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AFFILIATED OFFICE
TACOMA, WASHINGTON

June 7, 1972

Water Investigations Branch
Water Resources Service
Parliament Buildings
Victoria, British Columbia

Attention Mr. B. E. Marr, P.Eng.

Subject Habitat of Groundwater
Gabriola Island, British Columbia

Dear Sirs:

Consequent to your telephone instructions Messrs. R. B. Erdman and W. L. Brown of this office met with Dr. J. C. Foweraker on Thursday, June 1, 1972. We reviewed existing data and established the general framework of a program designed to ellucidate the basic factors controlling the habitat of groundwater on Gabriola Island. Once these factors are established the guidelines for the management of this most important natural resource can be formulated.

Work by Robinson, Roberts and Brown Ltd. on the subject island has consisted of a review, compilation and analysis of readily available pertinent groundwater information for the Nanaimo Regional District. Copies of the report on this study have been presented to the Groundwater Division. Work has also consisted of analyses of pump test data and reports for developers and engineering firms on certain water wells. Unfortunately, we were never able to persuade these clients that our services during construction, cleaning and stabilizing were valuable. We are therefore handicapped in rating the productive potential of the water-bearing zones because we cannot evaluate the effects that well construction may have impressed upon the test data.

Available information to date on the subsurface water-bearing reservoirs beneath Gabriola Island indicate:

1. Extensive deposits of sands and gravels do not exist on the Island. Thus groundwater developed from such deposits will be of limited value. This must be checked by field examination.

2. Limited amounts of groundwater can be obtained by wells drilled into the shale beds of the Island.

3. Little or no water can be obtained from the sandstone of the Island where they are not fractured.

4. Where fracture porosity and permeability are present the sandstone water-bearing reservoirs should produce up to 50 gpm and the shale water-bearing reservoirs should produce up to 100 gpm to properly designed, located and developed wells.

The fault and fracture pattern of the Island forms a natural subsurface water-bearing distribution system that can be tapped at various places. The primary features of this system have been established, but more detailed work is required both on the ground and from air photos.

Geologic information and as yet untried concepts indicate that the groundwater present in the fractured rocks of Gabriola Island comes from:

1. Infiltration of a part of the precipitation that falls on the Island itself.

2. Underflow from the eastern slopes of Vancouver Island along fracture zones that cut through the Cretaceous sandstones and shales.

3. Underflow from the eastern slopes of Vancouver Island along fracture zones that cut through basement rocks of altered volcanic tuffs and flows and quartzites, limestones and argillites.

Unfortunately, very few wells have been properly tested so that the full potential of the subsurface water-bearing reservoirs is unknown. Not only is test information limited but most wells have been drilled for single home use. The drilling of these wells was terminated when a few gallons per minute of water was obtained to satisfy the water needs of one family.

Any water management policy for Gabriola Island must not only establish where and how much groundwater is available but also discover how the subsurface water-bearing system can be protected. Our information from this Island and elsewhere indicates that

salt water contamination is present and could be increasing.

As the population of the Island increases policies governing the disposal of garbage, sewage and treatment plant effluent must be formulated.

Also our studies elsewhere have shown that relationships between potable and non-potable groundwater are complex. The academic simple concept of fresh water "floating" on top of salt water unfortunately rarely applies.

Any groundwater study of Gabriola Island must eventually obtain information that would allow the groundwater system to be protected from surface pollution, from seawater contamination and from parts of the system where non-potable waters might be present. The latter might for example be prevented by getting drilling contractors to seal off objectionable zones.

A groundwater exploration program should be designed to test the various concepts discussed above. Since funds are limited all aspects cannot be completely evaluated in one year. Also as information becomes available the program should be changed to suit results if warranted.

It is difficult to decide which concept to test first. For example is it more useful to put all monies into a single deep (4,000 ft.) test well to test potential of the Cretaceous sandstones and shales and that of the basement rocks or is it more useful to establish the groundwater regime above a depth of 300 feet. Examination of the topography of Gabriola Island will show that a large part of the Island lies close to or above an elevation of 300 feet A.S.L. Again should this year's program concentrate solely on exploration and water quantity with little regard for water quality or reservoir protection?

It is tempting to perform the heroic, drill a deep hole, and discover a highly productive artesian system. However the success of such a program would be dependent more on luck than geologic knowledge and would be contrary to widely accepted subsurface exploration practice. The basics of groundwater exploration programs are identical to those programs that explore for more exotic minerals.

A program designed to establish the basic geologic fundamentals is

therefore recommended after vacillation on the water's part as outlined above. This program would consist of:

1. Field mapping of surface outcrops and unconsolidated deposits aided by detailed airphoto studies and existing geologic and agricultural maps. This work will field check our existing maps and will look for second order features. Where possible the attitudes, widths, and degrees of fracturing or faulting will be studied so that test wells can be properly positioned to furnish maximum results.

2. Water quality samples will be collected for existing wells to supplement already available chemical information and to check for pollution and contamination in special areas.

3. Test drilling will be conducted along the main fracture zones and perhaps in certain places to solve geologic structural or strategraphic problems if warranted. All test drilling will be terminated at a depth of 300 feet unless results indicate that the holes should be deepened. All wells will be logged with our new logging devices.

4. As the test holes are being drilled simple water quantity tests will be made at intervals as warranted and water quality samples will be collected.

5. Where results warrant the test holes will be pump tested in accordance with standard practice but without observation holes.

All data will be accumulated on working maps, sections, charts, etc. so that for all practical purposes the results will be continuously reviewed and the program evaluated and changed if warranted. All results will be discussed and made available to interested members of your staff on request, as will our current interpretations, concepts and ideas. We would hope that there will be sufficient liaison so that ideas are transmitted quickly with regard to the whole of the Gulf Island program.

A completion report will be prepared that will upgrade our Gabriola report written for the Nanaimo Regional District.

The allocation of funds cannot be definitely set out at this time but will generally follow that outlined below:

1. Geologic mapping and airphoto interpretations

Principal Geologist	20 hrs.	@ $35	$ 700	
Junior Geologist	100 hrs.	@ $10	1,000	
Junior Technician	100 hrs.	@ $ 5	500	$ 2,200

2. Water quality samples collected during above and during pumping below and analysed in a commercial laboratory results must be received quickly

full, 6 @ $125	750	
10 @ $ 25 - 3 candidates	250	1,000

3. Test Drilling

1500 feet	@ $ 5.50	8,250	
testing - 50 hrs.	@ 20.00	1,000	
supervision 100 hrs.	@ 25.00	2,500	11,750

4. Pump Testing

150 hrs.	@ $20	3,000	
supervision 75	@ $10	750	3,750

5. Report, consultation, meeting and general supervision

W. L. Brown	3,500
	$22,200

We have contacted Ken's Drilling who will be the drilling contractor and Aqua Flow Testing who will run the pump tests. I would like to have twice the number of chemical analyses and about 300 more feet of drilling. My first cost estimates made without regard for available funds totalled approximately $37,000 with more drilling. If the Provincial laboratory can do the chemical analyses quickly we will add 150 feet of drilling. We will tailor the program to meet funds available.

We are very flexible with regard to contracts. Sometimes our clients

contract separately with the contractors and with ourselves. Other times we will contract for the whole program billing the client for works done by the contractors.

If any of the above needs clarification or amplification please do not hesitate to call.

We assume that your personnel will obtain all necessary permits, etc., to conduct the work.

Yours truly,

R B Edmonson

per W. L. Brown

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