# *Salt Spring Island Water Preservation Society*
# JANUARY 2019 NEWSLETTER

## Saving Our Groundwater by Saving Our Forests

When the new owner of a Beddis Road property began clearcutting the forest on the hillside, nearby residents and sympathetic community members mounted a campaign to stop the cutting. A large crowd came to the December Local Trust Committee (LTC) and held up signs. During the public comment period, they presented moving testimony about the importance of forests for our community including recharging groundwater and mitigating climate change.

The audience was informed by Trustees that a small portion of the property is protected by a Development Permit Area (DPA), which is the primary mechanism that the province has authorized LTCs to use for protection. But most of the 45-acre property is not protected. The LTC doesn't currently have a legal mechanism in place to stop the clearcutting; it will take months to pass additional DPA protection.

Even if clearcutting cannot be stopped on this particular property, it brings attention to this threat to forests across Salt Spring. Only a small portion of the island is protected by a DPA. To better protect our forests, and by extension our groundwater resources, the first step would be for the LTC to adopt this as a **top priority** for their 2019 work program.

At this same meeting, the new LTC decided to hold a public meeting to gather input on setting their priorities for the coming year. WPS will inform you of the date of this public meeting so that you can attend and give input.

The Islands Trust has published a Toolkit that provides the following background on our SSI forests from various sources. "The Coastal Douglas-fir (CDF) Biogeoclimatic Zone is found nowhere else in Canada. It includes a unique set of ecosystems that occur along the edge of south-east Vancouver Island, across the Gulf Islands, and along the southwest coast of Vancouver Island."

"Coastal Douglas-fir ecosystems are biologically, culturally, and physically important. These forested landscapes maintain our local climates, the sustainability of our freshwater systems, and the biodiversity of our islands. They are home to many endangered plant communities and are ranked as a high priority for preservation, globally and provincially."

"The relationship between trees and water is inherent in healthy forests. Water availability directly influences watershed ecological function and sustains healthy forests as a whole. Forests are a mosaic landscape of ecology and geology that maintains water storage and contributes to water quality by filtering through forest soils and biomass…. Tree canopies collect rainfall, releasing it slowly into forest floor that contributes to the health of the forest ecosystems and contribute significantly to sustained groundwater recharge."

Contact us if you can help with this effort to better protect our island's forests, and/or if you would like us to email you a copy of the complete Toolkit. We are at ssiwps@gmail.com

*—Maxine Leichter*

# Defining Environmental Stewardship

We hear the most astonishing facts about the natural world around us, such as the billions of bacteria in a spoonful of soil or the vast network of mycorrhizal fungi connecting tree roots across landscapes. We marvel at the creatures around us and have moments of peace and contentment when we connect with their world. At the same time, we learn of the terrible effects humans have on our fragile planet. Environmental stewardship is meant to allow humans to live in balance with the needs of the ecosystem and all its inhabitants.

Defining stewardship is a challenge. In one sense, it's a theology that believes humans, due to their place within the hierarchy of evolution, are responsible for the state of nature. Another definition places humans within Gaia, as one part of the living planet. And a further defining aspect may be the responsibility humans have to restore the degradation caused by past human activities.

A quick search of the internet, however, will show that another definition of environmental stewardship exists, one that is watered down to the idea that the natural world is cared for to some degree but cannot trump human desire. In this way of thinking, hunting, ranching and resource extraction groups can all call themselves environmental stewards when they make small concessions to the natural world. It seems the subjectivity stems from what level of human impact a person believes is acceptable.

In its simplest sense, environmental stewardship means taking care of the ecosystem, and though ecosystems are complex, they can be simplified by being broken down into five key components: the plants, the many green organisms that make sugar and oxygen from carbon dioxide, water, and the power of the sun; the animals, consuming plants, animals, or both; the decomposers, converting all those plants and animals back into basic molecules that can be reused again and again; the bacteria, simgle-celled organisms that live absolutely everywhere in great abundance and can do just about anything it seems; and finally, the abiotic or non-living world, the component that contains the climate, geology, and geography.

Within every component, humans can have a positive or negative effect. Our society allows humans to pursue nearly any activity they wish on their privately-owned property. And though forest ecosystems are resilient to a certain amount of disturbance, they can change to a poorly-functioning landscape if too many stresses occur at the same time. If human impacts across a landscape are to be balanced, then people need to be excluded from certain areas, such as the WPS property above Tripp Road (see photo). Not only does this aid the many creatures that call this landscape home, it keeps intact the ecosystem that purifies our drinking water. Part of environmental stewardship is knowing your place in nature.

*—Chris Drake, Ecologist and Consultant*


# The Interconnectedness of Things

***Part II: Shallow Groundwater (Aquifers) — Where and what are these and how do they work?***

**by John Millson**

Shallow aquifers are underground layers of permeable material. They can contain or transmit groundwater and (on the island) are predominantly associated with the deposits of recent glaciation. This article explores the what, how, and why of these important island water resources.

## An Introduction to Ice and Ice Related Sedimentary Deposits

Just a few thousand years ago, during a glacial period known as "the Pleistocene," glaciers overwhelmed western Canada. A long time ago? No. In an Earth's geological time clock, 24 hours represent the age of the earth, and the Pleistocene glaciations occurred in the last second!

The Pleistocene glacial periods were the last of four major glaciations. All of these glacial events left behind a significant geological record, revealing their role in shaping the planet (forgive the pun). The Pleistocene glaciations were no exception.

During the Pleistocene glaciation, ice sheets several kilometers thick (with few exceptions) buried large parts of the BC land mass. The ice loaded and depressed the earth's crust, scoured the surface, and transported vast amounts of the eroded

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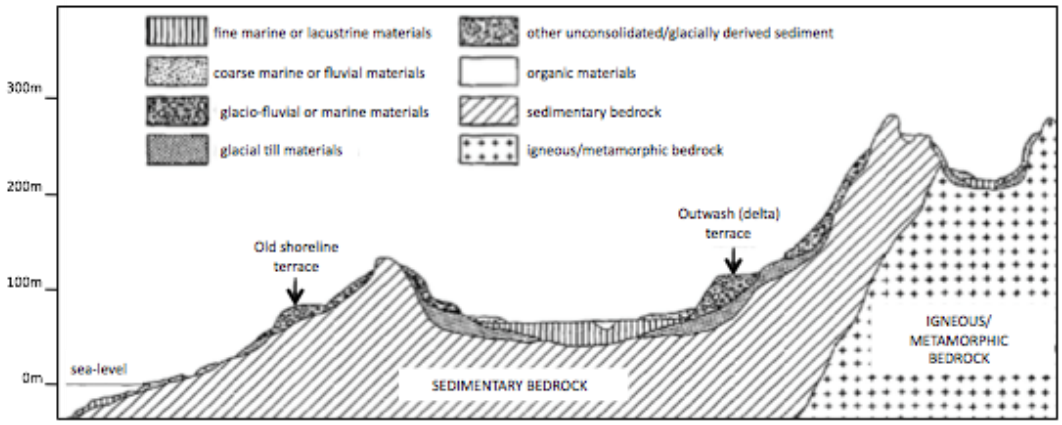
## Interconnectedness of Things (*cont'd from page 2*)

products over large distances, across Canada! As the ice advanced and retreated (yes, climate change was active even then), sculpted landforms and "dumped and jumbled sediment piles" were its legacy. The repercussions of this glaciation on what we now refer to as the "Salish Sea" and "Salt Spring Island" were dramatic. Ice sheets moved to and fro across the Salt Spring landscape, shaping and "enhancing" the overall profile of the island, resulting in some classic glacial landform shaping or "geomorphology." The ice movement created U-shaped valleys (Fulford Valley) and rôche moutonnées (Mount Maxwell?) and scoured hollows for some of our major surface freshwater resource (the island's lakes).

Importantly, the to-and-fro of the Pleistocene ice sheets across the Salish Sea draped the more resistant deeper and older "bedrocks"[1] with a variable veneer of sand and gravel. The resultant glacial sediments were derived from water flow, in ice marginal, sub-ice, or ice terminal rivers and deltas. Frequently, these coarser river-lain (glacio-fluvial) sediments (and potential aquifers) were overlain or interlayer with a mix of sediments dropped during glacial retreat (moraines) and/or clays associated with glacial lake (glaciolacustrine) or marine (fluviomarine) conditions.

Periods of Pleistocene ice sheet advance and retreat led to a complex reworking and layering of the glacio-fluvial and glacio-lacustrine/marine sediments across the island (see next figure) and to the formation of what was, in part, to become our island's "shallow aquifers."




**Generalized cross section of Salt Spring Island highlighting glacial and other "unconsolidated" near surface sediment and soil variability. Modified from van Vliet et al., 1987.**

[1] What is "bedrock" and our "deep" groundwater (aquifers) will be the subject of "Part III of the Interconnectedness of Things" newsletter series.

## Shallow Aquifers on Salt Spring: Where Are They?

Locally, remnants of the glacially derived, shallow sediments and their aquifers remain on the island. Elsewhere these sediments are largely absent, having been removed by post-Pleistocene period erosion. Known local glacial sediment "thicks" exist in the Fernwood area, to the southwest of Ganges, on the flanks of Lee Hill, and around Fulford Harbour. In these areas, shallow aquifers, located within residual glacial sediment sequences, are significant enough on their own to be exploited for groundwater.

An idea of the extent of the island's shallow glacial sediments (and any potential associated shallow aquifers) can be gleaned from looking at the island's landscape. Areas of smoother, gentler, rounder terrain, distinctively horizontal(-ish) benches of land, thicker and variable soils, and sometimes poor drainage may be associated with the legacy deposits of glaciation and the weathering of these.

Areas of the island with known slope stability issues may also help identify areas of shallow glacial sediment, as these areas are likely to be underpinned by shallow and largely unconsolidated glacial sedimentary layers.

## What Are Shallow Aquifers?

The term "shallow" is somewhat subjective. On SSI, a "shallow aquifer" refers to a particular group of sediments in the island's shallow subsurface, which are or may be entirely glacial in origin, are water bearing and permeable to varying degrees. The words "surficial" and "unconsolidated" are sometimes used as additional descriptors of local shallow aquifers.

SSI shallow aquifers have a number of distinguishing characteristics. They:

- may be formed of less permeable, poorly sorted clay and silt sediments (think *a difficult to walk on pebble and cobble beach),* or more permeable, well-sorted sand and gravel sediments (think *an easy to walk on sandy beach);* the former are challenging from a productivity perspective, the latter are high quality water drainage and water recharge units;
- are largely unconsolidated or partly consolidated sediments, not "solid rock" (hence the ability to create "dug" wells within them), being unconsolidated (i.e., not rock) explains their inherent geotechnical instability; and
- may vary laterally and vertically and be mixed over short distances; the resultant heterogeneity is a function of the types of (glacial) depositional systems that form the sediments and ice movements associated with these; this sediment variability leads to complex (water) flow paths (see figure below).

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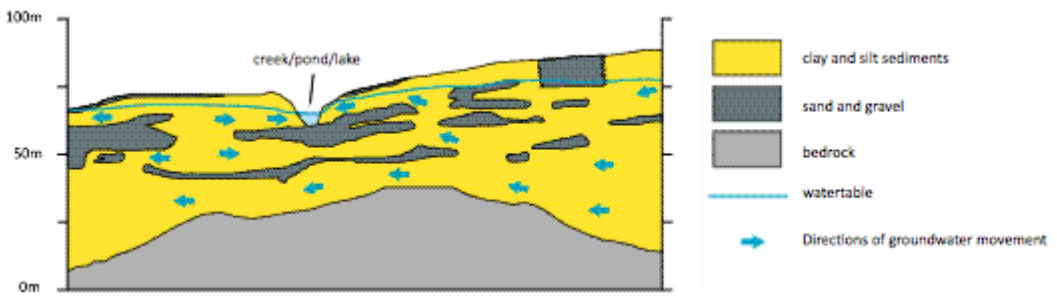
## Interconnectedness of Things (*cont'd from page 3*)

The variability in the shallow glacial sediments and their weathering profiles are likely to contribute to the large variability in the soils on the island. For example, well-drained soils are associated with coarse-grained sand and gravel sediments of glacio-fluvio origin. Poorly drained soils may be the result of the weathering of glacio-marine and lacustrine clays.




**Generalized conceptual cross-section of Salt Spring Island highlights near surface aquifer variability. Vertical scale indicative only! Modified heavily from Bailey et al., 1985.**

## SSI Shallow Aquifers: How Do They Work?

The heterogeneity and localized extents of the SSI shallow glacial sediments mean that any shallow aquifers associated with these are likely to have poor interconnectivity and limited freshwater resource (aquifer capacity) potential. Recharge of these shallow aquifers is usually driven by precipitation and by gravity controlled infiltration in the near subsurface. Improved surface water infiltration and shallow aquifer recharge may be related to surface flow localization in topographic lows, in the form of wetlands and/or small ponds.

Locally shallow aquifers may be "perched" with freshwater lenses sitting on localized clay layers. These local clay lenses may result in shallow freshwater being anomalously shallow (out of line with "known" regional groundwater table levels).

Our unconsolidated shallow aquifers are not brittle, so are not fractured. Think of cracking/fracturing warm toffee or fudge! This means that in our shallow aquifers there is *no* potential for enhanced water producibility (nor a storage uplift) associated with "fracture networks."

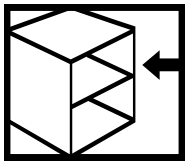
Shallow aquifers are vulnerable to contamination, as with any aquifer. Residual, glacially derived sand and gravel deposits are often found in valley locations, close to population centres. Bedrock aquifers are often in valley sides and/or upland areas with lower population. Overburden sediments/soils separating and isolating shallow aquifers from potential contamination mechanisms may be thin/absent.

## SSI Shallow Aquifers: Are They Important?

Despite their variability and often localized extent, shallow aquifers *do* contribute to the overall freshwater available on SSI. Shallow aquifers are locally exploited for water abstraction via seeps or springs, tapped by shallow "dug" wells," and in some cases, are a contributing element in deeper wells when sitting on top of deeper water bearing bedrock.

The shallow groundwater tables associated with the island's shallow aquifers are strongly interlinked with the health of the overlying ecosystems. For example, trees and forests draw groundwater up into the tree canopy by capillary action, significantly *elevating* groundwater tables from surrounding levels and providing an important element of *maintaining* near surface shallow groundwater. Fewer trees means lower water tables, with an inevitable impact on other freshwater dependant ecosystems (including your garden). There is likely to be a significant interplay between the presence and health of our island's wetlands and shallow groundwater levels.

Shallow aquifers may act locally as a deeper aquifer recharge mechanism and serve as a storage buffer for slow, deep aquifer recharge explained further in Part IV of this series "*How is it all interconnected?"*



**COUNTRY GROCER TAPES**
Please put your tapes in **Box 73**

### MEMBERSHIP

$15 for individuals | $30 for a family/couple

Additional donations are very gratefully received, and help to keep WPS active, effective and working hard to protect our island waters. Tax Receipts are issued.

Current members - mail membership fee to:
Box 555, Ganges PO, SSI, BC, V8K 2W3.

New members - request an application form to fill out and return.

### CONTACT US

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