GOVERNMENT OF BRITISH COLUMBIA

# MEMORANDUM

TO Mr. V. Raudsepp
Chief Engineer
Water Investigations Branch

FROM J.C. Foweraker, Geologist
Ground-Water Division
May 19th 1965

SUBJECT Ground-water Investigation for Malcolm Island, B.C.

OUR FILE 0239013/0162179

YOUR FILE

## INTRODUCTION

### General

A field investigation was made to Malcolm Island (see location map) during the period February 8th to February 22nd for the purpose of investigating possible sources of ground water for the community of Sointula. Reconnaissance field work was also carried out on the Pleistocene geology of the Island. The field investigations followed a request for assistance from the Sointula Water Committee (see file 0162179).

### Map Coverage

Malcolm Island is covered by the following maps and aerial photographs.

1:50,000 National Topographic Series Sheet 92 L/11 East
1:50,000 Provisional Map 92 L/10 West
Sointula Townsite - Map Scale 400 feet to one inch
Broughton Strait Map #3569 - Scale 1:37,580 (Canadian Hydrographic Service)

Air Photographs: (B.C. 1225:52-60, flown September 30th, 1950).

### Description of Malcolm Island

Malcolm Island (see location map) is located at the south end of Queen Charlotte Strait. The island is separated from Vancouver Island by Broughton Strait and is located opposite the Nimpkish Valley. Both Malcolm Island and adjacent Cormorant Island, have a prominent embayment on the south side, known as Rough Bay and Alert Bay respectively.

Malcolm Island is approximately 15 miles long in an east-west direction, and is approximately 3½ miles wide at its widest point. The Island rises to an elevation of over 400 feet, and this relief is most marked to the north and east of Sointula.

Records of rainfall are not available for Malcolm Island but on adjacent Cormorant Island, the average yearly rainfall for a 34-year period ending 1948 was 53.56 inches (from D.A. MacLean's report of April 1950, file 0183514).

Access roads on the Island are limited to a stretch of public road to the east and west of Sointula. There are also several logging roads covering the east half of the Island, the majority constructed by Mahood Logging Company (see Malcolm Island Map).

Mr. Cadorin, Secretary, Sointula Water Committee, states there are some 700-750 people living on Malcolm Island and 550-600 of these are living within a tentatively proposed water district for Sointula. There are about 200 permanent houses on the Island, also two oil company marine stations, a cafe-hotel, the Sointula Co-operative store, a laundromat, etc.

## Present Sointula Water Supply

The residents of Sointula obtain water for their domestic needs from dug wells, wash-bored wells, and from springs. While some of the dug wells produce good domestic supplies, many have a greatly reduced static level during dry periods. The subject of Sointula's water supply will be discussed further in a later section.

## Sanitation

Water wells and septic tanks are interspaced over much of the built-up area in Sointula. Mr. Cadorin informed me that there are many dug wells in Sointula, which were found to be contaminated according to recent Health Department tests.

## BRIEF NOTES ON THE GEOLOGY OF MALCOLM ISLAND

The following generalizations are based on reconnaissance field notes. Detailed maps, notes and sections on the surficial geology which were made during this field investigation are on file with the Ground-Water Division.

During the field investigation, only one outcrop was found on Malcolm Island which would appear to be older than the Pleistocene. This outcrop is an exposure of conglomerate which forms a prominent bluff at Meynell Point and is of possible Upper Cretaceous age.

The oldest surficial geology beds found on the Island are thought to be the horizontally-bedded brown and grey-blue fine-grained silts which occur at the base of several cliff exposures. These beds contain thin lenses of fine sands. There is evidence from the drilling of wash-bored wells in Sointula, that these silts may be present considerably below sea level and contain thicker water-bearing sand beds, possibly associated with coarser grain-size factions.

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Overlying silts at some exposures are cross-bedded sands and gravels of variable thickness; at some locations on the island, however, silts are overlain by a heterogeneous outwash mixture of dirty gravels, silts and sands, showing some bedding.

The overlying "till complex" varies in thickness and composition. At some exposures the "till complex" would be better described as "ice contact" deposits. This is evident particularly in exposures at lower levels (100 feet) around the coastline of the Island where till is closely associated with stratified gravels and sands and is overlain by some sometimes contorted silts, clay and "stony clays". Further field work is necessary here.

To the east and north of Sointula, the land rises to over 400 feet and there are several prominent depressions which are interpreted here as kettles, that is, depressions left after the ice melted. The preservation of these kettles and the presence of a prominent marine terrace on the northeast side below this kettled area would indicate that marine erosion was limited to lower elevations - possibly only 200-250 feet above present sea level. Much of the overlying material at the highest elevations and along the east-west ridge on the east half of Malcolm Island is gravel and sand; some cross-bedding, and channel-filling is evident in these deposits and together with the vertical and lateral changes in the beds and the compactness of the beds, would suggest ice contact deposits. There are several gravel pits in this material which are operated by the Mahood Logging Company.

South of Sointula, about 30 feet above sea level, there is an exposure of gently seaward dipping bedded gravels. These beds were not destroyed by marine action and this could imply that it was only on the northeast side of the Island, particularly, that the deposits were exposed to marine erosion. There are also on the west half of the Island, prominent features with a NNE-SSW trend. These lineations take the form of parallel discontinuous ridges or segments which appear from the aerial photographs to be 20-30 feet high. Although these features were not investigated in the field, it was suggested by Mr. Livingston that they may be remnants of former parallel moraine ridges. Alternatively, these features may represent a series of very small end moraines called "washboard moraines" by Flint. These features have been regarded as periodic and even as annual, but this has never been proved. There is also a less prominent trend at right angles to these ridges. These features were not destroyed by marine erosion and this would again indicate that only on the northeast side of the Island were these exposures subject to extreme marine erosion.

The fact that the lineation of these ridges persists at varying altitudes and that they do not conform to the contours of the land must indicate an origin associated with ice. Whether the direction of this late ice advance was from Knight Inlet or from the Nimpkish Valley is not known for certain. The latter direction would appear to be the most likely.

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DISCUSSION ON SOURCES OF GROUND WATER IN OR NEAR TO SOINTULA, AND SUGGESTIONS AND RECOMMENDATIONS FOR A TEST DRILLING PROGRAM

Some broad generalizations can be made concerning the well logs and well locations in Sointula. There are exceptions to these generalizations, however, and more specific information on Sointula well logs is filed with the Ground Water Division.

The Sointula townsite map shows that most of the community is spread out along the eastern shore of Rough Bay. East from the middle section of Sointula the land rises abruptly from sea level, and this is shown by the 100-foot contour. This slope is blanketed in part by till and several shallow wells have been dug in this material.

At the south end of Sointula, several wells have been dug in sands and gravels while further north towards the school, dug wells are located in clay and fine silt.

In the middle section of Sointula, north of the school, many of the dug wells are in till and stratified drift, sands and gravels, and exposures of till and ice contact materials are found in nearby road cuts. Near the northern end of Sointula in the area where there is a creek flowing into Rough Bay, logs of dug wells appear to be variable.

Information on logs of wash-bored holes is difficult to obtain. Most wash-bored holes in Sointula were put down with a half-inch pipe with an open pointed end. The pipe is connected to a water supply and by raising and lowering it, accomplished by the washing action of the water the pipe is gradually driven into the ground.

It would appear from wash-bore hole information that below the stratified drift complex and till there is a considerable thickness of fine silts which may be the same bedded silts found elsewhere near sea level at other exposures on the Island. There are several softer sand lenses, possibly containing coarser fractions reported in this silt sequence. Some of these sands are water-bearing and in several cases have been under an artesian head.

The location of several of the better wash-bored wells are shown on the attached map of Sointula. There is a noticeable concentration of artesian wash-bored wells immediately northwest of the school. In these wells, water-bearing sands were encountered beneath fine silts, etc., at about 60 feet. Several of the wells supply several users. The well on 10th Street supplies the Sointula Co-operative Store, the Imperial Oil Marine Station and several homes. A well adjacent to the school supplies the Cafe-Hotel. Although there is no record of a log for the successful Standard Oil Marine Station well, I was however able to obtain samples from the well of a very fine sand taken from below 200 feet. A wash-bore hole was drilled not far from the above site down to 240 feet, no artesian conditions were found, but the

owner reported there may have been a static level below ground level, however, he wanted an artesian source and abandoned this hole. The report on this hole indicated a considerable thickness of silt and clay beds with intervening soft beds - possibly water-bearing sand beds.

Further north from this area near the north end of Sointula, very fine water-bearing sands were encountered in a well from 78-85 feet between a sequence of very fine silts and hard "clays". The static level in this well is about 10 feet below ground surface.

Samples of well water taken from the cafe-hotel well at the school and the Standard Oil well were given bacteriology and chemical tests. The bacteriology tests were all negative indicating no contamination of this water. The results of the chemical analyses are attached to this memo.

There are several springs in or near to Sointula. These supply a limited amount of water, insufficient for the community supply. For example, there is a spring located on Lot L2, Pl.3023, which supplies several homes. The water is pumped up to a storage tank and feeds the homes by gravity.

Mention could also be made at this time of a small creek located near there at the north end of Sointula Townsite. The quality of this water is inferior and the supply is very limited in dry periods.

East of Sointula there is a series of springs located in bush (see map). These springs are located approximately at the 250-300ffoot level on the map. A sample of water from one of these springs was tested with the Hach field kit and gave the following results:

| | | | |
|---|---|---|---|
| Hardness | less than | 17 | parts per million |
| Iron | less than | 0.3 | parts per million |
| Ph | less than | 6.0 | parts per million |
| Chloride | less than | 2.5 | parts per million |

Although there were no surface exposures at the site of these springs, it is thought that the springs occur where water-bearing "ice contact" gravel and sand deposits are exposed at a contact with more impermeable strata, possibly underlying till. The kettled area lying above the springs is known to contain sand and gravel deposits and may be a potential source of ground water particularly for a site located within the prominent topographic depressions (see site #3).

## SUGGESTIONS FOR A TEST DRILLING PROGRAM AND NOTES ON ADDITIONAL SITES

It is suggested that one test hole be drilled at Malcolm Island to provide information on the Pleistocene succession and on ground-water supplies either beneath the bedded silts or contained in coarser grained beds within the silt sequence.

This test hole should be located close to or within Sointula so that the community could purchase the well if it were successful. A rough estimate of 200 gallons per minute would supply the present needs of Sointula, but it is doubtful if a well located within the silt sequence could supply this amount.

Based on the geology, well logs and sections, two test hole sites have been selected and the location of these sites is shown on the accompanying map of Sointula Townsite. Either of these sites would be satisfactory for test drilling purposes. The report of an unsuccessful wash-bore hole drilled close to the Standard Oil Marine Station well would suggest that possibly the water-bearing lenses or beds which are under artesian pressures may be of limited areal extent at this location. There is also a possibility that a test hole adjacent to the Standard Oil Marine Station well may temporarily affect the supply from that well at a time when the fishing industry would most need this supply of water. For these reasons, I would recommend that the test hole site be located at Site #1 - adjacent to the school.

Cable-tool drilling equipment should be employed. Samples should be taken every five to ten feet and every one to two feet in any aquifer. Grain size analyses should be run in aquifer materials to ensure correct screen slot size and if very fine material is encountered and a gravel pack required, then correct size analyses will be doubly important. Ten-inch casing should be used as eight-inch casing will not allow room for a possible gravel pack. Jetting equipment may be necessary to satisfactorily develop this well if the aquifer is in fine material.

Besides the two sites mentioned above, there are several other locations which should be mentioned in connection with ground-water supplies.

Site #3: located within, or near to one of the kettled depressions previously mentioned. Access to this site could be a problem, but use could be made to some extent of old logging roads at this location (see map of Malcolm Island). A hole at this location would provide information on ground-water at shallow depths within the overlying ice contact deposits in this kettled topography and also would explore for water-bearing stratified sands and gravels observed to overlie older bedded silts in exposures elsewhere on the island. Test hole site #3 is about 1.4 miles approximately from Sointula. A community well at this site would mean an additional cost for pipeline of about $32,560.00 (using 7,400 feet of eight-inch asbestos-cement pipe at $4.40 per foot).

Site #4: located inland from the exposures of flat-dipping bedded gravels and sands exposed in the gravel pit immediately south of Sointula. This area was not however investigated in the field in any detail.

Site #5: there is a small creek of limited supply and poor quality which drains the eastern slopes of Rough Bay (see map of Malcolm Island) and empties

into Rough Bay near the north end of Sointula. Within this general area, a possible ground-water supply may lie inland from the spring located on Lot L2, Pl.3023. There is, however, an unusual amount of surface runoff associated with this area, which could be due to the presence of impermeable layers (till) near the surface, and it would be necessary to penetrate through this.

RECOMMENDATIONS AND COST ESTIMATES FOR A DRILLING PROGRAM

I would recommend that a one hole test drilling program, as set out in this memo, be undertaken on Malcolm Island by the Water Resources Service. This test hole may provide a ground-water supply for the community of Sointula, and at the same time provide information on ground water and the Pleistocene succession below sea level in this relatively unknown area.

| Description of Work | Unit | Quant. | Unit Cost | Total cost |
|---|---|---|---|---|
| 1. Transportation of well drilling equipment and crew from Vancouver to Sointula and return. | | | | 500 |
| 2. Clearing at site | | | | 100 |
| 3. Drilling and casing one 10-inch hole by cable tool method | feet | 300 | 11.00 | 3,300 |
| 4. Install screen, develop well and pumping test for one well | per.hr. | 84 | 12.00 | 1,008 |
| Screen rental for one well | | | | 50 |
| Total Cost of Program - - - - - - - - - - - - - - - | | | | $4,958 |

(No allowance has been made here for casing recovered, or purchase price of a screen).

J. C. Foweraker

J.C. Foweraker
Geologist

JCF/ls
Attachments.

Noted May 19 '65
CL

DIVISION OF LABORATORIES
Health Branch
828 West Tenth Avenue
Vancouver 9, B. C.

Report Form L 76 (Rev. 11/61)

CHEMICAL ANALYSIS-ROUTINE

023903

Report No.: 738
Date Reported: 13-4-65
Date Received:

TO: J.C. Foweraker, Geologist
Ground Water Division,
Parliament Bldgs., Victoria, B.C.

COPY TO DIRECTOR, DIVISION OF PUBLIC HEALTH ENGINEERING.

Collector's Name: J.C. Foweraker (Geologist) Date Sampled: 21-2-65
Address: Parliament Bldgs., Victoria Time Sampled: 5 P.M.

Water Works System: Potential Sointula Community Well Treatment: None
Sampling Point: Tap - Marina Well Standard Oil Co.
Source of Water: Well

Test(s) done in field: None Temperature (°C): pH:
Residual Chlorine: Other:

Determinations Reported as mg/l unless noted otherwise.

| | | | |
|---|---|---|---|
| Colour (in units) | 5 | Alkalinity (as $CaCO_3$) | |
| Turbidity (in units) | 0.9 | Phenolphthalein | Nil |
| Temperature (°C) (on arrival) | | Methyl Orange (total) | 103 |
| pH (in units) (on arrival) | 8.3 | Free Carbon Dioxide (as $CO_2$) (calculated) | |
| Total Solids | 166 | Hardness (as $CaCO_3$) | |
| Fixed Solids | 1 | Total | 114 |
| Volatile Solids (calculated) | | Carbonate (temporary) (calculated) | |
| Dissolved Solids | 165 | Non-Carbonate (permanent) (calculated) | |
| Dissolved Solids (calculated) | | Silica (as $SiO_2$) | 18.3 |
| Suspended Solids | | Surfactants (as A.B.S.) | Nil |
| Albuminoid Notrogen (as N) | | Nitrite Nitrogen (as N) | 0.003 |
| Ammonia Nitrogen (as N) | | Nitrate Nitrogen (as N) | Nil |
| Calcium (as Ca) | 29.0 | Bicarbonate (as $CO_3$) (calculated) | |
| Magnesium (as Mg) | 9.8 | Carbonate (as $CO_3$) (calculated) | |
| Iron (total) (as Ferric ion) | 0.02 | Sulphate (as $SO_4$) | 20.3 |
| Sodium (as Na) | 7 | Chloride (as Cl) | 6.7 |
| Potassium (as K) | 5 | Fluoride (as F) | Nil |
| Specific Conductance (m.mhos) | 247 | Ortho-phosphate (as $PO_4$) | 0.5 |

Remarks: cc D/UIHU

Analysed by: A.J. Lynch
A.J. Lynch, B.Sc.

92 C/15 Sointula

DIVISION OF LABORATORIES
Health Branch
828 West Tenth Avenue
Vancouver 9, B. C.

Report Form L 76 (Rev. 11/61)

CHEMICAL ANALYSIS-ROUTINE

023903

TO: J. C. Foweraker, Geologist
Ground Water Division,
Water Investigation Branch, Victoria

Report No.: 737
Date Reported: 13-4-65
Date Received: 23-2-65

COPY TO: DIRECTOR, DIVISION OF PUBLIC HEALTH ENGINEERING.

Collector's Name: J. C. Foweraker
Address: (as above)

Date Sampled: - -
Time Sampled: - -

Water Works System: Proposed Sointula Community Well
Sampling Point: Tap - (Private Well - house & cafe)
Source of Water: Domestic well - 55 feet deep

Treatment: None

Test(s) done in field:
Residual Chlorine:

Temperature (°C):
Other:

pH:

Determinations Reported as mg/l unless noted otherwise.

| | | | |
|---|---|---|---|
| Colour (in units) | 5 | Alkalinity (as $CaCO_3$) | |
| Turbidity (in units) | 1.1 | Phenolphthalein | Nil |
| Temperature (°C) (on arrival) | | Methyl Orange (total) | 71.5 |
| pH (in units) (on arrival) | 8.1 | Free Carbon Dioxide (as $CO_2$) (calculated) | |
| Total Solids | 117 | Hardness (as $CaCO_3$) | |
| Fixed Solids | | Total | 74.0 |
| Volatile Solids (calculated) | | Carbonate (temporary) (calculated) | |
| Dissolved Solids | 115 | Non-Carbonate (permanent) (calculated) | |
| Dissolved Solids (calculated) | | Silica (as $SiO_2$) | 19.2 |
| Suspended Solids | | Surfactants (as A.B.S.) | Nil |
| Albuminoid Nitrogen (as N) | | Nitrite Nitrogen (as N) | 0.004 |
| Ammonia Nitrogen (as N) | | Nitrate Nitrogen (as N) | 0.93 |
| Calcium (as Ca) | 20 | Bicarbonate (as $CO_3$) (calculated) | |
| Magnesium (as Mg) | 6 | Carbonate (as $CO_3$) (calculated) | |
| Iron (total) (as Ferric ion) | 0.09 | Sulphate (as $SO_4$) | 4.2 |
| Sodium (as Na) | 5.5 | Chloride (as Cl) | 7.2 |
| Potassium (as K) | 2.5 | Fluoride (as F) | Nil |
| Specific Conductance (m.mhos) | 165 | Ortho-phosphate (as $PO_4$) | 0.2 |

Remarks:
cc D/UFHU

Analysed by: A J Lynch
A.J. Lynch, B.Sc.

DIVISION OF LABORATORIES
Health Branch
828 West Tenth Avenue
Vancouver 9, B.C.

Report Form L5 (Rev. 4-61)

0239013

# WATER BACTERIOLOGY

To • Ground Water Division
Water Investigation Branch
Parliament Buildings
Victoria, B. C.

Date • 25-2-65

Lab. No. • 1871-72

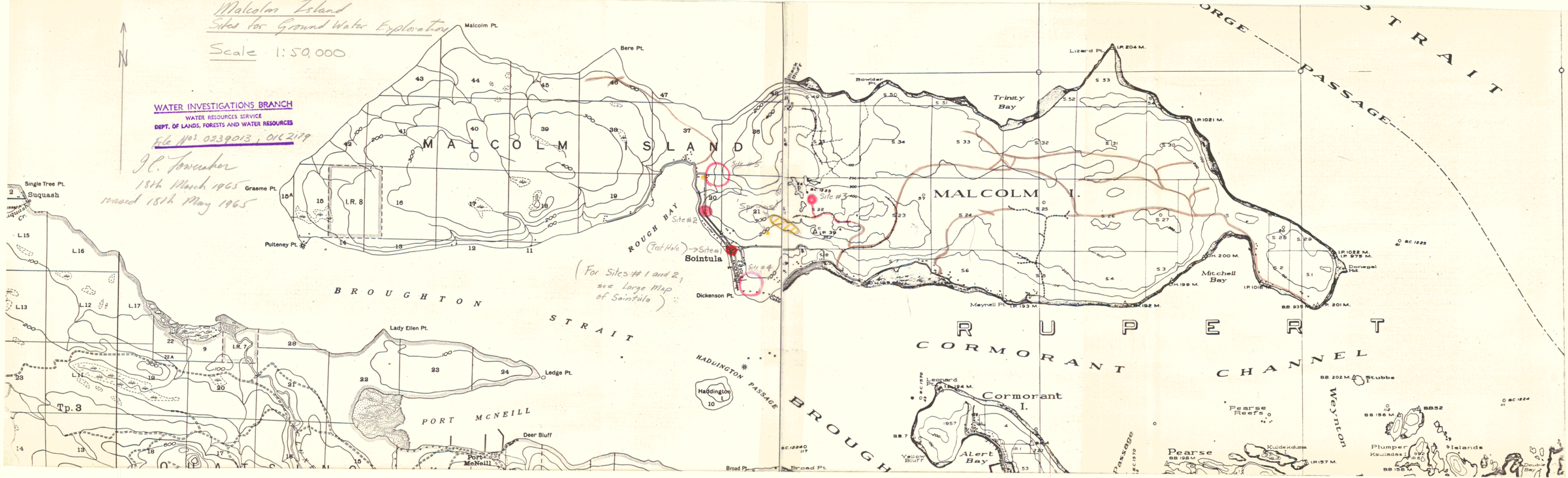
Date Received • 23.2.65

| SPECIMEN | Standard Plate Count per ml. | | Coliform Test | | |
|---|---|---|---|---|---|
| | 20° c | 35° c | 0.1 ml. | 1 ml. | 10 ml. |
| Seintula - Standard Oil Marina - well - sent by: J.C. Foweraker Ground Water Div. | | | | | 0/5 |
| Bill - Mai Inn - sent by: J.C. Foweraker, Ground Water Div., Victoria | | | | | 0/5 |

JC

Copy to: DEPUTY MINISTER OF HEALTH

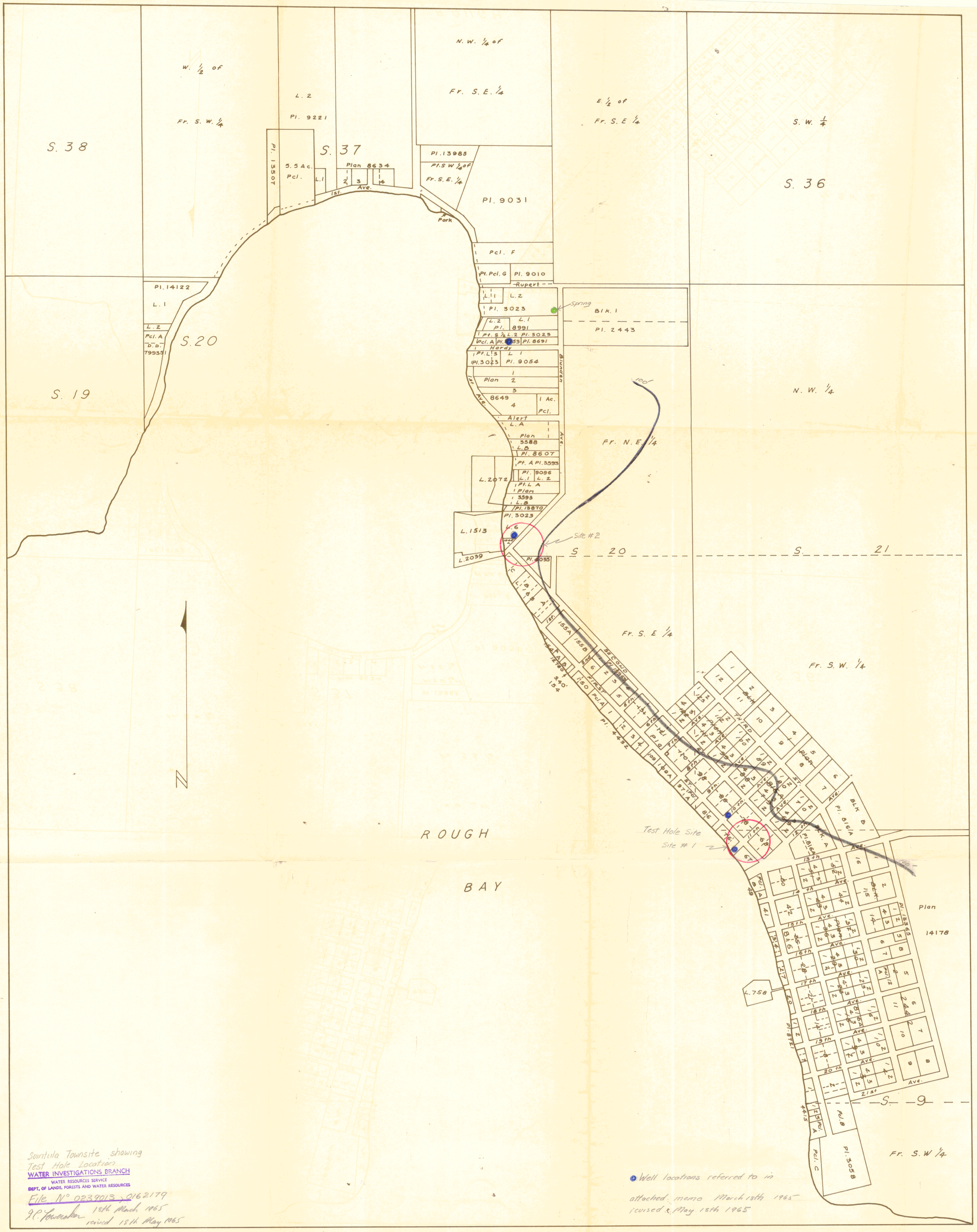
For Interpretation of Laboratory Results see "Standard Methods for the Examination of Water and Wastewater," Eleventh Edition, 1960, A.P.H.A., A.W.W.A., W.P.C.F.


Malcolm Island
Sites for Ground Water Exploration
Scale 1:50,000
N
WATER INVESTIGATIONS BRANCH
WATER RESOURCES SERVICE
DEPT. OF LANDS, FORESTS AND WATER RESOURCES
File Nos. 0239013, 0162179
J.R. Foweraker
18th March 1965
revised 18th May 1965
MALCOLM ISLAND
Malcolm Pt.
Bere Pt.
Graeme Pt.
Pulteney Pt.
I.R. 8
Site #3
Site #2
Site #1
Site #4
(Test Hole) → Site #1
Sointula
(For Sites #1 and 2, see large Map of Sointula)
ROUGH BAY
Dickenson Pt.
BROUGHTON STRAIT
Single Tree Pt.
Suquash
Lady Ellen Pt.
Ledge Pt.
PORT McNEILL
Deer Bluff
Port McNeill
Broad Pt.
HADDINGTON PASSAGE
Haddington I.
Tp. 3
Lizard Pt.
Bowder Pt.
Trinity Bay
MALCOLM I.
Mitchell Bay
Meynell Pt.
Donegal Hd.
RUPERT
CORMORANT CHANNEL
Cormorant I.
Leonard Pt.
Alert Bay
Yellow Bluff
Pearse Reefs
Pearse
Kuldekuba
Plumper Islands
Weynton
Stubbs
Double Bay
GEORGE PASSAGE
STRAIT


P. C. Fowcraker 18th March 1965
revised 18th May 1965

File # 0230013 , 016 2179

3




Saintula Townsite showing Test Hole Location

WATER INVESTIGATIONS BRANCH
WATER RESOURCES SERVICE
DEPT. OF LANDS, FORESTS AND WATER RESOURCES

File N° 0239013 ; 0162179

R.P. Sowerby 18th March 1965
revised 18th May 1965

● Well locations referred to in attached memo March 18th 1965 revised May 18th 1965

Scale 400' = 1"