CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 323

GROUND-WATER RESOURCES
OF
GLOUCESTER TOWNSHIP
CARLETON COUNTY
ONTARIO

By
E. B. Owen

OTTAWA
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ERRATA

Water Supply Paper 323

Page 151. Wells Nos. 3 and 3A; for Con. 4, O.F., lot 16, read Con. 5, O.F., lot 16.

" 199. Well No. 21; for Con. 1, O.F. lot 26, read Con. 2, O.F., lot 26.

" 201. Well No. 1; for Con. 1, O.F. lot 2, read Con. 2 O.F., lot 2.

" 203. For Well No. 23B, read 22B.

" 203. Below Well No. 23B insert the following data for Well No. 23:- Column 2-1 O.F.; 3-4; 4-D, 5-217; 6-13; 7-5M; 8-(Blank); 9-s/c; 10-(Blank); 11-S.cl; 12-D; 13-Sufficient

" 207. Well No. 85; for Con. 1, O.F. lot 2, read Con. 2, O.F., lot 2.

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PART I

INTRODUCTION

This report deals with the ground-water conditions of a township in the province of Ontario investigated by the Geological Survey of Canada. It is one of a series of ground-water reports on individual townships of Ontario.

All available information pertaining to the water wells in the area was recorded and water samples were taken for analysis. The elevation of the surface of the water in most of the wells was measured. As the ground-water conditions are directly related to the geology, the surface deposits were also studied and mapped. Descriptions of the bedrock geology are after A. E. Wilson[1].

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[1] Wilson, A. E.: Geology of the Ottawa-St. Lawrence Lowland, Ontario and Quebec; Geol. Surv., Canada, Mem. 241, 1946.

Thanks are here extended to the farmers and to the residents of communities throughout the township for their co-operation and willingness to supply information regarding their wells. Valuable assistance was also given by numerous contractors and well drillers in the area.

PUBLICATION OF RESULTS

The essential information pertaining to ground-water conditions is being issued in reports covering each township investigated in the province of Ontario. These reports, as published, will be supplied directly to the proper municipal and township authorities. In addition, pertinent data on wells investigated in each township will be kept on file at Ottawa. The well record compilation sheets will not ordinarily accompany the reports, as for most areas they are too numerous. However, persons interested in individual wells may receive the information upon application to the Director, Geological Survey of Canada, Ottawa. For this information the request should specify lot, concession, owner's name, and approximate location of the well — at house, at barn, in pasture, etc.

With each report are maps showing the surface deposits that will be encountered in the area, and the positions of all wells for which records are available, together with the class of the well at each location.

GLOSSARY OF TERMS USED

Alluvium. Recent deposits of clay, silt, sand, gravel, and other material deposited in lake beds and in flood-plains of modern streams.

Aquifer. A porous bed, lens, pocket, or deposit of material that transmits water in sufficient quantity to satisfy pumping wells, flowing artesian wells, and springs.

Bedrock. Bedrock, as here used, refers to the consolidated deposits underlying the glacial drift. South of a line drawn between Midland, on Georgian Bay, and Kingston, the bedrock consists mainly of sedimentary rocks such as limestone, shale, slate, and sandstone; north of that line the bedrock consists chiefly of hard, crystalline, granitic rocks.

Contour. A line drawn on a map that passes through points that have the same elevation above mean sea-level.

Continental Ice-sheet. The great, broad ice-sheet that covered most of the surface of Canada many thousands of years ago.

Escarpment. A cliff or relatively steep slope separating two level or gently sloping areas.

Effluent Stream. A stream that receives water from a zone of saturation.

Flood-plain. A flat part in a river valley ordinarily above water, but covered with water when the river is in flood.

Glacial Drift. A general term that includes all the loose unconsolidated materials that were deposited by the continental ice-sheet, or by waters associated with it. It includes till, deposits of stratified drift, and scattered boulders and rock fragments.

Several forms in which glacial drift occurs are as follows:

(1) End Moraine (Terminal Moraine). A more or less discontinuous ridge or series of ridges consisting of glacial drift that was laid down by the ice at the margin of a moving ice-sheet. The surface is characterized by irregular hills and undrained basins.

(2) Ground Moraine. A widely distributed moraine consisting of glacial drift deposited beneath an ice-sheet. The predominant material is till, which is clay containing stones. The topography may vary from flat to gently rolling.

(3) Kame Moraine. Assorted deposits of sandy and gravelly stratified drift laid down at or close to the ice margin. The topography is similar to that of an end moraine. Kame terraces are elongated deposits of this type laid down on the slopes of broad, flat-bottomed valleys.

(4) Drumlin. A smooth oval hill that has its long axis parallel with the direction of ice movement at that place. It is composed mainly of till.

(5) Esker. An irregular-crested ridge or series of discontinuous ridges of stratified drift deposited by a glacial stream that flowed beneath the continental ice-sheet or in deep crevasses within it. It is composed mainly of sand and gravel.

(6) Glacio-fluvial Deposits. Silt, sand, and gravel outwash deposited by streams resulting from the melting of the ice-sheet.

(7) Glacio-lacustrine Deposits. Clay, silt, and sand deposited in glacial lakes during the retreat of the ice-sheet. The clay deposits are commonly very distinctly stratified in layers a fraction of an inch to one or more feet in thickness; each layer is believed to represent deposition during one summer season and one winter season.

(8) Kame. An isolated mound or conical hill composed of stratified sand and gravel deposited in a crack or crevasse within the ice or in a depression along the ice front.

(9) Marine Deposits. Deposits laid down in the sea during the submergence that followed the withdrawal of the last ice-sheet. They consist chiefly of clay, silt, and sand, and have emerged beaches of sand and gravel associated with them.

(10) Shoreline. A discontinuous escarpment that indicates the former margin of a glacial lake or sea. It is accompanied by scattered deposits of sand and gravel located on former beaches and bars.

Ground Water. Sub-surface water in the zone of saturation below the water-table.

Hydrostatic Pressure. The pressure that causes water in a well to rise above the point at which it was first encountered.

Influent Stream. A stream that feeds water into a zone of saturation.

Impervious or Impermeable. Beds such as fine clays or shale are considered to be impervious or impermeable when they do not permit the perceptible passage or movement of ground water.

Pervious or Permeable. Beds are pervious or permeable when they permit the perceptible passage or movement of ground water, as, for example, porous sand, gravel, and sandstone.

Porosity. The porosity of a rock is its property of containing interstices or voids.

Pre-glacial Land Surface. The surface of the land as it existed before the ice-sheet covered it with drift.

Recent Deposits. Deposits that have been laid down by the agencies of water and wind since the disappearance of the continental ice-sheet; for example, alluvium in stream valleys.

<u>Unconsolidated Deposits</u>. The mantle or covering of loose, uncemented material overlying the bedrock. It consists of Glacial or Recent deposits of boulders, gravel, sand, silt, and clay.

<u>Water-table</u>. The upper limit of the part of the ground saturated with water. This may be near the surface or many feet below it. Water may be retained above the main water-table by a zone of impervious material; such water is said to be <u>perched</u> and its upper limit to be a <u>perched</u> water-table.

<u>Wells</u>. Holes sunk into the ground so as to obtain a supply of water. When no water is obtained they are referred to as <u>dry holes</u>. Wells yielding water are divided into four classes:

(1) Flowing Artesian Wells. Wells in which the water is under sufficient hydrostatic pressure to flow above the surface of the ground at the well.

(2) Non-flowing Artesian Wells. Wells in which the water is under hydrostatic pressure sufficient to raise it above the level of the aquifer, but not above the level of the ground at the well.

(3) Non-artesian Wells. Wells in which the water does not rise above the water-table or the aquifer.

(4) Intermittent Non-artesian Wells. Wells that are generally dry for a part of each year.

<u>Zone of Saturation</u>. The part of the ground, below a water-table that is saturated with water.

<u>GENERAL DISCUSSION OF GROUND WATER</u>

Almost all the water recovered from beneath the earth's surface for both domestic and industrial uses is meteoric water, that is, water derived from the atmosphere. Most of this water reaches the surface as rain or snow. Part of it is carried off by streams; part evaporates either directly from the surface and from the upper mantle of the soil or indirectly through transpiration of plants; the remainder infiltrates into the ground to be added to the ground-water supplies.

The proportion of the total precipitation that infiltrates from the surface into the zone of saturation will depend upon the surface topography and the type of soil or surface rock. More water will be absorbed in sandy or gravelly areas, for example, than in those covered with clay. Surface run-off will be greater in hilly areas than in those that are relatively flat. In sandy regions where relief is great, the first precipitation is absorbed and run-off only commences after continuous heavy rains. Light rains falling upon the surface of the earth during the growing season may be wholly absorbed by growing plants. The quantity of moisture lost through direct evaporation depends largely upon temperature, wind, and humidity. Ground water in areas overlain by pervious material may be recharged by influent streams carrying run-off from areas overlain by relatively impervious material.

Because of the large consumption of ground water in settled areas, it may seem surprising that precipitation can furnish an adequate supply. However, when it is borne in mind that a layer of water 1 inch deep over an area of 1 square mile amounts to approximately 14,520,000 imperial gallons, and that the annual precipitation in this region, for example, is about 30 inches, it will be seen that each year some 435,600,000 imperial gallons of water falls on each square mile. Although it would be impossible to determine the annual recharge of the ground-water supply of the area, if it were assumed that only 10 per cent of the total precipitation, namely 43,560,000 gallons, is contributed to the zone of saturation, it will be seen that the annual recharge for the entire area would be a very large volume. The annual consumption of water in all areas investigated is not known, but an estimate for some restricted areas, based on per capita consumption, shows it to be only about one-tenth of the annual recharge as estimated above.

In most regions of the world where precipitation is effective there is an underground horizon known as the ground-water level or water-table, which is the upper surface of the zone of saturation. The water-table commonly is a subdued replica of the surface topography. The water that enters from the surface into the unconsolidated deposits and rocks of the earth is drawn down by gravity to where it reaches the zone of saturation or comes in contact with a relatively impervious layer. Such a layer may stop further downward percolation, resulting in perched water and creating a perched water-table. If a water-table is at or near the surface, there will be a lake or swamp; if it is cut by a valley, there will be a stream in the valley. The terms influent and effluent are used with reference to streams and their relation to the water-table. An influent stream flows above the water-table and feeds water into the zone of saturation; an effluent stream flows at or below the water-table and receives water from the zone of saturation. An effluent stream may become influent and eventually dry up if the water-table is lowered sufficiently. The ground water in the zone of saturation is almost constantly on the move percolating towards some point of discharge, which may be a spring or a pumping well.

All rocks and soils are to some degree porous, that is, the individual grains or particles of which they are composed are partly surrounded by minute interstices or open spaces that form the receptacles and conduits of ground water. In most rocks and soils the interstices are connected and large enough for the water to move from one opening to another. In some rocks or soils, however, they are largely isolated or too small to allow movement of water. The porosity of a material varies directly with the size and number of its interstices, which in turn depend chiefly upon the size, shape, arrangement, and degree of assortment of the constituent particles.

Horizons within the earth's crust of fine-grained rock such as shale, limestone or dolomite, or unconsolidated clay or silt, may have such small interstices that the contained water will not flow readily and wells penetrating them may derive little or no water from them. Such horizons are considered impervious. Beds of more coarse-grained materials such as sand, gravel, or sandstone have greater porosity and readily yield their waters to wells. They are called water-bearing beds or aquifers. A clean water-bearing gravel is one of the best sources of water. This is true whether the water is derived from the zone of saturation or from a bed of gravel confined above, between, or below beds of less pervious material.

Consolidated rocks usually considered to be impervious may sometimes produce water in relatively good supply from openings within them of primary or secondary origin. Those of primary origin, original interstices, were created when the rocks came into existence as a result of the processes by which they were formed; e.g. bedding planes, and intergranular spaces. Secondary interstices comprise joints and other fracture openings, solution openings, and openings produced by several processes of minor importance, such as the work of plants and animals, mechanical erosion, and recrystallization; all of these involve movement of a type that acted after the consolidation of the rock. The most important interstices with respect to water supplies are the original interstices, next to them are the fracture and solution openings.

The most common wells and those that in drift-covered areas yield the largest aggregate supply of ground water are water-table wells. These are wells that derive their water from the zone of saturation. Many shallow wells become dry during the late summer and winter, or during periods of extreme drought. In most cases this is due to the lowering of the water-table below the bottom of the well. The grouping together of a number of water-table wells within a limited area will also lower the yield of any one of the wells. This is especially true of water-producing formations of low permeability. When a well penetrates an aquifer confined by impervious beds, water will be forced upward by hydrostatic pressure exerted at the point where the well enters the aquifer. If the hydrostatic pressure is great enough to force the water to or above the surface, a flowing well is formed.

Springs are formed where the water-table, or some water-bearing aquifer, outcrops at the surface of the ground. The water emerging from water-table springs is free-running water flowing down the gradient of the water-table. In many cases these springs occur as slow seeps along the steeper slopes of stream valleys. A large number in one area could maintain a swamp. A group of permanent springs occurring in one area could provide sufficient water to maintain a lake or form the source of a stream.

GENERAL DISCUSSION OF GROUND-WATER ANALYSIS

The mineral content of ground water is of interest to many besides those industries seeking water of specific quality. Both the kind and quantity of mineral matter dissolved in natural water depend upon the texture and chemical composition of the rocks with which the water has been in contact. Pollution is caused by contact with organic matter or its decomposition products. Analyses of well waters for mineral content are made by the Mines Branch, Department of Mines and Technical Surveys, Ottawa.

In any given area, an attempt is made to secure samples of water representative of all major aquifers. The quantities of the various constituents for which tests are made are given as "parts per million", which refers to the proportion by weight of each constituent in 1,000,000 parts of water.

The following mineral constituents are those commonly found in natural waters in quantities sufficient to have a practical effect on the value of the waters for ordinary uses:

Silica (SiO_2) may be derived from the solution of almost any rock-forming silicate, although its chief source is the feldspars. It is commonly determined in the analysis of water for use in steam boilers, as silica is classed as an objectionable encrustant.

Calcium (Ca). The chief source of calcium dissolved in ground water is the solution of limestone, gypsum, and dolomite. The common compounds of calcium are calcium carbonate ($CaCO_3$) and calcium sulphate ($CaSO_4$), neither of which has injurious effects upon the consumer, but both of which cause hardness and, the former, boiler scale.

Magnesium (Mg). The chief source of magnesium in ground water is dolomite, a carbonate of calcium and magnesium. The sulphate of magnesium ($MgSO_4$) combines with water to form Epsom-salts ($MgSO_4 \cdot 7H_2O$), and renders the water unwholesome if present in large amounts.

Sodium (Na) is found in all natural waters in various combinations, though its salts constitute only a small part of the total dissolved mineral matter in most waters in humid regions. Sodium salts may be present as a result of pollution by sewage, or of contamination by sea water either directly or by that enclosed in sediments of marine origin. Moderate quantities of these salts have little effect upon the suitability of a water for ordinary uses, but water containing sodium in excess of about 100 parts per million must be used with care in steam boilers to prevent foaming. Waters containing large quantities of sodium salts are injurious to crops and are, therefore, unfit for irrigation. The quantity of sodium salts may be so large as to render a water unfit for nearly all uses.

Potassium (K), like sodium, is derived originally from the alkaline feldspars and micas. It is of minor significance and is sometimes included with sodium in a chemical analysis.

Iron (Fe) is almost invariably present in well waters, but rarely in large amounts. Salts, or compounds, of iron are dissolved from many rocks as well as from iron sulphide deposits with which the ground water comes in contact. It may also be dissolved from well casings, water pipes, and other fixtures in quantities large enough to be objectionable. Upon exposure of the water to the atmosphere, dissolved iron separates as the hydrated oxide that imparts a yellowish brown discoloration. Excessive iron in water causes staining on porcelain or enamelled ware and renders the water unsuitable for laundry purposes. Water is not considered drinkable if the iron content is more than 0.5 parts per million.

Sulphates (SO_4). Deposits of gypsum ($CaSO_4 \cdot 2H_2O$) are the principal source of sulphates dissolved in ground water; soluble sulphates, chiefly of magnesium and sodium, are other sources. Sulphates cause permanent hardness in water and form injurious boiler scale. Sodium and magnesium sulphates are laxative when present in quantities of more than 900 parts per million.

Chloride (Cl) is derived chiefly from organic materials or from marine rocks and sediments. It occurs usually as sodium chloride and less commonly as calcium chloride and magnesium chloride. Sodium chloride is a characteristic constituent of sewage and a locally abnormal amount suggests pollution. However, because chlorides may be derived from many sources, such abnormal quantities should not, in themselves, be taken as positive proof of pollution. Chlorides impart a salty taste to water if they are present in excess of 300 parts per million.

Nitrates (NO_3) are of minor importance in the study of ground water. Relatively large quantities in a water may represent pollution by sewage, or drainage from barnyards, or even from fertilized fields. It is recommended that a bacteriological test be made of water showing an appreciable nitrate content if it is to be used for domestic purposes.

Carbonate (CO_3) forms a large percentage of the solid compounds held in solution by the average ground water. The two chief sources are the decomposition of feldspars and the solution of limestone by water carrying carbonic acid in solution, which is the primary agent in rock decomposition. They are indicated in the table of analyses as alkalinity. Calcium and magnesium carbonates cause hardness in water, whereas sodium carbonate causes softness.

Bicarbonate (HCO_3). Carbon dioxide dissolved in water renders the insoluble calcium and magnesium carbonates soluble as bicarbonates. Boiling reverses the process by changing the bicarbonates into insoluble carbonates, which form a coating on the sides of cooking utensils.

Total Dissolved Solids (Residue on Evaporation). The term is applied to the residue obtained when a sample of water is evaporated to dryness. Waters are considered high in dissolved mineral solids when they contain more than 500 parts per million, but may be accepted for domestic use up to that point if no better supply is available. Residents, accustomed to the waters, may use waters that carry well over 1,000 parts per million of total dissolved solids without inconvenience, although persons not used to such highly mineralized waters would find them objectionable.

Hardness is a condition imparted to waters chiefly by dissolved calcium and magnesium compounds. It here refers to the soap-destroying power of water, that is, the power of the water first to use a certain amount of soap to precipitate the above compounds before a lather is produced. The hardness of water in its original state is its total hardness. Permanent hardness remains after the water has been boiled, and is caused by mineral salts that cannot be removed from solution by boiling. It can be reduced by treating the water with natural softeners, such as ammonia or sodium carbonate, or with many manufactured softeners. Temporary hardness can be eliminated by boiling, and is due to the presence of bicarbonates of calcium and magnesium. Waters containing larger quantities of sodium carbonate than of calcium and magnesium compounds are soft, but if the latter compounds are more abundant the water is hard. The following table[1] may be used to indicate the degree of hardness of a water:

<u>Total Hardness</u>

Parts per million	Character
0-50	Very soft
50-100	Moderately soft
100-150	Slightly hard
150-200	Moderately hard
200-300	Hard
300 and over	Very hard

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1 Thresh, J. C. and Beale, J. F.; The Examination of Waters and Water Supplies, p. 21, London, 1925.

GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

GENERAL DISCUSSION

This report is the result of field work done during the season of 1951 except for areas along the Montreal Road and in the vicinity of the community of Cyrville, which were completed during May and June 1952.

The main purposes of the investigation were as follows: (a) as an aid to the Civil Defense authorities of the adjacent city of Ottawa in locating and describing all sources of ground water; (b) to investigate the possibility of overdevelopment of local ground-water supplies in areas where large numbers of housing units were being constructed; (c) to locate new areas where sufficient ground water is available for industries or housing projects requiring substantial amounts of water; (d) to aid individual home owners who are dependent upon ground water for their water supply.

As the quantity and quality of ground water in any one locality is dependent to a large extent upon the material from which it is derived, descriptions of both unconsolidated material and the underlying bedrock throughout Gloucester township are included in the report.

The author was ably assisted in the field by E. R. Sanford, G. R. Murphy, and J. L. Dion during the season of 1951 and by K. F. Pallett, W. R. Wellwood, and R. M. Lavallee during the 1952 field season.

Logs and pertinent data concerning a number of recently drilled wells were supplied through the courtesy of the Ontario Department of Mines.

Reference is frequently made in this report to Rideau Front (R.F.) and Ottawa Front (O.F.). These are land divisions of Gloucester township based upon two surveys; one of which fronts along Rideau River and the other along the Ottawa.

GEOGRAPHY

Location and Area

Gloucester township is located in the northeast corner of Carleton county on the south side of Ottawa River immediately east of the junction of Ottawa and Rideau Rivers. The city of Ottawa, a part of which is located in the northwest corner of the township, is 283 miles from Toronto and 126 miles from Montreal. The area of the township subsequent to the annexation of a large part by the city of Ottawa is approximately 110 square miles.

Topography and Drainage

Gloucester township has, for the most part, a gently sloping or undulating surface, a considerable part being nearly level. The higher ground is generally occupied by glacial till or outwash material and the lower, more level tracts, by marine sand and clay. A number of broad, flat valleys, trending eastward across the central part of the township north of the Russell Road, are important physiographic features. It is believed that these depressions represent former channels of Ottawa River when, in earlier times, its waters were at higher elevations. The most extensive flat areas in the township are in the southeast corner, where the drift consists chiefly of marine clay overlain, in places, by a thin veneer of sand.

The township, as a whole, has a relief of more than 250 feet. The highest elevations are on a drift ridge extending southeast from Bowesville, and on a second ridge that crosses the Metcalfe Road (Queen's Highway 31) about 1½ miles north of the community of South Gloucester. In both these localities elevations of slightly more than 400 feet above sea-level were measured. The lowest part is in the valley of Ottawa River in the northeast section of the township where the elevation is less than 150 feet.

As Gloucester township lies immediately adjacent to the confluence of Ottawa and Rideau Rivers, it is to be expected that these two rivers and their tributaries would carry the run-off for the entire township. The east half of Rideau Front is drained directly by a number of small, intermittent streams into Rideau River and the central and north part of Ottawa Front drains into Ottawa River, chiefly by means of Green Creek, which joins the Ottawa in lot 10, con. 1, O.F., about 1 mile west of Hiawatha Park. The east and southeast part of the township is drained by Bear Brook and tributaries of the north branch of Castor River. These streams flow in a westerly direction into South Nation River, which enters Ottawa River at the community of Wendover, some 32 miles downstream from the city of Ottawa.

Climate

Gloucester township has a cool, humid climate, tending to be colder than that commonly prevailing in the lowlands region of Ontario adjoining the Great Lakes and the St. Lawrence River[1].

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[1] Hills, G. A., Richards, N. R., and Morwick, F. F.: Soil Survey of Carleton County, Ontario; Ontario Soil Survey, Rept. No. 7, 1944, p. 21.

The following table shows the monthly precipitation in inches for the last 6 years as well as the total annual precipitation in the Ottawa area. An average precipitation for the last 65 years is also included. It should be noted that, not only has there been a gradual increase in the quantity of precipitation falling upon Gloucester township during the last 6 years, but also the annual totals are, in all instances, larger than the 65-year average total.

During the past years there has been little complaint as to shortage of ground water in the township and it is believed that, owing to the increased precipitation and consequent increased recharge, there will continue to be adequate supplies of ground water for domestic and stock purposes, except in those areas where there is always a shortage because of the lack of a satisfactory aquifer.

PRECIPITATION IN INCHES[1]

Station	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Rockcliffe (Airport)	1952	3.4	2.2	3.0	2.0	5.2	2.7	6.2	6.2	1.5	1.2	2.0	3.7	39.3
	1951	4.7	2.2	4.2	4.3	1.9	3.3	2.2	2.4	2.6	1.6	3.8	4.8	38.0
	1950	3.5	2.9	3.2	2.4	1.8	3.7	6.2	4.2	1.1	1.5	3.8	3.5	37.8
	1949	3.2	2.4	2.4	3.6	2.2	2.4	2.7	4.6	3.2	1.4	2.2	4.6	34.9
	1948	1.7	-	-	2.4	2.8	2.4	4.3	2.6	0.9	3.1	4.9	3.6	28.7
	1947	4.6	3.9	6.2	4.0	6.2	4.0	2.8	2.0	4.7	0.8	2.4	2.1	43.7
	average for 65 years (Ottawa)[2]	2.93	2.17	2.77	2.70	2.47	3.52	3.39	2.56	3.23	2.93	2.98	2.58	34.23

1 Extracts from the 'Monthly Weather Map', Meteorological Service, Dominion of Canada.

2 Data from "Climatic Summaries for Selected Meteorological Stations in the Dominion of Canada" Vol. I, Meteorological Division Department of Transport, Canada.

Population

The population of Gloucester township at the end of 1951 was 5,450 persons, or approximately 50 people per square mile. These figures do not include the inhabitants of the part of the city of Ottawa lying in the township. A large proportion of the population, especially those employed in non-agricultural pursuits, are located adjacent to the Ottawa city limits. There are no incorporated villages and except for Ottawa, Orleans is the largest community. Other smaller communities include Carlsbad Springs, Edwards, Leitrim, Ramsayville, and South Gloucester. Except for a limited number of establishments situated within a short distance of Ottawa and Rideau Rivers, the entire population is dependent upon ground water for their supply of water.

Transportation

Roads and railroads are plentiful in Gloucester township. Highway No. 17, running parallel with Ottawa River, traverses the north part of the township and joins the cities of Ottawa and Montreal. The River road follows the east bank of Rideau River from the Ottawa city limits to the south boundary of the township, and beyond. These highways as well as a number of township roads form a network of thoroughfares throughout the area. Both the Canadian Pacific and Canadian National Railway lines from Ottawa to Montreal cross Gloucester township near Mer Bleue, and a branch line of the New York Central Railway from Ottawa to Cornwall crosses the central part of the township in a southeast direction. There is also a large, modern airport at Uplands just within the Ottawa city limits, and the Rideau Canal system, which follows Rideau River, is annually utilized by many water craft, chiefly for pleasure.

Agriculture

The products of the farms in Gloucester township are chiefly those that find a ready market in the adjacent city of Ottawa. The dairy industry is possibly the best developed, but in the north and east parts of the township vegetables are grown on a commercial scale.

Industry

Building stone is plentiful and there are quarries in many parts of Gloucester township. Some lie along the Montreal Road in the east part of the city of Ottawa and some on MacArthur Road in the south part. All are quarrying limestone of the Ottawa formation.

Sand and gravel is plentiful in Rideau Front, especially in the area adjacent to the Bowesville Road.

Mineral springs in Gloucester township at one time provided quite an industry, but in recent years have fallen off considerably in importance. The most prominent of these is at the community of Carlsbad Springs, which once enjoyed a moderate reputation as a health resort. Waters from Borthwick spring in lot 19, con. IV, O.F. and from Victoria sulphur spring at the side of Green Creek, 2 miles east of Ottawa near Queen's Highway 17, were both at one time used extensively for Medicinal purposes[1].

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[1] Elworth, R. T.: Mineral Springs of Canada; Mines Branch, Bull. 20, pt. II, p. 43 (1918).

The site of the latter spring was not found during the course of the present survey.

A number of small industries such as cheese making and the manufacture of concrete blocks and wooden articles for construction purposes are operating in various parts of the township.

GEOLOGY

Bedrock Formations

Gloucester township is underlain by Palaeozoic rocks of Ordovician age. The following descriptions have been taken from a report by A. E. Wilson[1] published in 1946.

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[1] Wilson, A. E.: Geology of the Ottawa-St. Lawrence Lowland, Ontario and Quebec; Geol. Surv., Canada, Mem. 241, pp. 7-30 (1946).

Table of Formations

Era	Period	Sub Epoch	Formations	Thickness (feet)	Lithology
Palaeozoic	Ordovician	Lorraine	Carlsbad	500-550	Grey shale and sandy, rusty shales with thin dolomitic layers near top
		Gloucester	Billings	260-300	Black shale with a few feet of brown shale at base
		Collingwood	Eastview	up to 20	Limestone with a little inter-bedded shale
		Disconformity			
		Trenton and Black River	Ottawa	690-700	Limestone, with a little shale and some sand at its base
		Disconformity			
		Chazy	St. Martin Rockcliffe	20-155 150-165	Impure limestone Shale with sand-stone lenses
		Disconformity			
		Beekmantown	Oxford	240±	Dolomite with a little shale at the top
			March	30+	Interbedded sand-stone and dolomite
	Ordovician or Cambrian		Nepean	up to 500	Sandstone
Great unconformity					
Precambrian (archaean)?			Grenville		Crystalline lime-stone, quartzites, and metamorphic rocks; associated granite and granite-gneiss

Precambrian

Little information has been obtained concerning the rocks of the Precambrian complex, which underlies the Palaeozoic sedimentary formations throughout Gloucester township. They do not outcrop in the township, and so far as is known only one well has penetrated them. This well, located in lot 8, Gore, R.F., was reported to have encountered the Precambrian at 460 feet. However, no description of these rocks exists. The Precambrian rocks, where they are exposed in places adjacent to the township, consist of crystalline limestone, gneiss, and quartzite intruded, deformed, and metamorphosed by bodies of granite, syenite, and other igneous rocks.

Ordovician

Nepean Formation. The Nepean formation directly overlies the unevenly eroded Precambrian floor and is in turn overlaid by the interbedded sandy dolomite and sandstone of the March formation. The Nepean is, in general, a cream-coloured sandstone, weathering grey and mottled with irregular rust spots. It is made up of a coarse quartz sand, and on analysis has been found to contain an average of 99.31 per cent silica. Numerous outcrops indicate that the Nepean formation underlies the drift along a belt approximately 4 miles long and up to ½ mile wide with a southeast trend across concessions V and VI, R.F. in the south part of Gloucester township. This belt is bounded on the northeast by the Gloucester fault.

March Formation. The March formation lies above the Nepean sandstone and below the Oxford formation. It consists of alternating grey sandstone, and sandy dolomite or blue-grey dolomite, all weathering dark rusty brown. The sand grains are large, generally rounded and commonly loosely cemented. Rocks identified as March directly underlie the drift in a narrow belt on the southwest side of the belt of Nepean rocks described above. A second belt cuts across lots 21 to 23, cons. I and II, R.F.

<u>Oxford Formation</u>. The Oxford formation lies above the March and is succeeded by the Rockcliffe. It consists chiefly of a thick-bedded, rusty weathering dolomite, which here and there changes laterally to a limestone. The formation is generally considered to be early Beekmantown in age. Some 45 square miles of drift in Gloucester township is underlaid directly by the Oxford. The largest area occurs in the southwest corner of the township, where rocks of the Oxford formation extend along Rideau River from Black Rapids south to Manotick and along the south boundary from Manotick east to a point 2 miles beyond the community of South Gloucester. The third side of this triangular-shaped area is bounded by the Gloucester fault. A much smaller area lies along the south side of Ottawa River from the Ottawa city limits east to Orleans.

<u>Rockcliffe Formation</u>. In Gloucester township, the Rockcliffe formation overlies the Oxford and in turn is overlain by the St. Martin. These rocks are composed of friable shales with lenses of sandstone. The former is, for the most part, light olive-green with a few pockets of iridescent shale. The sandstone normally is fine grained and grey. Two areas within Gloucester township are underlain directly by the Rockcliffe formation. One narrow belt of these rocks extends from the Ottawa city limits east to Orleans; a second and much smaller belt occurs in lots 6 and 7, cons. Gore and III, R.F.

<u>St. Martin Formation.</u> The St. Martin formation lies conformably above the Rockcliffe and unconformably beneath the Ottawa limestone. It consists predominantly of limestone with some shaly or dolomitic limestone members towards the base. The only area of the St. Martin formation that directly underlies the drift in Gloucester township is a narrow belt extending from the Ottawa city limits east to the community of Orleans. It lies south of the belt of Rockcliffe formation previously described. The St. Martin and Rockcliffe are both considered to be Chazy in age.

Ottawa Formation. The Ottawa formation comprises those beds commonly called Black River and Trenton, including the Pamelia, Lowville, and Leray members of the former and the Rockland, Hull, Sherman Fall, and Cobourg members of the latter. The formation is dominantly limestone, but includes some shale and small quantities of sandstone at the base. The Ottawa formation underlies a roughly triangular-shaped area some 9 square miles in extent in the north-east part of the township.

Eastview Formation. The Eastview is a thin formation that overlies the Ottawa limestone and is overlain by the Billings. It is composed of dark grey, fine-grained limestone interbedded with shale. The dark, friable, shaly members of the formation are more common toward the top. The formation occurs only in the vicinity of Green Creek, in parts of lots 17, 18, and 19, cons. I and II, O.F.

Billings Formation. The Billings formation lies above the Eastview formation and below the grey shales of the Carlsbad. Except for a few feet of brown weathered shale in the lower part, the formation consists entirely of thick beds of black, fissile shale. It is not a widespread formation, exposures forming a somewhat horseshoe-shaped area in the western part of Gloucester township. One arm of this area crosses the north part of the township in a westerly direction from the east boundary of the township to the Ottawa city limits. The tip of the other arm extends into lots 6 to 9, con. III, R.F.

Carlsbad Formation. The Carlsbad formation is the uppermost of the bedrock formations underlying Gloucester township. The rocks consist predominantly of grey shale with some impure limestone or dolomitic bands and a little sand. It directly underlies the drift in some 54 square miles of Gloucester township, and is the largest area underlaid by one bedrock formation in the township.

Overburden

The Pleistocene geology of the greater part of Gloucester township was described by Johnston[1] in 1915. The mapping was completed by the author during the summer of 1951. The following description of the drift was taken principally from Johnston's memoir, supplemented by information gained by the author's own observations in the field.

[1] Johnston, W. A.: Pleistocene and Recent Deposits in the Vicinity of Ottawa, with a Description of the Soils; Geol. Surv., Canada, Mem. 101, pp. 11-36 (1915).

Pleistocene

Glacial Till. Glacial till is the unstratified, non-fossiliferous material laid down by the last ice-sheet over much of Gloucester township. Most of the till is spread over the township as undulating ground moraine. A few of the larger undulations that project through the overlying marine sand and clay in the southwest part of the township appear to be small, drumlinoid structures.

The character and composition of the till are largely determined by the nature of the bedrock upon which, or near which, it lies. However, there is a larger proportion of boulders and fragments of Precambrian rocks in the till in the northern part of the township than in the southern, for that part is adjacent to the areas of Precambrian rocks lying north of Ottawa River. The greater part of the material, especially the fine-grained part, is derived from local rocks.

Although the till is without stratification, in places it contains lenticular layers of irregularly shaped masses of stratified sand or silt, which may represent frozen masses of stratified material ploughed up by the glacier and incorporated in the till.

Fluvioglacial Sand and Gravel. Stratified sand and gravel of fluvioglacial origin are of local and irregular occurrence in Gloucester township. They rarely outcrop at the surface, generally being buried beneath a covering of marine sand and clay. The largest areas in which these materials are known to occur on the surface are in the northwest part of the township, where they extend southeast from the Ottawa city limits for a distance of some 4 miles along the Bowesville Road. The material, as revealed in a number of pits, varies from a sand, grey in colour and markedly crossbedded, to a poorly sorted, coarse, bouldery gravel. A number of wells drilled through the overlying marine sand and clay in search of a supply of potable ground water, have encountered gravel beds of various thicknesses beneath the clay, most of which lie directly on bedrock. This is especially true in the vicinity of Ramsayville and south of that community along the Base Line Road, which separates Rideau Front from Ottawa Front. It is known locally as 'black gravel' because of the high content of dark-coloured shale from the Billings and Carlsbad formations. It has been described by a local driller as consisting predominantly of fragments of greyish shale with smaller amounts of more rounded pebbles of crystalline rocks. The individual beds of 'black gravel' do not appear to extend over any great distance. Wells drilled close to wells that were reported to have encountered gravel did not intersect any. Gravel consisting predominantly of pebbles and boulders of limestone and crystalline rocks was reported to occur between the overlying marine clay and bedrock in the south parts of concessions B.F. and I. These gravels are in the same stratigraphic position as the 'black gravels' and are also considered to be fluvioglacial in origin.

Marine (Champlain) clay, silt, and sand. After the retreat of the ice-sheet from the Ottawa Valley, the area was enundated by an arm of the sea, known as the Champlain Sea. The drift laid down in Gloucester township as a result of this marine invasion consists of fine sand, silt, and clay in the low-lying areas and coarser sand and gravel as beach deposits in the higher areas.

The Champlain, or Leda clays as they are sometimes called, cover much of Gloucester township. Their colour is, for the most part, bluish grey changing to brownish red in the upper, weathered part where they are exposed. The upper part of the formation differs markedly in physical character from the lower. The lower part is a sandy or silty clay, generally well laminated, especially toward the base, whereas the upper is more massive and the bedding is indistinct.

Most of the areas in which the clays outcrop are extremely flat, but in the east part of the township this original surface of deposition has been partly destroyed by stream erosion and terracing.

The thickness of the clay varies considerably across the township. An examination of the drillers logs of a number of water wells in Gloucester township given on page 109 indicate its thickness in several places.

The marine or Champlain sand is somewhat irregular in its distribution and is generally of no great thickness, varying from a few inches to a few feet. In some areas it forms a thin veneer over both glacial till and bedrock. An exception is in lot 9 con. II, R.F., in the Bowesville area where the sand has been reported in two different localities to be at least 70 feet deep. It varies in character from very fine to coarse sand. Gravel is here and there associated with the coarser material. Most of the sand is somewhat oxidized and yellow in colour. The finest sand generally occurs in horizontal beds in the nearly level areas where it overlies marine clay.

The beach deposits of sand and gravel formed along the shorelines of the Champlain Sea are not extensive but are of local importance as they yield good quality concrete aggregate.

Recent

Alluvium or flood-plain material deposited by present streams occurs along Ottawa and Rideau Rivers as well as along some of their smaller tributaries. In the latter case the beds are of such small extent that it is not possible to show them on the geological map that accompanies this report. The islands in Ottawa River downstream from the mouth of Gatineau River are composed largely of alluvium. The material consists mainly of very fine sand containing considerable organic material and underlain in places by gravel. The sand is generally yellowish or reddish and is well leached and oxidized so that it contains little calcareous material. In places the beds have a thickness of 10 to 15 feet but in general the thickness is only from 6 to 10 feet.

Dune sand occurs chiefly in the north parts of cons. III and IV, Rideau Front, where it overlies sand and gravel of fluvioglacial origin, from which it was in part derived. Smaller, isolated dune areas occur in other parts of the township. They are commonly associated with, and adjacent to, exposures of marine sands or material of fluvioglacial origin.

Deposits of peat, consisting of partly decomposed organic material, occur over comparatively large parts of the township. The largest deposit is known as the Mer Bleue bog. This bog, which contains the largest supply of fuel peat in the district, was described by Nystrom and Anrep[1] in 1909.

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[1] Nystrom, E., and Anrep, A.: Investigation of the Peat Bogs and Peat Industry of Canada, During the Season 1908-9; Mines Branch, Canada, Bull. No. 1, 1909.

WATER SUPPLY

Gloucester township appears to be fairly well supplied with adequate quantities of ground water for both domestic and stock purposes except in a few localities. Supplies of ground water were reported as being unsatisfactory in the flat areas underlain by marine sediments in the southeast part of the township. In this area are the communities of Piperville and Edwards. The drift there consists predominantly of thick beds of relatively impervious marine clay overlain, in part, by thin beds of marine sand. In some parts of the township, moreover, the ground water is unsatisfactory for consumption by both humans and animals. A number of wells, for instance, dug in marine clay or drilled to the 'black gravel' beds underlying the clay, are reported to yield only highly mineralized water. The Carlsbad and Billings formations, which underlie a large part of Gloucester township, are reported, in many instances, to yield water too high in saline content to be used for domestic or stock purposes.

About 65 per cent of the wells in Gloucester township are of the dug type, and 14 per cent are drilled. The remainder consist of bored wells, sand points, and diamond drill-holes. Approximately 74 per cent are obtaining their water from depths of 40 feet or less. About 92 per cent of the wells have a permanent water supply sufficient for the present demands made upon them and 6 per cent constitute wells that go dry intermittently. In describing the principal beds that yield water to the wells, the statements of owners and drillers as to the character of the aquifer were necessarily accepted.

To facilitate the use of this report as a reference the ground-water conditions in Gloucester township are described systematically along, and adjacent to, the major concession roads, which form a complete network across the township, and also along a number of the better-known roads that radiate out across the township, chiefly from the limits of the city of Ottawa.

RIVER ROAD (MANOTICK ROAD)

The River Road is that paved highway that extends along the east bank of Rideau River from the limits of the city of Ottawa to the south boundary of the township. It is nowhere a greater distance than four-tenths of a mile from the river. It is entirely in that part of Gloucester township known as Rideau Front and crosses con. I at the north and con. B.F. at the south.

Bedrock in the area adjacent to the River Road consists entirely of the Oxford formation, except in lot 19, con. B.F., where the March formation has been brought to the bedrock surface on the north side of a large fault. Unconsolidated material exposed on the surface consists chiefly of marine clay covered by a veneer of sand. Some areas of glacial till, however, occur locally along the southern part of the road in lots 29 and 30, con. B.F. The till generally occurs as low, somewhat irregularly shaped hills or knolls with a general trend of south 10 to 20 degrees west. This is also the direction in which the last ice-sheet moved across the township and suggests that the till knolls are the tops of drumlinoid structures, partly buried by later deposits of marine sediments. The drift on Long Island consists of knobs and ridges of glacial till surrounded by level tracts of marine sand and clay.

The first well along the River Road immediately south of the Ottawa city limits is a diamond drill-hole sunk at a private residence in lot 19, con. I. The hole was reported to be 75 feet deep with bedrock encountered at 62 feet. Bedrock along this particular part of the River Road was formerly mapped as Oxford limestone and dolomite but grey shales believed to belong to the Rockcliffe formation were reported in the diamond drill-hole.

A number of cottages lie along the east bank of the Rideau River in lot 10, con. I. They are built on a narrow, flat plain at the foot of a steep bluff formed by Rideau River when it was at a higher elevation. The water supply for these cottages is derived both from the river and from shallow wells dug in what appears to be sandy alluvium overlying marine clay. The intake area for these wells is probably the general area above the east of the bluff. In any case the proximity of Rideau River would ensure a satisfactory supply of ground water for most dug wells in this area. If, in times of drought, a decrease in the quantity of ground water percolating down from the intake area should lower the water-table, Rideau River would change from an effluent stream to an influent and supply water to the wells. The water-table would thus be stabilized at a point possibly no more than a foot or two below the level of the water in the river. Any well that goes dry could thus be assured of water by being deepened.

In lots 9 to 12, con. I, considerable quantities of ground water were reported to occur in sand beds beneath the clay and lying immediately upon bedrock. These beds are probably of fluvioglacial origin and related to the large areas of similar material exposed a few miles to the east and northeast. The latter, no doubt, constitutes the intake area for the large quantities of ground water yielded by wells drilled through the clay, both in lots 9 to 12 and farther south along the road. The water in the sand is under considerable pressure and some difficulty was experienced while drilling in preventing the sand from rising in the casing. Sand will also enter the wells when the water levels are low following a period of heavy pumping. To overcome this some drillers have driven the casing tightly into the rock. This prevents not only the sand but also its water from entering the well and the well, consequently, depends on ground water derived from bedrock.

Two flowing wells, drilled in lot 13, con. I, R.F., at cottages along Rideau River, derive their supply of ground water from beds of sand and gravel beneath the marine clay, apparently the same beds encountered in the wells drilled in lots 9 and 10, con. I. The surface of the ground at the flowing-artesian wells is considerably lower than the latter and there is apparently sufficient hydrostatic head to create flowing-artesian conditions in this particular area.

Wells drilled at three cottages along Rideau River in lot 15, con. I, all encountered ground water under considerable pressure. In two of the wells bedrock was reported to have been penetrated to depths of from 20 to 30 feet. When these wells were visited in July 1951, one well was flowing at a rate of approximately 100 g.p.h. with the piezometric surface about 1 foot above the level of the surrounding ground. The chief source of the water is apparently sand beds similarly situated to those described above.

One well situated on the west side of the River Road, in lot 17, con. B.F., was bored 25 feet into marine clay and lined with small diameter concrete tile. This well is continually being pumped dry. It is believed that the reservoir capacity of this well is too small considering the type of material from which the ground water is being derived. It has been found that wells in marine clay, through which water percolates slowly, should have diameters of 36 to 42 inches to supply quantities of water sufficient for normal domestic use.

Some wells located in lots 18 and 19, con. I, encountered ground water under considerable pressure in gravel beds beneath marine clay and overlying bedrock. The water was reported to be medium hard and to have a faint odour of hydrogen sulphide gas. One well in lot 19 was drilled to a depth of 90 feet with bedrock, consisting of the March formation, encountered at 76 feet. No gravel was reported to have been encountered in this well, the water being derived directly from bedrock. The absence of sand and gravel in this well suggests that the beds so extensive along the north part of the River Road may be less continuous toward the south. The same thing is suggested by the fact that surface exposures of fluvioglacial materials apparently die out in the south part of the area. If this is so, some of the wells drilled along the south part of the River Road will not encounter these favourable beds.

In lots 21 to 23, con. B.F., the beds of marine clay, which occur on or very near the surface, are reported to be approximately 30 feet thick. Wells dug or drilled through the clay have encountered irregular beds of gravel containing considerable quantities of ground water. The thickness of the clay beds in this area is not too great to prevent well owners from digging through it and obtaining an excellent supply of ground water without the expense of drilling a well.

Wells drilled along the River Road from lots 26 to 30, con. B.F., obtain their water both from gravel and the underlying Oxford formation. The thickness of the drift varies from 20 to 46 feet. Gravel beds were reported from almost all the drilled wells, but contained only limited amounts of ground water. They are described as irregular and of various thicknesses. The chief source of ground water is, consequently, the Oxford formation, which yields supplies of ground water sufficient for all normal domestic and stock purposes.

It is apparent, to summarize the foregoing, that the principal aquifers yielding ground water to wells along the River Road consist of extensive but irregular beds of fluvioglacial sand and gravel underlying marine clay and directly overlying bedrock. The water yielded by these beds is under considerable hydrostatic pressure. It is medium hard and in some wells emits a faint odour of hydrogen sulphide gas. Hard, clear ground water can be obtained from the underlying Oxford and March formations.

The marine sand and clay, which covers most of the surface of the ground along the entire length of the road, is not a good source of ground water. Some of the wells belonging to farmers along the River Road, which are reported drilled, were originally dug wells deriving their ground water from marine clay. The quantity of water was reported to have been gradually diminishing, both because of increased consumption and because of a gradual lowering of the water-table. Such wells were deepened by drilling to assure a more adequate ground-water supply.

ROAD BETWEEN CONCESSIONS B.F. AND I (R.F.)

Information was gathered on only fifteen water wells along this road, which is about 2½ miles long. The drift is similar to that along the River Road. It consists of level tracts of marine sand and clay interspersed at the south end with low rounded hills of glacial till. Bedrock directly underlying the drift consists entirely of the Oxford formation. There is apparently a low ridge in the bedrock surface that trends easterly from lot 22, con. I (R.F.). At the west end of this ridge bedrock is reported to be only 16 feet from the surface and it outcrops about a mile to the east. Farther south along the road, the thickness of the overburden gradually increases to 40 feet in lot 29, con. I (R.F.). Groundwater conditions are similar to those along the River Road and need no further description here.

ROAD BETWEEN CONCESSIONS I AND II (R.F.)

This road branches off the River Road in lot 9 and extends in a southeasterly direction straight to the south boundary of Gloucester township. Bedrock directly underlying the drift consists of the Oxford formation except that in lots 22 and 23 rocks of the March formation are carried up along the north side of a large fault. The Oxford formation outcrops along the road in lots 24 and 25 where there is an easterly trending ridge on the bedrock surface. About a mile south of this a second rock ridge with a similar trend is indicated by the elevations reported of bedrock surface in drilled wells in lot 27, con. I (R.F.).

The unconsolidated material exposed on the surface in lots 22 and 23 along the road north of the outcrop area consists of marine sand and clay. In the outcrop area and south of it for about a mile, the drift is glacial till. Marine sediments again appear on the surface at the extreme south end of the road.

Information was gathered on only two wells along the road between lots 9 and 17. The northernmost well, in lot 11, con. II (R.F.), is a drilled well 65 feet deep, and is reported to yield large quantities of hard, clear water. If bedrock was encountered its depth is unknown. The second well, in lot 15, con II (R.F.), and dug 19 feet in marine clay, was reported to yield small quantities of water, sufficient for domestic use.

The most satisfactory supplies of ground water along this road are derived from bedrock. Unlike the River Road, no sand or gravel was reported beneath the marine sediments and, consequently, drilled wells have penetrated bedrock in the search for adequate ground-water supplies. No instance was recorded of a well drilled into bedrock failing to obtain sufficient quantities of potable ground water for normal domestic and farm needs. Three wells in lots 22 and 23 were reported to be obtaining excellent supplies of ground water from the March formation. The water here is under considerable hydrostatic pressure, so much so that a drilled well 45 feet deep, in lot 23, con. II (R.F.), flows during the greater part of the year. These exceptional pressures are probably the result of local bedrock conditions. The large fault in bedrock in this area, along which the March formation was uplifted, is apparently relatively impervious to the passage of ground water. Ground water percolating through the sandy beds of the March formation, therefore, tends to accumulate against the fault and to form a ready source of ground water under considerable pressure. It should be noted, however, that the sandy beds that constitute the major aquifers in the March formation are not continuous and ground water under sufficient pressure to reach the surface will not be found everywhere.

Wells dug in marine clay have not proved satisfactory. Wells dug in this material down to bedrock obtained a limited supply of ground water at the contact but in most cases it was necessary to drill a considerable distance into the bedrock from the bottom of the dug part of the well to obtain sufficient water.

The glacial till exposed along the south part of the road is reported to be a more satisfactory source of ground water than the marine clay. Wells dug in this material are yielding sufficient quantities of ground water for all normal farm use. Because the till contains more sand than the marine clay it is more permeable and yields a larger supply of ground water to a well.

BOWESVILLE ROAD

The part of the Bowesville Road considered here runs from the Ottawa city limits in lot 9, con. II (R.F.), southerly across cons. II and Gore (R.F.), crosses the Canadian Pacific Railway about 2 miles northwest of Gloucester station, and then follows the road between Gore and Con. III (R.F.), to the south boundary of Gloucester township. The area about Gloucester Station is also discussed.

Bedrock directly underlying the drift along this road consists entirely of rocks of the Oxford formation. Outcrops that occur in lot 26 in the vicinity of the Canadian Pacific Railway crossing evidently are the eastward extension of the rock ridge in lots 23 and 24 about $2\frac{1}{2}$ miles to the west, mentioned previously. Four wells were reported to have penetrated bedrock. Two of these, located in the outcrop area in lot 26, are 20 and 49 feet deep respectively, and the other two, in lot 30, con. III (R.F.), are 86 and 127 feet deep. A deep valley in the bedrock surface appears to exist between lots 26 and 30.

The unconsolidated material exposed on the surface along the north part of the Bowesville Road consists of fluvioglacial sand and gravel. In lots 15 and 16 there is a considerable amount of dune sand. Except in the vicinity of the outcrops of Oxford formation in lots 25 and 26, where the drift is a sandy type of till, the unconsolidated material along the part of the road separating Gore and con. III (R.F.), consists of irregular beds of marine sand overlying clay.

At the time the ground-water survey was conducted, it was found that the water-table was very low along the north part of the road between lots 9 and 15. There, the depth of eleven wells dug in fluvio-glacial sand and gravel ranges from 18 to 70 feet with an average of 55.5 feet, and the depth to the water surface in them varied from 37 to 68 feet with an average of 48.5 feet. One of the few dry wells in Gloucester township is in lot 13, Gore (R.F.), where a dug well 45 feet deep failed to encounter ground water.

The altitude of the area in which these wells occur is considerably greater than that of much of the surrounding country, being in some parts more than 375 feet above sea-level. In Edwardsburgh township, Grenville county, where fluvioglacial material exists at comparable elevations, the water-table was also found to be much deeper than in the surrounding, lower areas.

It is interesting to note that only one sand-point well was reported in the area. This is a well 45 feet deep in lot 5, Gore (R.F.). Two reasons have been given to explain this; (1) the extreme fineness of some of the sand, which causes trouble by entering the well; and (2) the great depth to which the sand point must be driven to obtain a satisfactory supply of ground water.

No wells were reported between lots 18 and 24. The unconsolidated material there consists of thin beds of marine sand overlying clay and it is doubtful if they contain aquifers from which large quantities of ground water could be obtained. The depth to bedrock is not known in this area, but is assumed to be great.

In the vicinity of Gloucester Station, the depth of a number of water wells varies from 19 to 40 feet. These wells are all dug into the marine sand, a few of the deeper penetrating the underlying clay. All wells are non-artesian, that is, they obtain their supply of ground water from the zone of saturation below the water-table. The water is reported to be fairly hard but to be of sufficient quantity for all normal farm use.

Wells dug in that area mapped as sandy till are reported to be yielding a plentiful supply of ground water, but along the extreme south part of the road the marine sand beds are thin and wells have been dug into the underlying clay in an attempt to obtain a sufficient supply. This clay is exceptionally massive and interbedded sandy layers that might yield fair amounts of ground water are scarce.

ROAD BETWEEN CONCESSIONS III AND IV (RIDEAU FRONT)

This road runs southeast from the Ottawa city limits at the junction of the Metcalfe Road and the Hunt Club Road, through the community of Johnston Corners, to the south boundary of the township.

The Oxford formation directly underlies the drift along the entire length of the road except for 1 mile at its extreme north end where the shaly rocks of the Billings and Carlsbad formations have been brought to the surface by the Gloucester fault, a major structural feature of the underlying bedrock formations.

Little is known concerning the depth to bedrock along this road. Bedrock was reported 14 feet from surface in lot 9, con. III (R.F.), at the point where the upward projection of the Gloucester fault crosses the road, and at 20 feet in lot 15, con. IV (R.F.). The presence of a small but fairly deep valley in the bedrock surface is indicated at Johnston Corners. The school well in this community was drilled to a depth of 125 feet without encountering bedrock, although a well in lot 26, con. III (R.F.), about ½ mile west of Johnston Corners, was reported to have encountered bedrock at 10 feet.

Marine sand is the principal material exposed at the surface and also lies beneath the large swamps in lots 11 to 14 and 19 to 21. The depth and extent of these sands have rendered much of the land in the area unsuitable for farming. A number of sand dunes, the material for which was derived from the marine sand, occur in lot 9, con. III (R.F.). Farther south along the road, in lots 22 and 23, there is an irregular area of fluvioglacial sand and gravel. There is also a small area of glacial till in lot 7 along the north part of the road.

Many houses have been built recently along the extreme north end of the road near the Metcalfe Road. These homes are entirely dependent upon ground water for their water supply. In most instances, the wells that supply the necessary water are of the the dug type. They have all been reported as yielding sufficient quantities of ground water for normal domestic consumption. Some of the dug wells are extremely shallow (5 to 8 feet in depth) and have been described as 'springs' by the owners. Ground water seeping rapidly into the well from porous, saturated sand gives this effect. No information was obtained as to the thickness of the sand or of the type of material immediately beneath it, but if it is thin and underlain by clayey material or compact till the ground water at present being obtained may be perched and the supply not dependable. A perched water-table would form because precipitation falling upon sandy material sinks in rapidly and percolates downward until this movement is slowed down by the more impervious clay or till beneath to such an extent that the sand immediately above becomes saturated with water.

As the intake area for the ground water is local, it is inadvisable to construct storm sewers along the road where wells serve as the source of water supply. Storm sewers would tend to drain off much of the precipitation that would otherwise reach the water-table, which would be lowered as a result and the shallower wells fail.

The shaly bedrock formations that directly underlie the drift along the road north of the Gloucester fault are a poor source of potable ground water. One well in lot 6, con. III (R.F.), was drilled into bedrock to a total depth of 300 feet. It was reported to have yielded considerable quantities of ground water, but the hydrogen sulphide gas content of the water was so high that it was unfit for domestic consumption. It is thought that the hydrogen sulphide gas came from rocks in either the lower part of the Carlsbad formation or the Billings, both of which were penetrated by the lower part of the well. It was, accordingly, decided to cement the well off at a depth of 150 feet. The yield was not appreciably decreased and after considerable pumping the ground water was found to be sufficiently free of hydrogen sulphide gas to be satisfactory for domestic purposes.

Farther south along the road in lot 8, con. III (R.F.), two wells drilled into bedrock to depths of 129 and 131 feet, respectively, were reported to yield large quantities of ground water with only a faint odour of hydrogen sulphide gas.

The most northerly drilled well along the road south of the Gloucester fault is located at the Aladdin Drive-in Theatre in lot 10, con. III (R.F.). It was drilled to a depth of 115 feet and was reported to enter the Oxford formation at 95 feet. The water, which is under considerable hydrostatic pressure, is reported to come chiefly from gravel beds 15 feet thick immediately above the bedrock. A second drilled well, in lot 15, con. IV (R.F.), is a diamond drill-hole 50 feet deep, the last 30 of which is in bedrock. Despite the small reservoir capacity of this well, the supply of ground water was reported to be sufficient with the water level remaining fairly constant at 25 feet from surface. The occurrence of a well of this type must mean that there are aquifers in some beds of the Oxford formation capable of yielding considerable quantities of ground water to a pumping well. Such aquifers may lie along bedding planes but in this well it seems more likely to be open fractures along joint planes extending down from the bedrock surface and along which ground water can pass freely.

There is little information about the water supply of the small housing development in lot 16, con. III (R.F.), between the road and the Canadian Pacific Railway, along what is sometimes known as Pine Road. One household was reported to obtain a satisfactory supply of fairly soft ground water from a sand point driven approximately 10 feet into marine sand, the only material exposed in the area. It is believed that other homes in the vicinity derive their ground-water supply in a like manner. A deeper drilled well is reported to exist in the area but, if so, no information was obtained regarding it.

No water wells are known along the road from lots 17 to 21 inclusive. The overburden here consists of marine sand with large areas of swamp. The area is one of limited agricultural possibilities.

There appears to be no shortage of ground water in the area about Johnston Corners. The drift, consisting of both fluvioglacial and marine material, is yielding excellent supplies of ground water to a number of dug wells, and drilled wells are reported to be deriving plenty of ground water from the underlying Oxford formation. One well, in lot 24, con. III (R.F.), drilled 42 feet to bedrock, was reported to obtain considerable supplies of ground water from a zone immediately above bedrock and it is possible that much of the ground water obtained from wells drilled in this area is coming from this zone. No water wells drilled in this area is coming from this zone. No water wells were reported along the road between lots 28 and 30, at the south boundary of the township.

METCALFE ROAD (QUEEN'S HIGHWAY 31)

The Metcalfe Road or Queen's Highway No. 31 is the paved road that connects the city of Ottawa with the town of Morrisburg on the St. Lawrence River, approximately 48 miles to the south. In Gloucester township it runs southeasterly from the Ottawa city limits, in lot 6, con. IV (R.F.), across concession IV to a point about ½ mile north of the community of Leitrim. From there it runs along the road concession line, through the communities of Leitrim and South Gloucester, to the south boundary of the township.

Bedrock directly underlying the drift along the part of the Metcalfe Road in Gloucester township consists of the Oxford and Carlsbad formations. The Carlsbad underlies that part of the road north of a point about ½ mile south of the community of Leitrim, the rest being underlain by the Oxford formation. The drift is thin in many places from Leitrim south to the township boundary and there are numerous outcrops of bedrock. About half a mile north of Leitrim the drift begins to thicken rapidly, indicating the presence of a wide, shallow valley in the bedrock. Information received from a number of well owners would indicate that this valley is filled with glacial outwash material and extends from some distance north and east across the region. The west limit of the valley is probably the Gloucester fault, along which an irregular scarp apparently occurs. An examination of the elevations of bedrock in the area immediately north of Leitrim indicates that the bedrock surface drops off at least 100 feet within a distance of ½ mile. More work, chiefly inside the limits of the city of Ottawa, will be necessary before the width and length of the valley can be determined. The greater part of the drift exposed along the central and southern parts of the road, in the areas where bedrock is relatively close to surface, is glacial till. Overlying this till are small scattered areas of marine sand and clay too small to show on the Pleistocene map. North of this, along that part of the road that extends diagonally across concession IV (R.F.), the drift consists of fluvioglacial sand and gravel, overlain in part by beds of sand and gravel laid in the Champlain Sea.

In recent years, a considerable number of new homes have been built along the north end of the Metcalfe Road in Gloucester township. The occupants of these houses are entirely dependent upon ground water for their water supply. In lot 6, con. IV (R.F.), there are two drilled wells. Both wells, one of which is 85 feet deep, are reported to be deriving abundant ground water from beds of fluvioglacial sand and gravel beneath considerable thicknesses of marine clay. Farther south, in lot 8, drilled wells are reported to be obtaining their supply of ground water from a similar source. Here the aquifer is described as a coarse, black gravel underlying a finer, grey sand. Both materials contain plenty of ground water under pressure, and difficulty has been experienced during drilling in preventing the sand from entering the casing before the well is completed. In the most satisfactory drilled wells in this area the casing has been driven through the sand into the coarse gravel.

Owners of drilled wells that derive ground water from sand report that the sand enters at the bottom of the casing when the water level is lowered by excessive pumping. This is to be expected because it is mainly the pressure of the column of water inside the casing that prevents the sand from entering the well. Accordingly, when the height of the column is shortened the pressure on the sand in the bottom of the well is lessened, allowing it to rise into the well.

Many of the sand points and dug wells along the road between lots 6 and 11, con. IV (R.F.), are relatively shallow. The depths vary from 6 to 35 feet with an average of 21 feet. Many of the dug wells are lined with 30-and 36-inch concrete tile. These shallow wells are believed to obtain their supplies of ground water from the zone of saturation below the water-table, and, consequently, have been classified as non-artesian. As there is only 2 to 5 feet of water standing in these wells the sandy material in which they are dug must yield its water readily to pumping wells. Because of the abundance of ground water available at shallow depths, drilling for water should be unnecessary in this area.

It has been found that the more potable ground water along that part of the Metcalfe Road in lots 11 to 17, immediately north of the community of Leitrim, is recovered from till immediately above bedrock by shallow, dug wells. The minimum depth of the better wells in this area is 14 feet. There is apparently plenty of ground water in the underlying Carlsbad formation but it contains too much hydrogen sulphide gas to be satisfactory for domestic use. Wells drilled into bedrock in the vicinity of Leitrim are reported to yield water that is unsatisfactory for this reason, and also because of the presence of particles of clay so fine that they are difficult to filter out by ordinary methods.

These characteristics are common in ground water from the Carlsbad shale and cannot be corrected without undue expense. It was was reported, for instance, that there was no decrease in the cloudiness of the water after it had been filtered through 6 feet of fine sand.

The upward projection of the Gloucester fault crosses the road in lot 17 about $\frac{1}{2}$ mile south of the community of Leitrim. South of this point bedrock is near the surface and as a result, between lots 19 and 27, a relatively large number of wells are drilled into the Oxford formation, which underlies the drift along this part of the road. The ground water obtained from the Oxford in this area is described as hard and clear and to be under some hydrostatic pressure. Few wells dug in the overlying till, chiefly to bedrock, are reported to yield sufficient supplies of potable ground water.

Conditions are similar in the area about the community of South Gloucester, where information was obtained on several shallow wells dug in the till and some deeper ones drilled into the Oxford. Most of these wells, which supply water for both domestic and stock purposes, are reported to yield all the water required. Some of the wells were reported to be pumping considerable sand although the casing was supposed to be driven tightly into the rock. If so, it is probable that some parts of the surface of the underlying Oxford formation may be badly fractured. Sand may enter a well through any fracture immediately below the bottom of the casing. Numerous irregular fractures in the bedrock surface, especially in areas where the drift is thin, may preclude the accumulation of a satisfactory supply of ground water. Such fractures may penetrate deep into bedrock and give ready passage to surface water or water contaminated by nearby septic tanks. In the South Gloucester area, this danger is not great because septic tanks are few and widely separated. Elsewhere in more built up areas this condition may constitute a real threat to the health of the inhabitants. The danger may be avoided if the casing is driven into bedrock deeper than the deepest of the large fractures and thoroughly cemented. The source of the water for the small springs in South Gloucester that appear to issue from the till is thought to be the underlying bedrock, the intake area being the high ground about 1 mile to the north.

ROAD BETWEEN CONCESSIONS V AND VI (RIDEAU FRONT), (HAWTHORNE ROAD)

The Hawthorne Road runs southeasterly straight across the central part of the township from the Ottawa city limits to its south boundary. There is a gap in lots 24 and 25 where, because of the rough terrain, the road was not completed. The road was found to be impassable in lots 28 and 29.

The projection of the Gloucester fault would cross the road in lot 23 and north of this point bedrock directly under the drift is Carlsbad shale. South of the fault to the boundary of the township, beds of the Nepean, March, and Oxford formations, in that order, directly underlie the drift.

The thickness of drift along the road in lots 6 to 8 varies from 2 to 14 feet and the elevation of the bedrock surface ranges from 262 to 285 feet above sea-level. Farther south, in lots 13 and 15, the thickness of the overburden increases to 80 feet and the elevation of the bedrock surface falls to 217 feet in lot 13 and 211 feet in lot 15. In other words, the elevation of the bedrock surface has decreased 68 feet in $1\frac{1}{2}$ miles. This decrease is probably gradual rather than a sudden change at any one place. Nothing is known concerning the bedrock surface between lot 15 and the Gloucester fault. In the vicinity of the fault the drift is thin and outcrops are numerous.

The unconsolidated material exposed along the road is till at the north end at the city limits and marine clay overlain by various thicknesses of sand and swamp deposits in the central part. Till again occurs along the extreme south part of the road.

A few wells dug in the northern exposure of till are reported to be yielding excellent quantities of potable ground water. Most wells are dug to the surface of bedrock and some have actually penetrated its surface. The first few feet of bedrock is reported to be soft and easily dug. A well dug in this area 14 feet deep, encountered bedrock at 4 feet, and is reported to be supplying the needs of an entire farm.

There is no shortage of ground water between lots 9 and 15, where the drift consists of extensive beds of sand overlying clay. In this area, the wells are all of the shallow, dug type, ranging from 6 to 14 feet in depth, and are reported to be obtaining their ground water from saturated sand beds directly overlying the clay. The ground water, when encountered, was not under pressure and the wells have been classified as non-artesian. No intermittent wells were reported. The well at the Roman Catholic school in lot 15, con. V (R.F.), was constructed by driving a small diameter pipe through the clay to bedrock. Ground water under sufficient pressure to reach within a few feet of surface was encountered at the contact of clay and bedrock.

Because of the poor quantity of the soil and the consequent lack of farms, only a few wells occur between lots 16 and 30 at the south boundary of the township. These are all of the shallow, dug type and are reported to be yielding sufficient quantities of potable ground water for domestic use and for small farms.

BASE LINE ROAD

The Base Line Road runs south of the community of Ramsayville to the south boundary of Gloucester township. North of Ramsayville, it extends a distance of approximately 1 3/4 miles. It separates Rideau Front from Ottawa Front.

Bedrock directly underlying the drift along the Base Line Road is composed entirely of the Carlsbad formation, except for a small area at the south end where the Nepean sandstone is brought up by the Gloucester fault, which crosses the road in lot 29.

A shallow, drift-filled valley apparently exists in the bedrock surface at the north part of the road, and in it few wells have been drilled to bedrock. This is part of a wider valley in the bedrock surface that underlies the area between Ramsayville and Blackburn in the north-central part of the township. Bedrock was reported at a depth of 165 feet in lot 9, con. VI (R.F.), at a point about ½ mile south of Ramsayville, and at depths of 157 and 138 feet in lot 12, about 3/4 mile farther south. The bedrock surface rose about 30 feet in elevation in this 3/4 mile.

Drift is thick along the southern part of the road. In lot 23, con. VI (R.F.), bedrock was reported at 60 feet but this figure is of doubtful accuracy. In lot 20, con. VI (R.F.), in the immediate vicinity of the Gloucester fault, bedrock was reported in two drilled wells at a depth of 97 feet, which corresponds to an approximate elevation of 170 feet above sea-level.

The unconsolidated material exposed along the road consists of sand overlying marine clay. The sand beds are particularly extensive in lots 13 to 15 and 17 to 24. All wells dug in these areas supply adequate quantities of ground water, chiefly from saturated sand beds lying immediately above the clay. Wells dug in areas where the sand is thin, and which are dependent, in part, upon the clay as the source of their water supply, are deeper than those in the more sandy areas. Farm wells dug in the clay should be at least 22 feet deep, in order to take full advantage of the maximum lift of the shallow well pumps generally in use in the area.

Sand is the chief source of ground water for wells of the shallow, dug type along the road between lots 21 and 30, con. VI (R.F.). Quantities of potable ground water sufficient for the needs of the present owners are generally obtainable from this material. Much larger supplies of ground water could probably be obtained from the sand if the need ever arose.

The most important aquifer for wells drilled along this road and the one from which the largest quantities of ground water are obtained is the 'black gravel' lying between bedrock and considerable thicknesses of marine clay. Wells obtaining their ground water from these gravels are located along the north end of the road between lots 7 and 14. The water was reported as being under considerable pressure when first encountered and to be sufficiently salt to be disagreeable to humans but not enough to be objectionable for stock purposes. The pressure exerted on the water in this aquifer is believed to be due, in part, to the presence of considerable volumes of inflammable gas. Some well owners report that there was sufficient gas present where the well was first drilled for it to be ignited and burn for some time with a reddish blue flame. This gas is believed to be the accumulation of gas seepages from the underlying bedrock formations into the porous materials immediately beneath the impervious capping of marine clay.

A well reported to have been drilled in 1900 and 1901 to explore the oil and gas possibilities in the area is located in lot 18, con. VIII (O.F.), near the Base Line Road, on what is now the farm of C. R. Nicholson. Little is known about this particular well except that it was drilled to a depth of 1,744 feet and then abandoned when it was thought that all the bedrock formations likely to contain oil and gas had been penetrated.

The gravel beds between the clay and underlying bedrock are reported to average 18 feet in thickness. They are thought to be glacial outwash material, similar in origin to gravel beds immediately overlying bedrock in other parts of the township. The generally dark colour of the material is due to the predominance of grey and black shale fragments derived from local bedrock formations.

The following is a summary of the depths in feet of wells along the Base Line Road:

	Dug		Drilled
	Sand	Clay	
Min.	6	7	80
Max.	16	24	208
Ave.	10	16	131

MONTREAL ROAD

The part of the Montreal Road described in this report runs east from the Ottawa city limits in l t 20, con. I (O.F.), to the village of Orleans in lot 4, cons. I and II (O.F.). The area discussed in this section includes Hiawatha Park and the Vehicle Proving Grounds of the Department of National Defence. A brief report on the water supply of the Proving Grounds was prepared by B. R. MacKay[1] in 1944.

Although the Montreal Road roughly parallels the strike of the underlying Palaeozoic bedrock formations, the orderly sequence of these formations is much disturbed by faults, as a result of which at least four different bedrock formations directly underlie the drift along the road. At the extreme east end bedrock at the village of Orleans is partly the Oxford and partly the Rockcliffe formations. West of Orleans, bedrock is the Rockcliffe and Ottawa formations with small areas of St. Martin.

The relief of the bedrock surface is relatively great. Two drift-filled valleys are indicated by wells separated by an area where the bedrock outcrops or is thinly covered. One valley is believed to exist beneath lots 5 and 6, about $\frac{3}{4}$ mile east of the Vehicle Proving Grounds. In this area, a well drilled in lot 5, con. II (O.F.), encountered bedrock at a depth of 180 feet and a second well in lot 6, con. II (O.F.), at a depth of 192 feet. The elevations of the bedrock surface in these two wells are 37 and 21 feet above sea-level respectively. The second valley is thought to occur beneath lot 17, where two wells drilled to depths of 237 and 220 feet failed to encounter bedrock. If this information is correct, and there is no reason to believe it is not, bedrock surface beneath the deeper hole would be no higher than 7 feet below sea-level. This is the lowest elevation found for the bedrock surface anywhere in the township. Little information was obtained as to the size of these valleys but they appear to have a

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[1] MacKay, B.R.: Possible Sources of Water Supply at the National Defence Proving Grounds, Orleans, Ontario; Geol. Surv., Canada, Dec. 1944.

general southerly trend and may connect with the shallower valley believed to occur in the east-central part of the township under the Borthwick and Russel Roads.

Numerous outcrops of the Ottawa formation occur in the area between the two valleys, and in this area lies much of the Vehicle Proving Grounds.

In lot 18, the bedrock surface rises from east to west some 130 feet in $\frac{1}{4}$ mile, and west of these in lots 19 and 20 along the Montreal Road the drift is thin and outcrops numerous.

The unconsolidated materials exposed along the Montreal Road consist chiefly of various thicknesses of sand overlying marine clay. In the wide, flat plain between Ottawa River and the irregular, north-facing bluff, which, in places, closely parallels the road, the sand overlying the marine clay is thin. The drift is clay till in lots 10 and 11 and 19 and 20, where bedrock is close to the surface. Considerable sand is exposed along the south side of the road between lots 4 and 7 and extends southerly in a wide band across the Vehicle Proving Grounds to the Blackburn Road.

Many wells occur along the road between lots 5 and 10, which includes the area between the village of Orleans, the Vehicle Proving Grounds, and Hiawatha Park on Ottawa River. Most of the wells in this area obtain water from the drift, which in this area consists of south of the road and a flat clay plain north to Ottawa River. The clay contains interbeds, of silt and sand and gravelly material below the clay lying directly on bedrock, and these are the chief aquifers supplying water to the wells. Most of the wells are dug or bored and are reported to be capable of yielding fair supplies of soft, sulphurous water.

Some of the wells drilled into the gravel beds beneath the clay have encountered ground water under sufficient pressure to form flowing-artesian wells. Wells of this type occur between the extensive areas of sand mentioned above and Ottawa River. It is thought that the sand is the intake area and its greater elevation provides the hydraulic head for the flowing-artesian wells to the north. The sandy area is the source of a number of small streams draining toward the Ottawa and evidently contains plenty of ground water. The sand beds do not, however, appear to be sufficiently thick for the development of large water supplies by drilled wells. A much better location for such wells would be in the flat clay area below the bluff immediately north of the road.

During the summer of 1951, measurements were made of the quantity of water issuing from some of the flowing-artesian wells in Gloucester township. These measurements are given in table on page 100 of this report.

Ground water from the drift between lots 5 and 10 is reported to be of better quality than that from the underlying bedrock. The result of this is that most wells along this part of the road are of the shallow, dug type. Only two wells, both in lot 10, are definitely known to have penetrated bedrock, and the ground water from both is reported to be soft but to have too high a content of dissolved minerals to be fit for drinking. One well, drilled to a depth of 308 feet at the Holy Rosary Scholasticate, is believed to have encountered the Ottawa and Rockcliffe formations, and possibly the underlying Oxford. The second well, used by personnel at the Vehicle Proving Grounds, was drilled to a total depth of 250 feet. It was reported to have penetrated 110 feet of clay and sand and 140 feet of the Oxford formation. The water is not suitable for drinking or domestic use.

The Ottawa formation is close to surface in lots 11 and 12 and, consequently, all but two wells along the road in this area are drilled into bedrock. The potability of the ground water derived from bedrock in this locality is much better than that farther east and it is used extensively for both domestic and farm use.

The thickness of the drift increases considerably in the immediate vicinity of Green Creek and all wells in this area, with the exception of one, are dug or bored into the clay. The depths of the dug wells range from 7 to 30 feet with an average of 20 feet. Bored wells vary from 27 to 42 feet in depth and, although only approximately 12 inches in diameter, are reported to yield potable water in sufficient quantities. Most of the water yielded by wells in the clay is believed to be derived from interbedded silty and sandy layers. In other parts of Gloucester township where such layers are infrequent or absent satisfactory supplies of ground water may not be obtainable from shallow wells. The only drilled well in this locality was reported to be 355 feet deep with bedrock encountered at a depth of 136 feet. The water was reported to be soft but too saline for drinking.

The most satisfactory supplies of ground water in lot 16 come from comparatively shallow wells dug or bored into marine clay. Wells drilled into bedrock or into gravel beds immediately overlying bedrock are reported to be yielding ground water with an extremely high mineral content. Ground water derived from the bedrock is rarely used but that from the overlying gravel beds is used for stock purposes in some places. This suggests that the salinity of the ground water from the ground is not as high as that from bedrock.

In lot 17, two wells drilled to depths of 237 and 220 feet, respectively, were reported to obtain large quantities of ground water from gravel beds beneath approximately 175 feet of clay. The water was reported as soft and sufficiently potable for drinking.

The elevation of the bedrock surface rises westward across lot 18 and the drift is, consequently, thin along the Montreal Road in lots 19 and 20, bedrock being exposed in many localities. Sufficient ground water for the average house is yielded by wells drilled along this part of the Montreal Road as well as in the subdivision to the north known as Rothwell Heights. However, the quantity of ground water available is not unlimited, and care is exercised by well owners to assure an adequate supply at all times. The depths of twelve wells in Rothwell Heights for which information was gathered range from 110 to 312 feet, with an average of 179 feet. The Ottawa formation outcrops in this part of the township but two deep wells, drilled to depths of 308 and 312 feet in Rothwell Heights, are believed to have penetrated to the underlying Rockcliffe formation before sufficient supplies of ground water were obtained. The first beds to be encountered in the Rockcliffe consist of greenish shale. Ground water was reported to occur in limestone beds of the Ottawa formation directly above the shale as well as in sandy beds of the Rockcliffe beneath it. Bedrock in this area has a shallow dip to the south and it has been suggested that the ground water contained in the Rockcliffe is influent seepage from the Ottawa River percolating southward down the dip of the beds. The writer believes this unlikely because the Rockcliffe does not outcrop along the river but is covered by thick beds of impervious marine clay.

Supplies of ground water occurring in the bedrock, in lots 19 and 20, are limited, probably because that locality is cut into blocks by several closely spaced vertical faults, each of which forms an effective seal against the movement of ground water. Each fault block must, therefore, rely upon local precipitation for the replenishment of its ground water supply and cannot draw from some more distant source.

A well about $\frac{1}{4}$ mile south of the Montreal Road, in the Cardinal Heights subdivision, close to the east limits of the city of Ottawa, was drilled to a depth of 300 feet. It was reported to be a large capacity well intended by the owners for use as a 'master well' to supply several homes in the new subdivision.

Most wells along the Skead Road, which runs north from the Montreal Road to Ottawa River immediately east of the Ottawa city limits, are of the shallow, dug type. These wells are all reported to obtain satisfactory supplies of ground water from the marine clay. Two wells drilled to depths of 125 and 150 feet were reported to derive large quantities of potable ground water from the Ottawa formation.

ROAD BETWEEN CONCESSIONS II AND III (OTTAWA FRONT)

This road, sometimes known as the Blackburn Road, crosses the north part of the township in a northeasterly direction from the Ottawa city limits to the east boundary of Gloucester township. It intersects the Navan Road in lot 11.

Along the east part of the road between lots 1 and 12 the drift is underlain by the Ottawa formation and farther west by the Billings. The contact between these two bedrock formations is a southeasterly trending fault that crosses the road in lot 12[1]. The Carlsbad formation, which overlies the Billings, occurs only beneath that part of the road inside the limits of the city of Ottawa.

Depths to bedrock range from zero in the area between lots 1 and 7, where bedrock outcrops at the surface, to 118 feet in the vicinity of Blackburn where the fault described above is reported to occur. Elevations of the bedrock surface along the road between lots

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[1] Wilson, A.E.: Ottawa Sheet, East Half; Geol. Surv., Canada, Map 413A, 1938.

8 and 10 indicate a drop to the west of approximately 100 feet within 1 mile. This is believed to be caused by a steep bluff on the bedrock surface, possibly at the trace of the fault. Information from drillers and comparison of the chemical qualities of the ground water yielded by wells drilled into bedrock suggest that the strike of the fault changes abruptly from southeast to east immediately south of the road near Blackburn.

There is probably also an east-facing bluff in lots 18 and 19, for the elevation of bedrock surface drops from 182 to 119 feet above sea-level within a distance of $\frac{1}{2}$ mile. Bedrock outcrops immediately west of this bluff in the vicinity of Green Creek. The valley in the bedrock surface between the two bluffs is 100 to 130 feet deep and is reported to be filled with marine clay except for minor amounts of outwash sand or till at the contact of overburden and bedrock. Between Green Creek and the Ottawa city limits the thickness of the drift varies from 18 to 40 feet.

The unconsolidated material exposed along the road is chiefly marine clay overlain, in some areas, by thin, irregular beds of marine sand. The eastern limit of the sand is lot 8 where the bedrock exposed to the east dips under the overburden. Sand appears on the surface from lot 8 west to the vicinity of Blackburn where it reaches a thickness of approximately 12 feet. Till is exposed along the east part of the road between lots 1 and 8 where bedrock outcrops or is relatively close to surface. Till and occasional deposits of marine clay also occur at the west end of the road near the Ottawa city limits.

The type of well found along the east part of the road, from lots 1 to 6, depends to a considerable extent on the proximity of bedrock to the surface. Most wells are of the shallow, dug type and are bottomed on bedrock. Ground water is reported to enter the well at the contact of the overburden with bedrock. Some wells were reported to obtain limited supplies of ground water from the drift. Although the drift directly above bedrock has been mapped as till and the surface exposures look like till, many well owners reported that it was necessary to dig through clay encountering bedrock. It is believed that this material is chiefly clay till some of which may be comparatively free of boulders and rock fragments. In some localities thin layers of clay were reported to overlie till-like material.

Some wells dug in localities where the drift is over 20 feet thick were reported to have encountered thin beds of sand lying immediately above bedrock. Excellent supplies of ground water are obtained from some of these sandy beds, and it may be under sufficient pressure to rise some distance in the well. One well 20 feet deep, in lot 2, con. II, was reported to flow during the spring. These sand beds are probably not continuous and will not be encountered in all wells.

Wells along the east end of the road that have proved to be intermittent are not sufficiently deep. To assure a greater supply of ground water, such wells, and wells that have been described as 'low in summer', should be deepened. The most opportune time to do this is generally late in the summer when the water-table is at its lowest point.

The following is a summary of the depths, in feet, of the shallow, dug wells along the road from lots 1 to 6 inclusive:

	Clay	Clay till	Contact, overburden and bedrock	Intermittent wells
Min.	6	7	8	6
Max.	16	12	20	11
Ave.	11	10	12.5	9

A number of flowing-artesian wells follow a line parallel with the road about ½ mile south of it on a flat, clay plain. These wells were constructed by the owners to supply water for their cattle in the fields and are formed by driving a small diameter pipe through the clay to the bedrock surface. They were reported as flowing-artesian, but when examined in September 1952 most of the wells were not flowing although the surface of the water was only a few feet below ground level.

Hard, clear water in limited amounts was reported as being obtained from three wells drilled into bedrock along the road between lots 1 and 6. The casing in these wells has apparently been driven sufficiently tight into bedrock to prevent ground water from entering the well at or near bedrock surface. The water is, consequently, being derived from minute cracks along bedding and joint planes in the massive limestone, none of which is sufficiently large to transmit much ground water. A brief description of the wells drilled in this area is as follows:

No.	Owner	Lot	Con.	Depth of well (feet)	Depth to bedrock (feet)
(1)	A. Parisien	3	III(O.F.)	68	1
(2)	E. Ouilette	3	III(O.F.)	60	20
(3)	N. Groulx	4	III(O.F.)	70	0

A few, shallow wells, in the area where bedrock is relatively close to surface, were dug to bedrock and then further deepened by blasting into the rock. The depths of such wells range from 10 to 12 feet. They are reported to supply quantities of ground water sufficient for normal domestic and farm use.

There are few wells along the road between lot 7 and the junction of the Blackburn and Navan Roads. This is mainly because much of the land north of the road in lots 9 and 12, con. II (O.F.), is occupied by the Vehicle Proving Grounds of the Department of

National Defence and because the occurrence of extensive deposits of sand render the area as a whole unsuitable for farming and truck gardening.

Much ground water is reported to occur in the sand immediately above its contact with the marine clay, but it has proved difficult to construct a well sufficiently deep in this sand to obtain satisfactory supplies. Most of the sand is saturated with ground water and is so fluid that it is difficult to dig a well deep enough to obtain a supply of water. An example is the well located at the Blackburn Protestant School. This well was dug in sand and lined with 30-inch diameter, concrete tile. At 12 feet the sand flowed into the well so fast that further digging was impossible and only a limited supply of water was obtained.

Information was obtained on some forty-four wells in the undulating clay-sand plain that extends from Blackburn west to Green Creek. Some of the homes located in lot 13, con. II (O.F.), north of the road, along the top of a 20-foot clay bluff, have difficulty obtaining sufficient quantities of ground water from wells dug in the clay. Larger supplies of ground water could have been procured for these houses had the wells been sited back farther from the edge of the bluff. The surface material becomes more sandy north of the bluff, which, from examples in other parts of the township, would suggest that more ground water would be available there. Furthermore, the water-table should be closer to the surface away from the bluff. Wells there should be dug as deep as possible to create a reservoir of free water large enough to lessen the chance of a ground-water shortage during dry periods or when more than ordinary amounts were required.

In lots 14 and 15, considerable quantities of ground water are being derived from shallow deposits of sand overlying clay. Many of the wells in this area are in the cellars of the houses, which suggests that the supply of ground water is plentiful. Farther west, in lot 15, wells have been dug through thin sand beds into clay. The well has then been deepened by augering a hole into the clay at the bottom of the well, thus creating a larger reservoir of free ground water. The need for such a reservoir does not necessarily mean a lack of ground water in the area but rather that the material exposed on the sides of the well will not yield its water readily.

In lots 16 and 17, the beds of sand overlying the clay are very thin and discontinuous. The best wells are where the sand is thickest. A few shallow wells dug where there is little or no sand are reported to be intermittent and a well 6 feet deep in lot 17, dug in clay, was reported to be dry.

Farther west between Green Creek and the Ottawa city limits, shallow, dug wells are reported to be deriving their water supply from the contact of the drift and bedrock.

Except for that part of the road immediately west of Blackburn, bedrock directly underlying the drift between Blackburn and Green Creek is not a good source of potable ground water. A well 75 feet deep in lot 12, con. II (O.F.), near Blackburn, encountered Ottawa limestone at 50 feet from surface. The hard, clear water yielded by this well is reported to be coming entirely from the bedrock. Just west of there in lot 13, con. III (O.F.), a well drilled 106 feet encountered black shale of the Billings formation, and yields water that is brownish in colour and has a strong odour of hydrogen sulphide gas. It is used for stock purposes only. A well in lot 15, con. III (O.F.), still farther west, reported to have been drilled to a depth of 230 feet, is yielding water with a saline taste and a distinct odour of hydrogen sulphide gas. Two of the deepest wells drilled for water in Gloucester township are along the Blackburn Road. One, in lot 19, con. II (O.F.), was reported to have been put down to a depth of 332 feet. Bedrock, consisting of brownish shale, was encountered at 84 feet but the rock in the bottom part of the well was reported to be grey limestone. The ground water yielded by this well is clear and fairly soft. A second well, on the farm of Emerson Woodburn in lot 21, con. II (O.F.), was drilled to a reported depth of 709 feet. No information was obtained about this well except that it yields unlimited supplies of soft, clear ground water.

It should be noted that the ground water derived from the bedrock directly under the drift along the road west of Green Creek does not contain hydrogen sulphide gas, which renders much of the ground water derived from bedrock farther east unpalatable. It may be that the Carlsbad formation occurs here instead of the black shale of the Billings formation.

Wells drilled to bedrock in lot 22 were reported to have encountered ground water under considerable pressure in sand beds between marine clay and bedrock. The pressure of the water was sufficient to force the sand considerable distances up into the casing, thus rendering it difficult to obtain sufficient supplies of ground water. To overcome this difficulty, the casing in most wells has been driven tightly into bedrock. This procedure although effective in shutting off the sand also shuts off the water contained in this material. Consequently, the ground water delivered by such wells must come from bedrock and is mostly poorer in quality than that contained in the sand.

CYRVILLE ROAD

The part of the Cyrville Road described in this report extends in a southeasterly direction from the community of Cyrville across con. II (O.F.), to its junction with the Blackburn Road in lot 22. The length is approximately 1 3/4 miles.

The drift is comparatively shallow with bedrock, consisting entirely of the Billings formation, reported to lie at depths ranging from 20 to 43 feet.

The drift consists of till overlain with thin, irregular beds of clay and sandy clay. The gravelly character of the till makes it a fair source of ground water and, consequently, wells dug in this material can be expected to yield satisfactory supplies from relatively shallow depths. The sandy clay also yields dependable supplies of ground water to pumping wells.

Bedrock surface is flat with a relief of only 17 feet in 1 mile. It has been penetrated along the road by six drilled wells. The shallow wells yield ground water containing considerable quantities of hydrogen sulphide gas but the deeper wells provide water reported to be soft with only faint traces of hydrogen sulphide. It is possible that the black shales of the Billings formation, which directly underlie the drift along this part of the road and which are considered to be the chief bedrock source of hydrogen sulphide gas, are thin in this area. If this is the case, the deeper wells have doubtless passed through the Billings and are obtaining their ground water from the underlying Carlsbad formation.

Bedrock in this area is not a good source of ground water. The deepest well, which penetrated bedrock, was drilled to a depth of 140 feet and was reported as intermittent.

The following is a summary of the depths of wells and the depths to bedrock, in feet, along the Cyrville Road:

	Dug wells Depth in feet		Drilled wells Depth in feet	Depth to bedrock in feet
	In sandy clay	In till	In bedrock	
Min.	8	5	72	20
Max.	13	22	140	43
Aver.	10	10.5	102.5	27.5

NAVAN ROAD

The part of the Navan Road described in this report starts in lot 15, con. II (O.F.), immediately west of the Proving Grounds, and crosses cons. II, III, and IV (O.F.), in a southeast direction to the east boundary of Gloucester township in lot 1, con. IV (O.F.).

Bedrock directly underlying the drift throughout the length of the road has been mapped as the Ottawa formation[1]. However, the presence of considerable quantities of hydrogen sulphide gas in the ground water yielded by wells drilled into bedrock in the vicinity of Blackburn suggests that the drift there is underlain directly by the Billings. It is possible that in this area there has been a change in the direction of the fault separating the Billings and Ottawa formations.

Few wells have been drilled to bedrock along the road and, consequently, the thickness of drift in most localities is unknown. In the vicinity of Blackburn, depths to bedrock are reported to range from 50 to 188 feet, being greatest in lot 10, con. III (O.F.). No bedrock outcrops were observed.

[1] Wilson, A. E.: Ottawa Sheet, East Half; Geol. Surv., Canada, Map 413A, 1938.

Marine sand is the chief unconsolidated material exposed along the road. It is particularly extensive between Blackburn and the east boundary of the township. Some of the deeper wells dug along this part of the road were reported to have encountered clay beneath the sand. The sand beds decrease in thickness northwest of Blackburn and clay is close to surface at many places.

In con. IV (O.F.), the Navan Road extends southeast from the north edge of lot 5 to the centre of lot 1. Information was obtained on many dug wells along this part of the road, all of which obtain their water supply from sand overlying clay. About 50 per cent of these wells were reported to have been dug to the top of the clay beds. Most of the remaining wells did not reach the clay, chiefly because of difficulties in attempting to pass through the zone of saturated sand immediately above it. It was necessary to dig the well into the underlying clay only where the sand covering is thin.

Most of the water supplying these wells comes from the lower few feet of sand immediately above the clay where much of the sand is completely saturated with water. The few wells that have penetrated the clay are reported to obtain limited quantities of water from cracks extending down into it. In some areas the part of the clay beds immediately under the saturated sand has been reported as soft and fluid but in most instances it is solid.

The wells are all non-artesian, that is the source of the ground water is the zone of saturation below the water-table. There is no evidence that the water is perched although in some instances it may be considered as 'semi-perched', where the downward movement of the ground water through the sand has been so slowed by the relatively impervious clay that the water-table is slightly higher than it would be if no clay were present.

The quality of water from these wells was reported to vary from soft to medium hard with no offensive odour except from poorly constructed wells.

The quantity is sufficient for a normal household and no pressure systems were noted along the road. About half the wells are pumped by hand and the remainder bailed.

Thickness of sand overlying marine clay (in feet)
lots 1 to 5, con. IV (O.F.)

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Min.	6	9	5	4	2
Max.	9	10	13	9	2
Aver.	7.5	9.5	9	6.5	2

Depths of 51 dug wells (all in sand), in feet,
lots 1 to 5, con. IV (O.F.)

Min.	4.5
Max.	18
Aver.	9.5

No drilled wells were reported along the road. This is because satisfactory quantities of potable ground water can easily be obtained from the less expensive, shallow, dug wells.

Most wells located along the Navan Road between lots 6 and 10, con. III (O.F.), are similar to those previously described between lots 1 and 5, con. IV (O.F.). The material exposed on the surface is predominately marine sand overlying clay. Ground-water supplies are chiefly obtained from wells dug into saturated sand beds immediately above the clay. The depths of these dug wells range from 9 to 17 feet, with an average of 13 feet.

Near Blackburn, several wells have been recently drilled to bedrock to obtain ground water for some houses under construction. In most instances the water is unsatisfactory for domestic use because of the hydrogen sulphide gas associated with it.

A general log of the wells drilled in the area about Blackburn is as follows:

Feet		
0 to 12	....	sand; some water
12 to 30	....	red clay; no water
30 to 110	....	blue clay; no water
110 to 120	....	hardpan; no water
120 to 123	....	fine, white sand; little water
123 plus	....	black shale; water with hydrogen sulphide gas

Two drilled wells in lots 11 and 12, con. II (O.F.), northwest of Blackburn, are reported to obtain excellent supplies of hard, clear ground water from the bedrock directly underlying the drift. It is believed these wells were drilled into the Ottawa formation whereas the Billings was encountered in those wells whose waters contain hydrogen sulphide gas.

The occurrence of ground water along the Navan Road between lots 11 and 15, con. II (O.F.), is limited. The unconsolidated material exposed along this part of the road consists of thin beds of sand overlying clay, which, in turn, is thought to overlie rocks of the Ottawa formation. Only three wells are known along this section of the road; all are dug and one has been reported as intermittent.

ROAD BETWEEN LOTS 6 AND 19, CONCESSION III (O.F.)

This road extends from its junction with the Navan Road in lot 6 southwest along the boundary between cons. III and IV (O.F.), to lot 10, and hence west across con. III to lot 19 where it joins the Blackburn Road in the vicinity of Green Creek.

The Billings formation underlies the drift along the entire length of the road. Elevations of bedrock surface, ranging from 128 to 137 feet above sea-level, were computed for some wells drilled in lots 11 and 12, and are slightly lower than those in the floor of the shallow valley believed to lie beneath the Blackburn Road about 1 mile to the north. The thickness of the overburden along the road is about

90 feet.

Overburden along the road consists of water-laid material, chiefly marine clay overlain by irregular beds of sand. Clay is the dominant material exposed between lots 6 and 9 farther west; sand is more common and reaches its maximum extent between lots 16 and 19. Clay is again exposed in the valley of the east branch of Green Creek in lots 15 to 18. Beds of outwash gravel, up to 5 feet, were reported between the marine clay and underlying bedrock in some localities along the road.

Sand is the chief source of ground water for the dug wells. The shallower of these wells reached the underlying clay but few of the deeper wells, because of the fluid condition of the saturated sand, reached the clay. The thickness of the sand beds varies greatly. In lot 13, they are reported to be at least 23 feet thick but in lot 14 to be only 10 feet thick. The water from the sand is clear and fairly hard and there is enough to satisfy the demands of normal usage. Little ground water was reported from the clay.

Several small springs or seeps issue from the contact between the sand and underlying clay in the valley of the east branch of Green Creek. The aggregate flow of these seepages is sufficient to maintain small stream during the greater part of the year.

Information is limited concerning two drilled wells in lots 6 to 7, con. IV (O.F.), but the water from these wells, whose depths were reported as 150 and 300 feet respectively, contains considerable quantities of hydrogen sulphide gas. It is, accordingly, assumed that both wells are in Billings shale from which at least part of the water is derived.

Most wells drilled to bedrock are in lots 11 and 12. The quality of the ground water has been variously described as soft, hard, saline, and containing considerable quantities of hydrogen sulphide gas.

It is believed that the water contaminated with the hydrogen sulphide is derived chiefly from bedrock whereas the other water is chiefly from gravel beds lying between the clay and bedrock. The quality of this ground water is similar to that yielded by gravel beds drilled to the south along the Russell and Baseline Roads.

The log of one well in lot 11, the water from which was reported as saline, is as follows:

Feet	
0 to 85	clay
85 to 90	gravel with saline water
90 plus	bedrock

The gravel beds underlying the clay do not always contain ground water. On one farm in lot 14 four dry wells were drilled into the gravel.

A well located in lot 18, con. III (O.F.), at the junction with the Blackburn Road, was drilled to a depth of 156 feet with bedrock reported at 100 feet. The water from this well is clear but saline, suggesting that it is coming from gravel beds beneath the clay rather than from bedrock.

SECOND RIDGE ROAD

This is a short, well populated road that crosses the east-central part of Gloucester township westerly from lot 7, con. V (O.F.), to lot 15, con. IV (O.F.), about $\frac{1}{2}$ mile south of Blackburn Station. The road has been called 'Second Ridge Road' primarily to differentiate it from the Ridge Road (Borthwick Road), which parallels it about 1 mile to the south. Both roads are similarly situated along the top of a north-facing bluff on the north side of parallel sand-covered ridges.

Bedrock directly underlying the drift along the entire length of the road consists of the Billings formation, but no outcrops are known.

Overburden exposed along the road consists chiefly of marine clay overlain by irregular beds of sand. The thickness of the overburden as indicated from the log of a well drilled in lot 11, con. V (O.F.), is about 180 feet. Clay is close to the surface at the east end of the road but is overlain by thick beds of sand along that part west of lot 12. The extent of the sand there is comparable with that of the sand exposed along the Ridge Road to the south.

The same difficulties are met in obtaining a satisfactory supply of ground water along the 'Second Ridge Road' as in other areas where sand beds overlie relatively impervious marine clay. The sand immediately above the clay is frequently saturated with water and flows into the well making it difficult to reach a depth where a sufficient supply of ground water can be obtained. It was also reported that in some wells where the tile lining was placed directly on the clay, a considerable part of the ground water in the overlying sand was prevented from entering the well. This problem could be solved to a great extent by the use of well screens.

A number of intermittent, dug wells occur along the east end of the road where the sand deposits overlying the clay are thin. In such wells the water-table probably drops in times of drought to a point where there is insufficient permeable material, saturated with water, exposed on the sides of the well to yield adequate supplies of water. To overcome this difficulty these wells should be deepened, into the clay if necessary, and thus create a larger reservoir of free water that would be available when needed.

No wells were reported to derive their entire supply of ground water from clay. Large quantities of ground water were reported to be available in the thick sand beds west of lot 12. Several small springs and seeps, which usually indicate the contact of sand and underlying clay, occur along both flanks of the ridge. Most of these have not been plotted on the accompanying map.

Thickness of sand along the Second Ridge Road

(Feet)

Lot	8	9	10	11	12	13	14	15
Min.	2	9	No	5	8	No	5	9
Max.	3	9	inform-	11	11	inform-	5	9
Aver.	2.5	9	ation	7.5	7.5	ation	5	9

Depths of wells along the Second Ridge Road (all in sand), in feet

Min.	7
Max.	15
Aver.	11

Only one drilled well is known along the Second Ridge Road. This well, in lot 11, con. V (O.F.), was reported to be 200 feet deep with bedrock at 180 feet. Although the quality of the ground water is saline it is considered adequate for watering stock but not sufficiently potable for drinking. Overburden encountered in this well consisted of 175 feet of marine clay overlain by 5 feet of sand. The absence of hydrogen sulphide gas, generally associated with ground water from the black shales of the Billings formation, suggests the source of the water to be either the Carlsbad formation or gravel beds lying above the Billings. Gravel was not mentioned in the log of the drilled well and it is, therefore, assumed that the Billings formation is thin and the well has reached the Carlsbad.

RIDGE ROAD (BORTHWICK ROAD)

This road crosses the east-central part of Gloucester township in a westerly direction from lot 8, con. VI (O.F.), to the

Ottawa city limits in lot 1, con. VI (R.F.). Its west end is about $\frac{1}{2}$ mile southeast of the community of Hawthorne. Most of the road lies along the north edge of the crest of an elongated sand ridge.

Rocks of the Carlsbad formation directly underlie the drift along the entire road but no outcrops are known.

Except for small areas where the sand is thin and clay near the surface in lots 13, 14, and 15, at the extreme west end, the overburden consists of extensive beds of sand overlying marine clay.

There is no shortage of ground water along the east end of the road where the sand is thick. One well, dug 15 feet in the sand, was reported to yield sufficient quantities of potable ground water for both domestic and farm use. Numerous small springs and seeps along the bottom of the bluff on the north side of the ridge indicate the presence of substantial quantities of ground water. The sand overlying the clay is, however, thin in parts of lots 13, 14, and 15, con. V (O.F.), and it is in this area (lot 14) that the only intermittent well was reported. This well was dug 20 feet almost entirely in marine clay. In lot 16, the thickness of the sand is only about 4 feet, and shallow wells here must be dug some distance into the clay to form a large enough reservoir of free water to provide adequate supplies of ground water.

Depths of dug wells along the east half of the road between lots 8 and 15 range from 10 to 30 feet with an average of 14.5 feet.

Satisfactory supplies of ground water are reported from shallow wells dug in the drift along the west end of the road between lot 17 and lot 1, con VI (R.F.). Most of the water is from saturated sand beds immediately above the clay. Some wells have reached the clay, but in most instances the sand was reported to be too fluid to permit digging the well more than a few feet into it. In the spring the ground along the lower edges of the bluffs, where the contact of the sand and the underlying clay appears at the surface, is exceptionally wet. Small gullies formed by the sloughing off of the saturated sand are common along the sides of the bluffs.

Borthwick Springs, in lot 19, con. IV (O.F.), on what was once the Borthwick farm, consist of several small springs and seeps, the water from which was once held in high esteem for its medicinal properties. The springs are no longer in use and when visited in September 1951 consisted of several small neglected pools of water situated in a flat, clay plain about 300 feet north of a steep north-facing bluff. There was no visible flow to the water, which apparently is seeping slowly out of the clay. The water has a saline taste not unlike that from gravel beds below the clay elsewhere in the township. The water for the springs is probably coming either from the underlying Carlsbad shale or gravel beneath the clay whose components are chiefly shale derived from the Carlsbad. Bedrock in the vicinity of the springs is thought to be about 50 feet from the surface.

Sand and gravel beds yielding large quantities of potable ground water were reported to have been encountered beneath the clay by several wells drilled along the road. However, they are probably not extensive and will not be encountered by every drilled well.

The writer believes that there are sufficient quantities of ground water to supply a larger number of houses than there are at present along the west half of the road. However, it must be pointed out that no surface drainage system that would remove much water from the saturated sand beds above the clay should be constructed.

Two long time residents of the Ridge Road have stated that the supply of ground water available in the drift was decreased noticeably during the past 25 years. Springs that formerly occurred along the bluffs have gone dry, and other areas that were commonly wet for part of the year are now always dry.

Seven drilled wells, all the wells of this type in the locality for which information was gathered, were reported along the west half of the Ridge Road between lot 17, con. IV (O.F.), and lot 3, con. VI (R.F.). The elevations of the surface of bedrock in five of the drilled wells apparently decreases rapidly along the road east from lot 19, there being a drop of about 100 feet in 1 mile with a corresponding increase in the thickness of the drift. The absence of drilled wells along the east half of the road is doubtless because of this increase in the thickness of the drift and the east with which satisfactory supplies of ground water may be obtained from the sand.

The deepest drilled well in the locality is in lot 3, con. VI (R.F.), about ½ mile south of the road. This well is 372 feet deep with bedrock at 40 feet. The water was reported to be soft and clear with a slight mineral taste. A general log of the well is as follows:

Feet		
0 to 6	....	sand; some water
6 to 30	....	clay; no water
30 to 40	....	clay and boulders (till ?); no water
40 plus	....	shale; water at several horizons

Excellent supplies of hard, clear ground water at a temperature of 43.5 degrees fahrenheit was reported from a well drilled to a depth of 105 feet in lot 20, con. IV (O.F.). The source of the water was stated to be a layer of compact gravel or hardpan below the clay. Carlsbad shale was encountered at 97 feet in a well drilled to a depth of 212 feet in lot 19, con. IV (O.F.). No gravel or hardpan was encountered. The water in this well was reported by the driller to come from the bedrock. It is only slightly saline. Slightly saline water was encountered in another well drilled to a depth of 186 feet in lot 7, con. IV (O.F.). It occurs in running sand underneath about 170 feet of marine clay.

RUSSELL ROAD

The Russell Road, which serves as a connecting link between the city of Ottawa and the communities of Hawthorne, Ramsayville, and Carlsbad Springs, is an important road in the east-central part of Gloucester township. It extends from the Ottawa city limits in lot 2, con. VI (R.F.), to the east boundary of Gloucester township in lot 1, con. VII (O.F.). The road is well populated by farmers and by other persons chiefly employed in the city of Ottawa, and there are a relatively large number of wells along it.

The drift along the Russell Road, as along the Ridge Road on the north, is underlain by rocks of the Carlsbad formation. Depths to bedrock along the west part of the road, between the Ottawa city limits and a point in lot 6, con. VI (R.F.), about 1 mile west of the community of Ramsayville, range from 20 to 30 feet. East of this point bedrock drops off abruptly and the drift is from 180 to 197 feet thick for a distance of about $2\frac{1}{2}$ miles east of Ramsayville. It then gradually decreases until at Carlsbad Springs it is reported to be about 50 feet thick. Bedrock outcrops at only one place, a small creek in lot 4, con. VI (R.F.). A well drilled to a depth of 169 feet at Ramsayville failed to reach bedrock. The elevations of the bedrock surface at Carlsbad Springs are from 30 to 40 feet lower than west of Ramsayville.

The unconsolidated material exposed along the Russell Road consists of marine clay overlain in places by various thicknesses of sand. Except for small areas in lots 12, 14, and 15, the sand is not as thick as along the Ridge Road. The Russell Road, in part, lies along the top of a fairly steep, north-facing bluff believed to have been formed by Ottawa River when it was at a higher elevation. The material exposed on this bluff is marine clay with only a little sand here and there and, consequently, few springs or seeps were reported.

As the cover of sand is thin many shallow wells dug along the Russell Road obtain ground water from the clay and only three wells were reported to be intermittent. This is in contrast with other parts of the township where most wells dug in clay are reported as 'low in summer' or dry for a part of each year. The clay along the Russell

Road may not be as massive as elsewhere and may contain irregular lenses of silt and fine sand that yield their water content more readily to wells. This is true for the clay in the vicinity of Orleans along the Montreal Road.

The water from a few wells dug in the clay has a faint odour of hydrogen sulphide gas. This is probably due to decaying organic material carried directly into the well by surface water. Water from such wells may be contaminated and should be tested before being used for drinking.

Some farmers in clay areas have constructed small dug-outs or cisterns adjacent to their barns into which excess surface water from nearby fields is drained by a system of tiles or ditches. Water from them is pumped into the barn for stock use.

The entire water supply for Johnston's Hotel in Carlsbad Springs is reported to come from a well dug 15 feet in clay. This is unusual and it is believed that the source of much of the ground water is some more permeable material, such as sand, interbedded with the clay. It is possible, too, that the ground water in this well is coming from bedrock or gravel beds beneath the clay, the water being under sufficient pressure to force it up through the clay.

The northern extremity of a large area of sand south of the Russell Road occurs in lots 12, 14, and 15, and is yielding satisfactory quantities of ground water to several shallow wells dug into it. Most of the water occurs in the sand immediately above the clay. A well in lot 14, con. VI (O.F.), on the south side of the road is dug 10 feet into the sand, and yields enough ground water for both domestic and stock needs. This water is pumped a distance of 300 feet from the well to the house and barn on the north side of the road. In lot 11, enough ground water for domestic purposes is pumped from a well dug 12 feet in the sand some 900 feet south of the road.

Satisfactory supplies of ground water are being obtained from shallow wells dug on a small sand ridge about 3/4 mile north of the Russell Road in lots 10 and 11, con. VI (O.F.). The sand there is about 9 feet thick. This sand ridge continues east and passes about 200 feet north of the Carlsbad Springs Hotel where it is from 3 to 4 feet thick. The hotel obtains its water supply from the sand, through a network of tiles laid on the clay at the base of the sand on the hillside immediately behind the hotel. The water is drained into a shallow well at the foot of the bluff and thence pumped into the hotel.

Sand points are not used along the Russell Road. The sand is so fine that it would plug the screen and render the well useless.

Gravel beds containing ground water, and in many places considerable quantities of inflammable gas, have been encountered beneath the clay by several wells drilled along the road. The pressure of the water and associated gas combine to force the water up the well and at times to cause it to flow. The water issuing from one flowing-artesian well, in lot 2, con. VII (O.F.), east of the community of Carlsbad Springs, is coming from gravel beds beneath about 61 feet of clay. A second well, in Carlsbad Springs, 150 feet deep encountered Carlsbad shale at 50 feet. The water in this well has a high sulphur content and is believed to come from a different aquifer to that in the first well.

Wells drilled into bedrock along the Russell Road west of Ramsayville yield water containing both hydrogen sulphide gas and dissolved mineral salts. Bubbles issuing from the water commonly burn with a bluish flame. In this locality, more potable ground water is obtained from the upper parts of bedrock than deeper. Probably much of the ground water encountered at depth has travelled a longer distance through the rock than water near the bedrock surface and has had a greater opportunity to dissolve mineral salts. In neither case is much ground water available.

The water from wells drilled to bedrock east of Ramsayville is more saline. In lots 18 and 19, con. V (O.F.), ground water is obtained at the bedrock surface by two wells 189 and 200 feet deep respectively. The water, although containing considerable dissolved mineral salts, is reported to be sufficiently potable for both drinking and stock.

Examples of the high mineral content of the ground water in the gravel and shaly bedrock underlying the clay and the pressures to which it is subjected at depth occur in the vicinity of Carlsbad Springs. There several mineral springs result from ground water being forced to the surface through cracks in the clay. These springs led to the development of Carlsbad Springs into a health resort of some prominence. At present there are three hotels, all with wells yielding ground water containing dissolved chemical salts, in the community. These wells are either springs that have been dug out or wells drilled through the clay. Excellent descriptions of the mineral content of these waters have been published by Satterly and Elworthy[1,2].

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[1] Satterly, John, and Elworthy, R. T.: The Radioactivity of Some Canadian Mineral Springs; Mines Branch, Canada, Bull. No. 16, pt. I, pp. 16, 21 (1917).

[2] Elworthy, R. T.: The Chemical Character of Some Canadian Mineral Springs; Mines Branch, Canada, Bull. No. 20, pt. II, pp. 33, 164 (1918).

ROAD BETWEEN CONCESSIONS VI AND VII (OTTAWA FRONT)

This section describes that part of the road between lot 10 where it branches off the Russell Road and lot 20 where it joins the Base Line Road. The part east of lot 10 has been described in the section on the Russell Road.

The Carlsbad formation directly underlies the drift all along the road. The wide, shallow valley in the bedrock surface that lies beneath much of the central part of the township is believed to underlie this road and the drift is, consequently, thick. Bedrock was reported at about 110 feet in lot 10, con. VII, (O.F.), a figure that may not be true as it was obtained by driving a small diameter pipe down through the clay until it stopped. The elevation of bedrock(?) at this point is 138 feet above sea-level. A well drilled to a depth of 206 feet, in lot 16, con. VII (O.F.), did not reach bedrock and in lot 18 of the same concession a second well drilled to a depth of 1,744 feet reached bedrock at 200 feet. The second well is on the farm now owned by C. R. Nicholson. It is one of the deepest in the township and was drilled during 1900 and 1901 in a search for oil-bearing rocks. A log of the well is included in the back of this paper. The elevation of bedrock surface in this well is about 73 feet above sea-level.

Sand is the most common unconsolidated material exposed along the road and, except for small areas in lots 10, 17, and 18, constitutes the chief source of ground water for shallow, dug wells. Altogether, some twenty wells were reported to obtain satisfactory supplies of ground water from the sand. They range in depth from 8 to 28 feet with an average of 13 feet.

The thickness of the sand deposits along the road in lot 10, con. VII (O.F.), varies and one farmer in the area has had to dig a well 16 feet deep some 700 feet south of his buildings where the sand beds are thicker than nearer by to obtain his water supply.

Much sand is exposed on the surface in parts of lot 14, con. VII (O.F.). In this locality a well dug 15 feet in the sand yields sufficient ground water to supply the domestic and stock needs for a farm but is about a $\frac{1}{4}$ mile north of the buildings. This unusually great distance indicated the wide variation in the capacity of the different unconsolidated materials in the locality to yield satisfactory supplies of ground water. The clay underlying the sand is a poor source of water. In areas where the sand beds are thin, some wells have been dug into the clay, not with the hope of obtaining much ground water from it but to form a larger reservoir to store fresh water derived from the thin layer of sand. Clay is the source of water for a well dug 12 feet deep in lot 10, con. VII (O.F.). This well yields a limited supply of brownish water that emits a slight odour of hydrogen sulphide gas, possibly from decaying organic material carried into the well by surface water.

Excellent quantities of ground water under considerable pressure were reported in beds of 'black gravel' directly overlying bedrock. The water is usually accompanied by gas that burns with a pale blue flame. Because of the high confining pressure the gravel commonly comes up into the casing during drilling operations. To overcome this undesirable condition, the driller is compelled to drive the casing down to bedrock, and that prevents the water in the gravel from entering the well. As a result, such wells are entirely dependent upon bedrock for their ground-water supply.

The dissolved mineral content of the ground water from the 'black gravel' and from bedrock immediately underlying it is generally too great to allow the water to be used for domestic and stock purposes. For instance, a well 200 feet deep in lot 18, con. VI (O.F.), was drilled into bedrock. Beds of 'black gravel' containing large quantities of saline ground water under pressure were encountered in this well between 190 and 195 feet. However, in lot 15, con. VII (O.F.), a well drilled 206 feet through marine clay and into 'black gravel' yields water that is only slightly saline and can be used by both humans and stock. The water is under considerable pressure and rises almost to the surface.

It is not definitely known if bedrock is the source of any ground water for wells drilled along the road. The upper part of the bedrock is soft and the drillers cannot be certain as to the exact depth at which bedrock was reached. It has been stated by various well owners that limited supplies of ground water can be obtained from bedrock, but no information has been received that would substantiate this.

ROAD BETWEEN CONCESSIONS VII AND VIII (OTTAWA FRONT)

This road, sometimes called the Piperville Road, extends across the southeast part of the township from its east boundary southwest to the Base Line Road.

The Carlsbad formation directly underlies the drift all along the road. Information regarding depths to bedrock along the road is scanty except at three wells drilled in lots 13 and 14, con. VII (O.F.), near Piperville. Bedrock was reported to have been reached in these wells at depths ranging from 100 to 120 feet. No information was available at a fourth well drilled in lot 7, con. VIII, (O.F.). The elevations of the bedrock surface beneath Piperville are 150 to 156 feet above sea-level, that is about 80 feet higher than beneath the road separating cons. VI and VII $1\frac{1}{4}$ miles to the north. Apparently the shallow valley in the surface of bedrock to the north is less definite here.

The overburden exposed along the road consists predominantly of marine clay overlain by various thicknesses of sand. Clay is close to the surface in lot 1, at the east end, where a covering of only 1 foot or 2 feet of sand was reported. The sand is 5 to 14 feet thick between lots 3 and 7. Clay is exposed on the surface in a small area in lot 8, con. VIII (O.F.), and also in the vicinity of Piperville. Thick sand deposits occur between lot 14 and the Base Line Road, the greatest thickness being in lot 18 where it was reported to be about 12 feet.

Fair quantities of ground water can be obtained from shallow wells along the road, the most satisfactory supplies being from where the sand is thickest. The water-bearing horizons are at the base of the sand immediately above the clay. Wells dug entirely in the clay, for example those in the vicinity of Piperville, are generally intermittent and yield brownish water that sometimes smells of hydrogen sulphide gas. The lack of satisfactory supplies of ground water at shallow depths in the Piperville area is no doubt why there are drilled wells in that locality. One farmer has supplemented his eater supply by a system of tiles and ditches through which excess surface water is drained from adjacent fields into a large diameter well dug in the clay. The water is used for stock.

No gravel beds were reported along the road between the marine clay and bedrock. These materials apparently exist only north of the road where they partly fill the shallow bedrock valley that extends through much of that area.

Plenty of ground water, most of which is, however, too saline to be used, is reported to occur at the contact between the drift and bedrock or in the upper few feet of bedrock. Two wells were drilled to bedrock on one farm in lot 14, con. VII (O.F.). The water from the first well contained so much dissolved mineral salt that it could not be used. That from the second has a saline taste but is sufficiently potable to be used by both humans and stock. Neither the confining pressures of the water beneath the clay nor the volume of gas associated with the water is as great as farther north where the (black gravel' was encountered.

No well was reported to penetrate bedrock very far and, consequently, little is known about the quantity or quality of ground water to be expected from the bedrock. It is doubtful, however, if large supplies of ground water could be obtained from this source.

ROAD BETWEEN CONCESSIONS VIII AND IX (OTTAWA FRONT)

The Carlsbad formation is believed to directly underlie the drift directly all along this road.

The thickness of the drift is not known, and bedrock does not outcrop anywhere, but, judging from the elevations of the bedrock surface at drilled wells along the two roads adjoining on the north and south, it seems probable that deeper wells drilled along the road being considered must have penetrated close to, if not into, bedrock.

The overburden exposed along the road consists chiefly of marine clay overlain by various thicknesses of sand. The sand is thickest along the east part of the road between lots 1 and 7, but decreases in thickness to the west and in many localities consists of mere layers of sandy loam overlying the clay.

All wells between lots 1 and 7 are of the shallow, dug type deriving their supply of ground water from the sand. Most farms have two such wells, one at the house and the other at the barn, which are reported to supply sufficient water for both domestic and stock purposes. No drilled wells were reported from this locality, which is a good indication that adequate supplies of potable ground water can be obtained from the sand.

Clay was reported in all dug wells west of lot 8 where the sand beds are thinner. Most of these wells are deeper than those at the east end of the road and do not yield as satisfactory a supply of ground water. The lack of overlying sand beds to filter the water has resulted in some instances in its being brownish coloured and smelling slightly of hydrogen sulphide gas. The shallow wells dug along this part of the road have been described as "intermittent" or "low in summer" and should be deepened if an increased supply is required.

Because most shallow dug wells are inadequate several wells have been drilled along the west part of this road. A well drilled to a depth of 90 feet in lot 9, con. IX (O.F.), yields large quantities of soft, slightly mineralized ground water, reported to be coming from beds of gravel beneath the clay. In lots 11 and 13, con. IX (O.F.), two wells, drilled to depths of 135 and 70 feet respectively, were reported to yield ground water too saline to be used. In both wells this water is also coming from gravel beds beneath the clay. No information was obtained as to the depths to bedrock.

With two exceptions all wells along the road between lots 16 and 20 are of the drilled type. Most of the water encountered is under pressure and rises some distance up the wells. It is, however, frequently saline and cannot then be used for domestic purposes.

The information for most drilled wells along the road is too incomplete to permit a satisfactory explanation to be made for the considerable variations in the mineral content of the ground water. It is suggested that the more saline water is probably coming from bedrock and the better water from sand and gravel beds between the clay and bedrock.

Depths (in feet) of wells along the road are summarized in the following table. Examination of the column for drilled wells indicates that the deeper wells yield the more highly mineralized water:

	Dug		Intermittent	Drilled	
	Sand.	Clay	All in clay	Slightly saline	Very saline
Min.	9	11	12	86	70
Max.	20	24	20	90	135
Ave.	13	16	16	89	101

ROAD BETWEEN CONCESSION X (OTTAWA FRONT), GLOUCESTER TOWNSHIP, AND OSGOODE TOWNSHIP

This road marks the east part of the boundary between Gloucester and Osgoode townships.

The Carlsbad formation directly underlies all the drift along the road except at the west end where rocks of the Nepean formation have been carried up to bedrock surface along the Gloucester fault, the upward projection of which crosses the road in lot 19, con. X (O.F.).

The thickness of the overburden varies from about 90 feet along the west and central parts of the road to 43 feet at the east end. This variation is not due to changes in the elevation of the land surface, which is relatively lined along the road, but to a gradual rise in the altitude of the bedrock surface from 161 feet above sea-level in lot 13 to 215 feet in lot 2 at the east end of the road. This is the highest elevation reached by bedrock anywhere in the southeast part of the township and indicates that the wide, shallow, drift-filled valley in the bedrock surface, known to exist throughout much of the east-central part of the township, does not extend into this area. It is believed that more potable waters would be obtained by drilling outside of this part of Gloucester township to the south and east.

Overburden exposed along the road is similar to that along the road to the north between cons. VIII and IX (O.F.). The material consists chiefly of a layer of fine sandy loam overlying marine clay. Most of the shallow, dug wells along the road are between lots 8 and 12, where the road is thickest.

Three drilled wells are known to occur between lots 1 and 5. These wells, all of which are in lot 3, were reported as obtaining excellent supplies of potable ground water from gravel beds beneath the clay. The gravel was described as being 2 to 3 feet thick and to lie on bedrock. One well penetrated about 8 feet of bedrock, and the water is lightly saline to the taste but is sufficiently potable for domestic purposes. Bedrock was not reached in the other two wells. There are no drilled wells along the road between lots 6 and 11, which includes the community of Edwards. The sand beds overlying the clay along this section of the road are relatively thick and sufficient supplies of ground water can be readily obtained from shallow wells dug through the sand to the top of the clay or, if larger reservoirs are desired a short distance into it.

The ground water under the greatest hydrostatic pressures was encountered in the well nearest the Gloucester fault. Farther east, away from the fault, the pressures decrease until finally the static level of the water in the wells is several feet below the surface.

It is believed that the flowing-artesian wells owe their presence chiefly to the Gloucester fault. The slow movement of ground water percolating south and wouthwest down the dip of the bedrock would be arrested by the impervious fault zone resulting in an accumulation of ground water under considerable pressure along the northeast side of the fault. An irregular northeast-facing scarp, which in the south part of the township may reach a height of 100 feet, is believed to occur along the fault and would interrupt the normal movement of the ground water along the surface of the bedrock. This ground water occurs chiefly in gravel beds between the bedrock and the overlying clay but may also be present in the upper few feet of bedrock, which in many places is reported to be partly weathered and gravelly in texture. Gravel lying directly on bedrock is reported to be the principal source of water for the flowing-artesian wells.

Hydrogen sulphide gas is associated with much of the water from wells drilled close to the northeast side of the Gloucester fault. This objectionable gas decreases in quantity farther east but in the same direction the amount of total dissolved solids in the water is reported to increase. In lot 14, for instance, there is little hydrogen sulphide gas but the dissolved mineral content is high.

A summary of the depths (in feet) of the wells along the road is as follows:

	Dug		Intermittent	Drilled
	Sand	Clay		
Min.	10	13	11	60
Max.	24	40	20	157
Ave.	17	19	15	72

Between lots 12 and 17 satisfactory supplies of potable ground water can be obtained with difficulty. The sand covering is extremely thin and wells dug into the drift are chiefly dependent upon the clay for their supply of ground water. The ground water from wells of this type is sufficiently potable for domestic purposes, but the wells can readily be pumped dry and few yield enough ground water to satisfy a farmer's needs. It is believed that the best method of obtaining sufficient ground water in this area is by constructing larger dug wells. This should be done in the late summer when the water-table is normally at its lowest point. Such wells would provide a reservoir of free water for use when shortage might otherwise occur.

Shallow wells dug in the clay along the road are mostly situated near the farmhouse, the deeper, drilled wells being near the barn or in the fields where the water would be more readily available for the stock, the reason being that the ground water from wells drilled into bedrock has too high a mineral content and too frequently gives off a disagreeable odour of hydrogen sulphide gas for drinking. It was reported that even cattle take at least a week to become accustomed to it when they are first brought into the area. The capacity of the drilled wells is, however, large.

Flowing-artesian wells, and wells in which the ground water is under considerable pressure, occur in lots 17, 18, and 19 on the northeast side of the Gloucester fault. These wells are part of a belt that crosses Gloucester and Osgoode townships close to and more or less parallel with the Gloucester fault. The most important is that occurring at the Royal Canadian Navy Establishment in lot 19, con. X (O.F.). This well was drilled 87 feet to the surface of bedrock and at that depth encountered ground water under sufficient hydrostatic pressure to force it 20 feet above the surface and to supply the entire establishment as well as several adjoining houses. The volume of water issuing from adjacent flowing-artesian wells, however, decreased or stopped entirely when this well was drilled. The rate of flow of one well in lot 18, con. IX (O.F.), was measured at 21 g.p.h. on August 10, 1952.

Community Supplies

The ground-water conditions of all communities in Gloucester township were investigated. The two more important, Cyrville and Orleans, are described in detail below but discussions of the others will be found in the section dealing with the road on which they are situated. Maps showing the location of all wells in Cyrville and Orleans for which information has been obtained and compilation sheets describing most of the wells will be found at the back of this report.

Community of Cyrville

The area described in this section includes the community of Cyrville, shown on the detailed map at the back of the report, and the built-up areas immediately adjacent in lots 25 and 26, con. 1, and lots 26 and 27, con. II (O.F.).

The Billings formation, consisting mainly of dark, almost black shale with a total thickness of about 200 feet, directly underlies the drift throughout the area. The thickness of the drift is rarely greater than 10 feet, and there are numerous outcrops in lot 25, con. I (O.F.).

Marine clay constitutes most of the overburden exposed at the surface. Beneath the clay, and directly overlying bedrock, there is in most places 2 to 3 feet of stony till, the stones being principally formed of rocks of the Billings formation. Exposures of stony till are a good indication that bedrock is close to the surface. Thin layers of sandy loam overlie much of the clay in the southern part of the locality. On this sandy soil several large gardens have been developed whose produce are marketed chiefly in the nearby city of Ottawa.

Water wells in the Cyrville area can be divided into three main types: (1) wells dug just to bedrock surface; (2) wells dug to bedrock surface and then extended into bedrock a few feet by picking or blasting; included in this group are those dug wells with holes drilled in the bottom; (3) drilled wells. These vary greatly in depth, but all derive their ground water supply from the Billings formation. The depths of the dug wells vary from 5 to 35 feet, with an average of approximately 14 feet, and the deeper wells drilled into bedrock are 35 to 175 feet deep, with an average of 82 feet.

At present there is no great shortage of ground water in the Cyrville area. This is surprising when it is remembered that the principal sources of water in the area are clay and shale, both of which are normally considered to be poor aquifers. Geological conditions, too, appear to be unfavourable for large ground-water supplies. Cyrville is on the north limb of a synclinal structure the beds of which have a low, southerly dip. The intake area for the ground water is considered to be entirely local.

One drilled well of unknown depth was reported to be capable of yielding 1,000 gallons an hour. The water from this particular well is used both for domestic purposes and to supply a large garden. A second well, drilled 140 feet into bedrock in lot 27, con. II (O.F.), was reported to be capable of yielding 1,600 gallons an hour. The water is used for irrigating a large garden.

The least satisfactory wells in the area are those that have been dug to bedrock surface. Some of these were reported to be low in the latter part of the summer and autumn, a few having gone completely dry. Such wells are dependent chiefly upon small quantities of ground water soaking along the bedrock surface from some nearby outcrop area, and, in lesser amounts to a lesser degree, to water percolating downward through the overlying marine clay or stony till. They are entirely dependent upon local precipitation and, as they draw from extremely small reservoirs, will go dry quickly in periods of little rainfall.

The quality of the ground water from the Cyrville area is not always satisfactory, although as a whole the water is more potable than in other areas where the aquifers are in the Billings formation. The dissolved mineral content is commonly high and much of the water has a strong odour of hydrogen sulphide gas. Several well owners carry their drinking water daily from the city of Ottawa. These undesirable characteristics are similar to those in other areas in Gloucester township where the ground water is derived from the Billings shale. Ground water percolates extremely slowly through this material and, consequently, dissolves much mineral salt.

A similar situation exists in the stony till above bedrock. This material consists predominantly of boulders and rock fragments of shale embedded in a clayey matrix, all of which could yield considerable mineral matter to slowly to slowly percolating ground water.

The water from a few wells in the Cyrville area was reported to be cloudy at certain times of the year. This cloudiness is probably caused by fine particles of rock falling into the water from the walls of the well, especially during periods of low atmospheric pressure such as immediately precedes a storm. Temporary cloudiness commonly occurs in water from wells put down in fine-grained rocks such as shale and, except for possible clogging of the water pipes, is not serious. The water from new wells is commonly cloudy for some time after the well has been first drilled. This cloudiness is due to fine rock cuttings disseminated through the water and will usually clear up after the well has been used for a few weeks.

Community of Orleans

The community of Orleans is on Queen's Highway 17, some $9\frac{1}{2}$ miles east of the city of Ottawa, and close to the boundary of Gloucester and Cumberland townships.

The Oxford and Rockcliffe formations directly underlie the drift throughout the community. Rocks of the Ottawa formation outcrop immediately to the north and they are separated from the Oxford and Rockcliffe by a strong east-west trending fault. This fault probably has no effect upon the hydrology of the community.

Overburden consists predominantly of marine clay interbedded with thin lenses of silt and fine sand. These lenses are believed to be the source of much of the ground water obtained by the numerous dug wells within the community.

A steep, north-facing bluff in the clay, believed to have been formed during some higher stage in the history of Ottawa River, parallels the south side of the highway. Wells dug along the base of the bluff are reported to be most satisfactory dug wells in the community. However, the absence of pressure systems for pumping water from these wells suggests that they yield limited supplies of ground water. A similar bluff, but at a lower elevation, extends for a considerable distance along the north edge of the community.

The thickness of overburden gradually decreases easterly across the community. It varies from 113 feet at the west end to 17 feet at the east, with an average of about 41 feet. Elevations of the bedrock surface rise gradually towards the northeast approaching the fault mentioned above. The bedrock surface contains a few minor undulations but they are too small to have much influence on the ground-water supply.

Bored wells, large enough to accommodate tile from 9 to 12 inches in diameter, are common in the community and yield sufficient supplies of ground water for about forty homes. Most wells of this type are bored through the clay until stopped by some obstruction, such as a large boulder or bedrock surface. Adequate supplies of ground water, much of it under considerable hydrostatic pressure, are commonly yielded by the deeper, bored wells. In some localities, the aquifers reported are beds of sand and gravel beneath the clay, in others, the bedrock surface.

Bored wells in the community have proved to yield as satisfactory supplies of water as more expensive, drilled wells. Ground water can only enter a well drilled in unconsolidated material through the open end at the bottom of the casing. If the end of the casing is not in some permeable material the capacity of the well is strictly limited. on the other hand, the joints in the tile lining a bored well are open and provide numerous pores along the whole length of the well for ground water to enter. The depths of wells bored in the community vary from 7 to 113 feet, with an average of 36 feet.

Drilled wells, that is, those constructed with a cable tool machine, are not common in Orleans. Most of them are deeper than the bored type, ranging from 35 to 194 feet deep with an average of 76 feet, and have penetrated to bedrock. The capacity of all drilled wells in Orleans was reported to be large, but except for the well at the Orleans Hotel none is being used at the present time for more than normal domestic purposes.

About 50 per cent of the wells in the community are of the dug type. They range in depth from 6 to 33 feet, with an average of about 12½ feet. The aquifers are chiefly small lenses of silt and fine sand in the clay. Few of these wells are satisfactory. Most of them have been dug by the owners and few are deep enough to ensure an adequate supply of water at all times. During a drought many of them go dry or the water level drops to a point where the well will yield only a limited supply of ground water.

There are four flowing-artesian wells in the northeast part of the community, at the base of a prominent, north-facing bluff. One well was drilled to a depth of 75 feet and the others bored to depths of 69, 52, and 42 feet respectively. The aquifers were reported to be extensive beds of sand and gravel beneath the clay. The rates of flow and temperatures of the water for three of the wells were taken at monthly intervals during the latter part of 1952 and the figures are given in a table at the back of this report. The water is fairly soft, slightly yellowish in colour, and frequently has a faint odour of hydrogen sulphide gas. A fifth well, drilled at the Orleans Hotel, flowed when first completed. The quality of the water was reported to be similar to that of the other flowing-artesian wells.

The aquifers yielding water to the flowing-artesian wells in Orleans are believed to be similar to those tapped by the flowing-artesian wells along Queen's Highway 17, west of the community toward the city of Ottawa. These wells were discussed in the section of this report dealing with the ground water problems along Queen's Highway 17.

Generally, the quality of the ground water in the Orleans area is poor. Many wells of all types were reported to yield ground water containing hydrogen sulphide gas and much of it with a mineral taste and a slightly yellowish colour.

Most of the water is believed to come from bedrock where it is normally contained under considerable pressure by the thick, overlying beds of clay, but can be tapped by deeper drilled or bored wells without difficulty. In some shallow wells small amounts of water have moved upwards through cracks in the clay imparting to it a faint odour of hydrogen sulphide gas. In two instances, the upward movement of ground water under pressure through the clay has formed a spring, much as has happened in the Carlsbad Springs area.

The ground water derived directly from the clay and its associated lenses of silt and fine sand is reported to be hard and clear.

The supplies of ground water in the Orleans area were reported to be adequate for most domestic establishments. Wells reported to go dry or to be low in late summer are generally too shallow and should be deepened. Water is obtained from dug wells either by bailing or by hand suction-type pumps whereas pressure systems are installed in many of the deeper drilled and bored wells.

DISCUSSION OF ANALYSES

Twelve samples of well waters from Gloucester township were analysed for their mineral content in the laboratory of the Mines Branch, Department of Mines and Technical Surveys, Ottawa. The samples were taken from wells ranging in depth from 12 to 212 feet with aquifers in both drift and bedrock. The samples taken are believed to be representative of the ground water from the more important aquifers. The figures are tabulated at the back of the report.

Samples 2 and 3 are of ground water from wells dug in marine sand overlying clay. The analyses are similar, and indicate the quality of the ground water yielded by most of the wells dug along the Blackburn Road, the Ridge Road, and other roads situated along the tops of the elongated, sand-covered ridges in the east-central part of the township. The ground water from these two wells has the lowest total dissolved solids of any of the waters sampled. Their chloride and nitrate contents are extremely low. It is evident that potable ground water can be obtained from properly constructed wells dug in the sand. It should be noted that 0.2 p.p.m. of fluorine was reported from the water of the Roman Catholic school (sample 3), and none from that at the Protestant school (sample 2).

Sample 7 is from a well bored 25 feet into marine clay. Its total dissolved solid content of 312.2 p.p.m. is well below the current United States federal standards for drinking water of 500 p.p.m. (1951). Except for the somewhat higher nitrate content, which indicates that some surface water may be entering the well, the analyses of the water is comparable with that of other water derived from similar material.

Samples 1 and 6 are from drilled wells, 71 and 120 feet deep respectively. These are reported to derive their supplies of ground water from the contact of marine clay and the underlying bedrock. The total dissolved solids contained by the waters from these two wells is fairly high, chiefly due to an increase in the chloride and carbonate content. The chloride content of the 120-foot well was calculated to be 526.8 p.p.m. This is extremely high for drinking purposes and will impart a salty or brackish taste to the water.

The ground water from the 120-foot well contains more dissolved solids than that from the 71-foot well, probably because it has percolated a greater distance through the ground and has been longer exposed to both overburden and bedrock, and has had a greater opportunity to dissolve more mineral salts.

The 71-foot well is a flowing-artesian well. The intake area is believed to be the high ground to the north and northwest of the well where outcrops are numerous. Only limited supplies of ground water can be obtained from wells drilled into bedrock in this area, which indicates that only a small percentage of the local precipitation actually penetrates the rock. Most of it apparently follows down along the bedrock surface beneath the overburden and can be recovered, some distance away, by wells drilled or bored through the overburden to bedrock.

Samples 11 and 12 are from two deep wells drilled along the Base Line Road south of the community of Ramsayville. The wells were reported to be 165 and 208 feet deep respectively. Ground water under considerable pressure, was encountered by both wells in beds described as 'black gravel' beneath thick beds of marine clay. Large quantities of inflammable gas were reported to have come from the wells when they were first drilled.

Ground water from these wells is distinguished by a high total dissolved solid content, due largely to a high proportion of sodium chloride. It is believed the associated gases and dissolved mineral salts contained in this ground water originated either in the bedrock or was dissolved out of pebbles of Carlsbad shale that constitute a large proportion of the 'black gravel'.

The lack of sulphates in these two samples and in sample 4 indicates that all this water may be from the same aquifer, most probably from 'black gravel'.

Samples 4 and 10 are from two wells, 212 and 86 feet deep respectively, that were reported to derive their ground water supply from the Carlsbad formation. The total dissolved solid content of the water from the deeper well is considerably greater than that from the shallower, indicating that there is less possibility of obtaining potable ground water at depth in these rocks than nearer the surface. The high sodium chloride content of the ground water from the deeper well is similar to that of the water from the 'black gravels', represented by samples 11 and 12.

Sample 3 is of ground water derived from dolomitic limestone of the oxford formation; the total hardness (as $CaCO_3$) of 622.9 p.p.m. and the calculated content of magnesium and sulphate are higher than that of any other water sampled, and compare with analyses of samples of ground water from the Oxford in other parts of the Ottawa-St. Lawrence Lowland.

The fluorine content of the water was determined because of current interest in the relationship of the fluorine content of water to the incidence of dental caries in children. The proportion of fluorine in the ground-water samples analysed ranges from 0 to 1.2 p.p.m. with an average of 0.03 p.p.m. The generally accepted figure deemed to be the most beneficial and least harmful is 1.0 p.p.m.

Summary of Amounts[1] of Dissolved Mineral Matter in Well Waters from Gloucester Township

Constituent	Well waters from glacial drift and bedrock (12 samples)		
	Maximum	Average	Minimum
Total dissolved solids	4217.5	1184.7	171.7
Silica	17.0	12.3	7.3
Fluorine	1.2	0.3	0.0
Calcium	134.7	43.7	1.8
Magnesium	69.8	28.3	0.4
Alkalis (as Na)	1614	211	13.3
Sulphate	248	56.0	0.0
Chloride	2056	461	2.2
Nitrate	40.0	12.7	trace
Bicarbonate	668.6	331	100.0
Alkalinity (as $CaCO_3$)	752.4	299	82.0
Total hardness	622.4	227	6.1

1 In parts per million

WELL STERILIZATION

The following method is recommended to sterilize a well[2]:

2 Well Drilling, Technical Manual, T.M 5-295, United States Government Printing Office, Washington, 1943.

mix one heaping tablespoon of chlorinated lime with a little water to make a thin paste, being sure to break up all lumps; stir this paste into 1 quart of water; allow the mixture to stand a short time and pour off the clear liquid. The chlorine strength of the solution is about 1 per cent: and 1 quart is enough to sterilize 800 imperial gallons of water.

Estimate the volume of water in gallons standing in the well, and for each 800 imperial gallons pour 1 quart of the sterilizing solution into the well. No harm is done if too much solution is used, and it is better to use too much than too little. Agitate the water thoroughly and let it stand for several hours, preferably over night, then flush the well thoroughly to remove all of the sterilizing agent. The sides of the well above the surface of the water can be sterilized by returning the water to the well during the first part of the flushing. Just before completion of the flushing, a sample of the water may be taken if required.

To determine the volume of water in the well, it is necessary to know the diameter of the well and the depth of water in it. With this knowledge, the volume of water present in the well can be easily calculated from the following table and the correct amount of lime solution added.

Diameter of well (feet)	Number of imperial gallons per foot depth
2.0	19.6
2.5	30.6
3.0	44.1
3.5	59.9
4.0	78.3
4.5	99.1
5.0	122.3

CONCLUSIONS

This investigation is believed to warrant the following conclusions:

(1) Except in a few localities, there appears to be enough ground water everywhere in Gloucester township for domestic, stock, and community purposes. There has been a gradual increase in the amount of precipitation in the last 6 years and it is thought that, with the consequent increased recharge, supplies of ground water will continue to be adequate.

(2) Ground water yielded by some aquifers here and there through the township is not sufficiently potable for domestic purposes. In some instances, indeed, the dissolved mineral content, usually in the form of sodium chloride, was so high that the water cannot be used even for watering cattle.

(3) The source of the largest quantities of ground water is beds of sand and gravel lying beneath marine clay and directly on bedrock. This is especially true where these more permeable materials are in some buried stream channel or valley-like structure in the bedrock surface.

(4) The marine clay that occurs at the surface over much of the township is not a good source of ground water. In areas where sufficient supplies of water were reported from the clay, it is probable that much of it is actually coming from lenses of silt and fine sand interbedded with the clay.

(5) In areas where there are approximately 12 or more feet of sand overlying the clay, potable water in quantities sufficient for domestic purposes can be obtained from the base of the sand.

(6) The Nepean and March formations are considered to be excellent sources of hard, clear ground water. These formations are, however, too deep to be important aquifers in Gloucester township.

(7) The Oxford formation is a fair source of ground water, and in most instances can be depended upon to yield sufficient ground water for domestic and farm use.

(8) Sandstone beds in the Rockcliffe formation yield considerable ground water to pumping wells, but in some instances they may be dry and may even absorb water from the well. This, however, is an infrequent occurrence. The quality of the ground water derived from the Rockcliffe formation is generally good, although in the Orleans area some ground water, believed to be coming from the Rockcliffe, has a decided odour of hydrogen sulphide gas.

(9) The Ottawa formation generally yields sufficient ground-water supplies for normal domestic use. In some localities, however, the rock is apparently massive and lacks bedding planes and joint fractures, which are the main aquifers carrying ground water into wells from this type of rock. In such localities, wells in the Ottawa formation are deeper than average.

(10) Ground water from the Carlsbad formation generally contains considerable quantities of dissolved mineral salts, chiefly in the form of sodium chloride, and in some instances it carries so much that it cannot be used for domestic or stock purposes.

(11) Much of the ground water from the Billings formation carries hydrogen sulphide gas and is not a good source of ground water. In the Cyrville area, however, some wells drilled into the Billings are reported to yield large quantities of potable ground water. There is a strong possibility that much of this water is coming from the first few feet of bedrock.

(12) The faults in the township are not believed to be aquifers; rather they form an impermeable barrier to the movement of ground water. Flowing-artesian conditions are thereby created in some areas, such as along the Gloucester fault, and in others the faults may cause a lack of ground water, such as along the west end of the Montreal Road.

(13) There are three distinct areas of flowing-artesian wells in the township, all of which are the result of local geological conditions. One of these is in the Orleans area, north of the Montreal Road; the second is along the Gloucester fault, which cuts across the south-central part of the township; and the third lies between the River Road and the Rideau River about 1 mile southwest of Uplands Airport.

(14) In some parts of Gloucester township the water-table has dropped during the last few decades. Some dug wells on farms along the River Road, which when first constructed yielded sufficient supplies of ground water have had to be deepened by drilling in recent years. It is possible that the shortage of water may have been due to an increased consumption with the installation of pressure systems rather than to the failure of the existing supply.

Flowing-artesian Wells

Rates of Flow[1] and Ground-water Temperatures[2]

Year and month	Well No. 1		Well No. 2		Well No. 3		Well No. 4		Well No. 5	
	Flow	Temp.	Flow	Temp.	Flow	Temp.	Flow	Temp.	Flow	Temp.
1952										
July	276.8		75.3		1282		387		62.7	-
Aug.	176.5		46.8		1091		346		35.7	-
Sept.	150.9	47	40.2	46.5	1062	47	343	47	61.2	-
Oct.	132.6	47	33.6	47	1059	47.5	310	47	69.1	-
Nov.	105.0	48	29.7	47	923	48	273	48	76.7	-
Dec.	100.3	48	28.8	47	930	48	294	48	83.4	-
1953										
Jan.	-	-	-	-	-	-	-	-	-	-
Feb.	-	-	-	-	-	-	-	-	-	-
Mar.	-	-	-	-	-	-	-	-	-	-
Apr.	-	-	-	-	-	-	-	-	-	-
May	303	48.5	83.2	48.5	1254	48	373.5	48	-	-
June	N.F.	-	11.1	-	494	49	134.8	48.5	54.2	47.5
July	N.F.	-	7.8	-	486	49	110.0	48.5	45.0	47.5
Aug.	N.F.	-	N.F.	-	480	49	66.2	48.5	30.6	47.5
Sept.	N.F.	-	N.F.	-	428	49	22.8	49	36.4*	47.5
Oct.	N.F.	-	N.F.	-	515	48	198	48	47	47
Nov.	N.F.	-	7.6	48.5	569	48	150.5	48	39	48
Dec.	N.F.	-	8.0	48.5	580	48	175	48	45	48

[1] In imperial gallons per hour; measurements taken approximately at the first of each month.

[2] In degrees fahrenheit.

N.F.: Not flowing.

*: Well had been cleaned out between readings.

DESCRIPTION OF FLOWING-ARTESIAN WELLS MEASURED, GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

NO.	NAME	LOT	CONC.	TYPE	DEPTH	ELEVATION[1]	AQUIFER
1	C. Cousineau	4	I (O.F.)	Drilled	194	200	Gravel beneath clay
2	H. Lalonde	4	I (O.F.)	Drilled	75	181	Gravel beneath clay
3	Grey Sisters of the Cross	6	I (O.F.)	Drilled		181(?)	Gravel beneath clay
4	Hiawatha Park	6	I (O.F.)	Drilled			Gravel beneath clay
5	F. Barrett	16	IV (R.F.)	Drilled	20	308	Contact of till and Carlsbad formation

[1] Elevation in feet above sea-level.

Summary of Wells and Springs Exclusive of Communities

Wells and springs	Concessions (Ottawa Front)										Totals in Ottawa Front area	Per cent of total
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Total number	137	173	167	125	42	54	74	55	40	34	901	100
Dug	60	117	122	109	34	45	59	50	32	20	648	71.92
Bored	12	15	1	0	0	0	0	0	0	0	28	3.10
Drilled	64	40	42	11	6	8	10	4	8	2	195	21.65
Diamond drill-hole	0	0	0	0	0	0	0	0	0	12	12	1.31
Dug spring	0	1	2	0	0	0	0	0	0	0	3	0.33
Springs	1	0	0	5	2	1	5	1	0	0	15	1.65
Wells: Feet deep												
0-20	48	110	116	103	25	41	54	48	32	14	591	65.65
21-40	22	19	11	1	4	4	3	2	1	6	73	8.1
41-60	5	4	5	0	0	0	0	0	0	4	18	1.98
61-80	5	10	6	1	0	0	0	0	1	1	24	2.63
81-100	2	5	7	0	0	1	2	1	3	2	23	2.54
Over 100	49	19	17	7	6	6	6	1	1	6	118	13.05
Depth unknown	6	6	5	13	7	2	9	3	2	1	52	5.77

<u>Summary of Wells and Springs Exclusive of Communities</u>

Wells and Springs	Concessions (Ottawa Front)										Totals in Ottawa Front area	Per cent of total
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Wells that yield hard water	76	80	87	58	30	47	48	34	31	24	485	53.6
medium water	27	33	0	0	0	0	0	0	0	0	60	6.5
soft water	14	36	48	55	4	1	10	14	3	3	188	19.86
salty water	8	1	2	5	5	9	6	3	5	10	54	5.98
sulphur water	7	13	18	2	0	3	2	3	3	7	58	6.42
mineral water	0	0	0	0	0	0	1	0	0	1	2	0.22
cloudy water	10	12	3	3	0	0	1	3	3	2	37	4.1
Wells with aquifer in clay	51	78	84	25	18	24	25	27	23	18	373	41.5
in sand	6	37	76	106	17	22	35	38	19	21	377	41.8
in gravel	16	3	0	1	2	5	7	1	8	3	46	5.15
in till	10	8	4	0	0	0	0	0	0	0	22	2.42
at overburden - bedrock contact	5	11	21	0	0	0	0	0	0	0	37	4.1
in bedrock	46	49	31	2	3	3	4	1	1	8	148	16.4
aquifer unknown	2	5	3	1	2	0	4	1	1	1	20	2.17

Summary of Wells and Springs Exclusive of Communities

Wells and springs	Concessions (Ottawa Front)										Totals in Ottawa Front area	Per cent of Total
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Flowing-artesian wells	6	0	1	1	0	2	3	0	0	2	15	1.66
Non-flowing artesian wells	57	40	39	9	6	6	9	4	6	13	189	21.0
Non-artesian wells	72	120	118	100	32	42	58	42	29	16	629	69.8
Intermittent wells	1	12	8	10	2	4	2	8	5	3	55	6.1
Dry holes	0	0	1	0	0	0	0	0	0	0	1	0.11
Not used	14	7	13	12	6	13	6	6	2	2	81	89.9
Springs	1	0	0	5	2	1	5	1	0	0	15	1.65

Summary of Wells and Springs Exclusive of Communities

Wells and springs	Concessions (Rideau Front)								Totals in Rideau Front area	Per cent of total
	I	II	III	IV	V	VI	BF	GORE		
Total number	46	51	42	115	76	89	39	9	467	100
Dug	22	40	27	66	43	57	10	6	271	58.03
Bored	0	0	0	0	0	0	1	0	1	0.21
Drilled	23	11	14	43	29	32	28	2	182	39.10
Diamond drill-hole	1	0	0	1	0	0	0	0	2	0.43
Sand point	0	0	1	5	1	0	0	1	8	1.71
Spring	0	0	0	0	3	0	0	0	3	0.64
Wells: Feet deep										
0-20	13	21	22	54	38	50	5	2	205	43.89
21-40	8	9	5	20	10	6	10	4	72	15.41
41-60	5	10	5	10	6	1	5	1	43	9.21
61-80	6	7	1	5	5	7	12	1	44	9.42
81-100	9	0	2	10	4	4	6	0	35	7.49
Over 100	3	3	6	9	6	14	1	1	43	9.21
Depth unknown	2	1	1	7	6	7	0	0	24	51.39

Summary of Wells and Springs, Exclusive of Communities

	Concessions (Rideau Front)								Totals in Rideau Front area	Per cent of total
	I	II	III	IV	V	VI	BF	GORE		
Wells that yield hard water	45	49	28	93	55	52	34	7	363	77.73
soft water	1	2	9	15	17	20	2	2	68	14.78
salty water	1	0	0	0	0	6	0	0	7	1.50
sulphur water	5	2	3	4	2	5	1	0	22	4.71
irony water	0	0	0	0	2	0	0	0	2	0.43
mineral water	0	0	0	0	0	4	0	0	4	0.86
Wells with aquifer in clay	17	10	3	5	3	28	10	1	77	16.48
in sand	5	21	22	44	26	36	2	4	160	34.26
in gravel	3	1	4	13	1	12	4	2	41	8.78
in till	5	8	3	26	14	3	0	0	59	12.63
at overburden-bedrock contact	0	0	0	0	0	0	0	0	0	0.00
in bedrock	16	10	7	30	32	16	23	0	136	29.12
aquifer unknown	0	1	1	2	0	7	0	0	11	2.36

Summary of Wells and Springs, Exclusive of Communities

Wells and springs	Concessions (Rideau Front)								Totals in Rideau Front area	Per cent of total
	I	II	III	IV	V	VI	BF	GORE		
Flowing artesian	2	1	1	1	0	0	1	0	6	1.28
Non-flowing artesian	22	12	12	51	22	32	29	2	182	38.97
Non-artesian	17	32	26	59	41	49	7	7	239	51.20
Intermittent	4	5	2	4	9	7	2	0	33	7.06
Dry holes	0	1	1	0	1	1	0	0	4	0.86
Not used	2	10	1	8	5	6	3	0	35	7.50
Springs	0	0	0	0	3	0	0	0	3	0.64

Summary of Wells and Springs (Communities of Cyrville and Orleans)

Wells and springs	Cyrville	Orleans	Total number in communities	Per cent of total
Total number	54	128	182	100
Dug	18	73	91	50
Bored	0	44	44	24.17
Drilled	36	10	46	25.27
Springs	0	2	2	1.10

Summary of Wells and Springs (Communities of Cyrville and Orleans)

Wells and springs	Cyrville	Orleans	Total number in communities	Per cent of total
Wells: Feet deep				
0-20	11	68	79	43.4
21-40	6	24	30	16.43
41-60	6	11	17	9.34
61-80	10	8	18	9.89
81-100	4	1	5	2.74
Over 100	8	2	10	5.48
Depth unknown	9	14	23	12.63
Wells that yield hard water	43	68	111	60.99
medium water	7	20	27	14.83
soft water	3	29	32	17.58
salty water	2	5	7	3.84
sulphur water	8	18	26	14.28
cloudy water	1	15	16	8.84
irony water	0	1	1	0.55

Summary of Wells and Springs (Communities of Cyrville and Orleans)

Wells and springs	Cyrville	Orleans	Total number in communities	Per cent of total
Wells with aquifer in clay	0	89	89	48.9
in sand	0	4	4	2.2
in gravel	0	8	8	4.5
at overburden-bedrock contact	10	21	31	17.03
in bedrock	44	4	48	26.37
aquifer unknown	0	1	1	0.55
Flowing artesian	0	4	4	2.2
Non-flowing artesian	38	26	64	35.16
Non-artesian	14	97	111	60.99
Intermittent	4	1	5	2.75
Dry holes	0	0	0	0.00
Not used	0	6	6	3.30
Springs	0	1	1	0.55

REPRESENTATIVE WELL LOGS

The following are logs of representative wells in various parts of Gloucester township. An asterisk has been placed against any formation from which ground water was reported to have been derived.

Well number	Lot	Concession	Log (depths in feet)
1	18	B.F.(R.F.)	0 to 77 - clay 77 to 82 - gravel* 82 to 99 - Oxford
2	19	B.F.(R.F.)	0 to 76 - clay 76 to 90 - March (N.B.) no gravel between clay and March formation*
2	21	B.F.(R.F.)	0 to 30 - clay 30 to 68 - gravel*
2	22	B.F.(R.F.)	0 to 30 - clay 30 to 50 - boulders 50 to 100 - Oxford
2A	30	B.F.(R.F.)	0 to 29 - clay 29 to 30 - gravel* at 30 - bedrock (N.B.) a flowing-artesian well
3	30	B.F.(R.F.)	0 to 1 - soil 1 to 15 - boulder clay 15 to 20 - gravel* 20 to 75 - Oxford*

Well number	Lot	Concession	Log (depths in feet)
2	29	I (R.F.)	0 to 42 - clay
			42 to 45 - gravel*
			at 45 - bedrock
1A	29	II (R.F.)	0 to 10 - clay
			10 to 16 - sand*
			at 16 - bedrock
1	8	Gore (R.F.)	0 to 16 - sand
			16 to 62 - clay, sand, gravel
			62 to 250 - Oxford
			250 to 270 - March
			270 to 460 - Nepean
			460 to 490 - Precambrian
4	10	III (R.F.)	0 to 1 - soil
			1 to 80 - running sand
			80 to 95 - gravel*
			95 to 115 - Oxford*
2	30	III (R.F.)	0 to 1 - sand
			1 to 25 - boulders
			25 to 55 - sand and gravel*
			55 to 85 - Oxford (?)
8	6	IV (R.F.)	0 to 5 - sand
			5 to 50 - clay
			50 to 80 - running sand*
			80 to 85 - coarse gravel*

Well number	Lot	Concession	Log (depths in feet)
6	7	IV (R.F.)	0 to 32 - sand
			32 to 36 - water gravel*
			36 to 75 - sand
			75 to 77 - water gravel*
			77 to 98 - sand
			98 to 122 - Carlsbad
1	8	IV (R.F.)	0 to 10 - gravelly clay
			10 to 50 - grey quicksand*
			at 50 - black gravel*
1	9	IV (R.F.)	0 to 2 - loam
			2 to 30 - clay
			50 to 32 - gravel*
5	9	IV (R.F.)	0 to 10 - sand
			10 to 57 - soft sandy clay
			57 to 60 - gravel and clay
			60 to 68 - silt, clay, gravel
			68 to 78 - silt, sand, gravel
			78 to 82 - sandy clay
			82 to 87 - gravel and clay
			87 to 110 - Billings (?)
2A	15	IV (R.F.)	0 to 3 - loam
			3 to 22 - blue clay
			22 to 35 - fine, grey sand*
			35 to 86 - shale

Well number	Lot	Concession	Log (depths in feet)
5A	3	VI (R.F.)	0 to 6 - sand*
			6 to 30 - clay
			30 to 40 - clay and boulders
			at 40 - Carlsbad*
1	5	VI (R.F.)	0 to 30 - clay
			30 to 36 - Carlsbad
1A	7	VI (R.F.)	0 to 75 - clay
			75 to 93 - gravel
			93 to 150 - Carlsbad
1	12	VI (R.F.)	0 to 50(?)- clay
			50(?) to 157 - gravel*
			157 to 209 - Carlsbad
1	28	VI (R.F.)	0 to 75 - clay
			75 to 96 - fine sand
			96 to 106 - Carlsbad*
19 (Orleans)	3	I (O.F.)	0 to 73 - clay
			73 to 79 - gravel*
			at 79 - bedrock
52 (Orleans)	3	I (O.F.)	0 to 35 - clay
			35 to 40 - gravel*
			at 40 - bedrock
7	6	I (O.F.)	0 to 155 - blue clay
			155 to 164 - Rockcliffe
			(N.B.) water from contact of clay and Rockcliffe

Well number	Lot	Concession	Log (depths in feet)
4	10	I (O.F.)	0 to 65 - clay 65 to 100 - Hardpan 100 to 250 - Oxford*
1	11	I (O.F.)	0 to 15 - drift 15 to 140 - Ottawa-St.Martin 140 to 245 - Rockcliffe 245 to 520 - Oxford 520 to 545 - March 545 to 558 - Nepean
6A	16	I (O.F.)	0 to (?) - drift (?) to 160 - Ottawa - St. Martin 160 to 300 - Rockcliffe 300 to 343 - Oxford (?)
8	19	I(O.F.)	0 to 295 - Ottawa 295 to 306 - Rockcliffe*
9	10	III(O.F.)	0 to 14 - Sand 14 to 97 - clay 97 to 100 - fine, white sand* 100 to 160 - Billings*
5	11	III(O.F.)	0 to 85 - clay 85 to 90 - gravel* at 90 - Billings
4	14	III(O.F.)	0 to (?) - sand (?) to 80 - clay 80 to 85 - gravel (N.B.) no water encountered in this hole

Well number	Lot	Concession	Log (depths in feet)
1	20	III(O.F.)	0 to 4 - sandy soil
			4 to 58 - blue clay
			58 to 66 - fine sand
			66 to 120 - Billings
1	21	III(O.F.)	0 to 3 - sandy loam
			3 to 38 - blue clay
			38 to 40 - gravel*
			40 to 84 - Billings*
1A	11	IV (O.F.)	0 to 5 - sand
			5 to 180 - clay
			at 180 - Billings*
			(N.B.) water also at contact of clay and Billings
5A	19	IV (O.F.)	0 to 10 - red sand
			10 to 97 - blue clay
			97 to 212 - Carlsbad (?)
2A	17	V (O.F.)	0 to 180 - clay
			180 to 200 - Carlsbad*
1B	19	VI (O.F.)	0 to 190 - clay
			190 to 195 - gravel*
			195 to 208 - Carlsbad
			(N.B.) water under considerable pressure
4A	1	VII (O.F.)	0 to 80 - clay
			80 to 90 - sand and* gravel
			90 to 100 - Carlsbad
			(N.B.) water very saline

Well number	Lot	Concession	Log (depths in feet)
1	18	VII (O.F.)	0 to 204 - overburden, chiefly clay
			204 to 469 - Carlsbad
			469 to 544 - Billings
			544 to 1,044 - Trenton
			1,044 to 1,144 - Black River
			1,144 to 1,294 - Chazy
			1,294 to 1,494 - Beekmantown
			1,494 to 1,744 - Nepean
1	3	10 (O.F.)	0 to 14 - clay
			14 to 16 - sand*
			16 to 41 - clay
			41 to 43 - gravel*
			at 43 - Carlsbad

ANALYSES OF WELL WATERS FROM GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

							Constituents as Analysed (parts per million)											Hardness (pts. per million)
Sample number	Owner	Lot	Concession	Depth of well (feet)	Aquifer *	Total dissolved solids (parts per million)	Silica (Col.) (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Alkalis (as Na)	Fluoride (F)	Sulphate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Bicarbonate (HCO_3)	Alkalinity (as $CaCO_3$)	Total hardness (as $CaCO_3$)
1	M. Sabourin	1	4 OF	71	C/B	448.6	14.5	14.2	11.3	145.9	1.2	47.8	67.2	1.0	284.8	242.2	81.8
2	Protestant School	10	3 OF	14	S/C	171.7	9.5	20.9	1.5	19.4		16.4	2.4	3.0	100.0	82.0	58.3
3	R.C. School	15	4 OF		S/C	179.2	17.8	39.1	7.0	13.3	0.2	20.6	2.2	0.5	154.5	130.6	126.4
4	C. D. Grey	19	4 OF	212	Ca	3,466.0	9.0	26.1	53.1	129.8	0.6	0.0	181.6	10.0	504.1	422.4	283.8
5	C. Kettles	17	7 OF	12	S	778.4	7.3	93.3	35.5	132.8	0.5	200.0	134.4	33.0	234.2	236.0	378.7
6	L. Landry	14	7 OF	120	C/B	1,252.9	15.5	80.6	58.8	316.4		28.8	526.8	19.0	420.2	344.4	443.2
7	R. I. Birtch	17	1 RF	25	C	312.2	17.0	59.9	24.7	13.6	0.3	29.6	6.2	20.0	246.9	234.4	250.9
8	K. Spratt	26	1 RF	53	Ox	762.1	13.5	134.7	69.8	27.3	0.0	248.6	60.3	Trace	421.6	345.6	622.9
9	F. Barrett	16	4 RF	20	?	440.7	10.3	27.1	18.4	118.4	0.7	42.8	100.9	Trace	217.2	203.2	142.8
10	C. H. Brown	15	5 RF	86	Ca	459.9	9.5	1.8	0.4	102.1		38.7	9.8	40.0	165.9	136.0	6.1
11	W. N. Ramsay	9	6 RF	165	C/G	1,756.3	13.3	9.6	15.3	686.0		0.0	747.6	6.8	548.0	462.0	87.0
12	Rowatt and Payne	12	6 RF	208	C/G	4,217.5	10.5	16.9	50.4	1614		0.0	2056	18.5	668.6	752.4	249.8

ANALYSES[1] OF WELL WATERS FROM GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

*	C	Clay
	S	Sand
	G	Gravel
	Ca	Carlsbad formation
	Ox	Oxford formation
	B	Bedrock

1 Analyses by Mines Branch, Dept. of Mines and Technical Surveys.

Compilation of Well Data

The following abbreviations were used in the accompanying compilation sheets of well data:

Concession: O.F. – Ottawa front
R.F. – Rideau front

Type: Brd. – bored; D. – dug; D.D.H. – diamond drill hole; Drl. – drilled; Spr. – spring; Spt. – sand point.

Depth to Water Surface: M. – measured.

Aquifer: Al. – alluvium; C. – clay; C.T. – clay till; G. – gravel; G.T. – gravelly till; S. – sand; S.T. – sandy till; S.-C.T. – stoney, clay till
(N.B.) Symbols such as S. lc. indicates that the ground water occurs at or near the contact of the two materials.
Ca: – Carlsbad formation; Bi. – Billings formation; Ot. – Ottawa formation; R. – Rockcliffe formation; Ox. – Oxford formation; M. – March formation; N. – Nepean formation; B.R. – bedrock.

Quality: C. – clear; Cl. – cloudy; H. – hard; I. – ironey; M. – medium hard; Min. – mineral taste; S. – soft; Sal. – salty; Sul. – sulphur; * Sample taken for chemical analyses.

Use: B. – baths for medicinal purposes;
D. – domestic; G. – gardening; I. – irrigation;
M. – municipal; N. – not used; S. – stock.

GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONT. RIO

Well No.	Conc.	Lot	Type	Altitude in feet above sea-level	Depth (feet)	Depth to Water Surface (feet)	Depth to Bedrock (feet)	Aquifer	Yield gals. per hour (approx)	Quality	Use	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13
1	1 O.F.	3	D.	187	17	8M		C.		M.C.	D.	At house; creek for stock
1	1 O.F.	4	Drl.			+3.0		G.	277 g.p.h. (July 1/52)	H.C.	S.	Flowing well
2	1 O.F.	4	Brd.	226	25	16M		C.		M.C.	D.	Sufficient supply
1	1 O.F.	5	Drl.	181				R.		C.Sal.	D.	Piezometric surface +4.0 feet in spring
2	1 O.F.	5	D.	199	10	3M		C.		H.Cl.	N.	
1	1 O.F.	6	D.	200	15	5M		C.		H.C.	D.	Low during late summer
1A	1 O.F.	6	D.	202	15	6M		C.		H.C.	N.	
2	1 O.F.	6	D.	204	13	4M		C.		H.C.	D.	Sufficient supply
3	1 O.F.	6	D.	196	16	4M		C.		M.C.	D.	Not a good well
4	1 O.F.	6	D.	170	10	3M		C.		H.C.	D.	Sufficient supply
5	1 O.F.	6	Brd.	170	21½	2M		C.		H.C.	N.	House under construction
6	1 O.F.	6	Drl.			0		C.	1282 g.p.h. (July 1/52)	S.C.	D.	Flowing well; supplies 6 houses
7	1 O.F.	6	Drl.	195	164	0		C./R.		H.C.	D.S.	Flowing well:
8	1 O.F.	6	D.	188	13	3M		G.		M.C.	D.	Water at 180 feet from gravel beneath clay

1	2	3	4	5	6	7	8	9	10	11	12	13
8A	1 O.F.	6	Drl.	187	197	20		G.		S.C.	D.	Water at 190 feet from gravel beneath clay
9	1 O.F.	6	Brd.	185	65	35		S.		M.Cl.	D.	Water from sand beneath clay
10	1 O.F.	6	Drl.		60+	+2			387.1 g.p.h. (July 1/52)	H.C.	D.	Flowing-artesian well
11	1 O.F.	6	Brd.		23	2M		C.(?)		H.C.	D.	Sufficient for cottage
1	1 O.F.	7	D.	192	4	2M		C.			N.	
2	1 O.F.	7	Drl.	202	114	9		S.&G.		Sal.C.	S.	Water from sand and gravel beneath clay
3	1 O.F.	7	D.(?)	232				C.(?)		S.C.	D.	Flowing-artesian well
1	1 O.F.	8	Drl.	217	170	30		R.		M.Sul.	D.S.	Excellent supply: strong hydrogen sulphide odour
2	1 O.F.	8	Brd.	199	25	5		C.		H.C.	D.	Low during late summer
2A	1 O.F.	8	Drl.	207	133	13		G.		H.Sal.	D.S.	Water from gravel beneath clay
1	1 O.F.	9	D.	248	12	4		C.		H.C.	D.	Sufficient supply
2	1 O.F.	9	Drl.	245	180			R.		H.C.	D.	Sufficient supply
1	1 O.F.	10	Drl.	268	212			O.&R.		H.C.	D.S.	Sufficient supply
2	1 O.F.	10	Drl.	287	308		5	O.&R.		S.Sal.	S.	Sufficient supply
1	1 O.F.	11	Drl.		558		15	Unknown			N.	Insufficient supply: at Vehicle Research Establishment
2	1 O.F.	11	D.	266	12	4M	4	T./O.		H.C.	D.	Low during late summer
2A	1 O.F.	11	Drl.	249	80	17	80	O.		H.Sal.	D.S.	Sufficient supply

1	2	3	4	5	6	7	8	9	10	11	12	13
3	1 O.F.	11	Drl.	244	160	70	8	O.		H.C.	D.	Sufficient supply
4	1 O.F.	11	Drl.									Insufficient information
5	1 O.F.	11	Drl.		250		100	O.(?)		H.Sal.	N.	At Vehicle Research Establishment
1	1 O.F.	12	Drl.	236	142	30	10	O.		H.C.	D.	Sufficient supply
2	1 O.F.	12	Drl.	254	183	65	10	O.			N.	
3	1 O.F.	12	Drl.	232	114	6	0	O.		H.C.	D.	Sufficient supply
4	1 O.F.	12	Brd.	221	7	4	8	C./O.		H.Cl.	D.	Sufficient supply
4A	1 O.F.	12	Brd.	220	9			G.		H.C.	G.	Sufficient supply
5	1 O.F.	12	Drl.	227	180			O.		H.C.	D.	Sufficient supply
6	1 O.F.	12	D.	220	28	15		G.		H.C.	D.	Sufficient supply
1	1 O.F.	13	D.	210	7	1		C.				Sufficient supply
1	1 O.F.	15	D.	184	20		20	C./R.		H.C.	D.	Sufficient supply,
2	1 O.F.	15	Brd.	184	27	3		C.		S.C.	D.	Sufficient supply
3	1 O.F.	15	Drl.	192	80			C.?		H.C.	D.	Insufficient supply
4	1 O.F.	15	Brd.	195	42	16M		C.		S.C.	D.G.	Excellent well
5	1 O.F.	15	D.	190	20	9M		C.		H.	D.	Sufficient supply
6	1 O.F.	15	D.	191	18	6M		C.		H.	D.	Sufficient supply
7	1 O.F.	15	D.	207	19	5M		C.		S.C.	D.	Sufficient supply
8	1 O.F.	15	Drl.	221	355	65	136	R.&O.		H.Sal.	D.S.	Sufficient supply

1	2	3	4	5	6	7	8	9	10	11	12	13
9	1 O.F.	15	D.	220	30		136	C.		H.	D.	Sufficient supply
10	1 O.F.	15	D.	218	24			C.		H.Cl.	D.	Sufficient supply
11	1 O.F.	15	D.	218	22			C.		H.C.	D.	Sufficient supply
12	1 O.F.	15	D.	218	19	4M		C.		H.C.	D.	Low in late summer
13	1 O.F.	15	D.	217	18	4M		C.		S.C.	D.	Sufficient supply
14	1 O.F.	15	D.	217	14	3		C.		H.Sul.	D.	Low during late summer
1	1 O.F.	16	D.	218	11	4M		C.		H.C.	D.	Sufficient supply
2	1 O.F.	16	Drl.	223	200	40		G.		M.Cl.	D.S.	Water from gravel beneath clay
2A	1 O.F.	16	D.		25			C.		H.C.	D.	Sufficient supply
3	1 O.F.	16	Brd.	230	16	4M		C.		H.C.	D.	Low in late summer
3A	1 O.F.	16	D.	230	14	1M		C.		M.C.	D.S.	Sufficient supply
4	1 O.F.	16	Drl.	231	172	40	None	G.		S.C.	D.	Sufficient supply
5	1 O.F.	16	Brd.	231	27	1		C.		M.C.	D.	Low in late summer
6	1 O.F.	16	D.	240	40	3		C.		M.C.	D.	Sufficient supply
6A	1 O.F.	16	Drl.	262	343	90		O.&R.		H.Sal.	S.	Water too saline for drinking purposes
1	1 O.F.	17	Drl.	231	237	45		G.		S.C.	D.	Water at 175 feet from gravel beneath clay
2	1 O.F.	17	D.	234	32	5		C.		H.C.	D.	Sufficient supply
2A	1 O.F.	17	Drl.	239	220	45	None	G.		S.Cl.	D.	Water from gravel beneath clay

1	2	3	4	5	6	7	8	9	10	11	12	13
3	1 O.F.	17	D.	235	18	3		C.		M.C.	D.	Sufficient supply
4	1 O.F.	17	D.	236	24	3		C.		M.C.	D.	Sufficient supply
5	1 O.F.	17	Drl.	233	287		95	O.		Sul.C.	D.S.	Sufficient for tourist camp
6	1 O.F.	17	D.	239	22	4		C.		M.C.	D.	Sufficient supply
7	1 O.F.	17	D.	244	12	5M		C.		H.C.	D.	Sufficient supply
8	1 O.F.	17	D.	254	21	9		C.		H.C.	D.	Sufficient supply; at house
8A	1 O.F.	17	Drl.	263	240	60	105	O.		H.Cl.	S.	Sufficient supply
9	1 O.F.	17	D.	247	18			C.		H.C.	D.	Sufficient supply
1	1 O.F.	18	D.	250	15	3M		C.		H.C.	D.	Sufficient supply
2	1 O.F.	18	Drl.		136			O.				Reported flowing artesian when first drilled
1	1 O.F.	19	Drl.	287	145		2	O.		H.C.	N.	
2	1 O.F.	19	Drl.	234	136	70	0	O.		H.Cl.	D.	Limited supply
3	1 O.F.	19	Drl.	317	110		11	O.	340	H.C.	D.G.	Sufficient supply
4	1 O.F.	19	Drl.	327	158+		1	O.		H.C.	D.G.	Sufficient supply
5	1 O.F.	19	Drl.	332	110	75	8	O.		H.Cl.	D.	Sufficient supply
6	1 O.F.	19	Drl.	310	178	22	(?)	O.		H.Cl.	D.	Sufficient supply
7	1 O.F.	19	Drl.	349	165	30	1	O.		M.C.	D.	Sufficient supply
8	1 O.F.	19	Drl.	346	308		0	O.&R.	450	H.C.	D.G.	Sufficient supply
9	1 O.F.	19	Drl.	349	280			O.&R.		H.	D.	Sufficient supply

1	2	3	4	5	6	7	8	9	10	11	12	13
10	1 O.F.	19	D.	167	15	3		C.		M.Cl.	D.	Sufficient supply
11	1 O.F.	19	Brd.	173	30			C.		M.C.	D.	Sufficient supply
1	1 O.F.	20	Drl.	341	146	4		O.		H.C.	D.	Low in late summer
2	1 O.F.	20	D.	331	12	7M		C.T.		H.C.	D.	Sufficient supply
3	1 O.F.	20	Drl.	367	312	60	1	O.&R.		H.C.	D.	Sufficient supply
4	1 O.F.	20	D.	337	15	7M		C.T./O.			D.	Sufficient supply (?)
5	1 O.F.	20	Drl.	348	170	130(?)	0	O.		H.C.	D.	Sufficient supply
6	1 O.F.	20	Drl.	347	110	25	0	O.		H.C.	D.	Sufficient supply
7	1 O.F.	20	Drl.	344	180		0	O.		H.	D.	Sufficient supply
8	1 O.F.	20	Drl.	344	120		0	O.		H.C.	D.	Sufficient supply
9	1 O.F.	20	D.	322	9	3M	11(?)	C.T.		M.	N.	
10	1 O.F.	20	Drl.	325	74(?)	20	2	O.		H.C.	D.G.	Sufficient supply
11	1 O.F.	20	Drl.	344	300	2M		O.		M.C.	N.	
11A	1 O.F.	20	D.		9	2M		S.T.		H.C.	D.S.	Sufficient supply
11B	1 O.F.	20	D.		7	3M		S.T.(?)			N.	
12	1 O.F.	20	S.	299		O.		G.(?)			N.	
12A	1 O.F.	20	D.		10	4M		S.T.			N.	
13	1 O.F.	20	D.	317	14	3M		C.T.			D.	Sufficient supply

1	2	3	4	5	6	7	8	9	10	11	12	13
14	1 O.F.	20	D.	325	9	7M		C.T.		H.C.	N.	
14A	1 O.F.	20	Drl.	326	92			O.		H.C.	D.	Sufficient supply
15	1 O.F.	20	D.	332	12	3M		C.T.				Information incomplete
16	1 O.F.	20	Drl.	336	98	12	2	O.		H.C.	D.	Sufficient supply
17	1 O.F.	20	Drl.	338	100+	10M		O.			N.	House under construction
18	1 O.F.	20	Drl.	339	131	18		O.			N.	House under construction
19	1 O.F.	20	Drl.	245	126(?)			O.		H.C.	D.G.	Sufficient supply
20	1 O.F.	20	Drl.	305	48	8		O.		H.C.	D.	Excellent well
21	1 O.F.	20	Drl.	311	125	9		O.		M.C.	D.	Sufficient supply
22	1 O.F.	20	Drl.	239	150		18	Ox.		M.	D.G.	Excellent well
23	1 O.F.	20	Drl.	184	48			C.(?)		M.C.	D.	Sufficient supply
24	1 O.F.	20	D.	178	32	5		C.(?)		M.C.	D.	Sufficient supply
25	1 O.F.	20	D.	176	28	5		C.		M.C.	D.	Sufficient supply
26	1 O.F.	20	D.	171	20	5M	20	C.		M.C.	D.	Sufficient supply
27	1 O.F.	20	D.	173	20	4M		C.		M.C.	D.	Sufficient supply
28	1 O.F.	20	D.	163	4	2	20	C.		H.C.	D.	Sufficient for several cottages
1	1 O.F.	22	Drl.	246	125			Bi.		H.Sul.	D.G.	Sufficient supply
1	1 O.F.	23	Drl.	243	125			Bi.		H.Sul.	D.G.	Sufficient supply

1	2	3	4	5	6	7	8	9	10	11	12	13
2	1 O.F.	23	D.	239	13	8M		C.T.(?)		H.C.	D.	Sufficient supply
1	1 O.F.	25	D.	234	17	12	17	G.(?)		H.C.	D.	Low in the late summer
2	1 O.F.	25	D.	234	10	4	10	C.		H.C.	D.	Goes dry in late summer
3	1 O.F.	25	D.	236	30			G.(?)		H.C.	D.	Low in late summer
4	1 O.F.	25	Drl.	233	75	4M	2	G.(?)		H.C.	D.	Excellent well
5	1 O.F.	25	Drl.	234	60	10	1	Bi.		Sul.C.	D.G.	Excellent well
6	1 O.F.	25	D.	231	13	4M	3	Bi.		M.C.	D.	Low in late summer
6A	1 O.F.	25	Drl.	231	24	3M		Bi.			N.	
7	1 O.F.	25	D.	232	7	3M		Bi.		M.C.	D.	Sufficient supply
8	1 O.F.	25	Drl.	238	81	6M	3	Bi.		H.Sul.	D.	Sufficient supply
9	1 O.F.	25	Drl.	233	160		12	Bi.		H.C.	D.	Sufficient supply
10	1 O.F.	25	D.	237	14		14	S.		S.C.	D.	Sufficient for four houses
11	1 O.F.	25	D.	237	5	4M		S.&G.		S.C.	N.	Water from sand and gravel beneath clay
12	1 O.F.	25	D.	233	22		22	S.		S.C.	D.	Sufficient supply
1	2 O.F.	1	D.	287	11	7M		C.T.				Sufficient supply; at barn
2	2 O.F.	1	D.	288	16	9		C.		H.C.	S.	Sufficient supply
2A	2 O.F.	1	D.	288	8	5M		C.T.		H.C.	D.S.	Goes dry in late summer
1	2 O.F.	2	D.	237	11	5M		C.		M.C.	D.	Sufficient supply; at house

1	2	3	4	5	6	7	8	9	10	11	12	13
2	2 O.F.	2	Drl.	237	85			O.		H.C.	D.	Sufficient supply
3	2 O.F.	2	D.	274	11	7M		C.		H.C.	D.	Sufficient supply; at house
4	2 O.F.	2	D.	269	11	7M	90	C.		H.C.	D.	Sufficient supply; at house
4A	2 O.F.	2	D.	279	17	9M	90	C.		M.C.	S.	Sufficient supply
5	2 O.F.	2	D.	247	10	8M		C.		S.C.	D.	Limited supply; at house
5A	2 O.F.	2	D.	254	16	5M		C.				Sufficient supply
6	2 O.F.	2	D.	256	12	8M		C.		H.C.	D.	Limited supply
7	2 O.F.	2	B.	252	86	3	86	C./O.		M.C.	D.	Sufficient supply
8	2 O.F.	2	Brd.	257	80	8	80	C.		S.C.	D.	Sufficient supply
9	2 O.F.	2	D.	258	10	8M		C.&S.		M.C.	D.	Sufficient supply; at house
10	2 O.F.	2	D.	280	14	11M		C.&S.		H.C.	D.	Sufficient supply
11	2 O.F.	2	Brd.	284	30	7M		C.&S.		M.C.	D.	Sufficient supply
12	2 O.F.	2	Brd.	282	37	6M		C.		M.C.	D.	Limited supply
13	2 O.F.	2	D.	282				C.			D.	Sufficient supply
14	2 O.F.	2	D.	282	31	3		C.&S.		M.C.	D.	Sufficient supply; at house
15	2 O.F.	2	Brd.	283	35	6		C.&S.		H.C.	D.	Sufficient supply; at house
15A	2 O.F.	2	Brd.	283	25	10		C.&S.		H.C.	D.	Sufficient supply
16	2 O.F.	2	D.	284	7	5M		C.		M.C.	D.	Sufficient supply

1	2	3	4	5	6	7	8	9	10	11	12	13
17	2 O.F.	2	D.	284	20	18		C.		H.C.	D.	Sufficient supply
18	2 O.F.	2	D.	284	12	7		C.&S.		H.C.	D.	Sufficient supply
18A	2 O.F.	2	D.	283	10	7		C.&S.		H.C.	S.	Sufficient supply
19	2 O.F.	2	Brd.	283	24	10		C.		H.C.	D.	Sufficient supply; at house
19A	2 O.F.	2	D.	283	12	9M		C.		H.Cl.	N.	
20	2 O.F.	2	D.	282	11	9M		C.		M.C.	D.	Sufficient supply; at house
21	2 O.F.	2	D.	283	11	8M		C.		H.C.	D.	Low in late summer
22	2 O.F.	2	D.	283	49	5M		C.		H.C.	D.	Sufficient supply
23	2 O.F.	2	D.	282	12	9M		C.		M.C.	D.	Sufficient supply; at house
24	2 O.F.	2	D.	283	14	4M		C.		M.C.	D.	Sufficient supply
25	2 O.F.	2	Brd.	288	20			C.		H.C.	D.	Sufficient supply; at house
26	2 O.F.	2	D.	290	6	3M		C.		S.C.	D.	Sufficient supply
27	2 O.F.	2	D.	291	6	4M		C.		S.C.	D.	Limited supply
28	2 O.F.	2	Drl.	292	20		20	C.(?)		H.C.	D.S.	Sufficient supply
1	2 O.F.	3	D.	294	12	5M		C.		H.C.	D.S.	Sufficient supply
1A	2 O.F.	3	D.	295	10	5M		C.		H.C.	S.	Sufficient supply
2	2 O.F.	3	D.	299	11	8M	12	C.&S.		H.C.	D.S.	Goes dry in late summer
2A	2 O.F.	3	D.	298	9	5M		C.			N.	
1	2 O.F.	4	D.	295	8	5M		C.		H.C.	D.	Sufficient for school

1	2	3	4	5	6	7	8	9	10	11	12	13
2	2 O.F.	4	D.	294	11	5M		C.		H.	D.S.	Sufficient supply
3	2 O.F.	4	D.	295	10	6M		C.		H.C.	D.	Sufficient supply
4	2 O.F.	4	D.	226	10	4M		C.		H.C.	D.S.	Low in late summer
1	2 O.F.	5	D.	293	9	4M	9	C./O.		H.C.	D.	Seldom used; at house
1A	2 O.F.	5	D.	291	8	6M	8	C.		H.C.	S.	Sufficient supply; at barn
1B	2 O.F.	5	D.	291	9	3	9	C./O.	900	H.C.	N.	In field
2	2 O.F.	5	Brd.	250	48	20M		C.		S.C.	D.	Low in late summer
2A	2 O.F.	5	D.	238	12	4M		C.&S.		S.C.	D.	Low in late summer
3	2 O.F.	5	D.	227	36	4M		C.		M.Cl.	D.	Sufficient supply
4	2 O.F.	5	Brd.	213	28	4M				S.C.		Sufficient supply
5	2 O.F.	5	D.	205	9	2M				Cl.		
6	2 O.F.	5	D.	207	25	3M		C.		Cl.		
7	2 O.F.	5	D.	219	11	4M		C.&S.		S.C.	D.S.	Goes dry during late summer
8	2 O.F.	5	Drl.	217	190	4M	180(?)	R.		M.C.	D.	Sufficient supply
9	2 O.F.	5	D.	229	10	3M		C.		S.C.	D.	Sufficient supply
10	2 O.F.	5	D.	216	13	3M		C.		H.C.	D.	Sufficient supply
1	2 O.F.	6	D.	297	10	9M	6	C.			D.	Sufficient supply
2	2 O.F.	6	D.	289	9	5M	9	C./O.		H.C.	D.S.	Goes dry
3	2 O.F.	6	D.	293	8	6M		C.			D.	Sufficient supply; at house

1	2	3	4	5	6	7	8	9	10	11	12	13
3A	2 O.F.	6	D.	294	9	5M		C.			S.	Sufficient supply; at barn
4	2 O.F.	6	D.	227	10	4M		C.				Limited information
5	2 O.F.	6	D.	222	13	9M		C.		H.C.	D.	Low in late summer
6	2 O.F.	6	D.	211	13	6M	190+	C.		H.C.	D.	Sufficient supply; at house
6A	2 O.F.	6	Brd.	209	28	1M	190+	C.		H.C.	D.	Low in late summer
6B	2 O.F.	6	D.	207	20	3M		C.		M.C.	S.	Low in late summer
6C	2 O.F.	6	Drl.	213	192	4M	192	O.		M.Cl.	N.	
7	2 O.F.	6	D.	211	8	1M		C.			D.	Sufficient supply
1	2 O.F.	7	Drl.	290	35	0	35	C./O.		S.C.	D.	Sufficient supply
2	2 O.F.	7	Drl.	288	40		40	C./O.		S.C.	D.	Sufficient supply
3	2 O.F.	7	D.	292	13	5M		C.&S.		H.C.	D.S.	Sufficient supply
4	2 O.F.	7	D.	235	8	4M	100+	C.&S.		S.	N.	
5	2 O.F.	7	D.	237	4	1		C.		H.C.	D.	Sufficient supply; at house
5A	2 O.F.	7	Brd.	252	20	12		C.		H.C.	D.S.	Sufficient supply; at barn
1	2 O.F.	11	D.	270	8	3M		C.		S.C.	N.	
1A	2 O.F.	11	D.	272	15	10M		C.		H.C.	D.	Sufficient supply
1B	2 O.F.	11	Drl.	270			95(?)	O.(?)				Low in early spring
1	2 O.F.	12	D.	258	13	6M		C.		S.C.	D.S.	Sufficient supply
2	2 O.F.	12	Brd.	259	10	6		C.			N.	

1	2	3	4	5	6	7	8	9	10	11	12	13
3	2 O.F.	12	Drl.	261	75	34M	50	O.		M.C.	D.	Sufficient supply
4	2 O.F.	12	Brd.	244	26	8M		C.		S.C.	D.	Sufficient supply
1	2 O.F.	13	D.	255	17	14M		C.&S.		C.	D.	Sufficient supply
2	2 O.F.	13	D.	255	18	7M		C.&S.		M.C.	D.	Limited supply
3	2 O.F.	13	D.	255	12	5M		C.&S.		M.C.	D.	Low in late summer; in house
4	2 O.F.	13	D.	239	12	6M		C.		C.	D.	Sufficient supply
1	2 O.F.	14	D.	240	13	5M		S.		S.C.	D.	Sufficient supply
2	2 O.F.	14	D.	242	15	3		C.&S.		M.C.	D.	Sufficient supply for school
3	2 O.F.	14	D.	242	14	5M		C.&S.		M.C.	D.S.	Sufficient supply
4	2 O.F.	14	D.	272	14	8		S.		M.C.	D.	Sufficient supply; at house
4A	2 O.F.	14	D.	272	10	5M		S.		M.C.	S.	Low in late summer; at barn
1	2 O.F.	15	D.	238	7	3M		S.			N.	
2	2 O.F.	15	D.	243	8	5M		S.		H.C.	D.	Sufficient supply
3	2 O.F.	15	Spr.					S.			D.	Sufficient supply
4	2 O.F.	15	D.	247	22	0		C.			N.	In field
1	2 O.F.	16	D.	233	18	6		S.		H.C.	D.	Sufficient supply; at house
1A	2 O.F.	16	Drl.	231	109	30	109(?)	C./O.		Sul.C.	S.	Sufficient supply; at barn
1	2 O.F.	17	D.	222	9	6M		C.&S.		H.C.	S.	Sufficient supply; at barn
1	2 O.F.	19	D.	214	32	12		C.		H.C.	N.	At house

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	2 O.F.	19	Drl.	214	332	45	84	Bi.(?)		S.C.	D.S.	Sufficient supply; at barn
1	2 O.F.	21	Drl.	263	133	20	35	Bi.		M.C.	S.	Sufficient supply; at creek
2	2 O.F.	21	Drl.	217	103	15	40	Bi.		H.C.	D.	Sufficient for school
3	2 O.F.	21	Drl.	268	58	8M	17	Bi.		S.C.	D.S.	Low in late summer
1	2 O.F.	22	D.	260		2M		S.(?)		C.	D.	Sufficient supply
2	2 O.F.	22	Drl.	218	709(?)	25	35	Bi.(?)		S.C.	D.	Sufficient supply
2A	2 O.F.	22	D.	216	18	6		S.		M.C.	D.	Sufficient supply
3	2 O.F.	22	D.	220	13	9M		S.		H.C.	D.	Sufficient supply
3A	2 O.F.	22	Drl.	220(?)	105	15M	24	Bi.		C.Sul.	D.S.	Sufficient supply
1	2 O.F.	23	D.	220	9	8M		C.&S.		H.C.	D.	Sufficient supply
2	2 O.F.	23	D.	223	10	6		S.		H.C.	D.	Sufficient supply; at house
2A	2 O.F.	23	D.	218	8	6M		S.		H.C.	S.	Sufficient supply; at barn
3	2 O.F.	23	D.	212	5	3		C.T.		S.C.	D.	Sufficient supply
4	2 O.F.	23	D.	219	8	3M		C.T.		H.C.	S.	Sufficient supply; in field
5	2 O.F.	23	D.	220	7	3		C.T.		H.C.	D.	Sufficient supply
6	2 O.F.	23	Drl.	220	105		20	Bi.		S.C.	D.	Sufficient supply
7	2 O.F.	23	D.	246	15	8M		C.T.		H.C.	D.	Sufficient supply; at house
7A	2 O.F.	23	D.	235	12	7M	12	C.T./Bi.		Sul.C.	S.	Sufficient supply; at barn
1	2 O.F.	24	D.	226	10	4M	10	S.		H.C.	D.	Sufficient supply; at house

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	2 O.F.	24	Drl.	222	90	16	20	Bi.		Sul.C.	D.S.	Sufficient supply; at barn
2	2 O.F.	24	D.	223	12	8		G.(?)		H.C.	D.	Sufficient supply
3	2 O.F.	24	D.	235	8	3		C.T.(?)		S.C.	D.	Sufficient supply
4	2 O.F.	24	D.	233	7	3M		S.&C.		M.Cl.	D.	Sufficient supply
5	2 O.F.	24	Drl.	242	105		22(?)	G.(?)		S.C.	D.	Water at 22 feet in gravel beneath clay
1	2 O.F.	25	Drl.	236	80	20	30	Bi.		S.C.	D.G.	Sufficient supply
2	2 O.F.	25	Drl.	226	105	25	43	Bi.		S.C.	D.	Sufficient supply
3	2 O.F.	25	Drl.	229	140	12M	29(?)	Bi.		C.	D.	Limited supply
4	2 O.F.	25	D.	227	22	11	22	C.T./Bi.		C.Sal.	N.	
4A	2 O.F.	25	Drl.	226	72	3M	30	Bi.		Sul.C.	D.S.	Sufficient supply; at barn
5	2 O.F.	25	D.	227	12	3		S.(?)		S.C.	D.	Goes dry; at house
6	2 O.F.	25	D.	233	13	4		S.		S.C.	D.	Sufficient supply
7	2 O.F.	25	D.	234	12	9		S.		S.C.	D.	Sufficient supply
8	2 O.F.	25	D.	236	8	6M		S.		M.C.	D.	Sufficient supply
9	2 O.F.	25	D.	225	20	6		Bi.		H.C.	D.	Sufficient supply; at house
9A	2 O.F.	25	Drl.	230						H.C.	S.	Sufficient supply; at barn
1	2 O.F.	26	D.	240	11		20			S.C.	D.	Limited supply
1A	2 O.F.	26	Drl.	235	60		10	Bi.		H.C.	D.S.	Low in late summer

1	2	3	4	5	6	7	8	9	10	11	12	13
2	2 O.F.	26	D.	232	11	4M	11	G.		H.C.	D.G.	Low in late summer
3	2 O.F.	26	Drl.	221	64		64(?)	G.(?)		M.C.Sul.	D.	Sufficient supply; water from gravel beneath clay (?).
4	2 O.F.	26	Drl.	228	150	3	7	Bi.		S.	D.	Excellent well
1	2 O.F.	27	D.	217	4	3M	4	Bi.		S.	D.	Limited supply
2	2 O.F.	27	D.	217	9	4	9	Bi.		M.C.	D.	Sufficient for 4 families
3	2 O.F.	27	Drl.	221	65	12M		Bi.		S.C.	D.	Sufficient supply
4	2 O.F.	27	D.	221	8	2M		C.T.(?)		H.Cl.	D.	Low in late summer
5	2 O.F.	27	D.	222	12	5M	12	Bi.		S.C.	D.	Sufficient supply
6	2 O.F.	27	Drl.	224	75	11M		Bi.		M.Cl.Sul.	D.	Sufficient supply
7	2 O.F.	27	Drl.	224	88	16	4	Bi.		S.C.	D.	Sufficient supply
8	2 O.F.	27	D.	226	10	5M		Bi.		H.C.	D.	Sufficient supply
9	2 O.F.	27	D.	228	16	5M		Bi.		M.Sul.	D.	Low in late summer
10	2 O.F.	27	D.	227	10	6M		Bi.		H.C.	D.	Sufficient supply
10A	2 O.F.	27	Drl.	227	51		4	Bi.		H.C.Sul.	N.	
11	2 O.F.	27	D.	222	8	2M	1	Bi.		H.C.	D.	Sufficient supply
12	2 O.F.	27	D.	218	9	3M	6	Bi.		H.Cl.	D.	Sufficient supply
13	2 O.F.	27	D.	218	6	2M		Bi.		H.Cl.Sul.	D.	Sufficient supply
14	2 O.F.	27	D.	218	5		5	Bi.		H.Cl.Sul.		Sufficient supply

1	2	3	4	5	6	7	8	9	10	11	12	13
15	2 O.F.	27	Drl.	216	80		4	Bi.		H.Cl.Sul.	N.	
16	2 O.F.	27	D.	221	9	5M	4	Bi.		C.	D.	Sufficient supply
17	2 O.F.	27	D.	221	6	2M	4	Bi.		H.C.	D.	Sufficient supply
18	2 O.F.	27	Brd.	221	9	4M		Bi.(?)		H.	D.G	Sufficient supply
19	2 O.F.	27	D.	221	14	6M	10	C./Bi.		H.C.	D.G.	Sufficient for 2 families
20	2 O.F.	27	D.	222	14		10	Bi.		H.C.	D.	Sufficient supply
21	2 O.F.	27	Drl.	226	140		8	Bi.		S.C.Sul.	D.	Sufficient supply
22	2 O.F.	27	Drl.	227	140	12	10	Bi.	1600 gal/hr.	M.Sul.	D.G.	Sufficient for irrigation system
22A	2 O.F.	27	D.	226	11	5	10	C./Bi.		H.C.	G.	Sufficient supply
23	2 O.F.	27	Drl.	231	100+		11	Bi.		H.C.	D.	Sufficient supply
24	2 O.F.	27	D.	230	27	12	13	Bi.		H.C.	D.	Sufficient supply
25	2 O.F.	27	Drl.	231	103	10M	12	Bi.		H.C.	N.	
26	2 O.F.	27	Drl.	231	86	15	10	Bi.		H.C.	D.	Sufficient supply
27	2 O.F.	27	Drl.	231	80(?)			Bi.		H.C.	D.	Sufficient supply
28	2 O.F.	27	D.	234	20(?)			C.(?)		H.C.	D.G.	Low in late summer
29	2 O.F.	27	D.	231						H.C.	D.	Used by school
30	2 O.F.	27	Drl.	233	85	25		Bi.		H.C.	D.G.	Sufficient supply
31	2 O.F.	27	Drl.	232	70			Bi.		H.C.	D.	Sufficient supply
32	2 O.F.	27	Drl.		80(?)			Bi.		S.C.	D.G.	Sufficient supply

1	2	3	4	5	6	7	8	9	10	11	12	13
33	2 O.F.	27	D.	232	28	8M		C.(?)		H.C.	D.G.	Sufficient for irrigation system
1	3 O.F.	1	D.	284	8	6M		C.		H.C.	S.	Sufficient
1A	3 O.F.	1	Drl.	284				Ot.		H.C.	D.	Sufficient; at house
1B	3 O.F.	1	D.	284	12	5M		C.		H.C.	S.	Sufficient; in field
2	3 O.F.	1	D.	288	11	7M	11	C.T.	12+	H.C.	S.	Water at till/Ottawa contact
2A	3 O.F.	1	D.	293	7	6M		C.T.		H.C.	D.	Low during late summer
2B	3 O.F.	1	Drl.	280	69	+1	69	C./Ot.	29M	H.C.	S.	Flowing well: water from clay/ Ottawa contact
2C	3 O.F.	1	Drl.	280	71	+1	71	C./Ot.		H.C.	S.	Flowing well: water from clay/ Ottawa contact
3	3 O.F.	1	D.	293	8	5M		C.		H.C.	D.	Sufficient
1	3 O.F.	2	D.	296	10	9M		C.T.		H.C.	N.	Extremely hard water; at house
1A	3 O.F.	2	Drl.	284	23	9M	23	S.		S.C.	D.	Water from sand between clay and Ottawa
1B	3 O.F.	2	D.	288	14	7M	23	C.	10+	S.C.	S.	Large diameter well
2	3 O.F.	2	D.	299	10	6M		C.		H.C.	D.	Sufficient
2A	3 O.F.	2	D.	303	12	8M	12	C.T.	10+	H.C.	S.	Sufficient
2B	3 O.F.	2	Drl.	291	14+	1M		C.		C.Sul.	S.	Sufficient
2C	3 O.F.	2	D.	291	9	4M		C.		H.C.	S.	Sufficient
1	3 O.F.	3	Drl.	305	60		20	Ot.		H.C.	N.	At house

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	3 O.F.	3	D.	301	12	9	12	S.	6+	H.C.	D.S.	Water from sand between clay and Ottawa
2	3 O.F.	3	Drl.	306	68	11	1	Ot.	10+	H.C.	D.S.	Water supply decreasing annually
2A	3 O.F.	3	D.	206	13	6M		C.		H.C.	D.	Sufficient for 2 families; at road
1	3 O.F.	4	Drl.	301	70		0	Ot.	13+	H.C.	D.S.	Never dry
1A	3 O.F.	4	D.	301	15	7	0	C.		H.C.	S.	Sufficient; in field
2	3 O.F.	4	D.	307	8	7	3	Ot.		H.C.	D.S.	Limited supply
2A	3 O.F.	4	D.	296	8	4	4	Ot.	5+	H.C.	S.	Never dry; in field
3	3 O.F.	4	D.	294	12	6M		C.	10+	H.C.	D.S.	Never dry
3A	3 O.F.	4	D.	293	7	6M		C.			N.(?)	
4	3 O.F.	4	D.	287	9	7M		S.&C.		S.C.	D.S.	Never dry
1	3 O.F.	5	D.	297	11	8M	2	C.		H.C.	D.	Goes dry
1A	3 O.F.	5	D.	289	12	8	4	Ot.	15+	S.C.	D.S.	Never dry
2	3 O.F.	5	D.	293	8	6M	8	C.		H.C.	D.	Never dry
3	3 O.F.	5	D.	287	10	6M		S.&C.		H.C.	D.	Sufficient; at house
4	3 O.F.	5	D.	273	7	4M		S.&C.		S.C.	D.	Sufficient
5	3 O.F.	5	Drl.	268				S.&C.		S.C.	D.S.	Sufficient
6	3 O.F.	5	D.	279	7	6M		S./C.		H.C.	D.	Sufficient
7	3 O.F.	5	D.	281	8	5M		S.		H.C.	D.	Never dry

1	2	3	4	5	6	7	8	9	10	11	12	13
8	3 O.F.	5	D.	283	8	6M		S.		S.C.	D.	Never dry
1	3 O.F.	6	D.	293	9	7M	9	C.		H.C.	D.	Limited supply
2	3 O.F.	6	D.	295	12	7M		C.		H.C.	D.	Low during late summer
2A	3 O.F.	6	D.	295	11	7M		C.		H.C.	S.	Sufficient; at barn
2B	3 O.F.	6	D.	290	12	6		C.		H.C.	S.	Low during late summer; in field
2C	3 O.F.	6	D.	290	16	10		C.		H.C.	S.	Low during late summer; in field
3	3 O.F.	6	D.	291	16	6M		C.		H.C.	D.S.	Never dry
3A	3 O.F.	6	D.	281	8	7		C.		H.C.	S.	Never dry; in field
4	3 O.F.	6	D.	286	11	6M		S.&C.	6+	H.C.	S.	Sufficient; in field
1	3 O.F.	7	D.	288	16	11M		C.	5+	H.C.	D.S.	Never dry
2	3 O.F.	7	D.	275	17	10M		S.&C.			N.	At abandoned house
2A	3 O.F.	7	Drl.	272							S.	Information incomplete
3	3 O.F.	7	D.	272	17	8M		S.&C.		H.C.	D.S.	Sufficient
4	3 O.F.	7	D.	283	14	6		S./C.		H.C.	D.	Sufficient; at house
4A	3 O.F.	7	D.	281	14	5M		S.&C.	12+	S.C.	S.	Sufficient; at barn
5	3 O.F.	7	D.	280	10	6M		S.&C.		H.C.	D.	Sufficient
1	3 O.F.	8	D.	285	29	4		S.&C.		S.C.	D.S.	Never dry
2	3 O.F.	8	D.	282	11	9M		S./C.		H.C.	D.	Sufficient(?) Water at 6 feet from sand/clay contact; at house
3	3 O.F.	8	D.	278	12	7M		S.&C.		H.C.	D.	Sufficient

1	2	3	4	5	6	7	8	9	10	11	12	13
3A	3 O.F.	8	Drl.	275	95	25		Bi.	25+	Cl.Sul.	S.	Never dry
4	3 O.F.	8	D.	279	9	8M		S.&C.		H.C.	D.	Sufficient
5	3 O.F.	8	D.	273	9	6M		S.&C.		H.C.	D.	Sufficient
1	3 O.F.	9	D.	271	15	7		S.&C.		H.C.	D.	Sufficient; at house
1A	3 O.F.	9	Drl.	272	150	25	50	Bi.	25+	C.Sul.	S.	Sufficient; at barn
2	3 O.F.	9	D.	278	15	8		S.&C.		H.C.	D.	Sufficient; at house
2A	3 O.F.	9	Drl.	272	150	30	60	Bi.	27+	C.Sul.	S.	Sufficient; at barn
1	3 O.F.	10	D.	272	17	10M		S.&C.	12+	H.C.	D.S.	Sufficient
2	3 O.F.	10	D.	270	15	8M		S.&C.		H.C.	D.S.	Sufficient
3	3 O.F.	10	Drl.	270	160	60M	118	Bi.	20+	C.Sul.	D.	Sufficient
4	3 O.F.	10	Drl.	271	160	60M	118	Bi.	20+	C.Sul.	D.	Sufficient
5	3 O.F.	10	Drl.	273	165	50.	118	Bi.	12+	C.Sul.	D.	Sufficient
6	3 O.F.	10	D.		10	9		S.		H.C.*	D.	Not sufficient supply for school 52° F
7	3 O.F.	10	Drl.	271	173	60M	118	Bi.	30+	C.Sul.	D.	Sufficient
8	3 O.F.	10	Drl.	272	173	60	118	Bi.		C.Sul.	D.	Sufficient
9	3 O.F.	10	Drl.	270	160	60	118	Bi.	120+	C.Sul.	D.	Sufficient
10	3 O.F.	10	D.	272	16	11M		S.&C.		H.C.	D.	Sufficient
1	3 O.F.	11	D.	272	9	1		S.&C.	20+	S.C.	D.	Sufficient

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	3 O.F.	11	Drl.	270	180	35	85	Bi.		H.C.	S.	Sufficient
2	3 O.F.	11	D.	273	20	10		C.		S.C.	D.	Sufficient
3	3 O.F.	11	D.	266	19	10M		S.&C.		S.C.	D.	Sufficient
4	3 O.F.	11	D.	224	10	8		S.&C.		S.Cl.	D.	Sufficient
5	3 O.F.	11	Drl.	219	90	0	90	G./Bi.		C.Sal.	D.(?)	Water at 89 feet in gravel over Billings
6	3 O.F.	11	Drl.	223						S.C.Sul	D.S.	Never dry; information incomplete
7	3 O.F.	11	D.	223	13	5		C.		S.C.	D.	Goes dry
8	3 O.F.	11	Drl.	221	48	5	90	S.&C.		H.C.	D.	Never dry
8A	3 O.F.	11	Drl.	222	90	10	90	Bi(?)		H.C.	S.	Water from drift/Bi. contact
9	3 O.F.	11	D.	223	12		95	S.&C.		H.C.	D.	Dry when measured
9A	3 O.F.	11	D.	223	8	6		S.&C.		H.C.	S.	Goes dry
1	3 O.F.	12	Drl.	244	48	22M		C.(?)	18+	H.C.	D.S.	Sufficient
2	3 O.F.	12	D.	243	24	6M		C.(?)		H.C.	D.	Water from clay beneath sand (?)
3	3 O.F.	12	D.	243	10	5M		S.&C.		H.C.	S.	Sufficient
4	3 O.F.	12	D.	241	15	4M		S.&C.			N.	
5	3 O.F.	12	D.	222	16	2		S.&C.			N.	Never dry
5A	3 O.F.	12	Drl.	221	100		93	Bi.		S.C.	D.	Water at 100 feet in Billings
6	3 O.F.	12	Drl.	222	85	2	85	C.(?)		S.C.	D.	Water at 85 feet from clay/ Billings contact

1	2	3	4	5	6	7	8	9	10	11	12	13
7	3 O.F.	12	Drl.	220	80	5M	None	S.&C.		S.C.	D.	Never dry
7A	3 O.F.	12	Drl.	220	80	20	None	S.&C.		S.C.	D.	
8	3 O.F.	12	D.	219	11	4		C.		H.C.	D.	Never dry; near a creek
9	3 O.F.	12	D.	225	12			C.		H.C.	D.	Sufficient; at house
9A	3 O.F.	12	D.	226	13	4M		S.		H.C.	S.	Never dry; at barn
1	3 O.F.	13	Drl.	243	106	30	100	Bi.		Cl.Sul.	S.	Sufficient
2	3 O.F.	13	D.	242	8	5M		S.&C.		H.C.	D.	Not a sufficient supply
3	3 O.F.	13	D.	216	11	8M		C.		H.C.	D.	Never dry
4	3 O.F.	13	D.	213	24	12		S.&C.		S.C.	D.	Never dry
5	3 O.F.	13	D.	221	12			C.		S.C.	D.	Never dry
6	3 O.F.	13	D.	221	13	6		S.(?)		H.C.	D.	Low in late summer
7	3 O.F.	13	D.	221	12	5M		S.		H.C.	D.	Low in late summer; at house
7A	3 O.F.	13	D.	225	25			S.		H.C.	N.	Never dry
8	3 O.F.	13	Drl.		97(?)			Bi.				Sufficient for school
1	3 O.F.	14	Drl.	246	157	8	110	Bi.		Sul.	S.	Sufficient for slaughter house; 110 feet of clay to bedrock
2	3 O.F.	14	D.	243	9	3		S./C.		S.C.	D.S.	Water at 5 feet from sand/clay contact
3	3 O.F.	14	D.	245	9	6M		S.		S.C.	D.	Sufficient; no clay in well
4	3 O.F.	14	D.	219	15	5M		C.		S.C.	D.	Low in late summer

1	2	3	4	5	6	7	8	9	10	11	12	13
4A	3 O.F.	14	D.	217	14	5		C.		S.C.	N.	
5	3 O.F.	14	D.	222	12	2M		S.&C.		H.C.	D.	Never dry
6	3 O.F.	14	D.	222	13	3M		S.&C.		S.C.	D.	Never dry
7	3 O.F.	14	D.	223	9	6		S.&C.		S.C.	D.	Goes dry during late summer
7A	3 O.F.	14	D.	220	9	6		S.&C.		H.C.	D.	Sufficient; at barn
8	3 O.F.	14	D.	224	12	7		S.&C.		H.C.	D.	Never dry
9	3 O.F.	14	D.	224	10	5		S.&C.		S.C.	D.	Never dry
10	3 O.F.	14	D.	229	9	6M		S.		S.C.	D.	Never dry; no clay in well
11	3 O.F.	14	D.	228	10	5		S.		S.C.	D.	Never dry; no clay in well
12	3 O.F.	14	D.	224				S.&C.		S.C.	D.	Goes dry during late summer
13	3 O.F.	14	D.	228	12	7		S.&C.		S.C.	D.	Never dry
13A	3 O.F.	14	D.	228	16	14		S.&C.		H.C.	D.	Never dry
13B	3 O.F.	14	D.	228	8	5		S.&C.		S.C.	S.	Never dry
13C	3 O.F.	14	D.	229	7	4		S.&C.		S.C.	S.	Never dry
1	3 O.F.	15	Spt.	238	11			S.		S.C.	D.	Sufficient
2	3 O.F.	15	Spt.	239	6			S.		S.C.	D.	Sufficient; in house
3	3 O.F.	15	D.	236	9	3		S.		S.	D.	Sufficient; in house
4	3 O.F.	15	Drl.	243	230(?)		100	Bi.		C.Sul.	D.	Sufficient
5	3 O.F.	15	D.	234	6	2		S.		H.C.	D.	Sufficient

1	2	3	4	5	6	7	8	9	10	11	12	13
6	3 O.F.	15	D.	233	6	2M		S.&C.		H.C.	D.S.	Sufficient
7	3 O.F.	15	D.	229	9	3		S.&C.			N.	House under construction
8	3 O.F.	15	D.	229	40	5		S.&C.		S.C.	D.	Never dry
8A	3 O.F.	15	D.	227	35	5		S.&C.		S.C.	N.	Never dry
8B	3 O.F.	15	D.	226	35	0		S.&C.	5+	S.C.	S.	Never dry
9	3 O.F.	15	D.	227	12			S.&C.		S.C.	N.	Never dry
9A	3 O.F.	15	D.	228	8	5		S.&C.		S.C.	D.	Never dry
10	3 O.F.	15	D.	227	10	8		S.&C.			N.(?)	
11	3 O.F.	15	D.	226	15	5		S./C.		H.C.	D.	Takes one day to fill after pumped dry
1	3 O.F.	16	D.	230	12	5M		S.		S.C.	D.	Sufficient
2	3 O.F.	16	D.	228	15	7M		S.		H.C.	D.	Sufficient
3	3 O.F.	16	D.	226	10	10M		S.&G.		S.C.	D.	Sufficient
4	3 O.F.	16	Brd.	228	26	12M		S./C.		H.C.	D.	Sufficient
5	3 O.F.	16	D.	222	11	5M		S./C.		H.C.	D.	Sufficient
6	3 O.F.	16	D.	223	13	5M		S.&C.		H.C.	D.	Sufficient
7	3 O.F.	16	D.	222	8	3M		C.		H.C.	D.	Goes dry
8	3 O.F.	16	D.	232	12	3M		S.&C.		H.C.	D.S.	Sufficient
9	3 O.F.	16	D.	225	4	4		S.		S.C.	D.	Sufficient

1	2	3	4	5	6	7	8	9	10	11	12	13
10	3 O.F.	16	D.	230	8	4M		S./C.		H.C.	D.	Sufficient
11	3 O.F.	16	D.	233	10	6		S.		S.C.	D.G.	Sufficient
12	3 O.F.	16	D.	234	11	6M		S./C.		H.C.	D.	Sufficient
13	3 O.F.	16	D.	230	12	7		S./C.		S.C.	D.	Sufficient
14	3 O.F.	16	D.	226	4	1M		S.		H.C.	D.	Sufficient; in house; clay at 10 feet
15	3 O.F.	16	D.	232	10	8M		S./C.			N.	Vacant house
1	3 O.F.	17	D.	222	6							Dry well; not deep enough
2	3 O.F.	17	D.	221	8	5M		S./C.		H.C.	D.	Sufficient
3	3 O.F.	17	D.	223	11	6M		S./C.		H.C.	D.	Sufficient; at house
3A	3 O.F.	17	D.	223	7	4M		S./C.	10+	H.C.	S.	Sufficient; at barn
4	3 O.F.	17	D.	253	12	10M		S./C.		H.C.	D.	Water at 10 feet from sand/clay contact
1	3 O.F.	18	D.	220	17	9M		S./C.			N.	At house
1A	3 O.F.	18	D.	220	13	6M		S./C.	15+	H.C.	S.	Sufficient; at barn
2	3 O.F.	18	D.	218	25	7M		S./C.		H.C.	D.	Sufficient
2A	3 O.F.	18	Drl.	219	156	40	100	Bi.(?)		C.Sal.	S.	Sufficient
1	3 O.F.	19	Drl.	217	98	25	35	Bi.	27+	S.Sul.	D.S.	Sufficient
1	3 O.F.	20	Drl.	216	120	8(?)	80	Bi.	55+	S.C.	D.S.	Water at 120 feet from Billings
1	3 O.F.	21	Drl.	217	110	15M	40	Bi.		S.C.	D.	Water at 84 feet from Billings

1	2	3	4	5	6	7	8	9	10	11	12	13
2	3 O.F.	21	Drl.	216	47	40	40	Bi.(?)	31+	S.C.	D.S.	Sufficient
1	3 O.F.	22	Drl.	220	165	140	18	Bi.		Cl.Sul.	N.	At house
1A	3 O.F.	22	Drl.	214	42	11	18	Bi.(?)	8+	C.Sul.	D.S.	Sufficient; at barn
2	3 O.F.	22	Drl.	225	105	10M	40	Bi.	20+	C.Sul.	D.S.	Sufficient
1	3 O.F.	24	Drl.	215	33	10	20	Bi.		H.C.	D.	Sufficient; creek for stock
1	4 O.F.	1	Drl.	281	105	85		C.(?)		H.Sal.	S.	Water may be from clay/ Ottawa contact
2	4 O.F.	1	Drl.	281	71	+1M	50	C.	220M	H.C.*	S.	Water at 50 feet from clay/ Ottawa contact 47° F
3	4 O.F.	1	D.	276	11	5M		S./C.		H.C.	D.	Water at 5 feet from sand/clay contact
4	4 O.F.	1	D.	279				S./C.		H.C.	D.	Goes dry; at store
5	4 O.F.	1	D.	262				C.		H.C.	D.S.	Sufficient
5A	4 O.F.	1	D.	262				C.		H.C.	D.	Sufficient
6	4 O.F.	1	D.	280	18	6M		S.&C.		S.C.	D.	Excellent supply
7	4 O.F.	1	D.	284	8	5M		S./C.		S.Cl.	D.	Low during late summer
8	4 O.F.	1	D.	278				S.		H.C.	D.S.	Sufficient
9	4 O.F.	1	D.	277				S.&C.		S.C.	D.	Never dry; in house
10	4 O.F.	1	D.	278	9	4M		S./C.		S.C.	D.	Well is bottomed on clay
11	4 O.F.	1	D.	271	7	3M		S./C.		S.C.	D.	Sufficient

1	2	3	4	5	6	7	8	9	10	11	12	13
11A	4 O.F.	1	D.	281	10	6M		C.			N.	
1	4 O.F.	2	D.	284	10	6M		S./C.		H.C.	D.	Water at 9 feet from sand/clay contact
2	4 O.F.	2	D.	283	10	5M		S.		H.C.	D.	water from coarse sand
2A	4 O.F.	2	D.	282	10	6M		S.		H.C.	D.S.	Never dry
3	4 O.F.	2	D.	281	9	5M		S./C.		H.C.	D.	Water at 6 feet from sand/clay contact
3A	4 O.F.	2	D.	282	9	6M		S./C.		S.C.	D.	Water at 5 feet from sand/clay contact
4	4 O.F.	2	D.	282	10	7M		S.		S.C.	D.	Well is bottomed on clay
5	4 O.F.	2	D.	280	7	5M		S.&C.			N.	
5A	4 O.F.	2	D.	281	13	8M		S.&C.		H.C.	D.S.	Sufficient
6	4 O.F.	2	D.	279	8	5M		S./C.		H.C.	D.	Sufficient
7	4 O.F.	2	D.	281	10	4M		S.		H.C.	D.	Well is bottomed on clay
8	4 O.F.	2	D.	280	8	5M		S./C.		H.C.	D.	Never dry
9	4 O.F.	2	D.	280	8	5M		S./C.		H.C.	D.	Sufficient
10	4 O.F.	2	D.	279				S./C.		H.C.	D.	Sufficient
11	4 O.F.	2	D.	281	9	5M		S.&C.		S.C.	D.	Low during late summer
12	4 O.F.	2	D.	282	8	5M		S./C.	7+	S.C.	D.S.	Sufficient
13	4 O.F.	2	D.	281	10	6M		S./C.		S.C.	D.S.	Never dry

1	2	3	4	5	6	7	8	9	10	11	12	13
14	4 O.F.	2	D.	283	12	7M		S./C.		S.C.	D.	Never dry
15	4 O.F.	2	D.	282	8	6M		S./C.		S.C.	D.	Sufficient
16	4 O.F.	2	D.	281	10	9M		S./C.		S.C.	D.S.	Dry during late summer
1	4 O.F.	3	D.	283	12	8M		S./C.		S.C.	D.	Sufficient
2	4 O.F.	3	D.	282	8	6M		S./C.		H.C.	D.	Well is bottomed on clay
2A	4 O.F.	3	D.	281	11	5M		S./C.	20+	H.C.	S.	Water at 8 feet from sand/clay contact
3	4 O.F.	3	D.	282	13	10M		S./C.	12+	S.C.	D.	Well is bottomed on clay
4	4 O.F.	3	D.	283	12	7		S./C.		S.C.	D.	Well is bottomed on clay
5	4 O.F.	3	D.	280	10	6M		S./C.		S.C.	D.	Well is bottomed on clay
6	4 O.F.	3	D.	283	9	6M		S./C.		S.C.	D.	Well is bottomed on clay
7	4 O.F.	3	D.	285	16	10		S./C.		H.C.	D.	Never dry; at house
7A	4 O.F.	3	D.	284	9	6M		S./C.		S.C.	S.	Never dry; at barn
8	4 O.F.	3	D.	283	9	7M		S.		H.C.	D.	Never dry
8A	4 O.F.	3	D.	280	5	3M		S.	5+	S.C.	S.	Goes dry
1	4 O.F.	4	D.	281				S.			D.	Information incomplete
2	4 O.F.	4	D.	281	8	5M		S./C.		H.C.	D.	Never dry
3	4 O.F.	4	D.	278	9	4M		S./C.		S.C.	D.	Sufficient
4	4 O.F.	4	D.	284	9	6		S./C.		S.C.	D.	Goes dry

1	2	3	4	5	6	7	8	9	10	11	12	13
5	4 O.F.	4	D.	283	11			S./C.		H.C.	D.	Goes dry
5A	4 O.F.	4	D.	281	8	5M		S.		S.Cl.	D.	Sufficient
6	4 O.F.	4	D.	281	11	3		S./C.		H.C.	D.	Water at 4 feet from sand/clay contact
7	4 O.F.	4	D.	283							D.	Sufficient for school
8	4 O.F.	4	D.	279	9	6M		S./C.		H.C.	D.	Never dry
9	4 O.F.	4	D.	281	13	6M		S./C.		S.C.	D.	Water at 9 feet from sand/clay contact
10	4 O.F.	4	D.	271	8	3		C.(?)		S.C.	D.	Never dry
1	4 O.F.	5	D.	270	9	6M		S./C.	30+	H.C.	D.S.	Never dry
1A	4 O.F.	5	D.	282	11	7M		S.		H.C.	N.	Never dry; at barn
1	4 O.F.	6	D.	260	7	4M		S.(?)		H.C.	N.	At house
1A	4 O.F.	6	Drl.	258	150	0		Bi.		S.C.Sul.	D.	Sufficient; at barn
1	4 O.F.	7	D.	258	16	10M		S.(?)		H.C.	D.	Never dry; at house
1A	4 O.F.	7	Drl.	258	300			Bi.		S.C.Sul.	S.	Never dry; at barn
1	4 O.F.	8	D.	229	12	6M		C.			N.(?)	
1	4 O.F.	10	D.	225	20	10		S.&C.		H.Cl.	D.	Sufficient
1A	4 O.F.	10	D.	225	24	9M		S.&C.		H.C.	S.	Never dry
2	4 O.F.	10	Drl.(?)	220	10			S.&C.		H.C.	N.	
3	4 O.F.	10	D.	240	13	9M		S.		S.C.	D.	Sufficient

1	2	3	4	5	6	7	8	9	10	11	12	13
3A	4 O.F.	10	D.	228	9	3M		S./C.		S.C.	N.	
4	4 O.F.	10	D.	244	15	10		S.		S.C.	D.	Sufficient; at house
4A	4 O.F	10	D.	243	8	8M		S.	6+	S.C.	S.	Sufficient; at barn
1	4 O.F.	11	D.	249	15	9		S./C.		S.C.	D.	Water at 6 feet from sand/clay contact
1A	4 O.F.	11	Drl.	250	200	70	180	Bi.		C.Sal.	S.	Excellent supply; at barn
2	4 O.F.	11	D.	248	15	10		S.		S.C.	D.	Sufficient
2A	4 O.F.	11	D.	247	15	10		S./C.		S.C.	D.	Water from sand/clay contact
3	4 O.F.	11	D.	255	8	4M		S.		S.C.	N.	Well bottomed on clay
4	4 O.F.	11	D.	261	11	4		S./C.	15+	S.C.	D.S.	Well bottomed on clay
4A	4 O.F.	11	D.	261	7	4		S./C.		S.C.	S.	Well bottomed on clay
1	4 O.F.	12	D.	259				S.			D.S.	Information incomplete
2	4 O.F.	12	D.	253	8	5M		S./C.		S.C.	D.	Well bottomed on clay
2A	4 O.F.	12	D.	252	9	5M		S.		S.C.	S.	Sufficient; at barn
3	4 O.F.	12	D.	2 59	11	7M		S.	50+	S.C.	D.	Sufficient; at house
3A	4 O.F.	12	D.	255	8	4		S.	7+	S.C.	S.	Sufficient; at barn
1	4 O.F.	13	D.	257	9	8M		S.&C.	12+	H.C.	D.S.	Sufficient
2	4 O.F.	13	D.	259	6	5M		S.&C.		H.C.	D.	Sufficient
3	4 O.F.	13	D.	257	8	6M		S.&C.		H.C.	D.	Low during late summer

1	2	3	4	5	6	7	8	9	10	11	12	13
1	4 O.F.	14	D.	259	11	5M		S.&C.		H.C.	S.	Low during late summer
2	4 O.F.	14	D.	261	11	9M		S./C.		S.C.	D.	Water at 5 feet from sand/clay contact
2A	4 O.F.	14	D.	261	11	10		S./C.		H.C.	S.	Goes dry
2B	4 O.F.	14	Spr.	223	0	0		S./C.		H.C.	S.	Water from sand/clay contact
1	4 O.F.	15	D.	257	6	5M		S.			N.	
2	4 O.F.	15	D.	258	7	6M		S./C.		S.C.	D.	Water from sand/clay contact
3	4 O.F.	15	D.	258	11	9M		S./C.		S.C.	D.	Water at 9 feet from sand/clay contact
4	4 O.F.	15	D.	254	12	5M		S.		H.C.*	D.	Sufficient for school; 55° F
5	4 O.F.	15	D.	254				S.		H.C.	D.S.	Sufficient; at house
6	4 O.F.	15	D.	218	3			S./C.		H.C.	S.	Sufficient; in field
1	4 O.F.	16	D.	255	7	6		S.		H.C.	D.	Goes dry during late summer
2	4 O.F.	16	D.	250	16			S./C.		H.C.	D.	Sand very thin; water from clay(?)
3	4 O.F.	16	D.	257	13	6		S./C.		S.C.	D.	Water at 4 feet from sand/clay contact
3A	4 O.F.	16	D.	252	10	6		S./C.	62+	H.C.	S.	Sufficient
1	4 O.F.	17	D.	252	23	9M		S./C.		S.C.	D.S.	Sufficient
1A	4 O.F.	17	Drl.	253						C.Sal.	S.	Information incomplete
1B	4 O.F.	17	Spr.	220(?)		0		S./C.		S.C.	S.	Sufficient

1	2	3	4	5	6	7	8	9	10	11	12	13
1	4 O.F.	18	D.	251	19	10		S./C.		H.C.	D.	Low during late summer; at house
1A	4 O.F.	18	D.	257	14	9		S./C.	25+	H.C.	S.	Water at 6 feet from sand/clay contact
1B	4 O.F.	18	Spr.	212	0	Q		C.(?)		S.C.	N.	
2	4 O.F.	18	D.	262	12	8		S./C.	25+	H.C.	D.S.	Low during late summer
2A	4 O.F.	18	Spr.	215	0	0		S./C.	25+	H.C.	S.	Water from sand/clay contact
1	4 O.F.	19	D.	257	12	9M		S./C.		H.C.	D.S.	Sufficient; in house
2	4 O.F.	19	D.	254	14	6M		S./C.		S.C.	D.	Water at 4 feet from sand/clay contact
2A	4 O.F.	19	D.	258	15	7M		S./C.		S.C.	D.S.	Sufficient; at barn
3	4 O.F.	19	D.	255	13	8M		S./C.		S.C.	D.	Sufficient; at house
3A	4 O.F.	19	D.	258	11	7M		S./C.	18+	H.C.	S.	Sufficient; at barn
4	4 O.F.	19	Spr.	209	0	0		C.(?)		C.Sal.	N.	Previously used for medicinal purposes
1	4 O.F.	20	D.	255	19	15M		S./C.		H.C.	N.	Low during late summer
1A	4 O.F.	20	Drl.	256	105	30	105	G.(?)		H.C.	D.S.	Excellent supply; water from gravel below clay; 43½° F
2	4 O.F.	20	D.	256	15	10M		S./C.		H.C.	N.	At house
2A	4 O.F.	20	Drl.	256	212	45	97	Ca.		H.C.Sal.*	D.	Excellent supply; 52° F in house
3	4 O.F.	20	Drl.	253		8M	50	S./C.	12	H.C.	D.S.	Previously dug 23 feet with limited supply

1	2	3	4	5	6	7	8	9	10	11	12	13
3A	4 O.F.	20	D.	230	16	3M		C.			N.	
1	5 O.F.	8	D.	249	15	13M		S./C.		H.C.	D.S.	Excellent supply
2	5 O.F.	8	D.	232	14	8M		S.&C.		S.C.	D.	Water from the clay (?)
2A	5 O.F.	8	D.	233	8	6M		S.&C.		S.C.	S.	Sufficient
3	5 O.F.	8	D.	234	8	4		S.&C.		S.C.	D.S.	Sufficient
1	5 O.F.	9	D.	236	12	11M		S.&C.		H.C.	D.	Low in late summer
1A	5 O.F.	9	D.	234	9	5M		C.(?)	5+	H.C.	S.	Sufficient
1B	5 O.F.	9	D.	236	11	6M		C.(?)	5+	H.C.	S.	Sufficient
2	5 O.F.	9	D.	231	12	3M		S.(?)		H.C.	D.S.	Sufficient
3	5 O.F.	9	D.	243	6	0		S.		H.C.	D.S.	Sufficient
1	5 O.F.	10	Spr.	241	0	0		S.		H.C.	N.	On north - facing bluff
1	5 O.F.	11	D.	252	12	8M		S.			N.	
1A	5 O.F.	11	Spr.	233	3	0		S.		S.C.	N.	On north - facing bluff
1	5 O.F.	12	D.	248				S.		H.C.	D.S.	Sufficient
2	5 O.F.	12	D.	246	19	5M		S.		H.C.	D.	Sufficient
1	5 O.F.	13	D.	249	17	7M		S./C.	7+	H.C.	D.S.	Sufficient; in field
1	5 O.F.	14	D.	256	13	8M		S./C.			N.	Vacant house
1A	5 O.F.	14	D.	248	11	6M		S./C.			N.	In field
2	5 O.F.	14	D.	255	15			S./C.		H.C.	D.	Low during late summer; thin sand layer

1	2	3	4	5	6	7	8	9	10	11	12	13
2A	5 O.F.	14	D.	250	20			S./C.		H.C.	S.	Low during late summer; thin sand layer
1	5 O.F.	15	D.	256	17	10M		S./C.		S.C.	D.	Low during late summer
1A	5 O.F.	15	D.	251	12	7M		S./C.		H.C.	S.	Sufficient; thin sand layer
1B	5 O.F.	15	D.	251	6	3		S./C.		H.C.	S.	Sufficient; in field
2	5 O.F.	15	D.	252	30	19M		C.			D.S.	Deep dug well; thin sand layer
3	5 O.F.	15	D.	252				S./C.		H.C.	D.	Sufficient for school
1	5 O.F.	16	D.	237	11	4M		C.		H.C.	S.	Sufficient; in field
2	5 O.F.	16	D.	251				C.		H.C.	H.C.	Sufficient; at house
2A	5 O.F.	16	Drl.	250	197		197(?)	Ca(?)		H.Sal.	S.	Too saline for domestic use
2B	5 O.F.	16	D.	250				C.		H.C.	D.S.	Never dry; at barn
1	5 O.F.	17	D.	232	19	10		C.		H.C.	D.	Sufficient
2	5 O.F.	17	D.	245	18	9		C.		H.C.	D.	Goes dry; at house
2A	5 O.F.	17	Drl.	241	200		180	Ca.		H.C,Sal.	S.	Too saline for domestic use; at barn
2B	5 O.F.	17	D.	227	16	10M		C.		H.C.	S.	Sufficient
3	5 O.F.	17	D.	258	12	5		S./C.		S.C.	D.	Never dry; at house
3A	5 O.F.	17	Drl.	255	186		None	S.		C.Sal.	S.	Water from sand under clay; at barn
1	5 O.F.	18	D.	244				C.		H.C.	D.	Sufficient; at house

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	5 O.F.	18	D.	247				C.		H.C.	S.	Sufficient; at barn
2	5 O.F.	18	D.	247	18	5		C.		H.C.	D.	Sufficient; at house
2A	5 O.F.	18	Drl.	247	200	5	None	G.(?)		H.C.Sal.	D.S.	Water from gravel (?) beneath clay
2B	5 O.F.	18	D.	246	16	5		C.		H.C.	S.	Sufficient
1	5 O.F.	19	Drl.	248	189	5M	189	C.(?)		H.C.Sal.	S.	Water at 189 feet from clay/ Carlsbad contact
2	5 O.F.	19	D.	250	10	6M					N.	Information incomplete
3	5 O.F.	19	D.	230				C.(?)		H.C.	D.S.	Information incomplete; at barn
4	5 O.F.	19	D.	268	8	5M					N.	
1	5 O.F.	20	Drl.	247	169			Ca.	12+	S.C.	D.S.	Sufficient
2	5 O.F.	20	D.	255	25	12M		C.		H.C.	D.	Sufficient for house & garage
3	5 O.F.	20	D.	253	25	13		C.		S.C.	D.	Sufficient
4	5 O.F.	20	D.	261	23	16M		C.		H.C.	D.S.	Sufficient; at house
4A	5 O.F.	20	D.	262	15	6M		C.			G.	Sufficient
5	5 O.F.	20	D.	261	12	8		C.		H.C.	D.	Sufficient
5A	5 O.F.	20	Drl.	263	149			G.		C.Sal.	D.	Water from gravel beneath clay
1	6 O.F.	4	D.	249	15	10		S.		H.C.	D.S.	Well is bottomed in clay
1	6 O.F.	6	D.	233	7	5M		S./C.		S.C.	D.	Water at 5 feet from sand/clay contact
2	6 O.F.	6	D.	226	15	12M		S.		H.C.	N.	Goes dry

1	2	3	4	5	6	7	8	9	10	11	12	13
2A	6 O.F.	6	D.	237	24	2M		S./C.		H.C.	D.	Never dry
2B	6 O.F.	6	D.	235	3	2M		S./C.		H.C.	N.	Never dry
1	6 O.F.	7	Drl.	229	133	6M	126	Ca.		H.C.Sal.	S.	Sufficient; at barn
1A	6 O.F.	7	D.	228	16	2M		C.			N.	At barn
1B	6 O.F.	7	D.	229	11	6M		C.			N.	At barn
1C	6 O.F.	7	D.	229	13	8M		C.		H.C.	D.S.	Sufficient; at house
2	6 O.F.	7	D.	236	14	8M		S./C.		H.C.	D.S.	Sufficient
1	6 O.F.	8	D.	228	20			C.		C.Sul.	S.	Goes dry; at house
1A	6 O.F.	8	Drl.	227	95	+2		Ca(?)	20	H.C.Sal.	D.S.	Flowing well; water contains considerable gas
1	6 O.F.	9	D.	234	20			C.		H.C.Sal.	D.S.	Sufficient
2	6 O.F.	9	D.	248	20			C.(?)		H.C.Sal.	D.	Sufficient; at house
2A	6 O.F.	9	Drl.	233	110	0	110	G.		H.C.Sal.	S.	Water in gravel beneath clay and directly above Carlsbad
1	6 O.F.	10	D.	250	20			C.		H.C.	D.	Low during late summer
1A	6 O.F.	10	D.	251	8	7M		C.		H.C.	S.	Low during late summer; at barn
1B	6 O.F.	10	D.	251	18	11M		C.		H.C.	S.	Low during late summer; at barn
1C	6 O.F.	10	D.	240	14	10M		C.		H.C.	S.	Low during late summer; in field
2	6 O.F.	10	D.	260	10	7		S./C.	8+	H.C.	D.S.	Water at 9 feet from sand/clay contact

1	2	3	4	5	6	7	8	9	10	11	12	13
1	6 O.F.	11	D.	251	12	8		C.		H.C.	D.S.	Sufficient; at barn
1A	6 O.F.	11	Drl.	249	150		None	G.(?)		H.C.Sal.	N.	Water too saline to be used
1B	6 O.F.	11	D.	264	8	6M		S.		H.C.	S.	Sufficient; in field
2	6 O.F.	11	D.	256	11	7M		S.		H.C.	N.	Never dry
1	6 O.F.	12	D.	256	11	3	135	S.		H.C.	D.	Water at 11 feet from sand/clay contact
1A	6 O.F.	12	D.	253	6	3		S.		H.C.	S.	Never dry; in field
2	6 O.F.	12	D.	244	20			C.		H.C.	D.	Sufficient; at house
2A	6 O.F.	12	D.	234	16	5M		C.		H.C.	N.	
2B	6 O.F.	12	D.	244	12	7M		C.		H.C.	N.	In field
2C	6 O.F.	12	D.	246	11	7M		C.		H.C.	S.	Sufficient
1	6 O.F.	13	D.	234	24	7M		C.			N.	At barn
2	6 O.F.	13	D.	244	11	7M		C.		H.C.	D.	Low during late summer; at house
2A	6 O.F.	13	D.	232	9	6		C.		H.C.Sal.	S.	Low during late summer
3	6 O.F.	13	D.	264	10	5M		S.		H.C.	D.S.	Sufficient
1	6 O.F.	14	D.	245	21	8M		C.		H.C.	N.	Low during late summer; at house
1A	6 O.F.	14	Drl.	245	17+		None(?)	G.(?)		H.C.Sal.	N.	Water too saline to be used
2	6 O.F.	14	D.	254	10			S./C.		H.C.	D.S.	Never dry; (in field)
1	6 O.F.	15	D.	245				C.			S.	Information incomplete; at barn

1	2	3	4	5	6	7	8	9	10	11	12	13
1	6 O.F.	16	D.	252	20	9		S./C.	18+	H.C.	D.S.	Sufficient; at house
1A	6 O.F.	16	Drl.	253	196		None	G.(?)		H.C.Sal.	S.	Water too saline for domestic use
1B	6 O.F.	16	D.	255	16	7		C.		H.C.	S.	Sufficient; in field
2	6 O.F.	16	D.	259	28	14		S./C.	5+	H.C.Sal.	D.S.	Water at 25 feet from sand/ clay contact
1	6 O.F.	17	D.	254	12	6		C.		H.C.	D.	Low during late summer
1	6 O.F.	18	D.	262	14	9M		S.		H.C.	D.	Sufficient
1A	6 O.F.	18	D.	260	9	6M		S.		H.C.	N.	
2	6 O.F.	18	D.	261	8	5M		S.		H.C.	S.	Sufficient; in field
3	6 O.F.	18	Drl.	242	208		195	Ca.		H.C.Sal.	N.	Water too saline for use.
1	6 O.F.	19	D.	256	20(?)			C.		H.C.	D.	Low during late summer
1A	6 O.F.	19	Spr.		0	0		S.		H.C.	S.	Never dry; in field
2	6 O.F.	19	D.	267	16	10		S./C.		H.C.	D.	Never dry; at house
2A	6 O.F.	19	D.	269	8	5		S.		H.C.	S.	Never dry; at barn
1	6 O.F.	20	D.	253	11	6M		C.		H.C.	D.S.	Goes dry during late summer
2	6 O.F.	20	D.	259	12	9		S.		H.C.	D.	Sufficient; at house
3	6 O.F.	20	Drl.	261	169	6M	None(?)	G.(?)	7+		S.	Sufficient; at barn
1	7 O.F.	1	D.	233	13	11M		C.				Well under construction

1	2	3	4	5	6	7	8	9	10	11	12	13
2	7 O.F.	1	D.	237	13	10M		C.			D.	Information incomplete
3	7 O.F.	1	D.	235	17	11		C.		H.C.	D.	Never dry
4	7 O.F.	1	D.	230	16	11		C.		H.C.	D.	Sufficient; at house
4A	7 O.F.	1	Drl.	232	100	11	90	G.		H.C.Sal.	S.	Water at 85 feet in sandy gravel beneath clay; at barn
1	7 O.F.	2	D.	247	9	8M		S.				Incomplete information
2	7 O.F.	2	D.	246	8	5M		S.&C.			S.	In field
1	7 O.F.	3	D.	223	12	8		C.		H.C.	D.	Goes dry
2	7 O.F.	3	D.	225	11	5M		C.		S.C.	D.	Two feet of sand overlying clay
3	7 O.F.	3	D.							S.C.	D.	Incomplete information
4	7 O.F.	3	D.	224	12	10M		C.		S.C.	D.	Sufficient
5	7 O.F.	3	D.	226	13	8		C.		H.C.	D.	Goes dry
6	7 O.F.	3	Drl.	220	150	3	48	Ca.		H.C.	D.B.	Sufficient; at Johnstons Hotel
6A	7 O.F.	3	D.	220	15	10		C.		H.C.	D.	Sufficient; at Johnstons Hotel
6B	7 O.F.	3	Drl.	220	115	+3	50	Ca.		S.C.	B.	Sufficient
7	7 O.F.	3	Drl.	220			55				N.	At Carlsbad Springs Hotel
8	7 O.F.	3	D.	246	13	10M		S.		H.C.	N.	At barn
9	7 O.F.	3	D.	237	11	6M		S.			D.	Sufficient; at house
9A	7 O.F.	3	D.	236	9	6M		S./C.			S.	Sufficient; at barn

1	2	3	4	5	6	7	8	9	10	11	12	13
1	7 O.F	4										
1A	7 O.F.	4										
1B	7 O.F.	4										
2	7 O.F.	4	D.	242	14	10M		C.		H.C.	D	Sufficient; at house
2A	7 O.F.	4	D.	232	23+	9M		C.		S.Cl.	N.	
2B	7 O.F.	4	D.	238	7	4M		C.		H.C.	S.	Sufficient; at barn
2C	7 O.F.	4	D.	225	7	4M		C.		H.C.	S.	Sufficient; in field
3	7 O.F.	4	D.	227	12	9M		C.		H.C.	D.	Sufficient
4	7 O.F.	4	D.	232	18	15M		C.		H.C.	D.	Low during late summer
5	7 O.F.	4	D.	232	13	8M		S.		H.C.	D.	Never dry; at Carlsbad Springs Lodge
5A	7 O.F.	4	Drl.	232	80+	10M		Ct.(?)		H.C.Cl.	D.B.	" " " " " "
6	7 O.F.	4	D.	232	15	8M		C.		H.C.	D.	Sufficient
1	7 O.F.	5	D.	227	3	2M		S./C.		H.C.	D.S.	Sufficient
1A	7 O.F.	5	D.	233	9	7M		S./C.			N.	At house
2	7 O.F.	6	D.	230	16			S./C.		H.C.	D.	Sufficient; at house
2A	7 O.F.	6	D.	230	16	8M		S./C.		H.C.	S.	" ; at barn
1	7 O.F.	6	D.	228	12	11		S./C.		S.C.	D.	" ; at house
1A	7 O.F.	6	D.	228	12	6	100+	S./C.		S.C.	D.	" ; at barn

1	2	3	4	5	6	7	8	9	10	11	12	13
1B	7.O.F.	6	D.	223	12	10		S./C.		S.C.	S.	Sufficient
2	7 O.F.	6	D.	256	14	6		S./C.		H.C.	D.	Water at 8 feet from sand/clay contact
2A	7 O.F.	6	Spr.		0	0		S./C.		H.C.	N.	In field
2B	7 O.F.	6	Spr.		0	0		S./C.		H.C.	N.	" "
1	7 O.F.	7	D.	223	17	14M		S./C.		H.C.Sal.	S.	Sufficient
2	7 O.F.	7	D.	234	20	12		C.		H.C.	D.	"
2A	7 O.F.	7	D.	222	22	5		C.		H.C.	S.	"
1	7 O.F.	8	Drl.	244	24	7	None	S./C.		C.Min.	D.S.	"
1	7 O.F.	9	D.	256	10	6M		C.		H.C.	D.S.	"
1	7 O.F.	10	D.	248	12		110(?)	C.		H.C.	D.	" ; at barn
1A	7 O.F.	10	D.	248	16			S.		H.C.	D.S.	Never dry; in field south of barn
1	7 O.F.	11	D.	253	16	7M		S./C.				Sufficient
1	7 O.F.	12	D.	262	12	6		S.		H.C.Sul.	D.	"
2	7 O.F.	12	D.	255	10	9M		S.		S.Cl.	D.S.	Never dry
1	7 O.F.	13	D.	260	13	9	110(?)	C.		H.C.	D.	Also a 110-foot,dry hole through clay to bedrock
1A	7 O.F.	13	D.	258	15			C.		H.Cl.	S.	Large diameter well; connected to field drainage ditch
1B	7 O.F.	13	D.	259	13			C.		H.C.	S.	Sufficient; at barn

1	2	3	4	5	6	7	8	9	10	11	12	13
1	7 O.F.	14	D.	252	13	7M		C.(?)		H.Cl.	G.	Sufficient
1A	7 O.F.	14	Drl.	251	120		120	G./Ca		H.C.Sal.*	D.S.	Water probably from gravel over bedrock: very saline: $56^{o}F.$; at barn
2	7 O.F.	14	D.	257				S.		H.C.	G.	Sufficient; at barn
2A	7 O.F.	14	D.	261	15	8M		S.	15+	S.C.	D.S.	Excellent supply; in field
1	7 O.F.	15	D.	264				S.		H.C.	D.	Sufficient; in house
1A	7 O.F.	15	D.	263	16			S.		H.C.	S.	" ; at barn
1	7 O.F.	16	Drl.	261	206	9	None	G.		H.C.Sal.	D.S.	" ; at barn
1	7 O.F.	17	D.	274	12	6		S.		H.C.*	D.	" ; $53^{o}F$: at house
1A	7 O.F.	17	D.	270	15	9		S./C.		H.C.	S.	Low during late summer; at barn
1	7 O.F.	18	Drl.	277	1744	6M	204	G.&.B.R.		H.C.Sal.	S.	Unlimited supply; in field
2	7 O.F.	18	D.	273	9	8M		S.		H.C.	D.	Sufficient; at house
2A	7 O.F.	18	D.	270	7	6M		S.		H.C.	S.	" ; at barn
1	7 O.F.	20	D.	272	11	5M		G.& C.		H.C.	D.	"
1A	7 O.F.	20	Drl.	272	165		None(?)	G.(?)	26+	C.Sal.	S.	Water probably from gravel beneath clay
2	7 O.F.	20	D.	275	9	6M		S./C.		H.C.	D.	Well is bottomed in clay
2A	7 O.F.	20	D.	273	7	3M		S./C.		H.C.	D.S.	Excellent supply
3	7 O.F.	20	D.	277	6	5M		S.			N.	Well under construction

1	2	3	4	5	6	7	8	9	10	11	12	13
4	7 O.F.	20	D.	275	10	7M		S.		H.C.	H.C.	Sufficient
5	7 O.F.	20	D.	283	9	6M		S.		H.C.	D.	"
5A	7 O.F.	20	D.	282	9	6		S.		S.C.	S.	"
1	8 O.F.	1	D.	241	16	12M		C.		H.C.	D.	"
1A	8 O.F.	1	Drl.	241				C.	5+	S.C.Sal.	S.	Never dry
2	8 O.F.	1	D.	264	9	6M		S.			N.	Vacant house
1	8 O.F.	2	D.	248	14	6M		S.& C.		H.C.	D.	Two feet of sand overlying clay
1A	8 O.F.	2	D.	247	13	6		S.& C.		S.C.	S.	Sufficient; at barn
1B	8 O.F.	2	Spr.	248	4	0		S./C.		H.C.	S.	"
1	8 O.F.	3	D.	255	12	9M		S.		H.C.	S.	" ; at house
1A	8 O.F.	3	D.	256	12	8M		S.		H.C.	S.	" ; at barn
2	8 O.F.	3	D.	255	10	7M		S.		S.C.	D.	"
3	8 O.F.	3	D.	252	10	8M		S.		H.C.	D.	" ; at house
3A	8 O.F.	3	D.	252	10	9M		S.		H.C.	S.	Never dry; at barn
1	8 O.F.	4	D.	260	9	7M		S.		S.C.	D.	" "
1	8 O.F.	5	D.	247	20	10M		S.		H.C.Sul.	D.	Sufficient
2	8 O.F.	5	D.	252	14	7M		S.			N.	Vacant house
2A	8 O.F.	5	D.	250	16	7M		S.			N.	" barn

1	2	3	4	5	6	7	8	9	10	11	12	13
1	8 0.F.	6	D.	245	6	1M		S./C.		H.C.	S.	Sufficient
2	8 0.F.	6	D.	255	14			S./C.		S.C.	D.S.	Never dry
1	8 0.F.	7	D.	254	11	8M		S./C.		S.C.	D.	Water at 5 feet from sand/clay contact
1A	8 0.F.	7	D.	254	18	8M		S./C.	15+	S.C.	S.	Not a sufficient supply
1B	8 0.F.	7	Drl.	252				G.(?)		Cl.Sal.	N.	Water probably from gravel under clay
1	8 0.F.	8	D.	257	13	9M		S./C.		S.C.	D.	Water at 10 feet from sand/clay contact
2	8 0.F.	8	D.	257	10	8M		C.		H.C.	D.	Sufficient; at house
2A	8 0.F.	8	D.	254	13	6M		C.	12+	H.C.	S.	" ; in barn
3	8 0.F.	8	D.	257	24	8M		C.		H.C.	D.(?)	"
1	8 0.F.	10	D.					C.	15+	S.C.	D.S.	Never dry
2	8 0.F.	10	D.	255	12	9M		C.		H.C.	D.	Low during late summer
2A	8 0.F.	10	D.	255	14	9		C.		H.C.	D.	Sufficient
3	8 0.F.	10	D.	260	10	5M		S.		H.Cl.	D.	" ; for school
1	8 0.F.	11	D.	261	12	8M		S.&C.		H.C.	D.(?)	"
1	8 0.F.	12	D.	259	12	4M		S./C.		H.C.	D.	" ; at house
1A	8 0.F.	12	D.	260	13	4		S./C.	12+	H.C.	S.	" ; at barn
2	8 0.F.	12	D.	265	19	8M		C.(?)		H.C.	D.(?)	"

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	8 O.F.	13	D.	256	16			C.		H.C.Sul.	S.	Goes dry during winter; at barn
1B	8.O.F.	13	Drl.	256	100		100			C.Sal.	S.	Water at clay/Carlsbad contact; large quantities of gas under great pressure
2	8 O.F.	13	D.	257	13	9M		C.		H.Cl:Sul.	D.	Goes dry; well not sufficiently deep
2A	8 O.F.	13	D.	259	12	8M		C.			N.	
2B	8 O.F.	13	D.	259	13			C.		H.C.	S.	" " " " " "
3	8 O.F.	13	D.	264	11	4M		S.	5+	H.C.	D.S.	Water at 11 feet in sand beneath clay
1	8 O.F.	14	D.	260	28			S.& C.		H.C.	D.	Never dry; at house
1A	8 O.F.	14	D.	259	14			S.		H.C.	S.	" " ; at barn
1	8 O.F.	15	D.	262	7	5M		S.		H.C.	D.	Sufficient; at house
1A	8 O.F.	15	D.	263	13	12M		S.		H.C.	S.	" ; at barn
2	8 O.F.	15	D.	264	15			S.		S.C.	D.S.	" ; in field
3	8 O.F.	15	D.	262	15	6M		C.(?)		H.C.	D.S.	"
1	8 O.F.	16	D.	265	7			S.		H.C.	D.	" ; in house
1A	8 O.F.	16	D.	263	6			S.		H.C.	S.	Goes dry during late summer
1B	8 O.F.	16	D.	262	7			S.		H.C.	S.	Never dry; at barn
1	8 O.F.	17	D.	268	9	8M		S.		H.C.	D.	Sufficient
1	8 O.F.	18	D.	271	9	7M		S.		S.C.	D.S.	Never dry
2	8 O.F.	18	D.	268	12	7		S.		S.C.	D.S.	Sand extremely fluid; at house

1	2	3	4	5	6	7	8	9	10	11	12	13
2A	8 O.F.	18	D.	268	16	8		S.		S.C.	S.	Sufficient
1	8 O.F.	19	Drl.	272	186			Ca.(?)		H.C.	D.S.	Never dry
1	8 O.F.	20	D.	274	10	7M		S.		H.C.	D.	
1A	8 O.F.	20	D.	272	16	12M		S.		S.C.	S.	Sufficient
2	8.O.F.	20	D.	276	8	6M		S.& C.			N.	At barn
1	9 O.F.	1	D.	254	14	7M		C.(?)		H.C.Sul.	D.S.	Sufficient
2	9 O.F.	1	D.	253	16			C.		H.C.	D.	Never dry; at house
2A	9 O.F.	1	D.	253	18			C.		H.C.	S.	" " ; at barn
1	9 O.F.	4	D.	249	12	9M		S./C.		H.C.	D.	Well is bottomed on clay
1	9 O.F.	5	D.	254	10	8		S./C.		H.Cl.	S.	Sufficient; at house
1A	9 O.F.	5	D.	251	16			S.		H.C.	S.	Low during late summer; at barn
2	9 O.F.	5	D.	249	18	13M		S.& G.		H.C.	D.S.	Sufficient
3	9 O.F.	5	D.	255	14	12M		S.	18+	H.C.	D.S.	Never dry
3A	9 O.F.	5	D.	254	15	8		S.		H.C.	N.(?)	" "
1	9 O.F.	6	D.	256	10	6M		S.		H.C.	D.	Sufficient; at house
1A	9 O.F.	6	D.	256	10	6		S.& C.		H.C.	D.S.	" ; at barn
2	9 O.F.	6	D.	255	15	10M		S.& C.		H.C.	S.	" ; at barn
3	9 O.F.	6	D.	254	18	12M		S.& G.	12+	H.C.	D.S.	Well is bottomed on clay

1	2	3	4	5	6	7	8	9	10	11	12	13
1	9 O.F.	7	D.	257	18	9		S.		H.C.	S.	Never dry
1A	9 O.F.	7	D.	254	20	6		C.(?)	13+	Cl.Sul.	S.	" "
2	9 O.F.	7	D.	256	9	7M		S.(?)				Information incomplete
3	9 O.F.	7	D.	257*	18	11		C.		H.C.	D.	Sufficient
3A	9 O.F.	7	D.	259	19	16		C.	6+	H.C.	S.	Goes dry; at barn
1	9 O.F.	8	D.	256	20	10		C.	37+	H.C.	D.S.	Goes dry during late summer
1	9 O.F.	9	Drl.	260	90		None	G.(?)		S.C.	D.	Water from gravel (?) beneath clay
1A	9 O.F.	9	D.	262	16	10		C.	5+	H.Cl.	S.	Sufficient; at barn
1B	9 O.F.	9	D.	259	14	13		C.(?)		S.C.	N.(?)	
1	9 O.F.	10	D.	255	19	9		C.		H.C.Sul.	D.	Clay beneath 3 feet of sand
1	9 O.F.	11	D.	264	17	14		C.	14+	H.C.	S.	Clay beneath 2 feet of sand
1A	9 O.F.	11	D.	265	17	12		C.		H.C.	S.	" " 2 " " " never dry
1B	9 O.F.	11	Drl.	263	135			Ca(?)		H.Sal	N.	Water may be from gravel above Carlsbad
2	9 O.F.	11	D.	264	13	8		S.& C.		H.C.	D.	Goes dry; at house
2A	9 O.F.	11	D.	265	12	9		S.& C.	27+	H.C.	S.	" " ; at barn
1	9 O.F.	12	D.	264	13	9M		C.(?)			N.(?)	
2	9 O.F.	12	D.	267	18			S.& C.		H.C.	D.S.	" "

1	2	3	4	5	6	7	8	9	10	11	12	13
1	9 O.F.	13	D.	264	13	7		S.& C.		H.C.	D.	Never dry
1A	9 O.F.	13	D.	266	12	6		S.& C.	6+	H.C.	S.	Sufficient
2	9 O.F.	13	D.	263	18	13		S.& C.		H.C.	N.	
2A	9 O.F.	13	Drl.	264	70			G.(?)	9+	H.C.Sal.	S.	Water probably from gravel beneath clay
1	9 O.F.	16	Drl.	265	97	40	None(?)	G.(?)		H.Sal.	S.	Water very saline; probably from gravel beneath clay
1	9 O.F.	17	D.	268	11	6M		S.(?)		H.C.	D.	Never dry
1A	9 O.F.	17	Drl.				None(?)	G.(?)		C.Sal.	S.	" " ; water probably from gravel beneath clay
1	9 O.F.	18	Drl.	268			None(?)	G.(?)		C.Sal.(?)	N.	Water probably from gravel beneath clay
1	9 O.F.	19	Drl.	270	90	8	None(?)	G.(?)	18+	S.C.	D.S.	Never dry
1	9 O.F.	20	Drl.	269	30+	6M			12+	H.C.	S.	Sufficient; at vacant house
1	10 O.F.	3	Drl.	257	43		43	G.	31+	H.C.	D.S.	Water at 41 feet from gravel beneath clay and above Carlsbad
1A	10 O.F.	3	Drl.	258	43		43	G.		H.C.	S.	Well similar to No. 1; in field
2	10 O.F.	3	Drl.	264	68	9M	60	G.(?)		H.C.Min.	S.	Never dries; water from gravel beneath clay and above Carlsbad
1	10 O.F.	6	D.	248	12	7M		S.&G.		H.Cl.	D.	Sufficient
1	10 O.F.	7	D.	253	15	7M		S.& C.		H.C.	D.G.	"

1	2	3	4	5	6	7	8	9	10	11	12	13
2	10 O.F.	7	D.	258	15	7M		S.& C.		H.C.	D.	Sufficient
3	10 O.F.	7	D.	259	22	10M		S.& C.		S.C.	D.	"
1	10 O.F.	8	D.	258	16	7M		S.& C.		H.C.	D.	" ; for cheese factory
1	10 O.F.	9	D.	256	10	8M		S.& C.		H.Cl.Sul.	D.	" ; at house
1A	10 O.F.	9	D.	256	24	7		S.& C.		H.C.	S.	" ; in field
2	10 O.F.	9	D.	253	15	12M		S.& C.		H.C.	D.S.	"
3	10 O.F.	9	D.	258	13	12M		S.& C.		H.C.	D.	"
1	10 O.F.	10	D.	256				S.& C.		S.C.	D.	" ; in house
1A	10 O.F.	10	D.	262	17	11M		S.& C.		S.C.	S.	" ; at barn
1	10 O.F.	11	D.	261	11	7M		S.& C.		H.C.	D.	" ; at house
1A	10 O.F.	11	D.	260	15	7M		S.& C.		H.C.	S.	" ; at barn
1	10 O.F.	12	D.	260	16	8		S.& C.		H.C.Sal.	D.	" ; at house
1A	10 O.F.	12	Drl.	260	110	4	80	Ca.		C.Sul.Sal.	S.	Excellent supply; at barn
1	10 O.F.	13	D.	261	20	10M		S.& C.		H.C.Sal.	D.	Low during late summer
1A	10 O.F.	13	Drl.	261	110		90	Ca.		C.Sul.Sal.	D.S.	Sufficient; at barn
1	10 O.F.	14	D.	261	14	8M	90	S.& C.		H.C.	D.	" ; at house
1A	10 O.F.	14	Drl.	261	100+	5M	90	Ca.	60+	C.Sal.	S.	" ; at barn
2	10 O.F.	14	D.	260	17	8		S.& C.		H.C.	D.	" ; at house

1	2	3	4	5	6	7	8	9	10	11	12	13
2A	10 O.F.	14	Drl.	261	127	4	100	Ca.		H.C.Sal.	S.	Sufficient; at barn
1	10 O.F.	15	D.	259	24	5		C.		H.C.	D.	" ; at house
1A	10 O.F.	15	Drl.	259	100+			Ca.		C.Sal.	S.	" ; at barn
1	10 O.F.	16	Brd.	263	60	10	90	S.& C.		C.Sal.	D.	" ; at house
1A	10 O.F.	16	D.	262	40	15		S.& C.	18+	C.Sal.Sul.	S.	" ; at barn
1	10 O.F.	17	Drl.	261	160			Ca.		H.C.	S.	"
1	10 O.F.	18	Drl.	262	50			Ca.	21M	H.C.Sul.	D.S.	Flowing well; measured 16/8/51
2	10 O.F.	18	Brd.	265	30	6M		S.& C.		H.C.Sul.	N.	
1	10 O.F.	19	Drl.	264	87	+20		Ca.		H.C.Sul.	D.	" " ; excellent supply for R.C. Navy buildings
1	10 O.F.	20	Drl.	267	96			N.(?)		H.C.Sal.	D.S.	Sufficient; at house
2	10 O.F.	20	D.	267	24	5M		S.& C.			N.	Vacant house
1	B.F.(R.F.)	18	Drl.	287	99		82	G./Ot.		H.C.	D.	Sufficient; at house
2	B.F.(R.F.)	18	D.	288	25	9M		C.	16+		N.	Goes dry in winter; at house
2A	B.F.(R.F.)	18	Drl.	289	70	13		G./Ot.		S.Sul.	D.S.	Sufficient; at barn
1	B.F.(R.F.)	19	Drl.	288	80	16	60	Ox.		H.C.	D.	" ; at house
2	B.F.(R.F.)	19	Drl.	292	90	15	76	M.		H.C.	D.S.	" ; at house
2A	B.F.(R.F.)	19	D.	290	30	14M		C.		H.C.	S.	" ; at barn
3	B.F.(R.F.)	19	Drl.	293	60	40		M.(?)	25+	H.C.	D.S.	
4	B.F.(R.F.)	19	Drl.	293	65	40		M.(?)		H.I.	D.	Total hardness = 250 p.p.m.

1	2	3	4	5	6	7	8	9	10	11	12	13
1	B.F.(R.F.)	20	Drl.	292	110	25	25	Ox.	30+	M.C.	D.S.	Never dry
1	B.F.(R.F)	21	Drl.	296	80	20		Ox.	45+	M.C.	D.S.	" "
2	B.F.(R.F.)	21	Drl.	290	68	15M		G.		H.C.	D	Previously a 25-foot, dug well
1	B.F.(R.F.)	22	D.	285	28	16M		C.	23+	H.C.	D.S.	Never dry
2	B.F.(R.F.)	22	Drl.	297	100	50	70	Ox.	45+	H.C.	D.S.	" "
2A	B.F.(R.F.)	22	Drl.	295	100	50	70	Ox.	45+	H.C.	D.S.	" "
1	B.F.(R.F.)	23	D.	259	13	9M		C.	16+	H.C.	D.	On alluvial plain of Rideau R.
2	B.F.(R.F.)	23	D.	259	12	7		C		H.C.	D.	Sufficient; at house
1	B.F.(R.F.)	24	Drl.	293	85	64	30	Ox.	6+	H.C.	D.S.	" " "
2	B.F.(R.F.)	24	Drl.	284	85	20	40	Ox.		H.C.	D.	Owned by Dept. of Transport
3	B.F.(R.F.)	24	Drl.	287	37	15M	30	Ox.	16+	H.C.	D.S.	Previously a 30-foot dug well
1	B.F.(R.F.)	25	Drl.	294	80	15		Ox.	16+	H.C.	D.S.	Never dry; at house
2	B.F.(R.F.)	25	D.	310	18	14		S.		H.C.	D.	Sufficient; at house.
2A	B.F.(R.F.)	25	Drl.	310	59	9	23	Ox.	26+	H.C.	S.	" ; at barn.
3	B.F.(R.F.)	25	Drl.	296	80	40	40	Ox.		H.C.	D.	" ; at house.
3A	B.F.(R.F.)	25	D.	296	21	11M		C.		H.C.	N.	Low in late summer
4	B.F.(R.F.)	25	Brd.	288	15	8		C		H.C.	D.	Goes dry; at cottage
1	B.F.(R.F.)	26	Drl.	293	50	10		Ox.		H.C.	D.	Sufficient; at house.

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	B.R.(R.F.)	26	Drl.	292	42	8	20	Ox.	25+	H.C.	S.	Sufficient; at barn.
1	B.R.(R.F.)	27	Drl.	301	80	21	40	Ox.	26+	H.C.	D.	" ; at house
1A	B.F.(R.F.)	27	Drl.	304	25	24		S.C.		H.C.	N.	Goes dry; at house.
2	B.F.(R.F.)	27	Drl.	316	80	6M	40	Ox.	25+	H.C.	D.S.	Previously a 34-foot, dug well.
1	B.F.(R.F.)	28	Drl.	292	42	28		Ox.	26+	H.C.	D.S.	Previously a dug well.
1	B.F.(R.F.)	29	Drl.		80	30	46	Ox.		H.C.	D.	Sufficient; at house.
1	B.F.(R.F.)	30	Drl.	295	40	5		Ox.	50+	H.C.	D.	Never dry; at barn.
2	B.F.(R.F.)	30	D.	306	20	5		C.		H.C.	D.	Sufficient; at house.
2A	B.F.(R.F.)	30	Drl.	300	30	12	30	G/Ox.		S.C.	S.	Flowing well; at barn.
3	B.F.(R.F.)	30	Drl.		75	15	20	Ox.		H.C.	D.	Sufficient; at house.
4	B.F.(R.F.)	30	Drl.		73	20	20	Ox.	180	H.C.	D.	" ; "
5	B.F.(R.F.)	30	D.	288	32	18		C.		H.C.	D.	" ; "
6	B.F.(R.F.)	30	D.	291	24	10M		C		H.C.	D.	" ; "
1	1R.F.	9	D.D.H.	303	75	5	62	Ca	125	H.C.	D.	
1	1R.F.	10	D.							H.C.	D.	
2	1 RF	10	Drl.	295	85		65	Ox.		H.C.	D.S.	Trouble with fine sand over bed-rock
3	1 RF	10	Drl.	298	92		71	Ox		H.C.	D.	Very hard water
1	1 RF	12	Drl.	297	93	45		S.		H.C.	D.S.	Water from fine sand under clay
2	1 RF	12	Drl.	262	82	+6		G.		H.C.	D.	Flowing well. Water from gravel under clay.

1	2	3	4	5	6	7	8	9	10	11	12	13
1	1 RF	13	Drl.	265	63			G.		H.C.	D.	Water from gravel under clay.
2	1 RF	13	D.	266	17	1		C.(?)		H.Sul.	D.	On alluvial plain of Rideau River
3	1 RF	13	D.	262	12	6M		C.		H.Sul.	D.	" " " " "
1	1 RF	14	D.	265	28			C.(?)		H.C.	D.S.	Sufficient; at house.
1	1 RF	15	D.	263	38	10		C.(?)		H.C.	D.S.	Sufficient for 3 families
2	1 RF	15	Drl.	266	65			S.		H.C.	D.	Water from sand/bedrock contact.
3	1 RF	15	Drl.	273	95	+1	75	S.		H.C.	D.	Flows 45 g.p.h. in July 1951. 50°F water from sand/bedrock contact.
4	1 R.F.	15	Drl.	277	99		75	S.		H.C.	D.	Flows at times: water from sand/bedrock contact.
5	1 R.F.	15	Drl.	279	111	30	104	Ox.		H.C.	D.	Sufficient.
1	1 R.F.	17	Drl.	289	98	21		Ox.	45+	S.Sul.	D.S.	"
2	1 R.F.	17	D.	286	25	10		C.		H.C.	D.	Low in late summer: 53°F.
3	1 R.F.	17	D.	288	30	10		C.		H.C.	D.	Goes dry in late summer.
3A	1 R.F.	17	Drl.	285	120	12		Ox.(?)	35+	H.C.	D.S.	Sufficient; at barn.
1	1 R.F.	20	Drl.	301	60	13	55	Ox.	35+	H.C.	D.S.	"
1	1 R.F.	21	Drl.	299	23	4M		C.	25+	H.C.	S.	Never dry
1	1 R.F.	22	D.	303	16	5M	16	C.		H.Sul.	D.S.	Water from clay/bedrock contact.
2	1 R.F.	22	Drl.	312	90			Ma.	27+	H.C.	D.S.	Sufficient.
2A	1 R.F.	22	D.	313	19	5M		C		H.C.	N.	

1	2	3	4	5	6	7	8	9	10	11	12	13
1	11R.F.	23	Drl.	325	32	11M	12	Ox		H.C.	D.S.	Previously a 12-foot dug well.
1A	1R.F.	23	D.	322	14	10	14	C		H.Sul.	S	Water from clay/bedrock contact.
1	1R.F.	24	Drl.	340	60	40	0	Ox.	25+	H.C.	D.S.	Water from large cracks in limestone.
1	1R.F.	25	Drl.	332	70	22	40	Ox.	20+	H.C.	D.S.	Never dry; at barn.
1A	1R.F.	25	D.	332	22	17M		C.		H.C.	N.	Dry during the winter.
2	1R.F.	25	Drl.	336	60	15	45	Ox.	20+	H.C.	D.S.	Never dry.
1	1R.F.	26	D.	325	10	6M		C.		H.C.	D.	" "
1A	1R.F.	26	Drl.					Ox.	12+	H.C.	D.S.	
2	1R.F.	26	D.	326	12	2M		S.T.		H.C.	D.	Supply steadily decreasing.
2A	1R.F.	26	Drl.	328	53	13	20	Ox.	30+	H.C.*	D.S.	Sufficient; 53°F.
1	1R.F.	27	Drl.	319	53	18	50	Ox.	20+	H.C.	D.S.	Never dry.
2	1R.F.	27	D.	316	20	10M		C(?)	20+	H.C.	D.S.	" "
3	1R.F.	27	Drl.	320	89	16	3	Ox.	33+	H.C.	D.S.	" "
1	1R.F.	28	D.	322	20	10		C.	13+	H.C.	S.	" "
1	1R.F.	29	D.	328		5		C.T.		H.C.	N.	Vacant house.
1A	1R.F.	29	D.	306	12	2M		C.	12+	H.C.	S.	In field.
2	1R.F.	29	Drl.	314	45		45	G.		H.C.	D.S.	Water from gravel/bedrock contact.
1	1R.F.	30	D.	311	22	5M		C.	25+	H.C.	D.S.	Never dry.

1	2	3	4	5	6	7	8	9	10	11	12	13
2	1R.F.	30	D.	318	15	10M		C.T.		H.C.	D	Never dry.
2A	1R.F.	30	D.	326	30	15		C.T.	20+	H.C.	S	" "
3	1R.F.	30	D.					C.T.		H.C.	D	Sufficient; at house
3A	1R.F.	30	D.	300	9	6M		C.		H.C.	S	" ; at barn.
1	2R.F.	9	D.	364	18			S		H.C.	D	Never dry
2	2R.F.	9	D.	365	33	6M		S		H.C.	D.	" "
3	2R.F.	9	D.	367	70	68		S.		H.C.	D.	" "; deepest dug well
1	2R.F.	10	D.	371	45	43		S.		H.C.	D.	Goes dry.
2	2R.F.	10	D.	371	45	43		G.		H.C.	D.	Goes dry.
3	2R.F.	10	D.	372	45	37M		S.		H.C.	N.	
1	2R.F.	11	D.	386	68	56		S.		H.C.	D.	Sufficient.
2	2R.F.	11	D.	387	70	55		S		H.C.	D.	"
3	2R.F.	11	Drl.	380	65	40		Ox.		H.C.	D	Never dry
1	2R.F.	12	D.	378	53	46M		S.		H.C.	D.	Sufficient.
2	2R.F.	12	D.	369	45							Dry hole
1	2R.F.	15	D.	302	19	6M		C.(?)		H.C.	D.	Never dry
2	2R.F.	15	D.	354	62	56M		S.(?)		H.C.	D.S.	Sufficient

1	2	3	4	5	6	7	8	9	10	11	12	13
1	2R.F.	16	Drl.	358	101	36		S/C		H.C.	D.	Never dry
2	2R.F.	16	D.	350	12	6M		S/C		H.C.	D	
3	2R.F.	169	D.	369	40	31M.	38	Ox.		H.C.	D.S.	Sufficient; at house.
3A	2R.F.	16	D.	367	40	35	38	C.	38+	H.C.	S.	Water at clay/bedrock contact.
1	2R.F.	17	D.	341	9	3M.		S./C.		H.C.	S.	Never dry.
1A	2R.F.	17	D.	344	9	6M		S./C.		H.C.	D.	" "
1	2R.F.	18	D.	299	16	5M		C.		H.C.	D.	" "
1A	2R.F.	18	Drl.	300	65			Ox.	28+	H.C.	D.S.	" "
1	2R.F.	19	D.	302	23	9M		C.		H.C.	N.	" "
1	2R.F.	20	D.	301	28	13M		C.		S.C.	D.	Sufficient; at house.
1A	2R.F.	20	Drl.	298	70	6	50	Ox.	20+	H.C.	S.	" ; at barn
1	2R.F.	23	D.	313	14	7M		S.		H.C.	D.	" ; at house.
1A.	2R.F.	23	Drl.	312	45	+3	25	Ma		H.C.	S.	Flows practically all year round.
1	2R.F.	24	Drl.	323	50	20		Ox.		H.C.	D.	Sufficient for cheese factory.
2.	2R.F.	24	Drl.	341	45	20	20	Ma (?)		H.C.	D.S.	Previously a 20-foot dug well.
3.	2R.F.	24	D.	346	29	19M		C.		H.C.	D.	Goes dry in late summer.
3A	2R.F.	24	Drl.	344	60			Ox.(?)	25+	H.C.	S.	Never dry; at barn
1	2R.F.	25	Drl.	331	103	21	24	Ox.	38+	H.C.	D.S.	Previously a 24-foot dug well.

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	2R.F.	25	D.	351	35	18M		C.T.		H.C.	S.	Goes dry; at barn
1	2R.F.	26	Drl.	348	105		85	Ox.	20+	H.C.	D.S.	Never dry.
1A	2R.F.	26	D.	330	20	6M		C.		H.Sul.	N.	
1B	2R.F.	26	D.	325	25	18M		C.		H.Sul.	N.	
2	2R.F.	26	Drl.	325	46	6		S.	25	H.C.	D.S.	Previously a 12-foot, dug well
2A	2R.F.	26	D.	323	12	3		S.		H.C.	N.	Never dry.
2B.	2R.F.	26	D.	324	10	0		S.		H.C.	N.	" "
2C	2R.F.	26	D.	323	10			S		H.C.	N.	Never dry; by the creek.
1	2R.F.	27	D.					C.		H.C.	D.	" "
1	2R.F.	29	D.	329	10	9		S		H.C.	N.	Water from sand under clay.
1A	2R.F.	29	D.	325	10	5	16	S/Ox.	15+	H.C.	D.S.	Water from sand over Oxford.
1B	2R.F.	29	D.	320	12	1		S		H.C.	S.	Water from sand under clay.
2	2R.F.	29	D.	328	12	9		S.T.(?)		H.C.	D.	Sufficient, at house.
2A	2R.F.	29	D.	335	12	9		S.T.(?)		H.C.	S	Never dry; at barn.
2B	2R.F.	29	D.	336	15	10		S.T.(?)		H.C.	S.	" " ; in field.
2C	2R.F.	29	D.	336	14	9		S.T.(?)		H.C.	N.	" " ; " "
3	2R.F.	29	D.	325	16	5M		S.T.(?)		H.C.	N.	Sufficient; in field.
1	2 R.F.	30	D.	346	23	15M		S.T.	15+	H.C.	S.	" ; at barn

1	2	3	4	5	6	7	8	9	10	11	12	13
2	2R.F.	30	D.	334	15	9M		S.T.(?)	20+	H.C.	D.	Low in late summer; at house
2A	2R.F.	30	D.	228	6	1M		C.		H.Sul.	S.	Never dry; by road.
1	GORE R.F.	8	Drl.		490		62	G.& Ox.		H.C.	N.	Water at 52 feet in gravel and at 79 & 245 feet in Oxford.
1	"	14	D.	365	40	35		S.	18+	H.C.	D.S.	Never dry.
1	"	15	D.	367	30					S.C.	D.	" "
2	"	15	Spt.	368	40	35M		S.		H.C.	D.	Goes dry.
1	"	16	D.	370	45	8		S/C		H.C.	D.	Never dry
2	"	16	D.	368	28	21M		S.		S.C.	D.	" .. "
1	"	25	D.	365	16	15		G.	10+	H.C.	D.S.	Sufficient
1	"	26	Drl.	362	71	20	11	Ox.	12+	H.C.	D.S.	Never dry
1	"	30	D.	334	14	7M		C.		H.C.	D.S.	Sufficient
1	3R.F.	6	D.	305	18	9		S.		H.C.	D.S.	Water from sand under clay.
2	3R.F.	6	Drl.	308	300			B.(?)		C.Sul.	D.	H_2S from lower half of well.
3.	3R.F.	6	D.	298	14			G.		H.C.	D.	Sufficient.
4	3R.F.	6	D.	298	4	3M		C.T.		H.C.	D.	"
1	3R.F.	7	D.	306	8	1		S.		H.C.	D.	"
2	3R.F.	7	Drl.	327	131			Ca.(?)		H.C.	D.	Excellent supply; at house.
2A	3R.F.	7	Drl.	327	129			"	30+	C.Sul.	S.	Sufficient; at barn.

1	2	3	4	5	6	7	8	9	10	11	12	13
3	3R.F.	7	D	320	8							Dry hole in clay till.
1	3R.F.	8	D	314	9	5		S		S.C.	D	Never dry; at house.
2	3R.F.	8	D	304	2	1M		S		S.C.	D.	Goes dry; in house.
3	3R.F.	8	D.	314	6	5M		S		S.C.	D.	Sufficient (?) at house.
1	3R.F.	9	D.	321	14	6M		C.T.		S.C.	D.S.	Water from till/Oxford contact
1A	3R.F.	9	D.	321	14	6	14	C.T.		S.C.	S.	" " " " "
2	3R.F.	9	D.	312	12	8M.		S.		H.C.	D.	Never dry; at house.
3	3R.F.	9	D.	317	16	5M.		S.&C.		H.C.	D.	" "
1	3R.F.	10	D.	311	5	3M		"		H.C.	D.	" "; in house.
2	3R.F.	10	D.	311	14	5		C.		H.C.	D.	" "; " "
3	3R.F.	10	D.	317	7	4M		S.		S.C.	D.	Water from fine sand.
4	3R.F.	10	Drl.	316	115	5	95	Ox.(?)		H.C.		Flows at times; water from gravel over Oxford and from Oxford.
1.	3R.F.	11	D.	317	4	4		S.		H.C.	D.	Goes dry; in house.
1	3R.F.	14	D.	369	41	37M		S(?)			N(?)	
1	3R.F.	16	Spt.	329	10	3		S.		S.C.	D.	Never dry; at house.
2	3R.F.	16	Drl.								D.	Limited information
1	3R.F.	17	D.	367	36	30		S		H.C.	D.	Sufficient; at house.

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	3R.F.	17	D.	365	40	36		S	65+	H.C.	D.S.	Sufficient for 4 families; at barn
1	3R.F.	18	D.	356	30	28		G.	25+	H.C.	D.S.	Water from gravel/clay contact; at barn.
2	3R.F.	18	D.	352	19	5M		S.	12+	H.C.	D.S.	Never dry.
1	3R.F.	19	D.	344	19	13		S.		H.C.	D.	Water from sand/clay contact.
1	3R.F.	20	D.	358	40	35		S	25+	H.C.	D.S.	Never dry.
1	3R.F.	23	Drl.	372	81	35M		Ox.	100+	H.C.	D.S.	Never dry.
1	3R.F.	24	D.	376	27	20M		S.	20+	S.C.	D.S.	Sufficient.
2	3R.F.	24	Drl.	373	42		42	S.		H.C.	D.S.	Water from sand/Oxford contact.
1	3R.F.	25	Drl.	387	80	30		S.	25+	H.C.	D.S.	Water from "running" sand;never dry.
2	3R.F.	25	Drl.	388	125			G.		H.C.	D.	Never dry; at school.
1	3R.F.	26	Drl.	351	49	20	9	Ox.	27+	H.C.	D.S.	" "
2	3R.F.	26	Drl.	360	20	9	10	Ox.		H.C.	D.	previously a 10-foot, dug well
3	3R.F.	26	Drl.	384	60	33		G.	32+	H.C.	D.S.	Never dry.
1	3R.F.	27	D.	324	15	4M		C.	6+	H.C.	D.S.	Sufficient.
1	3R.F.	28	D.	322	12	4M		C.	12+	H.Sul.	S.	Water is greenish colour.
1	3R.F.	29	D.	338	30	15		S.	6+	H.C.	D.S.	Never dry; at barn.
1	3R.F.	30	Drl.	343	127	20	85	Ox.	37+	H.C.	D.S.	Sufficient.
2	3R.F.	30	Drl.	339	85	22	55	S.	6+	S.C.	D.S.	Water from sand/Oxford contact.

1	2	3	4	5	6	7	8	9	10	11	12	13
1	4R.F.	6	D.	305	10	5		S.& C.		S.C.	D.	Sufficient
2	4R.F.	6	D.	308				S.		H.C.	D.	"
3	4R.F.	6	D.	303	12	5		S.		H.C.	D.	"
4	4R.F.	6	D.	306	15	5M.		S.		S.C.	D.	"
5	4R.F.	6	Drl.					Ca.(?)	40+	H.C.	D.	Sufficient for 2 families.
6	4R.F.	6	D.	328	32	20		G/C		H.C.	D.	Goes dry during late summer.
7	4R.F.	6	D.	306				S.		H.C.	D.	Sufficient.
8	4R.F.	6	Drl.	320	85	30M	None	G.		H.C.	D.	Water from sand & gravel under clay; under considerable pressure.
9	4R.F.	6	D.		35			S.		H.C.	D.	Sufficient.
9A	4R.F.	6	Spt.		32			S.		H.C.	N.	
10	4R.F.	6	Drl.	339	150	30	135	Ca.	1000	C.Sul.	D.	"
11	4R.F.	6	D.	300	16	8		C.		H.C.	D.	"
12	4R.F.	6	D.	303	12	7		S.& C.		H.C.	D.	Sufficient.
13	4R.F.	6	D.	304	16	7M		S/C		H.C.	D.	Water at 12 feet. at sand/clay contact.
14	4R.F.	6	D.	298	17	12		S.		H.C.	D.	Water at 12 feet; in sand under clay.
1	4R.F.	7	D.	297	10	6M		S.		H.C.	D.	Sufficient.
2	4R.F.	7	D.	325	20	10		C.T.		H.C.	D.	" , at house.
3	4R.F.	7	Drl.		300+			B.(?)		H.Sul.	D.	Sufficient for cemetary; too sulphurous for drinking purposes.

1	2	3	4	5	6	7	8	9	10	11	12	13
4	4R.F.	7	Drl.	328	120		None	G.(?)		S.C.	D.S.	Sufficient
5	4R.F.	7	Drl.	320	118	40	"	G.		H.C.	D.	" ; at grocery store.
6	4R.F.	7	Drl.	320	120	17M	98	Ca.(?)		H.C.	D.	Water at 117 feet in sand above Carlsbad.
1	4R.F.	8	Drl.	321	50	14	None	S.& G.		H.C.	D.	Water at 16 feet in sand and black gravel under clay.
2	4R.F.	8	Drl.	320	50		"	S.& G.		H.C.	D.	Water at 16 feet in sand and black gravel under clay
3	4R.F.	8	D.	325	21	17		S		H.C.	D.	Water at 17 feet in sand under clay
4	4R.F.	8	D.	323	18	15M		S.		H.C.	D.	Sufficient.
5	4R.F.	8	D.	321	17	15M		S.		H.C.	D.	"
6	4R.F.	8	Drl.	326	98	17M	92	Ca.		H.cl.	D	Water at 97 feet in Carlsbad.
7	4R.F.	8	Drl.	312	32	17		G.		S.C.	D.	Sufficient.
8	4R.F.	8	D.	311	23	19		S.		H.C.	D.	Sufficient; at house.
9	4R.F.	8	Drl.	311	84	6M		G.		H.C.	D.	Water at 80 feet in black gravel.
10	4R.F.	8	Drl.	321	50	10		G.		S.C.	D.	Water at 50 feet in black gravel.
10A	4R.F.	8	D.	318	6			S.		H.C.	S.	Sufficient; at barn.
11	4R.F.	8	D.	314	15	5		S.		S.C.	D.S	Goes dry; at house.
12	4R.F.	8	D.	314	6	4		S.		S.C.	.D.	Sufficient; at house.
13	4R.F.	8	D.	312	10	6		S.		S.C.	.D.	Never dry; " "
14	4R.F.	8	D.	311	10	4		S.		S.C.	D.	" "

1	2	3	4	5	6	7	8	9	10	11	12	13
1	4R.F.	9	Drl.	308	32	6		G.		S.C.	D.	Water at 30 feet in gravel under clay.
2	4R.F.	9	D.	315	15	9		S.		H.C.	D	Goes dry during late summer;at house.
2A	4R.F.	9	D.	310	11	4M		S.		H.C.	D.	Sufficient.
3	4R.F.	9	D.	304	15	6M		S.		H.C.	D.	"
4	4R.F.	9	D.	302	12	7		S.& C.		H.C.	D.	"; at house.
4A	4R.F.	9	D.	301	12	7		S.& C.		H.C.	S.	", at barn.
5	4R.F.	9	D.		110	5	87	Bi(?)		H.C.	D.	Pumping level = 91 feet at 25 I.G.M.
1	4R.F.	10	Spt.	303	40			S.		H.C.	I	Sufficient; at house.
1A	4R.F.	10	D.	303	15			S.		H.C.	I	" ; in field; may be drilled.
2	4R.F.	10	Spt.	302	14	2		S.		H.C.	D.	Water at 5 feet in sand under clay.
3	4R.F.	10	Drl.	302	39		30	Ca.(?)		C.Sul.	D.	Sufficient.
4	4R.F.	10	Drl.	299	38	2	None	S.		H.Sul.	D.	Water from sand under clay.
5	4R.F.	10	S.pt(?)	301	25			S.		S.C	D.	Sufficient
6	4R.F.	10	D.	301	11	5		S.& G.		H.C.	D.	Water from sand and gravel over clay.
7	4R.F.	10	D.	308	10	7M		S.		S.C.	D.	Sufficient
8	4R.F.	10	D.	301	7	4		S.			N.	Vacant house.
1	4R.F.	11	D	308	11	3M		S.		H.C.	D.S.	Sufficient.
2	4R.F.	11	Spt.	314	17			S.		H.C.	D.	Sufficient.

1	2	3	4	5	6	7	8	9	10	11	12	13
3	4R.F.	11	D.	3142	15	4		S.		H.C.	D.S.	Water at 15 feet in sand.
4	4R.F.	11	D.	316	13	7		S.		H.C.	D.	Sufficient.
5	4R.F.	11	Drl.	313	125	12		Ca.	18+	H.C.	D.S.	"
1	4R.F.	12	Drl.		60			Ca.		H.C.	D.S.	" ; at house.
1A	4R.F.	12	D.	310	15	9		C.T.		H.C.	S.	" ; at barn
2	4R.F.	12	Drl.					Ca.		"	N(?)	
1	4R.F.	13	D.	304	10	8M.		S.		H.C.	D.S.	Sufficient.
2	4R.F.	13	D.	318	12	5M		S(?)		H.C.	D.	Sufficient.
3	4R.F.	13	D.	324	12	9M		C.T.			N.	
3A	4R.F.	13	Drl.	318	100	8		Ca.		H.C.	D.S.	Previously a dug well; at barn.
4	4R.F.	13	D.	318	8	5M	8	C.T.		H.C.	D.S.	Water at till/Carlsbad contact.
5	4R.F.	13	D.		10			S.		H.C.	D.S.	Sufficient.
1	4R.F.	14	D.	320	14	87	3	Ca.		H.C.	D.	Water from 14 feet; from small crack in Carlsbad.
2	4R.F.	14	D.	330	14	10	14	S-C.T.		H.C.	D.	Water at 14 feet from till/ Carlsbad contact.
2A	4R.F.	14	D.	330	17	11M	17	S-C.T.	25+	H.C.	S.	Water at 17 feet from till/ Carlsbad contact.
1	4R.F.	15	D.	332	14	10M	14	S.-C.T.	18+	H.C.	D.S.	Sufficient
2	4R.F.	15	D.	340	15	7M		C.T.		H.C.	D.	"

1	2	3	4	5	6	7	8	9	10	11	12	13
2A	4R.F.	15	Drl.		86	18	35	Ca.	17+	H.C.	D.S.	Sufficient.
3	4R.F.	15	D.D.H.	320	50	25	20	Ma		H.C.	D.	" ; at house.
1	4R.F.	16	Drl.	338	33	15		C.T.	45+	H.C.	S.	" ; at barn
1A	4R.F.	16	D.	343	22	13M		C.T.		H.C.	N.	
1B	4R.F.	16	D.	346	22	12M		C.T.		H.C.	N.	
1C	4R.F.	16	Drl.	308	20	+4M		C.T.	60	S.C.*	S.	Flows 60 g.p.h.; Water probably from till/Carlsbad contact; 50°F.
1	4R.F.	17	D.	338	15	8		C.T.		S.C.	D.	Never dry; at house.
1A	4R.F.	17	Drl.	332	87	10		Ox.	25+	H.C.	D.S.	Previously a dug well; at barn.
2	4R.F.	17	D.	338	18	12		S.T.		H.C.	D.	Sufficient; at house.
2A	4R.F.	17	D.	337	7	0		S.T.(?)	25+	S.C.	S.	" ; at barn
1	4R.F.	18	D.	319	12	4		C.T.	37+	H.C.	D.S.	Never dry.
1	4R.F.	21	Drl.	319	60	30	16	Ox.		H.C.	D.	" " ; at house
1A	4R.F.	21	Drl.	319	92	30	16	Ox.	22+	H.C.	S.	" " ; at barn.
1B	4R.F.	21	Drl.	320	70	30	17	Ox.		H.C.	D.	" " ; at milk house
1	4R.F.	22	D.	359	20	15		S.				information incomplete.
2	4R.F.	22	D.	378	50	42M		S.& G.	27+	H.C.	D.S.	Never dry.
1	4R.F.	23	D.	381	45	43		C.& G.	13+	H.C.	D.S.	" "
2	4R.F.	23	Drl.	339	35	12M		Ox.		H.C.	D.S.	Previously a 10 foot dug well.

1	2	3	4	5	6	7	8	9	10	11	12	13
1	4R.F.	24	D.	345	30	10	30	S.T.	8+	H.C.	D.S.	Water at 30 feet from till/Oxford contact; at house.
1A	4R.F.	24	D.	344	30	4	30	S.T.	8+	H.C.	S.	Water at 30 feet from till/Oxford contact; at barn.
1B	4R.F.	24	D.	347	24		24	Ox.		H.C.	N.	
2	4R.F.	24	D.		120			Ox.		H.C.	S.	Sufficient.
1	4R.F.	25	Drl.	383	60		0	Ox.	35+	H.C.	D.S.	Never dry.
2	4R.F.	25	Drl.	388			0	Ox.		H.C.	D.	Sufficient.
1	4R.F.	26	Drl.	386	79	14M	0	Ox.		H.C.	D.	"
2	4R.F.	26	Drl.	388	90	10		Ox.	35+	H.C.	D.S.	Previously a 10-foot,dug well
1	4R.F.	27	Drl.	383	100	10		Ox.	35+	H.C.	D.S.	Never dry
2	4R.F.	27	Drl.	385	72	35M	None(?)	S.& G.		H.C.	D.	" " , at house.
1	4R.F.	28	D.	357	16	11M		C.T.		H.C.	D.S.	Sufficient; " "
1A	4R.F.	28	Drl.	359	63			Ox.		H.C.	N.	
1B	4R.F.	28	D.	354	13	9M		C.T.		H.C.	S.	Sufficient; in field
2	4R.F.	28	Drl.	359						H.C.	D.	Information incomplete;at church.
2A	4R.F.	28	Drl.	357						H.C.	D.	" " " "
1	4R.F.	29	D.	348	7	4M		C.T.		H.C.	D.	Sufficient for 2 families;at store.
2	4R.F.	29	D.	353	26		26	C.T.		H.cl.	D.	Water at 30 feet from till/Oxford contact; at house.
2A	4R.F.	29	Drl.	356	50	12	26	Ox.	600	H.C.	D.S.	Never dry; at barn.

1	2	3	4	5	6	7	8	9	10	11	12	13
3	4R.F.	29	Drl.	346	37	30M	37	C.T.		H.C.	D.	Water at 30 feet from till/ Oxford contact.
4	4R.F.	29	Drl.	347	76		6	Ox.		H.C.	D.	Sufficient; at house.
4A	4R.F.	29	D.	347	16	12		C.T.	12+	H.C.	S.	Never dry; at barn.
1	4R.F.	30	Drl.	342	25		8	Ox.		H.C.	D.S.	Sufficient; at house.
2	4R.F.	30	D.	341	19	3M		C.T.	14+	H.C.	D.S.	Sufficient
3	4R.F.	30	D.	342	16	8		C.T.		H.C.	D.	" ; at house
4	4R.F.	30	Drl.	339				Ox.(?)		H.C.	D.	Sufficient for new school.
5	4R.F.	30	Drl.	339	16+	8M					N.	At old school
1	5R.F.	6	D.	281	15		3	Ca.		H.C.	D.S.	Sufficient; at house
1A	5R.F.	6	D.	277	15		3	Ca.		H.Sul.	D.S.	" ; in field
2	5R.F.	6	D.	309	15			S.(?)		H.C.	D.S.	" ; at house
2A	5R.F.	6	D.	308	15			S.(?)		H.C.	S.	" ; at barn
3	5R.F.	6	D.	309	25	18		S.		S.C.	D.S.	" ; at house.
3A	5R.F.	6	D.	302	18	8		S.		S.C.	S.	" ; at barn
1	5R.F.	6	Drl.	286	145	7	2	Ca.		H.C.	D.S.	"
2	5R.F.	7	D.	305	10	6M		S.		S.C.	D.	Excellent supply; in house.
2A	5R.F.	7	D.	309	11	9M		S.		S.C.	S.	Sufficient; at barn.

1	5R.F.	8	D.	301	15	5M.		S.		H.C.	D.S.	Sufficient; at barn
2	5R.F.	8	Drl.	289	60	15	4	Ca.		H.C.	D.S.	" ; at house.
2A	5R.F.	8	D.	288	9	8M		C.T.(?)		H.C.	S.	" ; at barn
3	5R.F.	8	D.	305	5	1M		S.		S.C.	D.S.	" ;
1	5R.F.	9	D.	281	10	6M		S.		H.C.	D.	Several small springs from sand in area.
1A	5R.F.	9	D.	284	8	6M		S.		H.C.	N.	At barn.
2	5R.F.	9	D.	304	7	5		S.		H.C.	D.S.	Water boiled before drinking.
3	5R.F.	9	D.	283	6	4M.		S.		H.C.	N.	Vacant house.
1	5R.F.	10	D.	286	15	8M		S.		H.C.	D.	Sufficient; at house
1A	5R.F.	10	D.	286	15	6M.		S.			N.	
2	5R.F.	10	D.	307	10	8		S.		S.C.	D.	Sufficient
3	5R.F.	10	D.	307	11	9M		S.		S.C.	D.	"
4	5R.F.	10	D.	299	6	5M.		S.		H.C.	D.S.	"
5	5R.F.	10	D.	300	6	5M		C.		H.C.	D.S.	Never dries.
1	5R.F.	11	Drl.	306	80	12		Ca.		H.C.	D.S.	Water level never less than 30 feet from surface.
1A	5R.F.	11	D.	306	11	9M		S.	75+	S.C.	S.	Sufficient; at barn.
1	5R.F.	12	D.	301	11	5M		S.		H.I.	N.	
1A	5R.F.	12	D.	300	12	9M		S.		H.C.	S.	Sufficient.

1	2	3	4	5	6	7	8	9	10	11	12	13
2	5R.F.	12	D.	300	12			S.& C.		S.C.	D.	Sufficient.
1	5 R.F.	13	Drl.	304	35	12		S.		H.Sul.	D.S.	"
2	5R.F.	13	D.	299	9	5		S/C.		H.C.	D.S.	Well is bottomed in clay.
1	5R.F.	14	D.	300	12	9M		S.		H.C.	D.S.	Sufficient.
2	5R.F.	14	Drl.	329	80+			Ca.		H.C.	D.S.	"
1	5R.F.	15	D.	292	12	8		S.		S.C.	D.	"
2	5R.F.	15	Spt.	291	30		80	S.& C.		H.C.	D.	Water at 80 feet from sand/ bedrock contact.
3	5R.F.	15	D.	339	15	12M		S-C.T.		H.I.	D.	Never dry.
4	5R.F.	15	D.	335	11	7M		C.		S.C.	D.	" "
5	5R.F.	15	Drl.	334	180	11M.		Ca.		H.C.	D.S.	Excellent well; at barn.
6	5R.F.	15	D.	343	16	13M	7	Ox.		H.C.	D.	Goes dry annually during late summer.
6A	5R.F.	15	Drl.	341	180	7M.	7	Ox.			N.	
7	5R.F.	15	Drl.	338	86	8	7	Ca		S.cl.*	D.S.	Water frequently cloudy; 49°F.
8	5R.F.	15	Drl.					Ca.				Information incomplete.
9	5R.F.	15	Drl.	293				Ca.				" "
1	5R.F.	16	D.	350	14	9M		S-C.T.		H.C.	D.	Sufficient.
2	5R.F.	16	Drl.		190			Ca.		H.C.	D.S.	" ; at barn.

1	2	3	4	5	6	7	8	9	10	11	12	13
3	5R.F.	16	D.	347	16		10	Ca.		H.C.	D	Sufficient; at house.
3A.	5R.F.	16	Drl.	348	100		10	Ca.	31+	H.C.	S.	" ; at barn.
3B	5R.F.	16	Drl.	348	200		10	Ca.	31+	H.C.	S.	" ; at barn.
1	5R.F.	17	D.	343	10	4		C.T.(?)		S.C.	D.S.	"
1	5R.F.	18	D.	315				C.T		S.C.	D.	Never dry; at house.
1	5R.F.	20	Drl.	322	50+			Ox.		H.C.	D.	Goes dry during late summer.
1A.	5R.F.	20	Drl.	323	75			Ox.		H.C.	S.	Sufficient; at barn.
1	5R.F.	21	Drl.	309	90	0	4	Ox.		H.C.	D.S.	Insufficient supply at 25 feet.
2	5R.F.	21	Drl.	321	26	10	4	Ox.		H.C.	D.S.	Flowed when first drilled.
1	5R.F.	23	D.	320	28	0	4	Ox.		S.cl.	N.	
2	5R.F.	23	Drl.	313	57			Ma.(?)	19+	H.C.	D.S.	Sufficient.
1	5R.F.	24	Drl.	341	30		2	Ox.		H.C.	D.	Soft water when first drilled; limited supply.
2	5R.F.	24	Drl.	385	75		15	Ox.	49+	H.C.	D.S	Never dry; at house.
1	5R.F.	25	Drl.	392	75		11	Ox.		H.C.	D.	Sufficient.
1A	5R.F.	25	D.	388	50			C.T.(?)		H.C.	S.	"
2	5R.F.	25	Drl.	397	57	7	2	Ox.		H.C.	D.	Limited supply.
3	5R.F.	25	D.	393	5	1	5(?)	C.T.(?)		H.C.	D.	Sufficient.

1	2	3	4	5	6	7	8	9	10	11	12	13
1	5R.F.	28	Drl.	362	97	20	2	Ox.		H.C.	D.	Sufficient.
2	5R.F.	28	D.	374	10	7		S.T.		S.C.	D.	"
2A	5R.F.	28	Drl.		148			Ox.		S.C.	D.S.	"
2B	5R.F.	28	Spr.			0	0	Ox.		H.C.	D.	In field.
3	5R.F.	28	Drl.	356	32	7	6	Ox.		H.C.	D.	Sufficient.
1	5R.F.	29	Drl.	349	44	6M	6	Ox		H.C.	D.	Water at 40 feet in Oxford.
2	5R.F.	29	D.	359				C.T.		H.C.	N.	
3	5R.F.	29	Drl.	341	28	6	2	Ox.	6+	H.C.	D.S.	Sufficient.
4	5R.F.	29	Spr.	337	0	0		C.T.		H.C.	D.	Flow decreasing in last year.
5	5R.F.	29	Drl.	343	34	4		G.		H.C.	D.	Sufficient.
6	5R.F.	29	Spr.	339	4	0		C.T.	6+	H.C.	D.S.	"
1	5R.F.	30	D.	343	13	7M		C.T.		H.C.	D.S.	"
2	5R.F.	30	D.	339	25	15	15	C.T.	17+	H.C.	D.S.	Blasted 10 feet into Oxford. Water at 15 feet from till/Oxford contact.
2A	5R.F.	30	Drl.	338	15		5					Dry hole
2B	5R.F.	30	D.							H.C.	S.	Information incomplete; in field.
1	6R.F.	1	D	255	15	11M		S./C.	12+	H.C.	D.S.	Well is bottomed on clay.
1	6R.F.	2	D.	253				S.		H.C.	D.	Never dries

1	2	3	4	5	6	7	8	9	10	11	12	13
2	6R.F.	2	D.	262	18	10M		C.(?)		H.C.	D	Sufficient
3	6R.F.	2	Drl.	248				Ca.			D.S.	Information incomplete.
1	6R.F.	3	D.	243	13	12M		C.(?)		H.C.	D.	Sufficient.
2	6R.F.	3	Drl.	237	33+	12M		C.(?)		H.C.	D.	" ; at house.
3	6R.F.	3	D.	255	25	8M		S.		H.C.	D.	" ; at cemetery.
4	6R.F.	3	D.	255	14	7M.		S/C			N.	Vacant house
5	6R.F.	3	Drl.	251	65	40	40	Ca		S.C.	D.	Water partly from drift.
5A	6R.F.	3	Drl.	253	372	40	40	Ca.		S.Min.	D.S.	Constant water level; at barn.
1	6R.F.	4	Drl.	237	80	15	20	Ca.	25+	Sal.Sul.C..	D.S.	Considerable inflammable gas in well.
2	6R.F.	4	Drl.	236	67	12	20	Ca.		S.Sul.Cl.	D.	Sufficient for house and garage.
3	6R.F.	4	Drl.	260	58	15	30	Ca.		S.C.	D.	Sufficient; at house.
3A	6R.F.	4	Drl.	259	96		19	Ca.		H.C.	S.	" ; at barn.
1	6R.F.	5	Drl.	231	36		30	Ca.		S.C.	D.	Water at 36 feet in Carlsbad.
2	6R.F.	5	Drl.	232	80	12	35	Ca.		S.Min.	D.	" " 80 " " "
3	6R.F.	5	Drl.	232	80	12	35	Ca.		S.Min.	D.	" " 80 " " "
4	6R.F.	5	D.	229	16	6M.		S.		H.C.	D.	Sufficient.
1	6R.F.	6	D.	225	18	16		C.		H.C.	D.	Goes dry; at house.

1	2	3	4	5	6	7	8	9	10	11	12	13
1A	6R.F.	6	Drl.	223	25	2	25	C		S.C.	D.S.	Water at 25' from clay/Carlsbad contact; considerable inflammable gas in well.
1	6R.F.	7	D.	252	20	16		C.		S.C.	D.	Sufficient.
1A	6R.F.	7	Drl.	255	150	20		Ca.	540	H.Sul.	S.	" ; at barn.
2	6R.F.	7	Drl.	251	108	26	None	G.	16+	S.C.	D.	Water at 108 feet in gravel beneath clay; Considerable inflammable gas in well.
3	6R.F.	7	D.	255	22	9M		C.		H.C.	D.	Sufficient.
4	6R.F.	7	D.	275	14	4	4	Ca.		H.C.	D.S.	Never dry; excellent well.
1	6R.F.	8	Drl.	276	140		14	Ca.		H.Sul.	D.S.	" " ; " "
2	6R.F.	8	D.	273	18 (?)			C.		S.C.	D.	Sufficient for 2 families.
2A.	6R.F.	8	Drl.	275						C.Sal.	S.	At barn.
1	6R.F.	9	D.	261	8	6		S.		H.C.	D.	Sufficient; at house.
1A	6R.F.	9	D.	262	12	5M.		S.		H.C.	G.	" ; in field
2	6R.F.	9	D.	264	17	9M		S.		H.C.	D.	"
3	6R.F.	9	D.	258	20	15		C.		H.C.	D.	" ; at house.
3A	6R.F.	9	Drl.	257	165	9	165	G.		H.C.*	D.S.	Water from gravel beneath clay; 47°F. Water under strong pressure.
4	6R.F.	9	D.	285	18	4M		S.		H.C.	S.	Sufficient; in field.
1	6R.F.	10	D.	257	20	7M		C.		H.C.	D.S.	"

1	2	3	4	5	6	7	8	9	10	11	12	13
2	6R.F.	10	D.	260	16	12		C		H.C.	D.	Low during fall and winter.
3	6R.F.	10	Drl.	261	166	4	162	G.		S.C.	D.	Water at 160+ feet from gravel above Carlsbad; very little gravel encountered.
1	6R.F.	11	D.	264				C.		H.C.	D.	Goes dry; at house.
1A	6R.F.	11	Drl.	259	164			G.		C.Sal.	S.	Water from gravel beneath clay; too saline for domestic use; at barn.
2	6R.F.	11	D.					C.				Information incomplete.
2A	6R.F.	11	Drl.	262	149			G.		C,Sal	S.	Water from gravel beneath clay; at barn.
1	6R.F.	12	Drl.	259	209	6	157	G.	25+	S.C.Sal.*	D.S.	Water at 120 feet from gravel beneath clay; 50°F; at barn.
2	6R.F.	12	Drl.	286				G(?)		H.C.	D.S.	Sufficient; at barn.
3	6R.F.	12	D.	258	24	5		C.		H.C.	D.	" ; at house.
3A	6R.F.	12	Drl.	258	178	7	138	Ca.	18+	C.Sal.Sul.	S.	Water probably both from gravel & Carlsbad; considerable inflammable gas present; at barn.
1	6R.F.	13	D.	297	10	6	80	S./C.		S.C.	D.S.	Well is bottomed in clay; at house
1A	6R.F.	13	D.	296	12	7	80	S./C.		H.C.	B.	" " " " " ; at barn.
1	6R.F.	14	D.	268	15	8		S.			N.	
1A	6R.F.	14	Drl.	270	180			G.(?)		Sal.C	N.	Water too saline for domestic use.
1	6R.F.	15	D.	273	14	5		G.& C.		S.C.	D.	Sufficient.
1A	6R.F.	15	D.	273	7	3M.		G.& C.		S.C.	S.	"

1	2	3	4	5	6	7	8	9	10	11	12	13
2	6R.F.	15	D.	293	12	8M.		S./C		H.C.	D.	Well is bottomed in clay; at house.
2A	6R.F.	15	D.	291	10	4M		S./C.		H.C.	S.	" " " " " ; at barn.
3	6R.F.	15	D.	293	14	10		S.		S.C.	D.S.	Sufficient.
4	6R.F.	15	D.	288	7	5		S.		H.C.	D.	"
5	6R.F.	15	D.	288				S.				Information incomplete.
1	6R.F.	16	D.	299	7	6M.		S.		H.C.	D.S.	Sufficient.
2	6R.F.	16	D.	273	14	10		C.		H.C.	D.	Goes dry; at house.
2A	6R.F.	16	Drl.	271	80			G.		Sal.C.	D.S.	Water from gravel beneath clay; at barn.
1	6R.F.	17	D.	297	14	9		S.		S.C.	D.S.	Sufficient.
2	6R.F.	17	D.	297	9			S./C.		H.C.	D.	Well is bottomed with clay
3	6R.F.	17	Drl.	273	100+	7M.					N.	
1	6R.F.	18	D.	277	13	7M.		S.		H.cl	D.	Sufficient; at house.
1A	6R.F.	18	D.	277	7	5M		S.		H.C.	S.	"
1	6R.F.	20	D.	281	10	8M.		S.		H.C.	D.	"
1	6R.F.	21	D.	280	13	6M.		S.(?)		H.cl.	D.S.	"
2	6R.F.	21	D.	275	10	6M.		S			N.	"
3	6R.F.	21	D.	273	12	9		S.		H.C.	D.S.	" ; at house.
3A	6R.F.	21	Drl.	277	80			G.		Min.C.	S.	Water from gravel under clay; at barn.

1	2	3	4	5	6	7	8	9	10	11	12	13
3B	6R.F.	21	D.	277	12	9		S.		H.C.	D.S.	Sufficient; at barn.
1	6R.F.	22	D.	286	10	5M		S.		H.C.	N.	In field
1	6R.F.	23	D.	276	12	7M		S.		S.cl	N.	At house.
1A	6R.F.	23	D.	274	9	6M		S.		H.C.	D.S.	Sufficient; at barn.
2	6R.F.	23	Drl.	272	104	12	65	Ca.		S.cl.	S.	Water at 104 feet from Carlsbad.
2A	6R.F.	23	D.	275	11	8M		S.		H.C.	D.	Goes dry during late summer; at house.
3	6R.F.	23	D.	285	12	8M				H.C.	D.	" " " " " ; at house.
3A	6R.F.	23	D.	285	11	9M		G.& C	10+	H.C.	S.	" " " " " ; at barn.
3B	6R.F.	23	D.	287	12	7M		S. & C.		H.C.	S.	Sufficient; in field.
1	6R.F.	24	D.	287	9	7M		S.& C.		H.C.	D.	" ; at house.
1A	6R.F.	24	D.	287	5	4M		S.C& C.		H.C.	S.	" ; at barn.
2	6R.F.	24	D.	268	7	6M		S.		H.C.	D.	" ;
1	6R.F.	26	Drl.	269	85			S.		H.C.	D.S.	"
2	6R.F.	26	D.	301	7							Dry well in clay till (?)
1	6R.F.	27	Drl.	268	125(?)					Sal.C.	D.S.	Excellent supply.

1	2	3	4	5	6	7	8	9	10	11	12	13
2.	6R.F.	27	D.	326	13	7M.		C.T.			N	Vacant house.
1	6R.F.	28	Drl.	268	106	2	96	Ca.		H.C.	D.S.	Water at 106 feet in Carlsbad.
2	6R.F.	28	Drl.	268	97		97	G.		H.C.	D.S.	Water in gravel above Carlsbad.
1												
1	6R.F.	30	D.	315	14			C.T.		H.C.	D.	Low in late summer; at house.
1A	6R.F.	30	D.		7			C.T.		H.C.	S.	Sufficient; in field.

Community of Cyrville

1	2	3	4	5	6	7	8	9	10	11	12	13.
1	1 O.F.	26	Drl.	222	140+	3		Bi		M.Sul.	D.	Cloudy at times.
2	2 O.F.	26	D.	224	10	3M	13	C./Bi.		H.C.	D.	Water at contact of clay and Billings.
3	1 O.F.	26	Drl.	227				Bi.				Limited information.
4	1 O.F.	26	Drl.	227	45		20	Bi.		H.Sul.	D.	Water not used for drinking
5	2 O.F.	27	D.	226				Bi.		H.Sul.	D.	Sufficient supply.
6	1 O.F.	26	Drl.	230	94	9		Bi.		M.C.	D	" "
7	2 O.F.	27	Drl.	226	72	12	20	Bi.		H.C.	D.	" "
8	2 O.F.	27	Drl.	227	68	15	14	Bi.		H.C.	D.	Excellent supply.
9	2 O.F.	26	D.	225	7		2	Bi.		H.C.	D.	Goes dry during late summer.
10	1 O.F.	26	Drl.	227	55	11M.	30	Bi.		S.C.	D.	Sufficient supply.
11	2 O.F.	26	Drl.	231				Bi.		H.C.	D.	" "
12	2 O.F.	26	D.	230	9	4M	9	C./Bi.		H.C.	D.	Goes dry during late summer
13	2 O.F.	27	Drl.	288	85	4		Bi.		H.C.	D.	Sufficient supply.
14	2 O.F.	27	D.	227			5	Bi.		H.C.	D.	" "
15	2 O.F.	27	Drl.	228	110	15		Bi.		S.C.	D.	Excellent supply.
16	2 O.F.	27	D.	226	16	4M.	16	C./Bi.		H.C.	D.	Water from contact of clay and Billings; low in late summer.
17	1 O.F.	26	Drl.	229	175		22	Bi.		H.C.	D.	Sufficient supply.

1	2	3	4	5	6	7	8	9	10	11	12	13
18	1	O.F. 26	Drl.	230	150		20	Bi.		M.C.	D.	Sufficient supply.
19	2	O.F. 27	Drl.	228	70		13	Bi		H.C.	D.	" "
20	2	O.F. 27	Drl.	229				Bi.		H.C.	D.	Reported as capable of yielding 1800 G.P.H.
21	1	O.F. 26	Drl.	224	35	2	4	Bi.		H.C.	D.	Sufficient for 5 families.
22	2	O.F. 26	Drl.	219	55	2	6	Bi.		M.Sul.	D.	Sufficient supply.
23	1	O.F. 26	Drl.	224	41		6	Bi.		H.Sul.	D.	" "
24	2	O.F. 26	Drl.	224	43			Bi.		H.Sul.	D.	" "
25	2	O.F. 27	Drl.	227	40	8	6	Bi.		H.C.	D.	" "
26	2	O.F. 26	D.	229	11		11	C./Bi		H.C.	D.	Water from contact of clay and Billings.
26A	2	O.F. 26	Drl.	229	100	2		Bi.		H.C.	D.	Sufficient supply.
26B	2	O.F. 26	D.	233	12	2	12	C./Bi		H.C.	G.	Water from contact of clay and Billings.
27	2	O.F. 26	D.	234	20	15	9	Bi.		H.C.	D.G.	Low during late summer
28	2	O.F. 27	Drl.	227	67	4		Bi.		H.C.	D.	Sufficient supply.
29	2	O.F. 26	Drl.	227	75			Bi.		M.C.	D.	" "
30	2	O.F. 26	Drl.	228	65	4	15	Bi.		H.C.	D.	" "
31	2	O.F. 26	Drl.	230	104			Bi.		S.C.	D.	Insufficient Supply.
32	2	O.F. 26	D.	227	9	4M		C./Bi.		H.C.	D.G.	Goes dry during late summer.

Community of Cyrville

1	2	3	4	5	6	7	8	9	10	11	12	13
33	1	O.F. 26	D.	227	13	3M.	6	Bi.		H.C.	D.	Low during late summer.
33A	1	O.F. 26	D.	229	33	2M	7	Bi.		H.C.	G.	Sufficient supply.
34	1	O.F. 26	Drl.	207	75			Bi.		M.C.	D.	" "
35	2	O.F. 27	Drl.	225	75+		6	Bi.		H.Sal.	D.	" "
36	1	O.F. 26	Drl.	227				Bi.		H.C.	D.	" "
37	2	O.F. 27	D.	226	20+	6	20+	C./Bi.		H.C.	D.	Sufficient for 4 families.
38	2	O.F. 26	Drl.	225	38			Bi.		H.Sul.	D.	Low during late summer.
39	2	O.F. 26	D.	233	17	13	17	C./Bi.		H.C.	D.	Water from contact of clay and Billings.
40	2	O.F. 27	Drl.	226	76	9	6	Bi.		H.C.	D.G.	Sufficient supply
41	2	O.F. 27	D.	225	9	4M	6	Bi		H.cl.	D.	Goes dry during late summer
42	2	O.F. 27	Drl.		100+	10M		Bi.		H.Sal.	D.	Sufficient supply.
43	2	O.F. 26	Drl.	231	74		5	Bi.		H.C.	D.	Sufficient for 3 families.
44	2	O.F. 26	Drl.	227	35	4M.		Bi.		H.C.	D.G.	Sufficient supply.
45	2	O.F. 26	D.	231				Bi.		H.C.	D.	" "
46	2	O.F. 26	Drl.	230	130			Bi.		M.C.	D.G.	" "
47	2	O.F. 26	D.	228				C./Bi.		H.C.	D.	" "
48	2	O.F. 26	D.	227				C./Bi.		H.C.	D.	Low during late summer.

Community of Cyrville

1	2	3	4	5	6	7	8	9	10	11	12	13
49	2 O.F.	27	Drl.	228	100	4	20	Bi.		H.C.	D.	Sufficient supply.
50	2 O.F.	27	Drl.	229	100+			Bi.		H.Sul.	D.	" "
51	1 O.F.	26	Drl.	227	56	6M.	18	Bi.		H.C.	D.	" "

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
1	1 O.F.	2	Spr.	193	8M	0	8(?)	C.		S.Sul.	D.	Dug out spring; strong hydrogen sulphide gas odour
2	1 O.F.	2	Brd.	209	21	7M	21	C/Ox.		H.C.	D.S.	Excellent supply.
2A	1 O.F.	2	Brd.	209	11	2M	28	S.& C.		H.C.	N.	
3	2 O.F.	1	D.	226	15	5M		C.		M.C.	D.	Sufficient
4	2 O.F.	1	D.	221	13½	3M		C.		M.C.	D.	Located at base of bluff.
5	1 O.F.	3	Brd.	207	67		67	C./Ox.		S.C.	D.	Sufficient
6	2 O.F.	1	D.	217	10	2M.				M.C.	D.	Low in late summer.
7	1 O.F.	3	D.	214				C.		H.Sal.	D.	Sufficient
8	1 O.F.	1	D.	219				C.		H.Cl.	N.	
8A	1 O.F.	1	Drl.	219		6M		C.		H.Cl.	S.	"
9	1 O.F.	1	D.	216	14	3M		C.		S.C.	D.	
9A	1 O.F.	1	Brd.	216	27	4M.		C.		C.Sul.	N.	"

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
10	2	O.F. 1	Brd.	220	40(?)	8		C.		C.Sal.	D.	Sufficient for garage.
11	1	O.F. 3	D.	206	9	5M.		C.		H.C.	N.	
11A	1	O.F. 3	Brd.	207	45		45	G.		M.Sal.	D.	Water from gravel beneath clay.
11B	1	O.F. 3	D.	199	6	2M		C.		S.Sul.	D.	Sufficient.
11C	1	O.F. 3	Brd.	201	41	8M	41	C/Ox.		S.Sul.	D.	Water from clay/Oxford contact.
12	2	O.F. 3	D.	218	10	2M.		C.		H.C.	D.	Sufficient for one family.
12A	2	O.F. 3	Brd.	217	57	2M.		C.(?).		H.C.	D.	Sufficient.
13	1	O.F. 1	Brd.	211	20+			C.		S.C.	D.	Excellent supply.
14	1	O.F. 2	Brd.	218	32½	4M.		C.		H.C.	D.	Sufficient.
15	1	O.F. 1	D.	217				C.		H.cl.	D	"
16	2	O.F. 1	D.	210	25+	12		C.		H.C.	D.	"
17	1	O.F. 2	Drl.	223	64		64	C./Ox.		Sul.cl.	D.	Water from clay/Oxford contact; sufficient for restaurant.
18	1	O.F. 1	D.	215	12	3M.		C.		H.cl.	D.	Sufficient.
19	1	O.F. 3	Brd.	211	79	20	79	G.		H.C.	D.	Yields 300 gallons per day; water from gravel beneath clay.
20	1	O.F. 2	Brd.	219	35	6	35	C./Ox.		H.C.	D.S.	Water from clay/Oxford contact.
21	1	O.F. 4	Brd.	217	113	20M.	113	C./Ot.		H.C.	D.	Sufficient; water from clay/Ottawa contact.
22	1	O.F. 4	D.	217	13	5M.		C.		H.C.	D.	Low in late summer.

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
22A	1 O.F.	4	D.	216	9	2M		C.		H.C.	S.	Sufficient; at barn
23B	1 O.F.	4	Drl.	200	194	+3	194(?)	C./R.		H.Sal.	D.S.	Flowing-artesian well; water reported as coming from clay/ Rockcliffe contact.
24	2 O.F.	1	Drl.	231	37	15	37	Ox.		S.Sul.	D.	Sufficient.
25	1 O.F.	1	Brd.	208	20	10	20	C.		S.C.	D	Low in late summer.
26	2 O.F.	3	D.	211	9	3M		C.		H.I.	D.	Located at base of bluff.
27	2 O.F.	1	D.	221	12	4M.		C.		H.C.	D.	Sufficient.
28	1 O.F.	4	D.	219	12	4		C		H.C.	D.	"
29	1 O.F.	1	D.	213	14	3M.		C.		H.Cl.	D.	Low in late summer
30	1 O.F.	2	Brd.	218				C.		H.C.	D.	Sufficient for 2 families
31	1 O.F.	1	D.	211	10	6M.		C.		H.C.	D.	Low in late summer
32	1 O.F.	3	D.	208	12½	4		C.		H.C.	D.	Sufficient.
32A	1 O.F.	3	Brd.	201	42		42	C.		H.C.	D.	"
33	1 O.F.	3	D.	217	14	4M.		C.		H.C.	D.	"
34	2 O.F.	3	D.	214	10	3M		C.		H.C.	D.	"
35	2 O.F.	2	D.	223				C.		M.C.	D.	"
35A	2 O.F.	2	Brd.	224	52	19M	52	C./Ox.			N.	

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
36	2 O.F.	3	D.	212	13	2M.		C.		H.C.	D.	Low in late summer.
37	2 O.F.	3	D.	209	10	3.		C.		M.C.	G.	Located at base of bluff.
37A	2 O.F.	3	Brd.	211				C.		S.C.	D.	Sufficient.
38	1 O.F.	1	D.	219	16½	8		C.		M.C.	D.	"
39	1 O.F.	3	Drl.	208	77	12M	77	G.		S.C.	D.	Water from gravel beneath clay.
40	1 O.F.	3	Brd.	211	46	20M	46	G.		H.C.	D.	" " " " "
41	2 O.F.	1	Drl.	215	38	4	38	C./Ox.		Sul.Cl.	D.	Water from clay/Oxford contact.
42	2 O.F.	2	D.	200	6	4M		C.			N.	
43	2O.F.	1	Drl.	224	35½	3M.	15	Ox.		M.C.	D.	Sufficient.
44	1 O.F.	3	D.	204	10	3M.		C.		H.Cl.	D.	Low in late summer.
44A	1 O.F.	3	Spt.	203	6	0		C.		G.Sul.Cl	N.	Dug out spring.
45	2 O.F.	2	D.	221	29	10M.		C.		H.C.	D.	" " "
45A	2 O.F.	2	D.	222	13	6M.		C.		H.C.	D.	Sufficient
46	1 O.F.	1	D.	218	12	5M.		C.		H.C.	D.	"
47	2 O.F.	4	D.	218	12	4		C.		H.C.	D.	Low in late summer.
48	1 O.F.	1	Brd.	213	17	12M.	17	C./Ox.		H.C.	D.	Sufficient
49	1 O.F.	3	D.	202	11	3M.		C.		M.C.	D.	Sufficient for 3 families

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
50	1 O.F.	3	D.	203	15½	5M.		C.(?)		H.C.	D.	Low in late summer.
50A	1 O.F.	3	Brd.	200	34	2		S.		S.Sul.	D.	Water from sand beneath clay.
51	1 O.F.	1	Brd.	216	28	8	28	C./Ox.		Sul.C.	D.	Water from clay/Oxford contact.
52	1 O.F.	3	Brd.	204	40		40	G.		H.C.	D.	Water from gravel beneath clay.
52A	1 O.F.	3	Brd.	208	23			C.		H.C.	S.	Low in late summer.
53	1 O.F.	3	D.	203	10	4M.		S.(?)		S.C.	D.	Sufficient.
54	1 O.F.	4	Drl.	181	75	+1	75	G.	75.3 gph (July 1. 1952)	S.Sul	D.	Flowing well; Water from gravel beneath clay.
55	1 O.F.	3	D.	216	18	5M		C.		H.C.		Low in late summer.
56	1 O.F.	2	D.	214				C.		M.C.	D.	Sufficient
57	2 O.F.	2	Drl.	222	63		55	Ox.		S.Sul.	D.	Sufficient for Hotel.
57A	2 O.F.	2	Brd.	222	45			C.		H.C.	D.	Low in late summer.
58	2 O.F.	3	D.	216	12			C.		H.cl.	D.	Sufficient.
59	1 O.F.	3	D.	202	12	3M.		C.		H.C.	D.	Excellent well.
60	1 O.F.	3	D.	217	13	7M.		C.			N.	
61	1 O.F.	4	D.	218	10	4M.		C.		S.C.	D.	Low in late Summer.
62	1 O.F.	1	Brd.	217	28	14M		C.		M.C.	D.	Sufficient.

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
63	1 O.F.	1	Brd.	210	35	5	35	C.		S.C.	D.	Sufficient.
64	2 O.F.	3	D.	215				C.		M.C.	D.	Located at base of slope.
65	1 O.F.	1	D.(?)	214				C.		H.Cl.	D.	Sufficient.
66	1 O.F.	2	Brd.	213	32	10	32	C./Ox.		S.C.	D.	Water from clay/Oxford contact.
67	1 O.F.	3	D.	200				C.		S.Cl.	D.	"
68	1 O.F.	1	D.	207	10	3M.		C.		H.C.	D.	"
68A	1 O.F.	1	D.	201	5½	3		C.		H.Sul.	S.	Goes dry.
69	1 O.F.	3	D.	209	12			C.		H.C.	D.	Sufficient.
70	1 O.F.	1	D.	208	25		25	C./Ox.		H.C.	D.	Water " from clay/Oxford contact.
71	1 O.F.	4	D.	219	11	5M.		C.		M.C.		Low during late summer.
72	1 O.F.	2	Brd.	221				C.		H.C.	D.	Sufficient.
73	2 O.F.	2	D.	224	12			C.		H.C.	D.	"
73A	2 O.F.	2	Brd.	223	58		58	C./Ox.				Water from clay /Oxford contact.
74	1 O.F.	3	Brd.	207	7			C.		S.C.	D.	Low in late summer.
75	2 O.F.	2	D.	223	11½	8M		C.		H.C.	D.	Sufficient.
76	1 O.F.	1	Brd.	218	35		35			H.C.	D.	"
76A	1 O.F.	1	D.	218	15			C.		H.C.	D.	"

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
77	1 O.F.	2	D.	220	7	2M.		C.		S.C.	D.	Sufficient for 2 families.
78	2 O.F.	1	D.	215	13	3M.		C.		S.C.	D.S.	" " " "
79	2 O.F.	3	D.	216	5	2M.		C.		H.C.	D.	Located at base of bluff.
80	1 O.F.	2	D.	210	25	19	25	C./Ox.		H.C.	D.	Sufficient for 1 family.
81	1 O.F.	4	D.	218	10	4M		C.		H.Cl.	D.	Low during late summer.
82	1 O.F.	1	Brd.	206	13		13	C./Ox.		M.C.	D.	Sufficient; water from clay/ Oxford contact.
83	1 O.F.	1	D.	218	10	3M.		C.		H.C.	D.	"
84	1 O.F.	3	D.	207	10	3M.		C.		H.C.	D.	"
84A	1 O.F.	3	Brd.	206	17			C./R.		S.Sul.	D.	Water from clay/Rockcliffe contact.
84B	1 O.F.	3	Brd.	211	70(?)			C./R.		S.Sul.	D.	" " " " "
85	1 O.F.	2	D.	208	10½	5M.		C.		Sul.C.	D	Low in late summer.
86	2 O.F.	1	D.	217	10	2M.		C.		H.C.	D.	Sufficient.
87	1 O.F.	2	D.	221	32½	8M.		C.		H.C.	D.	"
88	1 O.F.	3	Brd.	212	50		50	C./R.		H.C.	D.	Water from clay/Rockcliffe contact.
88A	1 O.F.	3	D.	210	10½	2 M.		C.		H.C.	N	
89	1 O.F.	1	Brd.	212	26	6M.	26	C./R.		H.C.	D.	Water from clay/Rockcliffe contact.
90	1 O.F.	2	D.	222	14	3M.		C.		H.C.	D.	Sufficient.

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
91	2 O.F.	2	D.	222				C.		H.C.	D.	Sufficient.
91A	2 O.F.	2	Drl.	215	55		40	Ox.		Sul.Cl.	D.	"
92	1 O.F.	1	D.	219	15½	3M.		C.		M.C.	D.	Low in late summer,
92A	1 O.F.	1	Brd.	219	35	4M.		C.		M.C.	D.	Sufficient.
93	1 O.F.	1	D.	216	12	3M.		C.		M.C.	D.	Low in late summer.
94	1 O.F.	3	Brd.	210	51	3M.	51	C./R.		M.Sul.	D.	Water from clay/Rockcliffe contact.
94A	1 O.F.	3	D.	209	13½	3M.		C.		M.C.	D.	Sufficient.
95	2 O.F.	1	D.	220	13	4M.		C.		S.C.	D.	Sufficient.
96	1 O.F.	2	Brd.	212	20	2		C.		S.C.	D.	"
97	1 O.F.	2	Brd.	214	18+	3M.		C.		H.C.	D.	Sufficient for school.
97A	1 O.F.	2	D.	212	15½	5M.		C.		Sal.C.	D.	" " "
98	2 O.F.	3	D.(?)	213				C.		H.C.	D.	Sufficient
99	2 O.F.	3	D.	224	20+	10M.		G.		H.Cl.	D.	Water from gravel beneath clay.
100	2 O.F.	4	D.	218	12	3M.		C.		H.C.	D.	Sufficient.
101	1 O.F.	3	Brd.	191	52		52	G.	77.2 g.p.h. (July 1,1952)	S.Sul.	D.	Flowing-Artesian well; water from gravel beneath clay.
102	1 O.F.	3	Brd.	192	69	0	69	S.	40.2 g.p.h. (July 1,1952)	S.C.	D.	Flowing-Artesian well; water from sand beneath clay.

Village of Orleans

1	2	3	4	5	6	7	8	9	10	11	12	13
103	1 O.F.	3	Brd.	213	37	8M		C.		M.Cl.	D.	Sufficient.
104	1 O.F.	3	Brd.		42			S.		Sul.	D.	Flowing-Artesian well; water from sand beneath clay.

Compilation of Well Data

The following abbreviations were used in the accompanying compilation sheets of well data.

Concession: O.F. - Ottawa Front
R.F. - Rideau Front

Type: Brd. - bored; D. - dug; D.D.H. - diamond drill hole; Drl. - drilled; Spr. - spring; Spt. - Sand point.

Depth to Water Surface: M. - measured.

Aquifer: Al. - alluvium; C.- clay; C.T. - clay till; G. - gravel; G.T. - gravelly till; S. - sand; S.T. - sandy till; S.-C.T. - stoney, clay till.

(N.B.) Symbols such as S./C. indicate that the ground water occurs at or near the contact of the two materials.

Ca. - Carlsbad formation; Bi. - Billings formation; O t. - Ottawa formation; R. - Rockcliffe formation; Ox. - Oxford formation; M. - March formation; N. - Nepean formation; B.R. - bedrock.

Quality: C. - clear; Cl. - cloudy; H. - hard; I. - ironey; M. - medium hard; Min. - mineral taste; S. - soft; Sal. - salty; Sul. - sulphur; * Sample taken for chemical analyses.

Use: B. baths for medicinal purposes; D. - domestic; G. - gardening; I. - irrigation; M. - municipal; N. - not used; S. - stock.

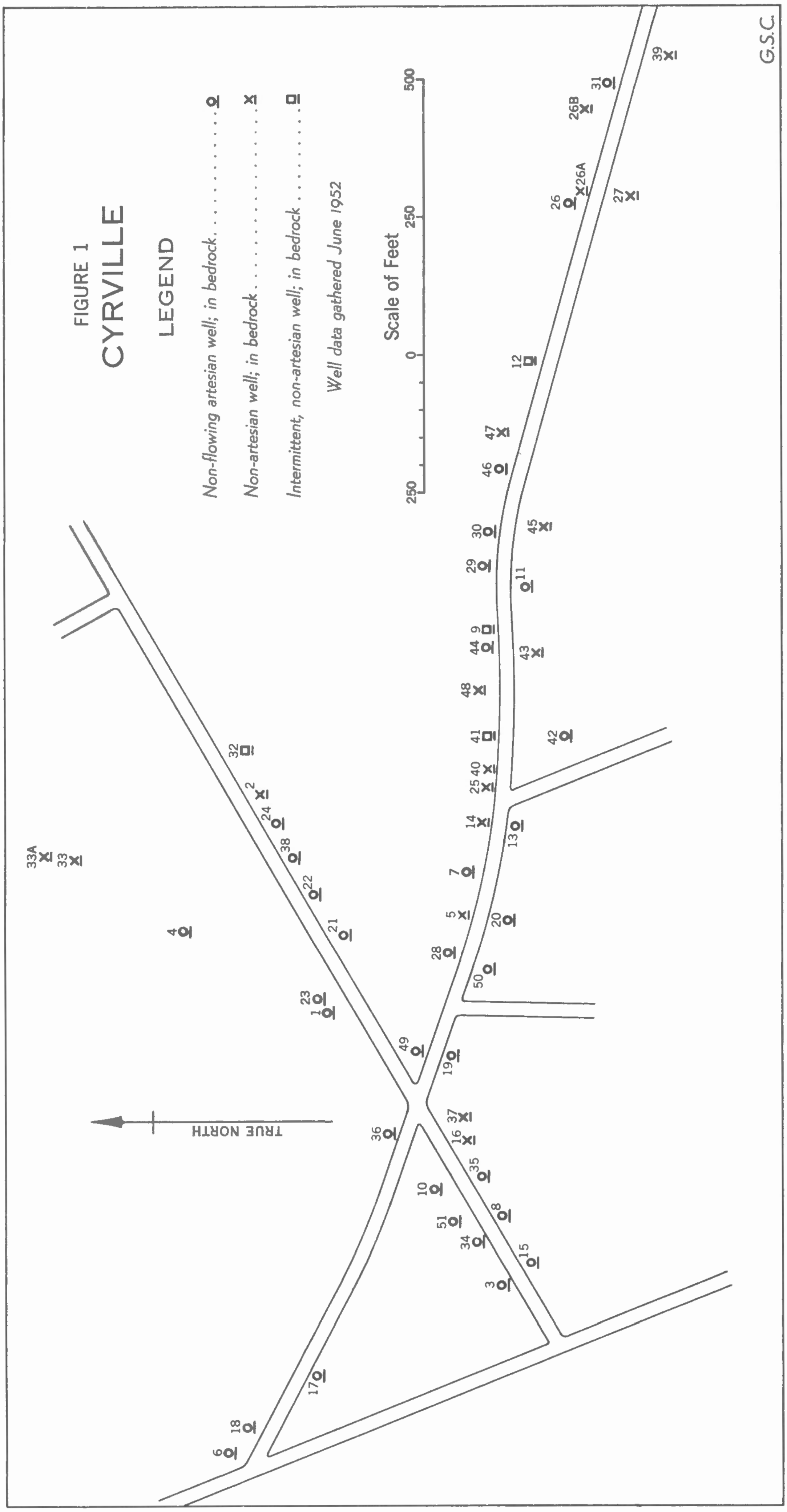
FIGURE 1
CYRVILLE
LEGEND
Non-flowing artesian well; in bedrock
Non-artesian well; in bedrock
Intermittent, non-artesian well; in bedrock
Well data gathered June 1952
Scale of Feet
250 0 250 500
TRUE NORTH
G.S.C.

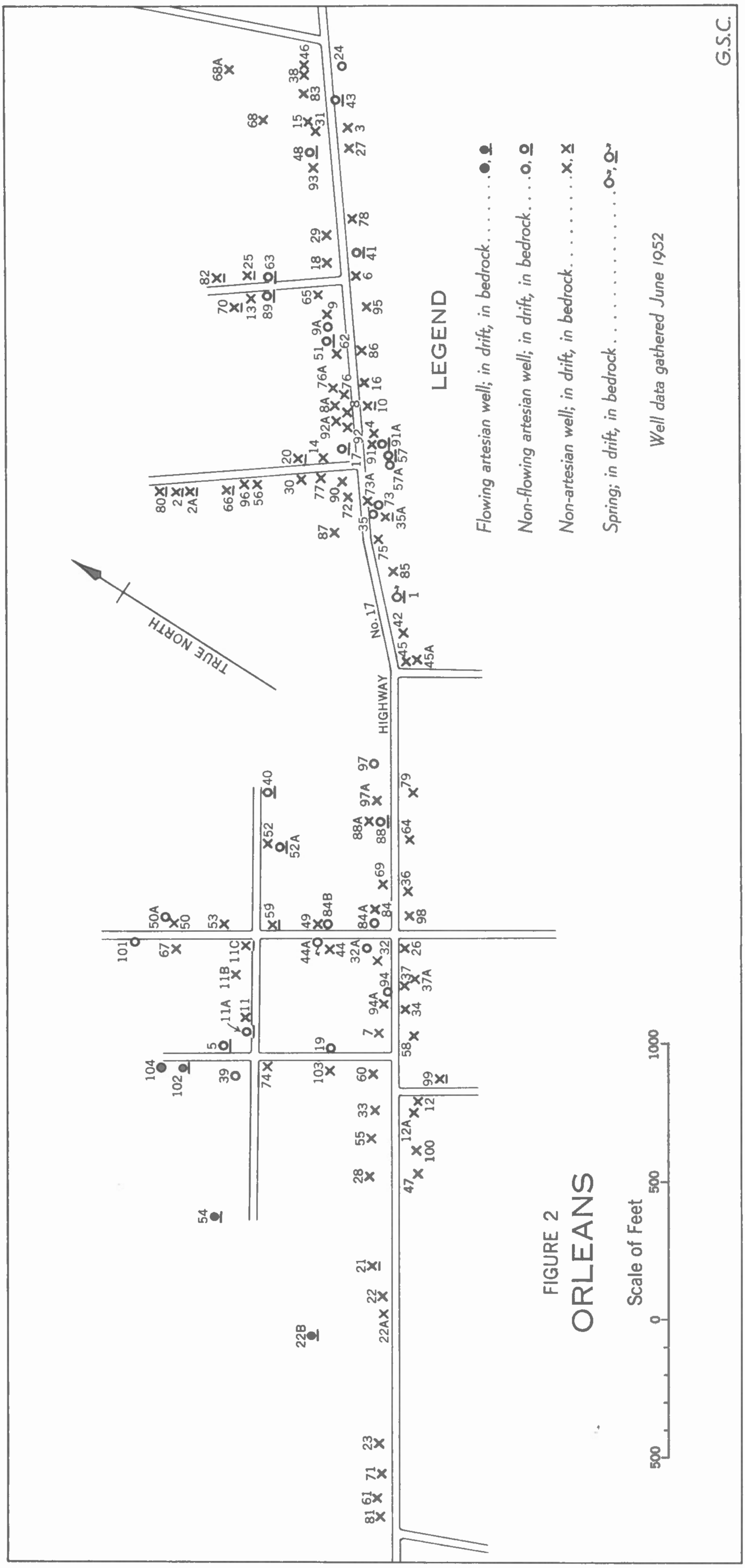

FIGURE 2
ORLEANS