYDRO MODERNISATION

CASE STUDY

## Blind Slough, Alaska, USA

GILKES

CASE STUDY

# Blind Slough, Alaska, USA

## KEY INFORMATION

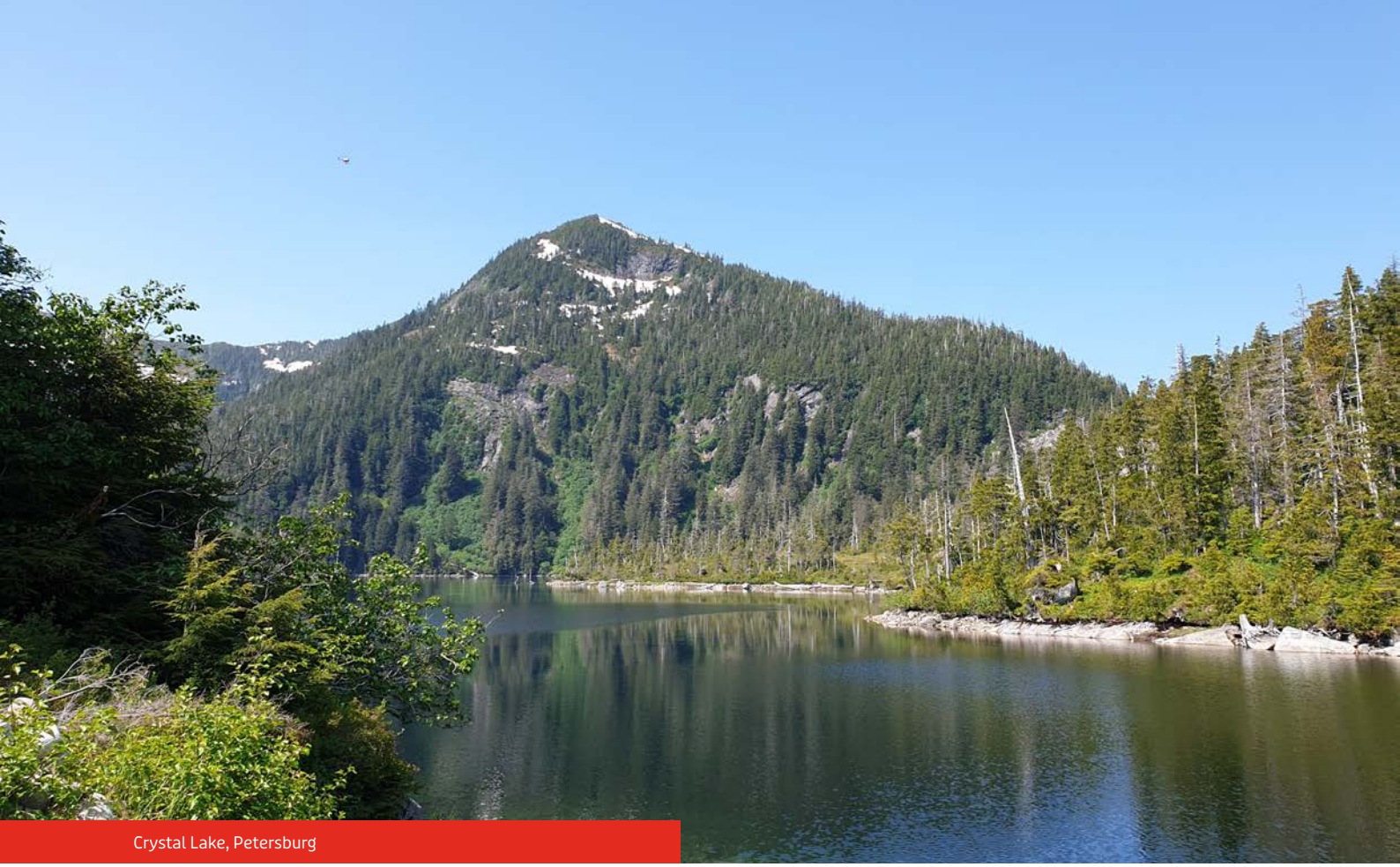
| | |
|---|---|
| Customer: | Petersburg Municipal Power & Light |
| Net Head: | 361 metres |
| Flow: | 708 litres/sec |
| Turbine type: | Gilkes Twin Jet Pelton |
| Number of Turbines: | 1 |
| Power (kW): | 2197 |
| Dia: | 850 mm |
| Speed: | 900 rpm |

## ORIGINAL INSTALLATION / MODERNISATION

| | |
|---|---|
| Original Installation: | 1921 |
| Original Turbines: | 2 x 400kW Pelton |
| | 1 x 1600kW Pelton |
| Modernisation: | Replanted 2024 |

## SCOPE OF MODERNISATION SUPPLY

- 2197kW Twin Jet Pelton Turbine
- 850mm Runner
- HPU with onboard control panel
- Main Inlet Valve
- Synchronous Generator
- Lube Oil Module
- Control Panel & Switchgear
- PLC Redundancy
- Modified Penstock
- New Generator Plinth
- Modifications to Turbine Pit



Crystal Lake, Petersburg

## CRYSTAL LAKE, PETERSBURG

Crystal Lake, situated 18 miles south of Petersburg on Mitkof Island, stands at an elevation of 1200 feet above sea level. The Blind Slough Hydro Plant is fed by water from Crystal Lake and is under the ownership of Petersburg Municipal Power and Light. It is one of three hydroelectric facilities supplying power to Petersburg. The other two facilities are owned by SEAPA (Southeast Alaska Power Agency) and are located at Tyee and Swan Lake, on the islands to the south of Mitkof. The Blind Slough plant is integrated into a regional mini-grid system supplying electricity to the communities of Petersburg, Wrangell and Ketchikan, via a mix of overland and subsea transmission lines.

The water from Crystal Lake also plays a vital role in the functioning of the salmon hatchery located downstream of the hydro plant.

## BLIND SLOUGH HYDRO PROJECT

The original Blind Slough hydro site, constructed in 1921, featured two 400 kW units. In 1955, a larger 1600 kW single jet Pelton turbine was added in a separate powerhouse. After more than six decades of service, the electrical components on the 1955 Pelton Turbine were nearing the end of their lifespan. The runner had already been replaced once after 25 years and was now worn out again.

A consultant's report evaluated various options and highlighted the risks associated with unplanned outages due to equipment failures and challenges in sourcing spare parts for repairs. Consequently, it was determined that upgrading the plant through refurbishment and equipment replacement would be a more cost-effective solution. This approach aimed to ensure the continued operation of the plant for an additional fifty years.

## FEASIBILITY

In 2019, Gilkes was contacted by the consultant who conducted the feasibility report and had prior experience of working with Gilkes. Providing information for the report, Gilkes was among five companies bidding for the E&M project scope. Due to the COVID-19 outbreak and global lockdowns in that period, a site visit was not feasible. The customer shared photos of the powerhouse and equipment until a site inspection could occur in 2022.

CASE STUDY

# Blind Slough, Alaska, USA

The customer specified that the replacement turbine needed to handle 25 cfs flow rate. A Pelton turbine remained the most appropriate turbine type, and with a 900 rpm machine, this would require a twin jet unit. A compact configuration was going to be necessary to fit the new equipment into the existing powerhouse. Consequently, a specially designed 2197kW Twin Jet Pelton Turbine with an 850mm Runner was selected for this project, and Gilkes were awarded the contract.

## GILKES SCOPE OF SUPPLY

2197kW Twin Jet Pelton Turbine & 850mm Runner

HPU – with on-board control panel

Main Inlet Valve (ball valve for high head)

Synchronous Generator inc lube oil module

Full control panel & switchgear (designed for automatic and fully manual mode)

PLC Redundancy – Sophisticated combination of automatic and manual controls to allow for hydro operation in the event that the main PLC is not functioning.

Other workscope – modified penstock, civils work with new generator plinth and modifications to the turbine pit.

Each major component underwent extensive factory testing and inspection by a third-party for quality assurance. This involved close collaboration with our European supply chain partners, such as valves sourced from the Czech Republic and a generator from Italy.

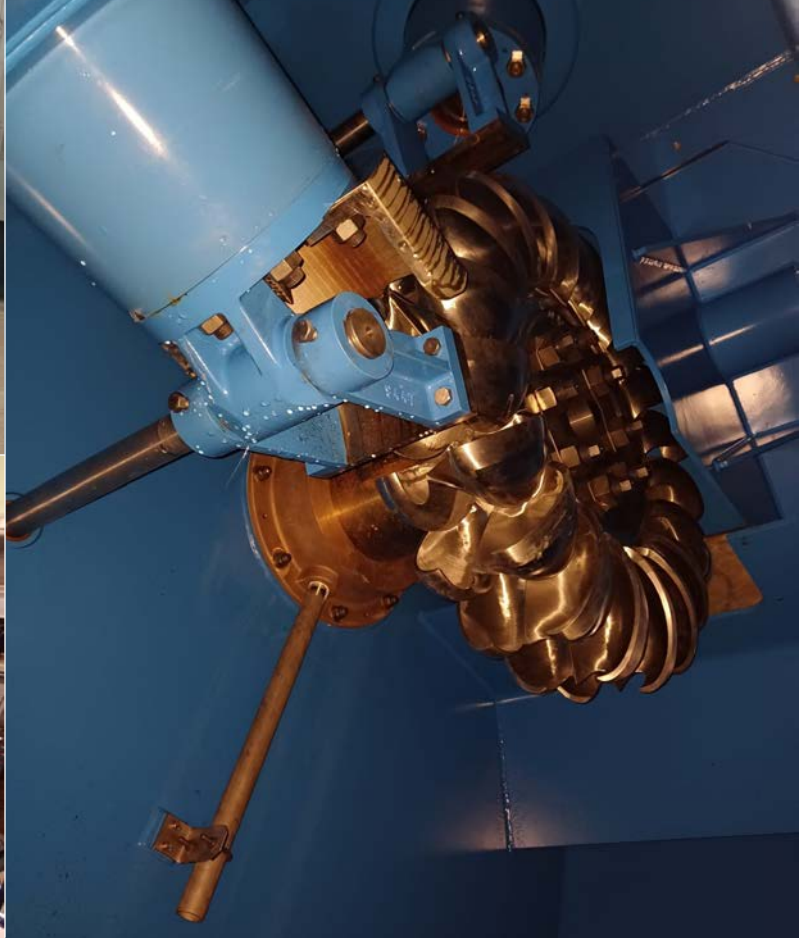
## INSTALLATION & COMMISSIONING

On-site installations are carried out by the same team of in-house fitters that assemble and pressure test the turbine at our facilities in the UK before shipping to site. This ensures close co-ordination and familiarity with the equipment.

Installation of the generator presented some challenges due to the size and weight of the generator, which as supplied fully assembled was heavier than the rated capacity of the existing station crane. Prior to attending site, our installation & design team engineered a solution using a combination of winches and rolling skates together with the station crane to move the generator into position in stages. A load cell was used to monitor the load on the station crane to ensure it was never overloaded. This worked well at site, and the generator was positioned in the powerhouse successfully.

Throughout the commissioning phase, Gilkes engineers collaborated closely with SEAPA. Being part of a small mini-grid, it was essential to advise SEAPA of our activities particularly when performing trip tests where power suddenly comes off the grid. This allowed SEAPA time to adjust the output of their other stations and avoid causing grid instability or power outage to consumers.

During commissioning, meeting the demands of various stakeholders was essential: in particular, maintaining water flow to satisfy the downstream fish hatchery's minimum flow needs was crucial. This required the operation of a bypass valve to be integrated with the hydro operational sequence during startup and shutdown to avoid water being cut off to the hatchery.

## THE COMMUNITY

The successful completion of the Blind Slough project guarantees the ongoing operation of the plant, providing significant benefits to both residents and businesses in the area for many years to come. The Petersburg community, with a population of 3000 that swells during the fishing season, heavily relies on the electricity supplied by the hydro mini-grid of which Blind Slough is a part, and its efficient operation has a direct bearing on the cost of electricity to consumers. Due to this dependency, there is substantial interest from the community who are regularly updated on project developments and plant operations through local news outlets and radio broadcasts.

## FUNDING

The hydroelectric project incurred a total cost of approximately $9.5 million, primarily financed through a bond issuance. In 2021, voters granted approval for an electric utility revenue bond amounting to $7.5 million to cover the expenses associated with the upgrades. Ratepayers will repay this bond over an estimated period of around twenty years.

The Borough also applied for a roughly $3 million grant through the US Dept of Energy and was selected as a recipient of those grant funds based on energy efficiency improvements and other qualifying factors. The grant funding will displace other funding used for the project and serves to keep local electric rates stable. (The Borough Assembly did approve of a transfer of funds ($880,000) to finish out the project and with the receipt of the grant monies, those funds may be returned to electric department reserves)

Globally, there is an increasing need to modernise and optimise aging installations to maintain their lifespan and increase generation. Modern technology brings increased safety, reliability, and efficiency.

The USA in particular has a number of incentives and grants currently in place to support the future of hydropower facilities. Gilkes have conducted recent upgrade and refurbishment work on several plants in the USA. Please visit our webite and search modernisation case studies to see some examples.

Petersburg, Alaska

With enhanced overall efficiency, the Blind Slough plant's 2MW output plays a significant role in the regional grid, contributing 4% of its total power.

Additionally, the plant can be operated remotely and supplies around 25% of the power consumed by Petersburg.

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