



AGENDA

Infrastructure Committee Meeting

Tuesday, April 8, 2025, 7:00 p.m.
Council Chambers, 400 Centre Road, Lions Bay
And Via Zoom Video Conference

Zoom Invite Link: <https://us02web.zoom.us/j/2780145720?omn=83622603570>
To join via phone, dial 778-907-2071 | Meeting ID: 278 014 5720

We are privileged to be meeting and doing work on behalf of the residents of Lions Bay on the traditional unceded territory of the Squamish and Musqueam Nations.

	Pages
1. Call to Order	
2. Adoption of Agenda	
Recommendation: That the Agenda of April 8,2025 Infrastructure Committee be adopted as presented.	
3. Public Participation	
4. Approval of Minutes of Prior Meetings	
4.1 Infrastructure Committee Meeting- March 11, 2025	3
Recommendation: THAT the Infrastructure Committee Meeting Minutes of March 11, 2025 be approved.	
5. Business Arising from the Minutes	
5.1 Portable Potable Water Treatment Plant	
Chair N Abbott - verbal update	
<i>- for information</i>	
5.2 Budget Update - pH Adjustment of the Potable Water Supply	
5.3 Water Strategy Analysis - Next Steps	
Brian Ulrich - verbal report	
<i>- for information</i>	
6. Unfinished Business	
6.1 Unfinished Business Log	11
Chair N Abbott - verbal update	
<i>- for information</i>	
7. Reports	
7.1 Drilling Wells	13

Chair N Abbott - Review of drilling quotes:

- Recent estimate for drilling water test hole received by the committee. The estimate for \$65k to drill one 400' test hole includes a drilling production rate of \$85/ft or an all in cost of \$162.50/ft.
- The Piteau report (2005) concludes that drinking water wells will need to be 300-500 ft deep, cost for 3 production wells \$109-182k in 2005 \$'s average all in cost of \$121/ft but if escalated for 20 years will be 5 times that amount.
- The heat pump quote for geothermal has the well drilling for 5-6 wells of +-300' (total 1,500') was estimated at around \$30/ft. This includes U-tubes and grouting.

- for information and discussion

8. Resolution Recommendations to Council

8.1 UBCM Draft Water Filtration Resolutions

Chair N Abbott - Draft resolution and supporting letters to be presented to the UBCM for endorsement.

- for information and discussion

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9. New Business

9.1 Suitability of Geothermal Drilling to Inform Drinking Water Wells

- for discussion

9.2 Alberta Drinking Water Operations Specialist: Drinking Water & Wastewater Programs - Banff presentation

- for discussion

10. Public Questions and Comments

11. Adjournment

Recommendation:

THAT the Infrastructure Committee Meeting be adjourned.



**INFRASTRUCTURE COMMITTEE MEETING
OF THE VILLAGE OF LIONS BAY
HELD ON TUESDAY, 11 MARCH, 2025 AT 6:00 PM
COUNCIL CHAMBERS, 400 CENTRE ROAD, LIONS BAY
AND VIA ZOOM VIDEO CONFERENCE**

MINUTES

In Attendance : Councillor Neville Abbott (NTA) – Chair
Mayor Ken Berry (KB)
Councillor Michael Broughton (MB)
Committee Member Anthony Greville (ASG)
Committee Member Brian Ulrich (BU)

Absent with regrets :

Absent : Councillor Jaime Cunliffe (JC)
Committee Member Mark Ignas (MI)
Committee Member Hilary Monfared (HM)

Staff : Director of Operations Karl Buhr (DOO)

1. Call to Order

The Chair called the Infrastructure Committee Meeting to order at 18:05 pm.

2. Appointment of Recorder

ASG was appointed recorder this meeting.

3. Approval of the Agenda

Moved/Seconded

THAT the agenda of 11 March, 2025, Infrastructure Committee be adopted as circulated/amended.

Amendment;

CARRIED.

4. Public Questions & Comments

No public comments or delegation were forthcoming.

5. Approval of Minutes

- A. Infrastructure Committee Meeting Minutes – 11 February, 2025
THAT the Infrastructure Committee Meeting Minutes of 11 February, 2025 be approved as circulated.
CARRIED.

6. Business Arising from the Minutes

Snow Pack Accumulations at Palisade Lake – The snow pack continues to be a cause for potential concern and is being properly monitored by all. The DOO made the observation that while snow pack levels are important in planning, the major influence is the amount of rain that falls, and when, during the summer drought months. See notes and graph below.

Training Opportunities – ASG and BU are to meet with the DOO and Staff on Friday 14 March to review the ENSuRe initiative and to determine the best training opportunities and best schedule, including the awarding of CEU for staff.

7. Unfinished Business

24073 – A joint meeting between the I.C. and the A.F.C. did not take place in 2024 prior to the recommendations forwarded to inform the 2025 budget cycle. The I.C. would like to plan such a meeting in September 2025 ahead of the 2026 budget cycle in anticipation that consistent recommendations will be seen as stronger project endorsements.

24113 – A meeting has been scheduled between I.C. members and staff to discuss ENSuRe protocols for Friday 14 March. See the technical notes below.

24114 – A lengthy discussion was undertaken concerning Long Term Water Supply Strategy. For more information, see below under New Business and further below in the technical notes.

25011 – Little action was reported during the past month – with the UBCM deadline in May, work needs to be completed in short order. It was requested that NTA, ASG and MI make a full commitment to contact their respective bodies.

8. New Business

- A. **Long Term Water Supply Strategy spreadsheet** – BU presented the revised Long Term Water Strategy Spreadsheet, which included the weightings for each category as suggested by each committee member. There was remarkable consistency in the outcomes, with a pipeline from M.V., well water supply, and a desalination plant universally being the top options. See technical notes below.

9. Public Questions & Comments

No public comments or delegation were forthcoming.

10. Adjournment

Moved/Seconded

THAT the Infrastructure Committee Meeting be adjourned.

CARRIED

The meeting adjourned at 19:33.

11. Next Meeting

Next meeting of the Infrastructure Committee was scheduled for 08 April, 2025.

DRAFT



**INFRASTRUCTURE COMMITTEE MEETING
 OF THE VILLAGE OF LIONS BAY
 HELD ON TUESDAY, 11 MARCH, 2025 AT 6:00 PM
 COUNCIL CHAMBERS, 400 CENTRE ROAD, LIONS BAY
 AND VIA ZOOM VIDEO CONFERENCE**

Discussion and Background Notes

Contribution by : Anthony Greville (ASG)

Also in attendance : Councillor Neville Abbott (NTA) – Chair
 Mayor Ken Berry (KB)
 Councillor Michael Broughton (MB)
 Committee Member Brian Ulrich (BU)

Absent with regrets :

Absent : Councillor Jaime Cunliffe (JC)
 Committee Member Mark Ignas (MI)
 Committee Member Hilary Monfared (HM)

Staff : Director of Operations Karl Buhr

Discussion and Background Notes.

Identifier	Description	Responsible	Status
23112	Convene a February I.C. Round Table Meeting to focus on a 10 and 20 year horizon plan to identify the new and replacement infrastructure requirements and related expenses.	NTA/All	

23117	BU will review the SCADA system on behalf of the I.C. and work with the PWM to up-grade the hardware and software. A Requirements Document is anticipated at mid 2024.	BU/PWM	Partial
23121	HM to assist the PWM in preparing REQ/RFP documentation for estimate and work on water main replacement Creekview Place and for the estimate for Highview Place. HM to assist the PWM and CAO in reviewing submissions once received.	HM/PWM	
24073	In light of discussion at the 03 July Finance and Audit Committee Meeting, the documents relating to asset management and asset replacement funding deficiencies need to be up-dated and presented to the F & A C, the CAO and staff and the Village as a whole. This should be an early Fall project for this group.	All	
24081	BU to set up and manage a Google Drive (or similar) to manage the water supply data as it is collected.	BU	
24112	The I.C. should provide direction and support to Staff in order for the Village to prepare an Active Transport Plan. Coordinating same with the Climate Action Committee should be evaluated.	HM	
24113	ASG to work with the DOO and VCH to revise the ENSuRe trigger points and guidelines recommendations.	DOO/ASG	
24114	BU to further up-date the Long Term Water Supply Strategy spreadsheet to separate out CAPX and OPX costs for each raw water source/treatment option to assist in the evaluation process.	BU	✓
25011	NTA, ASG and MI to contact to contact various groups/associations they believe may support Lions Bay in advocating/petitioning higher levels of Governments to inventory portable potable WTP to use should raw water supplies become contaminated as a consequence of forest fires in their watersheds.	NTA/ASG/MI	
25031	An action step resulting from the Long Term Water Supply Strategy discussions, is the I.C. is to work with staff to put forward a recommendation to Council outlining the preferred steps to determine if well water has sufficient supply, recharge capacity and quality to be considered a viable option as a water source for peak shaving application.		
25032	ASG to prepare a training package for staff relating to UVT, chlorine dosage and distribution system residual, disinfection, required Ct, and water storage times as they relate to the ENSuRe protocol (Fall 2025).	DOO/ASG/BU	

25033	ASG to review the options for VoLB to purchase a bench top pH meter. Include standard calibration buffer solutions and an option for magnetic stir bar mixing.	ASG	
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NOTES:

Long Term Water Supply Strategy – BU presented the revised Long Term Water Strategy Spreadsheet, which included the weightings for each category as suggested by each committee member. There was remarkable consistency in the outcomes, with a pipeline from M.V., well water supply, and a desalination plant universally being the top options.

The parameters were that demand is still almost twice what it should be on a per capita basis, but can be considered at least “under control”. Supply is the variable, and it can be influenced by the effects of climate change, geomorphic adjustments (“pinching off the creek water”) and forest fires. Losing total supply due to geomorphic effects is very unlikely, and cannot really be predicted. Climate change is happening, and over time will have an effect, but equally, over time mitigation measures can be put in place. We have already lowered demand somewhat, and increased supply through ASAP. Other measures can be anticipated, such as water metering and wells. Losing water quality (but not quantity) due to forest fires is the most immediate threat to our water supply.

When considering the options, it was acknowledged that further short term strategies are required to bring demand down to 400 lpppd. If this can be accomplished, then the best long term strategy is not total replacement of the water supply, but rather a peak shaving and supply enhancement option. Therefore, the most expensive and difficult option, a pipeline from Metro Vancouver’s SCFP facility was determined to be beyond the scope fo the Village for the immediate future.

The peak shaving alternatives are introducing well water or desalination. Desalination is expensive to install and operate, and there are significant issues with the concentrated brine disposal. Desalination does, however, offer an unlimited supply of water (at least for VoLB needs) and land has been purchased by the Village which could be used for a desalination plant at some point in the future.

Activating wells could offer an immediate limited supply for the peak shaving function, and will have an added advantage that well water would not be subject to the quality fluctuations consequent to a forest fire. It is likely there would not be sufficient well water available to supply the entire Village water requirement, but, when combined with the spring like Alberta Creek water source, there may be enough supply for the “necessities of life”.

The main drawbacks associated with wells at this time is that we do not know where to drill, how much water might be available, recharge rate, and most significantly the quality of the water in any well. There is a 2005 (so 20 years old) report from Piteau Assocaites that offers some insight, especially with respect to potential aquifer locations and cautions surrounding dissolved metals concentrations. 20 years ago, it was suggested that drilling and testing wells in the Lions Bay bedrock would cost between \$109,000 and \$181,000, and would be between 100 m – 140 m deep.

Notwithstanding the above, it was felt that wells should be investigated further, especially due to their resiliency to the effects of forest fire. Unfortunately, the option of piggybacking on a well used for geothermal heating at the community complex has not materialized, so any test wells will have to be specific to water supply. It had been hoped that should a well be dug within the Village boundaries, at least the potential water quality could be analyzed.

The action step left with the I.C. is to put together a meaningful recommendation to Council and staff with respect to drilling at least one test well at an elevation higher than the water treatment plants to determine the volume of water present, flow rate, recharge rate, and its quality. There might be significant costs associated with site preparation, electrical energy supply, and ultimately drilling 150 m through bed rock; and there is the very real risk no water would be found at all, or that it is of such poor quality it cannot be used without significant treatment protocols and expenditures. Careful consideration needs to be included in any such recommendation.

ENSuRe Protocol and Staff Training – As previously discussed, the ENSuRe protocol needs to be put in place to prevent “off spec water” from entering the water treatment intakes and plants. Recent developments include adjustments to the UV lamp operating protocols, new external UVT metering at the raw water in-takes, distribution system in-line chlorine residual monitoring, and other management protocols. Consequently, the ENSuRe trigger protocols have become more sophisticated, but also far more meaningful and robust.

To this end, ASG and BU are to meet with the DOO and staff on Friday 14 March, 2025 to begin the process of writing an ENSuRe trigger protocol. As an initial request, the DOO asked that a recommendation be forwarded to his office in regards to purchasing a bench top pH meter for the PWY laboratory.

Snow Pack Accumulations at Palisade Lake – The snow pack level at Palisade Lake continues to be a cause for concern, although the situation has improved with some early March snow. The B.C. Government *Snow Water Equivalent at B.C. Automated Snow Weather Stations, expressed as Percent of Period-of-Record Median* indicated Palisade Lake was at 13% of normal on 01 March, and still only at 36% of normal for 15 March. Maybe of more significance, the snow pack for this year is below that of last year, which was, in itself, a record low year. Please see the graph below, dated to 19 March.

Lions Bay water demand for 10 March was 370,000 usg, or 1,400,500 L, or 1,000 lpppd. For the month of February, the integrated average demand was shown to be 560 lpppd. This consumption rate is unsustainable, especially when the snow pack is so low. While the one day demand on 10 March is not good, overall the February average, while still high, is an improvement on the average 800 lpppd demand seen in early 2024, prior to the “leak blitz” by the PWD.

Council and Staff members confirmed that investigating all potential water leaks, identifying the exact location, and either repairing, or requiring the property owner to repair, the leak remains a high priority of staff and will continue throughout 2025.



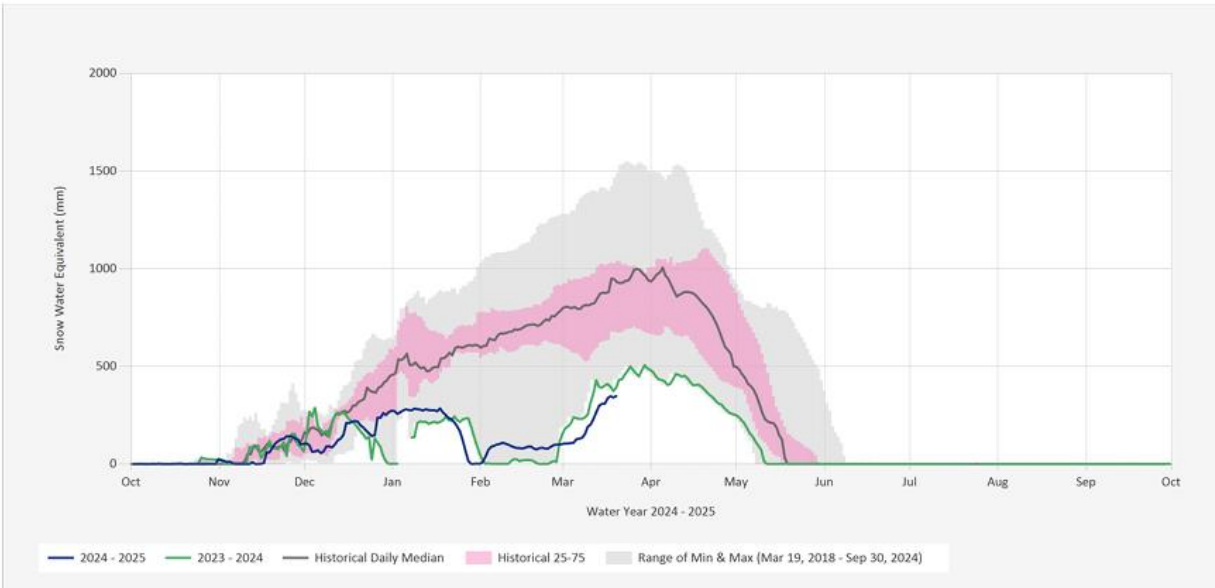
Automated Snow Weather Station Graph

Snow.3A09P.Automated Snow Weather Station Graph

Mar 20, 2025 | 1 of 1

Source Data: SW.Daily@3A09P

Location: Palisade Lake, Latitude: 49.454444, Longitude: -123.031944, Elevation: : 900 m



Statistics are based on the period of record prior to the current Water Year
Statistics are only displayed for locations with at least two years of data
Automated Snow Weather Station Graph is only available for Active locations

Data last appended: March 19, 2025 16:00 UTC+00:00

Status: Active

Unfinished Business Log as of March 11th, 2025

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PITEAU ASSOCIATES
GEOTECHNICAL AND
HYDROGEOLOGICAL CONSULTANTS

215-260 WEST ESPLANADE
NORTH VANCOUVER, B.C.
CANADA V7M 3G7
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Our file: 2681

March 18, 2005

Earth Tech Canada Inc.
1901 Rosser Street, 6th Floor
Burnaby, B.C.
V5C 6S3

Attention: Mr. Scott Neuman

Dear Sirs:

Re: Hydrogeologic Assessment for Groundwater Supply, Lions Bay, B.C.

Piteau Associates Engineering Ltd. (Piteau) was retained by Earth Tech Canada Inc. (Earth Tech) to perform a hydrogeological assessment to define areas near the Village of Lions Bay which are most prospective for a potential development of a groundwater source. The work involved the review of available topographic and geological maps and reports, stereo-paired aerial photographs, information on existing water wells drilled in the area, and reports pertaining to groundwater resources.

BACKGROUND

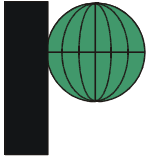
The Village of Lions Bay (the Village) is a community of about 1400 residents located on the east shore of Howe Sound, 25 km north of Vancouver (Fig. 1). Access is by Hwy. 99, which intersects the town.

The Village operates a water distribution system that supplies potable water to residences and businesses. According to Earth Tech, water is drawn into the system at intakes on Harvey Creek (79% of production), Magnesia Creek (21% of production) and Alberta Creek (used only during droughts). Earth Tech has indicated that the average daily water demand in 2004 was 28 L/s. However, after allowing for leakage, the actual consumption is about 10 L/s. Having regard to possible future expansion of the community, they have indicated that the feasibility of developing a 10 to 15 L/s groundwater supply source should be assessed.

SITE DESCRIPTION

The Village of Lions Bay is located along Hwy. 99, 11 km north of Horseshoe Bay on NTS mapsheet 92G/6.

The original settlement at Lions Bay was built on the alluvial fan of Harvey Creek, which juts into Howe Sound. Topography of the fan is subdued, with an average grade from tidewater to fan apex of about 20%. The fan consists of rapidly changing sand and gravel layers with occasional accumulations of unsorted sand, silt and gravel that were deposited by mass wasting events.



Earth Tech Canada Inc.

Attention: Mr. Scott Neumann, P. Eng. -2- March 18, 2005

Beyond the top of the fan, slope grade increases to 25%, and the built-up portion of town extends to an elevation of about 220 metres above sea level (m-asl). At this elevation, the slope breaks uphill to 50%, except in the Harvey Creek Valley, where the slope maintains a grade of about 25%.

Creeks draining Mount Harvey and The Lions are incised through overburden and into bedrock. The horizontal depth of the Magnesia Creek valley is about 16m, while that of the Harvey Creek valley is about 18m. The topographic divides along the eastern sides of these two creek catchment basins rise up to about 1700 and 1600 m-asl, respectively.

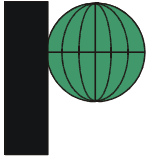
HYDROGEOLOGY

The dominant geologic profile in the Village area is about 1m of unconsolidated colluvium overlying metamorphosed sedimentary and volcanic bedrock belonging to the Gambier Group. According to Roddick (1965), this bedrock consists of bedded and foliated deposits of clastic sediments and a range of intermediate to felsic, subaerially deposited, flow and fragmental volcanics. The general morphology of Gambier Group rocks resembles a hanging pendant, or remnant, of older Gambier Group suspended in the main mass of Coast Plutonic rocks. The colluvium is likely quite a bit thicker than 1m in the area around the creek mouths, where it merges into fan deposits.

The eastern extent of Gambier Group rocks is at an intrusive contact about 1200m east of the Howe Sound shore, where a large mass of quartz diorite is exposed. Given the expected shape of the Gambier pendant, its contact with the quartz diorite likely dips to the west.

Groundwater in the Lions Bay area is likely controlled by bedrock openings called fractures. While bedrock is relatively impermeable to water, it can act as an aquifer when it has been fractured. Brittle plutonic and volcanic rocks are most susceptible to fracturing, and these have commonly been subjected to tectonic activity in this setting. While the porosity of the resulting rock is relatively low, the fractures can be extensive and intersecting fracture sets can result in moderately productive aquifer zones. The morphology of such zones is often erratic compared to sedimentary layering, and locations of suspected fracture zones should be confirmed in the field. The Gambier rocks have been tilted as they were thrust into place by regional faulting, and now exhibit bedding of various attitudes. Some sections dip nearly vertically. Their susceptibility to tectonic fracturing is variable, with the fine-grained clastic sediments forming foliated rocks, and the brittle volcanics tending to shatter.

Faults are fractures along which relative movement of rock has taken place. Rather than a single discrete plane, faults are commonly zones several metres or tens of metres wide, along which rocks have been crushed or torn. Fault zones can subsequently become conduits for groundwater movement, and are a good place to prospect for water in a bedrock environment. In particular, locations where intersecting fault sets are suspected warrant further investigation, as they may host a volume of rock that has been fractured in three dimensions.



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Attention: Mr. Scott Neumann, P. Eng. -3- March 18, 2005

Through-going faults have not been identified on the regional bedrock geology maps (Roddick, 1965) and the Armstrong map (1990), but localized faulting and fracturing is common along Howe Sound.

As part of this hydrogeological assessment, Piteau has examined stereoscopic aerial photographs of the region surrounding Lions Bay, to delineate potential regional faulting and/or fractures. Linear geographic features that are interpreted as potential fault or fracture planes are indicated in Fig. 2. Areas where potential fault intersections exist are circled, and suggested locations for a test well are also indicated.

Water migrating along a fault plane projecting at an angle other than vertical would be intercepted by a vertical well from the top surface of the fault. The orientation of the fault or fracture must be ascertained prior to the selection of a drill site, so that the zone can be intersected at a depth of at least 30m below ground.

EXISTING WATER WELLS

There are no government records of water wells in the area covered by Fig. 1. Wells operating at Fury Creek north of Lions Bay are in a different hydrogeological regime. They draw water from a gravel aquifer that is not comparable to Lions Bay lithology.

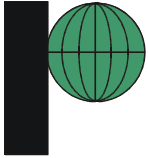
Information obtained from a representative of the Seascapes development project, which is located just north of Horseshoe Bay, confirms that they drilled eight test wells on the property and that they now have three production wells. Typical well depths are 100 to 140m and yields are in the 0.8 to 1 L/s range. Many of the successful wells could not be used due to unacceptably high arsenic concentrations in the groundwater. Elevated arsenic concentrations have been a problem in geologically similar areas on Bowen Islands and some regions along the Sunshine Coast. However, this issue tends to be less of a problem in areas located near large creeks.

CLIMATE

Environment Canada climate data indicate that the average annual precipitation for Lions Bay Station for the 17-year period between 1984 to 2001 was 1662mm (Table I). This compares to reported 30-year annual average precipitation values of 2367mm and 2044mm for Squamish Upper Station and North Vancouver Capilano Station, respectively. As precipitation increases with increasing elevation, a value of 1850mm was used for estimating groundwater recharge for this assessment.

RECHARGE

If the presence of an aquifer is confirmed, an additional consideration is recharge. Recharge is the volume of water flowing through the ground into an aquifer. Recharge must exceed the sum of all discharge for the aquifer's water level to remain stable.



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Attention: Mr. Scott Neumann, P. Eng. -4- March 18, 2005

The area available for recharge in each of the three basins of Harvey, Alberta and Magnesia creeks multiplied by the annual average precipitation provides an estimate of total annual hydrologic flow. Of this, most flows as surface runoff, while only a portion is available for groundwater recharge. Assuming that about 8% of the average annual precipitation can seep into the ground, the potential maximum available recharge in each of the three basins is summarized as follows:

Basin	L/s	USgpm
Harvey Creek	28.6	454
Magnesia Creek	17.3	275
Alberta Creek	4.3	68

This calculation suggests that, while a single well located in either the Harvey or Magnesia Creek basins could theoretically sustain the design flow, it is likely that a number of production wells will be needed to provide the 10 to 15 L/s required flow.

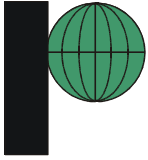
Based on available information, it is judged that individual well yields ranging up to about 4 L/s are possible for wells located close to Harvey and Magnesia Creeks. If it is confirmed that the local area fault/fracture zones dip towards the north, the best location for a test well is about 50m north of the creek channel. Other potential areas are along what appears to be cross faults, such as site 4, indicated on Fig.2.

A number of potential sites are represented as red dots on Fig. 2. These are presented as potential sites that appear worthy of additional assessment and consideration, especially in regards to land ownership and site access. The additional assessments, will involve examining bedrock exposures, looking for evidence of faults or large fracture zones in bedrock exposures, delineating the structural strikes, assessing the feasibility of bringing a truck-mounted drill rig to the site and proximity to existing water mains. Many of these sites may prove to be very expensive to access, and yet others may be relatively inexpensive, such as a site located near the fire hall.

WATER QUALITY

Experience from hydrogeologically similar areas suggest that the groundwater in the area should meet Canadian Drinking Water Quality guidelines. However, there are some metals that could potentially pose a water quality concern in water drawn from Gambier sediments. These include arsenic, mercury, lead, iron and manganese. However, high metals concentrations are normally expected where water has a long residence time in contact with its host formation. The fractured bedrock and high hydraulic gradients anticipated in the Lions Bay area suggest a high flux rate, and hence, a low residence time.

Elevated concentrations of iron and manganese only have an aesthetic impact on water quality and can normally be relatively easily removed, while some metals, such as arsenic, pose a health problem and are difficult to treat.



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Attention: Mr. Scott Neumann, P. Eng. -5- March 18, 2005

In some areas, oxidation of sulphides in the bedrock can lead to water with low pH and/or a pungent “rotten egg” smell. If present, this is relatively easily removed.

COSTS

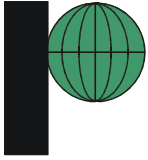
The cost of drilling and testing bedrock wells in the Lions Bay area could range from about \$109,614 to about \$181,342, as indicated on Table II. In developing these costs, the following assumptions were made:

1. It is estimated that it may be feasible to drill between four and six test holes and have three of these holes completed as production wells, which have the potential for yielding a combined flow of at least 10 L/s.
2. The pumps required to pump from the successful wells will fit into either a 150mm diameter bedrock hole or a 106mm diameter PVC casing that has been installed to stabilize the rock walls in the well.
3. The depth of the wells and test holes will range from 91.4 to 152.4m (300 to 500 ft) below ground surface.
4. Each successfully completed well will be aquifer pump tested for a period of 72 hours.
5. Groundwater quality will not be a significant issue.

The lowest cost estimate assumes that four 91m deep, unlined wells are constructed and that three have sufficient yield capacity to sustain a flow of at least 3.3 L/s.

CONCLUSIONS

- 1) Groundwater recharge estimates for the creek basins surrounding Lions Bay indicate that there is a potential for the required minimum 10 L/s flow being produced from wells drilled into fractured bedrock in either in the Harvey or Magnesia Creek basins.
- 2) It is estimated that between three and four wells will be required to sustain the minimum 10 L/s flow, and up to six 152m test deep holes may be required to prove up the desired yield and water quality.
- 3) Groundwater in the Lions Bay area will most likely be drawn from fractured bedrock aquifers, and experience suggests there is about a 70% chance that the required yield and water quality can be obtained from three wells drilled in this type of bedrock.
- 4) While there is a possibility that a well could be developed in the Harvey and Magnesia Creek fans, these potential water bearing zones (aquifers) are not well protected from surface contamination. Given that the potentially most productive zones are located below the



Earth Tech Canada Inc.

Attention: Mr. Scott Neumann, P. Eng. -6- March 18, 2005

highway, where contaminants could enter the aquifers and near the ocean where there is a potential for salt water intrusion, this option has been ruled out.

- 5) The estimated cost of a drilling and testing program, leading up to the construction of testing of three tested production wells is likely to be in the \$109,000 to \$182,000 range. This does not include the cost of preparing access to the selected drill sites, but does include the cost of engineering supervision of the program and GST.

RECOMMENDATIONS

- 1) Potential sites should be selected according to their potential ease of access to water mains and accessibility for a drill rig. Follow-up geological mapping should then be conducted at prioritized sites. The objective of this mapping should be to confirm the potential presence of fractured bedrock and determining the orientations of exposed geological structures such as faults and fractures.
- 2) A 150mm (6") diameter test hole should be drilled at the most promising sites, to a depth of about 100m and possibly as deep as 150m.
- 3) If an aquifer is encountered, the stability of the bedrock in the hole should be assessed to determine if liner pipe is required to protect a submersible pump installed in the hole.
- 4) Soon after a well is completed, an aquifer pumping test should be performed.
- 5) One or more water samples should be collected during the test and a sample sent to a laboratory for potability analysis.

We trust this is sufficient for your current needs.

Yours truly,

PITEAU ASSOCIATES ENGINEERING LTD.

Arnd Burgert, G.I.T.

R. Allan Dakin, P.Eng.

AB/RAD/dls
Att.

REFERENCES

Armstrong J.E., 1990. Vancouver Geology. Geological Association of Canada. 128 p.

Roddick, J.A., 1965. Vancouver North, Coquitlam and Pitt Lake Map Areas, British Columbia, Geological Survey of Canada, Memoir 335. 275 pp.

TABLES

TABLE I
CLIMATE DATA FOR HOWE SOUND
Canadian Climate Normals 1971-2000

Latitude				Longitude				Elevation				Climate ID
49° 54' N				123° 16' W				46.00 m				1047672
Temperature												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
0.2	2.3	5.7	9.0	12.5	15.2	17.7	17.8	14.6	9.1	3.5	-0.1	9.0
2.5	2.0	1.8	1.3	1.3	1.3	1.2	1.0	1.3	1.1	2.0	2.2	1.8
2.9	6.0	10.6	14.6	18.3	20.9	24.0	24.5	21.0	13.8	6.2	2.2	13.7
-2.5	-1.5	0.7	3.4	6.7	9.4	11.3	11.2	8.2	4.4	0.8	-2.4	4.1
Precipitation												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
265.7	235.3	188.9	159.2	105.8	85.8	61.1	59.6	88.2	279	357.5	245.2	2131.3
71.7	47.6	22.5	2.5	0.0	0.0	0.0	0.0	0.0	0.6	21.4	69.1	235.5
337.4	283	211.4	161.7	105.8	85.8	61.1	59.6	88.2	279.6	378.9	314.3	2366.8

Latitude				Longitude				Elevation				Climate ID
49° 21' N				123° 7' W				93.00 m				1105655
Precipitation												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
219.2	224.7	188	142.4	112.1	89.2	69.4	62.4	94.4	205.9	294.5	284.6	1986.8
17.8	14.5	3.3	0.4	0.0	0.0	0.0	0.0	0.0	0.1	4.4	16.4	56.9
237	239.2	191.3	142.8	112.1	89.2	69.4	62.4	94.4	206	298.9	301	2043.7

Climate Averages 1984-2001

Latitude				Longitude				Elevation				Climate ID
49° 27' N				123° 14' W				52.00 m				1104634
Precipitation												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
217.5	161.4	152.5	139.2	102.6	80.0	48.8	60.3	67.1	195.4	241.7	195.9	1662.3

TABLE II

WELL DRILLING AND TESTING COST

Lined Bedrock Well = 500 feet deep

Item	Units	Qty	Field Drilling	
			Rate	Cost
Mobe & Demobe	LS	1	300	300
Drill and Case 200mm diam.	ft	15	50	750
Drill - 200mm diam in rock	ft	5	40	200
Set 150mm casing	ft	20	15.0	300
Drill - 150mm diam in rock	ft	480	30.0	14,400
Supply 110mm diam blank liner	ft	460	8	3,680
Supply 110mm diam screen	ft	40	11	440
Hourly work	Hour	6	250	1,500
200mm diam casing shoe	Unit	1	360	360
Bentonite seal and cap	Unit	1	300	300
Contingency	Unit	1	200	200
Per diem	day	3	300	900
TOTAL				23,330
GST				1,633
TOTAL				24,963

72 Hour Pumping Test on Well

Item	Units	Qty	Precision Pumps	
			Rate	Cost
Mobe & Demobe	LS	1	400	400
Set and with draw pump	hr	6	125	750
Pump testing	hr	72	95	6,840
Recovery	hr	4	80.0	320
Supply lay flat hose	ft	150	1.0	150
Per diem	day	4	200	800
TOTAL				9,260
GST				648
TOTAL				9,908

Unlined Hole 300 feet deep

Item	Units	Qty	Field Drilling	
			Rate	Cost
Site move	LS	1	600	600
Drill and Case 200mm diam.	ft	15	50	750
Drill - 200mm diam in rock	ft	5	40	200
Set 150mm casing	ft	20	15.0	300
Drill - 150mm diam in rock	ft	280	30.0	8,400
Supply 110mm diam blank liner	ft		8	
Supply 110mm diam screen	ft		11	
Hourly work	Hour	6	250	1,500
200mm diam casing shoe	Unit	1	360	360
Bentonite seal and cap	Unit	1	300	300
Contingency	Unit	1	200	200
Per diem	day	2	300	600
TOTAL				13,210
GST				925
TOTAL				14,135

Abandoned Test Hole

Item	Units	Qty	Field Drilling	
			Rate	Cost
Site move	LS	1	600	600
Drill and Case 200mm diam.	ft	15	50	750
Drill - 200mm diam in rock	ft	5	40	200
Set 150mm casing	ft	20	15.0	300
Drill - 150mm diam in rock	ft	280	30.0	8,400
Supply 110mm diam blank liner	ft		8	
Supply 110mm diam screen	ft		11	
Hourly work	Hour	6	250	1,500
200mm diam casing shoe	Unit	1	360	360
Bentonite seal and cap	Unit	1	300	300
Contingency	Unit	1	200	200
Per diem	day	2	300	600
TOTAL				13,210
GST				925
TOTAL				14,135

Scenario 1

Unlined well	Well	3	\$14,135	42,404
Abandoned test hole	Hole	1	\$14,135	14,135
Pumping test	Test	3	\$9,260	27,780
Sub total				84,319
Contingency	10%			8,432
Engineering	20%			16,864
Total				109,614

Scenario 2

Lined well	Well	3	\$24,963	74,889
Abandoned test hole	Hole	3	\$14,135	42,404
Pumping test	Test	3	\$9,260	27,780
Sub total				145,073
Contingency	10%			14,507
Engineering	15%			21,761
Total				181,342

Notes

- 1) Drilling costs based on Field Dilling quotation
- 2) Cost of gaining site access is not included

FIGURES



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 VANCOUVER
 LIMA

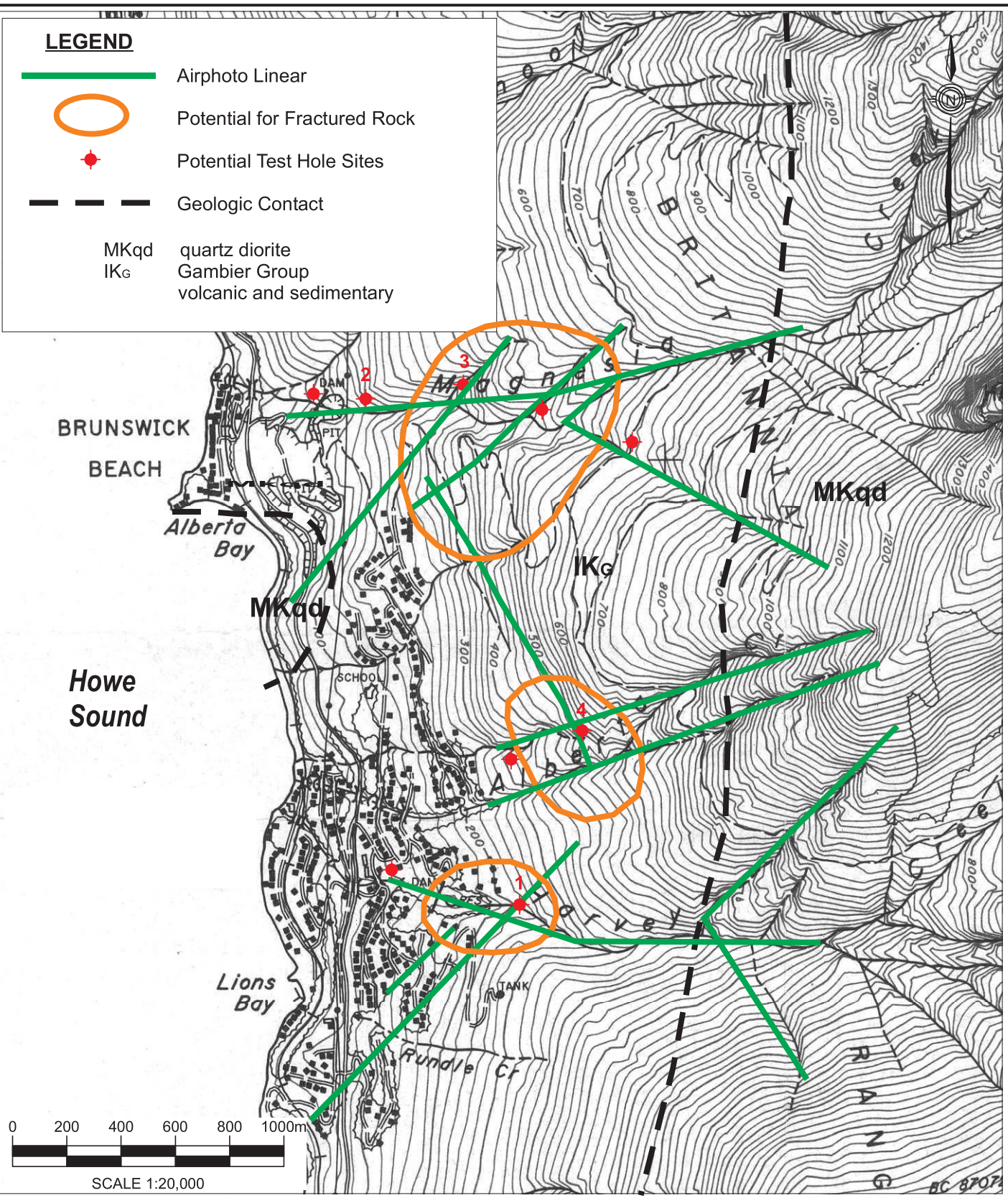
REVIEW OF GROUNDWATER
 SUPPLY POTENTIAL
 LIONS BAY, B.C.

LOCATION MAP

BY:	DATE:
AB/ss	MAR. 05
APPROVED:	FIG:
	1

LEGEND

-  Airphoto Linear
-  Potential for Fractured Rock
-  Potential Test Hole Sites
-  Geologic Contact
- MKqd quartz diorite
- IK_G Gambier Group volcanic and sedimentary



GEOLOGY FROM RODDICK et al 1974.

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PITEAU ASSOCIATES
 GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS
 VANCOUVER
 LIMA

REVIEW OF GROUNDWATER
 SUPPLY POTENTIAL
 LIONS BAY, B.C.

**LINEAR FEATURES INTERPRETED
 FROM AERIAL PHOTOGRAPHS**

BY:	DATE:
AB/ss	MAR. 05
APPROVED:	FIG:
	2

BRIEFING NOTE

TOPIC: Water Treatment Plants for Mountain-Watershed Communities

BACKGROUND:

Mountain-watershed communities face significant vulnerability due to the increasing risk of wildfires, which can severely compromise local water supplies. Wildfires introduce ash, sediment, and other residues into watersheds, leading to long-term contamination that can impact the community's drinking water for years. Addressing this contamination requires advanced filtration and treatment systems that are technically complex and prohibitively expensive for small municipalities to construct and maintain.

The financial burden of creating this infrastructure far exceeds the capacity of small communities, leaving them susceptible to prolonged water supply disruptions following a significant wildfire event. Such disruptions not only pose immediate public health risks but also undermine the long-term sustainability of such communities. Given these vulnerabilities, the Province's support in the form of external funding and long-term emergency planning is essential for ensuring the resilience and water security of communities.

REQUEST:

The Village of Lions Bay is respectfully requesting that the Province of British Columbia acquire and maintain one to three skid-mounted, 500,000-gallon-per-day (GPD) water treatment plants. These portable units would be held in reserve for emergency deployment to B.C. communities experiencing significant water contamination resulting from wildfires or other disasters.

SUMMARY:

- **Wildfire Vulnerability:** Mountain-watershed communities are particularly susceptible to wildfire-related water contamination, which can compromise water quality for extended periods.
- **Financial Challenge:** The infrastructure required to address such contamination is beyond the financial means of small municipalities, posing a significant burden on these communities.
- **Provincial Support Request:** Lions Bay requests that the Province acquire and maintain portable water treatment units to provide emergency assistance to communities impacted by water contamination. These units would ensure swift response and minimize the risk of long-term water supply disruptions.

This proactive measure will safeguard public health and support the long-term sustainability of B.C.'s mountain-watershed communities, enhancing their resilience in the face of increasing wildfire risks.

[Date, 2025]

[Recipient Name/Title]

[Municipality Name]

[Address]

SUBJECT: Request for Support and Endorsement – UBCM Resolution on Emergency Water Treatment Plants

On behalf of the Council of the Village of Lions Bay, we are seeking your support and endorsement for an important resolution that will be presented at the upcoming Union of British Columbia Municipalities (UBCM) Convention. This resolution advocates for provincial investment in emergency portable water treatment plants to safeguard the drinking water of communities facing wildfire-related contamination.

Background

Mountain-watershed communities, such as Lions Bay, are particularly vulnerable to the increasing frequency and severity of wildfires. These fires introduce ash, sediment, and other pollutants into watersheds, often rendering drinking water sources unsafe for extended periods. Unfortunately, the infrastructure required to address such contamination—advanced filtration and treatment systems—is prohibitively expensive for small municipalities to construct and maintain. As a result, communities affected by wildfires may face prolonged disruptions to their water supply, posing serious public health and sustainability risks.

To mitigate this growing threat, the Village of Lions Bay is calling on the Province of British Columbia to acquire and maintain one to three skid-mounted, 500,000-gallon-per-day (GPD) portable water treatment plants. These units would be held in reserve and deployed as needed to communities experiencing significant water contamination following a wildfire or other disasters. This proactive measure would provide critical emergency response capacity and ensure that small communities are not left struggling to restore safe drinking water in the wake of a crisis.

UBCM Resolution

The following resolution will be presented at UBCM, and we respectfully request your Council's support and endorsement:

WHEREAS mountain-watershed communities face increasing risks of wildfire-related contamination of their drinking water sources due to the increasing impacts associated with

climate change, with wildfires introducing ash, sediment, and other pollutants that can render water supplies unusable for extended periods;

AND WHEREAS *the cost of advanced water treatment infrastructure required to address such contamination far exceeds the financial capacity of small communities, leaving them vulnerable to prolonged water supply disruptions that pose significant public health and community sustainability risks:*

THEREFORE BE IT RESOLVED *that the Union of British Columbia Municipalities (UBCM) request that the Province of British Columbia acquire and maintain one to three skid-mounted, 500,000-gallon-per-day (GPD) portable water treatment plants to be held in reserve for emergency deployment to communities experiencing significant wildfire-related water contamination, ensuring rapid response and long-term water security for vulnerable communities.*

Request for Support

We kindly ask your municipality to consider endorsing this resolution and lending your voice to this urgent issue. Your formal support will strengthen our collective advocacy efforts and help demonstrate to the Province the widespread need for proactive emergency water treatment solutions in British Columbia.

If your Council passes a resolution of endorsement, please notify us at [contact email] so we can include your municipality in our advocacy efforts leading up to the UBCM Convention.

Thank you for your time and consideration. We appreciate your support in ensuring that small communities across B.C. have the resources necessary to maintain safe drinking water in the face of growing wildfire risks.

Sincerely,
Ken Berry, Mayor
Village of Lions Bay

[Email]

[Phone Number]

DRAFT RESOLUTION

Emergency Water Treatment Support for Mountain-Watershed Communities

WHEREAS mountain-watershed communities face increasing risks of wildfire-related contamination of their drinking water sources due to the increasing impacts associated with climate change, with wildfires introducing ash, sediment, and other pollutants that can render water supplies unusable for extended periods;

AND WHEREAS the cost of advanced water treatment infrastructure required to address such contamination far exceeds the financial capacity of small communities, leaving them vulnerable to prolonged water supply disruptions that pose significant public health and community sustainability risks:

THEREFORE BE IT RESOLVED that the Union of British Columbia Municipalities (UBCM) request that the Province of British Columbia acquire and maintain one to three skid-mounted, 500,000-gallon-per-day (GPD) portable water treatment plants to be held in reserve for emergency deployment to communities experiencing significant wildfire-related water contamination, ensuring rapid response and long-term water security for vulnerable communities.