CANADA
DEPARTMENT OF MINES
AND
TECHNICAL SURVEYS

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WATER SUPPLY PAPER No. 168

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF CANAAN NO. 225 SASKATCHEWAN

By
B. R. MacKay and D. C. Maddox

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BUREAU OF ECONOMIC GEOLOGY

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CONTENTS

Illustrations

GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF CANAAN, NO. 225, 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 Canaan covers an area of 228 square miles in southern Saskatchewan. The centre of the municipality is about 78 miles northwest of Moose Jaw, about 52 miles northeast of Swift Current, and about 88 miles southwest of Saskatoon. The municipality comprises the whole of tps. 22 and 23, ranges 8 and 9, most of tp. 21, ranges 8 and 9, and parts of tps. 21, 22, and 23, range 7, and less than $\frac{1}{8}$ square mile of river bank in township 20, range 9, all W. 3rd mer. South Saskatchewan river forms the eastern and southern boundary of the municipality. A branch line of the Canadian National railways passes through the northwest part of the municipality. Lucky Lake village in the north is the largest centre of population. South Saskatchewan river occupies a valley that is nearly 400 feet deep in the southwest and a little over 200 feet deep in the northeast. Water-level in South Saskatchewan river falls from about 1,725 feet above sea-level at the western boundary of range 9, to about 1,680 feet above sea-level at the northern boundary of township 23. Snakebite creek in the southwest occupies a deep valley, the sides of which, near the western boundary of the municipality, are very steep. Snakebite creek and a short stream tributary to South Saskatchewan river near the northeast corner of the municipality are permanent streams. Several intermittent streams are tributary to South Saskatchewan river or to Snakebite creek. Drainage is to Saskatchewan river except for the eastern half of township 22, range 9, where the local drainage is to several depressions that have no outlets. The surface is generally rolling, but the creek valleys and the coulées dissect the country near the river banks. Much of the west-central and northwestern parts of the municipality are over 2,200 feet above sea-level and in the northwestern corner of township 22, range 8, elevations of over 2,300 feet above sea-level

occur. From this high area the land slopes southward and eastward towards South Saskatchewan river and northward towards the depression formerly occupied by Luck lake. In the northeast the land slopes gently eastwards from elevations of about 2,050 feet above sea-level to the banks of South Saskatchewan river which in the northeast are about 1,900 feet above sea-level. South Saskatchewan river and the two small, permanent streams are the only surface water supplies in this municipality, but the river and the creeks lie so far below prairie level that the water is not readily accessible and is generally used only by owners of ranches near the river, or by farmers in cases of emergency.

Water-bearing Horizons in the Unconsolidated Deposits

A considerable area in the northeast part of the municipality, including most of the western part of township 23, range 7, and a belt 1 to 2 miles in width along the eastern border of township 23, range 8, and also an area of a little less than half a square mile in the extreme northwest corner of the municipality, is underlain by glacial lake clays that are generally impervious to water but that may contain ground water in beds of sand. In the western part of the municipality there is an area in the northern half of township 22, range 9, and in the southwest part of township 23, range 9, which is underlain by moraine. With these exceptions the municipality is covered by boulder clay or till. Ground water in the boulder clay and moraine will be found only in pockets, lenses, or discontinuous layers of sand and gravel irregularly distributed through the clay which forms a large proportion of these deposits.

Water-bearing Horizons in the Bedrock

The Bearpaw formation underlies the glacial drift throughout the municipality. This formation is composed chiefly of dark grey, impervious shale, but beds of sand that contain

ground water are generally present. The Belly River formation underlies the Bearpaw formation, but is not exposed in the municipality and the elevation of the contact between the two formations is not known. Some of the deeper wells in the municipality are thought to have penetrated the Belly River formation.

The depth of the wells that obtain water from the Bearpaw formation ranges from 80 feet to 800 feet, but in the deepest well the water was obtained from an aquifer 508 feet below the surface. All the bedrock wells 250 feet deep or less are in township 23, range 9. There are several aquifers in the Bearpaw formation. In the northern third of the municipality there are four aquifers at elevations above sea-level of 1,499 feet to 1,538 feet, 1,790 feet, 1,875 feet, and 1,950 feet to 1,975 feet. In the central third of the municipality there is an aquifer at about 1,831 feet above sea-level and in the southern third there are three aquifers in the Bearpaw at elevations above sea-level of about 1,648 feet, 1,728 feet to 1,733 feet, and 1,797 feet. The water in the Bearpaw sands is generally soft and can be used for drinking, but the water contains too much "alkali" to be used for irrigation.

The water in the well on the SE.$\frac{1}{4}$, sec. 32, tp. 21, range 8, is hard and the base of the well is probably in the Belly River formation. No record of the quality of the water in the well on the SE.$\frac{1}{4}$, sec. 22, tp. 21, range 8, is available as the water was reported as not being used, the base of the well is probably in the Belly River formation.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 21, Range 8

Back from the river banks the country is gently rolling. The general slope of the surface is southeastward from an elevation a little over 2,200 feet above sea-level in the northwest corner to the banks of South Saskatchewan river, which in this township are about 2,000 feet to 2,050 feet above sea-level. In the northeast an intermittent stream with rather a deep valley passes into the township to the north. South Saskatchewan river, bordering the township on the southeast, lies about 300 feet to 350 feet below prairie level and the slopes are steep. There are no permanent streams in the township, but the general direction of surface run-off is to South Saskatchewan river.

The township is underlain by glacial till or boulder clay except for part of the slopes to South Saskatchewan river where the Bearpaw formation is exposed. The depth of the producing wells in the glacial drift ranges from 14 feet to 150 feet. No widespread aquifer can be traced. Four wells 60 to 150 feet deep in the eastern two-thirds of the township obtain water from an aquifer that is about 1,970 to 1,985 feet above sea-level; water-level in these wells stands at about 2,000 feet to 2,015 feet above sea-level. The aquifer does not appear to extend far as dry holes 150 feet deep were put down north and west of this group of wells. Two wells 60 feet deep, in sections 7 and 18, appear to obtain water from the same aquifer, but the supply of water in the wells is small. Dams in the coulées and stream valleys that extend back from South Saskatchewan river could probably be used for storage of water. The water in the producing wells in the glacial drift is not too "alkaline" for drinking and the supply is generally sufficient for local needs.

Two wells 640 feet and 710 feet deep are thought to have penetrated the Belly River formation. The deeper well

is not in use, whereas the shallower well provides a large supply of water that is hard and contains a large proportion of dissolved solids. This water is being used for stock. A sand bed was encountered in this well at a depth of 300 feet, or at 1,797 feet above sea-level, which is probably in the Bearpaw formation. The supply of water was small and it seems probable that the Bearpaw sands, at least in the southern two-thirds of the township, are not a source of large supplies of ground water; the well on section 22 apparently did not obtain water from the Bearpaw sands.

Township 21, Range 9

In the northern third of this township the land surface is gently rolling and elevations range from about 2,100 feet above sea-level in the south to about 2,200 feet above sea-level in the north. In the southern two-thirds the surface is deeply dissected by the valleys of Snakebite creek and by the valley of a creek east of it. The valley slopes of South Saskatchewan river occupy a large proportion of this part of the township. Snakebite creek is a permanent stream that occupies a narrow, steep-sided valley near the western boundary of the township, but widens out in the lower part of its course. The creek drops at the rate of about 50 feet to the mile for the lower 2 miles. The general direction of surface run-off and the general slope of land surface are southward towards Snakebite creek and South Saskatchewan river. The creek and the river are the only permanent sources of surface water in the township. South Saskatchewan river is about 400 feet below prairie level in the township. The slopes to Snakebite creek are steeper than the slopes to the river, especially in the west. The valleys of many of the intermittent streams and the coulées extending back from the valleys of South Saskatchewan river and Snakebite creek could probably be used for the storage of surface run-off water.

The Bearpaw formation is at the surface at places along the slopes to South Saskatchewan river; elsewhere boulder clay or till underlies the whole township. A well on the NE.¼, section 30, is 70 feet deep. All the other producing wells in glacial drift in the township are less than 35 feet deep and many of them are seepage wells. There are no aquifers of wide extent in the township. Dry holes 150 feet deep were put down on the NE.¼, section 24, and on the NE.¼, section 30, and several other dry holes 30 feet or less deep were put down elsewhere in the township. In the western two-thirds of the township the water in several wells is "alkaline". The supply of ground water from the glacial drift in this township is not satisfactory and water is hauled at several farms.

Three wells in this township obtain soft water from sands thought to be in the Bearpaw formation. Two of the wells are located on section 21, and the other in section 28. The wells on section 21 obtain water from an aquifer about 1,730 feet above sea-level, whereas the well on section 28 obtains water from an aquifer about 1,648 feet above sea-level. The yield of water from the well on the NW.¼, section 21, was small owing to "sanding up" of the well. The other two wells gave large supplies of water that can be used for all purposes except irrigation. The water-bearing sands in the Bearpaw formation may underlie the whole township, although the driller of the well on the NW.¼, section 21, reported that the water-bearing sand was shaly and was probably not much over 12 feet thick.

Township 22, Range 7

Two detached areas of this township are included in the municipality of Canaan. The northern area comprises nearly the whole of section 31, and parts of sections 30 and 32. The valley slopes to South Saskatchewan river occupy the entire area and no well records were obtained. The southern area comprises parts of..

sections 6, 7, and 18. This area is also within the valley of South Saskatchewan river and no records of wells were obtained. Boulder clay or till underlies most of both the areas, but outcrops of Bearpaw formation occur.

Township 22, Range 8

The eastern border of this township is occupied by the valley slopes of South Saskatchewan river. The slopes are comparatively steep and are dissected by the valley of an intermittent stream in the southeast and by several coulées north of this stream. South Saskatchewan river is about 350 feet to 400 feet below prairie-level, water-level in the river at the southern boundary of township 22 being about 1,695 feet above sea-level. In the western two-thirds of the township the country is rolling. The general slope of the surface, exclusive of the river valley, is towards the east and south from an area a little over 2,300 feet above sea-level in the northwest corner, to a little less than 1,900 feet above sea-level in the southeast. There are no lakes or permanent streams in the township. Direction of surface run-off is to South Saskatchewan river. The upper part of the valley of the intermittent stream in the southeast and the upper part of the several smaller coulées could probably be used for the storage of surface water. The township is underlain by boulder clay or till and shale beds of the Bearpaw formation outcrop at intervals along the slopes of South Saskatchewan River valley. The depth of the producing wells in the glacial drift ranges from 14 feet to 130 feet. Two wells on section 27 obtain water from an aquifer that is about 2,025 feet above sea-level. No other aquifers could be traced over any large areas. Several dry holes ranging from 80 feet to 380 feet in depth were put down in sections 15, 20, and 30. The quality of the well water in this township is generally good. In two shallow wells the water is soft, and no "alkaline" water is reported.

The Bearpaw formation underlies the glacial drift in this township. No producing wells have been put down to the Bearpaw sands, but it is probable that the dry hole in section 20, 380 feet deep, passed into the Bearpaw. The base of this well is about 1,825 feet above sea-level.

Township 22, Range 9

In the eastern half of the township the country is flat to gently rolling. Elevations in this part range from about 2,200 feet above sea-level to about 2,300 feet above sea-level. There are several low marshy areas into which much of the surface run-off flows. An irregular-shaped area of about 9 square miles in the northwest is underlain by moraine, the surface of which is characterized by low hills and undrained depressions. The remainder of the township is underlain by boulder clay or till. In both these types of glacial drift ground water is found only in discontinuous beds or lenses of sand and gravel. There are no natural permanent supplies of surface water in the township. A valley in the western part of the township and the coulées tributary to it could probably be used for the storage of surface run-off if dams were constructed. The depth of the producing wells in the glacial drift ranges from 10 feet to 145 feet. Several dry holes ranging in depth from 30 feet to 165 feet have been put down in sections 14, 15, and 22. The water in the wells in the glacial drift is hard and in four wells the water is "alkaline", but in only three wells is it too "alkaline" for drinking. In one well the water is laxative, probably due to the presence of magnesium sulphate. No widespread aquifers are known to exist, but adjacent wells on several quarter sections appear to obtain water from the same aquifer. For example, there appears to be a common aquifer for wells on the NW.$\frac{1}{4}$, section 19, and the SE.$\frac{1}{4}$, section 28, the elevation of the aquifer being about 2,205 feet to 2,220 feet above sea-level. Also two wells on

section 36 obtain water from an aquifer that is about 2,190 to 2,197 feet above sea-level.

The well, 454 feet deep, on the NE.¼, section 14, is the only one that obtains water from sands in the Bearpaw formation. The elevation of the top of the aquifer is 1,831 feet above sea-level and the water rises to 2,092 feet above sea-level. The water is described as hard and it seems probable that hard water from the glacial drift is entering the well. Sands, probably in the glacial drift, are reported to have been passed through at depths of 200 feet to 240 feet. It is probable that the Bearpaw water-bearing sands underlie the whole township.

Township 23, Range 7

The western half, and about a square mile of the eastern half, of this township are included in the municipality of Canaan. Back from the river valley the country is flat to gently rolling, but the valley of a creek near the northern boundary of the township and the valley of a creek about 2½ miles south of the northern boundary extend back several miles from South Saskatchewan river. The general slope of the land surface is eastward from a little over 1,950 feet above sea-level at the western boundary to about 1,900 feet at the edge of South Saskatchewan River valley which, within the township, is a little over 200 feet deep.

Glacial lake clays overlie the boulder clay throughout the whole township except along the lower slopes to South Saskatchewan river and the valleys of the creeks. Most of the wells in the glacial lake clay area for which records are available are probably drawing their water from the underlying drift. Depth of the wells in this township ranges from 17 feet to 42 feet. In section 7, soft water is obtained by the use of sand-points from a bed of sand at the base of the glacial lake clay. In only one well is the water "alkaline". No wells have

been put down to bedrock, but it is probable that the Bearpaw sands extend into the township. South Saskatchewan river is the main permanent source of surface water. The valleys of the intermittent streams would probably provide good sites for dams for water storage.

Township 23, Range 8

The land surface in this township is flat or gently rolling except in the south where the country is elevated and hilly. The general slope of the ground surface is northeastward. In the southwest elevations of nearly 2,300 feet above sea-level occur and in the northeast the surface is about 1,900 feet above sea-level. There are no lakes or permanent streams in the township. The general direction of surface run-off is to South Saskatchewan river and its tributary creeks, or northwards to the bed of Luck lake.

An area of glacial lake clays overlies the glacial till throughout most of the eastern fourth of the township. In these clays layers of sand and gravel form water-bearing beds but many of the wells may be drawing their supplies from the underlying till. In the northeast part of the township conditions for ground water are very unfavourable and there are many dry holes as much as 97 feet deep. The producing wells in the area of glacial lake clays are 20 feet to 50 feet deep. The water in three wells on sections 24 and 25 is "alkaline", but is used for drinking. The water in a well in section 26 is described as salty. The depth of the producing wells in the boulder clay ranges from 13 feet to 30 feet. Several wells in section 32, ranging in depth from 20 feet to 120 feet, obtained water unfit for use.

The Bearpaw sands are thought to supply water to three wells in this township. Two wells in the northwest obtain soft water from an aquifer that is 1,507 feet to 1,516 feet above

sea-level. A well on section 28 obtains soft water from an aquifer that is about 1,790 feet above sea-level.

Township 23, Range 9

The land surface in this township slopes northeastward from the southwest corner of the township where the surface is 2,300 feet above sea-level. Most of the country is flat or gently rolling. An intermittent stream crosses the northeastern part of the township and flows northwards to the depression formerly occupied by Luck lake. About 2½ square miles in the southwest is underlain by moraine and the remainder of the township is covered by boulder clay or till. In both these types of glacial drift well water supplies are found only in pockets or lenses of sand or gravel that occur in the clay.

The depth of the wells in the glacial drift ranges from 9 feet to 102 feet. Three wells 100 feet, 84 feet, and 102 feet, deep, in the central part of the township, obtain water from an aquifer that is about 2,120 feet to 2,140 feet above sea-level. The water in several wells in the western half of the township is "alkaline", but in only two wells is the water too "alkaline" for human use. A spring of "alkaline" water occurs in section 36.

Five wells in the township, ranging in depth from 80 feet to 642 feet, obtain soft water from sands in the Bearpaw formation. There seem to be three aquifers at elevations above sea-level of 1,499 feet to 1,538 feet, 1,875 feet, and 1,950 to 1,975 feet. The thickness of the drift on section 11 is about 60 feet, the thickness elsewhere is not known.

An area of about 2½ square miles in the northwestern corner of the municipality is a flowing artesian water area. The water is soft and comes from sands in the Bearpaw formation. Water-level in two wells, one of which is 80 feet deep and the other 162 feet, is 2,038 feet to 2,058 feet above sea-level. It is probable that other wells in the area outlined on Figure 1 of the accompanying map, would obtain a flow of water from the Bearpaw sands.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF CANAAN, NO. 225, SASKATCHEWAN

West of 3rd meridian — Township / Range	21 7	21 8	21 9	22 7	22 8	22 9	23 7	23 8	23 9	Total No. in Municipality
Total No. of Wells in Township	0	19	52	0	28	39	15	32	27	212
No. of wells in bedrock	0	2	3	0	1	1	0	3	5	15
No. of wells in glacial drift	0	17	49	0	27	38	15	29	22	197
No. of wells in alluvium	0	0	0	0	0	0	0	0	0	0
Permanency of Water Supply										
No. with permanent supply	0	18	37	0	22	31	14	27	25	174
No. with intermittent supply	0	0	1	0	2	0	0	2	0	5
No. dry holes	0	1	14	0	4	8	1	3	2	33
Types of Wells										
No. of flowing artesian wells	0	0	0	0	0	0	0	0	2	2
No. of non-flowing artesian wells	0	8	5	0	10	14	6	5	13	61
No. of non-artesian wells	0	10	33	0	14	17	8	24	10	116
Quality of Water										
No. with hard water	0	18	35	0	22	29	10	26	17	157
No. with soft water	0	0	3	0	2	2	4	3	8	22
No. with salty water	0	0	0	0	0	0	0	1	0	1
No. with "alkaline" water	0	3	4	0	1	5	6	11	6	36
Depths of Wells										
No. from 0 to 50 feet deep	0	10	44	0	17	29	15	22	12	149
No. from 51 to 100 feet deep	0	5	1	0	5	3	0	4	6	24
No. from 101 to 150 feet deep	0	2	4	0	5	5	0	3	3	22
No. from 151 to 200 feet deep	0	0	0	0	0	1	0	0	3	4
No. from 201 to 500 feet deep	0	0	3	0	1	1	0	1	1	7
No. from 501 to 1,000 feet deep	0	2	0	0	0	0	0	2	2	6
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is used										
No. usable for domestic purposes	0	16	26	0	23	26	13	23	23	150
No. not usable for domestic purposes	0	2	12	0	1	5	1	6	2	29
No. usable for stock	0	18	36	0	24	30	14	24	25	171
No. not usable for stock	0	0	2	0	0	1	0	5	0	8
Sufficiency of Water Supply										
No. sufficient for domestic needs	0	17	36	0	22	31	14	27	25	172
No. insufficient for domestic needs	0	1	2	0	2	0	0	2	0	7
No. sufficient for stock needs	0	15	11	0	14	19	9	12	18	98
No. insufficient for stock needs	0	3	27	0	10	12	5	17	7	81

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 Canaan, No. 225, Saskatchewan

No.	LOCATION					Depth of Well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS								Source of Water
	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	SE.	28	21	8	3	150	2,480	400	300	100	62	420	80	90	1324	682	2,449		194		268	445	1,440	102		x-1
2	SE.	32	21	8	3	640	3,749												(2)		(3)	(4)	(1)	(5)		x-3
3	NE.	21	21	9	3	422	1,549															(1)		(2)		x-2
4	SE.	32	23	7	3	42	1,129											(3)	(1)		(2)				(4)	x-1
5	SW.	16	23	9	3	84	1,706											(2)	(1)		(4)		(3)		(5)	x-1
6	SW.	25	23	9	3	642	1,817															(1)		(2)		x-2
7	SW.	31	23	9	3	80	2,180	130	50	80	27	450	20	25	1129	1000	2,246	36		52		384	1,729	45		x-2
8	SE.	32	23	9	3	162	1,860	25			54	420	20	11	931	867	1,904	36		23		378	1,378	89		x-2

Water samples indicated thus, x-1, are from glacial drift.
Water samples indicated thus, x-2, are from bedrock, Bearpaw formation.
Water samples indicated thus, x-3, are from bedrock, Belly River formation.
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 ($CaCO_3$).

Analyses Nos. 2, 3, 4, 5, and 6, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The glacial drift is an aggregate of material that has been derived from a number of different sources. It is not to be expected, therefore, that ground water in such a composite mass would be at all uniform in composition. The mineral character of ground water is dependant on many conditions, of which the following are the most important: (1) the character of the water before it entered the rocks both as regards solid matter and as regards dissolved gases such as oxygen and carbon dioxide; (2) the composition of the rocks with which the water comes in contact,- much of the rock flour in the glacial drift has not been previously leached by water or weathered and would be expected to yield more mineral matter to water than similar material that had been transported by rivers; (3) the length of time that the water has been in contact with the rock; this is dependant on the fineness of grain of the materials and on the rate of movement of water through the rocks. For this reason the water of springs usually contains less dissolved matter than the water of wells; and much of the water of wells near stream valleys or other drainage channels is comparatively pure.

Ground water from the glacial drift is usually very hard, but the water may be soft if it comes from sands and gravels in which the circulation of water is comparatively rapid. Ground water in the drift usually contains a very small proportion of sodium chloride, NaCl and a large proportion of the sulphates of sodium Na_2SO_4, calcium $CaSO_4$, and magnesium $MgSO_4$. Calcium carbonate, $CaCO_3$, is usually present and magnesium carbonate, $MgCO_3$, in many cases, although usually in smaller amounts than calcium carbonate. Large amounts of magnesium sulphate, $MgSO_4$, make water bitter. Sodium sulphate and magnesium sulphate are the salts that make water laxative. Water containing a considerable proportion of sodium carbonate is not suitable for irrigation, but ground water in the glacial drift usually

contains a very small proportion of sodium carbonate. Sodium sulphate also has a deleterious action on plant growth, but it is less injurious to vegetation than sodium carbonate.

Analyses Nos. 1, 4, and 5, are of water from the glacial drift. The total dissolved solids in parts per million range from 1,129 to 2,480. Only in places where conditions are exceptional does water from the glacial drift in the prairies contain less than 1,000 parts per million. Analysis No. 1 represents a water that contains a large proportion of sodium sulphate and will be laxative if drunk in large amounts. The sulphates of calcium and magnesium in solution render the water permanently hard; the hardness of the water will not be removed by boiling. The water contains an unusually large proportion of sodium carbonate. In the waters represented by analyses Nos. 4 and 5 sodium sulphate is either absent or subordinate in amount. Both waters are very hard as they contain sulphate of magnesium, and carbonate, sulphate, and chloride of calcium. Boiling will remove more of the hardness of water No. 5 than of water No. 4, but in both waters artificial softeners will be required to remove the permanent hardness due to the sulphates of calcium and magnesium.

Water from the Bedrock

The analyses of water from the Bearpaw formation fall into two classes. Analyses Nos. 3 and 6 are of waters that are very soft and are excellent for washing purposes. The water is fairly good for drinking, but it will have a "soda" taste unless it is drunk when quite cold. It is not laxative, but is useless for irrigation purposes as it contains so much black alkali, Na_2CO_3 and white alkali Na_2SO_4. Analyses Nos. 7 and 8 are of waters that contain a large proportion of sodium sulphate with sodium carbonate next in order of abundance and sodium chloride subordinate in amount. Water No. 8 is very soft and comes from the deeper well of

the two. Water No. 7 is slightly hard. Neither water is well adapted for irrigation purposes, although the water is less injurious to vegetation than the water represented by Nos. 3 and 6.

Analysis No. 2 represents water thought to come from the Belly River formation. It is a sulphate water that contains too large a proportion of dissolved solids to be used continuously for drinking, but it might be used for stock. The water is slightly laxative due to the sulphates of sodium and magnesium and is very hard due to the sulphates of calcium and magnesium. Sodium carbonate and sodium chloride are subordinate in amount. The water should probably not be used for irrigation except in small amounts and at long intervals.

WELL RECORDS—Rural Municipality of CANAAN NO. 225, 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	NW.	7	21	8	3	Bored	60	2,080	- 56	2,024	56	2,024	Glacial clay	Hard,clear		D, S	Sufficient for local needs.
2	NW.	9	"	"	"	Dug	14	2,050	- 8	2,042	14	2,036	Glacial sand	Hard,clear	43	D, S	Sufficient for local needs.
3	NW.	15	"	"	"	Dug	18	2,045	- 10	2,035	18	2,027	Glacial drift	Hard,clear	42	D, S	Sufficient for local needs.
4	SE.	18	"	"	"	Bored	60	2,100	- 57	2,043	57	2,043	Glacial sandy clay	Hard,clear, "alkaline"	45	D, S	Insufficient for local needs.
5	SW.	21	"	"	"	Dug	16	2,050	- 10	2,040	16	2,034	Glacial sand	Hard clear	43	D, S	Sufficient for local needs.
6	NW.	21	"	"	"	Dug	25	2,055	- 11	2,044	25	2,030	Glacial drift	Hard,clear	42	D, S	Sufficient for local needs; also 12-foot well for stock use.
7	SE.	21	"	"	"	Bored	60	2,030	- 30	2,000	60	1,970	Glacial drift	Hard,clear, "alkaline"	43	D, S	Sufficient for local needs.
8	SE.	22	"	"	"	Dug	22	2,010	- 18	1,992	19	1,991	Glacial sand	Hard,clear	42	D, S	
9	SE.	22	"	"	"	Drilled	710	2,010	- 30	1,980	550	1,460	Belly River sand			N	Well not used.
10	NW.	23	"	"	"	Bored	70	2,020	- 20	2,000	50	1,970	Glacial sand	Hard,clear	43	D, S	Sufficient for local needs.
11	NE.	26	"	"	"	Bored		2,015					Glacial drift	Hard,clear	43	D, S	Good supply.
12	NE.	27	"	"	"		150	2,010									Dry hole base in glacial drift.
13	SE.	28	"	"	"	Bored	150	2,045	- 30	2,015	150	1,895	Glacial gravel	Hard,clear, soda	43	D, S	Sufficient for local needs. #
14	NW.	28	"	"	"	Bored	100	2,070	- 60	2,010	90	1,980	Glacial sand	Clear,"alkaline"	44	D, S	Sufficient for local needs.
15	NE.	31	"	"	"	Bored	33	2,160	- 27	2,133	29	2,131	Glacial sand	Hard,clear	43	D, S	Insufficient for local needs; another similar well.
16	NW.	32	"	"	"	Bored	36	2,150	- 28	2,122	36	2,114	Glacial sand	Hard,clear, iron	43	D, S	Sufficient for local needs.
17	SE.	32	"	"	"	Drilled	640	2,097			640	1,457	Belly River sand	Hard	44	S	Oversufficient for local needs. #
1	NE.	7	21	9	3	Spring		2,100								S	Haul water for domestic purposes.
2	SE.	13	"	"	"	Bored	12	2,100	- 1	2,099	12	2,088	Glacial drift	Clear	46	D	No further information.
3	NW.	13	"	"	"	Dug	16	2,100	- 15	2,085	16	2,084	Glacial drift	Hard,clear	54	D, S	Insufficient for local needs; similar well near, also a 30-foot dry hole.
4	SE.	20	"	"	"	Dug	8	2,100	0	2,100			Glacial drift			S	Water for house hauled.
5	NE.	21	"	"	"	Drilled	422	2,148	-320	1,828	415	1,733	Boarpaw sand	Soft		D, S	Large supply. #
6	NW.	21	"	"	"	Drilled	426	2,142	-320	1,822	414	1,728	Boarpaw sand	Soft			Poor supply; farm abandoned, another well in slough.
7	NE.	22	"	"	"	Dug	16	2,100	- 9	2,091	16	2,084	Glacial drift				Another seepage well; supply insufficient.
8	NW.	22	"	"	"	Dug	10	2,100	0	2,100	10	2,090	Glacial drift	Hard,clear, "alkaline"	48	D, S	Small supply; dependent on dam similar well and 20 dry holes.
9	SE.	22	"	"	"	Dug		2,100					Glacial drift			D	Poor supply; dam for stock use.
10	NE.	23	"	"	"	Dug	12	2,100	0	2,100	12	2,088	Glacial drift			D	Sufficient for domestic need only. A similar well and several 30-foot dry holes.

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 CANAAN NO. 225, 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
11	NE.	24	21	9	3	Dug	16	2,150	- 6	2,144	16	2,134	Glacial drift	Hard,clear	44	D	Sufficient for domestic needs only; also a similar well and 3,150-foot dry holes.
12	SW.	25	"	"	"	Dug	18	2,150	- 7	2,143	16	2,134	Glacial sand	Hard,clear	42	D, S	Sufficient for domestic needs only; 18-foot well for stock use.
13	NW.	28	"	"	"	Drilled	500	2,148	-450	1,698	500	1,648	Bearpaw sand	Soft			Large supply.
14	NE.	28	"	"	"	Dug	20	2,150	0	2,150	10	2,140	Glacial sand	Hard,clear, "alkaline"		S	Insufficient for local needs; similar well not used.
15	NE.	30	"	"	"		70	2,175					Glacial drift				Small supply of water; also a 150-foot dry hole.
16	SW.	30	"	"	"	Dug	10	2,075	- 3	2,072	10	2,065	Glacial gravel and sand	Hard,clear, "alkaline"	60	S	Sufficient for local stock needs; also a 6-foot well for stock.
17	NE.	31	"	"	"	Bored	34	2,175	- 15	2,160	34	2,141	Glacial drift		42	S	Sufficient for local needs; also a 14-foot well for house use.
18	SW.	32	"	"	"	Dug	25	2,155	- 20	2,135	25	2,130	Glacial drift	Hard,clear, "alkaline"	40	D, S	Intermittent supply.
19	NE.	32	"	"	"	Bored	32	2,190	0	2,190	32	2,158	Glacial drift	Hard,clear		D	Sufficient for domestic needs only.
20	NW.	34	"	"	"	Dug	20	2,160	- 14	2,146	12	2,148	Glacial clay	Hard,clear		D	Sufficient for domestic needs only. 5 other wells not used.
21	NW.	35	"	"	"	Dug	18	2,155	0	2,155	18	2,137	Glacial drift	Hard		S	Insufficient for local needs other similar wells add to supply. Drinking water hauled.
22	SW.	35	"	"	"	Dug	26	2,150	- 2	2,148	26	2,124	Glacial clay	Hard,clear	43	D, S	Sufficient for local needs. A similar well 1½ mile north.
23	SE.	36	"	"	"	Bored	12	2,175					Glacial drift	Hard,clear		D	Sufficient for domestic needs only. 2 wells by slough used for stock.
1	NW.	2	22	8	3	Bored	120	2,000	- 20	1,980	118	1,882	Glacial gravel	Hard,clear, iron	43	D, S	Sufficient for local needs.
2	SW.	2	"	"	"	Bored	30	1,950	- 14	1,936	30	1,920	Glacial sand	Hard,clear	43	D, S	Sufficient for local needs.
3	SW.	4	"	"	"	Dug	20	2,118	- 10	2,108	20	2,198	Glacial sand	Hard,clear	42	D, S	Sufficient for local needs.
4	NE.	6	"	"	"	Bored	120	2,205	-100	2,105	115	2,090	Glacial sand	Hard,iron, bitter	42	S	Sufficient for 17 head stock; also a 25-foot well for domestic use.
5	SE.	9	"	"	"	Dug	15	2,090	- 10	2,080	15	2,075	Glacial clay	Hard,cloudy	42	D, S	Sufficient for local needs; also an 80-foot well for cooling purposes.
6	SE.	15	"	"	"	Bored	130	2,100									Another dry hole SW. 14; dry hole base in glacial sand.
7	SW.	15	"	"	"	Dug		2,130					Glacial drift	Hard,cloudy	43	D, S	
8	SW.	16	"	"	"	Dug	20	2,160	- 10	2,150	20	2,140	Glacial clay	Soft,clear	42	D, S	Sufficient for local needs.
9	SE.	18	"	"	"	Dug	21	2,200	- 13	2,187	21	2,179	Glacial clay	Hard,clear		D	Sufficient for domestic needs only; also a 2nd slough well for stock.
10	NE.	19	"	"	"	Bored	51	2,200	- 15	2,185	51	2,149	Glacial clay	Hard,clear, iron	41	D, S	Sufficient for local needs.
11	SW.	20	"	"	"	Dug	24	2,205	- 14	2,191	24	2,181	Glacial clay	Soft,clear	42	D, S	Sufficient for domestic needs only. Two dry holes 41 feet and 380 feet deep.
12	NE.	20	"	"	"	Bored	87	2,200	- 65	2,135	82	2,118	Glacial sand	Hard,clear	44	D, S	Sufficient for local needs.
13	NE.	21	"	"	"	Dug	14	2,210	- 9	2,201	10	2,200	Glacial sand	Hard,clear	44	D, S	Intermittent supply; sloughs for stock.
14	SE.	22	"	"	"	Bored	88	2,150	- 50	2,100	80	2,070	Glacial gravel	Hard,iron, clear	43	D, S	Sufficient for local 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 CANAAN NO. 225, 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
15	NE.	22	22	8	3	Dug	23	2,100	- 18	2,082	23	2,077	Glacial sand	Hard, clear	42	D, S	Sufficient for local needs; a similar well nearby.
16	SE.	27	"	"	"	Bored	130	2,155	-127	2,028	130	2,025	Glacial clay	Hard, clear	42	D	Intermittent supply; hauls water.
17	NE.	27	"	"	"	Bored	120	2,140	-117	2,023	120	2,020	Glacial clay	Hard, clear	44	D	Intermittent supply; also a 20-foot well, poor supply.
18	SW.	28	"	"	"	Dug	15	2,210	- 11	2,199	15	2,195	Glacial sand	Hard, clear	42	D, S	Sufficient for 9 head stock.
19	SW.	30	"	"	"	Dug	40	2,250	- 24	2,226	40	2,210	Glacial sand	Hard, clear	42	D, S	Sufficient for local needs.
20	SE.	30	"	"	"	Dug	80	2,235									Dry hole; glacial to base.
21	NE.	35	"	"	"	Dug	22	2,000	- 12	1,988	22	1,978	Glacial sand	Hard, clear	42	D, S	Sufficient for local needs.
1	NW.	1	22	9	3	Dug	14	2,210	- 10	2,200	12	2,198	Glacial sand	Hard, clear	42	D, S	Sufficient for local needs.
2	NE.	2	"	"	"	Bored	40	2,215	- 18	2,197	40	2,175	Glacial drift	Hard, clear, "alkaline"	42	S	Sufficient for local needs.
3	NE.	4	"	"	"	Dug	12	2,210	- 9	2,201	10	2,200	Glacial sand	Soft, clear	44	D, S	Sufficient for local needs.
4	SW.	2	"	"	"		15	2,200									Dry hole in glacial drift.
5	SW.	4	"	"	"	Bored	150	2,270	- 90	2,180	150	2,120	Glacial sand and gravel	Hard, clear, "alkaline"		N	Poor supply; also a shallow well for drinking
6	NW.	6	"	"	"	Bored	145	2,220	- 38	2,182	145	2,075	Glacial sand	Hard, clear		N	Good supply; also a shallow well with 6 feet of water.
7	NE.	10	"	"	"	Dug	16	2,210	- 8	2,202	10	2,200	Glacial sandy clay	Hard, clear	42	D, S	Sufficient for local needs. Seepage well by dam on NW. 11.
8	NE.	12	"	"	"	Bored	60	2,235	- 40	2,195	60	2,175	Glacial sand	Hard, clear, iron	43	S	Sufficient for local needs; also a 25-foot well for domestic use.
9	SE.	13	"	"	"	Bored	22	2,210	- 7	2,203	22	2,188	Glacial sand	Hard, clear	43	D, S	Sufficient for local needs; also two similar wells.
10	NE.	14	"	"	"	Drilled	454	2,256	-164	2,092	442	1,814	Bearpaw sand	Hard, clear	44	D, S	Sufficient for local needs.
11	SW.	14	"	"	"	Bored	150	2,240									Dry hole in glacial drift; also a seepage well nearby.
12	NE.	15	"	"	"	Bored	30	2,255	0	2,255	30	2,225	Glacial clay	Hard, clear		D, S	Intermittent supply; also 14-foot well for house and 165-foot dry hole.
13	SE.	17	"	"	"	Dug	35	2,150	- 3	2,147	35	2,115	Glacial drift	Hard, clear		D, S	Sufficient for local needs.
14	NW.	19	"	"	"	Dug	50	2,270	- 40	2,230	50	2,220	Glacial clay	Hard, "alkaline", laxative		N	Poor supply. use dugout and haul water.
15	NE.	20	"	"	"	Dug	10	2,200	- 4	2,196	10	2,190	Glacial sand	Hard, clear		D, S	Sufficient for local needs.
16	NW.	21	"	"	"	Bored	25	2,160	- 23	2,137	25	2,135	Glacial sand	Hard, clear	42	D, S	Sufficient for local needs.
17	NW.	22	"	"	"	Bored	24	2,250	- 8	2,242	24	2,226	Glacial sandy clay	Hard, slightly, "alkaline"	42	S	Sufficient for local needs. Dry holes 30 to 50 and 140 feet deep.
18	SW.	28	"	"	"	Dug	18	2,200									Good supply of water.
19	SE.	28	"	"	"	Bored	45	2,250	- 36	2,214	45	2,205	Glacial sand	Hard, clear, iron	42	D, S	Sufficient for local 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 CANAAN NO. 225, 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
20	SE.	31	22	9	3	Spring		2,185	0	2,185	0	2,185	Glacial sand	Hard, clear	42	D, S	Sufficient for local needs.
21	NE.	31	"	"	"	Bored	30	2,195			30	2,165	Glacial sand	Hard, clear	42	D, S	Sufficient for local needs.
22	NW.	32	"	"	"	Dug	13	2,250	- 10	2,240	13	2,237	Glacial sand	Hard, clear, "alkaline"	43	D, S	Sufficient for local needs; also a similar well for house use.
23	NW.	36	"	"	"	Bored	105	2,295	- 99	2,196	105	2,190	Glacial gravel	Hard, clear, sod	42	D, S	Sufficient for local needs; also a 35-foot well; fair supply.
24	NE.	36	"	"	"	Bored	75	2,272	- 67	2,205	75	2,197	Glacial sand	Hard, clear, iron	42	D, S	
1	NW.	5	23	7	3	Dug	17	1,920	- 14	1,906	17	1,903	Glacial gravel	Hard, clear	43	D, S	Insufficient for local needs.
2	NW.	7	"	"	"	Sand-point	18	1,920			18	1,902	Glacial sand	Soft, clear	43	D, S	Sufficient for local needs.
3	SW.	7	"	"	"	Sand-point		1,900						Soft		D	Sufficient for domestic needs; dam used for stock.
4	NE.	20	"	"	"	Dug	25	1,940	- 23	1,917	25	1,915	Glacial sand	Hard, clear	43	D, S	Sufficient for local needs.
5	SW.	28	"	"	"	Dug	24	1,930	- 21	1,909	24	1,906	Glacial sand	Soft, clear	43	D	Sufficient for domestic needs; also a 24-foot well for stock use.
6	SE.	30	"	"	"	Dug	20	1,950			20	1,930	Glacial sand	Hard, clear		D, S	Sufficient for local needs.
7	SW.	30	"	"	"	Dug	22	1,945	- 17	1,928	19	1,926	Glacial sand	Hard, slightly, "alkaline"	43	D, S	Insufficient for local needs; 20-foot similar well; one well filled in; 40-foot dry hole.
8	NW.	30	"	"	"	Dug	20	1,950	- 15	1,935	18	1,932	Glacial sand	Hard, slightly, "alkaline"		D, S	Sufficient for local needs; also a similar well.
9	SW.	32	"	"	"	Bored	40	1,910	- 22	1,888	40	1,870	Glacial drift	Hard, clear	43	D, S	Sufficient for local needs; also a 40-foot well, 18 feet of "alkaline" water.
10	SE.	32	"	"	"	Bored	42	1,915			42	1,873	Glacial sand	Hard, clear	43	D, S	Sufficient for local needs. #
1	NE.	2	23	8	3	Bored	113	1,980	- 53	1,927	103	1,877	Glacial sand	Hard, sulphur, soda, clear		D, S	Sufficient for 8 head stock only.
2	SE.	3	"	"	"	Dug	16	2,100	- 11	2,089	16	2,084	Glacial sand	Hard, clear	43	D	Sufficient for domestic needs only; also a 26-foot well and a spring.
3	NE.	5	"	"	"	Dug	30	2,170	- 23	2,147	30	2,140	Glacial sand	Hard, clear	43	D, S	Sufficient for local needs.
4	NW.	8	"	"	"	Dug		2,080					Glacial sand	Hard, clear	42	D, S	Sufficient for local needs.
5	SE.	10	"	"	"	Bored	16	2,040	- 4	2,036	16	2,024	Glacial sand	Hard, clear	43	D, S	Intermittent supply; also an 8-foot well, 3 feet of water.
6	SW.	12	"	"	"	Dug	20	1,980	- 16	1,964	16	1,964	Glacial sand	Hard, clear	43	D, S	Sufficient for local needs.
7	NW.	12	"	"	"	Dug	20	1,975	- 18	1,957	20	1,955	Glacial sand	Hard, clear	42	D, S	Insufficient for local needs; also a similar well.
8	SE.	14	"	"	"	Dug	19	1,975	- 15	1,960	19	1,956	Glacial sand	Hard, clear, iron	44	D, S	Sufficient for local needs.
9	SW.	15	"	"	"	Dug	17	2,030	- 10	2,020	17	2,013	Glacial sand	Hard, clear	42	D, S	Sufficient for local needs.
10	NW.	16	"	"	"	Dug	13	2,050	- 6	2,044	13	2,037	Glacial sand	Hard, clear	46	D, S	Sufficient for local needs.
11	NW.	24	"	"	"	Bored	40	1,975	- 27	1,948	40	1,935	Glacial sand	Hard, clear, "alkaline"	42	D, S	Sufficient for local needs.

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

WELL RECORDS—Rural Municipality of CANAAN NO.225, 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
12	NE.	24	23	8	3	Dug	27	1,960	- 22	1,938	27	1,933	Glacial sand	Hard,clear,	43	D	Sufficient for domestic needs only; also a 23-foot well, good supply.
13	SW.	25	"	"	"	Dug	20	1,955	- 12	1,943	20	1,935	Glacial clay	Hard,clear, "alkaline"			Insufficient for local needs; also a 17-foot well, small supply and a 40-foot dry hole.
14	NE.	25	"	"	"	Dug	80	1,950									Dry hole; base in glacial drift.
15	NE.	26	"	"	"	Dug	50	1,975			50	1,925	Glacial drift	Salty		N	Dugout used for stock.
16	SW.	27	"	"	"	Bored	19	2,055	- 16	2,039	19	2,036	Glacial clay	Hard,clear, "alkaline"	42	S	Intermittent supply.
17	SE.	28	"	"	"	Drilled	450	2,065	- 80	1,985	275	1,790	Bearpaw sand	Soft,clear		D, S	Sufficient for local needs.
18	NW.	32	"	"	"	Drilled	800	2,015	-125	1,890	508	1,507	Bearpaw sand	Soft,clear	45	D, S	Yields 40 barrels per day. Several 60 to 120 foot wells,poor quality water.
19	SE.	32	"	"	"	Drilled	543	2,059	-350	1,709	543	1,516	Bearpaw sand	Soft,clear	45	D, S	Sufficient for local needs.
20	SW.	35	"	"	"	Dug	17	2,005	- 4	2,001	17	1,988	Glacial clay	Hard,clear, "alkaline"	48	D, S	Insufficient for local needs.
21	SW.	36	"	"	"	Bored	97	1,950									Dry hole, base in glacial drift.
1	SW.	2	23	9	3	Bored	96	2,220	- 11	2,209	96	2,124	Glacial sand	Hard,clear, soda	42	D, S	Sufficient for local needs; also a 17-foot well near dam.
2	NW.	2	"	"	"	Bored	35	2,198	- 20	2,178	35	2,163	Glacial gravel	Hard,clear	42	D, S	Sufficient for local needs; also a 35-foot well used by village of Lucky Lake.
3	SE.	10	"	"	"		640	2,178	- 12	2,166	640	1,538	Bearpaw sand	Soft,clear, soda	45	D, S	Sufficient for local needs.
4	NW.	11	"	"	"		110	2,200									Dry hole, base in Bearpaw shale.
5	NE.	14	"	"	"	Dug	12	2,150	- 8	2,142	12	2,138	Glacial clay	Hard,clear	48	D, S	Sufficient for local needs.
6	NW.	14	"	"	"	Drilled	250	2,200			250	1,950	Bearpaw sand	Soft,clear	44	D, S	Sufficient for local needs.
7	NE.	15	"	"	"	Bored	100	2,220	- 50	2,170	100	2,120	Glacial sandy clay	Hard,clear	42	D, S	Sufficient for 12 head stock.
8	SE.	16	"	"	"	Dug	20	2,235	- 16	2,219	20	2,215	Glacial sand	Hard,clear, iron	43	D, S	Sufficient for local needs.
9	SW.	16	"	"	"	Bored	84	2,225	- 82	2,143	84	2,141	Glacial sand and gravel	Hard,clear, iron,"alkaline"	41	D, S	Sufficient for 17 head stock. #
10	NW.	16	"	"	"	Dug	16	2,190	- 12	2,178	16	2,174	Glacial sand	Hard,"alkaline",sulphur			Yields 2 barrels an hour.
11	NE.	18	"	"	"	Bored	102	2,225	- 92	2,133	102	2,123	Glacial sand	Hard,clear	42	D, S	Sufficient for local needs.
12	SW.	19	"	"	"	Bored	40	2,230	- 10	2,220	30	2,200	Glacial sand	Hard,clear	43	D, S	Insufficient for local needs.
13	NW.	19	"	"	"	Bored	34	2,160	- 10	2,150	16	2,144	Glacial sand	Hard,clear, "alkaline"	42	D, S	Sufficient for 20 head stock; also a 5-foot well, soft water.
14	NE.	19	"	"	"	Bored	17	2,165	- 9	2,156	17	2,148	Glacial sand	Hard,clear, iron,"alkaline"	43	D, S	Sufficient for 100 head stock; also a sprin
15	SW.	25	"	"	"	Drilled	642	2,101	-150	1,951	602	1,499	Bearpaw sand	Soft,clear	44	D, S	Used by village of Lucky Lake. #
16	SE.	26	"	"	"	Bored	80	2,085									Dry hole, base in glacial drift.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of CANAAN NO.225, 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
17	NW.	27	23	9	3	Bored	40	2,055	- 24	2,031	40	2,015	Glacial clay	Hard,clear, "alkaline"	43	S	Insufficient for local needs; also an 8-foot seepage well.
18	SE.	28	"	"	"	Bored	73	2,075	- 51	2,024	73	2,002	Glacial sand	Hard,clear, "alkaline"	42	S	Sufficient for local needs,
19	SE.	30	"	"	"	Bored	28	2,160	- 14	2,146	28	2,132	Glacial sand	Soft,clear	42	D, S	Sufficient for local needs.
20	NW.	30	"	"	"	Dug	9	2,100	- 7	2,093	9	2,091	Glacial sand	Hard,slightly,"alkaline"	42	D, S	Intermittent supply.
21	SW.	31	"	"	"	Bored	80	2,055	+ 3	2,058	80	1,975	Bearpaw sand	Soft,clear	44	D, S	Sufficient for local needs.
22	SE.	32	"	"	"	Drilled	162	2,035	+ 3	2,038	162	1,873	Bearpaw sand	Soft,clear	44	D, S	Sufficient for local needs. #
23	NW.	36	"	"	"	Spring		2,050					Glacial drift	Hard,"alkaline"			Small flow.

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(#) Sample taken for analysis.