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Proactive protection

Taking active steps to sustain a pristine aquifer

Written by [Stefanie Wallace](#)

Despite its small area and wee population of 4,400, the community of Gibsons, B.C., has several claims to fame. Located on the coast of British Columbia's mainland along the Strait of Georgia, the town is inaccessible by road from the rest of the Lower Mainland.



The Gibsons mapping project shed light on how the aquifer responded to tidal fluctuations.

Gibsons has been the setting of various movies, perhaps most notably the CBC television series *The Beachcombers*. In 2009, the town was declared the Most Liveable Community in the World at the international LivCom awards. But a major source of pride for the town is the confined aquifer that lies under it and its oh-so-pure water that's not chemically treated.

The aquifer provides two-thirds of the Town of Gibsons' water supply. In 2005, the town earned the title of best drinking water in the world at the Berkeley Spring International Water Tasting Contest, beating out more than 60 municipal entries from around the world. This raised awareness of the importance of the aquifer within the community.

"It's a pristine aquifer source," says Darren David, principal hydrogeologist at Waterline Resources. "I think the town is very proud of it."

David is part of a team that's undertaken an aquifer-mapping program project as part of the Town of Gibsons' greater long-term initiative to protect its point of pride. The town's proactive approach makes it unique. Usually projects like this aren't undertaken until something catastrophic happens. David serves as Waterline's project director, joining Sue Gordon, principal at Gordon Groundwater Consultancy, who was a project co-ordinator during Phase 1 and has taken the lead on the outreach component in Phase 2 (currently being completed). Dave Newman, the town representative and director of engineering at the Town of Gibsons, Shelley Bayne, senior hydrogeologist at Waterline Resources, and Jessica Doyle, masters of science student at the University of British Columbia, also work with the team.

"Ultimately we're looking to understand the sustainability of the supply for [what they call] the Gibson aquifer and essentially complete a water budget to assess the present and future demand and stress on the aquifer," David says. "One of the key questions that we're trying to answer for the town is if there's sufficient water to supply the existing population."

The community's population is anticipated to eventually reach 10,000, so the team is also looking at whether or not there would be enough water to meet the demand of its future residents.

Planning for the program was a lengthy process. The first grant application took place in 2007, says Newman. In 2009, the town received a \$400,000 provincial "Towns for Tomorrow" grant. The municipality then committed \$100,000 and the project began that year.

Newman and Gordon consulted over proposals from 11 companies interested in the project with published criteria on which to base their recommendation to Gibsons' council. Based on the recommendation from Newman and Gordon, Waterline Resources was selected by town council to develop the approach to map the aquifer in an area covering approximately five square kilometres. The study area extends from the Gibsons' waterfront, north to the top of Mount Elphinstone, east to Gibson Creek and west to Chaster Creek, covering the entire Town of Gibsons and beyond town boundaries within the Sunshine Coast district. Existing geology and hydrogeology data, including surficial and bedrock geology maps, more than 100 water well logs from the provincial Ministry of Environment database, climate reports, and groundwater and surface water monitoring data, was entered into Waterline's groundwater geodatabase and compiled into ArcGIS (geographic information system) format for presentation. That data was supplemented with a field portion, including surficial and bedrock geology mapping, creek surveys, hydraulic testing of wells, installation of data loggers, water quality sampling and ongoing long-term monitoring.

"Our role was to develop a conceptual model of the hydrogeology and to be able to understand the relationship between the aquifers and the creeks, as well as how the groundwater is being used."

Phase 1 wrapped up in the summer of 2010 and the conceptual hydrogeological model was constructed.

"We now have much of the data in an electronic form, in various databases, which is being integrated on a GIS platform," David says. Eventually, the town will be presented with ArcGIS files that can be incorporated into the town's own database system. David says preliminary analyses led him to believe there is sufficient water for a larger community, but Phase 1 presented several data gaps with the conceptual model, which were addressed in Phase 2.

"The data related to the conceptual model is now being used to construct a numerical [computer] model to complete predictive estimates or simulations of aquifer performance under various future scenarios," David explains.

Simulations being investigated include effects from climate change with corresponding sea-level rise, and increased future groundwater extraction to meet the water supply demand of the town.

In 2011, Jessica Doyle began a master's degree in hydrogeology at the University of British Columbia and was granted a \$30,000 scholarship from the Natural Sciences and Engineering Research Council, plus a \$12,000 contribution from Waterline as an industry sponsor for her degree. As part of her thesis, Doyle is examining recharge characteristics of the aquifer.

Phase 2 has an estimated completion deadline of March 2013. "The conceptual model will be presented along with numerical modelling simulation results and predictive estimates of potential effects on the aquifer," David says. "The final deliverables will be provided in a report and presentation to the town."

Another major component of Phase 2 of the project is a community outreach effort. The town found that an ample supply of high-quality groundwater does not necessarily foster concern from the community, resulting in a lack of engagement in the town's efforts to sustain and protect the supply.

"Finding the most effective communication and engagement approaches so the community grasps the importance of what we're doing is a bit of a challenge," says Newman. The town held an open house during Phase 1 that was poorly attended, "despite the fact that the community identifies with and values the water. But to actually get them to come out and learn more about it was a struggle."

Recognizing the importance of community involvement, Sue Gordon of Gordon Groundwater Consultancy took the lead of the outreach component in Phase 2.

"One of the important issues is that even with the hydrogeological study and master's thesis providing all this great data, ultimately it's really the community values and behaviours that can have the most direct effect on sustainable groundwater management efforts," Gordon says.

The social marketing strategies started with a community survey to determine residents' background knowledge of groundwater and the Town's relevant initiatives, and its knowledge of preferred methods of community engagement.

The project benefits from the assistance of students from British Columbia Institute of Technology Sustainable Business Program. Next steps are to develop a blog/website linked with a smartphone app to promote awareness of the Town's initiatives and the role the community has in sustaining and protecting their groundwater supply.

Thanks to the outreach component and Gordon's involvement, the town was selected as one of the Canadian Council of the Ministers Environment (CCME) Groundwater Sustainability pilots. These CCME pilots are part of a national and provincial initiative to develop a universal approach to evaluate and communicate about the sustainability of groundwater resources across Canada. Several areas across Canada were also chosen as pilots, but the Town of Gibsons' proactive approach set the community apart from the rest.

"Based on the data collected by Waterline and Gordon Groundwater, groundwater sustainability indicators are to be developed that will be comparable across these pilots," Gordon says. "The town will have these indicators to show the community, politicians, businesses and visitors, how well they're doing, and to impress upon them the importance of continued efforts to sustain and protect their great groundwater supply."

Engaging the community is one of the most important parts of the project, and David hopes this proactive approach will spark similar projects in neighbouring communities before it's too late.

"We want to be able to monitor groundwater extraction in conjunction with water levels and quality in order to confirm sustainable and responsible groundwater use. It is important that we can respond to any changes in the aquifer long before it becomes an issue," Newman says.

And of course, not taking their most precious natural resource for granted is key.

"We also have a strong desire to maintain our unchlorinated water supply. Being responsible with continued monitoring and community engagement is certainly going to go a long way to ensure we can retain that privilege."