Growing a Green Water Treatment Plant

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ABSTRACT

A water treatment plant has been designed, manufactured and assembled for the community of Ymir in the Regional District of Central Kootenay (RDCK) in British Columbia. This "green" facility is one of the first small plants to employ an analysis and design based on a triple bottom line framework, meeting the financial, environmental and social goals of the community. The focus was to build sustainable infrastructure, reduce the carbon footprint, conserve energy and ensure long-term financial viability.

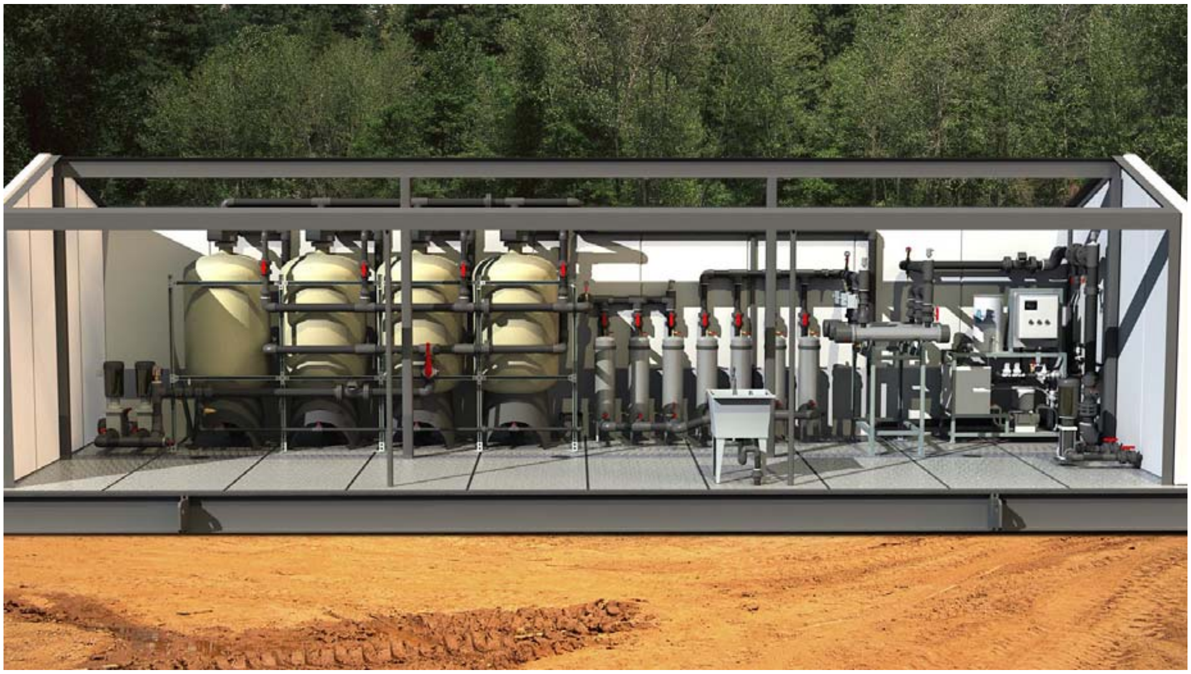

Figure 1 - The water treatment plant was constructed on a steel skid and uses energy efficient SIP wall and roof panels.

INTRODUCTION

The Town of Ymir, once a booming mining town is a small community of about 200 people; amenities include a hotel, general store, and a seasonal cat skiing operation. The catalyst for building a new water treatment plant in Ymir was a failure to meet drinking

water standards due to bacteriological contamination from wildlife. The community's water had been on permanent boil water advisory. There are 106 water service connections in the community; this is expected to grow to 150 connections in the next 15 years. The community demonstrated their commitment, imagination and desire to finance a sustainable water treatment plant using the triple bottom line approach.
Triple bottom line is an integrated approach; incorporating economic, environmental and social objectives so that each enhances the attributes of the others. A holistic, closed-loop design approach created synergies and helped us achieve our sustainability goals.

Green Building

Project Goals for Building Sustainable Infrastructure

- Design to a LEED Silver or LEED Gold rating
- Provide energy savings equivalent to a Model National Energy Building Code of Canada building
- Satisfy BC Interior Health requirements
- Satisfy the needs of the community
- Find free energy sources and employ energy reduction techniques
- Reduce carbon footprint and ensure energy conservation where possible
- Utilize local materials and resources to complete the facility where practical
- Complete the project within the financial constraints established
- Minimize the impact on the local environment.

Site Development

- All site work was completed using local services, equipment and contractors
- Construction management was performed internally by the RDCK personnel
- Timber was sold to local saw mills and revenue used to offset project costs
- Special attention to site planning and remediation
- Sedimentation ponds ensures all water is naturally filtered to ground
- Propane as a back-up power supply reduces the risk of environmental damage
- No site works were completed in stream, minimum riparian set backs were established, and, where possible, these setbacks were exceeded.

Site Design

The RDCK Environmental Services Coordinator was involved with all stages of the project to ensure that all environmental issues on site were addressed. Site restoration and rehabilitation activities were considered high priority.

Building Design

Structural insulated panels (SIPs) for walls and roof create a well insulated and air tight building envelope. The main advantages of SIPs are the high R-Value and low levels of air infiltration providing 50%-70% savings compared to the Canadian Model Energy Code (MEC) building. The building was assembled and tested at the factory and shipped to site on one truck to minimize material wastage and to reduce the project carbon footprint.

Water Efficiency

- New pipes were oversized for future expansion so as not to require underground utilities to be excavated and replaced. Internal expansion is also possible.
- SCADA ensures that only water that is needed will be drawn into the facility and waste water is minimized due to self-cleaning media filters
- The treatment process does not use chemicals; all wastewater can be directed to the sedimentation/infiltration ponds for treatment.
- Level switches in the existing reservoir prevent overflow and the emergency reservoir overflow has a de-chlorination chamber.

Indoor Environmental Air Quality

To facilitate safe and easy maintenance and to provide additional air exchange for the building if needed, a mechanical ventilation system was installed.

Energy Efficiency

In order to meet the terms of the RDCK climate action charter energy efficient building materials and components were integrated into the design of the facility. All materials for construction were considered from a closed loop perspective as well as opportunities for life cycle savings. The facility was designed to be de-constructed (end of life) so the majority of the material could be put back into the resource stream.

Figure 2 - The water treatment process includes dual booster pumps, self-cleaning media filters, 5 and 1 micron A cartridge filters, ultraviolet primary disinfection and residual chlorination.

Carbon Credits/Footprint

The main focus at this facility was to minimize energy consumption so that the long term operational and maintenance costs and energy needs are manageable. This facility features a small photovoltaic solar panel that provides some power to the building. Maximizing water and energy conservation reduces the overall carbon footprint. Reducing GHG emissions (by reducing energy and water consumption) will therefore reduce the amount of carbon credits the RDCK will have to purchase in the future.

Green Design Process

The success of this project can be attributed to the collaborative approach taken with committed stakeholders. The green design process incorporated the community, stakeholder objectives, costs, energy, water, site, materials and indoor air quality. The building met the cost expectations of the community and included the purchase of carbon filters for each homeowner to further polish the water and to facilitate the removal of chlorine at the point where the water enters the household for those home owners that still had concerns about the use of residual chlorine in their drinking water. The cost for the installation and future maintenance was agreed to be born by the members of the community.

Water Treatment Process Design

Quartz Creek has exceptional water quality for a surface water source. As well, elevation differences provided gravity flow to the plant and gravity flow to the end users. Pilot testing was utilized to confirm the process selected and to predict operational costs. The process consisted of efficient Grundfos booster pumps, self-cleaning media filters, 5 micron and 1 micron absolute cartridge filters, R-Can SUVAM ultraviolet primary disinfection and Accu-Tab Calcium Hypochlorite residual chlorination. The facility exceeds the 4-3-2-1-0 drinking water objectives established by the Interior Health Authority for drinking water.
An analysis of the project was made using RETScreen Clean Energy Project Analysis Software. This is a decision support tool to evaluate the energy savings, costs, emission reductions, financial viability and risk for various types of Renewable-energy and Energy-efficient Technologies (RETs).

CONCLUSION

The objective of this project was to build sustainable infrastructure, effectively creating a facility that is composed of recyclable material, energy efficient components, and employed low environmental impact construction techniques. This resulted in energy conservation and supports the long term financial viability of the facility. Local resources were used for site work, minimum riparian setbacks were exceeded, propane backup power eliminates the risk of liquid fuel contaminating the water supply, and the groundwater is recharged with naturally filtered backwash water.
In the future, carbon regulations, as well as rising energy costs, are going to create a need for an integrated financial, social and environmental approach to all infrastructure projects. “Green” water plants may have a higher capital cost but are cost-effective over the life cycle when O&M costs and other costs are added in. This particular facility saved considerable up front capital by employing the triple bottom line perspective. Water systems like Ymir demonstrate the effectiveness of stakeholder collaboration to achieve common sustainability goals. The triple bottom line approach is an effective way to build sustainable infrastructure, reduce the carbon footprint, conserve energy and ensure long-term financial viability. Future facilities will incorporate new and existing technology and could produce more energy than the water treatment plant consumes. Now that’s green!

PS: This project has won the 2008 BCWWA Small Water Systems Award.