PROJECT DELIVERY: NEW WATER TREATMENT PLANT IMPACTS CAMBRIDGE BAY, NUNAVUT

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The Challenge

North of the Arctic Circle at 69° 07", Cambridge Bay is a very remote community along the Northwest Passage. To carry out potable water treatment projects in Cambridge Bay, the Government of Nunavut selects an engineering company to oversee the project, and a general contractor, who in turn contracts various subcontractors and suppliers. All must have experience working in the north.

The Community

The population of Cambridge Bay is close to 1,800 people, which has been increasing by approximately 10 per cent every six years. Approximately 80 per cent of the residents are Inuit. With an expanding population comes an increased demand for potable water.

The Stages

Detailed aspects of this design-bid-construct "Project Delivery" process includes planning with the involvement of stakeholders, preliminary and detailed designs, public tendering, awarding of the contract, component sourcing, parts delivery, construction of modular units and pre-testing in the factory. This is followed by loading and shipping, site delivery, assembling on site, commissioning, operator training, and ongoing support.

The shrink-wrapped building was barged North on the MacKenzie River to the Arctic Ocean.

The packaged water treatment plant undergoing testing and pre-commissioning in the Surrey factory.

Planning

Stantec Consulting was chosen by the Government of Nunavut to complete the overall design and manage the project. Stantec determined the design criteria, which included population growth, raw water characteristics, and other design information. From this information, Stantec prepared a tender package that was used as the basis for a public tender of the project.

Project Award

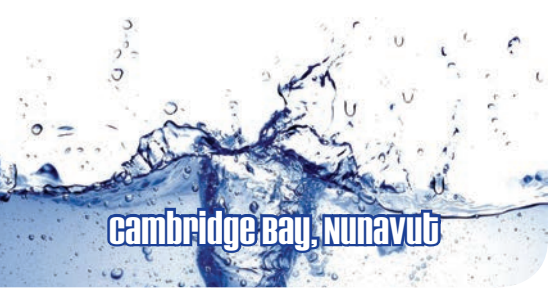
NDL Construction Ltd. was awarded the project in 2014 and partnered with BI Pure Water to manufacture and deliver the packaged water treatment plant in 2015. The project delivery timeline was extended to accommodate the short construction season and other challenges of northern construction.

Process Engineering and Construction

BI Pure Water engineers apply "Design for Resilience" for the process engineering. The objective of this approach is to sustain the required operations during and after the impact of severe disturbances, plus to adapt to longer term influences. The water treatment plants are custom engineered to a specific water quality and available budget. The well-insulated building contains a standby generator, electrical room, boilers, ventilation equipment, process piping, and the treatment system.

The Treatment Process

The water treatment plant has a design flow rate of 20 litres per second (317 USGPM). Raw water turbidity is a significant problem during spring breakup. The water treatment system included three steel vessels with Zeolite filtration media, UV disinfection units, a chlorination unit, a large treated water storage tank, and distribution pumps.



The package treatment plant is shown next to one of the site-built water storage tanks.

Delivery

Four modules of the plant – three metres by 13 metres each – were trucked for shipment by sealift from Surrey, B.C. to the Port at Hay River, NWT in July 2015. The barge then travelled more than 1,800 kilometres from Hay River up the MacKenzie River to Tuktoyaktuk, NWT on the Arctic coast, then an equal distance east through the Northwest Passage to Cambridge Bay, Nunavut. The barge arrived on August 22, 2015, and the modules were skidded off the barge and pulled by a bulldozer to the plant site

The building modules were lifted onto foundation piles when they arrived at site.

A view of the treatment portion of the plant showing control panel and filter vessels.

Site Work

Local equipment was used to set the building modules on piles, and the sections were bolted together. The storage tanks were set on their pads, but no buried piping was completed in 2015 due to the arrival of winter in September. Work was continued in 2016, and during the long daylight hours, workers installed the piping and access vaults. The outside work was completed in August 2016.

Commissioning

After the power was on, and raw, waste, and treated water lines were connected to the building, an initial leak test was performed, followed by testing of the controls and equipment operation. Commissioning and test plans for each system were followed. The post-commissioning phase to monitor the facility performance may take up to one year.

Owner Inspection and Approval

The owner and their technical representative visited the facility to confirm the plant operation. The owner's validation of proper operations triggered the owner acceptance phase, which may include a deficiency list to address.

Operator Training

Local operators were trained during start-up and commissioning. The plant may be remotely monitored and controlled, which allows remote access of the control system by factory technicians for monitoring and ascertaining the need for further training.

Ongoing Support

Staff turnover occurs, so there is a continuing need for ongoing training and support of new staff. Remote monitoring assists in the operations when the operator is not available. Remote diagnostics from thousands of kilometres away helps reduce downtime and travel to the site by factory technicians. Issues do occur that need to be resolved, like additional manganese in the raw water from the concentration of water under the ice in late winter.