What We Found

C-1 TOPOGRAPHY, GEOLOGY AND SOIL

C-1.1 Geomorphology of South Western British Columbia

10-15 Million years ago - Western Cordillera and Coast Mountains uplifted by the convergence of the Juan de Fuca and North American tectonic plates.
2 Million years ago - Volcanic activity forms the Garibaldi, Cayley, Beager, and Baker Mountains. Coast Mountains sculpted by glacial activity. Twelve ice ages occur, Fraser Glaciation the most recent.
30000-10000 years ago - Fraser Glaciation occurs
15000 years ago - Increased sediment loads in glacial meltwater streams results in depositional formation of coastal lowlands. Outwash plains develop into the Georgia Straight as glaciers emerge from the Coast Mountains. British Columbia buried by the 1.5km thick Cordilleran Ice Sheet causing glacial depression of the land by 120m lower than it is today.
13000 years ago - Climate change results in ice receding northwards uncovering the Vancouver region and Fraser Lowlands. Ocean is 200m higher than it is today.
10000 years ago - Vancouver region emerged from under the sea as it rebounds from reduced glacial weight. Upland areas at 200m elevation reveal evidence of marine deposits and erosion.
8000 years ago - Sea rises to 12m below its present level in combination with rapid rebound. Increased coastal exposure results in streams cutting deeper valleys to maintain course.
5000 years ago - Present sea and land relationship established, vegetation cover established.

C-1.2 Effect of Glacial Activity on Soils

Typically, Glaciated landscapes contain soils of limited structure, that may have traveled 1000s of kilometers before settling in their current location. The soil profiles that result are in combinations of the generic model of parent material, Glacial sediment, and 'Vashon till', and are capped with stream and marine deposits. Glacial sediment is the conglomerated remnants of local and foreign materials brought in and deposited by glacial activity. 'Vashon till' is typically the conglomerated remnants of liquefied material left behind as ice rotted and melted under its own depressive forces. The stream deposits are left behind by meltwater and outwash of the receding glaciers, and consist of sedimentary materials such as sand and silt. Marine deposits consist of similar materials left behind by receding sea levels as land rebounds once glacial weight has been alleviated. Water tables, while occurring on parent material, may also occur on the 'Vash on till' layer, as its content may produce an impervious layer, depending upon clay content and degree of compaction.

C-1.3 Soil Mapping of the Gibsons Area

The soils study of Gibsons was done in 1981 as part of a larger, regional soil study. The age and lack of resolution of this study limits the amount of detailed analysis that can be done. The soils mapped in Gibsons (Figs. 2 & 3) are commonly associated with mountainous landscapes. Specifically, Albion soils are common to low-lying areas; Summer, Capilano, Sunshine and Eunice soils occupy lower mountain slopes; while Bose, Nicholson, Heron and Whatcom soil types are usually found in upland areas. Some soils in the 100 + elevation reveal that they were once below sea level thus relating Gibsons to the glacial geomorphology outlined above.

What We See

Fig. 1 The topography of Howe Sound typifies the glacial landscape of South Western British Columbia (Wynn 1998, p22).

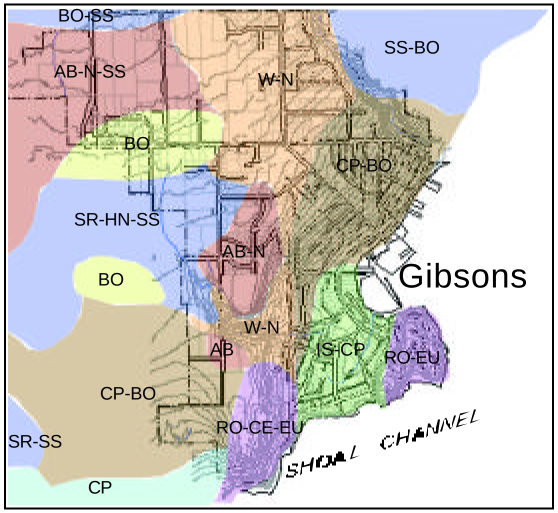


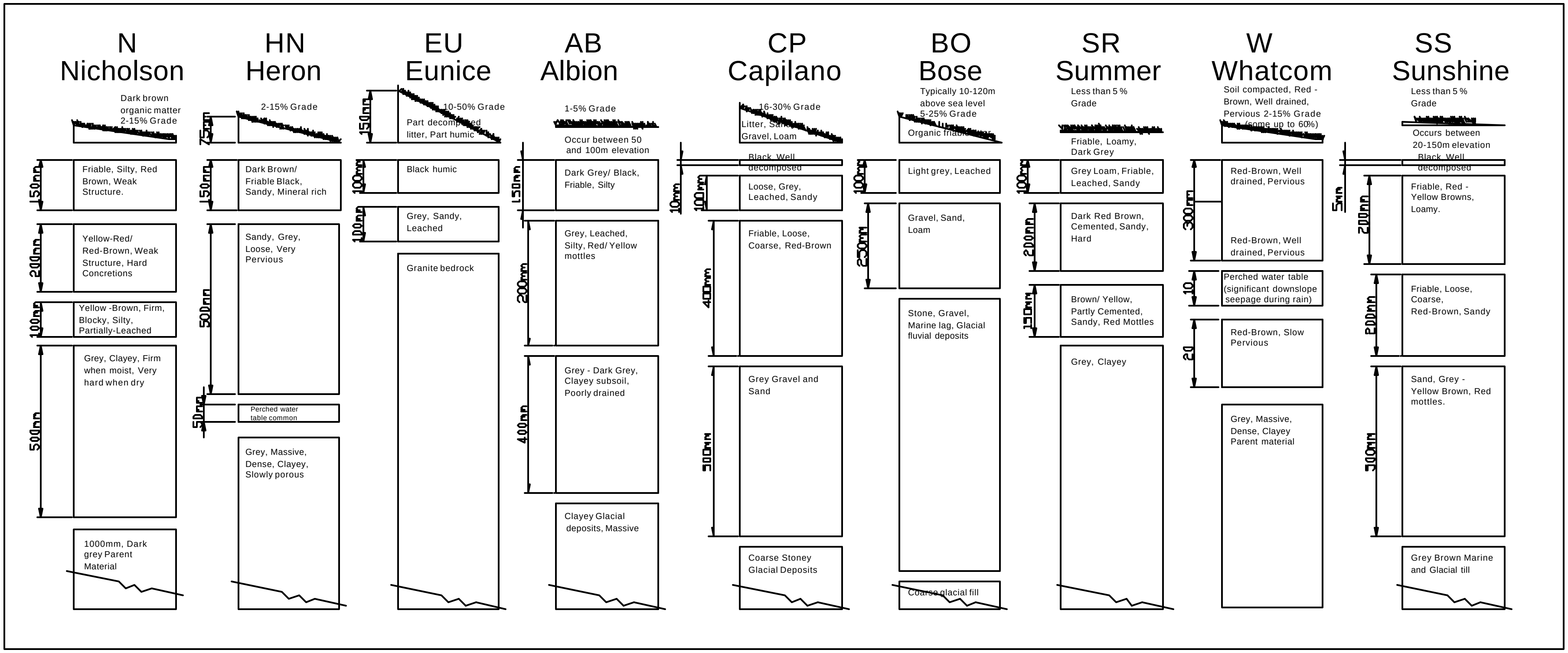
Fig. 2 Soil map overlaid with contours and cadastral information (B.C soil study 1981)

C-1.4 Suitability of soils for Land Use

Most soils profiled have only limited bearing capacity in of the amount of weight they can support without buildings being prone to failure. The clayey materials, loosely compacted sands and gravels common to this area are prone to compress and slip laterally under the stress of loading (Marsh, p. 95). Therefore, many of the soils in the region are not suitable for development. Heron and Capilano are two types that at higher grades may encounter these types of stability problems. Heron, Albion and Summer are also poor soil types for development due to high water tables and/or poor drainage. The best soils for urban development in Gibsons are Capilano (at moderate grades), Whatcom and Bose. Sunshine is acceptable but will have drainage problems and Eunice is ideal in terms of stability but is limited due to the cost of building infrastructure into bedrock.

As the Soil Classification Map of Gibsons (Fig. 2) shows the soils covering the developed portions of the city have all been removed, replaced with fill and covered with hard impervious surfaces. As the soil profiles show, the naturally occurring soils run only 1 to 2 meters deep before turning into parent materials such as glacial till, clay or granite.

Figure 3 (below): Diagrammatically represented Classifications and profiles of the more common soils at Gibsons (B.C Soil Survey 1981).



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What We See

C-1.5 The Importance of Soil and its Effect on Water Resources

1. Healthy soil acts as a storehouse for water and nutrients. As the water is released slowly, it assists plants in water and nutrient uptake.
2. Healthy soil regulates and partitions water flow, thus naturally maintaining flow rates and cycles year round.

Healthy soil allows for intensive physical, chemical and biological activity.

Figures 5 & 6 illustrate the important role that soils play in the hydrologic cycle and the negative impact that traditional forms of development have upon this process.

The first section (Fig. 5) shows a typical soil profile in a natural watershed. While vegetation plays an important role in absorbing and cleansing rainfall, the soil (particularly the first 2-3 meters) are mostly responsible for moisture retention. The uppermost soil layer traps the majority of rainfall. When this layer becomes saturated, it generally escapes in the form of shallow flow and inter-flow. Some of the moisture gradually works its way through the more porous sections of the lower soil layers. This process not only filters rainfall, it can store it for long periods of time – up to several months. This is vital in maintaining a balance in stream flows during the dry summer.

The second section (Fig. 6) shows a typical stream profile after traditional suburban development. With the initial soil and vegetation layers replaced by impervious surfaces moisture flows immediately off-site and into an infrastructure of retention ponds and storm drains. Very little water flows into underground reservoirs, because it flows off-site so quickly there is no chance of the rainwater sinking too deep into the water table. As a result this natural process of water level regulation is lost

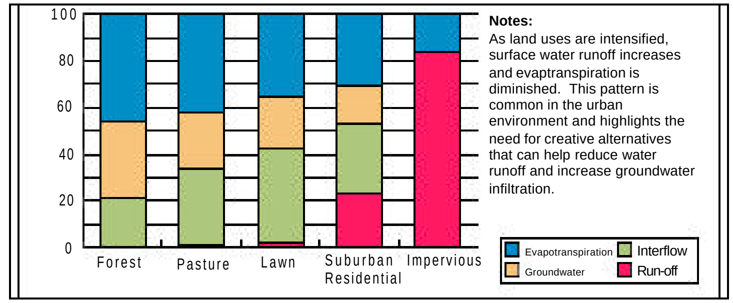

Figure 4 (above): Soil/ water interaction chart (http://depts.washington.edu/cuwrm/PUBLICTN/s4s.pdf)

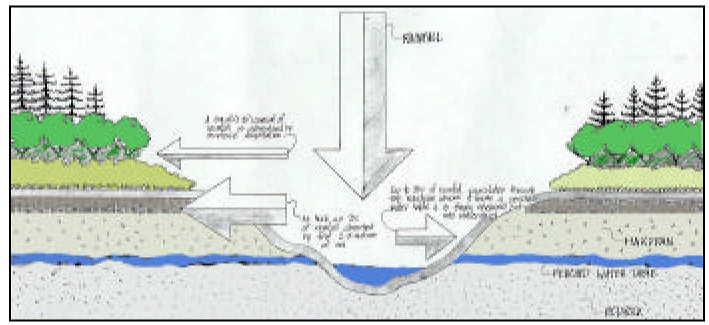

Figure 5 (above): Water and soil interaction in natural situation

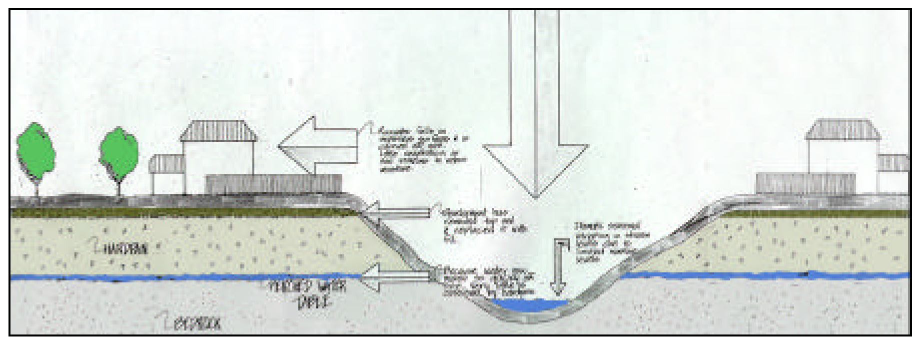

Figure 6 (above): Water and soil interaction in urban situation