



REPORT

TO: Chief Administrative Officer

Date: September 4, 2019

File: 5600.014

FROM: Michael Dillistone, Planning Consultant

**RE: Draft Groundwater Protection Implementation
and Work Plan - Consultant Report**

To CoTW
September 9, 2019

PURPOSE

This report provides a brief context for consideration of the draft Highlands Groundwater Protection Implementation and Work Plan consultant's report being presented to Committee of the Whole for review and comment.

BACKGROUND

In April of this year, Elucidate Consulting was awarded the contract to prepare a Groundwater Protection Implementation and Work Plan for Highlands, based on the recommendations of the Phase 3 Golder and Associates report and subsequent considerations from SLUSC. The funding for the project was approved under the Federal Gas Tax funding administered by UBCM. Under the terms of the funding agreement the work must be completed by the end of 2019.

The purpose of this project is to prepare a practical and realistic plan to implement a Groundwater Protection Plan that works within the resource limitations of the District of Highlands. This includes an understanding of sequencing of work i.e. what work should be done first, required resources i.e. costs, and exploration of partnerships and potential funding opportunities. The consultants have studied the Phase 1, 2 and 3 Golder and Associates work and other sources and have carried out an analysis of the current information available about the state of the aquifer and prepared a draft plan for discussion and review.

The draft Plan will be posted on the website for public review and comment until October 1st. The consultant will then work with staff to draft a final version for Council's consideration by the end of November this year.

Funding for the program will have to be considered as part of Council's Strategic Planning and budgetary processes.

DISCUSSION

An important part of the draft Plan is an understanding of the groundwork necessary to establish a plan for the long term sustainability of the aquifer, a critical community asset. The plan points out the relationship between science, policy, and community stewardship initiatives and the importance of understanding the sequencing of work to be done to ensure that the program is as effective as possible.

RECOMMENDATION

That Committee of the Whole receive this report for information and provide feedback to the consultants on the draft Groundwater Protection Implementation and Work Plan.

Respectfully submitted,



Michael Dillistone
Planning Consultant

Concurrence,



Lorraine Hilton
Chief Administrative Officer

District of Highlands Groundwater Protection
Draft Work Plan

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August 2019

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Acronyms and Abbreviations

BC	British Columbia
BCCF	BC Conservation Foundation
CRD	Capital Regional District
DAIA	Development Approval Information Area
DPA	Development Permit Area
DFO	Department of Fisheries and Oceans
DoH	District of Highlands
EHO	Environmental Health Officer
ELC	Environmental Law Clinic
EMS	Environmental Monitoring System
GW	Groundwater
HVA	Highly Vulnerable Area (of aquifer)
IC	Industrial-Commercial
MDA	Master Development Agreement
MOE	Ministry of Environment
MFLNRORD	Ministry of Forests, Lands and Natural Resource Operations and Rural Development
OCP	Official Community Plan
RDN	Regional District of Nanaimo
SGRA	Significant Groundwater Recharge Area (of aquifer)
SLUSC	Sustainable Land Use Select Committee
SW	Surface Water

District of Highlands Groundwater Protection

DRAFT Work Plan

Introduction

This document presents a draft groundwater protection work plan to support the District of Highlands in the long-term maintenance of a sustainable groundwater resource. This work plan is in draft and is provided to the District staff, Council, and community for review and comment. The proposed plan builds on three phases of Golder and Associates studies, as well as recommendations from the Highlands Sustainable Land Use Select Committee (SLUSC) and the University of Victoria Environmental Law Clinic (ELC) gap analysis.

This work plan was developed based on recommendations from prior work, research into current best practices, and an assessment of the current status of groundwater in the District. The plan provides a 'road map' to the sustainable management of the Highland's groundwater resources, identifying recommended actions, associated sequencing, potential partnerships, and resource implications. The plan was developed with a recognition of the limited resources available to the District and wherever possible, proposes the most low-cost and effective approach to the long-term protection of the community water supply source.

Background

The District of Highlands is a small, primarily rural residential community that is blessed with an exceptional abundance of natural beauty. The majority of residents in the Highlands obtain their drinking water from private wells that tap into the local bedrock aquifer (BC Aquifer #680). The community has a strong interest in maintaining the health of the aquifer and has invested heavily in groundwater protection initiatives over the past 20 years. The work to-date, as outlined in Figure 1, has been well-timed, well-executed, and provides a solid foundation for future groundwater protection efforts. Previous studies have provided a good understanding of the aquifer, identified risks to water quality, and provided high-level recommendations for action. With this firm foundation, the District of

SCIENCE



POLICY & PLANNING



COMMUNITY ENGAGEMENT



Figure 1: Groundwater Protection in the Highlands - What's Been Done?



Develop groundwater protection work plan

Highlands is seeking to understand the next steps to move forward and support the long-term sustainable management of the Highland's water resource.

Rationale

The District of Highlands is in a unique position as the primary level of government responsible for land use planning over the community aquifer. Although the provincial Government is responsible for water allocation, through land use planning, the District plays a large role in managing how much water enters the aquifer (through recharge), how much water is extracted from the aquifer (through land development), and how much contamination may impact the aquifer (as a result of land use activities).

The District is also in a unique position as the level of government that is best able to communicate community interests with other levels of government.

However, at this point, the District does not have a well-developed understanding of the groundwater entry points (significant recharge areas) or which areas are most sensitive (areas that are highly vulnerable to groundwater contamination or areas with limited water supplies). The information that is available is not at a scale that can be used with policy and regulatory tools such as zoning and official community plans (OCP). There are also currently limited opportunities for collaboration with other levels of government that are involved in managing the aquifer.

In 2019 the District of Highlands developed an Asset Management Plan, to support the long-term sustainable management of services in the District and protect future generations of Highlands residents. In this plan, the local aquifer was identified as a critical piece of infrastructure for the community, with a replacement cost of approximately \$47 million. Given the value of the aquifer to the community, it will be important to take steps to maintain this resource and ensure its long-term sustainability.

Linked Projects

The District of Highlands is already taking several actions to protect groundwater for the community. These include:

- Ongoing planning and management of development (with a focus on groundwater protection)
- South Highlands Area Plan
- Monitoring of the Bear Mountain Master Development Agreement (MDA)
- Ongoing groundwater monitoring (thanks to volunteer private well owners)
- Community outreach regarding water levels and groundwater stewardship (inserts in tax bills)
- Emergency response planning

This work plan proposes several new actions to enhance the understanding of the resource and to address gaps in aquifer protection. Where possible, it integrates recommendations for future work with existing activities to increase efficiency and effectiveness.

Work Plan Goals

This work plan was developed to ensure the Highlands community has a sufficient **quantity** and **quality** of groundwater now and in the future, considering the uncertainty created by climate change and potential increases in population.

Objectives

The plan has been developed to meet the following objectives:

- 1) Maintain or improve groundwater levels
- 2) Maintain or improve groundwater quality
- 3) Maintain groundwater storage
- 4) Maintain groundwater extraction within sustainable levels
- 5) Protect ecological health by protecting interconnected surface water flows

Strategy

The following work plan provides an achievable set of steps that the District can take to support long-term groundwater sustainability. The plan recognizes associated District goals such as the next OCP update and identifies opportunities for cost-savings and partnerships. The work plan is developed to provide full flexibility to the District with respect to timing and implementation. It identifies critical sequencing of items and any situations where there are efficiencies in delivering tasks concurrently.

The work plan begins by proposing several low-cost and effective steps to support groundwater sustainability. They include increasing collaboration with other levels of government that play a role in aquifer management, updating existing land use planning policies, and supporting the sharing of currently collected groundwater data to enhance decision-making at provincial and regional levels.

Once these initial steps have been taken, the District can begin identifying key parts of the aquifer that require special considerations in land use planning and then use tools such as Development Permits Areas (DPAs) to protect these areas.

The plan recommends ongoing engagement with the community and a Highlands Groundwater Stewardship Program to support residents in caring for the aquifer.

Throughout, it will be important to continue monitoring groundwater levels and quality so that any changes to aquifer health can be addressed as soon as possible.

Actions

Proposed actions in this work plan can be grouped into the three main categories as shown in Figure 2.

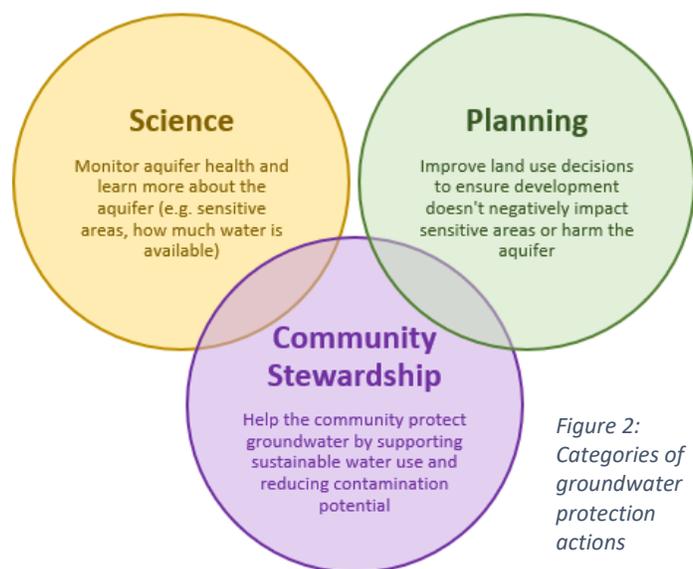


Figure 2:
Categories of
groundwater
protection
actions

Table 1, below, provides an overview of the recommended short, medium, and long-term priorities. Details on the recommended actions are provided in the ‘Work Plan’ section.

Table 1: District of Highlands groundwater protection work plan - short, medium, and long-term priorities

Planning Horizon	Science	Planning	Community Stewardship
Pre-Implementation	<ul style="list-style-type: none"> Continue groundwater level monitoring 	<ul style="list-style-type: none"> Incorporate groundwater protection options in strategic planning. Determine level of investment in groundwater protection Provide resources from Phase 3 report to Emergency Response Plan contractor Ensure implementation of Bear Mountain Master Development Agreement (MDA) Update the requirements for hydrogeological assessments in the DAIA 	<ul style="list-style-type: none"> Continue to provide information on groundwater levels to the community in yearly tax inserts
Short Term	<ul style="list-style-type: none"> Identify sensitive areas that require special management such as significant recharge and highly vulnerable areas Continue monitoring groundwater levels and begin gathering groundwater level and quality data. Implement “easy to access” data management system Delineate ‘community aquifers’, collect hydrometric data for water budget 	<ul style="list-style-type: none"> Take early protective actions District-wide to support land use decision-making Develop a Technical Advisory Committee to increase coordination across multiple levels of government and the community Work with the Province and potentially UBCM to request referrals for groundwater license applications Continued collaboration with emergency planning efforts 	<ul style="list-style-type: none"> Update website, install signage, develop workshops and stewardship program (e.g. rebates for private well testing, wellhead protection, septic maintenance, low flow plumbing upgrades, rainwater harvesting, etc.)
Medium Term	<ul style="list-style-type: none"> Continue monitoring groundwater quality and quantity Develop monthly water budgets on community aquifers to identify areas with seasonal water stresses (at a resolution that can be used in land use planning) 	<ul style="list-style-type: none"> In OCP update, consider DPAs for sensitive aquifer areas (significant groundwater recharge areas, highly vulnerable aquifer areas, and community aquifers with water quantity concerns) Consider water offsets bylaw 	<ul style="list-style-type: none"> Continue communications and stewardship support Share information about the aquifer as available
Long Term	<ul style="list-style-type: none"> Continued monitoring Additional science as needed (refine water budgets, recharge mapping)* 	<ul style="list-style-type: none"> Continued improved assessment of development applications and input on groundwater license referrals 	<ul style="list-style-type: none"> Continued communications and community stewardship support New incentives and education programs as needed
Ongoing	Continue groundwater protection efforts		

*With climate change uncertainty, it is wise to have funds available for additional monitoring and analysis as needed

Work Plan Overview

A draft work plan overview is provided in Figure 3 on the following page. The pages following this provide a detailed description of each work item. A summary table of all of the actions/tasks is also provided as an appendix to this report

Please note that program activities and resource allocations are in draft and to be discussed with staff, Council, and the community.

District of Highlands Groundwater Protection Work Plan Overview

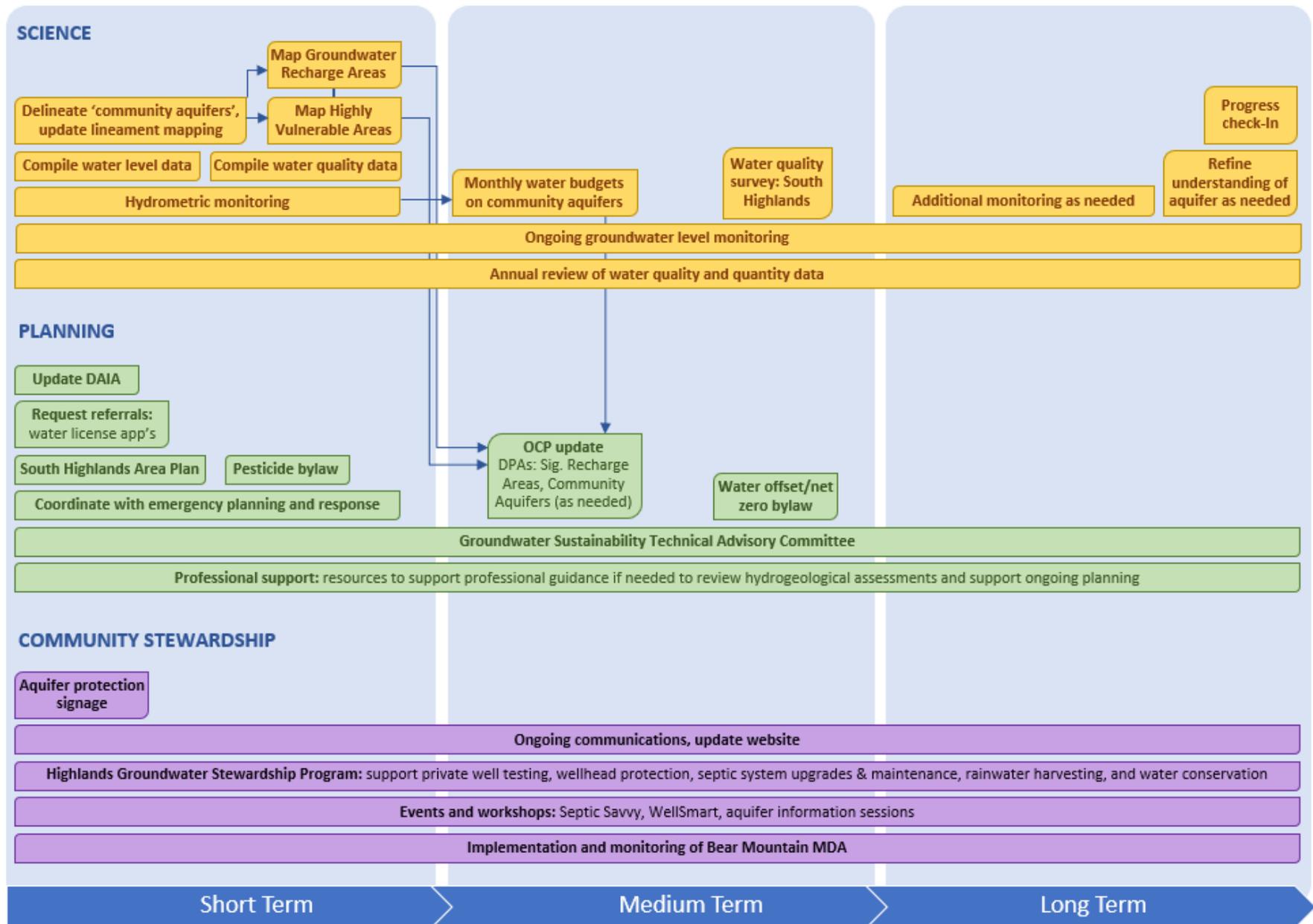


Figure 3: District of Highlands Groundwater Protection Work Plan Overview

Work Plan 'Legend'

The following provides further details on the activities proposed above. Each item below summarizes the recommended action, and provides relevant background, details on the approach, and estimated cost/resources necessary to carry out the work. The estimated cost/resource level is based on the project team's collective experience with this area of work. For the purposes of attributing costs we have assumed the need to have auxiliary/contract staff carry out the work at a cost of \$40/hour.

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Compile groundwater level data

Summary: Engage with groups that are currently collecting groundwater level data and request that they share it through provincial databases.

Background: The provincial Aquarius database has been designed to host third party hydrometric data. This data is shared publicly and used to enhance decision-making at the provincial and regional level.

Approach: Year 1: Reach out to third party data collectors and request that they share data online in the provincial Aquarius database. Then, work with the third party data collectors and provincial staff who manage the Aquarius database to input available groundwater level data and establish automatic uploads created for real-time continuous data. Request that third party data gatherers continue to upload data on an ongoing basis.

Potential third-party data sources include the District of Highlands monitoring wells (currently managed by Golder), as well as data from the Bear Mountain monitoring wells, any water suppliers that monitor water levels (potentially River Road, Hannington Creek), and the CRD (they may monitor water levels as part of the Millstream Meadows remediation project).

In year two, ensure that data continues to be uploaded to Aquarius.

Cost: Most cost-effective if done by contract staff. \$1,600 (year one), \$800 (year two).

Ongoing groundwater level monitoring data collection

Summary: Continue to monitor water levels in existing wells. Begin monitoring water levels in wells DOH-05 and DOH-08 in year two. Upload data to Aquarius.

Approach: It would be most cost-effective to have the groundwater level data collection done by District contract staff. Contract staff could easily be trained to collect and upload to Aquarius and a hydrogeologist be paid to review and report out annually. It would be important for staff to be trained in how to calibrate and use the equipment properly. This training could be done by MFLNRD for free or a consulting hydrogeologist for \$1,000. It would be valuable to have a dedicated District staff person doing this work to ensure integration with other projects and effective coordination of work with MFLNRD staff, consultants, and the private well owners.

The data obtained from the volunteer private wells is very valuable for the long-term management of the aquifer. If possible, set up long-term agreements with the existing monitoring well owners to ensure long-term access to the data. Alternately, pursue grant funding to drill new observation wells that are owned by the District.

Cost: Data collection cost: \$2,200 year one (including training). \$900/year in following years. Cost for review and analysis of all data (see below): \$5,000.

Review and interpret surface water and groundwater data

Summary: Review monitoring data and share information on the status of the aquifer with the community.

Timing: Once per year, on an ongoing basis.

This review should consider groundwater and surface water monitoring data from the provincial Environmental Management System (EMS), Aquarius, and other sources. It should be done by a professional and a summary provided to Highlands contract staff to be used in public communications. Staff should communicate the results to the public as part of the communications plan.

Cost: \$5,000 yearly.

Delineate 'Community Aquifers'

Summary: Create aquifer management units (e.g. sub-aquifers) so that development can be better managed in areas where there are more concerns about the sustainability of groundwater use.

Background: A similar approach is being used on the Southern Gulf Islands. The intent would be to calculate monthly water budgets for each of the community aquifer units.

Approach: The units would need to be mapped at a resolution that could be used for planning purposes (e.g. at a relatively high resolution e.g., 10m grid cell resolution – or at the resolution used on the Gulf Islands). This action should include detailed lineament mapping. This lineament mapping is important because groundwater movement is controlled by flow through fractures/lineaments. It is critical to identify the fracture network in order to understand the geometry of the main groundwater pathways.

Cost: \$12,000.

Hydrometric monitoring

Summary: Monitor streamflow at the outlets of the Craigflower and Millstream for three years to support water budgeting.

Background: There is limited hydrometric data for the area. To develop water budgets, at least three years of good quality hydrometric data is required. Both the MFLNRD and the British Columbia Conservation Foundation (BCCF) could potentially support the District in obtaining high quality hydrometric data. The Department of Fisheries and Oceans (DFO) could also play a supporting role. The MFLNRD Regional Hydrologist is experienced and interested in working with local governments and stewardship groups to establish hydrometric monitoring programs across the Island. MFLNRD staff can install monitoring equipment, train volunteers, support equipment calibration, conduct data review and analysis and develop rating curves. They ask that local governments provide funding for a level logger at each monitoring point (\$700), if possible. BCCF is also experienced in working with volunteer groups to gather high quality hydrometric data and is considering installing a monitoring station on the Millstream in partnership with the Goldstream Volunteer Association. The DFO Community Advisor has less technical equipment but is available as a potential resource and support for volunteers. The Peninsula Streams Society and the Goldstream Volunteer Association (related to the Goldstream Hatchery) groups are active in the area and may be interested in collaboration. Several local governments, including the Regional District of Nanaimo (RDN) have developed partnerships for stream monitoring and can be contacted for guidance and support.

Approach: Partner with MFLNRD Regional Hydrologist, BCCF, DFO and stewardship groups. When this project is initiated, all potential

organizations should be contacted as soon as possible to identify interest, availability, and resource needs. Stewardship groups should be consulted with a formal letter that can be taken to the organization's decision-makers. It makes sense to work with volunteers for this data collection because groups such as BCCF, DFO, and MFLNRORD have well-developed programs to support volunteers through training, supervision, and support. Hydrometric monitoring is also aligned with the objectives of several volunteer groups.

Cost: Equipment cost (\$1,400). Equipment may be provided MFLNRORD, but \$1400 should be budgeted to purchase two \$700 level loggers, if needed. Contract staff/volunteer time (\$4,800/year) for data collection. \$2,000 first year for contract staff time setting up program. The contract staff/volunteer time estimate for data collection is conservative as it assumes limited volunteer support and it is likely that volunteers will be able to assist with this task.

Compile groundwater quality data

Summary: Gather and upload existing water quality data into provincial databases.

Background: The provincial Environmental Monitoring System (EMS) database is designed to host third party water quality data. It makes data publicly available to enhance decision-making at the provincial and regional level. Many water suppliers already collect water quality data and are required to share it publicly through Island Health. However, this data is not stored or shared in a format that is easily accessible and it would be ideal to upload this data to the EMS. Many water quality testing labs can automatically upload data to the EMS (if requested). In recent years, the MOE Environmental Monitoring Reporting Program has been working with water suppliers in some areas to upload test results to the EMS. Labs will often upload to one database for free. However, if a water supplier has already asked the lab to upload to their own database, it may cost more to upload to the EMS, too. It is recommended that the District contact the MOE Environmental Monitoring Reporting staff and request assistance with additional upload costs.

Water quality data is generally viewed as more sensitive information than water level data, so there may be some third-party collectors that do not want to share. Because of this, it is proposed that this work happens after the collection of water level data, once relationships have been established, and water level data is already being shared.

Approach:

1. Connect with Regional Hydrologist, MOE Water Reporting team, Island Health to determine if there are opportunities to share costs of automatic uploads from lab to EMS. Connect with local lab to determine automatic upload options for water suppliers and options for private well owners.
2. Connect with third party data collectors to request participation. For those who do not want to share publicly, obtain data under confidentiality agreement for future studies.
2. Support third party data collectors in uploading to EMS.
4. In a year check to see if participants continue to upload data.

Cost: \$2,400 (year one), \$800 (year two).

Monthly water budgets on 'Community Aquifers'

Summary: Conduct monthly water budgets to understand which areas of the Highlands are more water scarce and which areas are more abundant. It is important that this is done with a level of certainty and at a high enough resolution that it can be used for planning purposes. This would help planners identify which areas could support additional development or secondary suites (for example) and which areas may not be able to support additional development.

Cost: \$15,000 for a high-level monthly water budget on all community aquifers in the District. \$20,000 for a more detailed water budget on areas of concern.

Background data required: Three years of hydrometric monitoring on the Millstream and Craigflower watersheds (map of suggested locations will be provided in implementation report).

Map significant groundwater recharge areas

Summary: Map areas of significant groundwater recharge at a resolution useful for planning so that development can be more carefully managed in these areas.

Background: Many of the recommended actions include suggestions to protect recharge areas but the current recharge mapping is overly simplistic (based on topography) and is not at a scale suitable for planning. Islands Trust is developing recharge mapping at a suitable scale for planning so that it can be used with planning tools (e.g. DPAs). As recharge areas are the "real" water sources, protecting them should definitively be a priority and mapping them at a scale that can be used for planners is important.

Approach: Complete before next OCP update (estimated, 2023) so that information can be used to support OCP updates (e.g. through establishment of DPAs).

Cost: \$5,000 initially. An additional \$5,000 to refine in year 10 based on additional data gathered through hydrogeological assessments and monitoring.

Map highly vulnerable areas

Summary: Map groundwater vulnerability to identify areas more at risk of contamination. This work should be done at a resolution that is useful for planning (e.g. 10m x 10m grid cells).

Background: There has been some vulnerability mapping done in the area, but the approach that was used is not very applicable to bedrock aquifers and has not been done at a scale that is useable for planning.

Approach: Complete before next OCP update (estimated, 2023) so that information can be used to support improved planning (e.g. establishment of DPAs).

Cost: \$3,000 initially. An additional \$3,000 to refine in year 10 based on additional data gathered through DAIA and monitoring.

Water quality survey: South Highlands

Summary: Check water quality in residential wells around Industrial Commercial properties to ensure that there has been no migration of contaminants.

Approach: Do one sampling event at a time where there is a high-water table and identify any red flags. Sample wells within 500 m of contaminant sources.

Timing: In 5 years. There is currently significant monitoring as part of the Millstream Meadows remediation project.

Cost: Approximately \$6,000. Estimate local groundwater regime and potential locations of concerns/wells (\$1,500); review of land activities and selections of PCOC: \$500: 5 wells @ \$300 (lab) + sampling & data review (approximately \$2,500, based on water quality test requirements).

PLANNING

Emergency planning and response

Summary: Direct the contractor responsible for the Highlands emergency response plan development and implementation to the sections of the Phase 3 report related to Emergency Management. Include an emergency response representative on the Technical Advisory Committee.

Cost: \$400 in year one

Groundwater Sustainability Technical Advisory Committee (TAC)

Summary: Develop a Groundwater Sustainability Technical Advisory Committee to increase coordination among different community groups, staff, and levels of government.

Background: Other local governments have found that a Technical Advisory Committee can support knowledge-sharing, collaboration, and coordinated management of water resources. A TAC also demonstrates a level of organization and commitment that attracts funding and partnerships. A TAC requires minimal staff and financial resources (about 1.5 contract staff days/meeting and \$200 to cover lunch). Although members may not attend every meeting, the TAC allows other levels of government and community stakeholders to stay engaged via meeting minutes.

Approach: Suggest inviting First Nations to participate in a format that works for them. Invite representatives from the MFLNRORD (Regional Hydrogeologist), BC Ministry of Environment (Aquatic Ecosystems or Water Allocations staff), Island Health (EHO), DFO, District of Highlands planning, Highlands District Community Association, Industrial/Commercial businesses, Bear Mountain, Environmental Stewardship Community (e.g. Peninsula Streams, Goldstream Volunteer Association), Capital Regional District (Onsite System Coordinator), the general public, academic community, and emergency response program. Suggest meeting two times/year.

Cost: \$2,200 (year one), \$1,200 (years 2-10)

Request referrals when groundwater license applications go to adjudication

Summary: Through the Water Sustainability Act, the Province has stated that it will provide local governments with an opportunity to provide input on water license applications, however the Province has not yet formalized a process for this. As the Highlands has a strong interest in ensuring that groundwater is used sustainably in the region, the District should request that the provincial government implement a protocol and referral system for groundwater license applications. The Highlands may also want to consider putting a motion forward at UBCM, requesting that the Province creates a process for referrals. Once a referral process is in place, the District should request to be notified when groundwater license applications in the District are going to adjudication. The District would then be notified of groundwater license applications in the area and, if desired, can provide feedback on applications that may be of concern to the community. Although it does not make sense for the District to respond to all referrals, it would be helpful to be aware of major proposed changes to groundwater use in the area. As science evolves (e.g. as a result of water budget project), the District may play a greater role in the referral process.

Cost: \$2,000 (year one), \$800/year ongoing.

South Highlands Local Area Plan

Summary: The District of Highlands should ensure that the South Highlands Local Area Plan includes groundwater protection and water conservation considerations. The District should request that development applicants identify potential contaminants of concern, provide a management and monitoring plan (if needed), and share any monitoring data on the EMS.

Cost: To be discussed. It is unclear how much of the cost is part of existing plan development and how much would need to be identified separately. Estimated \$2,000.

Incorporate groundwater protection tools into OCP update

Summary: Propose Development Permit Areas (DPAs) over Significant Groundwater Recharge Areas (for Environmental Protection and Water Conservation), Highly Vulnerable Areas (for Environmental Protection), and Community Aquifers that have water supply limitations (Water Conservation).

Timing: Next OCP update (estimated: 2023)

Cost: This would be incorporated into the overall terms of reference for the OCP review so would not require additional funds.

Pesticide bylaw

Summary: Finish the draft pesticide bylaw.

Background: District staff have had a draft bylaw in development for several years.

Timing: To be discussed. Sooner is better but flexible.

Cost: Variable. Estimated \$2,000.

Water offsets/net-zero bylaw

Summary: Develop a bylaw requiring proof that any additional water demand resulting from secondary suites, accessory dwelling units, or major renovations is offset by increased water efficiency to meet BC Building Code standards in existing homes (or businesses).

Background: As many households in the District of Highlands do not irrigate and were built prior to the BC Building Code water efficiency updates, it is estimated that the greatest residential water use is related to older plumbing fixtures. It is possible to require water offsets, or upgrades as part of major renovations under the Community Charter 53 (2) (b) & 8 (3) (1).

Approach: Timing is flexible, but sooner is better. Implementation would need to be simplified, as it is not advisable to request before/after water audits. One way implementation could be simplified would be for the District to require before and after photos showing old fixtures removed and new water efficient fixtures installed (as is done in the RDN toilet rebate program).

Cost: Estimated \$4,000.

Update development approval information area requirements

Summary: Update requirements for hydrogeological assessments (required in the DAIA of OCP) as soon as possible.

Background: In 2019 the RDN convened a group of land use planners, hydrogeologists, and a range of other staff and professionals to develop clear, defensible requirements for the hydrogeological assessments that are required as part of rezoning and development permit applications. The RDN board adopted these requirements as a board policy (RDN Board Policy B1.21 Groundwater assessment requirements for rezoning un-serviced lands and for development permits) in April 2019. This approach was taken as an alternative to updating the subdivision servicing bylaw. Provincial and regional staff anticipate it will be very beneficial in clarifying the requirements for assessments and will save costs for applicants, because it reduces duplication between assessments required by the Province and those for local government. It would be useful to adopt in the Highlands as a standard for the DAIA.

Cost: To be discussed. Estimated \$1,600.

Professional support

Summary: Consider having a small amount of funding available yearly to hire professional expertise who can support the District planner and contract staff in reviewing development applications.
Cost: \$1,500/year. Likely not used every year.

Progress check-in

Summary: In year 10 conduct an update on the status of groundwater to identify any red flags or trends requiring attention. In yearly check-ins, consultants will report out on groundwater levels. In this step, a consultant will take a more thorough look at the data and consider additional measures of aquifer health (e.g. how the aquifer is recharging to identify potential impacts of changes in storage). There should also be a review of program activities that considers feedback from staff and the community. This feedback, combined with the groundwater status update, will be used to assess program effectiveness, identify any new priorities or concerns that need to be addressed, and guide the next steps in groundwater protection.

Cost: \$20,000 (\$10,000: science/technical, \$10,000: planning)

COMMUNITY STEWARDSHIP

Aquifer protection signage

Summary: Install aquifer protection signage at every entrance to the District. This action is relatively low cost and would help keep aquifer protection 'top of mind' for residents and visitors.

Costs: It costs approx. \$350-\$400 per sign to buy (base, sign, pole) and install. Plus \$400-\$500 for graphic design and layout first time. Add 10 hours of contract staff time for coordination (\$400).

Communications

Summary: Ongoing communications and outreach can provide residents and business with up-to-date information on the aquifer, the groundwater sustainability program, and guidance on groundwater stewardship. Communications should provide relevant, seasonal information on how residents and business can take care of the aquifer and share details of the Highlands Groundwater Stewardship Program. Contract staff should update the website with information on the program, aquifer, and available resources.

Background: Communications alone is not necessarily effective at supporting improved water stewardship, so this program should be paired with incentives to support residents in protecting groundwater quality and quantity through the Highlands Groundwater Stewardship Program.

Cost: \$4,600 first year, \$2,000/year ongoing (contract staff time and limited graphic design support).

Highlands Groundwater Stewardship Program

Summary: It is recommended that the Highlands develop the Highlands Groundwater Stewardship Program to support community members in sustainable groundwater management. This incentive program would encourage landowners to use water more sustainability, store rainwater, improve contaminant management, test their wells (and share the data, as desired), and maintain their septic systems.

Background: The RDN has developed a similar incentive program for rural water quality, water conservation, and rainwater harvesting. With the RDN well-testing incentive, a private well owner can volunteer (by 'checking a box') to share water quality test results with the RDN or the province on the EMS. The Sunshine Coast Regional District has also developed a rainwater harvesting incentive

program. Both can be used as models and both organizations are happy to share resources.

Incentivizing rainwater harvesting in the Highland would be effective at addressing many water concerns, as it would provide additional water storage in the event of an emergency, help modulate flows from marginal wells, assist with slowing down rainwater to increase infiltration and reduce erosion, provide an alternative supply for outdoor watering, and provide additional supply for fire fighting.

Timing: Establish as soon as possible.

Cost: \$19,950 first year, \$15,950 years 2-10.

Ensure Implementation of Bear Mountain MDA

Summary: Monitor and ensure the implementation of the Bear Mountain MDA, including appropriate timing of irrigation and use of storage, as well as water quality and level monitoring.

Background: Bear Mountain is a significant groundwater user and manages several potential contaminants on site (e.g. landscaping chemicals). Ongoing monitoring of the impact of activities and MDA implementation is required for the long-term sustainability of the aquifer. The District is currently investigating the impact of the irrigation wells on the aquifer and this should continue.

Cost: To be discussed. Estimate \$1,000 (year one) and 600/year after

Workshops and events

Summary: Deliver Septic Savvy Workshops, WellSmart Workshops, and special events to support the community in groundwater stewardship and share new information on the aquifer.

Approach: Work with the CRD to deliver the Septic Savvy workshops in the Region for the first year. This program is already paid for by District residents. Approximately 10 hours of time would be needed to coordinate. In the following year, develop a WellSmart program to support communities in managing their private wells. This program would share information on wellhead protection, maintenance, water quality testing, contaminant management, and water conservation practices. The WellSmart workshops would be customized to the District of Highlands context (with support from the MFLNRORD, Island Health, the BC Groundwater Association, local well drillers, and water quality labs). The RDN can share resources. The District should also allot some funds for special events to share new information on the aquifer gathered as part of the water budget project and other studies. It is recommended that outreach programs are delivered for five years. After that, assess to determine if there are new messaging needs (e.g. how to use rainwater for potable use, as new guidelines are released).

Cost: Variable by year. Year 1 (Septic Savvy only): \$400, Year 2 (Septic Savvy, develop WellSmart Program): \$3,400, Ongoing: \$2,800/year.

Funding Mechanisms

The need for a Local Government to fund the work necessary to develop, implement and maintain an effective groundwater protection program is likely the most important and limiting issue as part of this consideration. The ideal is to have some form of stable annual funding for a program however this is not always possible. There are several possible funding mechanisms that can be considered for groundwater protection measures. These include:

- Special Projects Funds
- Grant Funding (e.g. Gas Tax Community Works Fund, Infrastructure Planning Grants)
- A Groundwater Protection Service

Special Projects Funds

The District of Highlands budget includes provisions for Special Projects under the General Government Services budget (for Council Special Projects) and the Planning Services budget (for Planning Special Projects).

Grant Funding

The District of Highlands can apply for grants through several funding programs. Examples include the Gas Tax Community Works Fund, administered by the UBCM and the Infrastructure Planning Grants administered by the Ministry of Municipal Affairs and Housing.

Gas Tax Community Works Fund

The Gas Tax funding program is provided through an agreement between the Federal Government, Province of BC, and the Union of BC Municipalities (UBCM). It provides local governments with predictable, long-term and stable funding (from gas taxes) to support investment in infrastructure and capacity building projects. The Community Works Fund is based on a per capita formula with a funding floor and delivered twice annually. The District can make choices about which projects to fund.

Infrastructure Planning Grants

The infrastructure planning grant program offers grants of up to \$10,000 to support local government in projects related to the development of sustainable community infrastructure. The grants are intended to help develop or improve long-term comprehensive plans and can be used for a range of activities related to assessing the technical, environmental and/or economic feasibility of municipal infrastructure project. The program is open for applications year-round and has regular processing deadlines.

Groundwater Protection Service

Under the Local Government Act, municipalities have broad authority to provide any services that Council considers necessary or desirable. Examples of services that local governments provide include traditional services such as sewer, water and roads and newer services such as drinking water protection and public WiFi.

Some local governments have established watershed protection service areas (e.g. Regional District of Nanaimo and Cowichan Valley Regional District Drinking Water and Watershed Protection Programs). These programs are intended to increase collaboration between stakeholders and local and provincial governments, support community stewardship, and inform land use planning.

Conclusion

This draft groundwater protection work plan has been provided to the District of Highlands and the community for feedback and comment. The work plan has been developed to support the long-term protection of the groundwater resource and aid the District in meeting its responsibilities related to land use planning and emergency preparedness. Implementation of the recommended actions will help support the community in managing its most valuable asset – its drinking water source.

Appendix: District of Highlands Groundwater Protection Work Plan Summary

Task #	Action	Goal	Key Steps	Collaboration Needs/ Partners	Linked Projects	Method of Delivery	Resource Needs	Information/ Data Needs	Timing	Expected Outcome	Priority	Estimated Cost
S1	Compile Groundwater Level Data	Increase understanding of groundwater levels, to support improved groundwater management, by supporting the sharing of data that is already being collected	<ol style="list-style-type: none"> Engage with third-party data collectors Work with Aquarius team to support users in uploading Ensure work continues (Year 2) 	<p>Bear Mountain River Road</p> <p>Hannington Creek Estates</p> <p>Golder Associates</p>	<p>Current groundwater monitoring</p> <p>Bear Mountain MDA (C4)</p> <p>Ongoing planning and information from DAIA (P9)</p>	Contract staff	<p>Year 1: 40 hrs</p> <p>Year 2: 20 hrs</p>	Contact information of third-party data gatherers	ASAP	Groundwater level data stored in provincial database (Aquarius) and accessible by provincial and regional government, academia, and the public	High	<p>Year 1: \$1,600</p> <p>Year 2: \$800</p>
S2	Groundwater Monitoring	Understand the health of the aquifer and identify any changes requiring attention	<ol style="list-style-type: none"> Continue monitoring existing wells Begin monitoring water levels in wells DoH05, DoH08 (Year 2) 	Owners of private wells	Current groundwater monitoring	Contract staff	<p>Yearly: 30 hrs (4 days)</p> <p>Year 2: \$2,000 (equipment)</p>	Contact information of private well owners	Continue	District and provincial staff will have information to understand the health of the aquifer, identify trends, and respond, as needed	High	<p>Year 1: \$900</p> <p>Year 2: \$2,900</p> <p>Year 3+: \$900</p>
S3	Surface Water / Hydrometric Monitoring	Understand the amount of water leaving the District via streams, in order to conduct a monthly water budget.	<ol style="list-style-type: none"> Develop partnerships/approach Install gauges on the Craigflower and Millstream Volunteer training Data collection, calibration, reporting Share data on Aquarius 	<p>MFLNRORD</p> <p>BCCF</p> <p>Peninsula Streams</p> <p>Goldstream Volunteer Salmonid Enhancement Society</p> <p>DFO</p>	<p>Internal: Water budget (S7)</p> <p>External: Millstream Fishway Project (Peninsula Streams Society)</p>	Partnership with MFLNRORD, BCCF, DFO, stewardship groups	<p>Depends on level of partnership: If District of Highlands (DoH) purchases equipment: \$1,400 (2 x \$700)</p> <p>If DoH does all data collection (no volunteer support): 120 hrs/year</p> <p>Coordination: Year 1: 50 hrs Ongoing: 20 hrs</p> <p>MFLNRORD will provide equipment installation, training, data analysis</p>	Map showing preferred location of monitoring sites	Three years prior to Water Budget (S7)	Three years worth of hydrometric data from the Craigflower and Millstream watersheds, rating curve	Medium-High	<p>Year 1: up to \$8,200</p> <p>Year 2 & 3: up to \$6,800</p>

Task #	Action	Goal	Key Steps	Collaboration Needs/ Partners	Linked Projects	Method of Delivery	Resource Needs	Information/ Data Needs	Timing	Expected Outcome	Priority	Estimated Cost
S4	Review and Interpret Surface Water and Groundwater Data	Understand health of aquifer	Hire consultant to review groundwater and surface water quality and quantity data from monitoring programs		Current groundwater monitoring Bear Mountain MDA (C4) Hydrometric monitoring (if applicable) (S3) Any other monitoring programs	Consultant	Yearly: \$5,000 + 5 hrs contract administration	Data from EMS, Aquarius, other DoH monitoring (e.g. hydrometric data), IC property owners, CRD, any volunteer private water quality test results)	Yearly	Understanding of status of aquifer health	High	\$5,200 Yearly
S5	Delineate Community Aquifers	Create aquifer management units (e.g. sub-aquifers) so that groundwater can be managed at a more local level	1. Hire consultant to develop model 2. Refine geological knowledge - map lineaments	Refer to Southern Gulf Islands: Groundwater Sustainability project	OCP update Water budget (S7), significant groundwater recharge area (S8), groundwater vulnerability mapping (S9)	Consultant	\$12,000 + 15 hrs contract administration	Data from Golder Phase 1, 2, 3 studies	Once. At least a year before OCP update	Mapping of aquifer management units, at a 10m grid resolution. Detailed lineament mapping.	Medium-High	\$12,600
S6	Compile Groundwater Quality Data	Collect existing water quality data and upload to provincial database (EMS) to enhance decision-making at the provincial and regional level	1. Develop partnerships/approach 2. Connect with third party data collectors 3. Support participants in uploading to EMS 4. Ensure work continues (Year 2)	Third Party Data Collectors: Bear Mountain, Hannington Creek, CRD, River Road, IC property owners, Golder, private well owners Potential Partners: MFLNRORD, MOE Environmental Monitoring and Reporting, Water quality testing lab(s), Island Health	Bear Mountain MDA Highlands Groundwater Stewardship Program (private well testing rebate) (C3)	Contract staff	Year 1: 60 hrs Year 2: 20 hrs	Contact information of water suppliers	Year 3, Year 4	Publicly available water quality data that is already being collected in the Highlands is now shared publicly in an easy to use format on the provincial EMS	Medium-High	\$3,200

Task #	Action	Goal	Key Steps	Collaboration Needs/ Partners	Linked Projects	Method of Delivery	Resource Needs	Information/ Data Needs	Timing	Expected Outcome	Priority	Estimated Cost
S7	Monthly Water Budgets on Community Aquifers	Identify which areas of the Highlands are more water scarce and which areas are more abundant (and associated water use) at a resolution that can be used for planning	<ol style="list-style-type: none"> 1. Conduct a high-level monthly water budget on all community aquifers in the District 2. Conduct a more detailed water budget on areas of concern 		<p>Delineate community aquifers (S5)</p> <p>Hydrometric monitoring (S3)</p> <p>OCP update</p>	Consultant	<p>High-level monthly water budget: \$15,000</p> <p>Detailed monthly water budget: \$20,000</p> <p>+ 25 hrs contract administration</p>	<p>Three years of hydrometric data on the Millstream and Craigflower</p>	<p>Once</p> <p>Suggest before OCP update</p>	Monthly water budgets for community aquifers	Medium-High	\$36,000
S8	Map Significant Groundwater Recharge Areas	Identify areas that act as significant 'entry points' for water into the aquifer at a resolution that can be used by planners	<ol style="list-style-type: none"> 1. Map recharge areas, based on Tasks S5, S7 2. In 10 years, update recharge area mapping based on groundwater monitoring and hydrogeological assessments from DAIA 		<p>Delineate community aquifers (S5)</p> <p>Monthly water budgets on community aquifers (S7)</p>	Consultant	<p>\$5,000</p> <p>+ 15 hrs contract administration (per mapping)</p>	<p>Based on tasks S5 and S6</p> <p>Combined with S9</p> <p>More efficient if S5, S6, S7, S8 done by same consultant</p>	<p>Twice</p> <p>Suggest before OCP update, then in 10 years</p>	Mapping of significant groundwater recharge areas at a resolution that can be used for planning (e.g. 10m grid cells)	Medium-High	\$5,600
S9	Map Highly Vulnerable Areas	Identify areas more vulnerable to contamination at a resolution that is useable for planning	Combine work with Task S8		<p>Delineate community aquifers (S5)</p> <p>Mapping of significant groundwater recharge areas (S8)</p>	Consultant	\$3,000	<p>Based on tasks S5 and S6</p> <p>Combined with S8</p> <p>Preferably, S5, S6, S7, S8 done by same consultant.</p>		Mapping of highly vulnerable areas at a resolution that can be used for planning (e.g. 10m x 10m grid cells) and included in the next OCP update	Medium-High	\$3,000
S10	Water Quality Survey: South Highlands	Test water quality in volunteer private wells around contaminated sites and Industrial Commercial (IC) properties to ensure that there has been no migration of contaminants	<ol style="list-style-type: none"> 1. Develop partnerships/approach 2. Hire consultant to identify sampling locations and analytical program, conduct sampling, and interpret results 	<p>MFLNRORD</p> <p>CRD (Millstream Meadows)</p> <p>Private well owners</p>	CRD Millstream Meadows remediation	Consultant, contract staff	<p>\$6,000: consultant</p> <p>+ 20-50 hrs contract staff time (depending on approach)</p>	<p>Water quality results from IC property owners, CRD Millstream Meadows remediation project</p> <p>Phase 2 Golder Report</p>	<p>Once</p> <p>In year five or later</p>	Report on water quality, protecting anonymity of private well owners to the greatest degree possible	Medium	\$6,800-\$8,000

Task #	Action	Goal	Key Steps	Collaboration Needs/ Partners	Linked Projects	Method of Delivery	Resource Needs	Information/ Data Needs	Timing	Expected Outcome	Priority	Estimated Cost
P1	Emergency Response Planning	Integrate groundwater considerations into emergency planning and response efforts	<ol style="list-style-type: none"> 1. Provide the emergency response plan contractor with the emergency response planning materials from the Golder Phase 3 2. Include contractor on the Technical Advisory Committee 3. Coordinate communications 	Emergency Response Plan Contractor	DoH Emergency Response Plan Groundwater Sustainability Technical Advisory Committee (P2)	Contract staff	Yearly: 10 hrs	Emergency Response Plan implementation schedule Golder Phase 3 Report: Emergency Response Planning	ASAP, ongoing	Increased coordination and improved messaging	Very High	\$400
P2	Groundwater Sustainability Technical Advisory Committee	Increase coordination among stakeholders, staff, and multiple levels of government	<ol style="list-style-type: none"> 1. Invite participants 2. Create Terms of Reference 3. Meet twice yearly 	Many		Contract staff	Year 1 (setup): 25 hrs Ongoing: 20 hrs + + \$200/meeting for lunch	Recommended membership list	Ongoing	Improved coordination of groundwater protection efforts, increased opportunities for partnership, funding, and engagement	Very High	Year 1: \$2,200 Year 2+: \$1,200
P3	Obtain Referrals for Groundwater License Applications	Be aware of, and provide input on, proposed groundwater extractions in the District	<ol style="list-style-type: none"> 1. Request the Province notifies DoH when license applications in the Highlands go to adjudication 2. Put forward a motion at UBCM to request the Province create a referral system for municipalities 3. Once referrals established, review applications, focusing on large withdrawals or areas of concern (particularly after water budgets complete) 	MFLNRORD MOE UBCM CRD	Groundwater Sustainability Technical Advisory Committee (P2)	Contract staff	Year 1: 50 hrs Year 2+: 20 hrs		ASAP, ongoing	Improved management of groundwater within the DoH and provincially	High	\$800-\$2,000

Task #	Action	Goal	Key Steps	Collaboration Needs/ Partners	Linked Projects	Method of Delivery	Resource Needs	Information/ Data Needs	Timing	Expected Outcome	Priority	Estimated Cost
P4	South Highlands Local Area Plan	Protect groundwater quality and quantity in the South Highlands	1. Include groundwater protection and water conservation policies. Consider net-zero groundwater use policy. 2. Require developers to identify potential contaminants of concern, provide a management and monitoring plan (if needed), and share monitoring data on EMS	DoH Planner	South Highlands Local Area Plan	DoH Planner, contract staff	Uncertain. May be included in existing budget. Up to 50 hrs	Example of groundwater protection and water conservation policies and net-zero groundwater policy in the RDN Bowser Village plan	Unknown	Increase protection of groundwater in the South Highlands and improve information sharing	High	\$2,000
P5	Incorporate Groundwater Protection Tools in OCP Update	Protect the aquifer by requiring improved management over highly sensitive areas	Create Development Permit Areas (DPAs) over Significant Groundwater Recharge Areas, Highly Vulnerable Areas, and Community Aquifers that may have water supply issues	DoH Planner	OCP update S3, S5, S6, S7, S8	DoH Planner, contract staff	Incorporated into terms of reference for OCP update, so no additional cost.	Information and mapping products from S3, S5, S7, S8	2023 or later	DPAs for sensitive areas, requiring improved management and monitoring	High	\$0
P7	Pesticide Bylaw	Protect groundwater quality by prohibiting pesticide use	Complete draft pesticide bylaw	DoH Planner		DoH Planner, contract staff	Up to 50 hrs		ASAP / Flexible	Pesticide bylaw	Medium-High	\$2,000
P8	Water Offsets	Net-zero water development	Develop a bylaw that requires that any additional water demand from secondary suites, accessory dwelling units, or major renovations to be offset by increased water efficiency in the existing structure (up to BC Building Code standards)	DoH Planner	Secondary Suites and Accessory Dwelling Units Study	DoH Planner, contract staff	Up to 100 hrs		Flexible	Fixtures in existing homes are updated when a new dwelling unit is added to a property (or a major renovation is completed)	Medium	\$4,000
P9	Update DAIA Requirements	Ensure that new development will not negatively impact aquifer, provide clarity regarding DAIA requirements, increase amount of groundwater data	Adopt the RDN Board Policy B1.21 Groundwater assessment requirements for rezoning un-serviced lands and for development permits to	DoH Planner		DoH Planner, contract staff	Estimate 40 hrs		ASAP	Clear requirements regarding hydrogeological assessments for the DAIA, improved aquifer protection, more groundwater data	High	\$1,600

Task #	Action	Goal	Key Steps	Collaboration Needs/ Partners	Linked Projects	Method of Delivery	Resource Needs	Information/ Data Needs	Timing	Expected Outcome	Priority	Estimated Cost
P10	Progress Check-in	Assess effectiveness of groundwater protection efforts and determine if there are any new priorities that need to be addressed	1. Assess aquifer health including potential changes in storage 2. Assess program effectiveness		All	Contract staff, consultant	\$20,00 + 30 hrs contract admin (\$1,200)		Year 10	Understanding of aquifer health, key priorities, program effectiveness	Medium-High	\$21,200
P11	Professional Support as Needed	Provide technical support to DoH staff	Funding to support DoH in assessing development applications			Consultant	\$1,500/year (likely not used every year)		ASAP	Improved capacity to assess development applications	Medium-High	\$1,500
C1	Signage	Remind residents and inform visitors of the important of groundwater protection	1. Create sign (message and graphic design) 2. Install signs at entrances to District	DoH Building Inspector		Contract staff	Staff time: 10 hrs + Sign installation: \$400/sign x 4 + Graphic design: \$500		ASAP	Groundwater protection signs at entrances to the District	Medium	\$2,500
C2	Communications	Provide residents and business with up-to-date information on the health of the aquifer, DoH groundwater protection initiatives, and guidance/tips on groundwater stewardship	1. Develop and deliver outgoing messaging (ongoing/seasonal) 2. Update Website 3. Maintain website			Contract staff	Communications: 40 hrs/year Update website: 50 hrs (year 1) + \$1,000 graphic design Maintain website: 10 hrs/year		ASAP	Improved communications with community and improved groundwater stewardship	Medium-High	\$2,000-\$4,000
C3	Groundwater Stewardship Program (Incentive Program)	Improved groundwater stewardship practices	1. Develop Incentive program 2. Deliver program		Communications (C2)	Contract staff	Year 1 program development: 75 hrs Program delivery (ongoing): 50 hrs Incentives: Variable. Suggest \$11,000/year		ASAP	Residents use water more sustainability, store rainwater, manage water quality risks, test their wells (and share data if desired), and maintain septic systems	Medium-High	Year 1: \$16,000 Year 2+: \$13,000/year
C4	Ensure Implementation of Bear Mountain MDA	Ensure that Bear Mountain will not negatively impact the community water supply	1. Ensure appropriate timing of irrigation (and water storage use) and continued monitoring and assessment of water quality and quantity				Variable. Year 1: approx. 25 hrs Year 2: approx. 15 hrs		ASAP	Bear Mountain provides water level and quality monitoring data and does not use irrigation wells in dry months.	Very High	\$600-\$1,000

Task #	Action	Goal	Key Steps	Collaboration Needs/ Partners	Linked Projects	Method of Delivery	Resource Needs	Information/ Data Needs	Timing	Expected Outcome	Priority	Estimated Cost
C5	Events and Workshops	Support community groundwater stewardship and share new information on the aquifer	<ol style="list-style-type: none"> 1. Work with CRD to deliver Septic Savvy Program in Highlands yearly 2. Partner to develop WellSmart program for the Highlands 3. Deliver WellSmart program 4. Special events and aquifer updates 	Septic Savvy: CRD WellSmart: MFLNRORD, Island Health, BC Groundwater Association, local well drillers, water quality testing labs	Communications (C2) Groundwater Stewardship Program (C3)	Contract staff, CRD partnership, consultants	Variable. Year 1 (Septic Savvy only): 10 hrs Year 2 (WellSmart program dev.): 50 hrs + \$1,000 graphic design Ongoing: 45 hrs/year + \$600 in expenses		Soon	Improved well and septic management and understanding of aquifer Brochures and resources available	Medium-High	Year 1 : \$400 Year 2: \$3,400 Ongoing: \$2,800/year