Mission Hill Water Treatment Plant

Treatment Plant Pilot Testing

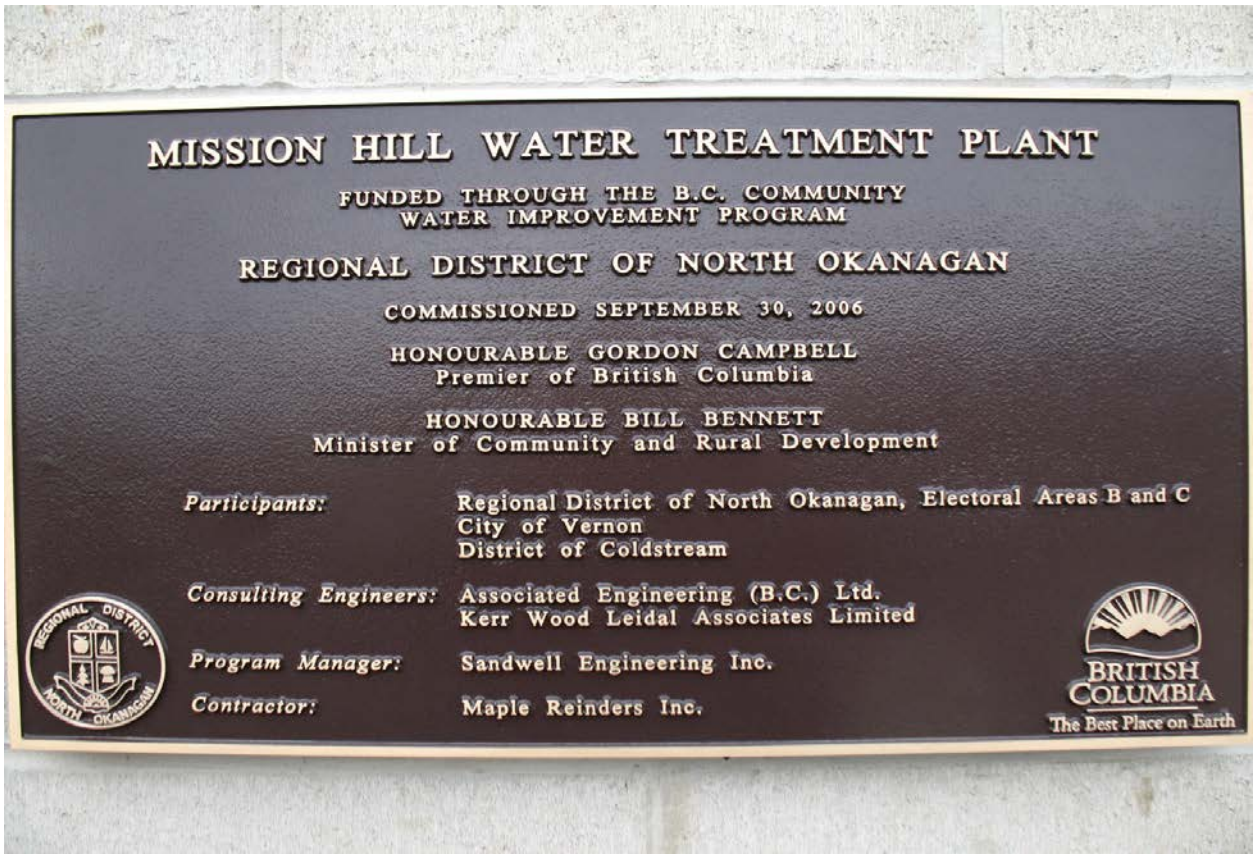
Regional District of North Okanagan, assisted by Sandwell Engineering Services and four manufacturers conducted pilot scale water treatment plant testing. The testing occurred on Greater Vernon Water's two main water sources, Kalamalka Lake and Duteau Creek. Initial piloting occurred between July and December 2003 adjacent to Sawicki Park on Middleton Way. Two years of piloting was performed on the Duteau Water source. The objective was to establish design and operating parameters to allow development of conceptual water treatment plant designs and detailed capital and life cycle costs.

Mission Hill Water Treatment Plant & Kalamalka Lake Pump Station Upgrades

AEKWL consulting, a partnership between Associated Engineering (Burnaby/Kelowna) and Kerr Wood Leidal was awarded the conceptual design contract in October 2004, and detailed design in February 2005 for the $7.2 million, 60ML/Day (16 Million Gallons per Day) capacity Mission Hill Water Treatment Plant (WTP). The program Manager was awarded to Sandwell Engineering and the general contract was

awarded to Maple Reinders Inc. The Mission Hill WTP was commissioned September 30, 2006 and was partially funded through the BC community water improvement program.

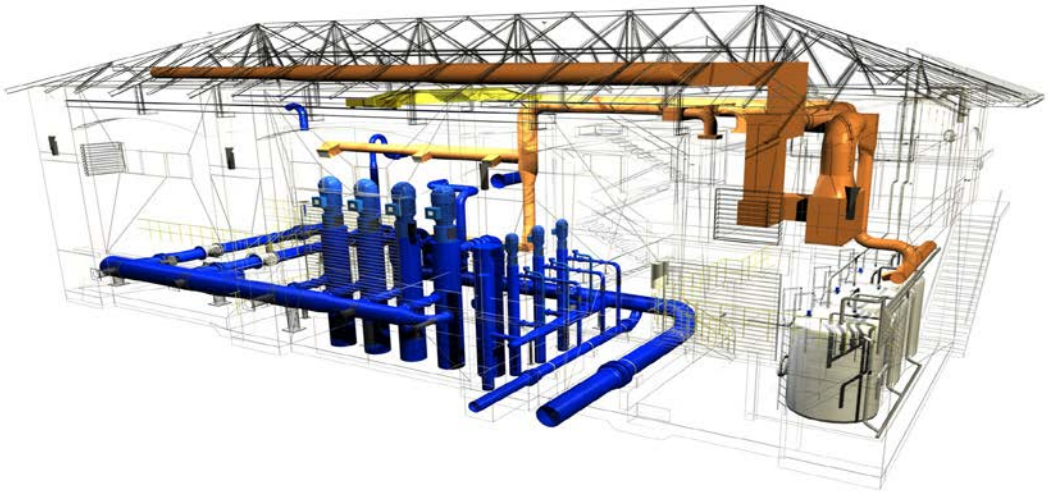
Demolition of the 550 pressure zone station to prepare for the Mission Hill Water Treatment Plant.



North Kalamalka Intake

The North Kalamalka Lake intake pipe is 252 meters long and is 20 meters deep. The capacity of the pump station increased from 35 ML/day to 60 ML/day. The pumping station was upgraded in conjunction with the Phase 1 Mission Hill WTP upgrade to two 200HP and two 400HP fixed speed vertical turbine pumps. These pumps supply the Mission Hill WTP based on the McMechan Reservoir Level located on Vernon's East Hill.

Mission Hill Water Treatment Process



1. Water enters a small wetwell at the Mission Hill WTP and is pumped utilizing four low lift variable speed turbine pumps and three high lift variable speed turbine pumps equipped with ultrasonic flow meters.

2. The first treatment is ultraviolet (UV). UV alters the DNA of pathogens resistant to chlorine such as Cryptosporidium and Giardia and makes them inactive. Two Trojan UV reactors consisting of a flow through chamber made of stainless steel houses six UV lamps and are designed for a flow

rate of 60 ML/d at 89% UVT (Ultra Violet Transmittance[1]). The lamps are enclosed in quartz sleeves and are mounted horizontally in a cross-flow arrangement. The UV transmittance is measured at a wavelength of 254nm along with turbidity. These measurements control the output of the lamps compensating for changes in water quality and flow rate in order to automatically achieve the target dose[2] of approximately 40mJ/cm^2 for disinfection.

3. ClorTec™ generator produces Sodium Hypochlorite electrolytically using sodium chloride (salt), water, and power. This unit replaced the origin MIOX™ generator in the summer of 2013 which was at the end of its life cycle.

[1] Percentage of light passing through a column of water in the ultra violet light frequency of 254nm

[2] At the time of plant construction 40MJ/cm^2 was the European standard for UV disinfection. In 2009 the American Water Works Association (AWWA) announced a standard of 15MJ/cm^2.

The reaction: $2NaCl + H_2O \rightarrow NaOCl + H_2 + Na^+ + Cl^- + Heat$

Sodium Hypochlorite (NaOCl or bleach) is produced by passing an electric current through a saturated brine solution from a 30,000 kg heated brine tank. The brine tank replaced 2 original smaller tanks with the ClorTec™ upgrade to accommodate a larger salt deliver load. This project reduced the cost of shipping/handling of salt, increasing available hypochlorite, and improved the efficiency of salt/power consumption.

The generator has a single electrolytic cell capable of producing 1360 kg/day of available free chlorine. The solution has a concentration of 0.7 – 0.9% sodium hypochlorite and is stored in three 10,000 liter storage tanks. Three Watson Marlow variable frequency drive peristaltic pumps, deliver sodium hypochlorite to the disinfected water from the UV system. The water is measured for residual chlorine to ensure an appropriate dosage is maintained. Hydrogen is a byproduct from the generation of sodium hypochlorite and the generator and tank systems are equipped with blowers that vent to the atmosphere. Hydrogen is an explosive gas with a lower explosion limit of 4.1% and is lighter than air. The building is equipped with hydrogen sensors set to alarm at 0.1% and shut down the ClorTec™ generator. Hydrogen is safely disposed of to the atmosphere and reacts with oxygen to form water.

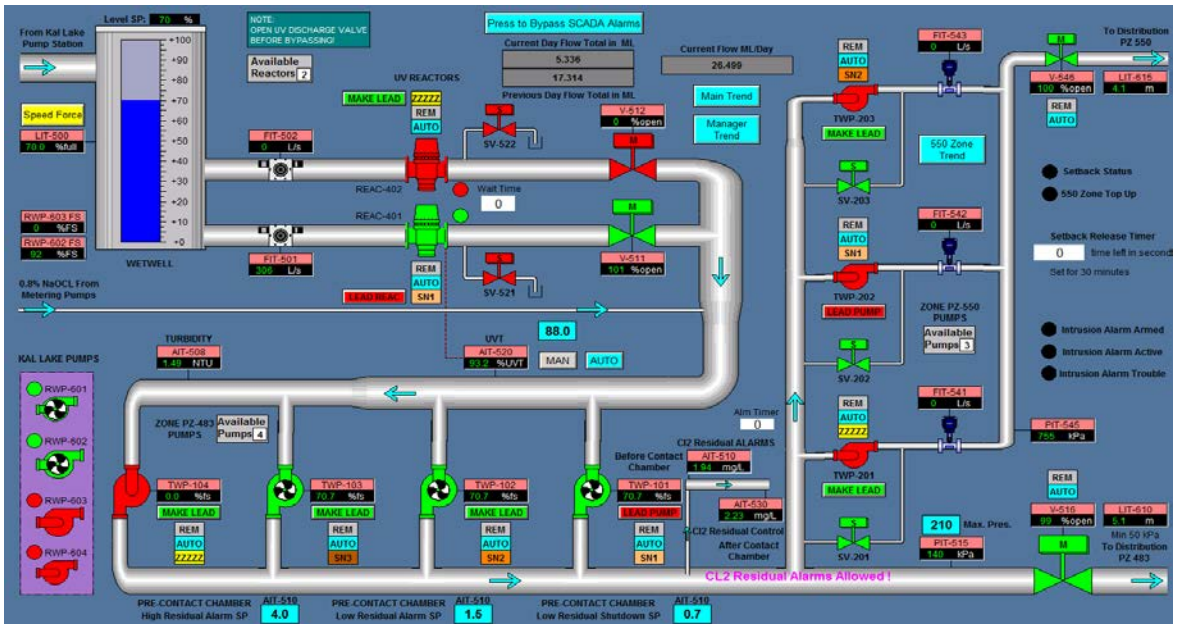
Three, 10,000L Hypochlorite Tanks

30,000 kg brine tanks

Operation

The Regional District of North Okanagan (RDNO) owns and operates the Mission Hill Water Treatment Plant and Kalamalka Lake Pump Station. The RDNO employs certified operators who carry out quality assurance tests to ensure the treated water meets or exceeds the Guidelines for Canadian Drinking Water Quality. Treated water is then pumped to the distribution system providing treated water to 35% of the residents in the Greater Vernon Area. The distribution aspects of the operation are contracted out to the City of Vernon and Coldstream.

Water Quality Analyzers



Screenshot of the operation plant overview.

Water Quality Objectives

Phase 1: Ultraviolet and chlorine treatment, Disinfection inactivate microbiological parameters ranging from viruses and bacteria to pathogens.

Future…Phase 2 (Future): Particulate removal, reduction of suspended solids, turbidity, colour, taste and odour.