BRIEFING

To:	Regional Planning Committee	**For the Meeting of:**	October 8, 2020
From:	William Shulba, P.Geo	**Date Prepared:**	October 2, 2020
SUBJECT:	**Review of the Southern Gulf Islands Groundwater Sustainability Strategy**		

PURPOSE:

The purpose of this briefing is to provide Regional Planning Committee (RPC) with an update of the peer and professional review process of the Southern Gulf Islands Groundwater Sustainability Strategy (Project).

BACKGROUND:

At its regular business meeting on March 11, 2020, Trust Council passed the following resolution:

> *That Trust Council add to the 2020-2021 budget 'Northern Islands Groundwater Sustainability Strategy,' with an amount of $50,000, and that work on this project not commence until products of the Southern groundwater study project have been peer reviewed and deemed useful by Trust Council.*

At its regular business meeting on September 15 2020, Trust council passed the following resolution:

> *That Trust Council delegate to the Regional Planning Committee the consideration of the peer review and the usefulness of the Southern Island groundwater project.*

The Southern Gulf Islands Groundwater Sustainability Strategy is a project of the Galiano, Mayne, North Pender, Saturna and South Pender Local Trust Committees. Each LTC endorsed a master project charter that included which included several phases.

PEER AND PROFESSIONAL PREVIEW

Review Process

Due to the complexity and scope of the Project, Islands Trust Senior Freshwater Specialist identified in the Project Charter that a review is required to ensure the applicability and efficacy of the Project.

$10,000 allocated to “Technical Services” for this project were carried over to fiscal year 2020/21 to retain groundwater consultants to provide professional reviews of the Project. In addition, several organizations, agency staff, and researchers supplied peer reviews at no cost to the project.

The peer review was sent out to:

- Hornby Water Stewardship,
- Salt Spring Island Watershed Protection Alliance,
- Provincial Staff Hydrogeologists,
- Dr. Diana Allen of Simon Fraser University,

- Dr. John Cox of Mount Royal University,
- Mr. Allan Daikin P.Eng, (Elanco Enterprises),
- Mr. Allan Kohut P.Eng, (Hy-Geo Consulting),
- Mr. Mike Wei P.Eng, (Hydro Geo Logic Consulting),
- Western Water Associates, and
- Dr. James Henderson P.Geo.

In July 2020, Islands Trust received peer reviews of the Project from the Hornby Water Stewardship, Salt Spring Island Watershed Protection Alliance, Provincial Hydrogeologists, Dr. Diana Allen of Simon Fraser University, and Dr. John Cox of Mount Royal University.

Islands Trust retained groundwater professionals Allan Daikin P.Eng, Allan Kohut P.Eng, Mike Wei P.Eng, Western Water Associates, and Dr. James Henderson P.Geo to provide professional reviews of the Project.

All but one of these peer and professional reviews have been received by the Senior Freshwater Specialist.

The intentions of the review is:

- to update the GW Solutions Project report to Islands Trust;
- to refine the recharge potential mapping methodology to be applied to the Southern Gulf Islands, and to Denman, Hornby, and Gabriola in FY20/21; and
- to coordinate sharing of groundwater expertise, information and knowledge.

Project Scope, Background, and Objectives

Western Water Associates, the only other consultant to submit a proposal for the project in the procurement process acknowledged "*GW Solutions has done a lot of work and brought good value to the Islands Trust."*

The Hornby Water Stewardship described the report as a *"fascinating read"* and described the approach as providing a promising understanding of the health of groundwater supplies in any Gulf Island. Others stated that the report provided a lot of very useful information to Islands Trust.

There were several common themes and recommendations among the reviews regarding the reporting of the Project including that:

- the report should have a glossary of terms, use consistent terminology, correct grammatical errors, clarify methodology, and provide references;
- more description of the figures, in particular, the groundwater availability assessments; and,
- conversion of technical aspects of the results and conclusions is a necessity in communicating the science to community and other interested parties.

Data Collection and Review

In general, it was considered that:

- There is a lot of useful data and information collated for the Project.
- Datasets are mainly from peer-reviewed public or academic sources and the collection of those data for the purposes of groundwater recharge potential mapping and water availability assessments is an essential step for the Project.
- The assessment involved collating a lot of data for a large region with complex structural geology.

In general, it was recommended that:

- information sources could be more complete, cited, and consistent with the references section;
- increased organization of data to allow for ease of access to other researchers and islanders;
- more description of the local area bedrock geology along indicating groundwater flow patterns;
- identifying recharge and discharge areas;
- provide comments on observed correlations between bedrock lithology, geological structures and well yields;
- describe limitations of data sets including the Pacific Climate Impacts Consortium data be discussed.

Groundwater Regions, Bedrock Contacts, Fractures, and Topographic Wetness Index

In general, it was considered that:

- Groundwater regions delineation as an intermediate-scale groundwater management unit is valuable and applicable to the size, nature, and behavior of freshwater resources in the Islands Trust Area.
- Incorporating both surface and subsurface information for delineating groundwater regions as an intermediate scale is an appropriate approach for groundwater management studies.
- The assessment involved collating many datasets for a large region with relatively complex structural geology. However, the report does not adequately address and explain the complexity of the structural geology including fractures, faults, and lineaments of the Nanaimo Group Formation.

In general, it was recommended that:

- More study is needed on the geological environments of the area.
- Revisiting geological elements is needed due to the significance in recharge potential mapping.
- A summary discussion of the geology of the Gulf Islands be provided to describe different rock types, major structures and faults, and the methodology of the lineament mapping, etc.
- Discussions of knowledge and data gaps of geological structure permeability is required.
- That the lineaments were overestimated and that contacts between units of the Nanaimo group may not be structural contacts but rather grain size changes in the lithology.

Groundwater Recharge Mapping and Assessment

In general, it was considered that:

- GIS-based desktop assessment to estimate infiltration codes and factors to assess groundwater recharge potential across the Study islands is a viable alternative to detailed recharge modelling due to data limitations.
- An ecosystem approach and terrestrial ecosystem mapping is a good method for groundwater recharge potential mapping.
- The relative percentage of Terrestrial Ecosystem Mapping, to bedrock lineament co-efficient, to slope co-efficient for the recharge equation was not adequately referenced and explained.
- Limitations and estimations of the assumption that all surplus is available for recharge was not discussed.
- Return flow from septic fields and natural storage and release of stormwater was absent in the methodology.
- Upland areas seemed to be under-represented recharge areas and that areas of known groundwater discharge over represent recharge.
- If all surplus is estimated to be groundwater recharge that overall recharge may be overestimated.

In general, it was recommended that:

- Further investigation hydrogeological flux of the groundwater regions is needed to determine discharge areas.
- Reclassify TEM structural stage infiltration codes to consider tree canopy capture of mature forests.
- Describe and reclassify for root capture as a significant factor in recharge interception.
- Calibrate recharge potential mapping equation by conducting the methodology on Gabriola island to be upscaled and compared to the Simon Fraser University groundwater recharge model.

Groundwater Availability Assessment

In general, it was considered that:

- More explanation of the water balance methodology is needed.
- Calibration of the recharge and water balance models will be difficult with limited amounts of field data.
- Surface water and groundwater hydraulic conductivity and environment flow needed were not largely discussed.
- Calculations only include recharge and groundwater usage and do not address assessments of discharge from the groundwater basins.
- Discussions of groundwater well registrations, including multiple wells on a parcel, vacant vs. non-vacant properties, and the role of water licensing was stated to be largely missing from the methodology.

In general, it was recommended that:

- The report should include a brief description of the local area bedrock geology along with some typical profiles, indicating groundwater flow patterns, recharge, and discharge areas.
- Discussions of observed correlations between bedrock lithology, geological structures and well yields should be included in the report.
- Sensitivity analysis of assumptions and errors used in deriving the input parameters should be identified.
- Narrowing in on the areas where groundwater use is more than 50% of recharge and reviewing the water use estimates to determine if they are realistic for the specific parcel/use. The Province stated that it is likely in greater stress it would be good to refine these estimates so they are more site specific and that this could be done in partnership with Islands Trust and the Province.

REVIEW SUMMARY

The review in general found that:

- GW Solutions has done a lot of work and brought good value to the Islands Trust.
- Collation of data for the purposes of groundwater recharge potential mapping and regional groundwater assessments is a significant undertaking and the data management of those datasets is an imperative component of the process.
- An ecosystems approach to groundwater recharge is a good thing to do and that the methodology should be continued to be developed and applied to other islands in the Islands Trust Area.

- The report is significantly lacking definition of terms, description of methodology, and references.
- Updates to figures and tables are needed for establishing clarity of the topic.
- Several fundamental hydrogeological processes need to be explained as they relate to the methodology.
- Sensitivity analysis is needed for determining parameter error and efficacy.
- Calibration of the model against other models and data was missing.

The review in general recommended that:

- GW Solution consider the suggestions and recommendations of the reviewers to further develop the methodology to grow certainty of the findings.
- Calibration of the model is needed and if a certain element of the model cannot be calibrated than this should be state to inform the need for future work.
- Gabriola Island is a good calibration opportunity due to previous groundwater recharge modelling from Simon Fraser University and water balance analysis from the Regional District of Nanaimo.
- Testing of water balance model using spreadsheet analysis methods.
- Pursue the difference between diffuse and focused groundwater recharge.
- Use the updated groundwater recharge methodology for water allocation planning with FLNRORD.

FOLLOW-UP:

Staff have included in the proposed contact for the Islands Trust Groundwater Mapping project an update to the Southern Gulf Islands Groundwater Sustainability Strategy incorporating peer and professional recommendations.

Staff have included in the proposed contact for the Islands Trust Groundwater Mapping project considerations and recommendations from the reviewers to be implemented in the methodology for Denman, Hornby, and Gabriola islands.

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Reviewed By/Date: David Marlor, Director Local Planning Services, October 2, 2020