

A Hydrological Integrity Framework for the Gabriola OCP

The Case for Systemic Integrity

The recent GWSolutions study and the subsequent "Freshwater Footprint" methodology provide a valuable "triage" of current island conditions. However, a "Science-to-Policy" pipeline that focuses only on localized hazards and regional "budgets" risks the long-term stability of the island's water table.

The OCP should consider adopting a **Hydrological Integrity Framework** based on four macro-pillars:

1. **Pillar I: The "Big Ridge" Recharge Engine** – Recognition of the highlands as the primary pressure engine for the entire island.
2. **Pillar II: The Integrated Capacity Model** – Aligning density with hydrological capacity, not just historical zoning.
3. **Pillar III: The Water-Neutral Mandate** – Requiring zero-net impact for all new development.
4. **Pillar IV: Biological Retention Targets** – Protecting the forest "sponge" as essential water infrastructure.

The Fallacy of Regional Segmentation

In 2021, *GW Solutions* published the *Islands Trust Area Aquifer Conceptualization Models*. This report was a turning point; it explicitly moved toward treating Gabriola as a **single geological unit**.

Assigning "Groundwater Regions" (Project GWSS 6) as the basis for land-use planning would be a significant flaw. Hydrogeology does not stop at a line on a map. Our island's fractured bedrock creates a singular, interconnected pressure system where the health of the coastal fringe is directly dependent on the hydrostatic head maintained in Gabriola's highlands—our 'Water Tower.'

To assign carrying capacity based on isolated regional budgets "Balkanizes" the water table. We risk a scenario where density is increased in an interior "low-hazard" zone, inadvertently severing the hydrostatic head-pressure required to hold back saltwater intrusion at the coastal fringe. The OCP must govern Gabriola as a **single hydrological organism**.

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An inquiry on the Gabriola Freshwater Footprint Study

Climate Acceleration

1. **The Intensity Paradox:** The 2016 Model projected an 8% recharge deficit by 2050. However, Dr. Diana Allen's research (the Green-Ampt effect) proves that high-intensity rainfall leads to "rejection" (runoff) rather than infiltration. Given the extreme weather observed from 2021–2025, how has Staff adjusted the "8% deficit" to reflect the reality of climate acceleration and surface-saturation limits?
2. **Effective Imperviousness:** As the island approaches build-out, how does the study calculate the cumulative impact of "hard" surfaces on reducing infiltration. Does the OCP intend to mandate Biological Retention Targets to counteract this loss, (Pillar IV)?

II. The "Single Aquifer" & Pumping Density

3. **The Hydrological Commons:** Since fractured bedrock does not respect property lines, a "water-limited area" is a symptom of the whole island's health. Should the OCP recognize the island as a **Single Hydrological Commons**, or will it continue to permit density based on site-specific well-yields that ignore cumulative impact?
4. **Pumping Hazard vs. Climate:** Recent research (Klassen & Allen, 2017/21) shows that pumping density is a more immediate hazard than recharge loss. Should the OCP address the *density* of extraction points rather than just the *location* of recharge?

III. The "Baseflow Standard" & Ecosystem Survival

5. Research indicates that once bedrock storage is "exhausted" in late summer, the system enters an irreversible seasonal state. Will the "Proof of Water" requirements for new developments be shifted from deceptive annual averages to a Net-Zero August Baseflow requirement?
6. **Trees as "Hydrological Brakes":** Trees as "Hydrological Brakes": Why is forest cover currently treated as an aesthetic or "environmental" asset rather than Essential Water

Infrastructure? Without mandatory canopy retention to slow high-velocity rain, how does Staff propose to facilitate deep-fracture recharge?

7. **Residence Time Lag:** Groundwater levels often reflect rainfall patterns from years or decades ago. In fractured bedrock, the "lag" can be unpredictable—sometimes very fast through major fractures, sometimes decades through the matrix. How will the OCP protecting against the "Ghost of Recharge Past"—the risk that our current "stable" levels are a lagging indicator of a crisis that has already begun?
8. **Environmental Flow Needs (EFN):** To what extent does the methodology explicitly calculate the "Biological Minimum"—the groundwater discharge required to maintain wetlands and forest floor hydration—before determining "available" water for human use?
9. **Saline Interface & Upconing:** What are the identified technical thresholds where pumping density induces lateral or vertical saltwater intrusion?

IV. Topographical Integrity (The Water Tower)

10. **The highlands "Water Tower":** How does the model weight the high-elevation Big Ridge as the primary recharge engine for the island's down-gradient aquifers? How does the model account for the 'Upstream-Downstream' relationship between the Big Ridge and the coastal aquifers?
11. **Anthropogenic Drainage:** Does the study calculate the loss of recharge potential caused by historic drainage alterations (ditches/culverts) that accelerate runoff into the sea?
12. **Biological Retention Targets:** Does the study define a "minimum soil hydration" level necessary to prevent the forest floor from becoming hydrophobic?

V. Data Integrity & The Statement of Omission

13. **Uncertainty Quantification:** Given the lack of long-term data from private wells (Statement of Omission), what is the statistical "Uncertainty Factor" applied to the conclusions?
14. **Sub-Basin Resolution:** Is the data analyzed at a catchment level, or is it an "island-wide average" that masks localized depletion?

15. The Strategy Alignment Gap: How does this technical focus fulfill the Islands Trust 2021 Strategy regarding the spiritual and cultural values of water?

VI. Policy Mechanics & Restoration

16. Hydrological Restoration Zones: Does the study identify areas where active intervention (e.g., "slow it, spread it, sink it") could technically increase carrying capacity?

17. Monitoring Triggers: What are the recommended technical "triggers" (specific water level benchmarks) that would necessitate a halt to further water allocation?

18. Micro data for Macro vision: While the Freshwater Hazard Map identifies localized risks like saltwater intrusion and drawdown, how does the OCP integrate these 'micro' failure points into a 'macro' water-neutral mandate that ensures island-wide recharge keeps pace with total consumption?

Technical Omissions in the 2025 Groundwater Assessment

I. The "Missing" Water

The SFU model identifies an 8% annual recharge deficit and significant summer losses. However, the report fails to account for how this deficit is compounded by human activity:

- 1. The "Surface Hardening" Multiplier:** The model assumes the land surface remains as it is. It does not calculate the cumulative recharge loss caused by new roofs, driveways, and land clearing.
- 2. The "Ecosystem Baseflow" Tax:** The report calculates water available for human extraction but omits the minimum volume required to sustain terrestrial life.

II. The "Silent" Degradation

While the report monitors salinity, it ignores the chemical evolution of a shrinking freshwater lens:

- 1. Chemical Concentration (Stagnancy):** As the "bucket" empties (the 8% deficit), the remaining water interacts more intensely with the bedrock. As volume drops, Total Dissolved Solids (TDS), manganese, and iron concentrations rise. A well can be "stable" in level but "failing" in potability.

2. **The Septic-Recharge Feedback Loop:** The report treats recharge as a single "input" but doesn't distinguish between clean rain and "recycled" septic effluent. In high-density areas, a "stable" water level may be maintained by returning treated wastewater to the aquifer. Over time, this concentrates nitrates and pharmaceuticals, a risk not captured in current mapping.

III. "Swiss Cheese" vs. Anchors

The report acknowledges Saltwater Intrusion due to "pumping-induced drawdown" but fails to provide a land-use solution. By continuing to allow decentralized "Swiss cheese" wells along the coast, the OCP is ignoring the report's own warning.

The study does not identify specific "**Hydrological Restoration Zones**" where active intervention (e.g., slowing runoff) could technically increase the island's carrying capacity.