GROUNDWATER SURVEY
TATAMAGOUCHE AREA

HENNIGAR

Colchester County,
Nova Scotia

By

Terry W. Hennigar
Groundwater Geologist
Groundwater Section
Nova Scotia Department of Mines

July 10, 1968

CONTENTS

ABSTRACT

This report presents information on the nature and occurrence of groundwater in the Tatamagouche area, Colchester County, Nova Scotia. It is part of a feasibility study, requested by A.R.D.A., to determine the most suitable water source for the village of Tatamagouche. Field investigation carried out for this report reveals that the geology of that area is unsuitable to supply the quality and quantity of groundwater required in the village.

Field exploration was confined to the bedrock and surficial deposits within a three mile radius of the village. It was found that both of these deposits allow the transmittance of water into drilled wells in quantities only large enough to supply individual household demands. Chemical analyses of water samples collected from the bedrock test holes and some of the existing wells in the village reveal the presence of two highly undesirable constituents: colloidal clay materials and sodium chloride.

INTRODUCTION

A groundwater survey was carried out in the Tatamagouche area, Colchester County, Nova Scotia, in May 1968, at the request of the Nova Scotia Directorate of A.R.D.A.

This survey was undertaken to determine the feasibility of obtaining groundwater within about a three mile radius of Tatamagouche. The primary need for groundwater is to satisfy the water requirements of the domestic and commercial demands in that area, as the present supply is regarded inadequate for future growth. In the past, water from many wells in the Tatamagouche area has been found to be unsuitable for both domestic and commercial purposes. The groundwater potential, however, has never been studied in detail in the past.

The village obtains its water supply mainly from drilled wells. Dug wells have little importance as domestic supplies on account of the heavy clay content of the surficial deposits.

Location and Population

The village of Tatamagouche is located approximately 30 miles north of Truro on route 6 and lies on the south shore of the Northumberland Strait (see location map, Fig. 1). Another map, scale 1:50,000, showing test hole locations and water sample locations is included (Fig. 2). The study area is included in the north east portion of the west topographic map of Tatamagouche map sheet 11 E 11.

Census figures for the village of Tatamagouche showed a population of 627 in 1951, 529 in 1956 and 581 people in 1961 (Dominion Bureau of Statistics).

Climate

The mean annual precipitation is about 43.5 inches, which is the mean value for Truro, Debert, and Nappan based on 20 - 30 years of precipitation data. The mean precipitation from May to September determined from the above stations, is about 17.0 inches.

Evapotranspiration exceeds precipitation during some months of summer. Therefore during these periods water is withdrawn from the soil moisture storage in the area.

In general, the climate of the Tatamagouche area and Colchester County corresponds closely to that of the other northern counties of the province such as Cumberland and Pictou which together comprise a climate region within the Maritime Provinces. This climate is described in general terms as humid and temperate.

Physiography and Drainage

The Tatamagouche area is part of the Nova Scotia Lowlands. It is bordered on the north by Tatamagouche Bay, a part of the Northumberland Strait. On the west it is bordered by the French River and its estuary, while the Tatamagouche River and its estuary mark the boundary to the east. The map area varies in altitude from sea level in the north part of the village up to about 150 feet above sea level in the south part of the area.

Two main rivers, the French and Tatamagouche rivers, drain the watershed areas south of the map area and flow northward past the village.

French River, flowing from the south and southwest has a watershed area of about 53 square miles above its salt water estuary. During its course it drops from about 1,100 feet elevation at its headwaters in the Cobequid Mountains to less than 50 feet at its estuary. The stream profile of the French River has a grass slope of about 70 feet per mile (1.3 per cent).

Tatamagouche River, draining frcm the south and southeast has a watershed area of about 75 square miles above its salt water estuary. This river drops from about 1,200 feet elevation at its headwaters in the Cobequid Mountains to less than 50 feet at its estuary. The stream profile of the Tatamagouche River has a gross slope of about 78 feet per mile (1.5 per cent).

Water Use

At present the domestic and commercial water supply for Tatamagouche residents is supplied by groundwater, which is mostly obtained from drilled wells.

Many residents using drilled wells complain about their water being turbid or "roily" during periods of heavy pumping. This problem was first investigated by E. J. Young (1951) who found that the turbidity was caused from agitation of the soft argilloceous sediments in which the wells were drilled. Young (1951) also found that the quality of water from drilled wells is variable; often the total dissolved solids and chloride contents were high.

Estimated water requirements to satisfy the domestic and commercial demands is approximately 60,000 imperial gallons per day (approximately 40 igpm*). In addition a reservoir capacity of 100,000 imperial gallons is required to satisfy the recommendations of the Canadian Underwriters Association standard of Municipal Fire protection.

Previous Work

Several geologic reports and maps have been published which include the Tatamagouche area. The first workers were J. W. Dawson (1868), R. W. Ells (1885), and Hugh Fletcher (1890-91) who mapped the Carboniferous rocks along the Northumberland Strait. A. O. Hayes (1920) investigated the Malagash salt deposit and W. A. Bell (1924, 1940, 1944) did age determinations to map the sequence of Carboniferous rocks in Nova Scotia.

A complete soil survey was carried out in the area in 1948 by the Dominion of Agriculture.

---

* igpm - imperial gallons per minute

E. J. Young (1951) published a report dealing with the geology and groundwater of the Tatamagouche area. This study was initiated because of complaints from residents of the water quality from drilled wells.

A groundwater probability map of the Truro map sheet (1" = 4 miles) west half was compiled in 1963 by L. V. Brandon. This map outlined the major hydrogeologic units in the area and indicates the probable quality and quantity of the groundwater yielded by wells drilled into the various water bearing rock units.

Acknowledgements

The Groundwater Section, Geology Division, Nova Scotia Department of Mines, would like to acknowledge the co-operation of the inhabitants of the area for supplying information on their own water supplies.

GEOLOGY

Introduction

Underlying the Tatamagouche area are rock types deposited during the Pennsylvanian age. In the map area these rocks belong to the Pictou Group, and consist of sandstones and shales.

Surficial deposits of till are found in the area overlying the bedrock. These deposits are in most areas of a limited thickness.

Bedrock Deposits

The Pictou strata, consisting of sequences of sandstones with minor amounts of conglomerates, and shales underlie all of the map area. These strata are gently folded and form a broad open syncline trending eastward with the synclinal axis about one mile north of the village. This syncline plunges northeast under Northumberland Strait 3° to 10°. South of Tatamagouche the Pictou strata strike east and dip approximately 10° north; while west of the village the strata strike southeast and dip approximately 8° northeast.

Faulting is apparently negligible in the Tatamagouche area. The only fault recorded in the literature is a small (displacement about six feet) one striking north and outcropping on the Tatamagouche River about 3 miles southeast of the village.

Surficial Deposits

Mantling the bedrock are deposits of glacial drift. Glacial drift includes unsorted till (unstratified drift) deposited during the Pleistocene Epoch (ice age), and washed material consisting of ice contact stratified drift deposited by glacial melt water. Till is composed of a mixture of clay, silt, sand and gravel. Esker, Kame and outwash are genetic terms applied to sand and gravel deposited by glacial melt water.

The material found in this area was probably deposited while the remains of the glacier still occupied the Carboniferous lowland area. The most common surficial material is in the form of a clay till which was derived from the underlying shales.

Small areas of more granular till were found but this also has a high clay and silt content which make it unfavorable for the movement of water.

Recent Deposits

Since the disappearance of the glaciers, the Pleistocene deposits as well as the bedrock in some areas have been eroded to some extent. The presence of bottom-land alluvium, which includes silt, clay, and sand, especially along the French River south of Tatamagouche, and the Tatamagouche River southeast of the village, indicates recent deposition which followed the initial erosion of the stream beds.

HYDROLOGY

Introduction

The shales and tills seldom yield more than a domestic water supply in one well. The sandstones in the area are capable of yielding slightly larger volumes of groundwater but are not considered good aquifers because of three main limitations: 1) their wide range of particle size; 2) their compactness; and 3) their limited thickness.

Of the surficial and recent deposits investigated none was favourable for the transmittance of groundwater in a larger volume than that required for a domestic supply. These materials were of a limited thickness and contained a large amount of silt and clay sized particles which retard the movement of groundwater.

Pictou Aquifer

The Pictou sediments may be a very good aquifer in some areas. These types of sediments may have a significant natural permeability while at the same time yield large volumes of water by a secondary permeability due to fractures, cracks, etc. However, the test drilling done for this investigation revealed that in the Tatamagouche area these rocks have a low combined natural and secondary permeability. In addition, several small pockets or lenses of salt deposits were encountered at various depths in the test holes. These deposits resulted in contamination, by solution of the highly soluble salt minerals, of the groundwater from the sandstone aquifers.

The logs of the three deep test holes drilled into the Pictou sediments are shown in figure 3. Bail tests were conducted on test holes 373 and 375 to determine the hydrologic characteristics of the sediments penetrated at these sites. During these bail tests both wells failed to yield over 2 igpm.

A four hour pump test was conducted on the municipal park well (W 1, in Fig. 2) which is 4 inches in diameter and 148 feet deep. The pumping rate of 4 igpm resulted in 74 feet of drawdown (95 percent of the total available drawdown) at the end of the pump test. These data indicate a transmissibility of 34 igpd/ft, and a safe pumping rate of about 1.5 igpm (Fig. 4), although a pumping rate of 2 igpm would be sustained for short periods or pumping. However, it is recommended that a smaller and more uniform pumping rate be maintained in the well to prevent agitation of the soft argillaceous sediments. During the pump test it was found that when the pumping

level dropped below about 110 feet from the ground surface, a turbid and roily water resulted.

Surficial Aquifers

In most places surficial deposits of sands and gravels are very good aquifers. For example a screened well developed in a gravel aquifer, near Truro, with a saturated thickness of about 20 feet, is capable of yielding over 200 igpm.

The surficial deposits found in the Tatamagouche area were all classed as clay till and are not a good water bearing material. About 50 feet of clay till was penetrated in test hole 373 before bedrock was reached. However, this material is too fine to allow movement of water in quantities large enough to be of any economic importance.

Recent Aquifers

In many areas the Recent deposits of sands and gravels provide a very good source of groundwater. Commonly these deposits are hydraulically connected to the stream which is usually adjacent to and paralleling the Recent aquifer.

Test drilling, with a power auger, in the Recent deposits along the French and Tatamagouche Rivers revealed that these deposits are unfavorable for transmitting significant quantities of groundwater. The thickness of these deposits is about twelve feet and they consist mostly of sand, silt and clay.

WATER QUALITY

Surface Water

A surface water supply is available from the French River watershed. However, this water will require filtration and chlorination before it is used as a domestic supply. Preliminary results of a water sampling program on this river by W. N. Horner and Associates indicate a good quality water with respect to dissolved mineral content. The sampling has, however, indicated the presence of larger amounts of suspended material (resulting in color and turbidity) and coliform bacteria than is recommended by drinking water standards. Treatment of the water therefore, may be confined to filtration (possibly with coagulation and sedimentation) and sterilization.

Groundwater

Complete chemical analyses of samples from test holes 373 and 375 indicate a poor quality water (see table 1 and 2). Both samples contained large amounts of calcium, sodium, sulphates, chlorides, hardness, and turbidity. The concentrations of sulphates, chlorides and turbidity are all greater than the suggested upper limits set by the U. S. Drinking water Standards (1962). Chemical analysis (see Table 3) of the sample from the municipal park well (W. 1) indicated that only iron and suspended material (resulting in turbidity) were present in amounts greater than those set by the U. S. Drinking Water Standards.

Table 4 lists the results of chemical analyses done on samples collected from other wells within the village of Tatamagouche. All well owners indicated that the quality is satisfactory where pumping is uniform and light (this was the case when the samples were collected). However, when the pumping rate is increased from these wells a turbid and roily water results.

RECOMMENDATIONS AND CONCLUSIONS

1. From the results of test drilling and pumping tests it appears that the water bearing strata in the Tatamagouche area will not yield large enough volumes to wells to be of economic significance as a central water supply for the village.

2. Chemical analyses of samples from wells and the test holes indicate the presence of sodium chloride, color and turbidity in the form of colloidal clay material in large enough quantities to make the water unsuitable for a domestic water supply.

3. It is recommended that the French River watershed be used as a central water supply source for the village of Tatamagouche. By using a mean volume of flow per unit area of 5.0 acre-ft. per day per square mile of watershed area (for 1967 in the Salmon River watershed this value was 5.62 acre-ft/ day/ square mile) the mean daily flow of the French River, at a point just above the estuary, would be about 265 acre-ft. per day. This daily flow is equivalent to 72 million gallons.

REFERENCES CITED

1. Atlantic Development Board (April 1967): Nova Scotia Water Resources Study; prepared by the Groundwater Section, Nova Scotia Department of Mines.

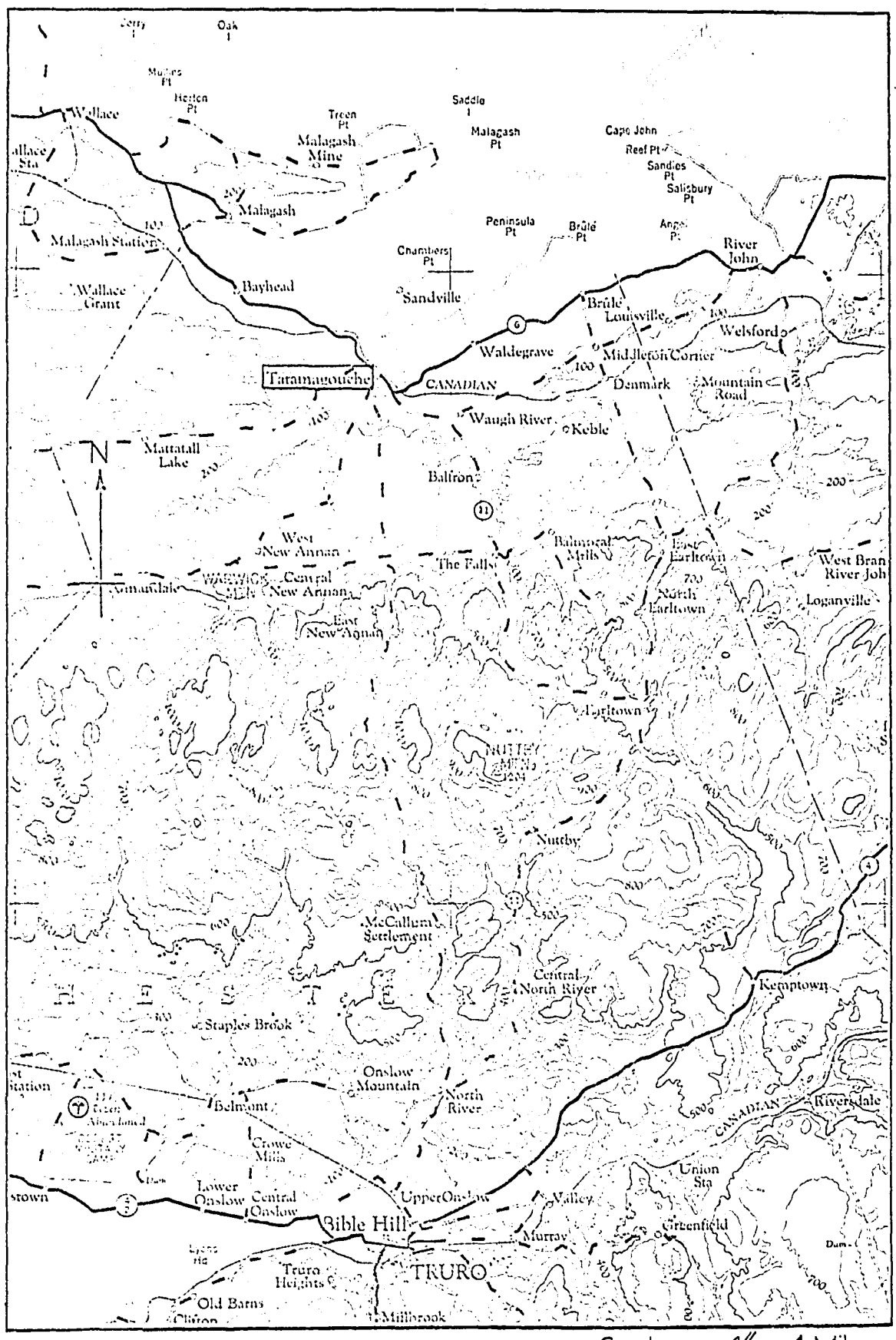
2. Brandon, L. V. (1963):
Groundwater Probability Truro (west half) Nova Scotia; Geological Survey of Canada, Map 1160 A.

3. Hennigar, T. W. (1968)
Groundwater Survey Brookfield Area; Colchester County, Nova Scotia; Nova Scotia Department of Mines, unpublished report.

4. Hennigar, T. W. (1968)
Hydrogeology of the Salmon River and Adjacent Watersheds, Colchester County, Nova Scotia Department of Mines, unpublished thesis.

5. Wicklund, R. E. and Smith, C. R. (1948):
Soil Survey of Colchester County; Report No. 3, Nova Scotia Survey.

6. Young, Edward J. (1951):
A Groundwater Problem in the North Shore Area, Nova Scotia; Nova Scotia Department of Mines, Annual Report, Part II.



Scale : 1″ = 4 Miles

FIGURE 1. Location map.

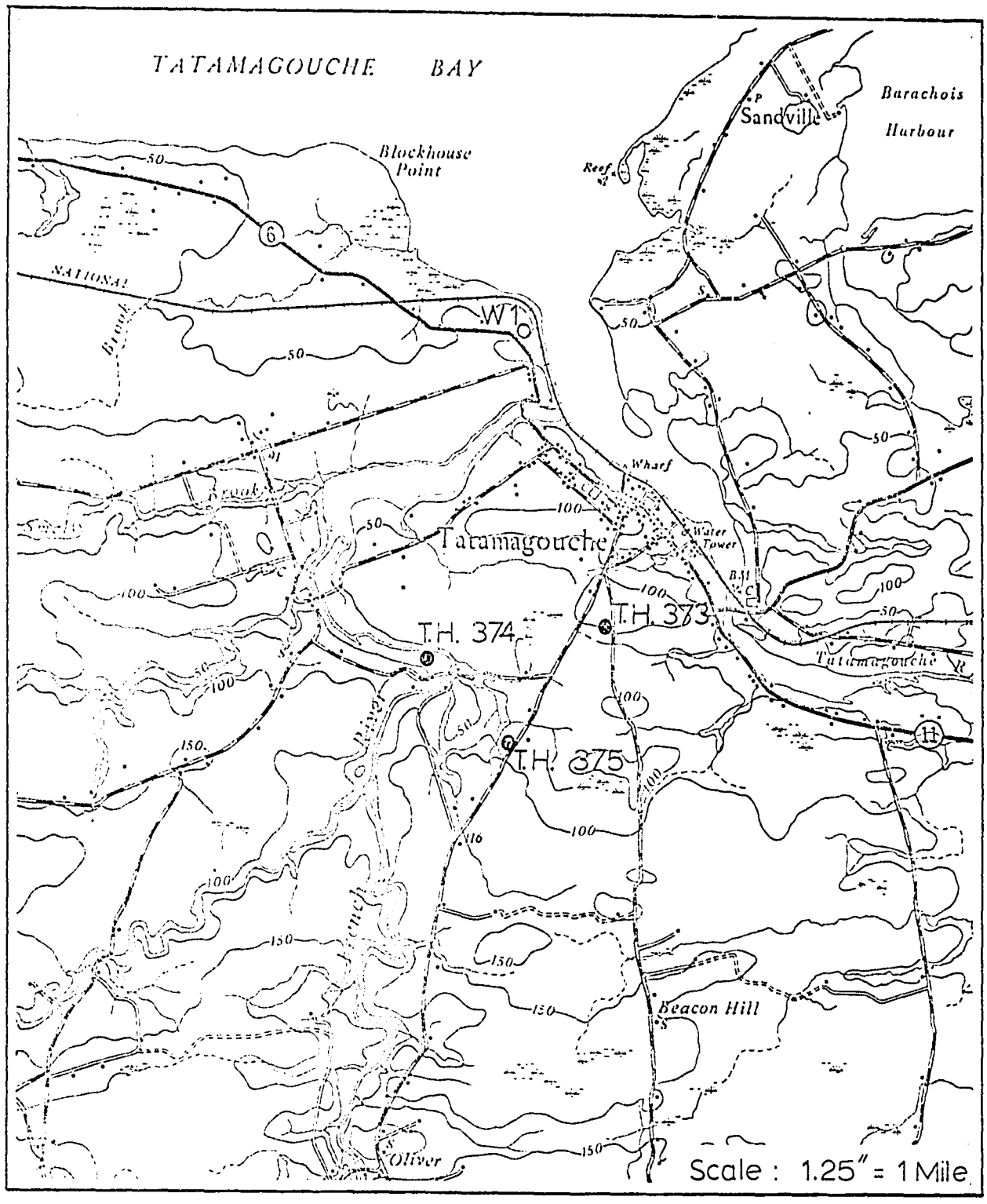
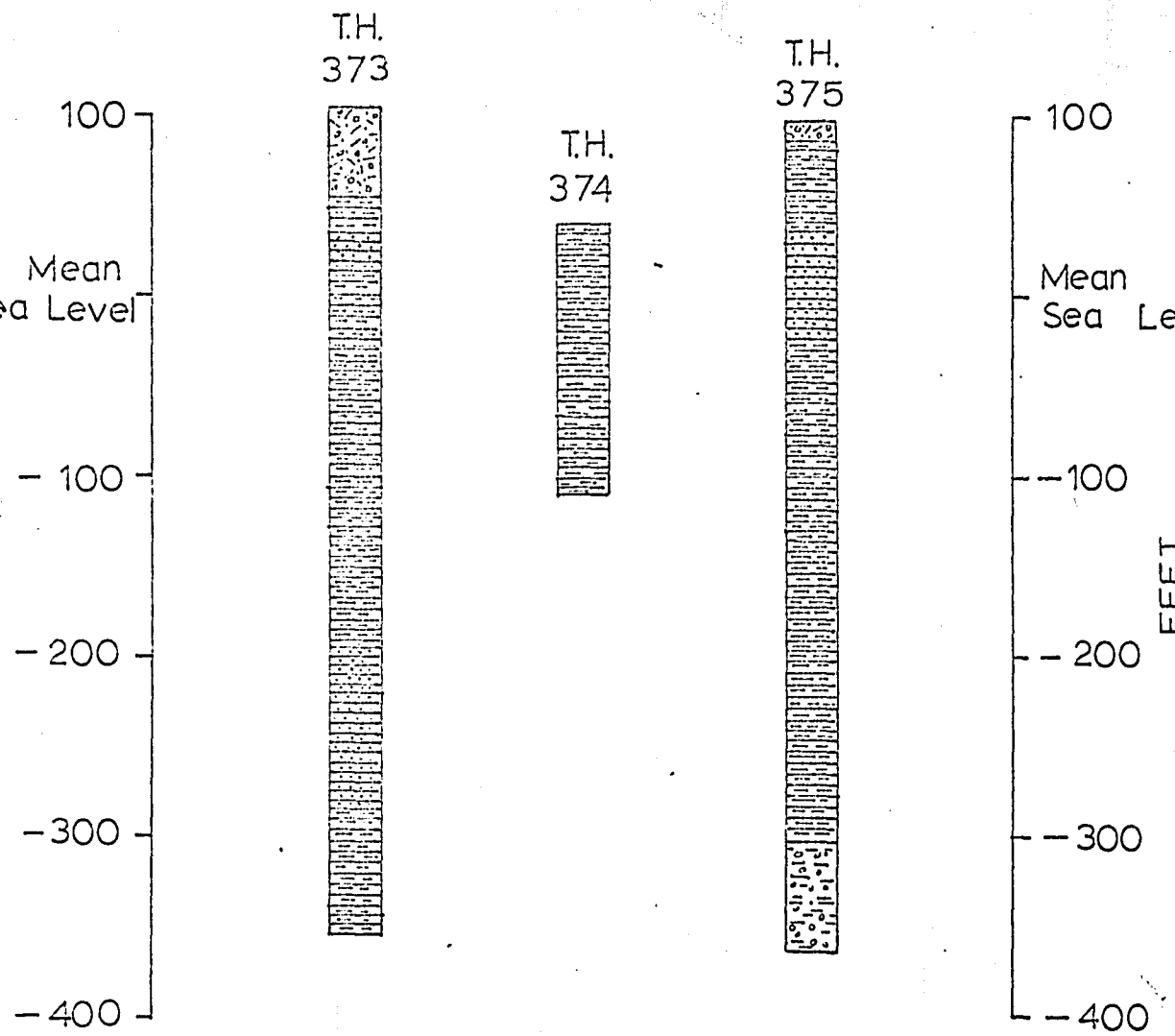


FIGURE 2 Well locations in Tatamagouche area



LEGEND

Silt and Clay
Till
Sandstone
Shale
Conglomerate & Sandstone

FIGURE 3 Logs of test holes in the Tatamagouche area

FIGURE 4.

Drawdown vs Time Plot During

NOVA SCOTIA WATER AUTHORITY

CHEMICAL ANALYSIS OF WATER

19

TABLE 1

LOCATION: Tatamagouche

TH #373

IDENTIFICATION MARK: Drilled Well

SUBMITTED BY: T. W. Hennigar

11 E 11 C 70 J SE

DATE SAMPLED: 6/5/68

DATE RECEIVED: 10/5/68

SAMPLED BY: T.W. Hennigar

	ppm	epm		
Calcium	50.5	2.52	Alkalinities –Phenolphthalein as $CaCO_3$ –Methyl Orange as $CaCO_3$	 0 150
Magnesium	7.3	0.60		
Sodium	244.6	10.64	Hardness (Total as $CaCO_3$)	156.3
Iron Total	0.12	0.006	Loss on Ignition (1 hr. @500°C)	
Manganese Total	T		Total Dissolved Solids	
Sulphate	270	5.62	Suspended Matter	
Chloride	405.3	11.43	Specific Conductance (mhos. x 10^{-5})	194
Nitrate	T		pH Value	7.5
			Color	40
			Turbidity	28

REMARKS:

TOTAL HARDNESS - DETERMINED BY EDTA TITRATION.
T - T DENOTES TRACE AMOUNT (LESS THAN 0.01 p.p.m).
T - T DENOTES TRACE AMOUNT (LESS THAN 0.01 p.p.m).
Na - DETERMINED BY FLAME PHOTOMETER.

DATE: May 16, 1968

ANALYSED BY: L. Thornburn

42401/1

NOVA SCOTIA WATER AUTHORITY

CHEMICAL ANALYSIS OF WATER

20

TABLE 2

LOCATION: 11-E-11-C-51-O-Center
Tatamagouche T.H. 375

DATE SAMPLED: 31/5/68

DATE RECEIVED: 7/6/68

NTIFICATION MARK: Sample #2

SAMPLED BY: T. Hennigar

UBMITTED BY: T. Hennigar

Depth 460' after 4 hrs. bailing

	ppm	epm		
Calcium	70.5	3.52	Alkalinities –Phenolphthalein as $CaCO_3$ –Methyl Orange as $CaCO_3$	 4 90
Magnesium	8.6	0.71		
Sodium	890	38.7	Hardness (Total as $CaCO_3$)	211.6
Iron Total	0.05	0.003	Loss on Ignition (1 hr. @500°C)	
Manganese Total	0.3	0.022	Total Dissolved Solids	
Sulphate	275	5.73	Suspended Matter	840 ppm
Chloride	829.8	23.41	Specific Conductance (mhos. x 10^{-5})	375
Nitrate	Trace		pH Value	8.0
			Color	—
			Turbidity	30

REMARKS:

TOTAL HARDNESS - DETERMINED BY EDTA TITRATION.
n - T DENOTES TRACE AMOUNT (LESS THAN 0.01 p.p.m).
e - T DENOTES TRACE AMOUNT (LESS THAN 0.01 p.p.m).
Na - DETERMINED BY FLAME PHOTOMETER.

DATE: July 10th, 1968

ANALYSED BY: [signature]

42645/2

NOVA SCOTIA WATER AUTHORITY

CHEMICAL ANALYSIS OF WATER

2 /

TABLE 3

LOCATION: 11-E-11-C-94-C-N.E.

Tatamagouche Mun. Park

NTIFICATION MARA: Sample #1

SUBMITTED BY: T. Hennigar

DATE SAMPLED: 5/6/68 - 8:30 A.M.

DATE RECEIVED: 7/6/68

SAMPLED BY: T. Hennigar

Drilled well 148' deep

	ppm	epm		
Calcium	8.8	0.44	Alkalinities –Phenolphthalein as $CaCO_3$ –Methyl Orange as $CaCO_3$	 10 212
Magnesium	1.6	0.13		
Sodium	7.7	0.33	Hardness (Total as $CaCO_3$)	28.5
Iron Total	0.60	0.032	Loss on Ignition (1 hr. @500°C)	
Manganese Total	Trace		Total Dissolved Solids	
Sulphate	23	0.48	Suspended Matter	1690 ppm
Chloride	13.3	0.38	Specific Conductance (mhos. x 10^{-5})	55
Nitrate	Trace		pH Value	8.3
			Color	N.A.
			Turbidity	230

REMARKS:

TOTAL HARDNESS - DETERMINED BY EDTA TITRATION.
1 - T DENOTES TRACE AMOUNT (LESS THAN 0.01 p.p.m).
2 - T DENOTES TRACE AMOUNT (LESS THAN 0.01 p.p.m).
Na - DETERMINED BY FLAME PHOTOMETER.

DATE: July 10th, 1968

ANALYSED BY: J. H. Hennigar

42645/1

TABLE 4. Chemical Composition of Groundwater

From the Bedrock Aquifers in Tatamagouche

Sample No.	Name and Location	Type of Well	Depth	Chemical Analyses (parts per million) Iron	Chloride	Total Hardness	Sulphate
1	Charles Clarke, French River Road	Drilled	70'	0.02	20	20	61
2	Post Office, Main Street			0.03	75	15	56
3	Mrs. E. H. Langille, Church Street	Drilled	164'	0.05	35	25	52
4	Hospital, Blair Avenue	Drilled	200'	0.04	25	210	51
5	Raymond Ross, Main Street	Drilled		0.04	20	180	41