Introduction:
In British Columbia, many aquifers occur in unconsolidated sediments and it can be seen as a result of the deposition of glacial sediment. Analyzing these glacial sediment packages will allow for the understanding of aquifer and aquitard material, forming a basis for the local assessment of groundwater flow. The area of study has gone through several periods of glaciation in recent geologic history, with the most recent being the Fraser glaciation (25-10ky), preceded by the Penultimate glaciation (100-65ky). The local sediment packages (ordered oldest to most recent) and their sediment sources are:
- **Dashwood drift** - glacial and glacio-marine
- **Penultimate glaciation**
- **Cowichan Head Formation - marine and fluvial**
- **Olympia interglacial**
- **Quadra Sand - glacio-fluvial**
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Regional Geological History (2):
Many productive aquifers result from the deposition of glacial sediment. These glacial sediment packages form a basis for the local assessment of groundwater flow. The area of study has gone through several periods of glaciation in recent geologic history, with the most recent being the Fraser glaciation (25-10ky), preceded by the Penultimate glaciation (100-65ky). The local sediment packages (ordered oldest to most recent) and their sediment sources are:
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Standardization (2):
Materials in each well were sketched by hand showing the vertical extent of each material within the series of wells aligned in series and adjusted to show depth relative to sea level. Next, lithostratigraphic correlations between wells were made to show lateral extents of material types, and materials were grouped into packages of similar porosity and hydraulic conductivities inferred from the material descriptions to define the three separate hydrostratigraphic units described below:
- **Materials that were described as sand without or with small amounts of silt or clay – treated as aquifer media (Quadra Sands)**
- **Materials that were described as gravel with little amounts of sand and without or with small amounts of silt or clay – treated as aquitard media (Capilano and/or Salish sediments for top section. Cowichan Head for lower section)**
- **Materials that were described as till or clay or tight – treated as aquitard media (Vashon drift for top section. Dashwood drift for lower section)**

Vulnerability Assessment (1):
TopoDrive was used to determine groundwater flow paths and the DRASIC method was then applied to assess contaminant vulnerability of each unique aquifer. From the gathered information we determined the location of aquifers and aquitards as well as the region’s vulnerability to contaminants.

Parameter Calculations (3):
Conductivity and porosity are determined by using the Hazen Method. The determined hydraulic conductivity, transmissivity and porosity values are listed below:

\[ K = C(D_{50})^3 \]
Where:
- \( K \) = hydraulic conductivity
- \( D_{50} \) = effective grain size (cm) at 10% finer by weight
- \( C \) = Hazen coefficient

\[ T = Kb \]
Where:
- \( T \) = transmissivity
- \( b \) = aquifer thickness

Hydrostratigraphy (5.6):
TopoDrive representations of BC water well record data showing potentiometric surfaces and groundwater flow lines. Cross-sections represent lines displayed in Figure 1 and arrows indicate water well logs used in study.

Vulnerability Assessment (1):
Hydrostratigraphy (5,6):
TopoDrive of line 2

Conclusion and Recommendations:
This study identifies three hydrostratigraphic units: a confined aquifer, a partially confined aquifer and an intervening aquitard. The unconfined aquifer is significantly more vulnerable to pollution than the lower confined one due to its shallow water table and uncapped nature. This improved understanding of the regional hydrogeology has identified key areas for future research:
- Analyze the contact characteristics between the two aquifers
- Investigate the interaction between the two present aquifers
- Study the effect that fractured media has on local flow paths
- Investigate the materials beneath the lower aquifer with additional deep drilling

References: