

January 28, 2019

Mr. Bryan Bertacchi
Electric Utility Director
City and Borough of Sitka
131 Jarvis Street
Sitka, Alaska 99835

Dear Bryan,

Subject: **Summary of 2018 Study Findings
Industrial Water Systems**

An evaluation of the industrial water systems located near the Blue Lake powerhouse and the Gary Paxton Industrial Park (GPIP) was recently completed by McMillen Jacobs Associates (MJA). The industrial systems currently include a 10 cubic ft per second (10 cfs) raw water supply to the NSRAA hatchery and an approximate 50 cfs bulk water export system. This letter summarizes the findings of these evaluations and identifies possible actions that the City and Borough of Sitka (CBS) community might take to address the findings.

Safety

The NSRAA water supply is currently fed from the Blue Lake Hydro penstock and operates safely (this evaluation was performed by NSRAA consultants, not MJA).

The existing bulk water system cannot be safely operated due to two major components:

- The Bulk Water 36 inch high pressure steel pipeline (approximate 200-ft length) is known to have significant corrosion damage and thus has an unknown pressure capacity. The operating pressure was increased by 32% when Blue Lake Dam was raised. No testing or inspection reports could be identified for this buried 58 year old pipe section.
- Two existing 36-inch butterfly valves are used for isolation and control of Bulk Water flows. The lower butterfly valve (V-130) is of 1992 vintage. It has an electric operator which is currently non-functional. Should this valve be opened manually, the valve has essentially no safe downstream back-up in the event that it cannot be closed against full system differential pressure. The upper butterfly valve (V-300) is of 1959 vintage and is located at the far end of the existing 36-inch buried piping and is thus unable to protect the steel pipeline.
- Neither of these existing valves are of proper design to attempt to control (throttle) the Bulk Water flow. As a result, MJA recommends removing the upper butterfly valve entirely from the system, and installing a new valve just downstream of the existing valve V-130.

NSRAA Water Supply – Existing

NSRAA water is presently fed through pressure reducing valves off the Blue Lake Hydro penstock. This system wastes energy in the pressure reduction process and by spill of penstock water at the bulk water head tank. A 10 cfs pump system installed at the Blue Lake powerhouse for the hatchery supply is now idle, as the pumps cannot deliver the pressure demanded by the existing flow control valve installed inside the hatchery. Modification of the hatchery valves and controls would allow operation of the existing pumps to deliver the full 10 cfs.

NSRAA Water Supply – Expansion

Expansion of the hatchery water flow to 20 cfs will require replacement of valves at the NSRAA penstock tap. Alternately, pumping of 20 cfs would require adding pumps and new piping near the powerhouse; in addition to providing modifications to a backup water supply system for the hatchery. One possible backup water supply to the hatchery is to modify the existing penstock tap and piping, located at the Raw Water Valve House (aka Secret Shack) to provide 20 cfs. Other options for providing penstock backup water supply to NSRAA are discussed in MJA's TM-02 (Part 3.0g) and TM-05.

NSRAA Water Supply – Impact of drought and electric load growth

Presently there is a surplus of water in the Blue Lake drainage. Taking hatchery water off the penstock and wasting part of it has no net effect on power generation or domestic water fed to the city at the present time. However, a number of conditions will quickly lead to the need for either supplemental diesel generation or an alternate water supply system for NSRAA. These conditions will include:

- Drought years
- Electric load growth
- Outages of the Green Lake Project

If these conditions occur the cost of supplying the hatchery from the penstock would be a continuous net loss of about 150 kW of energy (for the 10 cfs flow). Replacing this lost energy with the City's diesel generators would cost about \$68 per hour or \$590,000 per year (fuel cost only, this does not include O&M costs). A 20 cfs hatchery flow would have twice this impact.

The CBS – NSRAA business agreement does not define who is responsible for capital costs, O&M costs, pumping energy costs and replacement diesel generation for operation of the existing (or the expanded) hatchery water supply.

Bulk Water – Existing Capacity

The 2018 review team confirmed with SSY Ship Brokers (the CBS consultant for export water) that the industry standard for loading bulk liquid tankers involves the following:

- The shipper must provide a pressure of 100 psi at the ship's rail i.e. at the ship's deck
- The tanker must be loaded in 2 to 3 days or the shipper pays a delay charge
- A tanker capacity of about 40.5 million gallons is appropriate for export of water from Sitka.

The existing bulk water system cannot deliver 100 psi at the ship's rail under any circumstance. The system cannot deliver its stated 50 cfs design flow rate to the ship at any pressure. It can deliver 40 million gallons of water in 3 days (20 cfs) at about 30 psi, (this includes an additional 10 cfs flowing to the NSRAA hatchery thru the bulk water system as presently configured). There is a fundamental disconnect between what the study team found for the ship loading requirements and what the existing bulk water system is capable of delivering.

Bulk Water – Possible Changes

Addressing the safety concerns mentioned earlier in this memo will require replacement of the bulk water existing control/isolation valves and either replacement or reconfiguration of the 36 inch steel pipeline. This work cannot proceed until the municipal water filter plant is in operation at Sawmill Creek.

It is very important to confirm what bulk water flow rate and pressure is needed at the ship. This could have a huge effect on what the ultimate system looks like. For example, providing 100 psi pressure at the ship will require either addition of an expensive booster pump system at the GPIIP dock or replacement of virtually all of the existing bulk water system. Either of these options would cost millions of dollars.

The bulk water flow control valves that require replacement, including the 36 inch "root" valve at the Blue Lake penstock do not have mechanical locks which ensure the valves will remain in the closed position when working on the valves or downstream piping. Therefore it is not safe to work behind the root valve at present and this valve cannot be replaced without draining the Blue Lake tunnel.

Future Actions to Improve Industrial Water Systems

The 2018 study effort suggests the following actions by the Sitka community are needed to provide a functional and economic industrial water system at Sawmill Creek:

- The NSRAA hatchery system should be modified to allow a pumped water supply from the Blue Lake powerhouse, before drought conditions or load growth end the current water surplus.
- As part of the 20 cfs hatchery expansion, an agreement should be reached between NSRAA and CBS that defines how the water will be physically be provided (i.e., the physical piping and equipment) along with cost responsibilities for construction, maintenance, operation, pumping energy, and replacement power.
- The municipal water filter plant should be constructed, mainly to provide a backup for the penstock water supply. Constructing the filter plant would then also allow safety improvements and modification of the bulk water system.
- The specific water pressure and flow requirements of the bulk water customer(s) must be defined to confirm that the present bulk water system configuration is acceptable. If the present system is not capable of meeting the customers' needs then modifications or expansions of the bulk water would be necessary. This should be figured out before any additional funds are spent on design, repairs or construction of the bulk water system.

The above summary includes comments and information provided by the CBS Electric Department, related to water agreements and cost sharing. Details of the industrial water system

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analyses carried out by MJA are included in a group of 10 technical memos issued in 2018 and early 2019. Those memos should be consulted for specific information on flow capacities, pressure losses, valves, piping, and equipment in the two industrial water systems.

Very Truly Yours,

A handwritten signature in blue ink that reads "Paul Carson". The signature is written in a cursive, flowing style.

Paul Carson, P.E.
Principal

cc: Matt Moughamian, MJA