Water Quality and Quantity: A Plan for Hornby Island

Discussion Paper

Autumn, 2016

Sponsored by:

Hornby Water Stewardship Project
Groundwater is a shared responsibility.

Hornby Island Community Economic Enhancement Corporation

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Executive Summary

Hornby Water Stewardship and Hornby Island Community Economic Enhancement Corporation (HICEEC) are collaborating on a plan on water issues. Its overarching objective is: *ensure the quantity and quality of water resources for Hornby Island, both in the short and long-term.*

In the context of environmental awareness and care, water is perceived as a major potential issue with growth, planned or unplanned. There is concern that the island has not properly addressed its water needs, and that the problem may only get worse in the future.

Our goal here is not to reinvent any wheels. It is, however, to review the various wheels lying around and see which ones could be joined together to get moving. It began by pulling together existing and previous studies and references. As well, it determined that a logical process for the creation of the plan would be:

1. Pull together a report – this *Discussion Paper* – that shows what *could* be done
2. Engage the community to review it and prioritize what *should* be done
3. Finalize a plan that incorporates these priorities
4. In parallel, participate as appropriate in research on the relationship of Hornby's geology and its water.

Based on the first step, which brought together individuals with subject matter knowledge in water-related areas, "opportunities for action" on Hornby were suggested and are listed to drive further dialogue and suggestions, broken up under five categories:

- Individuals
- Community infrastructure
- General awareness and education
- Planning
- Regulation and Bylaw enforcement

Ultimately, all of the opportunity areas will be bundled for prioritization – likely including a public survey – with a set of recommendations for, and decisions by, the Boards of the Water Stewardship Project and HICEEC for inclusion in their 2017 plans.

Background

Hornby Water Stewardship (HWS)

The Hornby Water Stewardship Project is a program since 1993 of the Heron Rocks Friendship Centre, and is being undertaken by members of the community on a volunteer basis.

The fundamental goal of the Project is respect by all for the water that sustains our island and indeed our planet. Water has been declared by the United Nations as a human right. Therefore water belongs to everyone.

The Project endeavors to encourage and enable everyone to learn about the value and vulnerability of the groundwater, the fresh surface waters and the marine waters of Hornby Island. The Project also fosters the conservation and protection of these waters for today and for future generations. This is accomplished through active involvement of its members and encouragement to others so they may make the right choices on water and land use and on wastewater disposal.

The HWS group maintains an informational website: hornbyislandwater.org.

Hornby Island Community Economic Enhancement Corporation (HICEEC)

The Hornby Island Community Economic Enhancement Corporation (HICEEC) is a publicly funded organization that has worked to support a healthy, diverse, and green economy on Hornby Island since 1997. In 2002, HICEEC was responsible for crafting the Community Vision to 2020, and conducting a Quality of Life survey to understand resident priorities, challenges, and opportunities at the time.

In 2015 HICEEC created an Economic Action Plan. This foundational piece of work, which polled 323 respondents on their household and employment situations, and opinions on a variety of economics-related topics, is providing the guiding principles and strategies for the work that HICEEC does.

One of the most significant results of the survey was that 78% of respondents would like to see an increase in the population of Hornby. In fact 32% would like to see the population at more than 1,500. This strong sentiment for growth leads to the question of what the island's carrying capacity is; foremost in that discussion is *water supply*.

A project has been created in the annual plan, *Promote and Incent Water Conservation*, which has as its purpose: "Water is one of Hornby Island's most precious, and often scarce, resources. It is also seen as a major obstacle to support for development. Working with partners, we will investigate the best ways to improve water storage on the island, including consideration of community water systems, incentives to home-owners to invest in rainwater catchment, and education and outreach."

Joint Opportunity

Within HICEEC's project, the initial activity was to "collaborate with Hornby Water Stewardship to develop a best way to grow public water infrastructure on the island." Ellen Leslie from (HWS) and Darren Bond from HICEEC met in February 2016 to explore whether there was an opportunity for support and collaboration on water conservation issues. The conclusion was that there did seem to be. Both checked in with their respective

organizations and received support for moving forward on the creation of a Hornby Island Water Plan.

Objective

Based on exploratory discussions, this project has a range of possible activities in support of an overarching objective: *ensure the quantity and quality of water resources for Hornby Island, both in the short and long-term.*

In the context of environmental awareness and care, water is perceived as a major potential issue with growth, planned or unplanned. Indeed, one of the guiding principles established in the 2015 Economic Action Plan exercise is: "conservation-oriented economy; we have no economy without the environment." There is concern that the island has not properly addressed its water needs, and that the problem may only get worse in the future.

Measures of Success

As the saying goes, what gets measured gets managed. Beyond objectives, it is important to establish a few critical indicators of progress or success. A few candidates, both at the project milestone level as well as the ultimate objective, include:

1. Water storage capacity (public and private)
2. Average water consumption per capita (including commercial and farms)
3. Water quality index
4. Commitment and engagement (e.g., incentive program uptakes, education attendance, role model projects)

Project Approach

As a US southerner might say, "this ain't our first barbecue." Studies have been done on the island over the years, and individuals with a great deal of expertise have offered possible solutions to various components of the range of water issues. As well, government organizations at regional, provincial, national and international levels have produced numerous options and recommendations.

Our goal here is not to reinvent any wheels. It is, however, to review the various wheels lying around and see which ones could be joined together to get moving. Some have said that Hornby doesn't have a water problem; it has a water *storage* problem. Others are concerned the quality of water as it currently exists, such as issues with wastewater proximity to drinking water, and salt water intrusion. Some are mostly concerned about the density of certain neighbourhoods; others are focused largely on the potential effects of the extreme seasonality of the population.

To get going, a small committee was established, and which has been meeting since May 2016.

- Hornby Water Stewardship: Ellen Leslie, Dr. John Cox
- Hornby Island Community Economic Enhancement Corporation: Karen Ross, Darren Bond

It began pulling together existing and previous studies and references for a bibliography of work. As well, it determined that a logical process would be:

5. Pull together a report that shows what *could* be done on Hornby by consulting with individuals with expertise, reviewing outside plans (e.g., other gulf islands), and incorporating "best practice" research
6. Engage the community to review it and to prioritize what *should* be done.
7. Finalize a plan that incorporates these priorities to focus time, energy and budgets on a select few initial projects beginning in 2017, and report regularly on their status.
8. In parallel, participate as appropriate in research on the relationship of Hornby's geology and its water, better to drive further initiatives to enable the quality and quantity objectives of the overall Hornby Water Plan.

General Considerations

There are four ways for getting water:

- Storing it in the ground
- Catching it from the air
- Reusing it
- Purchasing it from a provider

As an island, with no lakes or rivers or snowcapped mountains, the main source of water for Hornby is from drilled and dug wells, along with some rainwater collection. Historically, people viewed the water from their drilled wells with an ownership mindset.

However, groundwater flows freely across property boundaries and is therefore a shared resource. People already experience the effect of their neighbour's actions as water levels can be affected by the pumping of other wells in the immediate vicinity.

Aquifers in BC are classified according to vulnerability. Aquifers on Hornby are unconfined fractured bedrock and are classified as highly vulnerable.

Climate change may have an effect on water. Spring rains may come earlier; fall rains may come later. We may need a diversity of sources to run our homes.

Residential wells are concentrated in the more populated areas and are not evenly distributed throughout the island. There are very few wells in the centre of the island.

The Official Community Plan (OCP) includes references to water throughout and, as such, helps to frame much of the work that may be proposed.

John Cox, a geology professor from Mount Royal University in Calgary – and now a member of the project – gave a public presentation in the summer of 2015, and indicated the potential value of "slowing water down" before it flows off the island, in order better to replenish the island aquifer, and to lessen the flow of contaminated water due to shallow wells and septic systems.

Issues of private versus public land will arise in any study; some properties could be deemed to be higher or lower value, based on their ability to produce water.

The demographic and economic profile of Hornby shows that its population has a higher median age and a lower median income than the average for other areas of the province. Considerations for the *expense* of solutions will, of course, be central in prioritizing possible follow-on initiatives. As one water forum participant pointed out: *most people won't spend $15,000 for a water system if their well still produces, but they will spend that if their well runs dry. Septic, 25 years old, people don't think they have a problem until there is poop on the ground.*

Finally, water isn't just ours; full ecosystems need it, too. Looking to the future, we may want, or need, to be more self-sufficient in food, and this should be a consideration in the water plan. Similarly, there is a concept of a "water budget" which requires some give-and-take. For example, mature trees may consumer 300 gallons per day, but the roots help retain water in the soil, foliage droppings help build soil, etc.

Research

As already mentioned, numerous studies have been done in the past, some Hornby-specific, most generic to water conservation. Although the overall intent of this plan is to establish both what *could* be done to be ready for the future as well as to prioritize what *should* be done beginning right away, this doesn't mean that we know everything there is to know.

- Are we appropriately testing our wells?
- Is there a problem with contamination?
- Does our geological understanding of faults and cracks give us clues as to where the best-producing wells might be?
- Why do certain wells produce such a high volume (e.g., High Salal) while others do not?
- Would this help with planning for gentle density planning of the population over time?
- Does our groundwater replenish itself to levels to handle the summer crush?
- What would it take to do so?
- How big an issue is saltwater intrusion?

People suggest that there isn't a water shortage. Is this true? In all areas? In all seasons?

There are still a number of outstanding issues that could help with making the best possible investment decisions – both individually and as a community – based as much as possible on data.

Existing users typically don't want to subsidize a change but according to some, the biggest concern is pollution and wastewater treatment. Is this the case across the board?

Based on keen interest expressed even at these early stages, there is an opportunity to engage community members in "citizen research." A few have been gathering rainwater data for years. Others test community wells. Yet others are willing to do so.

A general survey may well be a good tool in uncovering both "as is" conditions as perceived by Hornby residents, as well as opinions and comfort levels with taking either individual or collective actions resulting from the options offered. The last one was done twenty-four years ago (1992).

For example, with just a small taste of this, at the September Fall Fair, the Water Stewardship folks had an information table and ran an informal poll:

- 12 responses – 3 people had "no problem" while the majority had some issue:
    - Quality: salt water intrusion, sulphur, iron, etc.
    - Quantity: water runs out

Finally, while we look for solutions, we need to look globally, not just locally. Many areas of the world have used various water conservation techniques for years.

Opportunity Areas

As described briefly in the *Project Approach* section, a group of people with expertise from both Hornby and off-island (Island Health, Comox Valley Regional District, BC government) met at a two-and-a-half hour forum held at New Horizons on September 12th. The organizing committee provided background and context information – such as is documented above – and threw the door open to all to share their thoughts, and especially their top one or two ideas for how to move Hornby's water requirements forward.

In the following, each is described briefly to capture the essence of the idea and any further add-on dialogue from the group, and then some *specific* opportunities for consideration. These specifics may in turn trigger further options.

Ultimately, all of the opportunity areas will be bundled for prioritization – possibly in the form of a public survey – with a set of recommendations by the committee and decisions by the Boards of the Water Stewardship Project and HICEEC.

1. Individuals

There is much that can be done at the household level to help ensure the necessary quantity and quality of water. The ability to move toward to the objectives of this water plan is perhaps mostly easily achieved at the individual level; decision-making is simpler rather than having to engage with neighbours, community members and regulators. You're in control of your own world.

However, depending on the person's financial or personal situation, they may wish to take a position that's optimal for themselves but less so for the community at large.

1.1. Conservation

One approach for individuals is to reduce current amounts of water consumption:

1.1.1. Measurement devices

Gadgets are available to monitor well levels, well intake and wastewater outflows.

Pros: Information is power; people can, and do, adjust behaviours.
Cons: Hassle with getting something installed
Considerations:
Complexity: do-it-yourself / hire somebody / big deal ??
Cost: cheap / moderate / pricey ??

1.1.2. Well restrictor devices

Restrict overconsumption automatically.

Pros: Prevent wells from getting into trouble in the first place.
Cons: Hassle with getting something installed
Considerations:
Complexity:
Cost:

1.2. Collection

Rather than going to the well for water, people can harness the rain, in whole or in part.

1.2.1. Storage tanks

It fills up when it's wet outside.

Pros: Less problem with septic contamination; lots of winter rainfall; you know how much water you have in the tank
Cons: Possible space constraints; can't do it during pollen season.
Considerations: Some say that storage tanks are adequate for most residences.
Complexity:
Cost:

1.2.2. Membrane for torch-on roofs

Having a torch-on roof doesn't mean you're out of the ballgame. There's some kind of new membrane that can be overlaid, and voila.

Pros: Enables rainwater collection for people that otherwise thought it wasn't possible for them.
Cons:
Considerations:
Complexity:
Cost:

1.3. Quality assurance

Proactive and periodic monitoring helps prevent contamination situations.

1.3.1. Well testing (bacteria, salination)

Early warning about issues may help your own health and that of your neighbours.

Pros: Fewer health issues.
Cons: Finicky procedure.
Considerations: Do it when it's dry as a bone, and do it after all the rains… During heavy rains is a good time to test because one of the main sources of well water contamination is from surface runoff moving down the outside of the well shaft into the bore hole and the ground water. The surface water carries fecal coliform from deer, dogs, cats, mice, etc. If there is contamination higher during the time of year then the well shaft has to be sealed near the surface at the limiting layer. On Gabriola Island they thought that they had well contamination from septic systems until a retired health officer started sealing people's wellheads and the wells cleared up.
Complexity:
Cost:

1.4. Public investment possibilities

The specific opportunities above can be undertaken without any support from government organizations (regional, provincial, federal). However, sometimes it doesn't hurt to grease the wheels to get momentum and results.

1.4.1. Laboratory delivery service

Engage a person to collect samples to take into Courtenay for testing.

Pros: An easier process encourages more participation.
Cons: Lots of coordination effort.
Considerations: volunteer or paid
Complexity:
Cost:

1.4.2. Water testing service on-island

Engage a trained individual to do it here rather than taking samples into Courtenay.

Pros: Cheaper (basic well test has gone from $40 to $60; material cost is about $2.00)
Cons:
Considerations:
Complexity:
Cost:

1.4.3. Incentives for conservation and catchment

Source government programs where they exist.

Pros: Higher participation rate; reduced pressure on aquifer.
Cons: Usually go to people who are already going to take action.
Considerations:
Complexity:
Cost:

1.4.4. Incentives for converting pit toilets to composting toilets

Source government programs to stimulate citizen action.

Pros: Higher participation rate; reduced contamination of groundwater
Cons: The logistics of emptying a pit toilet of compost would be ergonomically challenging. A second chamber would be required otherwise raw material would be handled if cleaning out took place when the pit was full. Sealing a pit latrine to make it effective as a composting processor would be challenging and expensive. Draining such a design would also be challenging if not impossible in most cases.
Considerations: *Replace* with a composting toilet rather than convert a pit toilet.
Complexity:
Cost:

1.4.5. Coordination of group purchases

Work with suppliers, and possibly the Co-op, to facilitate cheaper purchases by residents and owners.

Pros: Reduced costs on items that may not qualify for incentives
Cons: Additional effort to create awareness
Considerations:
Complexity:
Cost:

2. Community infrastructure

Moving beyond the ability of individuals to effect change, some strategies may involve collective action at the neighbourhood, subdivision or island levels. Reasons for this often include overall cost factors – higher on the surface but possibly cheaper than the equivalent sum total of individuals replicating approaches – as well as regulatory requirements for both subdivided and crown land.

2.1. Distribution

Some people think that there isn't a water *shortage* on Hornby, but rather a water *storage* issue. This can move beyond the individual residence perspective and into the community realm, suggesting that, should the storage issue be resolved, then it's the movement of water that becomes crucial, either above ground or below (groundwater).

2.1.1. Watershed designation and enhancement

Adopt regulatory measures to protect a critical component of water storage, both for ecosystems and us.

Pros: Ensuring long-term health of the watershed.
Cons:
Considerations: must be complementary to any riparian act requirements
Complexity:
Cost:

2.1.2. Reservoirs

Establish holding areas for water.

Pros: Slows water down to allow greater refilling of the aquifers
Cons: Alteration of the natural landscape
Considerations:
Complexity:
Cost:

2.1.3. Run-off collection

Areas of the island overflow during the rainy season and the water rushes to the ocean through streams and ditches. This could be slowed down.

Pros: Replenish groundwater
Cons: Potential conflict with Islands Trust Riparian Area Regulations
Considerations:
Complexity:
Cost:

2.2. Intrusion prevention

We are in a geological "teardrop" of fresh water, but surrounded by saltwater. Once it finds its way in, it's a meddlesome visitor. Go easy on the pumping.

Pros: An ounce of prevention is worth a pound of cure.
Cons:
Considerations:
Complexity:
Cost:

2.3. Sewage treatment

A number of properties have inadequate systems for treating waste, causing contamination of groundwater that crosses boundaries. Implement solutions.

Pros: Community system
Cons: Water is not returned to native soils from where it was extracted or collected and thus further depleting the water shed.
Considerations: The soil root zone is the most effective and likely place where complex chemicals will be broken down. Collecting a large volume across property lines for treatment would either require a very large soil bed downstream from the treatment centre in order to disperse the water to soil or a pipeline out into marine waters where endocrine disruptors will be concentrated in that water body. Nutrient concentration also is an issue either in the soil or on a marine shoreline causing algae blooms, which lead to eutrophication creating sterile waters.

It is ultimately preferable to keep systems small and onsite or perhaps sharing with a very small grouping of homes where there is good soil and vegetation.

As in the recent Union Bay referendum, home owners with functioning septic systems will be very determined to not have to pay for a collective system.

Rather than go to the expense of going collective, lobby regional district to initiate a program of inspections of existing systems. If problem systems are identified then perhaps a rebate program to assist with the required upgrade. This addresses the potential problem at the source rather than penalizing everyone to pay for one large system when a large portion of the existing is functioning.

Are there proven examples of a failing septic contaminating neighboring wells or is this a rural myth?
Complexity:
Cost:

2.4. Public investment possibilities

2.4.1. Lake behind recycling depot

Once a natural lake existed in the 1950s, before it was lost after the logging that took place. If it were to be reestablished, it would be a valuable piece of the Mt. Geoffrey watershed, slowing water down in order to help replenish the island aquifer.

Pros:
Cons:
Considerations: This is not confirmed – neither Don Nixon (long-time resident developer) nor Betty Kennedy (HIRRA Parks committee chair) are aware of this ever existing. Sasha LeBaron indicated that Ron Dalziel reported this in a video interview he did with him.
Complexity:
Cost:

2.4.2. Strachan valley run-off

Divert winter stream run-off into wetland areas in order to increase the volume of water sinking into in the ground.

Pros: Rainfall is plentiful each winter
Cons: Flooding of farm land without remediation
Considerations: Check with owner.
Complexity:

Cost:

2.4.3. Mt. Geoffrey "sponge" / "fractured brick"

As the single largest protected area of land on the island, it plays a central role in the water health of Hornby. Such as been done by the mountain biking community – for different reasons – ways could be found to "slow down" and protect the water replenishing our aquifer, such as ditches to guide rainfall runoff to infiltration ponds.

Pros: Increased refilling of Hornby groundwater
Cons: Alteration of the natural landscape
Considerations:
Complexity:
Cost:

2.4.4. Two ponds near helipads

Enhance them.

Pros: Water catchment
Cons:
Considerations: Alteration of the natural landscape?
Complexity:
Cost:

2.4.5. Public building roof-top collection

Harness the large spaces and use the water for something.

Pros: Formulas indicate that there is a huge amount of water that could be made available.
Cons: Retrofitting issues
Considerations: Possible use of roofs for solar panels
Complexity:
Cost:

2.4.6. Centralize composting site for toilets

With new regulations in place for composting toilets, establish a public mechanism for harnessing the goodness.

Pros: Makes it easier for citizens to employ that technology; humanure potential
Cons:
Considerations:
Complexity:
Cost:

2.4.7. Neighbourhood treatment system for sewage

Without taking the retrofitting route for individual properties, establish centralized facilities.

Pros: Protect groundwater across boundaries
Cons: See 2.3 above
Considerations: See 2.3 above
Complexity:
Cost:

2.4.8. Dog poop collection

Provide containers.

Pros: Less contamination of runoff water in ditches and at the beaches
Cons:
Considerations: education and awareness
Complexity:
Cost:

3. General awareness and education

Perhaps before anything else can be achieved, or even started, continuing to raise the level of acknowledgement of the seriousness of the issue is paramount. Water isn't a priority until the day there isn't any. There may be a small percentage that isn't aware, but there may also be a small percentage that doesn't feel action is required beyond current practices.

Some vacation rental clients are very water conscious; they come with an attitude of conservation, but education is still required for the rest.

3.1. Low-use plantings

Not all trees, bushes, plants and groundcover – edible and ornamental – require the same amount of water to survive and thrive. At the decision-making moment at the store, is it easy to consider those that are drought resistant, such as native plants?

Pros: Easier on the water supply
Cons:
Considerations:
Complexity:
Cost:

3.2. Do-it-yourself

There are likely a number of projects people could undertake themselves if they were shown how, both on the water and septic fronts, such as installing grey water systems or composting toilets that don't smell.

Pros: Greater ability for more people to become more water-friendly themselves
Cons:
Considerations: According to the B.C. Sewerage Regulation, only an Authorized Person (AP) can plan and install or supervise a homeowner to install an onsite wastewater system, this includes greywater and composting toilets. It may be that a trained person could mentor people in this regard but ultimately the AP would have to sign off on the filing that goes on file at Environmental Health.

For those that do decide to take the initiative and not file with the Health office, there is good guidance and standards in the new B.C. Manual of Compost Toilet and Greywater Practice. This could be a problem should they decide to sell the property without a certified system.
Complexity:
Cost:

3.3. Usage visibility

Out-of-control fires have long been a source of dread, while signage – think Smokey the Bear – has provided an alert to people driving to their destination. Water is more invisible but the consequences can be dire. Providing a heads-up moment via signage and/or a reporting mechanism re: water could affect behaviour even while thoughts turn to barbecues and beer.

Pros: Just-in-time education
Cons:
Considerations:
Complexity:
Cost:

3.4. Polluting chemicals

Treatment of wastewater is all well and good, yet, further upstream, people are flushing toxic substances such as cleaning products, construction fluids, cosmetics and pharmaceuticals down the drain. That can't be good.

Pros: Reduce nasty substances getting into the ground
Cons:
Considerations:
Complexity:
Cost:

3.5. Recognize success

Showcase individuals or organizations that are making great strides. High Salal has a meter ($85) and posts usage for people to take pride in what they've done.

Pros: Nothing breeds success like success
Cons: Piecemeal approach.
Considerations:
Complexity:
Cost:

3.6. Highlight quality results

Island Health currently produces results of testing. Highlight these results.

Pros: Regular sharpening of awareness of water quality
Cons:
Considerations:
Complexity:
Cost:

3.7. Public investment possibilities

3.7.1. One source of information

Make it easy for residents to find information: rules, guidelines, incentives, etc. Also, highlight its presence. Also, continue to develop it. Candidate: www.hornbyislandwater.org

Pros: Greater citizen comfort level with taking action
Cons:
Considerations:
Complexity:
Cost:

3.7.2. Welcome-to-Hornby-Island package

Develop a brochure to be given to newcomers, pointing out water practices, and sources of information, and assistance in making wise choices.

Pros: Timely, all-in-one package for newcomers
Cons: Gets lost in all of the activity that takes place during a move
Considerations:
Complexity:
Cost:

3.7.3. Do-the-math rainwater collection template

Due to mere ignorance, people likely don't know how much water can be collected from the rain falling on their property. Using existing formulas, provide a little spreadsheet that might shed the light on the wisdom of rainwater collection to get through the summer.

Pros: Greater adoption of rainwater collection
Cons:
Considerations:
Complexity:
Cost:

3.7.4. Water "risk" signage

Utilize the existing "groundwater" signs on the road as solid backings for new signs that mimic the intent of the Smokey the Bear signs.

Pros: Existing "real estate" along the road
Cons:
Considerations:
Complexity:
Cost:

3.7.5. Topic-specific articles

Publish regular articles or brochures to continually make people think about their behaviours and available alternatives (e.g., chemicals, expired drugs)

Pros: Regular awareness-raising
Cons:
Considerations:
Complexity:
Cost:

3.7.6. Home-and-water tour

Invite people to see actual water systems in place around the island, from basic and cheap to complex and expensive.

Pros: Hands-on experiences to bring conceptual thoughts to life
Cons:
Considerations:
Complexity:
Cost:

3.7.7. School instruction

Prepare the next generation, plus they'll harass their parents.

Pros: Early education on the value of water and how to protect it
Cons: One more thing to add to the curriculum
Considerations:
Complexity:
Cost:

3.7.8. Summer public sessions

Give visitors something to learn while they're here that also fits the "brand" of Hornby.

Pros: Well received – if the last one was any indication – and contributes to behaviour change, and future decision-making on which way to go with water systems
Cons:
Considerations:
Complexity:
Cost:

4. Planning

We can't go back in time, but we can make efforts in retrofitting potable water and wastewater systems. Better still, we can lay the groundwork for groundwater, making it faster, better and cheaper to do the right things first.

4.1. Homes

When people are in the midst of designing or building a new home, or when organizations are constructing new public buildings, wouldn't it be great if the decision-making allowed for water-smart solutions rather than missing the boat and bemoaning the cost afterwards. Not every lot should drill its own well, and yet the earth is a brilliant storage system, which is naturally filtered and has continuous recharge (as opposed to depending on rainwater which is finite after collection).

Pros: Individuals feel more "in control" of their destiny
Cons:
Considerations: With new options for seasonal greywater irrigation, it is necessary to divert the flow from the year round system to the irrigation system. Even if the new homeowner doesn't request it or intend to irrigate their landscape in this way, the house design and construction should provide for this as a future option rather than have to retrofit later, which could be costly and/or quite challenging in some cases. A split and valved drainage system on specified fixtures is an easy matter during construction. Educating designers, builders, DIY home builders, would be quite easy. Education on the Real Hornby web site would be a starting point.

Complexity:
Cost:

4.2. Density

As the HICEEC Economic Action Plan of 2015 indicated, people want the population to rise. Whether this is by design or by happenstance, it would be best if the development were such as to optimize the available land and water resources. In much the same way that the Elder Village elegantly accommodates a number of people in a constrained area, it would be advantageous to determine where additional housing could go.

Pros: Eco-density versus people spread out
Cons: Detracts from the historical rural lifestyle
Considerations: When Hornby was at its peak population in the nineties the population to my memory was 1250 – 1300 people. That means there was enough housing at that time to accommodate that many people. Many more homes have been built since then. If our population is around 900 now that means there is a large supply of unused housing stock available in some capacity.

The housing problem is exacerbated with housing being committed to seasonal vacation rentals and thus removing it from use by year round residents. Increasing the shoulder season tourism will only exacerbate the issue. The problem right now is not one of housing shortage but of social/economic priorities.

Once or if the population starts to exceed 1300 in a significant way it may be necessary to strategize more about centralization or other options.
It is an interesting phenomena globally that urban populations are growing and rural populations are shrinking. We are not an isolated case of this happening and it is not

necessarily a local issue. Why would it change here when everywhere else urban areas grow. This may be a complete non-issue for Hornby.
Complexity:
Cost:

4.3. Public investment possibilities

4.3.1. Roof brochure

Develop and distribute a leaflet to people building new homes, providing options for installing a "green roof" for water collection, either immediately or down the road.

Pros: Just-in-time education and decision-making
Cons:
Considerations: Provide to designers, builders, realtors
Complexity:
Cost:

4.3.2. Eco-density plan for Hornby

If the population is to rise – to 1,500, to 2,500, whatever – better it should be done in a thoughtful way to cluster homes that are sensitive to the environment wherever possible, such as seen with the Elder Village or ISLA.

Pros: Sensitive development, as desired by the community, that reflects the principle that with out the environment, we have no economy.
Cons:
Considerations:
Complexity:
Cost:

5. Regulation and enforcement

Sometimes education and awareness only take you so far; actual practices may go around regulations with a wink of the eye. Currently, most bylaws rely on a complaint-driven system, reflecting the historic culture of the island; many (most?) people are reluctant to put in complaints for fear of disagreeable relationships with neighbours, or a sense of "let he who is without sin cast the first stone."

Some inspection does take place – electrical – on new homes, but beyond that, not so much.

Land-use zoning reflects decisions both from the past – prior to the creation of the Islands Trust – and from ongoing updates to reflect current desires and concerns of the population. For example, the Galleon, Whaling Station, and Sandpiper subdivisions – designed in the '60s – have more than 70% usage rates of available water, and little possibility of increased development.

Given the desirability of Hornby Island, both as a summer destination for both part-time owners as well as visitors generally, there is a high level of occupancy when water is in shortest supply.

5.1. Official Community Plan

The Official Community Plan goes through an intense process of engagement and development. It refers to water throughout and forms a fundamental platform for any and all investments.

Pros: Part of official land use processes already in place
Cons:
Considerations:
Complexity:
Cost:

5.2. Requirement for collection/storage

Xeriscaping required for any issuance of Development permits (required by all commercial properties on Hornby).

Pros: Maximize adoption
Cons: Blunt force
Considerations: Before requiring xeriscaping encourage rainwater collection, or greywater reuse for landscape irrigation for perennials. Native plantings rather than xeriscaping is more appropriate in that if they are not irrigated they will come back when there is rain again just like the whole natural landscape of the island. If irrigated with rain or gray water then they will be that much more lush in the summer. Using native plants would create much more vegetation than a xeriscaped landscape and would provide more habitat for local fauna. Construction always decreases natural habitat, the more habitat retained on-site the more the natural world around us will be able to survive.

Complexity:
Cost:

5.3. Regulation for short-term vacation rentals (STVRs)

Require additional capacity to handle the seasonal stress.

Pros: Zero in on higher-intensity properties

Cons: Economic hardship for owners
Considerations:
Complexity:
Cost:

5.4. Requirement for grey water reuse

Mandatory requirement.

Pros:
Cons:
Considerations: If rainwater is collected and used then it is not necessary to mandate greywater reuse. By putting greywater in a dispersal field (septic) and using rainwater for irrigation then the local soils are being hydrated by both the greywater and rainwater. If rainwater is not collected then traditionally it is considered storm water and dumped in a ditch to rush to the sea. If it were to be kept on site then the hydrology would more closely match historic levels. Where at all possible, even if rainwater is not collected it should be infiltrated to native soils.
Complexity:
Cost:

5.5. Regulations for composting toilets

Centralized offsite discharge – centralized facility after somewhat cured; onsite burial; on-surface application.

Pros: easier to take on if a person knows they have help
Cons:
Considerations:
Complexity:
Cost:

5.6. Regulations for chemicals and medications

Public pleas. Central collection recycling centre.

Pros: Reduction of nasty products getting into the groundwater.
Cons:
Considerations:
Complexity:
Cost:

5.7. Public investment possibilities

5.7.1. Centralized site for composting toilets discharge

Make it easy for people to use them as a matter of course and optimize the uses of humanure.

Pros: could be given back to the people; Hornby reputation for leading-edge solutions.
Cons:
Considerations: Recycling depot; trained people working to ensure full composting takes place
Complexity:
Cost:

5.7.2. Water governance and operations

As recommended by the OCP, establish a committee to coordinate water resources. (Other than for individual wells, this is more about quantity as opposed to quality, which already falls under the jurisdiction of the Island Health Authority.) As part of that, implement an anonymous reporting procedure. There's a Fire Chief; shouldn't there be a Water Chief?

Pros: Water-centric planning
Cons: Liability (as per Walkerton situation)
Considerations: New property tax line item
Complexity:
Cost:

Summary of opportunities

This table represents a format to be used to capture the input of contributors to the Discussion Paper.

Category	Area	Ranking	Complexity	Cost
1. Individual	1. Conservation			
	2. Collection			
	3. Quality Assurance			
2. Community	1. Distribution			
	2. Intrusion prevention			
	3. Sewage treatment			
3. Awareness & Education	1. Low-use plantings			
	2. Do-it-yourself			
	3. Usage visibility			
	4. Polluting chemicals			
	5. Recognize success			
	6. Highlight quality results			
4. Planning	1. Homes			
	2. Density			
5. Regulation & Enforcement	1. OCP			
	2. Collection & storage			
	3. STVRs			
	4. Grey water reuse			
	5. Composting toilets			
	6. Chemicals & medications			

Appendix

Water Forum participants

In addition to submissions of numerous studies, documents, websites, and so on, individuals took time from their busy schedules to participate in a meeting in September, 2016, providing valuable input on opportunities and issues. Many have also agreed to participate in reviewing and refining the plan itself, as well as help move it forward however they can.

John Cox	HWS (and geologist from Mount Royal University)
Ellen Leslie	HWS
Darren Bond	HICEEC
Karen Ross	HICEEC
Josh Moran	Island Health, Env. Health Officer
Sylvia Barroso	Hydrologist, Min. Forest, Lands & Nat. Resources
Tony Law	Island Trust
Ryan O'Grady	CVRD Manager of Liquid Waste Planning
Rob McCreary	HIRRA
David Cloud	Water delivery/sales
Dave Wishart	Well drilling
Allan Dakin - submission	Groundwater engineering and hydrogeology
Ed Hoeppner	Green solutions
Ron McMurtrie - submission	Engineer
Giff LaRose	Fire Chief/Water Storage
Garth Millan	Certified septics
Donna Tuele	Realtor/proof of servicing
Michael McNamara	Architect, Green roofs
Sasha LeBaron - submission	Hornby Parks & HIMBA
Tig Cross - submission	HIMBA and Strachan Valley
Jennie Ambrose	Cape Gurney Landowners Assoc.
April Shopland	Cape Gurney Landowners Assoc.
Mary Mackenzie	Hornby Water Stewardship
Cathie Howard - submission	Hornby Water Stewardship, Past Isl. Trust
Ilze Raudins	Hornby Water Stewardship
Rudy Rogalsky	Hornby Water Stewardship
Margot Bushnell	Hornby Water Stewardship
Judith Lawrence	Hornby Water Stewardship
Jake Berman	Engineer, HICEEC help

List of Available Information Sources

I. Hornby Island
   a. Water Stewardship website: http://hornbyislandwater.org/
   b. List of existing water licences
   c. Study: *Areas known to have a Problem with the Supply of Freshwater on Hornby Island*, Tony Law, March 2010, including sources:
      1) Islands Trust Policy Statement
      2) Islands Trust Act
      3) Hornby Island Official Community Plan, Bylaw No. 104, 2004
      4) Results of the Groundwater Geochemistry Study on Hornby Island, BC - D.M. Allen, G.P. Matsuo, 2001
      5) A Preliminary Groundwater Assessment of a Crown Land Parcel on Hornby Island - W.S. Hodge, 1993
      6) The Hornby Island Groundwater Pilot Project - Final Report, 1994
      7) Hornby Island Land Use Bylaw No. 86, 1993
      8) Hornby Island Planning Study - Regional District of Comox-Strathcona, 1971
      9) A Preliminary Review of Groundwater Conditions on Hornby Island, BC - F. Chowjka, 1984
      10) Groundwater Conditions on Hornby Island, BC, 1989 Update and Review - F. Chowjka, 1989
      11) Census Canada
      12) BC Ministry of Environment - Groundwater levels
      13) Meteorological Service of Canada - Climate data for Comox
      14) British Columbia Passenger Volume Modelling - Urban Futures, 2008
      15) British Columbia Assessment Authority
      16) Hornby web-sites (Wind and Waves, hornbyisland.com, hornbyisland.net), 2009
      17) Water Stewardship and Wastewater Management on Hornby Island - Third Eye Consultants RRU, 2000
      18) Hornby Island Water Stewardship Project: Report on the Activities of the Project - Ed. D. Christie, 1999
      19) Bedrock Aquifers on Hornby Island - Groundwater Section, BC Ministry of Environment, 2001
      20) An Aquifer Classification System for Groundwater Management in BC - BC Ministry of Environment

II. Islands Trust
   a. Water Resource information: www.islandstrust.bc.ca/trust-council/projects/water-resource-information-for-islanders/water-conservation

III. Comox Valley Regional District
   a. Rebate program for: low flush toilet rebates, smart control irrigation rebates and water leak rebates

IV. Vancouver Island Health Authority
   a. Hornby Public Health Officer: Josh Moran

b. Water Samples: www.healthspace.ca/Clients/VIHA/VIHA_Website.nsf/Water-Samples-Frameset

V. Capital Regional District:
   a. Green Infrastructure: www.crd.bc.ca/education/low-impact-development
   b. Salt Spring Island Well Monitoring Kit: www.ssiwatercouncil.ca/well-monitoring-kit

VI. Regional District of Nanaimo
   a. Rainwater Harvesting, Best Practices Guidebook, rdn.bc.ca/events/attachments/evID6235evattID1344.pdf
   b. Rainwater Harvesting Incentives, www.rdn.bc.ca/cms.asp?wpID=2500
   c. Gabriola Water Plan, 2013, www.rdn.bc.ca/dms/documents/dwwp-reports/gabriola-water-region/phase_1_water_budget_study_gabriola_-_2013.pdf
   d. "Recognize the water savers" contest: www.rdn.bc.ca/cms.asp?wpID=3525
   e. RDN Drinking Water and Watershed Protection Program: www.dwwp.ca
   f. Program brochures and guides: www.rdn.bc.ca/cms.asp?wpID=2155
   g. Rainwater harvesting guidebook: rdn.bc.ca/events/attachments/evID6235evattID1344.pdf

VII. Govt of BC
   a. Water Sustainability Act (WSA) February 29, 2016: https://engage.gov.bc.ca/watersustainabilityact/
   b. Govt of BC Water Portal: www.gov.bc.ca/water
   c. Groundwater information: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/groundwater-wells
   d. Provincial observation well network (groundwater level monitoring): http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/groundwater-wells/aquifers/groundwater-observation-well-network
   e. Ministry of Environment Water Stewardship Division: www.env.gov.bc.ca/wsd
   f. Provincial inventory of wells: a100.gov.bc.ca/pub/wells/public/indexreports.jsp
   g. BC Ministry of Health, water supply system permitting and operation: www.health.gov.bc.ca/protect/dw_index.html
   h. BC Agricultural Council: www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/Documents_and_Reports.htm
   i. Guidebook for Urban and Rural Land Development: www.env.gov.bc.ca/wld/documents/bmp/devwithcare2006
   j. MOE Groundwater reference library: www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library.html
   k. MOE Groundwater reference library: www.env.gov.bc.ca/wsd/plan_portect_sustain/groundwater/library.html

l. Infrastructure Planning Grant Program www.cscd.gov.bc.ca/Lgd/infra/infrastructure_grants/infrastructure_planning_grant.htm

VIII. Non-Government Organizations
- a. POLIS Project on Ecological Governance: water sustainability project http://poliswaterproject.org
- b. BC Groundwater Assn: www.bcgwa.org
- c. Real Estate Foundation (http://www.refbc.com/news/building-knowledge-and-capacity-bc-water-movement#.VzJQyiFBln8)
- d. Comox Valley Project Watershed: projectwatershed.ca
- e. Our Living Waters / Pooling Water Knowledge working group: Realizing the Potential of Community Based Monitoring (www.ourlivingwaters.ca)

IX. Natural Resources Canada
- a. Gulf Island waterscape poster: publications.gc.ca/collections/collection_2007/nrcan-rncan/M41-8-89E.pdf

X. Health Canada
- a. Water quality resources: www.hc-sc.gc.ca/ewh-semt/water-eau/index-eng.php

XI. Canada Mortgage and Housing Corporation
- a. Buying a house with a well and a septic system: www.cmhc-schl.gc.ca/en/co/buho/buho_003.cfm

XII. US Geological Service
- a. Guide on groundwater sustainability: pubs.usgs.gov/circ/circ1186/pdf/circ1186.pdf

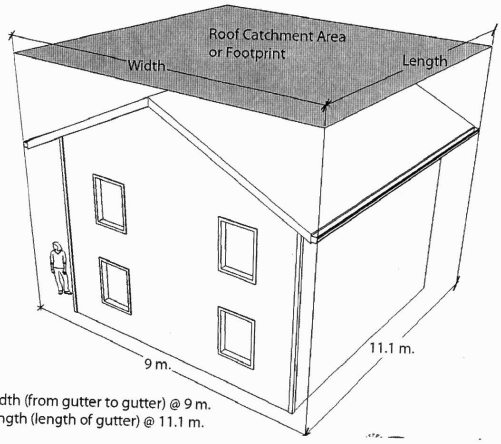
Rainwater Collection Formula

This can be used to estimate the volume of water that can be captured.

Regional Dist of Nanaimo
Rainwater Harvesting
Best Practices Guidebook
Sept 2012

3.1.2 Size or Footprint of Your Roof (Roof Catchment Area)

The roof catchment area refers to the footprint or horizontal plane under the eaves, rather than the actual surface area of the roof. Catchment area is not affected by roof slope. Determining the roof catchment area will allow you to calculate the total amount of water you can collect for a given rainfall event.



Width (from gutter to gutter) @ 9 m.
Length (length of gutter) @ 11.1 m.

Calculating the roof catchment area

Width (from gutter to gutter) multiplied by Length (length of gutter) equals Catchment Area

9m (29.5ft) x 11.1m (36.5ft) = 100m² (1,076 sq.ft)

Therefore, if the roof footprint is 9m wide by 11.1m long, the catchment area equals 100m² (1,076 sq.ft)

Calculating the roof catchment area.

Hornby Island Water Licences

Likely out-of-date. Part of research to update and add to map.

July 1990 Master Plan
Mt Geoffrey Nature Park
Rev. Sept 2004

Appendix 1: Hydrology / Water Licences (from MELP / BC Env. GOAT - Vancouver Island Region)

Source	License	File No.	Date	Client Name	PUC Descriptio	Quantity	Unit
Anne Spring	C042346	0316110 C	10/23/1972	Van Blankenstein, Louis	Domestic	500	GD
Aspen Swamp	C064088	1000463 C	5/3/1985	Bevan, Janice Mary	Domestic	500	GD
Beulah Creek	C027774	0245415 C	8/6/1962	Savory, Bevan & Helena	Domestic	500	GD
Beulah Creek	C057670	0368350 C	4/10/1981	Fenger, Michael	Domestic	500	GD
Bond Spring	F021522	0262369 C	5/5/1965	Rubinoff, Jeffrey	Domestic	1500	GD
Canary Swamp	C070765	0317653 C	8/22/1973	Blais, Danielle	Domestic	600	GD
Crabapple Swamp	C070765	0317653 C	8/22/1973	Blais, Danielle	Domestic	600	GD
Fallows Spring	C054322	0192682 C	12/3/1951	Johansen, Ethel	Domestic	500	GD
Fraser Spring	C043428	0323063 P	5/10/1974	Witt, Ronald & June Diver	Domestic	500	GD
Fraser Spring	C043428	0323063 P	5/10/1974	Witt, Ronald & June Diver	Irrigation	0.33	AF
Fraser Spring	C0105744	0323909 C	9/26/1974	Werner, Martha	Domestic	500	GD
Godfrey Spring	C067546	0305702 C	7/22/1971	Shire Community Cooperative	Irrigation	1	AF
Godfrey Spring	C067546	0305702 C	7/22/1971	Shire Community Cooperative	Water Works	2000	GD
Godfrey Spring	C067546	0305702 C	7/22/1971	Shire Community Cooperative	Irrigation	1	AF
Godfrey Spring	C047546	0305702 C	7/22/1971	Shire Community Cooperative	Water Works	2000	GD
Jenny Spring	C047106	0329888 C	12/5/1975	Johnston, Rollin	Domestic	500	GD
Joshua Spring	C061400	1000572 C	3/20/1986	Thompson, M Kathleen	Domestic	500	GD
Lea Spring	C041863	0270660 C	10/11/1966	Lamarre, Noella	Domestic	500	GD
Lea Spring	C041863	0270660 C	10/11/1966	Lamarre, Noella	Irrigation	1	AF
Lea Spring	C041864	0317533 C	10/11/1966	Peters, Milton	Domestic	500	GD
Lea Spring	C041864	0317533 C	10/11/1966	Peters, Milton	Irrigation	1	AF
Lea Spring	C041865	0317534 C	10/11/1966	Smith, Richard & June	Domestic	500	GD
Lea Spring	C041865	0317534 C	10/11/1966	Smith, Richard & June	Irrigation	1	AF
Maude Brook	C029825	0275325 C	6/15/1964	Chartam Inc	Irrigation	20	AF
Maude Brook	C029826	0257325 C	6/15/1964	Chartam Inc	Storage	5	AF
McLachlan Spring	C034301	0277493 C	8/6/1968	McLachlan, George & E. Nancy	Domestic	500	GD
Neal Spring	C061462	1000100 C	11/19/1982	Shire Community Cooperative	Domestic	1000	GD
Neal Spring	C061462	1000100 C	11/19/1982	Shire Community Cooperative	Irrigation	2	AF
Parnell Spring	C054112	0210646 C	2/1/1956	Fisher, Kenneth	Domestic	500	GD
Parnell Spring	C054222	0365442 C	4/19/1979	Yeomans, William	Domestic	500	GD
Rubinoff Pond	C045729	0328160 C	12/4/1974	Rubinoff, Jeffrey	Irrigation	30	AF
Rubinoff Pond	C045730	0328160 C	12/4/1974	Rubinoff, Jeffrey	Storage	30	AF
Slade Spring	C057099	0300050 P	8/24/1970	Slade, Ginger	Irrigation	50	AF
Slade Spring	C0571010	0300050 P	8/24/1970	Slade, Ginger	Storage	30	AF
Spruce Spring	C061343	1000102 C	11/19/1982	Shire Community Cooperative	Domestic	500	GD
Spruce Spring	C061434	1000102 C	11/19/1982	Shire Community Cooperative	Irrigation	1	AF
Timnick Spring	C061464	1000099 C	11/19/1982	Shire Community Cooperative	Domestic	500	GD
Timnick Spring	C061464	1000099 C	11/19/1982	Shire Community Cooperative	Irrigation	2	AF
ZZ Creek	Z100948	1001143 Z	10/12/1989	Roberts, David	Domestic	250	GD
ZZ Creek	Z100948	1001143 Z	10/12/1989	Roberts, David	Irrigation	2	AF
ZZ Creek	Z100948	1001143 Z	10/12/1989	Roberts, David	Storage	3.5	AF
ZZ Creek	Z100944	1001127 Z	9/5/1989	Snowden, Victor & Donna	Domestic	500	GD
ZZ Creek	Z100944	1001127 Z	9/5/1989	Snowden, Victor & Donna	Irrigation	2	AF
ZZ Creek	Z100944	1001127 Z	9/5/1989	Snowden, Victor & Donna	Fire Protection	1	GD
ZZ Creek	Z102252	1001466 Z	6/25/1991	Parrish, Michael & Margaret W.	Irrigation	1	AF

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Cape Gurney Landowners' Association – Guidelines for Guests

CAPE GURNEY LANDOWNERS' ASSOCIATION

GUIDELINES FOR GUESTS

Water

This home is on a community well shared by 28 homes. The water source is an underground aquifer and there is danger of salt water contamination if it is drawn down too much. While staying here, please follow these guidelines for conserving water:

Bring your own bed linens and towels
Take your dirty laundry home - no washing machine available
Use bath or dish water for plants
Turn tap off while brushing teeth, ditto for shaving – save a gallon a minute!
Flush only when necessary, if it's yellow let it mellow, if it's brown flush it down
Shower – wet yourself down, turn off tap, soap yourself then rinse off quickly. Ditto for hair washing. Better yet – go for a swim.
Remember a bath uses much more water than a shower, make do with a few inches in the tub
For dishes, use a small bowl of soapy water to clean cutlery and dishes. Fill dishpan only for rinsing. Never let tap run continuously.
If using dishwasher, run only full loads
Don't run tap to get cold water, keep jug of water in fridge
You may prefer to drink bottled water available at the Co-op
Using a hose for car washing or gardens is prohibited
Please do not let children play with the hose
Remember to turn the water off at the blue post when leaving

Fire

Note location of fire extinguishers
Don't burn garbage or driftwood in fireplace
In event of chimney fire, close air intake, throw a cup of water onto embers, close fireplace door immediately then phone 911 Fire Dept.
Don't smoke around dry grass, use sand buckets
Operate barbecue in sheltered area out of wind
Turn off propane after use

Street address of this cabin:

_____

Tel.No: _____

Call 911 for emergency (police, fire, ambulance)

Call doctor's pager for medical emergency only – 250-703-7751

Hornby Medical Clinic – 250-335-3036

If you see something or someone on the water in trouble call 1-800-567-5111 (Coast Guard Emergency Search & Rescue)

Septic System

Our waste water and sewage goes into a septic tank. A malfunctioning septic system can contaminate ground water or cause backups. Please follow these guidelines to help us maintain our septic system :

Use only cleaning products recommended for use with septic systems
Do not put the following down sinks or toilets:

- Kleenex
- Paper towels
- Hair
- Sanitary products
- Cigarettes
- Grease
- Cat litter
- Diapers
- Coffee grounds
- Bleach or other chlorine products
- Varnish, paint thinners, motor oils, gasoline or similar chemicals

Results of the Groundwater Geochemistry Study on Hornby Island, British Columbia (April 2002)

The following is an extract from a study prepared by D.M. Allen and G.P. Matsuo, Department of Earth Sciences, Simon Fraser University, prepared for Islands Trust

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

- Groundwater on Hornby Island is recharged locally, typically at high elevation in areas corresponding to Mount Geoffrey and the Crown Land. However, the relatively immature chemical composition of many well waters (calcium-bicarbonate type water) situated at lower elevations suggests that recharge occurs over a significant portion of the island.
- Groundwater regions, originally defined on the basis of topography, appear to coincide with chemical evolution trends identified in the sample groups employed for this study. However, due to the limited amount of structural data available for Hornby Island, and a corresponding lack of subsurface lithological control, there are some areas where topographic divides may be bypassed by subsurface inhomogeneities like discontinuous fractured mudstone stringers and non-systematic fractures.
- Chemical evolution of groundwater on Hornby Island demonstrated cation exchange and salinization as dominant evolutionary pathways. This is in general agreement with the observations and results from Saturna Island.
- Cation exchange (Ca exchanging for Na) is identified as a dominant geochemical process during the evolution of groundwater. In general, cation exchange was observed to be most prevalent in areas underlain by fine-grained sedimentary rocks. Therefore, it is suggested that groundwater flow through mudstone units may be the cause for the high occurrence of cation exchange. However, there was variability in this trend when sample groups containing different fine-grained formations were compared. This may suggest that cation exchange is dependent on the lithology encountered. Not all fine-grained units have the same ability to support cation exchange.
- Mature groundwaters, characterized by higher concentrations of chloride, result from mixing between the Na-rich groundwater and saline groundwater at depth, associated with either modern seawater or remnant seawater. Several wells in the Whaling Station Bay area show significant salinization, and suggest that saltwater intrusion may be prevalent in that area.

5.2 Recommendations

- Continue to collect and reevaluate groundwater geochemical data as a means of tracking potential trends in water quality. Observation of long-term patterns in groundwater geochemistry may allow for better understanding of the processes causing the changes. This type of exercise may be particularly useful for areas like Whaling Station Bay.
- Additional sampling of wells not sampled in this study may provide a higher resolution, and an improved database, for future studies.
- Groundwater quality and quantity are of paramount importance to residents on Hornby Island and the other Gulf Islands. As such, water conservation, proper waste disposal and placement of human development should be made a priority in future

land use planning. This should be done so as to protect sensitive groundwater recharge areas in upland locations.

- For future wells drilled on the Gulf Islands the collection of detailed drill logs may allow for the collection of otherwise unobtainable subsurface geological controls on groundwater flow and evolution.
- The collection of whole rock geochemical analysis of samples of the fine-grained units (Northumberland and Spray Formations) and from fine-grained interbeds within the Geoffrey Formation may allow for the quantification of the differing cation exchange capacities of the different mud rich units underlying Hornby Island. Without this and other geologic data (e.g., structural data) a clear understanding of subsurface groundwater flow and evolution will be made extremely difficult.
- Conduct detailed surficial mapping for Hornby Island so as to be able to delineate the spatial distribution of permeable surficial sediments, and eventually incorporate this information into the hydrogeological model for this island.

Hornby Island Groundwater Protection Pilot Project, Phase II Report (June 2002) – Appendix I

The following is an extract from a report undertaken as a partnership between Islands Trust and the Ministry of Water, Land & Air Protection, prepared by Eleanor N.M. Kneffel
Draft 4 July 22 /01 (corrected Aug.16/01)

HORNBY ISLAND GROUNDWATER PROTECTION STRATEGY
INTRODUCTION

This Strategy was developed under a Pilot Project undertaken by concerned Hornby Island residents under a joint initiative of the Groundwater Section of the Provincial Government and Islands Trust. It is intended that this Strategy will contribute significantly to the successful completion of groundwater protection strategies for other similar areas in British Columbia.

The quantity and the quality of groundwater on Hornby Island are of paramount importance and yet are of growing concern.

In the absence of natural surface water sources, groundwater is the primary water source with limited supplies provided by cisterns and man made ponds.

There are already depletion problems in a number of areas on the Island and yet many approved lots are still to be developed in these same areas. Also, there is a potential for additional development in recharge areas delineated in recent hydrgeological studies and which are the source of supply for only partially developed areas already experiencing groundwater depletion problems. The need for water conservation is apparent.

The need for better protection of groundwater quality also is apparent. From 1996 to 1999 over 800 surface, marine and well water samples were tested under the Water Stewardship Program undertaken by Island volunteers. Almost 80% of streams had fecal coliform counts above background levels and over 20% of the 167 well tested had levels of fecal coliform which exceeded drinking water standards. A study undertaken by a team of Royal Roads students for Water Stewardship demonstrated that groundwater pollution from older and inadequate wastewater treatment systems is already a problem. This situation is made worse by a lack of understanding by residents of the need for action and of what remedial options are available to them. Many seek neither and sometimes install their own solutions or do nothing because of fear that the costs of an approved treatment system may be beyond their means.

Fortunately the current situation can be overcome with the help of recent proposed changes to Health Act Regulations and the opportunity for more local involvement in their application. These changes provide an opportunity to have a wastewater system approved which is less expensive and an alternative to the standard septic field. The successful future completion of projects designed to test other wastewater treatment systems will no doubt increase these options.

The new Drinking Water Protection Act and amendments to the Health and Water Acts also add to the potential for success in achieving the Goal of the Strategy. Also, the ongoing review of the Official Community Plan should result in the policies and supporting Regulations necessary for success.

In addition it has become very apparent that educational programs emphasizing water conservation methods are necessary to reduce water consumption and lead to recycling of effectively treated wastewater.

This Strategy was developed by the Advisory Groundwater Protection Committee in consultation with the concerned Island residents. This Strategy will be recommended as the core of the "implementation" phase of the Pilot Groundwater Protection Project of the Islands Trust and the Provincial Ministry of Environment. Its success will depend on continued local involvement and can only be achieved with the technical, administrative and financial support of the Comox Strathcona Regional District and pertinent agencies of the Province and the Federal Government. The order and timing of different projects and programs under the Strategy will depend totally on the extent of this support and when it is provided. The purpose of the Strategy is to achieve the following Goal and Objectives.

GOAL - To preserve and protect the quantity and quality of the groundwater resource on Hornby Island through initiatives and programs which achieve the following:

OBJECTIVES

1. - Preservation, and where possible, the enhancement of groundwater recharge quantities through the protection of existing natural wetlands, prudent land clearing and responsible drainage practices.
2. - Preservation and enhancement of available groundwater supplies through the development and use of supplemental storage such as lined dugouts to capture surficial runoff and cisterns to capture rainwater runoff from structures.
3. - Preservation of available groundwater supplies by minimizing water use through responsible indoor and outdoor conservation practices.
4. - Protection of groundwater quality against pollution from land use practices including; application of pesticides, herbicides, and fertilizers, disposal and leakage of chemicals including fuel and oil , and, concentrations of livestock wastes or garbage, including hazardous wastes.
5. - Protection of groundwater quality from contamination by wastewater from all new development by ensuring that these have approved treatment and dispersal systems.
6. - Reduction and eventual elimination of groundwater contamination from existing development caused by effluent from aging and inadequate wastewater treatment and dispersal systems through a program which fosters the upgrading or replacement of these systems to approved standards.
7. - Prevention of aquifer contamination at well locations through programs which result in proper well drilling, completion and abandonment practices and, prudent management of activities in the vicinity of well heads.

ORGANIZATION AND METHODOLOGY

The strategy will be developed, implemented and modified over time under the direction of a Groundwater Protection Committee. These actions will be undertaken in consultation with the residents and landowners of the Island and in partnership with government agencies. Implementation will be through Island organizations, consultants and regulatory authorities. Administration and coordination will be through the office of a Co-ordinator established under assured government funding. Support for obtaining funding from senior governments and local taxpayers and for developing and managing local infrastructure systems will be provided by the

Regional District. Technical and financial and regulatory support will be provided by the Regional District, Islands Trust and agencies of both senior governments. Enforcement of Bylaws and Regulations will be undertaken in a way that is consistent with the intent of the Official Community Plan so that there is due consideration for programs being developed and implemented under the Strategy when applying discretionary powers under Regulations and Bylaws.

The fundamental approach to Strategy implementation will consist of;

a. Developing, with due regard for privacy, the best possible understanding of the current situation regarding groundwater quantity and quality and the factors threatening further degradation in the absence of this Strategy.
b. Raising public awareness of the need and value in taking the initiative to preserve and protect the resource.
c. Evaluating and compiling information on preservation and protection options available to individuals or groups of neighbours or, involving the use of centralized facilities.
d. Compiling and then providing residents and landowners with the information which will enable them to consider and then take meaningful action with an adequate understanding of their options, the technical and financial support available and what their benefits and costs should be.
e. Advocating and supporting test projects to develop better technologies and information.
f. Advocating enforcement of Bylaws and legislated Regulations by appropriate authorities using permitted discretion in a way which reflects the Strategy.
g. Facilitating the establishment of a permanent performance assurance system which, through ongoing monitoring, ensures all performance based wastewater disposal systems are operated and maintained to meet their performance standards.
h. Monitoring implementation of the Strategy and its effectiveness and ensuring the community is kept informed on progress being made and the extent of beneficial impacts.

PROGRAMS AND PROJECTS

The Objectives will be fulfilled through implementation of a number of programs/projects which are considered appropriate for community leadership or significant support. These will be assisted or coordinated by the Groundwater Protection Committee. The success of these programs/projects will require both public and government support and involvement. The government support/involvement will range from the provision of financial, material, administrative and technical resources to the application of the necessary degree of regulation under pertinent legislation and bylaws while using permitted discretion to support Strategy implementation. The development and operational responsibility for certain systems and a range of technical and administrative support will also be included in this involvement.

The number and type of programs/projects will change over time as feasibility studies are completed, new legislation is passed, new opportunities arise and community values and needs change as the Strategy unfolds.

Programs/Projects will initially include;

1. A program to develop respect for and foster protection of wetlands on both

private and public lands. This will include the preparation of a map of natural wetlands on the Island which will then be used to develop a brochure and other tools to be used to increase awareness of the value and location of these wetlands and the need to protect them in order to preserve their contribution to groundwater recharge.

2. A program to preserve and where possible enhance groundwater recharge quantities which could be affected by land use activities. The focus will be on education through the presentation of information explaining how activities such as clearing and drainage changes on private and public lands can enhance or adversely affect groundwater recharge. This will include the preparation of a brochure containing information on how to get technical advice and on what financial incentives may be available.

3. A program to increase water conservation. This will be accomplished by convincing more people of the need and value of water conservation through careful supply management, recycling and wastewater disposal which minimizes or eliminates the use of water. A public information program will be developed and implemented to encourage conservation and then provide information which people need if they are to make this happen.

4. A project to enable approved greywater treatment and dispersal. This would include the continued testing of promising greywater treatment systems until the approval of one or more systems is given by the Ministry of Health.

5. A project to assess the feasibility of a centralized composting facility. This facility would treat combinations of waste including toilet compost, properly treated septic tank sludge, unrecyclable paper products and kitchen and yard organics. The study would investigate siting, facility funding and management alternatives and options for educating those who would use such a facility.

6. A program to assist and expand the use of composting toilets. This program will be based on the results of Projects 4 and 5 above. This program would include the siting, funding, establishment and operation of a centralized composting facility, if viable, and the installation by landowners of approved greywater systems which are monitored for performance thus ensuring their use is limited to this purpose. This program would have an education component which would include a brochure providing information on available composting toilets and greywater treatment systems. This would include features of various products and systems, the associated costs and where information on specific products can be obtained. Guidance on how to proceed with an application for approval will also be included.

7. A project to assess the desirability and feasibility of centralized wastewater treatment facilities for existing subdivisions. The possibility of such a study would be addressed early in the development of the Strategy. Any pre feasibility study would only be undertaken upon request of from a majority of landowners in a subdivision. The Regional District would be the lead agency for this project including the decisions on further studies, project viability, financial arrangements, project construction, and, operation and maintenance of the works.

8. A program which promotes proper wastewater treatment. This will enable landowners to make informed decisions on installing approved wastewater treatment systems. The program will provide an updated description of

technologies suitable for wastewater treatment on Hornby Island and which have been approved by the Ministry of Health. A technical bulletin would be prepared which would describe the approximate cost and physical aspects of each system, siting constraints and operation and maintenance requirements and approximate costs. The types of system would be limited to those which treat wastewater from individual and small neighbouring clusters of residential buildings. This program would also provide information on how and where to get additional technical information and how to proceed in getting approval. The bulletin will be updated periodically and a full understanding of its contents supported by technical information meetings.

9. A program which reduces and eventually eliminates groundwater pollution caused by effluent from failing or inadequate wastewater treatment systems. This will be accomplished by encouraging and supporting landowners in extending the life of, or replacing failed, septic tank and field systems and other inadequate systems. A public awareness program will be developed and initiated to make the public aware of the value in proper septic tank loading and timely pumpout. This will emphasize health, environmental and financial benefits. A technical bulletin will be prepared so owners understand the operation and maintenance required for their particular system. In the case of failed or inadequate systems, landowners will be referred to the information bulletins made available under programs 6 and 8 above. Information/technical meetings will be held as required.

10. A program to reduce and eventually eliminate pollution of aquifers resulting from contaminated water entering groundwater through the well itself or around the well casing. A brochure will be prepared explaining preventative structural measures and how to take these. The brochure also will describe how pollution from land use activities in the vicinity of well heads can be prevented. All community wells will be evaluated and a program developed to eliminate pollution from activities in the area around each well head.

11. A program to prevent contaminated water from entering aquifers through abandoned wells. The groundwater Section, of the Provincial Government will be asked to prepare a brochure on how to seal unused wells. It will advise of the urgent need to seal unused wells and explain how this can be done and by whom. The brochure will be made available to all landowners. An inventory of known abandoned wells will be prepared using MOEL&P records and local knowledge. Owners of properties containing these wells will be contacted and encouraged to undertake remedial action. Inaction may be followed by a request that measures be taken under the Drinking Water Protection Act.

12. A program to protect aquifers from pollution resulting from improperly constructed wells. The Groundwater Section, MOEL&P will be encouraged to develop and enforce appropriate well construction and completion standards. On site support will be provided where possible through monitoring of siting and use permits. All landowners with new wells will be provided with a copy of the brochure produced under Program 10.

13. A program to prevent the pollution of aquifers caused by land use including household activities such as the application of herbicides, pesticides and fertilizers to yards and gardens and the use, leakage and disposal of chemicals such as household cleaners, garbage and petroleum products. This program will consist of

an education program to raise public awareness of the necessity of preventing this type of groundwater pollution and will foster the use of alternative products and practices to make this happen.

14. A program to protect aquifers from pollution caused by inappropriate agricultural practices. This program will promote the pertinent agricultural related policies of the Official Community Plan such as encouraging organic farming while discouraging the use of chemicals and farming methods such as the management of manure in such a way as to cause groundwater contamination from polluted and nutrient enriched recharge waters entering aquifers through underlying soils or through infiltration of surficial runoff. In addition this program will promote use of the Code of Agricultural Practice for Waste Management and related legislation and regulations.

15. A program to measure the effectiveness of Strategy implementation. This will include documentation of the quantity and quality of the groundwater resource, water use and wastewater disposal practices for the island as a whole at the start of Strategy implementation. Subsequent activities would include ongoing measurement and documentation of changes and the preparation of an annual progress "report card" which will be made available to the public. Also, monitoring will be undertaken on a site/area specific basis where it is considered prudent to evaluate the impacts of potentially excessive groundwater withdrawal or waste storage/disposal practices. In cases where such withdrawal involves the transport of water to other properties this monitoring will measure and document the location, timing and the amounts of deliveries made necessary by aquifer depletion.

PRIORITIES AND SCHEDULING

Consultations with the public, community organizations and government officials will determine priorities and the initial levels of financial and technical support. A framework for implementation of the Strategy, which will include scheduling, will then be developed.

Official Community Plan (2014) – Extracts

Water resources are referred to throughout the OCP. Certain sections, however, speak directly to the elements of this water plan and are worth noting.

Section 2.2 Objectives and Policies for All Land Use

Groundwater

Groundwater is the primary source of potable water supply on Hornby Island. Studies have identified the importance of protecting the groundwater supply, ensuring that catchment areas are protected to provide for effective groundwater recharge, that groundwater is not contaminated from development and that the rate and use of groundwater does not exceed the rate of replenishment both in localized areas of the island and for the island in general. Effective planning and land use management are identified as some of the most effective means to address groundwater management.

2.2.2 In order to protect the groundwater resource of the Island, the following should be addressed: a) wherever possible through zoning and land use regulations and where appropriate through Development Permit Areas; b) when considering applications for permits, re-zoning and sub-division; and c) through information and advocacy directed to residents, property owners and agencies with jurisdiction on Hornby Island:

i) maintaining the recharge of the groundwater resource in identified recharge areas by restricting extensive logging, modification of natural drainage features, residential, commercial and industrial developments, extensive road development, excavation, quarrying and soil removal, ditching and drainage works;

ii) maintaining the quality of the groundwater resource by preventing contamination from: sewage and grey water, concentrated animal feeding operations, intensive fertilizer or pesticide application, improper use or storage of toxic chemicals, improper waste disposal, such as burning and open dumps, inadequate protection of wells, inadequate sealing of abandoned wells, over-pumping of groundwater in areas where salt-water intrusion is likely to occur;

iii) maintaining the quantity of the groundwater resource by: limiting new development and land uses that will put an additional demand upon the groundwater resource in areas where availability is already a problem, using rainwater catchment and storage systems wherever possible in new and existing developments, establishing water conservation measures and practices; and

iv) supporting the implementation of a groundwater protection plan, including innovative and remedial programs.

Section 4.5 Water

Groundwater is a limited and vulnerable resource that requires restrictions on land use and development. However, the water supply situation can be improved significantly by three measures that are being increasingly utilized: water

conservation, water re-use and the direct catchment and storage of rainwater. Because groundwater concerns need to be taken into account in all land uses and development, policy 2.2.2 applies to every section of the plan. This section includes additional or more specific policies to protect the resource.

Note-All shared (commercial and public) wells, cisterns or water supply infrastructure must comply with the requirements of the *BC Drinking Water Protection Act*.

Area
The Hornby Island Trust Area is subject to the following objectives and policies.

Objectives:
The objectives of this subsection are:

(1) to encourage water conservation to ensure that existing users of the water supply do not deplete the supply;
(2) to ensure that new demand for water does not stress the groundwater resource;
(3) to ensure that activity pertaining to use of land does not lead to degradation of the current supply of fresh water;
(4) to enable more local involvement in the protection and management of groundwater;
(5) to encourage the use of effective alternative systems and technologies;
(6) to encourage the use of shared systems that provide water, store water and treat grey water; and
(7) to encourage protection of water in wells.

Policies:

4.5.1 The establishment of a community-based water resource protection/management committee is supported to provide a coordinated and proactive approach to the protection and careful use of the Island's water resources.

4.5.2 A Groundwater Protection Strategy, based upon available technical information, community and agency consultation, should be developed and implemented.

4.5.3 Development should be restricted in areas where groundwater limitations have been identified by a groundwater geochemistry study, aquifer classification, hydrological report or other technical information.

4.5.4 Watersheds, wetlands, lakes, water courses and riparian areas should be protected through development permit or regulation, including requirements for protective setbacks.

4.5.5 Sources of potable water should be protected through "water supply protection area" designation and covenants and/or regulations that restrict land uses to those that are compatible with protecting the water source.

4.5.6 Activities that would pollute fresh water or salt water should be prohibited and land uses that may involve a potential for pollution should be regulated.

4.5.7 Alternative water source methods such as rain water catchment, lined dugouts and well reservoirs should be used for large scale uses such as for filling swimming pools.

4.5.8 Enclosed cisterns and ponds for storage of rainwater to supplement water supply for individual or group household use and fire protection and irrigation are encouraged.

Advocacy Policies:

4.5.9 The Vancouver Island Health Authority shall be requested to ensure that drinking water sources and recreational water bodies are not contaminated by deleterious liquid discharges.

4.5.10 The Ministry of Forests and Range and the Ministry of Forests, Lands and Natural Resource Operations are requested to require that any tree cutting be carried out according to a management plan designed to fully protect the groundwater recharge function of the area based upon hydrological information and that draft management plans be referred to the Local Trust Committee for community review.

4.5.11 The Ministry of Transportation and Infrastructure is requested to review ditching practices with respect to maximizing groundwater recharge and retention and to work with the Local Trust Committee and the community to identify and carry out pilot projects involving alternative management of run-off in appropriate locations.

4.5.12 The Real Estate Board is requested to require from land owners disclosure of septic and well conditions and locations at the time of property transfer so that prospective buyers are informed of the water/septic situation.

4.5.13 Sellers of properties and their real estate agents are requested to disclose water and septic information to prospective buyers of property on the Island.

4.5.14 Any education program directed toward the conservation of Island water supplies, the re-use of water and the utilization of rainwater catchment and storage systems is supported.

4.5.15 The use of chemical fertilizers, pesticides, and herbicides by any agency or individual is strongly discouraged.

4.5.16 Property owners with wells on their property that are dry or contaminated (including by saltwater intrusion) are encouraged to back fill those wells.