Memorandum

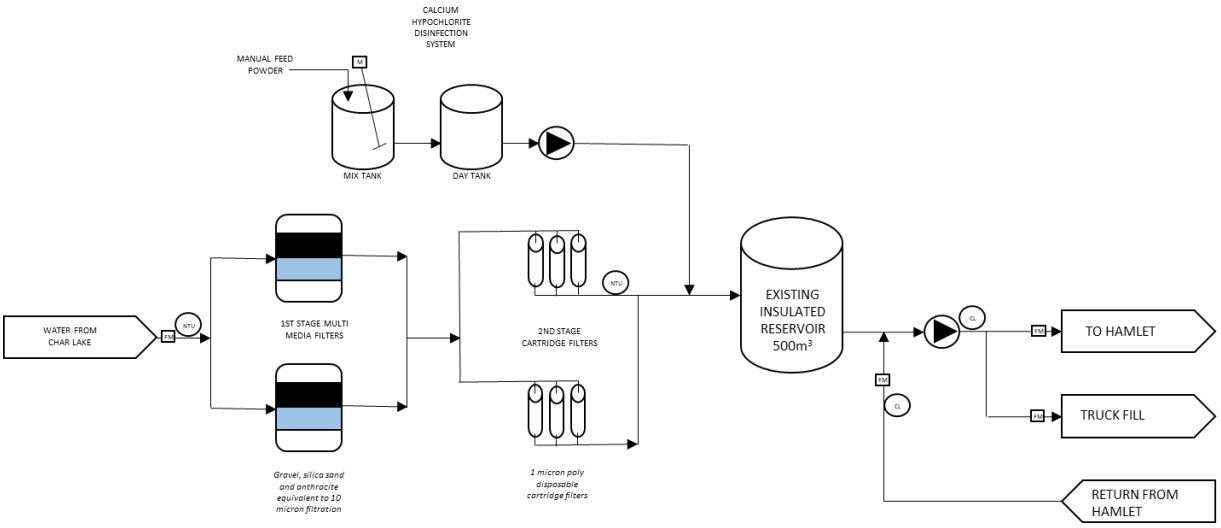
Project Name: Resolute Bay Water	Project #: FRE-00261400-A0
To: Bhabesh Roy, P.Eng.	From: Tony Whalen, P.Eng.
Date: September 22, 2020	
Subject: Signal Hill Existing Water Treatment Plant Replacement Design and Construction – Summary Notes	
Distribution: Daryl Burke, P.Eng.	

This memo will provide the Government of Nunavut with a summary related to the design and construction of the replacement of the existing Water Treatment Plant in Resolute Bay, Nunavut.

The upgrade to the WTP on Signal Hill examines the requirements for water treatment as outlined by the Canadian Drinking Water Guidelines. This includes the upgrade of disinfection equipment and the inclusion of filtration equipment. The assessment considered both capital costs as well as operational needs for a 30-year operating life.

The recirculation pumps for the WTP will provide boosted water pressure for the Hamlet, provide water for fire protection and act as a truck fill station for the airport and the other contractors. The pump configuration at the WTP will have a variety of duties to fulfill. It is proposed that 3 main electric duty pumps be installed and a diesel backup pump for high flow periods. The peak output from these pumps will be 12 Lps (720 Lpm) each at 210 kPa and 66 Lps (3,960 Lpm) on the diesel pump. During periods of truck fill, 2 pumps will be in operation. This is the design point including max hourly consumption, max bleed rates and truck fill.

The recommended water treatment process includes multiple filtration steps and disinfection with Calcium Hypochlorite. The filtration will provide for the suitable protection for microorganism removal and any small amounts of TSS that may get picked up by the Char Lake pumps. The chlorine addition will protect against viruses and microorganisms from the water source and provide protection for any cross contamination that may occur in the distribution system. The figure below illustrates the flow diagram for the proposed water treatment process, which is discussed in detail in the following sections.



The filtration method includes two parts. The first stage filters are to be a duplex backwashable media filter. A media filter typically removes particles down to a 7 to 10 micron size which is suitable for larger turbidity particles and Giardia Cysts. The duplex system allows for backwashing processes to be activated without having to expose the secondary filters to raw water. The use of a media filter that can be backwashed is the most cost-effective means to operate a filter system, provided that the facility has the ability to handle the backwash water. Filter media includes gravel, silica sand and anthracite. The upgraded water treatment plant will have sewage handling capacity included; and therefore, will be able to handle the backwash events from the filters. The secondary proposed filters will be disposable polymer-based filters that will filter down to nominal 1 micron size which is suitable from further removal of smaller particles and Cryptosporidium. The secondary filters are to be configured in such a manner that a duplex filter housing will be utilized, each housing 3 active filter cartridges. It is proposed to use the same size filter cartridges (Hurricane Polyester - 8" diameter, 30 -3/4" length) that are utilized in other communities in Nunavut. This should add to the security of an adequate filter supply available in the North.

The disinfection method to be employed will be Calcium Hypochlorite. This will be delivered to site in a dry format and prepared for a 24-hour period in a mix tank. Following mixing, the blend should be transferred to a day tank. This method ensures that a consistent blend of disinfection chemical is available for injection into the treatment system.

The proposed pumps are positive displacement hose pumps. These have minimal wear parts and require no isolation or foot check valves which have historically caused clogging issues. There is a single cartridge replacement part when the hose fails. The injection pumps will be a duplex configuration and be controlled by the PLC system with active feedback from a flowmeter and an online chlorine analyzer. For the injection of the chlorine solution into the process line, dual injection points will be included (operation and backup) and injection quills will be used to ensure good mixing. This is believed to be the "best fit" disinfection method for this application.

The use of UV Disinfection was considered but does not appear to be a good fit for this application.

The upgraded water treatment plant will be in the same building but will incorporate filtration equipment, new disinfection equipment, new circulation pumps, washroom facilities, storage area, laboratory area and maintenance area. The unused reservoir tank will be removed, and the building will be expanded in an easterly direction.

A summary of the major equipment items that will be a part of the replacement Signal Hill Water Treatment Plant are as follows:

- Building addition;
- An upgraded building envelope;
- Multi Media Filters (3);
- Cartridge Filters (2);
- Calcium Hypochlorite Disinfection system (feed pumps, mixers, day tank, mix tank);
- Electric Distribution pumps (3);
- Emergency Diesel Fire Pump (1);
- Temperature gauges, sensors and transmitters;
- Pressure gauges, elements and transmitters;
- Turbidity analyzers;
- Chlorine analyzers;
- Flowmeters;
- Hydrostatic pressure sensor; and
- Ultrasonic level sensor.

A significant amount of work has been completed during the 2020 construction season at the Signal Hill site that includes the following:

- Site grading;
- Concrete demolition work;
- East wall of the building was demolished;
- Temporary east wall was constructed;
- Formwork and rebar installation;
- Concrete was poured for footings, housekeeping pads, columns, interior walls and slabs;
- Building (steel) studs were installed;
- Steel was erected;
- Roof was replaced;
- Cladding and insulation were replaced;
- Formwork was removed;
- Mechanical work was done in the building;
    - Old storage tank piping was removed;
    - Tank level sensor was relocated;
    - Obsolete piping was removed;
    - Pipe supports were removed;

- Electrical work was done in the building;
    - Tank level sensor was relocated;
    - Abandoned electrical components were removed;
    - Panels, boxes and conduit were dismantled

The work remaining at the Signal Hill Water Treatment Plant relates to the installation of the equipment and materials previously referenced in this memo. This work will be completed during the 2021 construction season which generally runs from June to October.

If you have additional questions or require any clarification, please do not hesitate to contact me directly.

Submitted by:

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EXP Services Inc.