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WATER SUPPLY PAPER No. 207

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF ST. PHILIPS NO. 301 SASKATCHEWAN

By

B. R. MacKay, H. N. Hainstock and P. D. Bugg

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GROUND WATER RESOURCES OF PART OF THE RURAL MUNICIPALITY OF ST. PHILIPS, NO. 301 SASKATCHEWAN

INTRODUCTION

Lack of rainfall during the years 1930 to 1934 over a large part of the Prairie Provinces brought about an acute shortage both in the larger supplies of surface water used for irrigation and the smaller supplies of ground water required for domestic purposes and for stock. In an effort to relieve the serious situation the Geological Survey began an extensive study of the problem from the standpoint of domestic uses and stock raising. During the field season of 1935 an area of 80,000 square miles, comprising all that part of Saskatchewan south of the north boundary of township 32, was systematically examined, records of approximately 60,000 wells were obtained, and 720 samples of water were collected for analyses. The facts obtained have been classified and the information pertaining to any well is readily accessible. The examination of so large an area and the interpretation of the data collected were possible because the bedrock geology and the Pleistocene deposits had been studied previously by McLearn, Warren, Rose, Stansfield, Wickenden, Russell, and others of the Geological Survey. The Department of Natural Resources of Saskatchewan and local well drillers assisted considerably in supplying several hundred well records. The base maps used were supplied by the Topographical Surveys Branch of the Department of the Interior.

Publication of Results

The essential information pertaining to the ground water conditions is being published in reports, one being issued for each municipality. Copies of these reports are being sent to the secretary treasurers of the municipalities and to certain Provincial and Federal Departments, where they can be consulted by residents of the municipalities or by other persons, or they may be obtained by writing direct to the Director, Bureau of Economic Geology, Department of Mines, Ottawa. Should anyone require more detailed information than that contained in the reports such additional information as the Geological Survey possesses can be obtained on application to the director. In making such request the applicant should indicate the exact location of the area by giving the quarter section, township, range, and meridian concerning which further information is desired.

The reports are written principally for farm residents, municipal bodies, and well drillers who are either planning to sink new wells or to deepen existing wells. Technical terms used in the reports are defined in the glossary,

How to Use the Report

Anyone desiring information about ground water in any particular locality should read first the part dealing with the municipality as a whole in order to understand more fully the part of the report that deals with the place in which he is interested. At the same time he should study the two figures accompanying the report. Figure 1 shows the surface and bedrock geology as related to the ground water supply, and Figure 2 shows the relief and the location and type of water wells. Relief is shown by lines of equal elevation called "contours". The elevation above sea-level

is given on some or all of the contour lines on the figure.

If one intends to sink a well and wishes to find the approximate depth to a water-bearing horizon, he must learn: (1) the elevation of the site, and (2) the probable elevation of the water-bearing bed. The elevation of the well site is obtained by marking its position on the map, Figure 2, and estimating its elevation with respect to the two contour lines between which it lies and whose elevations are given on the figure. Where contour lines are not shown on the figure, the elevations of adjacent wells as indicated in the Table of Well Records accompanying each report can be used. The approximate elevation of the water-bearing horizon at the well-site can be obtained from the Table of Well Records by noting the elevation of the water-bearing horizon in surrounding wells and by estimating from these known elevations its elevation at the well-site.[1] If the water-bearing horizon is in bedrock the depth to water can be estimated fairly accurately in this way. If the water-bearing horizon is in unconsolidated deposits such as gravel, sand, clay, or glacial debris, however, the estimated elevation is less reliable, because the water-bearing horizon may be inclined, or may be in lenses or in sand beds which may lie at various horizons and may be of small lateral extent. In calculating the depth to water, care should be taken that the water-bearing horizons selected from the Table of Well Records be all in the same geological horizon either in the glacial drift or in the bedrock. From the data in the Table

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[1] If the well-site is near the edge of the municipality, the map and report dealing with the adjoining municipality should be consulted in order to obtain the needed information about nearby wells.

of Well Records it is also possible to form some idea of the quality and quantity of the water likely to be found in the proposed well.

GLOSSARY OF TERMS USED

Alkaline. The term "alkaline" has been applied rather loosely to some ground-waters. In the Prairie Provinces, a water is usually described as "alkaline" when it contains a large amount of salts, chiefly sodium sulphate and magnesium sulphate in solution. Water that tastes strongly of common salt is described as "salty". Many "alkaline" waters may be used for stock. Most of the so-called "alkaline" waters are more correctly termed "sulphate waters".

Alluvium. Deposits of earth, clay, silt, sand, gravel, and other material on the flood-plains of modern streams and in lake beds.

Aquifer or Water-bearing Horizon. A water-bearing bed, lens, or pocket in unconsolidated deposits or in bedrock.

Buried pre-Glacial Stream Channels. A channel carved into the bedrock by a stream before the advance of the continental ice-sheet, and subsequently either partly or wholly filled in by sands, gravels, and boulder clay deposited by the ice-sheet or later agencies.

Bedrock. Bedrock, as here used, refers to partly or wholly consolidated deposits of gravel, sand, silt, clay, and marl that are older than the glacial drift.

Coal Seam. The same as a coal bed. A deposit of carbonaceous material formed from the remains of plants by partial decomposition and burial.

Contour. A line on a map joining points that have the same elevation above sea-level.

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

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

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

Glacial Drift. The loose, unconsolidated surface deposits of sand, gravel, and clay, or a mixture of these, that were deposited by the continental ice-sheet. Clay containing boulders forms part of the drift and is referred to as glacial till or boulder clay. The glacial drift occurs in several forms:

(1) Ground Moraine. A boulder clay or till plain (includes areas where the glacial drift is very thin and the surface uneven).

(2) Terminal Moraine or Moraine. A hilly tract of country formed by glacial drift that was laid down at the margin of the continental ice-sheet during its retreat. The surface is characterized by irregular hills and undrained basins.

(3) Glacial Outwash. Sand and gravel plains or deltas formed by streams that issued from the continental ice-sheet.

(4) Glacial Lake Deposits. Sand and clay plains formed in glacial lakes during the retreat of the ice-sheet.

Ground Water. Sub-surface water, or water that occurs below the surface of the land.

Hydrostatic Pressure. The pressure that causes water in a well to rise above the point at which it is struck.

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

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

Pre-Glacial Land Surface. The surface of the land before it was covered by the continental ice-sheet.

Recent Deposits. Deposits that have been laid down by the agencies of water and wind since the disappearance of the continental ice-sheet.

Unconsolidated Deposits. The mantle or covering of alluvium and glacial drift consisting of loose sand, gravel, clay, and boulders that overlie the bedrock.

Water Table. The upper limit of the part of the ground wholly saturated with water. This may be very near the surface or many feet below it.

Wells. Holes sunk into the earth so as to reach a supply of water. When no water is obtained they are referred to as dry holes. Wells in which water is encountered are of three classes.

(1) Wells in which the water is under sufficient pressure to flow above the surface of the ground. These are called Flowing Artesian Wells.

(2) Wells in which the water is under pressure but does not rise to the surface. These wells are called Non-Flowing Artesian Wells.

(3) Wells in which the water does not rise above the water table. These wells are called Non-Artesian Wells.

NAMES AND DESCRIPTIONS OF GEOLOGICAL FORMATIONS, REFERRED TO IN THESE REPORTS

Wood Mountain Formation. The name given to a series of gravel and sand beds which have a maximum thickness of 50 feet, and which occur as isolated patches on the higher parts of Wood Mountain. This is the youngest bedrock formation and, where present, overlies the Ravenscrag formation.

Cypress Hills Formation. The name given to a series of conglomerates and sand beds which occur in the southwest corner of Saskatchewan, and rests upon the Ravenscrag or older formations. The formation is 30 to 125 feet thick.

Ravenscrag Formation. The name given to a thick series of light-coloured sandstones and shales containing one or more thick lignite coal seams. This formation is 500 to 1,000 feet thick, and covers a large part of southern Saskatchewan. The principal coal deposits of the province occur in this formation.

Whitemud Formation. The name given to a series of white, grey, and buff coloured clays and sands. The formation is 10 to 75 feet thick. At its base this formation grades in places into coarse, limy sand beds having a maximum thickness of 40 feet.

Eastend Formation. The name given to a series of fine-grained sands and silts. It has been recognized at various localities over the southern part of the province, from the Alberta boundary east to the escarpment of Missouri coteau. The thickness of the formation seldom exceeds 40 feet.

Bearpaw Formation. The Bearpaw consists mostly of incoherent dark grey to dark brownish grey, partly bentonitic shales, weathering light grey, or, in places where much iron

is present, buff. Beds of sand occur in places in the lower part of the formation. It forms the uppermost bedrock formation over much of western and southwestern Saskatchewan and has a maximum thickness of 700 feet or somewhat more.

Belly River Formation. The Belly River consists mostly of non-marine sand, shale, and coal, and underlies the Bearpaw in the western part of the area. It passes eastward and northeastward into marine shale. The principal area of transition is in the western half of the area where the Belly River is mostly thinner than it is to the west and includes marine zones. In the southwestern corner of the area it has a thickness of several hundred feet.

Marine Shale Series. This series of beds consists of dark grey to dark brownish grey, plastic shales, and underlies the central and northeastern parts of Saskatchewan. It includes beds equivalent to the Bearpaw, Belly River, and older formations that underlie the western part of the area.

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of St. Philips, No. 301, consists of twelve townships, west of the First meridian, in southeastern Saskatchewan. It lies between the Manitoba border and the Second meridian, 180 miles north of the International Boundary line. The rural post office of St. Philips is 24 miles east and 35 miles north of the city of Yorkton. Only the eight southern townships of the municipality are covered by this report. They have a total area of approximately 220 square miles and consist of six full townships, described as townships 31 and 32, ranges 30, 31, and 32, and two fractional townships described as townships 31 and 32, range 34. Keeseekoose Indian Reservation and part of Cote Reservation occupy an area of approximately 14 square miles in townships 31 and 32, range 32. Duck Mountain Forest Reserve occupies township 30, range 31, and sections 1 to 24, inclusive, of township 32, range 30. The maximum elevation of approximately 2,200 feet above sea-level is attained in this forest reserve, from where it decreases in a westerly direction to 1,450 feet along Assiniboine river. The river flows through the southwestern corner of the municipality, occupying a wide, gently sloping valley. The flood-plain of the river is mantled by sands and silty clays. An area paralleling the river on the east is mantled by glacial lake clays. In the vicinity of Fort Pelly, and a narrow area along the western border of the municipality, the lake deposits are sandy. Glacial till that has been modified by water action occurs in the southwestern corner and unmodified glacial till borders the glacial lake deposits on the east and covers an area in the northeastern corner of the municipality. The remainder of the area is mantled by part of a large moraine that was deposited when the front of the continental ice-sheet that covered this area was stationary or nearly so. This large moraine forms Duck mountains. The moraine-covered area is

characterized by numerous steep, rock-strewn knolls, and undrained depressions. A number of fairly large lakes occur in the eastern part of the municipality, the largest being Madge lake. Lac La Course, another large body of water, occurs in the northwestern part of the area. Numerous creeks drain into the lakes and Assiniboine river. The area lying within Duck Mountain Forest Reserve is heavily wooded with poplar, birch, and spruce. The northeastern corner of township 31, range 31, the northern part of township 32, range 30, and the eastern half of township 32, range 31, are also thickly wooded, and few people have settled in these areas.

The moraine is usually more irregular in composition than is the glacial till, but an average section of either of these deposits generally consists of 1 to 4 feet of sandy top soil; 4 to 20 feet of weathered yellow boulder clay containing pockets of sand and gravel; a discontinuous layer of sand and gravel that varies in thickness from a few inches to several feet; and unweathered blue boulder clay that contains layers and pockets of sand and gravel at various depths. The blue boulder clay is known to extend to a depth of 102 feet, or to an elevation of 1,357 feet above sea-level, and it will probably extend to the bedrock that lies at an unknown elevation.

Water-bearing Horizons in the Unconsolidated Deposits

The glacial lake sands at the western border of the municipality yield abundant supplies of water. The wells are from 7 to 40 feet deep and the water is moderately hard and usable for all farm purposes. In the glacial lake clay-covered area east of Assiniboine river some difficulty has been experienced in obtaining sufficient water for local requirements. A few wells tap thin layers of sand in the lake clays from which small amounts of very highly mineralized water are obtained. Residents in this area usually haul water from Assiniboine river for stock, and in some instances for household purposes. Ice is packed during the winter for domestic use in the summer months.

In the glacial till and moraine-covered areas the principal and uppermost water-bearing horizon is formed by pockets of sand and gravel in the yellow boulder clay, and by discontinuous beds of sand and gravel that immediately underlie the yellow boulder clay. The wells tapping this horizon are from 6 to 20 feet deep and are located in all parts of the area. A few wells that tap pockets or beds of sand and gravel of large areal extent yield abundant supplies of water which in some wells is under slight hydrostatic pressure. The water is moderately hard and suitable for household, stock, and irrigation purposes. Most wells, however, yield a supply of water that is sufficient for only a few head of stock, and often two to five wells are used to obtain adequate water for local needs. Some farmers use water from the creeks for stock. The water from wells that yield smaller supplies is more highly mineralized than that from wells yielding abundant supplies, but with few exceptions it is usable for all farm purposes.

In some sections water has been located in wells at depths of 30 to 66 feet. The aquifers for these wells are formed by layers of sand in the blue boulder clay. Only small supplies of very highly mineralized water are obtained. The water is very hard and often termed "alkaline", but that from most wells is usable for domestic purposes. These water-bearing deposits do not form a continuous horizon, as many dry holes have been sunk.

It is possible that water-bearing deposits may occur at depth in the moraine and glacial till-covered areas, but the uncertainty of obtaining adequate supplies, and the usual poor quality of water derived from the lower part of the drift, may not warrant the expense of drilling. In the NW. $\frac{1}{4}$, sec. 23, tp. 31, range 32, holes were drilled to depths of 75 to 102 feet, or to elevations of 1,357 feet, without encountering water, and it is not thought advisable to drill below this elevation at any point in the municipality. The conservation of surface water throughout the

area is recommended. Many of the small creeks could be dammed and the impounded water used for stock. Dugouts could also be excavated to collect surface water.

Water-bearing Horizons in the Bedrock

The Marine Shale series underlies the glacial drift throughout the municipality. The shale beds have not been encountered although holes have been dug to an elevation of 1,357 feet above sea-level. In this part of Saskatchewan the shale rarely contains usable water, and drilling into it is not recommended.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 31, Range 30

This fractional township consists of sections 19 to 36, and parts of sections 13 to 18 inclusive. It lies within the Duck Mountain Forest Reserve, and is heavily wooded with poplar, birch, and a few spruce. The area is very rough and is characterized by steep knolls and undrained depressions. It is mantled by moraine. Madge lake, a large, permanent body of water, covers the south-central part of the township. Other smaller lakes occur throughout the area. A few small creeks drain into the lakes. The elevation attains 2,100 feet in some parts of the township.

Only one well is reported in this township. It is a 12-foot well at Benito beach on Madge lake, in section 23. The water is probably derived by seepage from the lake, and the well yields a permanent supply of water. The water is used for all purposes, but it is hard and slightly "alkaline". There should be little difficulty in obtaining usable water in this township.

Township 31, Range 31

This fractional township comprises an area of 24 square miles and is mantled by part of the Duck Mountain moraine. Hills and undrained depressions are numerous. The area is drained by two streams that flow in a westerly direction. It is heavily wooded with poplar and spruce, and the northeastern corner has not been settled. The elevation varies between 1,750 and 1,900 feet above sea-level.

The moraine consists of a weathered zone of yellow boulder clay and an unweathered zone of blue boulder clay. The weathered zone is from 10 to 30 feet thick and is underlain by the blue boulder clay which probably extends to the bedrock. Pockets of sand and gravel are scattered throughout the clays, and a discontinuous beds of sand and gravel usually separates the yellow and blue boulder clays.

The principal and uppermost source of ground water in this township is formed by the scattered pockets of sand and gravel in the yellow boulder clay or oxidized zone of the drift, and by a discontinuous layer of sand and gravel that lies between the yellow and blue boulder clays. Wells that tap this horizon are from 6 to 25 feet deep and yield small or intermittent supplies of water. Water for stock use is usually obtained from springs, creeks, and undrained depressions, and the wells are used mainly for domestic needs. The water is hard and often termed "alkaline", but it is usable for drinking and other domestic purposes. A few of the wells yield water that is under hydrostatic pressure.

The deepest well in the township is 41 feet and it taps a thin layer of sand in the blue clay. It yields sufficient water for local needs, but the supply is not large. The water is highly mineralized and "alkaline", but it is usable for domestic purposes. Wells sunk to similar depths in other parts of the township may encounter water-bearing deposits in the blue clay.

No deep holes have been sunk and it is not advisable to drill to great depths as the uncertainty of obtaining water, and the usual poor quality of the water located at depth in the drift, do not warrant the expense of deep drilling. Many suitable locations for the construction of dams or the excavation of dugouts exist, and these methods of conserving surface water for stock use are recommended.

Township 31, Range 32

This fractional township comprises an area of 24 square miles, but approximately 3 square miles in the southeastern corner is occupied by the Cote Indian Reserve, No. 64, and part of Keeseekoose Indian Reserve, No. 66, is located in the north-central part of the township. Approximately 13 square miles of the township has been subdivided into sections. Assiniboine river meanders in a southeasterly direction through the central part of the township. It occupies a

wide, gently sloping valley approximately 75 feet deep. The elevation on the western side of the river rises fairly rapidly, but on the eastern side the rise is gentle until the moraine-covered area is reached, where it rises abruptly, attaining 1,700 to 1,885 feet above sea-level. An area from 1 to 1½ miles in width to the east of Assiniboine river is mantled by glacial lake clays. A narrow area to the east of the lake clays is covered by boulder clay or glacial till. The flood-plain of the Assiniboine is composed of Recent sands and silts, and the area to the west of Assiniboine river is mantled by glacial till that is modified by wave action. The remainder of the township is covered by moraine.

No water is obtained from the Recent deposits that form the flood-plain of the Assiniboine, but those residing near the river use water from the river for all their needs. The deposits of lake clay yield little or no water, but they have not been fully prospected. They consist of fine-textured clay underlain by dark, compact clay. The water that is obtained is by seepage, and is very highly mineralized.

In the glacial till and moraine-covered areas, wells sunk to depths of 8 to 24 feet encounter beds of water-bearing sand in yellow or blue boulder clays. The supply of water obtained from individual wells is usually very small and each farmer may use two or more wells to obtain an adequate supply. The water is very highly mineralized and that from some wells is not usable for household purposes. A well on the SW. ¼, section 20, passed through 40 feet of sand and yields an abundant supply of water that is usable for all purposes. The deposits penetrated in this well may be glacial lake sands, but they do not cover an extensive area. In the moraine-covered area several dry holes to depths of 80 to 100 feet were dug. It is not probable that water will be located at depth throughout the township. In the lake clays and glacial till-covered areas the conservation of surface water in dugouts is

recommended. In the moraine-covered area suitable locations exist for the construction of small dams.

Township 31, Range 33

This strip of territory, less than one-quarter mile wide, lying between township 31, range 32, and the Second meridian, is mantled by glacial lake sands. No wells were reported in this area, but water should be obtained at shallow depth.

Township 32, Range 30

Sections 1 to 24 of this township lie within Duck Mountain Forest Reserve. This area is covered by moraine and is characterized by many steep knolls and undrained depressions. The area is heavily wooded with poplar, birch, and spruce. Sections 24 to 36, inclusive, are mantled by glacial till and the area is not as rough as that to the south. It is, however, also heavily wooded and sparsely settled. Due to the poor condition of the roads this part of the area was not visited, but the forest ranger reported the following: "a few of the sections are homesteaded, but no wells deeper than 20 feet have been dug. Most wells are sunk in yellow clay near depressions. The supply depends entirely on rainfall. Springs and lakes are used where possible". It is probable that with further prospecting fairly abundant supplies of water could be located.

Township 32, Range 31

The elevation in this township increases from 1,530 feet in the northwestern corner to 1,875 feet above sea-level in the southwestern part of the township. Lac La Course covers section 31 and parts of sections 30 and 32. Several small creeks in the northern and central parts of the township drain into this lake. The stream North Branch of Two Creeks flows in a southerly direction and drains a small lake in the south-central part, and other small creeks flowing in a northerly and westerly direction drain other sections of the township. With the exception of a small area in the northeastern

corner that is mantled by glacial till, the entire township is covered by part of the moraine that forms Duck mountains. The ground surface is rough and is characterized by knolls and undrained depressions, particularly in the eastern part of the area. The eastern and south-eastern sections of the township are heavily wooded with poplar and spruce, and this area is unsettled.

The moraine consists of 10 to 20 feet of yellow, oxidized boulder clay, containing scattered pockets of sand and gravel; a discontinuous bed of sand and gravel varying in thickness from a few inches to several feet; and blue boulder clay that probably extends to bedrock. All wells in the township, with the exception of two or three obtain water from the pockets of sand and gravel within the yellow boulder clay or the layer of sand and gravel lying between the yellow and blue boulder clays. None of the wells yields abundant supplies of water, but a few yield sufficient water for 15 to 25 head of stock. Many of them yield small or intermittent supplies, and a farmer may have to use several wells to obtain sufficient water for farm requirements. The water is highly mineralized, often "alkaline", and that from some wells is not usable for domestic purposes.

A few wells from 35 to 66 feet deep encounter layers of sand in the blue boulder clay from which small quantities of water are obtained. The water is very highly mineralized, but it is used for household purposes. These wells are very poor sources of water.

Although most of the wells in this township do not yield abundant supplies of water, a shortage of water is not experienced in most sections as creeks and springs are used for watering stock. In most sections surface water could be conserved by using small dams or dugouts. Deep drilling is not advised, as the water obtained at depth in the drift is highly mineralized.

Township 32, Range 32

A small area along the western border of the township, and an area paralleling Assiniboine river on the east, are mantled by glacial lake deposits. In the western part the deposits are very sandy, but east of the river they consist mainly of clay. This area is very flat and slopes gently towards Assiniboine river. The river is very meandering and its flood-plain consists of Recent sands and silts. A small area of glacial till that has been modified by water action occurs in the southwestern corner. Glacial till or boulder clay also covers an area paralleling the lake deposits on the east. The remainder of the area is covered by moraine and is characterized by steep knolls and undrained depressions. Lac La Course occupies section 36 and parts of sections 25, 26, and 35 of this township. The water in this lake is too highly mineralized and too "alkaline" for stock use. The elevation in the western part is approximately 1,470 feet, and it rises gradually in an easterly direction to approximately 1,800 feet. An area of approximately 11 square miles in the southern part of the township is occupied by Keeseekoose Indian Reserve, No. 66.

Several wells sunk into the glacial lake sands tap abundant supplies of water. The wells are from 6 to 18 feet deep and the water is usable for all farm purposes including irrigation. Little or no water, however, is obtained from the glacial lake clays. Wells sunk through the lake clays may encounter water-bearing deposits in the underlying boulder clay.

The glacial till and moraine deposits are similar in composition, consisting of an oxidized and an unoxidized zone of clays. The oxidized zone consists of yellow boulder clay in which scattered pockets of sand and gravel occur. Most of the wells in these areas are shallow, and tap these pockets of sand and gravel. The supply of water is variable and depends upon the areal extent of the pocket of sand and gravel, and upon the amount of rainfall. The water from wells

that yield fairly abundant supplies is moderately hard and usable for all purposes, whereas that from wells that yield small or intermittent supplies is highly mineralized and may not be usable for drinking or other household uses. Several holes are generally dug before water is located and it is, therefore, advised to locate the water-bearing deposits by means of a small hand auger before digging a well.

The unoxidized zone consists of blue boulder clay that contains a few scattered deposits of sand and gravel. A 62-foot well in the SE. $\frac{1}{4}$, section 24, taps a bed of fine sand in the blue boulder clay and yields an abundant supply of water. The water is hard, but usable for all general farm purposes and can be used for the irrigation of gardens. The aquifer in this well is of small areal extent, as other holes nearby failed to encounter water in the blue clay. Similar deposits, however, may be encountered in other parts of the township.

Most of the residents in this township obtain sufficient water for local needs. Creeks and springs are used extensively in some parts of the township. The water from Assiniboine river is used for watering stock. In the lake clay-covered areas surface water can be collected in dugouts. In the moraine-covered area dams can be constructed on the creeks, and the impounded water used for stock.

Township 32, Range 33

This fractional township is 6 miles long and approximately 60 rods wide. The area is very flat, mantled by glacial lake sands, and not suitable for cultivation. Only one well is reported in the area and it yields a good supply of water. It is 6 feet deep, dug in sand, and the water is hard and usable for all purposes. It is probable that water can be located at shallow depths throughout this fractional township.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF ST. PHILIPS, NO. 301, SASKATCHEWAN

Township	31	31	31	31	32	32	32	32	Total No. in Municipality
West of 1st meridian — Range	30	31	32	33	30	31	32	33	
Total No. of Wells in Township	2	37	33	0	0	56	86	1	215
No. of wells in bedrock	0	0	0	0	0	0	0	0	0
No. of wells in glacial drift	2	37	33	[illegible]	[illegible]	56	86	1	215
No. of wells in alluvium	0	0	0	0	0	0	0	0	0
Permanency of Water Supply									
No. with permanent supply	1	22	27	0	0	30	42	1	123
No. with intermittent supply	1	6	2	0	0	10	7	[illegible]	26
No. dry holes	0	9	4	0	0	16	37	0	66
Types of Wells									
No. of flowing artesian wells	0	0	[illegible]	0	0	1	1	0	2
No. of non-flowing artesian wells	0	5	3	0	0	5	6	0	19
No. of non-artesian wells	2	23	26	0	0	34	42	1	128
Quality of Water									
No. with hard water	2	28	27	0	[illegible]	40	42	1	140
No. with soft water	0	0	2	0	0	0	7	0	9
No. with salty water	0	0	0	0	0	0	0	0	0
No. with "alkaline" water	1	14	13	0	0	12	14	0	54
Depths of Wells									
No. from 0 to 50 feet deep	2	37	29	0	0	54	84	1	207
No. from 51 to 100 feet deep	0	0	3	0	0	2	2	0	7
No. from 101 to 150 feet deep	0	0	1	0	0	0	0	0	1
No. from 151 to 200 feet deep	0	0	0	0	0	0	0	0	0
No. from 201 to 500 feet deep	0	0	0	0	0	0	0	0	0
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0
How the Water is Used									
No. usable for domestic purposes	2	25	25	0	0	34	42	1	129
No. not usable for domestic purposes	0	3	4	0	0	6	7	0	20
No. usable for stock	2	27	26	0	0	36	48	1	140
No. not usable for stock	0	1	3	0	0	4	1	0	9
Sufficiency of Water Supply									
No. sufficient for domestic needs	1	22	27	0	0	30	42	1	123
No. insufficient for domestic needs	1	6	2	0	0	10	7	0	26
No. sufficient for stock needs	1	17	17	0	0	25	37	1	98
No. insufficient for stock needs	1	11	12	[illegible]	0	15	12	[illegible]	51

ANALYSES AND QUALITY OF WATER

General Statement

Samples of water from representative wells in surface deposits and bedrock were taken for analyses. Except as otherwise stated in the table of analyses the samples were analysed in the laboratory of the Borings Division of the Geological Survey by the usual standard methods. The quantities of the following constituents were determined; total dissolved mineral solids, calcium oxide, magnesium oxide, sodium oxide by difference, sulphate, chloride, and alkalinity. The alkalinity referred to here is the calcium carbonate equivalent of all acid used in neutralizing the carbonates of sodium, calcium, and magnesium. The results of the analyses are given in parts per million--that is, parts by weight of the constituents in 1,000,000 parts of water; for example, 1 ounce of material dissolved in 10 gallons of water is equal to 625 parts per million. The samples were not examined for bacteria, and thus a water that may be termed suitable for use on the basis of its mineral salt content might be condemned on account of its bacteria content. Waters that are high in bacteria content have usually been polluted by surface waters.

Total Dissolved Mineral Solids

The term "total dissolved mineral solids" as here used refers to the residue remaining when a sample of water is evaporated to dryness. It is generally considered that waters that have less than 1,000 parts per million of dissolved solids are suitable for ordinary uses, but in the Prairie Provinces this figure is often exceeded. Nearly all waters that contain more than 1,000 parts per million of total solids have a taste due to the dissolved mineral matter. Residents

accustomed to the waters may use those that have much more than 1,000 parts per million of dissolved solids without any marked inconvenience, although most persons not used to highly mineralized water would find such waters highly objectionable.

Mineral Substances Present

Calcium and Magnesium

The calcium (Ca) and magnesium (Mg) content of water is dissolved from rocks and soils, but mostly from limestone, dolomite, and gypsum. The calcium and magnesium salts impart hardness to water. The magnesium salts are laxative, especially magnesium sulphate (Epsom salts, $MgSO_4$), and they are more detrimental to health than the lime or calcium salts. The calcium salts have no laxative or other deleterious effects. The scale found on the inside of steam boilders and tea-kettles is formed from these mineral salts.

Sodium

The salts of sodium are next in importance to those of calcium and magnesium. Of these, sodium sulphate (Glauber's salt, Na_2SO_4) is usually in excess of sodium chloride (common salt, NaCl). These sodium salts are dissolved from rocks and soils. When there is a large amount of sodium sulphate present the water is laxative and unfit for domestic use. Sodium carbonate (Na_2CO_3) "black alkali", sodium sulphate "white alkali", and sodium chloride are injurious to vegetation.

Sulphates

Sulphates (SO_4) are one of the common constituents of natural water. The sulphate salts most commonly found are sodium sulphate, magnesium sulphate, and calcium sulphate ($CaSO_4$). When the water contains large quantities of the sulphate of sodium it is injurious to vegetation.

Chlorides

Chlorides are common constituents of all natural water and are dissolved in small quantities from rocks. They usually occur as sodium chloride and if the quantity of salt is much over 400 parts per million the water has a brackish taste.

Iron

Iron (Fe) is dissolved from many rocks and the surface deposits derived from them, and also from well casings, water pipes, and other fixtures. More than 0.1 part per million of iron in solution will settle as a red precipitate upon exposure to the air. A water that contains a considerable amount of iron will stain porcelain, enamelled ware, and clothing that is washed in it, and when used for drinking purposes has a tendency to cause constipation, but the iron can be almost completely removed by aeration and filtration of the water.

Hardness

Calcium and magnesium salts impart hardness to water. Hardness of water is commonly recognized by its soap-destroying powers as shown by the difficulty of obtaining lather with soap. The total hardness of a water is the hardness of the water in its original state. Total hardness is divided into "permanent hardness" and "temporary hardness". Permanent hardness is the hardness of the water remaining after the sample has been boiled and it represents the amount of mineral salts that cannot be removed by boiling. Temporary hardness is the difference between the total hardness and the permanent hardness and represents the amount of mineral salts that can be removed by boiling. Temporary hardness is due mainly to the bicarbonates of calcium and magnesium and iron, and permanent hardness to the sulphates and chlorides of calcium and magnesium. The permanent hardness

can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in excess of 300 parts per million; when the total hardness exceeded 3,000 parts per million no exact hardness determination was made. Also no determination for temporary hardness was made on waters having a total hardness less than 50 parts per million. As the determinations of the soap hardness in some cases were made after the samples had been stored for some time, the temporary hardness of some of the waters as they come from the wells probably is higher than that given in the table of analyses.

Analyses of Water Samples from the Municipality of St. Philips, No. 301, Saskatchewan

LOCATION						Depth of Well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS								Source of Water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alka-linity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	
1		34	32	32	1	13	2,020												(2)		(3)	(4)	(1)	(5)	* 1

Water samples indicated thus, * 1, are from glacial drift.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analysis No. 1 by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

One sample of water from the glacial drift in the municipality of St. Philips was analysed and the results are listed in the accompanying table. This sample is taken from a 13-foot well and is considered as being representative of most of the water obtained at shallow depth in the moraine and till-covered areas. It has a total dissolved solid content of 2,020 parts per million, but is being used for drinking and other household purposes. The water is a "sulphate" water. It may have a slight laxative effect on those not accustomed to the use of highly mineralized water.

The water from wells sunk in the glacial lake sands is not so highly mineralized, and is reported as being soft. It is usable for irrigation and all other farm purposes. Water from wells in the glacial lake clay-covered area is reported as being very highly mineralized and is generally not usable for household purposes as it acts as a strong laxative. The water is derived by seepage from the clay and contains a large amount of magnesium sulphate (Epsom salts) and sodium sulphate (Glauber's salt).

Water from the Bedrock

No water is obtained from the bedrock in this municipality. In this part of Saskatchewan any water obtained from the Marine Shale series is too highly mineralized for general farm use.

WELL RECORDS—Rural Municipality of ST. PHILIPS, NO. 301, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	NE.	23	31	30	1	Dug	122	2,012	- 7	2,005	7	2,005	Glacial gravelly clay	Hard, clear, "alkaline", iron		D	Sufficient supply; also another well 12 feet deep with intermittent supply.
1	NE.	14	31	31	1	Dug	7	1,905	- 4	1,901	6	1,899	Glacial gravel	Hard, clear, "alkaline"		D, S	Insufficient for local needs.
2	NE.	16	"	"	"	Dug	8	1,853	0	1,853			Glacial drift	Hard, clear, "alkaline"		N	Intermittent supply; use creek for all requirements.
3	SE.	17	"	"	"	Dug	14	1,796	- 5	1,791			Glacial drift	Hard, clear		D, S, I	Sufficient for local needs; use creek also for stock.
4	NE.	18	"	"	"	Dug	18	1,721	- 16	1,705			Glacial drift	Hard, clear, "alkaline", iron		D	Intermittent supply; use creek when well goes dry.
5	NW.	19	"	"	"	Dug	16	1,721	- 2	1,719	14	1,707	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient supply; use creek for stock during winter.
6	NE.	20	"	"	"	Dug	45	1,894	- 40	1,854			Glacial drift	Hard, clear, "alkaline", iron		D, I	Sufficient only for domestic needs; use a creek and a spring for stock.
7	NW.	20	"	"	"	Spring							Glacial drift	Hard, clear		S	Farmer on SE.¼, section 30, uses this spring.
8	SE.	21	"	"	"	Dug	8	1,858	- 4	1,854	5	1,853	Glacial sand	Hard, clear, "alkaline"		D, S	Intermittent supply; use a slough for stock in winter.
9	NE.	22	"	"	"	Dug	41	1,951	- 13	1,938			Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient supply only during summer season; use a creek for stock.
10	NW.	23	"	"	"	Dug	18	1,956	- 10	1,946			Glacial drift	Hard, clear, "alkaline"		D, S	Oversufficient for local needs.
11	SE.	28	"	"	"	Dug	10	1,928	- 5	1,923	9	1,919	Glacial gravel	Hard, clear		D, S	Oversufficient for local needs; also 6 dry holes to a depth of 22 feet.
12	SW.	28	"	"	"	Dug	8	1,814	- 2	1,812			Glacial drift	Hard, clear		D	Intermittent supply; also a spring 5 feet deep on farm.
13	SE.	30	"	"	"	Dug	20	1,799	- 18	1,781			Glacial sandy clay	Hard, clear, "alkaline"		D, I	Intermittent supply.
14	NE.	30	"	"	"	Spring		1,794	0	1,794	0	1,794	Glacial sand	Hard, clear, "alkaline", iron		D, S, I	Oversufficient for local needs.
15	SW.	30	"	"	"	Dug	23	1,776	- 6	1,770	21	1,755	Glacial gravel	Hard, clear		D, S	Oversufficient for local needs; also a 30-foot dry hole.
16	NW.	30	"	"	"	Dug	16	1,874	- 4	1,870			Glacial drift	Hard, clear		D, S	Sufficient supply with aid of another well and a slough.
17	SW.	31	"	"	"	Dug	25	1,877	- 15	1,862	25	1,852	Glacial gravel	Hard, clear, "alkaline"		S	Sufficient supply; a 25-foot well is used for domestic needs.
18	NW.	31	"	"	"	Dug	15	1,837									Dry hole; base in galcial clay.
19	NE.	31	"	"	"	Dug	10	1,823	- 7	1,816	9	1,814	Glacial sand	Hard, clear, "alkaline", red sediment, iron		S	Oversufficient for local needs.
20	NW.	32	"	"	"	Dug	24	1,828	- 2	1,826	19	1,809	Glacial snad	Hard, clear		D, S	Sufficient supply; also use a spring.
21	SW.	32	"	"	"	Dug	12	1,868	- 4	1,864			Glacial drift	Hard, clear, "alkaline", iron		D, S, I	Sufficient supply; also a 5-foot well is used.
22	SW.	34	"	"	"	Dug	6	1,874	- 2	1,872	2	1,872	Glacial sand	Hard, clear, "alkaline" iron		D, S	Sufficient supply.

NOTE—All depths, altitudes, heights and elevations given above are in feet.

(D) Domestic; (S) Stock; (I) Irrigation; (M) Municipality; (N) Not used.
(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ST. PHILIPS, NO. 301, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
23	NW.	34	31	31	1	Dug	7	1,458					Glacial gravel	Hard, clear		D, S	Intermittent supply.
1	NW.	16	31	32	1	Dug	23	1,455									Dry hole; base in glacial drift; use river for stock and ice for domestic needs.
2	SW.	17	"	"	"	Dug	16	1,532	- 10	1,522	10	1,522	Glacial sand	Hard, clear		D, S	Sufficient for 20 head stock; also another well 14 feet deep.
3	NE.	13	"	"	"	Dug	25	1,550	- 19	1,531			Glacial drift	Hard, clear, iron		S	Insufficient supply; also two other wells 20 and 12 feet deep.
4	SE.	19	"	"	"	Dug	25	1,560	- 15	1,545			Glacial drift	Hard, clear		D, S	Sufficient for local needs.
5	NW.	19	"	"	"	Dug	19	1,538	- 14	1,524	14	1,524	Glacial sand	Hard, clear, "alkaline", iron		D, S	Sufficient for 25 head stock.
6	NE.	19	"	"	"	Dug	8	1,521	- 4	1,517	4	1,517	Glacial sand and gravel	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
7	NE.	20	"	"	"	Dug	20	1,552	- 6	1,546	6	1,546	Glacial sand	Hard, clear		D, S	Sufficient supply.
8	NW.	21	"	"	"	Dug	24	1,462	- 18	1,444			Glacial sand	Hard, clear		D	Sufficient for domestic needs.
9	NW.	23	"	"	"	Dug	102	1,459									Dry hole; base in glacial drift; two other wells 80 and 75 feet deep with mineralized water; also a spring.
10	SE.	25	"	"	"	Dug	23	1,770	- 20	1,750	20	1,750	Glacial gravel	Hard, clear, "alkaline"		D, S	Insufficient for 35 head stock during winter; also a 100-foot dry hole.
11	SW.	25	"	"	"	Dug	12	1,652	- 5	1,647	11	1,641	Glacial gravel	Hard, clear		D, S, I	Sufficient supply; also another well 12 feet deep with poor supply.
12	NW.	25	"	"	"	Dug	10	1,725	- 4	1,721			Glacial drift	Hard, clear		D, S, I	Intermittent supply.
13	NE.	25	"	"	"	Dug	17	1,876	- 10	1,866	14	1,862	Glacial gravel	Hard, clear		D, S	Sufficient for 20 head stock with the aid of a slough.
14	NE.	29	"	"	"	Dug	14	1,438	- 8	1,430	11	1,427	Glacial gravel	Hard, clear		D	Sufficient for domestic needs; stock watered at river.
15	SE.	30	"	"	"	Dug	10	1,521	- 3	1,518	8	1,513	Glacial gravel	Hard, cloudy		D, S	Sufficient supply.
16	SW.	30	"	"	"	Dug	40	1,531					Glacial sand	Soft, clear		D, S	Abundant supply.
17	NW.	30	"	"	"	Dug	10	1,512	- 7	1,505	7	1,505	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient supply during summer season; also a 15-foot dry hole.
18	SW.	32	"	"	"	Dug	12	1,474	- 6	1,468			Glacial drift	Hard, clear, "alkaline"		D	Intermittent supply; stock watered at river.
19	SW.	35	"	"	"	Dug	12	1,605	- 4	1,601	10	1,595	Glacial sand	Hard, clear, "alkaline"		D, S, I	Sufficient for 12 head stock; also another similar well.
20	NE.	35	"	"	"	Dug	30	1,763	- 26	1,737	29	1,734	Glacial gravel	Hard, clear, "alkaline", iron		D, S	Sufficient for domestic needs and 6 horses; also a 14-foot well not used.
21	SE.	36	"	"	"	Dug	12	1,888	- 6	1,882	10	1,878	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply.
22	NW.	36	"	"	"	Dug	5	1,777	- 3	1,774	4	1,773	Glacial gravel	Hard, clear		D, S, I	Sufficient supply; stock also watered at river.
1	NW.	5	32	31	1	Spring							Glacial drift	Hard		D, S	Farmer on NE.¼, section 6, uses this spring.
2	NE.	6	"	"	"	Dug	24	1,795	- 4	1,791			Glacial drift	Hard, clear		D	Sufficient for domestic needs.

NOTE—All depths, altitudes, heights and elevations given above are in feet.

(D) Domestic; (S) Stock; (I) Irrigation; (M) Municipality; (N) Not used.
(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ST. PHILIPS, NO. 301, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
3	SE.	5	32	31	1	Bored	45	1,835	- 23	1,812	42	1,793	Glacial gravel	Hard, clear, "alkaline"		D, S, I	Sufficient supply.
4	NW.	6	"	"	"	Dug	34	1,863	- 22	1,841	33	1,830	Glacial sand	Hard, clear, "alkaline", iron		D, S	Sufficient supply; also eleven dry holes from 10 to 32 feet deep.
5	SE.	7	"	"	"	Bored	25	1,803	- 13	1,790			Glacial drift	Hard, clear, "alkaline"		D	Sufficient for domestic needs; a spring is used for stock.
6	NW.	8	"	"	"	Dug	14	1,790	- 6	1,784	12	1,778	Glacial sand and gravel	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
7	NE.	16	"	"	"	Dug	18	1,781	- 15	1,766	18	1,763	Glacial sand	Hard, clear		D, S	Sufficient supply; also two dry holes 12 feet deep.
8	SW.	16	"	"	"	Dug	10	1,829	- 7	1,822			Glacial sand	Hard, clear		D, S, I	Oversufficient supply; also two springs are used for stock.
9	NW.	16	"	"	"	Dug	6	1,772	+ 1	1,773	6	1,766	Glacial sand	Hard, clear		S	Oversufficient supply; also an 8-foot well with a good supply.
10	SE.	18	"	"	"	Bored	66	1,804	- 15	1,789	66	1,738	Glacial sand	Hard, clear, "alkaline"		N	Unfit for use; a 15-foot well supplies all requirements.
11	SW.	18	"	"	"	Dug	16	1,780	- 8	1,772	16	1,764	Glacial gravel	Hard, clear		S	Oversufficient supply; a 20-foot well supplies domestic needs; also a 32- and 62-foot wells that are not used.
12	NW.	18	"	"	"	Spring							Glacial drift	Hard		D, S	
13	NW.	19	"	"	"	Dug	7	1,647	- 3	1,644	3	1,644	Glacial sand	Hard, clear		D, S	Sufficient supply.
14	NE.	19	"	"	"	Dug	14	1,632	- 8	1,624			Glacial sandy clay	Hard, clear, "alkaline"		D, S	Insufficient supply.
15	SW.	19	"	"	"	Dug	32	1,662	0	1,662			Glacial gravelly clay	Hard, clear		D, S	Intermittent supply; another similar well 12 feet deep.
16	SE.	20	"	"	"	Dug	14	1,770	- 0	1,770	11	1,759	Glacial sandy clay	Hard, clear		D, S, I	Sufficient for 50 head stock.
17	NE.	20	"	"	"	Dug	20	1,735	- 5	1,730	5	1,730	Glacial sand	Hard, clear		D, S, I	Sufficient for 16 head stock; also a 40-foot well with poor supply of mineralized water.
18	NW.	20	"	"	"	Dug	12	1,630	- 6	1,624			Glacial drift	Hard, clear, "alkaline"		D, S	Intermittent supply; also two other wells 12 and 22 feet deep.
19	NW.	21	"	"	"	Dug	15	1,715	- 9	1,706			Glacial drift	Hard, clear		D, S	Intermittent supply.
20	NE.	28	"	"	"	Dug	24	1,618	0	1,618			Glacial drift	Hard, clear, iron		D, S	Intermittent supply; also a well beside a dugout.
21	SE.	30	"	"	"	Dug	28	1,638	- 26	1,612			Glacial drift	Hard, clear, "alkaline"		D	Intermittent supply; also a 30-foot dry hole.
22	NE.	30	"	"	"	Dug	20	1,558	- 10	1,548	18	1,540	Glacial sand	Hard, clear, "alkaline"		D, S, I	Sufficient supply; also a 12-foot well and a 40-foot dry hole.
23	SW.	30	"	"	"	Dug	23	1,598	- 12	1,586	12	1,586	Glacial sand and gravel	Hard, clear		D, S	Sufficient for 16 head stock; also eight other wells 12 to 20 feet deep with mineralized water; now filled in.
24	SW.	32	"	"	"	Dug	18	1,551	- 9	1,542	[illegible]	[illegible]	Glacial sand	Hard, clear		D, S	Intermittent supply.
25	NW.	33	"	"	"	Dug	10	1,590					Glacial drift	Hard, clear		D	Intermittent supply.
26	SW.	33	"	"	"	Dug	25	1,589									Dry hole; base in glacial clay; also a seepage well beside a dugout.

NOTE—All depths, altitudes, heights and elevations given above are in feet.

(D) Domestic; (S) Stock; (I) Irrigation; (M) Municipality; (N) Not used.
(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ST. PHILIPS, NO.301, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	NE.	1	32	32	1	Dug	29	1,792									Dry hole; base in glacial clay; other dry holes from 9 to 28 feet deep.
2	NW.	1	"	"	"	Dug	9	1,850	− 6	1,844	6	1,844	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient supply.
3	SW.	2	"	"	"	Dug	35	1,616	− 30	1,586	30	1,586	Glacial sand	Hard, clear		D	Sufficient supply; also another well 10 feet deep and several springs.
4	SE.	6	"	"	"	Dug	10	1,480	− 6	1,474	6	1,474	Glacial sand	Soft, clear		D, S	Abundant supply; also a spring on farm.
5	NE.	6	"	"	"	Dug	8	1,481					Glacial sand	Soft, clear		D, S	Abundant supply; also a spring.
6	SW.	11	"	"	"	Dug	13	1,598	− 10	1,588			Glacial drift	Hard, clear, "alkaline"		S	Sufficient supply; also a 9-foot well with good supply.
7	NW.	11	"	"	"	Spring							Glacial drift	Hard			
8	NE.	12	"	"	"	Dug	32	1,741	− 20	1,721	29	1,712	Glacial sand	Hard, clear		D, S	Sufficient supply; also a 12-foot well and a 16-foot dry hole.
9	NE.	13	"	"	"	Dug	8	1,654	+ 1	1,655	8	1,546	Glacial sand	Hard, clear		D, S	Abundant supply; also ten dry holes 10 to 27 feet deep.
10	SE.	13	"	"	"	Dug	9	1,648	− 4	1,644	8	1,640	Glacial gravel	Hard, clear		D, S	Oversufficient supply.
11	SW.	13	"	"	"	Dug	10	1,600	− 2	1,598	2	1,598	Glacial sand	Soft, clear		D, S	Abundant supply.
12	NE.	14	"	"	"	Dug	9	1,586	− 8	1,578	8	1,578	Glacial sand	Soft, clear		D, S	Sufficient for 20 head stock.
13	SE.	14	"	"	"	Dug	36	1,624	− 26	1,598			Glacial drift	Hard, clear		D, S	
14	SW.	14	"	"	"	Dug	13	1,552	− 5	1,547			Glacial drift	Hard, clear, "alkaline"		S	Intermittent supply; also a similar well 8 feet deep.
15	NE.	20	"	"	"	Dug	16	1,529	− 10	1,519	16	1,513	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply.
16	NW.	21	"	"	"	Dug	30	1,537	− 10	1,527	30	1,507	Glacial gravel	Hard, clear, "alkaline"		S	Sufficient supply; also another well 12 feet deep and a 24-foot dry hole.
17	NW.	23	"	"	"	Dug	27	1,543	− 25	1,518			Glacial drift	Hard, clear		D, S	Intermittent supply.
18	NE.	23	"	"	"	Dug	32	1,557	− 20	1,537	20	1,537	Glacial gravel	Hard, clear		D	Sufficient for domestic needs; also another well 11 feet deep.
19	SE.	23	"	"	"	Dug	20	1,624	− 5	1,619	5	1,619	Glacial sand and gravel	Soft, clear		D, S	Sufficient supply; also a 60-foot dry hole.
20	SE.	24	"	"	"	Dug	62	1,594	− 27	1,567			Glacial sand	Hard, clear		D, S	Oversufficient supply; also two other wells with intermittent supply.
21	NE.	30	"	"	"	Dug	18						Glacial drift	Hard, clear		D, S	Also several other wells.
22	NW.	31	"	"	"	Dug	6	1,471	− 4	1,467	5	1,466	Glacial sand and gravel	Soft, clear		D, S	Sufficient for 100 head stock; also another well 8 feet deep.
23	SE.	31	"	"	"	Dug	28	1,476	− 10	1,466	10	1,466	Glacial gravel	Hard, clear, iron, "alkaline"		D, S	Intermittent supply; another similar well 50 feet deep.
24	SW.	31	"	"	"	Dug	6						Glacial sand	Hard, clear		D, S	Fair supply.
25	NW.	32	"	"	"	Bored	27	1,510	− 11	1,499	21	1,489	Glacial gravel	Hard, clear, iron, "alkaline"		S	Sufficient supply; also another well 16 feet deep.

NOTE—All depths, altitudes, heights and elevations given above are in feet.

(D) Domestic; (S) Stock; (I) Irrigation; (M) Municipality; (N) Not used.
(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ST. PHILIP, NO. 301, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
26	SE.	32	32	32	1	Dug	27	1,553									Dry hole; base in glacial drift; twelve other similar dry holes.
27	SW.	33	"	"	"	Dug	16	1,553	- 11	1,542			Glacial sand and gravel	Hard, clear, iron		D, S	Sufficient supply.
28	SE.	33	"	"	"	Dug	35	1,577	- 20	1,557			Glacial drift	Hard, clear, iron		D, S	Sufficient supply; sloughs are also used for stock.
29	SW.	34	"	"	"	Dug	28	1,572	- 25	1,547	25	1,547	Glacial sand	Hard, clear, "alkaline"		D, S	Insufficient supply; also another similar well.
30		34	"	"	"	Dug	13						Glacial sand	Hard			#
31	SW.	35	"	"	"	Dug	40	1,552									Dry hole; base in glacial clay; also a well with mineralized water.
1	NE.	36	32	33	1	Dug	6	1,473	- 4	1,469	4	1,469	Glacial sand	Hard, clear		D, S	Sufficient supply; several other similar wells now caved in.

NOTE—All depths, altitudes, heights and elevations given above are in feet.

(D) Domestic; (S) Stock; (I) Irrigation; (M) Municipality; (N) Not used.
(#) Sample taken for analysis.