CANADA
DEPARTMENT OF MINES

HON. T. A. CRERAR, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF MANTARIO No. 262 SASKATCHEWAN

BY

B. R. MacKay, H. N. Hainstock & G. Graham

Water Supply Paper No. 191

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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 purpose 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 Na ural 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 fine the approximate depth to a water-bearing horizon, be 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 ago.

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 rest 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 côteau. 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 Mantario, No. 262, in an area of approximately 440 square miles in western Saskatchewan. It consists of eight full townships, five fractional townships, and two partial townships. They are described as tps. 23, 24, 25, 26, and 27, ranges 27, 28, and 29, W. 3rd mer. The western boundary of the municipality is formed by the Fourth meridian and the southern boundary by Red Deer and South Saskatchewan rivers. The centre of the area lies approximately 8 miles east of the Saskatchewan-Alberta boundary and 148 miles north of the International Boundary.

A branch line of the Canadian National railways from Alsask enters the municipality in sec. 31, tp. 27, range 28, and traverses the northern part of the area, leaving in sec. 36, tp. 26, range 27. On it is located the village of Mantario, the main trading centre within the municipality. The Acadia Valley branch enters the municipality in sec. 9, tp. 26, range 29, and joins the above line at Eyre.

For the most part the surface of the municipality is rolling and hilly. In the vicinity of the rivers the ground surface is rugged, being dissected by numerous, small, tributary ravines. The river valleys are quite deep and the banks rise fairly steeply to plain level. Cabri lake, at an elevation of approximately 1,950 feet above sea-level, is located in townships 24 and 25, range 27. The ground surface in the vicinity of the lake is also dissected by a number of small streams. A wide valley extends north from the lake, and to the southwest and northeast of the lake the elevation rises rapidly. A number of small lakes occur in the northern part of the municipality, particularly in township 27, range 28. Sodium sulphate is being mined in the lake basin in sec. 28, tp. 27, range 28.

The minimum elevation of less than 1,900 feet above sea-level occurs along the rivers. Cabri lake at 1,950 feet, and the lake in sec. 28, tp. 27, range 28, at 2,100 feet, above sea-level, are the lowest depressions within the municipality. The maximum elevation occurs in parts of townships 24 and 25, ranges 28 and 29, where summits rise above 2,500 feet above sea-level.

Recent stream deposits occur along the valleys of South Saskatchewan and Red Deer rivers. A large area in the west-central part of the municipality, together with a long, narrow strip in the northeastern part, and small areas in the northern part of the municipality, are covered by moraine. The remainder of the area is mantled by boulder clay or glacial till. In the eastern parts of townships 23 and 24, range 27, and in small areas in townships 23, ranges 28 and 29, township 26, range 28, and townships 27, ranges 27 and 28, the boulder clay is overlain by glacial lake clay. Glacial lake sands occur in small areas surrounding some of the lakes in the northern part of the municipality, and dune sands occur in the same vicinity. A few small patches of glacial outwash sands and gravels occur throughout the municipality. The Belly River formation underlies the drift throughout the municipality.

Water-bearing Horizons in the Unconsolidated Deposits

Due to lack of data and the apparent local distribution of water-bearing deposits, it has been impossible to outline any continuous water-bearing horizons in the unconsolidated deposits. Neither the Recent dune sands nor the Recent stream deposits have been very fully investigated for water. Water should be obtained from the Recent stream deposits at shallow depth, and small quantities may also be encountered in some localities in the area covered by dune sands. The water from these Recent deposits should be entirely satisfactory for all farm needs.

The deposits of glacial lake sands, and glacial outwash sand and gravel, should also contain water at shallow depth. Some of the water from the lake sands in township 27, range 28, may be too highly charged with sodium sulphate to be used for drinking or for stock. That from the glacial outwash deposits should be suitable for all farm needs. The yield from wells tapping these porous deposits is usually sufficient for local needs.

The glacial lake clays have been found to contain few or no water-bearing deposits, but wells in these areas obtain water from deposits of sand and gravel in the boulder clay that underlies the lake clays.

In the areas covered by moraine and glacial till or boulder clay the water conditions are somewhat similar. In general, these deposits consist of a few feet of top soil 20 to 30 feet of weathered or yellow clay that contains scattered deposits of water-bearing sand and gravel at or near its base; and an unweathered zone of blue boulder clay that also contains a few discontinuous deposits of water-bearing sand and gravel. Wells sunk beside sloughs, undrained depressions, dugouts, and dams generally yield sufficient water for domestic needs and a few head of stock. Usually two or more wells of this type are used. They obtain their supply by direct seepage from the impounded waters and are quickly affected by drought conditions. By deepening the well as the water-table lowers a sufficient supply for domestic needs should be obtained throughout the greater part of the year. The water should be found entirely suitable for domestic purposes providing it does not become polluted by surface refuse. If used for drinking, it should be frequently tested for bacteria content.

The deposits of sand and gravel in the weathered zone of the glacial drift act as aquifers for a number of shallow

wells scattered throughout the municipality. The depth of these wells rarely exceeds 30 feet. A few of those wells are springs that have been cleaned out and cribbed, and the supply from them is abundant. In a few small areas the deposits appear to be fairly numerous, but in no place do they appear to form a continuous horizon, and dry holes may be sunk before a water-bearing deposit is tapped. In order to save time and expense the deposits should be located by means of a test auger before a well site is selected. The yield from most of the wells in this group is adequate for local needs and that from many of them is more than sufficient. A few, however, yield only enough water for domestic needs. The water from most of the wells is satisfactory for domestic purposes.

The wells tapping the sand and gravel deposits in the unweathered drift are sunk to depths ranging from 35 to 192 feet, most of them, however, being from 60 to 100 feet deep. No correlation in the occurrence of the aquifers is evident as the wells are widely separated. With further drilling on the intervening areas a correlation of aquifers may be possible. Wells sunk in the immediate vicinity, and to the same depth as producing wells, should obtain water, but it is impossible to outline the areal extent of any of the aquifers. Dry holes have been sunk to a depth of 150 feet. From the information at hand it does not appear advisable to sink deep wells. The supplies from the deeper drift wells vary considerably, and those from a large number are inadequate for local needs. The water in many of the wells is also highly mineralized, and some of it cannot be used for domestic purposes.

The residents in a number of areas in this township, where the topography is favourable, would be well advised to construct small dams for the impounding of surface water. In other areas the excavation of dugouts may be found more economical.

Sufficient surface water should be stored in this manner to last throughout the greater part of the year. Wells sunk near the impounded waters should yield sufficient water for local needs.

A considerable number of springs occur throughout this municipality and yield water that is usually satisfactory for farm needs. The yield is usually more than sufficient, and it can be considerably increased by the use of collecting galleries. The Canadian National Railways use this method in sec. 31, tp. 27, range 28, and the estimated yield from their collecting gallery is 300 gallons a minute. The overflow can be impounded in artificial reservoirs.

Water-bearing Horizons in the Bedrock

The Belly River formation is thought to underlie the glacial drift throughout the municipality. No outcrops of bedrock were observed in this municipality, but outcrops of the Belly River formation were observed a short distance to the west, and also in the municipality of Deer Forks, immediately to the south. The elevations at which they occur is not noted, but it is thought to be between 1,900 and 2,000 feet above sea-level. In the rural municipality of Milton, No. 292, bedrock in some areas was thought to occur at an elevation of approximately 2,200 feet above sea-level. A coal seam was encountered in a well in sec. 28, tp. 26, range 29, at an elevation of 2,100 feet above sea-level, and in sec. 36, tp. 26, range 27, coal was reported at an elevation of 2,160 feet above sea-level. From the evidence at hand it would appear that at the southern boundary of the area the Belly River formation occurs at an elevation of from 1,900 to 1,950 feet above sea-level, and at the northern boundary at an elevation between 2,125 and 2,175 feet above sea-level. The general dip of the Belly River formation appears to be towards the southeast.

The highest elevation at which water is reported to be obtained from the bedrock in this municipality is 2,070 feet above sea-level. It is derived from a 385-foot well in sec. 28, tp. 26, range 29. The areal extent of the aquifer that this well taps is unknown. The aquifer should be tapped by other wells in the immediate vicinity of the producing wells. The supply from the well is abundant, but the water is highly mineralized.

In the eastern part of the municipality considerable data are available on wells in the bedrock, and one area is outlined in which a number of wells in the bedrock appear to be drawing water from the same general water-bearing horizon. Other wells that are dug in the bedrock may be tapping the same horizon, but lack of data in the intervening areas makes it impossible to correlate the aquifers. The "A" boundary line on the accompanying map outlines the area referred to, and wells obtain water at depths of 274 to 370 feet, or at elevations of 1,932 to 1,983 feet above sea-level. It is possible that the two wells in section 36, range 27, and also the wells located in secs. 22 and 28, tp. 25, range 27, should be included in the outlined areas. The three wells located in township 27, range 27, also tap a similar aquifer, but two wells located in secs. 33 and 36, tp. 26, range 27, appear to prove the discontinuity of the water-bearing horizon in this area. A few of the wells yield fairly soft water.

The water from all these wells is quite highly mineralized, and that from some wells tastes of soda. The supply is abundant and the water is under considerable hydrostatic pressure. In a few of the wells, however, the water is too highly mineralized for domestic use, the water from the well at Mantario being condemned for drinking. The well in sec. 33,

tp. 26, range 27, may have passed through the general aquifer encountered by the other wells. It was necessary to drill this well to a depth of 328 feet, or to an elevation of 1,837 feet above sea-level, before a producing aquifer was tapped. The water is under pressure and rises 100 feet above the aquifer. It is used for domestic purpo. s, although it has a slight laxative effect. A well in section 36 of the same township obtained water at an elevation of 2,021 feet above sea-level. The supply is more than sufficient for local needs, and the water is suitable for all farm use. Little trouble should be experienced in obtaining water from the bedrock in this municipality.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 23, Range 27

Only that part of this township that lies to the north of South Saskatchewan river is considered in this report. The river, which forms the southern boundary of the municipality, meanders in a general northeasterly direction, entering the township in section 7 and leaving in sections 24 and 25. Its northern slope is cut by many tributary ravines that contain water only in the spring, or after heavy rainfalls. The elevation rises rapidly from the river at 1,900 feet above sea-level, and in the northwestern corner is 2,300 feet above sea-level. All the area is mantled by glacial till or boulder clay, but in the northeastern corner the till has been overlain by glacial lake clays, and in the southwestern corner and along the river valley it has been covered by thin deposits of Recent stream alluvium.

The Recent deposits and the glacial lake clays have not been investigated for water. The Recent stream deposits should prove productive, but it is improbable that the lake clays will contain water, although water-bearing deposits will no doubt be found in the boulder clay that underlies the lake clays.

It appears advisable to prospect the upper part of the glacial till with a small test auger in order to locate water-bearing deposits before sinking a well. The best locations for shallow wells are in depressions and along the valley floors. One well located in section 19 obtains water from a quicksand aquifer 35 feet below the surface. Two holes in sections 19 and 32, 103 and 153 feet deep, respectively, were drilled in the lower part of the drift, but they did not encounter water. As the water-bearing deposits in the lower part of the drift are in the form of pockets, dry holes may be sunk before producing wells are obtained. If it is possible to obtain sufficient water for

local needs from shallow wells, the lower part of the drift need not be investigated. The bedrock may contain water, but its possibilities are unknown.

Springs are not uncommon throughout the area. One, located in the NE.$\frac{1}{4}$, section 20, supplies two farms with water, and one in section 34 also yields a large supply. The latter spring is used to irrigate from 40 to 60 acres of land and where the land is sandy crops flourish, but where it is heavy and the water does not drain away quickly it has a deleterious effect on vegetation.

The topography is favourable in some sections of the township for the erection of small dams to retain surface water. Dugouts might also be used to collect and store surface water for stock use. Shallow wells sunk near the impounded water should yield sufficient water for domestic purposes.

Township 23, Range 28

Approximately 27 square miles of this township lie within the municipality of Mantario. The ground surface is rolling and is cut by many shallow ravines containing intermittent streams that drain into South Saskatchewan river. Recent stream deposits occur along the flood-plain of the river. The north-central part is mantled by moraine and the remainder of the area is covered by boulder clay or glacial till. Glacial outwash sands and gravels overlie the till in parts of sections 23 and 24, and glacial lake clays overlie it in parts of sections 18, 19, 20, and 21.

The stream deposits long the river should prove productive, and a well located in the SW.$\frac{1}{4}$, section 14, obtains a large supply of water from a fine sand aquifer at a depth of 16 feet. The water is suitable for domestic needs.

The glacial outwash sands and gravels have not been investigated, but they should contain usable water at shallow depth. The glacial lake clays are not thought to contain water, but water may be obtained from the underlying boulder clay.

The water conditions in the areas that are covered by moraine and glacial till are quite similar. In general the deposits of moraine and glacial till consist of a few feet of top soil; a weathered or oxidized zone of clay that is 30 feet thick in some areas; and an unweathered zone of boulder clay. In some areas the weathered zone contains scattered deposits of water-bearing sand and gravel that yield small supplies of drinkable water. In some sections two or more wells are used and in others the supply must be augmented by hauling. Before a well is dug a small test auger should be used to locate a water-bearing deposit. The unweathered zone of the drift has not been very fully investigated, but water-bearing sands have been tapped at depths up to 90 feet. The deposits, however, are considered to be of scattered distribution, and probably do not form a continuous aquifer. Dry holes may be encountered before a producing well is sunk. The 90-foot well in the NE.$\frac{1}{4}$, section 26, is not used at present, but a well in section 19, and a second well in the NE.$\frac{1}{4}$, section 26, yield adequate supplies of usable water for local requirements.

Springs were observed in sections 14, 16, 22, and 34, and no doubt others occur in various locations. A large supply of water is obtained for stock use from the spring in section 34, but information about the others is lacking. They will doubtless be found entirely satisfactory for stock and may be usable for domestic purposes.

Many of the small ravines in this township could be dammed and the impounded water used for stock. Shallow wells sunk beside the impounded waters can be used for domestic needs.

Township 23, Range 29

The Fourth meridian, or the boundary between Saskatchewan and Alberta, forms the western border of this township, and Red Deer river forms its southern border. The area under discussion is limited to approximately 18 square miles. The ground surface is rolling and is cut by many small valleys that trend in a southerly direction towards the river valley. The elevation decreases from more than 2,300 feet above sea-level in the north, to less than 1,900 feet at the river.

Recent stream deposits overlie the till along the river valley, and lake clays cover e boulder clay in parts of sections 13, 24, and 25. The remainder of the surface, with the exception of part of section 36 which is mantled by moraine, is covered by glacial till or boulder clay.

The Recent stream deposits have not been tested for water, but water should be obtained from them at shallow depth. The water-bearing deposits, however, may be scattered, and a small test auger should be used to prospect the Recent deposits before a well is dug. The water obtained should be found quite satisfactory for domestic and stock needs. The glacial lake clays do not contain water.

It appears rather difficult to locate good supplies of water in this township. Dry holes have been dug to depths of 60 and 70 feet in sections 24 and 25. Two producing wells in sections 23 and 28 are thought to derive most of their supply by direct seepage from water impounded by dams. The use of dams to obtain water for stock use is economical, and many favourable locations for their construction exist throughout the township. Shallow wells dug beside the impounded waters yield sufficient usable water for domestic needs.

The resident in section 24 hauls water from a spring located in section 14. Other springs will probably prove a source

of supply in other localities. The yield from the springs may be increased by digging out and cribbing the spring, and by using collecting galleries, and the available supply may be increased by conserving the overflow in some type of reservoir.

Township 24, Range 27

The surface of the northwestern half of this township is rough, being dissected by number of streams that flow into Cabri lake. The headwaters of a few small streams that are tributary to South Saskatchewan river occur in the southern part of the area. The southeastern part of the area is more nearly level. The elevation rises from slightly less than 2,000 feet at Cabri lake to more than 2,250 feet above sea-level in the northeastern corner. Glacial till or boulder clay overlies the bedrock throughout the township, but in a large area in the east, and a small area in the south-central part, the boulder clay is concealed by glacial lake clays. The lake clays may exceed 40 feet in thickness in some localities.

It is improbable that the lake clays contain water, but water-bearing deposits may occur at the contact with the underlying boulder clay. Probably the most advisable procedure in this township is to locate the water-bearing deposits by means of a test auger before shallow wells are dug. The best locations for shallow wells are in depressions and ravines and near impounded surface waters. The area has not been very fully prospected for shallow water-bearing deposits, but dry holes in section 4 and 22 would appear to indicate that the deposits are of scattered and sparse distribution. A 26-foot well in section 22 obtains sufficient water for domestic requirements. The unweathered drift does not appear to be more productive than the weathered or oxidized zone, as dry holes have been drilled to a maximum depth of 140 feet in section 4. In section 16 a

well obtains water from a fine sand aquifer at a depth of 112 feet. The fine sand has plugged the casing and the available supply is inadequate for local needs.

Two wells in the SW.$\frac{1}{4}$, and NE.$\frac{1}{4}$, section 36, obtain water at depths of 312 feet, or at an elevation of 1,933 feet above sea-level. It is probable that both wells have tapped aquifers in the Belly River formation. The extent of the aquifers is not known, but wells sunk in this immediate vicinity should obtain water at an approximate elevation of 1,900 feet above sea-level. The supply obtained from the wells is sufficient for farm needs, but that from the well on the SW.$\frac{1}{4}$ has decreased considerably due to the fine sand of the aquifer plugging the casing. The water is under hydrostatic pressure, is hard and slightly mineralized, but has been found suitable for domestic purposes as well as for stock.

No springs were recorded in this township. The topography in some areas should be favourable for the construction of small dams to impound surface water for stock needs. Water for domestic use could be obtained from wells sunk near the impounded surface water. Care must be taken to see that the water does not become contaminated.

Township 24, Range 28

The greater part of this township is mantled by moraine, an irregular strip along the eastern edge being covered by boulder clay or glacial till. The ground surface is rough and is characterized by small knolls and undrained depressions. The water conditions in the glacial till-covered area have not been fully prospected, but no doubt they will prove somewhat similar to those in the moraine-covered area.

Undrained depressions are common in this township and most of the wells are dug in or near them. Most of the wells,

however, tap aquifers of sand and gravel, but part of the water supply is undoubtedly obtained by direct seepage from the impounded water. From the evidence at hand it appears that the best location for shallow well is in the vicinity of depressions. It is advisable, however, to locate the water-bearing deposits by means of a small auger before the well is dug. Water should be obtained within 30 feet of the surface with little difficulty throughout the greater part of this township. The supply from the existing shallow wells varies with the annual precipitation, but in all the wells the supply is more than adequate for household needs and usually it is also sufficient for stock requirements. The water from a well in section 18 is recorded as being too laxative for human use but suitable for stock, but the water from the other shallow wells is usable for all farm purposes.

One well located in the SW.$\frac{1}{4}$, section 4, was sunk to a depth of 50 feet and obtains water from an aquifer at an elevation of 2,390 feet above sea-level. It is improbable that the aquifer is of large areal extent. This is the deepest well in this township, but it is probable that the water-bearing deposits that exist in the lower part of the drift are in the form of pockets. Dry holes will probably be dug before producing wells are obtained. The water from the well in section 4 is usable for all farm needs and the supply is sufficient for local requirements.

Springs were observed in section 4, 19, and 30, and no doubt others occur throughout the township. These three springs yield adequate supplies for stock needs, but the water is not used for domestic purposes. In some sections it may be economical to erect small dams to impound surface water for stock use, whereas in other parts dugouts can be excavated to retain surface water. Shallow wells sunk near the impounded waters should yield sufficient water for domestic use, and the water should be found entirely suitable for household needs.

Township 24, Range 29

This township is an area of approximately 24 square miles, the Fourth meridian forming its western boundary. The ground surface of this fractional township is rolling to somewhat hilly and the general slope is towards the south. A narrow valley containing an intermittent stream enters the township in section 30. The stream flows in a southerly direction to section 17 where it disapp .rs. A second valley, which is considerably wider with gently sloping banks, trends from section 2 to section 35. The eastern part of this township is covered by moraine, whereas the remainder of the area is mantled by glacial till or boulder clay.

A few wells in this township are sunk near depressions or sloughs and obtain a supply of water that is sufficient for, at least, domestic needs. By using two or more of these wells a sufficient supply for local needs may be obtained, but the wells are readily affected by drought conditions.

A few shallow wells have encountered water-bearing sands or gravels in the upper part of the glacial drift. These wells are not more than 35 feet deep, and the supply is sufficient for local needs. The water can generally be used for domestic needs as well as for stock. Since the water-bearing deposits are of scattered occ rence, they should be located by means of a small test auger before a well is dug, as this lessens the chances of digging dry holes.

The lower part of the drift has not been extensively prospected, and only four wells were recorded that are deeper than 90 feet. The wells located in sections 13 and 34 were sunk to depths of 95 to 125 feet. Some relationship may be present in the aquifers of the two wells in section 34, but the aquifer of the well in section 13 cannot be correlated with them. The deposits of water-bearing sand and gravel in the lower part

of the drift are no doubt in the form of pockets, and they are not thought to be of numerous occurrence as dry holes were sunk in section 3 to depths of 80, 112, and 144 feet. The supply from the well in section 13 is insufficient for farm needs, but that from the wells in section 34 is adequate. The water from the well in the SW. $\frac{1}{4}$, section 34, is used for domestic purposes, but that from the others has been found suitable only for stock. It is advisable to prospect the upper part of the drift thoroughly before boring or drilling into the lower part of the drift.

Springs occur in sections 9 and 28, but the water from them is being used only for stock. A few residents are forced to haul water. By using dams or dugouts to collect surface water for stock use, the supply of water can be greatly increased on most farms. A shallow well sunk near the dugout, or the water impounded by the dam, should provide an adequate supply of water for domestic purposes.

Township 25, Range 27

The surface of this township is very hilly and most of the area is too rough and stony for cultivation. Cabri lake occupies approximately four sections in the southwestern corner. This lake is fed by an intermittent stream that occupies a fairly deep valley in the western part of the area. The general slope of the township is from the northeast towards Cabri lake and its tributary stream. In parts of the northeastern half of the township the elevation exceeds 2,300 feet above sea-level, whereas Cabri lake is considerably less than 2,000 feet above sea-level. A narrow strip extending from section 12 to section 34 is covered by moraine, but the remainder of the township is mantled by glacial till or boulder clay. The drift in some parts of the township is thought to have a thickness of more

than 250 feet, but in the immediate vicinity of Cabri lake it is probably much thinner.

Lack of information prevents the outlining of definite water-bearing horizons in this township, but it is improbable that any general water-bearing horizons exist either in the upper or lower parts of the glacial drift. If possible, shallow wells should be sunk near depressions, or sloughs, as wells sunk in these locations usually obtain sufficient water for local needs. Two or more wells may have to be used to obtain adequate supplies of water for stock needs. It is advisable to locate water-bearing deposits in the upper part of the drift by means of a small test auger before digging a shallow well. Two of the shallow wells now in use yield an adequate supply of usable water, whereas the third yields an insufficient supply but the water is suitable for domestic needs.

Two wells in section 24 are 43 and 103 feet deep and both yield inadequate supplies of water. The water-bearing deposits in the lower part of the drift are apparently of infrequent occurrence, as none of the wells deriving water from the bedrock were reported as having passed through aquifers in the glacial drift. Deep drilling into the drift is not advised unless one is prepared to drill into the bedrock, providing water is not encountered in the unconsolidated deposits.

Four wells, located in sections 22, 28, 34, and 36, are thought to have tapped aquifers in the Belly River formation. The wells are drilled to depth of 300, 365, 370, and 311 feet, respectively, and the aquifers were encountered at elevations of 1,955, 1,915, 1,955, and 1,964 feet above sea-level. The wells in sections 34 and 36 are thought to be tapping a common aquifer. Although a single aquifer may not extend throughout the township it is probable that wells sunk into the bedrock to elevations of 1,900 to 1,960 feet will obtain water. The supply from the four

wells is more than sufficient for local needs. The hydrostatic pressure is sufficient to raise the water at least 100 feet above the aquifer. The water from the well in section 36 is recorded as fairly soft, whereas that from the others is hard. It is used for both domestic and stock use with no apparent ill effects.

Dugouts and dams can be used to advantage in this township to collect and store surface water for stock use. Shallow wells sunk beside the impounded water should yield sufficient water for domestic needs.

Township 25, Range 28

The surface of this township is rolling and hilly. The elevation decreases from 2,500 feet above sea-level in the northwestern corner to approximately 2,300 feet in the southwestern corner, and to less than 2,100 feet above sea-level along the eastern border. Many coulées and small valleys, which contain intermittent streams, occur along the eastern part of the area and are tributaries of Cabri lake. The western two-thirds of the township is covered by moraine, whereas the remainder is mantled by boulder clay or glacial till.

The glacial till or boulder clay had not been prospected for water-bearing deposits, but water conditions should be similar to those existing in the area covered by moraine. The moraine deposits generally consist of a few feet of a sandy loam top soil; a zone of weathered or oxidized clay that contains pockets of water-bearing sands and gravels near its base; and a zone of dark-coloured clays that extends to the bedrock. This part of the drift has not been fully explored for water, but it will probably contain scattered deposits of water-bearing sand and gravel.

Most of the wells in this township obtain their supply from water-bearing deposits in the weathered zone of the drift, usually within 35 feet of the surface. Some of the wells have been sunk near depressions and are no doubt obtaining part of their supply by direct seepage from the surface waters. There should not be any great difficulty in obtaining water at shallow depth in this township, especially in the southern half, but test augers should be used to locate the water-bearing deposits before a well is sunk. With few exceptions, the shallow wells in this township yield adequate supplies for local needs. Deficient supplies may be supplemented by using a second well, or by collecting surface water in dugouts or at dams for stock use. The water from the shallow wells is recorded as satisfactory for domestic use. A spring in section 3 flows throughout the year and yields a large supply of usable water. The available supply has been increased by collecting the overflow water in a dugout.

Two wells in section 33 obtain water at depths of 68 and 85 feet. Dry sand was encountered at the base of the yellow clay, at a depth of approximately 30 feet, and the wells were sunk deeper. The water-bearing deposits in the lower part of the drift are not thought to form a continuous horizon and dry holes may be dug before a producing deposit is tapped. In most sections in this township it should not be necessary to sink wells into the lower part of the drift to obtain water. The supply from the 68-foot well is inadequate for local needs, but the water from both wells can be used for drinking.

No wells have been drilled into the bedrock in this township. It is probable that wells drilled to elevations of 1,925 to 1,975 feet above sea-level will tap aquifers in the bedrock.

In certain parts of the township the topography is favourable for the construction of small dams. The surface water thus impounded can be used for stock. Dugouts can be used in other sections to retain surface water. Shallow wells sunk beside these artificial reservoirs should provide adequate supplies of water for domestic purposes.

Township 25, Range 29

The Fourth meridian, the boundary between Saskatchewan and Alberta, forms the western border of this township which has an area of 24 square miles. The ground surface is rolling, being somewhat hilly in certain sections, and small ravines and undrained depressions are common. The elevation in the northern part of the area is more than 2,500 feet above sea-level. The minimum elevation of slightly less than 2,300 feet above sea-level occurs in the southeastern corner. The northeastern corner of the township, and parts of sections 1, 6, and 12, are covered by moraine, whereas the remainder of the area is mantled by glacial till or boulder clay. The northern part of the township is too hilly and stony for cultivation. Only the southern part has been prospected for water-bearing deposits.

The glacial drift in this area is usually composed of a few feet of top soil; 15 to 30 feet of light-coloured or oxidized boulder clay that may or may not contain deposits of sand and gravel; and a zone of compact, dark-coloured boulder clay that contains scattered deposits of water-bearing sand and gravel.

About one-half the wells in the area derive water from the weathered zone of the drift, usually within 20 feet of the surface. There does not appear, however, to be any relationship in the occurrence of the aquifers, and a general aquifer is not thought to exist. The producing wells usually yield

sufficient water for local needs, and the water from all the wells but one is satisfactory for domestic purposes. Ravines and depressions are the best locations for shallow wells, but a prospective well site should be tested with a small auger to ascertain if water-bearing deposits are present at that location.

The remaining wells in this township derive their supplies from deposits of sand and gravel that occur in the unweathered zone of the drift. The wells vary from 40 to 100 feet deep and no correlation is evident in the occurrence of the aquifers that feed the producing wells. Dry holes have been sunk to a depth of 120 feet in section 16, and this would indicate that the water-bearing deposits are probably in the form of pockets rather than beds of large areal extent. Two of the wells are used exclusively for stock, but the water is not recorded as being unsuitable for domestic purposes. The remaining wells are used for both domestic purposes and stock. In general the supply from the deeper wells in this township is adequate for local requirements. Small dams could be constructed in many of the small coulées in this township, and the surface water impounded for stock use. In some sections dugouts can be excavated and surface water collected. Shallow wells dug beside the reservoirs yield suitable water for domestic needs.

Township 26, Range 27

The elevation in this township increases from less than 2,250 feet in the northeastern corner to 2,350 feet in the central part, and then decreases to less than 2,100 feet above sea-level in the southwestern corner. The land surface is gently rolling. A belt of territory generally less than a mile in width, extending from section 3 to section 32, is mantled by moraine, and the remainder of the township is covered by boulder clay or glacial till.

Scattered deposits of sand and gravel that occur in the upper part of the drift supply a few wells in this township. The deposits are not numerous and are of small areal extent. Dry holes will probably be dug before a producing deposit is tapped. Dry holes have already been dug in sections 7, 8, 26, and 27. Test augers should be used to locate the water-bearing deposits at shallow depth before a well is dug. Many farmers have dug shallow wells beside sloughs or artificial reservoirs, from which they obtain water for domestic needs. Care should be taken to see that the water does not become contaminated. The supply from these seepage wells is less dependable than that from shallow wells that have encountered pockets of water-bearing sand and gravel. All the shallow wells are readily affected by drought conditions. Two wells, located in the NE.$\frac{1}{4}$, section 30, and the NW.$\frac{1}{4}$, section 31, yield water of good quality and the supply is fairly abundant; neighbouring farmers often haul water from these wells.

A few wells, from 50 to 192 feet deep, tap pockets of sand and gravel in the unweathered part of the drift. The pockets are sparingly distributed, as shown by the dry holes sunk in section 2 to depths of 104 feet, in section 8 to 50 feet, in section 26 to 132 feet, and in section 33 to 150 feet. The producing wells probably tap pockets of local extent, and no correlation can be noted between the aquifers. It does not appear advisable to attempt to locate water in the lower part of the drift. Not only is the supply from the producing wells inadequate for local needs, but the water is highly mineralized and that from a number of wells cannot be used for domestic needs.

Notwithstanding that it is not advisable to prospect for water in the lower part of the drift, drilling into the bedrock is advised. In section 36 a well drilled to a depth of

339 feet taps an aquifer in the bedrock at an elevation of 2,021 feet above sea-level. Coal was reported at a depth of 200 feet, and there is little doubt that the aquifer is in the Belly River formation. The areal extent of the aquifer is unknown, but a well in section 26 encountered a white sand aquifer at an elevation of 2,001 feet above sea-level, and it is possible that both these wells are tapping a common aquifer, although no coal was encountered in the well in section 26. The supply from these two wells is abundant and the water is used for all farm requirements.

The "A" boundary line outlines an area in which a few wells obtain water from the Belly River formation at depths of 274 to 300 feet, or at elevations of 1,932 to 1,983 feet above sea-level. The two wells discussed above may be tapping the same aquifer as encountered by these wells. Water will probably be obtained anywhere in the outlined area by drilling to depths of from 274 to 300 feet, but the areal extent of the horizon, other than that shown on the map, is unknown. A well in section 33 was drilled to an elevation of 1,837 feet above sea-level before water was encountered, so the horizon probably is of no greater areal distribution than shown on the map. The supply from the wells is more than adequate for local needs, and the water is under considerable hydrostatic pressure. The water from the wells in sections 1, 22, and 34 is recorded as fairly soft, whereas that from a well in section 8 is hard. All the waters contain a relatively large amount of mineral salts in solution, and that from the well in section 34 was pronounced unfit for drinking. The water from the other wells is being used with no apparent ill effects.

A 328-foot well, located in section 33, taps an aquifer in the bedrock at an elevation of 1,837 feet above sea-level. The areal extent of this aquifer is unknown, but it

might be tapped by other wells in the immediate vicinity. The water is under pressure and rises 100 feet above the aquifer, and the supply is more than sufficient for local needs. The water is hard and acts as a laxative, but it is being used for all farm purposes.

Many of the residents in this township use dugouts for the collection and retention of surface water for stock. If they are of sufficient areal extent and at least 12 feet in depth they should retain sufficient water for stock throughout the year. A few dams are in use, but they do not impound sufficient water to last more than a few months. Shallow wells dug beside the reservoirs should yield suitable water for domestic needs.

Township 26, Range 28

The surface of this township is rolling and hilly throughout and is cut by a number of ravines. A small "alkali" lake occurs in parts of sections 32 and 33. A fairly large depression occurs in the northeastern corner of the township. The elevation decreases from 2,475 feet above sea-level in the southwestern corner to less than 2,200 feet at the northern boundary, and to 2,100 feet in the southeastern corner. The southwestern corner of the township is covered by moraine, whereas the remainder of the township is mantled by glacial till or boulder clay. In parts of sections 14 and 23 the boulder clay has been overlain by lake sands; in parts of sections 26, 27, 34, 35, and 36 the till is overlain by glacial lake clays; and in parts of sections 25, 34, 35, and 36 it is overlain by Recent dune sands. A small area in sections 17 and 18 is mantled by glacial outwash sands and gravels.

The Recent dune sands have not been tested for water, but shallow wells should obtain some water from these deposits.

The glacial outwash sands and gravels should also contain good water at shallow depth. One well has been sunk in the area that is overlain by glacial lake sands. This well is really a spring that has been dug out and cribbed. It should be possible to obtain water at shallow depth in the lake sands, especially in low-lying areas. The water is usable for all farm needs. The glacial lake clays will probably be found to contain little or no water. Small supplies of water, however, may be derived from sand and gravel deposits that occur at the contact of the lake clays and the underlying boulder clay.

The moraine-covered area in the southwestern part of the township is not cultivated and no wells have been dug in it. Wells sunk near undrained depressions in this area, however, should yield small supplies of water. Similar supplies should be obtained from pockets of sand and gravel at shallow depths on the uplands.

The glacial till generally consists of a few feet of top soil; a weathered zone of light-coloured clay that contains scattered deposits of water-bearing sand and gravel; and a zone of unweathered or dark-coloured clay that contains a few scattered deposits of water-bearing sand and gravel. Most of the wells in this township obtain water at depths of less than 16 feet in the weathered zone of the drift. Many of these shallow wells are springs that have been cleaned out and deepened. Springs are of common occurrence in this area. With the exception of the eastern part of the township, no great difficulty should be experienced in obtaining a good supply of water. It is advisable to locate water-bearing deposits at shallow depth by means of a small hand auger before sinking a well. The yield from most of the shallow wells is more than sufficient for farm requirements. The supplies from most of the springs and wells could be greatly increased by the use of

collecting galleries. The water is relatively hard, but is usable for all farm needs.

The lower part or unweathered zone of the glacial drift has not been fully prospected, but two 90-foot wells in sections 24 and 25 and a 42-foot well in section 36 have been sunk into it. The well in section 25 is not used and the supply from the other wells is inadequate for local needs. The deposits that form the aquifers in the lower drift are not thought to be extensive and are probably of scattered distribution, as dry holes were drilled to depths of 130 feet in section 36. When insufficient supplies are obtained from wells, the use of dugouts is recommended for the collection of water for stock. The dugouts should be at least 12 feet deep. Dams may also be used to impound water for stock requirements. Shallow wells dug beside the reservoirs will yield suitable water for domestic use, but care must be taken to see that the water does not become contaminated.

Township 26, Range 29

The ground surface of this fractional township is rolling and hilly, and ravines and draws are common. The elevation decreases from more than 2,500 feet in the southwestern corner to 2,300 feet in the northeastern corner. The siding of Cuthbert lies at an elevation of 2,403 feet above sea-level. The southeastern corner, and parts of sections 7, 8, 17, 18, 33, 34, and 35, are mantled by moraine, but the remainder of the area is covered by boulder clay or glacial till.

Approximately one-half the wells in this township obtain water from the upper part of the drift. Most of these wells are dug near sloughs and derive their supply by direct seepage from the impounded surface water. The supply is readily affected by drought conditions. Those wells that tap water-

bearing deposits and which do not depend upon seepage from sloughs are not so easily affected. The water-bearing deposits in the upper part of the drift do not form a continuous horizon, and they are not thought to be numerous. Dry holes will no doubt be sunk before producing wells are obtained. The water-bearing deposits should be located by means of a small auger before the well is sunk. The wells that are sunk near undrained depressions yield sufficient water only for domestic purposes, but those tapping fairly extensive deposits of water-bearing sands and gravels yield adequate supplies for local needs.

A number of wells tap water-bearing sands and gravels at depths of 60 to 140 feet. It is almost impossible to trace any correlation in the occurrence of the aquifers feeding the wells, but two wells located in sections 24 and 35 may be deriving their supply from a common source. If they are, the aquifer should be encountered at an approximate depth of 140 feet in the intervening area. No dry holes were recorded. The supplies from three of the wells in this group are adequate for local needs, and the well in section 24 yields an abundant supply. The water from the well in section 35 is too highly mineralized for domestic use.

The use of dams and dugouts to collect surface water for stock use is recommended on those farms where an adequate supply of water cannot be obtained from wells.

Township 27, Range 27

The ground surface in the southern part of this township is slightly rolling. The greater part of the township is covered by glacial till or boulder clay, but a small area in the south-central part and two small areas in the northwestern corner are mantled by moraine. Glacial lake clays overlie the boulder clay in an area near the centre of the township and in parts of sections 6 and 7.

The glacial lake clays do not generally contain water-bearing deposits, but water is sometimes obtained from beds and lenses of sand and gravel that occur at the contact of the lake clays and underlying boulder clay, or within the upper part of the boulder clay. One well located in section 15, in this lake basin, taps a water-bearing deposit at a depth of 65 feet. This is the only well that has been dug in the glacial lake clay-covered areas and it doubtless obtains its water from the underlying boulder clay. The water is used only for stock and the supply is sufficient for local needs.

The deposits of moraine and glacial till consist of a few feet of top soil; 30 feet or less of light-coloured, weathered clay that contains scattered deposits of water-bearing sand and gravel; and a zone of dark-coloured, or unweathered, clays that also contain a few scattered pockets of sand and gravel. Approximately one-half the wells are deriving water from sand and gravel deposits in the drift, usually at depths of less than 50 feet. A few of these wells are sunk near depressions. The aquifers are not continuous and should be located with a small test auger prior to digging a well. The water from the shallow producing wells is used for drinking and for stock raising purposes, but that from some of the wells is quite highly mineralized.

The unweathered zone of the drift has been tested by a number of wells and water is encountered at depths of 62 to 110 feet. The water-bearing deposits do not form a continuous horizon and dry holes have been sunk in sections 2 and 32 to depths of 129 feet. Wells have also been sunk into the bedrock, and no water-bearing horizons in the drift were reported to have been passed through. The supply from most of the wells is not large and in some instances it is necessary to supplement the supply by using a second well, or by hauling. The water is

highly mineralized and that from a few wells cannot be used for domestic purposes.

Three wells, located in sections 3, 7, and 14, obtain water from aquifers in the bedrock of the Belly River formation at depths of 328, 328, and 300 feet, respectively, or at elevations of 1,930, 1,987, and 1,961 feet above sea-level. The same aquifer may be common to the three wells. Other wells sunk to similar depths will probably encounter water in this formation. The supply from the wells is abundant. The water is hard and that from the wells in sections 7 and 14 is too highly mineralized to be used for domestic purposes.

Where the water supplies are inadequate for local requirements they are supplemented by the use of dugouts, dams, and springs. One dam, in section 23, has impounded water, with the exception of two years, since 1910. The dugouts, however, become dry in the autumn. They should be at least 12 feet deep in order to retain sufficient water throughout the year. Little difficulty should be experienced in obtaining a good supply of water from aquifers in the Belly River formation.

Township 27, Range 28

The surface of this township is rolling and hilly throughout. The area is covered largely by boulder clay, but small deposits of moraine occur in sections 6, 24, and 36. Glacial lake clays and dune sand cover a considerable area in the southeastern corner. A small deposit of glacial outwash sands and gravels occurs in the eastern part of section 19. A large depression occurs in the north-central part of the area, which is underlain by glacial lake sands and sandy clays. A number of lakes occur in this depression. In the lowest part of this basin, at an elevation of approximately 2,100 feet above sea-level, there occurs a large deposit of sodium sulphate.

No great difficulty should be encountered in obtaining sufficient water for farm needs at shallow depths in this township. With the exception of a 70-foot well in section 6, all of the wells are less than 36 feet in depth, and many of them are fed by direct seepage from flowing springs. Two springs located in sections 14 and 17 are estimated to yield 3 gallons a minute, and another in the NE.$\frac{1}{4}$, section 31, is recorded to flow 14 gallons a minute. The Canadian National Railways has erected a collecting gallery along the side of a slope in section 31, and it is recorded that the yield is 300 gallons a minute. It is pumped from the collecting reservoir to Alsask, where it is used in the round house. The town of Alsask also uses this water supply for fire protection. The water obtained from the springs is moderately hard, but it is quite satisfactory for domestic use. The water from some of the wells in the immediate vicinity of "alkali" flats is highly mineralized, but it can be used for drinking.

Township 27, Range 29

This fractional township is approximately $2\frac{3}{4}$ miles wide, its western boundary being the Fourth meridian, which forms the boundary between Saskatchewan and Alberta. The ground surface is less rolling and hilly than that of the townships to the south and east. The highest elevation of 2,400 feet above sea-level is attained in sections 1 and 2, and the lowest, less than 2,300 feet, occurs along the northern part of the area. A few undrained depressions or sloughs occur throughout the township, but they contain water only in the spring months or after particularly heavy rains.

Recent dune sand overlies the boulder clay in an area of approximately 2 square miles in the west-central part, and in a smaller area in sections 11 and 12. Glacial outwash sands

and gravels occur in a very small area in section 34. Moraine covers section 1, and parts of sections 23, 24, 25, and 26, whereas the remainder of the township is covered by glacial till or boulder clay.

The Recent dune sand, the glacial outwash, and the morainic deposits have not been prospected for water, but it is probable that some water would be obtained at shallow depth from the dune sand and glacial outwash gravels. The water conditions in the moraine-covered area should be somewhat similar to those in the till-covered area.

In general the glacial till in this township consists of a few feet of sandy top soil; a weathered zone of light-coloured, oxidized clay that may extend to a depth of 30 feet; and an unweathered zone of boulder clay that extends to the underlying bedrock. Three wells, located in sections 23, 27, and 34, derive water from sand aquifers in the weathered zone of the drift at depths of less than 25 feet. It is probable that the water-bearing deposits in the upper part of the drift are of scattered occurrence and should be located by means of a test auger before digging a well. Wells dug beside sloughs, undrained depressions, or dugouts should yield small quantities of water, and two or more such wells should yield supplies adequate for local farm needs. The recorded wells yield inadequate supplies, but the water can be used for domestic purposes as well as for stock.

Three wells, located in sections 2, 11, and 25, derive water from the lower, unweathered zone of the drift. The wells in sections 2 and 11 tap fine sand aquifers at depths of 120 and 65 feet, but the well in section 25 taps an aquifer of coarse sand at a depth of 105 feet. The aquifers of the wells are located at elevations of 2,250, 2,255, and 2,250 feet above sea-level. Even though the water-bearing deposits occur

at the same elevation they are not thought to form a continuous horizon. Due to lack of data the areal extent of these aquifers cannot be outlined. The wells yield small supplies of usable water. Similar deposits may occur throughout the area, but dry holes may be sunk in an effort to encounter them. Two or more wells will have to be used in order to obtain sufficient water for local needs, or surface water for stock use may be impounded by dams or dugouts. Fairly abundant supplies of water may be obtained from the Belly River formation.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF MANTARIO, NO.262, SASKATCHEWAN

Township	23	23	23	24	24	24	25	25	25	26	26	2o	27	27	27	Total No. in municipality
West of 3rd meridian Range	27	28	29	27	28	29	27	28	29	27	28	29	27	28	29	
Total No. of Wells in Township	6	14	9	9	13	25	11	16	19	57	36	12	40	11	6	284
No. of wells in bedrock	0	0	0	2	0	0	4	0	0	7	0	1	3	0	0	17
No. of wells in glacial drift	o	13	9	7	13	25	7	1o	19	50	36	11	37	10	6	265
No. of wells in alluvium	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2
Permanency of Water Supply																
No. with permanent supply	3	14	7	4	13	22	9	16	1o	31	18	12	35	11	6	217
No. with intermittent supply	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	3
No. dry holes	3	0	2	5	0	3	0	0	3	25	18	0	5	0	0	64
Types of Wells																
No. of flowing artesian wells	2	1	0	0	3	1	0	1	0	0	4	0	0	4	0	16
No. of non-flowing artesian wells	1	1	0	3	1	3	5	6	5	12	2	5	13	1	0	58
No. of non-artesian wells	0	12	7	1	9	18	6	9	11	20	12	7	22	6	6	146
Quality of Water																
No. with hard water	3	14	7	4	11	18	9	14	12	28	18	11	34	9	5	197
No. with soft water	0	0	0	0	2	4	2	2	4	4	0	1	1	2	1	23
No. with salty water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. with "alkaline" water	1	1	0	0	2	1	3	2	3	0	2	2	3	0	1	21
Depths of Wells																
No. from 0 to 50 feet deep	4	12	7	3	13	19	6	14	9	32	32	0	22	10	3	192
No. from 51 to 100 feet deep	1	2	2	1	0	3	0	2	7	8	2	3	10	1	1	43
No. from 101 to 150 feet deep	1	0	0	3	0	3	1	0	3	9	2	2	5	0	2	31
No. from 151 to 200 feet deep	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
No. from 201 to 500 feet deep	0	0	0	2	0	0	4	0	0	7	0	1	3	0	0	17
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
How the Water is Used																
No. usable for domestic purposes	3	14	7	4	12	20	10	14	14	30	17	12	33	11	6	207
No. not usable for domestic purposes	0	0	0	0	1	2	1	2	2	2	1	0	2	0	0	13
No. usable for stock	3	14	7	4	13	22	11	15	15	32	17	12	34	11	o	216
No. not usable for stock	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	4
Sufficiency of Water Supply																
No. sufficient for domestic needs	3	14	7	4	13	22	10	16	16	31	18	12	35	11	6	218
No. insufficient for domestic needs	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
No. sufficient for stock needs	3	11	4	2	12	17	6	11	10	1o	14	7	24	6	0	143
No. insufficient for stock needs	0	3	3	2	1	5	5	5	6	16	4	5	11	5	6	77

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 boilers 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 harness 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 Mantario, No. 262, 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	SE.	34	23	27	3rd	Spring	1,420	4o0	.240	220	44	380	30	119	o15	454	1,318	54		249		32	910	73	x1 ?
2	NW.	34	25	27	3	370	1,760	540	400	140	22	545	120	119	927	o38	1,908	215		249		3o	1,372	36	x2
3	NE.	3o	25	27	3	311	1,780	50	10	40	31	575	20	14	845	885	1,901	3o		29		534	1,251	51	x2
4	NE.	15	2o	27	3	192	1,700	750	o25	125	1:	425	20	184	83o	512	1,610	36		328	80		1,143	23	x1
5	NE.	22	2o	27	3	274	1,920	220	85	135	35	5oo	30	58	1,021	878	2,oo4	54		121		320	1,511	58	x2
o	NW.	2o	2o	27	3	2oo	2,o6o	540	420	120	17	375	20	148	1,521	978	2,596	36		286	33		2,313	28	x2 ?
7	NE.	33	2o	27	3	328	2,6oo	16o	50	110	41	585	30	47	1,353	1,166	2,718	54		98		438	2,002	68	x2
8	SW.	34	2o	27	3	294	2,520	300	1oo	140	47	515	30	79	1,287	1,035	2,483	54		165		281	1,905	78	x2
9	NE.	3o	2o	27	3	339	1,400	85	15	70	12	575	40	18	5o6	o59	1,453	72		38		485	838	20	x2
10	SE.	14	27	27	3	300	4,780	o00	440	160	41	315	40	155	2,960	1,856	4,695	72		205	170		4,180	68	x2

Water samples indicated thus, x1, are from glacial drift.
Water samples indicated thus, x2, are from bedrock, Belly River formation.
Analyses are reported in parts per million.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

One sample of water from a spring was analysed and the results are listed in the accompanying table. It should be satisfactory for domestic needs as well as for stock, as it is not excessively hard and does not contain a very large amount of mineral salts in solution. The water from most of the other springs in this area is suitable for farm needs and is probably similar to the sample analysed. Some of the water may contain a considerable amount of iron in solution. The water from the lake in secs. 27 and 28, tp. 7, range 28, contains an excessive amount of mineral salts in solution. One sample collected in 1923 when the brine was 5 inches deep had a total dissolved solid content of 86,157 parts per million, 39,000 of which were Na_2SO_4 and 35,000 NaCl or common salt. A sample taken in 1924 when the brine was 2 inches deep contained 130,900 parts per million of dissolved solids, Na_2CO_3 (Glauber's salt) forming 47,500 parts per million and NaCl (common salt) 77,200 parts per million. The water from wells in the vicinity of this lake will probably be totally unfit for use.

Water from wells dug near small depressions, dugouts, or dams should be suitable for all farm needs, if care is taken to see that it does not become contaminated by water containing animal refuse. The water should be tested frequently for bacteria content.

The water obtained from pockets of sand and gravel in the upper part of the drift is usually satisfactory for all farm needs. It contains a considerable amount of mineral salts in solution, but the water from all the shallow wells in this municipality is used for stock, and only from a few is it unfit for domestic purposes.

One sample of water from the lower part of the drift was collected and analysed. This water is from a depth of 192 feet and part of the supply may be from the bedrock. It contains 1,700 parts per million of total dissolved solids and is excessively hard. It contains a large amount of sodium sulphate (Glauber's salt) and may have a slight laxative effect on those not accustomed to its use, but it is suitable for stock. The water from the unweathered zone of the drift in this municipality contains a relatively large amount of mineral salts in solution. It is usable for stock, but in many instances is unsatisfactory for drinking.

Water from the Bedrock

A number of samples of water from the bedrock were collected by the field party, and the results are listed in the table accompanying the report. Samples Nos. 6 and 10 may be a mixture of waters from the drift and bedrock, but due to the depth of the wells and the elevations of the aquifers the wells are thought to be deriving their water from the bedrock. The water contains from 1,400 to 4,780 parts per million of dissolved solids, and is moderately hard. Sodium sulphate is the predominant mineral salt, with sodium carbonate (black alkali) and magnesium sulphate (Epsom salts) next in abundance. Smaller amounts of calcium carbonate and sodium chloride also occur in solution. With the exception of samples 7, 8, and 10, all the waters analysed should be satisfactory for drinking, but they may be mildly laxative until one becomes accustomed to their use. They are satisfactory for stock. The water may have a slight soda taste due to the relatively large amount of sodium carbonate present, but the sodium chloride content is not sufficient to render the water salty. It will probably be unsatisfactory for irrigation.

WELL RECORDS—Rural Municipality of ONTARIO, NO. 262, 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.	19	23	27	3	Dug	36	2,115	- 29	2,086	36	2,079	Glacial quick-sand	Hard, clear		D, S	Sufficient supply. A dry hole 103 feet in glacial sand. A 40-foot dry hole in glacial sand.
2	NE.	20	"	"	"	Spring	0	2,055					Glacial sand	Medium hard, iron, clear		D, S	Steady flow supplies two farms.
3	SW.	32	"	"	"	Dug	153	2,250									Dry hole in glacial drift.
4	SE.	34	"	"	"	Spring	0	1,970					Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient supply. #.
1	SW.	14	23	28	3	Dug	16	1,920	- 13	1,907	13	1,907	Recent stream deposits	Hard, iron, rusty		S	Sufficient supply. A 12-foot well supplies 80 head stock.
2	NE.	14	"	"	"	Spring	0						Glacial drift	Hard, clear		S	Supplies stock.
3	NW.	16	"	"	"	Spring	0						Glacial drift	Hard, clear		S	Supplies stock.
4	NW.	19	"	"	"	Dug	50	2,185	- 47	2,138	47	2,138	Glacial sand	Hard, clear, "alkaline"		D, S	Fair supply.
5	SE.	22	"	"	"	Spring	0									S	Spring for stock use.
6	NE.	26	"	"	"	Dug	60	2,305	- 58	2,247	58	2,247	Glacial drift	Hard, clear		D, S	Large supply. A 90-foot well with 40 feet of water, not used.
7	NW.	31	"	"	"	Dug	12	2,265	- 8	2,257	8	2,257	Glacial sandy clay	Medium hard, clear		D, S	Barely sufficient from two wells. A 25-foot well similar.
8	SW.	34	"	"	"	Spring	0	2,325	0	2,325			Glacial drift	Hard, clear		S	Steady flow.
9	SE.	36	"	"	"	Dug	20	2,300	- 17	2,283	17	2,283	Glacial drift	Hard, clear		D, S	Insufficient supply. Another well supplies soft water.
10	NE.	36	"	"	"	Dug	20	2,310	- 16	2,294	16	2,294	Glacial quick-sand	Hard, clear		D, S	Insufficient supply. Hauled water last year.
1	NE.	14	23	29	3	Spring	0						Glacial drift	Hard			
2	NW.	23	"	"	"	Dug	24	2,150	- 21	2,129	21	2,129	Glacial drift	Hard, clear	42	D	Insufficient; two other wells, hard water. A spring with a small supply.
3	SW.	24	"	"	"	Bored	60	2,240									Dry hole in glacial drift.
4	SW.	25	"	"	"	Bored	70	2,290									Dry hole in glacial drift. Haul water.
5	NE.	28	"	"	"	Dug	27	2,150	- 23	2,127	23	2,127	Glacial quick-sand	Medium hard, clear		D, S	Sufficient supply. Another well with better quality of water for house. Small supply.
1	NE.	4	24	27	3	Bored	140	2,168									Two other dry holes 120 feet and 80 feet deep in glacial drift.
2	SW.	16	"	"	"	Drilled	112	2,090	- 77	2,013			Glacial sand	Hard, clear			Insufficient supply, because sand plugs well.
3	NW.	22	"	"	"	Bored	26	2,160	- 25	2,135	25	2,135	Glacial fine sand	Medium hard, clear		D	Insufficient supply. Also several dry holes.
4	SW.	36	"	"	"	Drilled	312	2,245	-180	2,065	312	1,933	Belly River sand	Hard, clear		D, S	Sufficient supply.
5	NE.	36	"	"	"	Drilled	312	2,245	-270	1,975	312	1,933	Belly River	Hard, iron, clear, rusty, fine sediment		D, S	Sufficient supply.
1	SW.	3	24	28	3	Dug	30	2,370	- 18	2,352	18	2,352	Glacial drift	Hard, clear		D, S	Insufficient 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 MANTARIO, NO. 262, 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
2	SW.	4	24	28	3	Dug	50	2,440	- 10	2,430	50	2,390	Glacial sandy clay	Hard, clear		D, S	Sufficient supply.
3	NW.	"	"	"	"	Dug	3	2,380	0	2,380			Glacial drift	Hard, clear, "alkaline"		S	Good supply.
4	SW.	6	"	"	"	Dug	18	2,300	- 12	2,288	12	2,288	Glacial sand and gravel	Medium hard, clear		D, S	Sufficient for 15 head stock. A 30-foot well in quicksand also.
5	NW.	17	"	"	"	Dug	15	2,290	- 3	2,287	3	2,287	Glacial sand	Medium hard, clear		D, S	Sufficient supply.
6	SE.	18	"	"	"	Dug	10	2,330	- 2	2,328	2	2,328	Glacial hard, blue sand	Hard, clear, "alkaline"		S	Sufficient supply. Laxative.
7	NW.	19	"	"	"	Spring	0	2,250					Glacial drift	Soft, clear		S	Sufficient supply.
8	NW.	20	"	"	"	Dug	8	2,310	- 5	2,305	5	2,305	Glacial quick-sand	Medium hard, clear		D, S	Sufficient supply.
9	SW.	27	"	"	"	Dug	8	2,370	- 5	2,365	5	2,365	Glacial sand	Hard, clear		D, S	Sufficient supply.
10	SE.	30	"	"	"	Dug	12	2,300	- 6	2,294	6	2,294	Glacial quick-sand	Soft, clear		D	Sufficient supply. A spring also used.
11	NE.	34	"	"	"	Dug	12	2,335	0	2,335	0	2,335	Glacial sandy clay	Medium hard, clear		D, S	Sufficient supply.
1	SE.	2	24	29	3	Dug	8	2,330	- 4	2,326	4	2,326	Glacial gravel	Hard, clear		D, S	Good supply. Two other wells 12 feet and 25 feet deep yield good supplies of hard water.
2	NE.	2	"	"	"	Bored	35	2,250	- 30	2,220	30	2,220	Glacial sand	Hard, clear		D, S	
3	SW.	3	"	"	"	Bored	144	2,335									Dry hole. Two others 112 feet and 80 feet in glacial drift.
4	NE.	9	"	"	"	Dug		2,185					Glacial quick-sand	Hard, clear, iron		S	Sufficient for 6 to 8 head stock.
5	NW.	13	"	"	"	Bored	95	2,210	- 88	2,122	88	2,122	Glacial drift	Hard, iron		S	Insufficient supply.
6	SW.	15	"	"	"	Dug	12	2,140	- 4	2,136	4	2,136	Glacial quick-sand	Medium hard, iron, clear, rusty		D, S	Sufficient supply.
7	NW.	15	"	"	"	Dug	20	2,150	- 2	2,148	2	2,148	Glacial drift	Hard, clear		D	Sufficient for household. Dam for stock.
8	NE.	16	"	"	"	Dug	12	2,145	- 6	2,139	6	2,139	Glacial gravel	Soft, clear		D, S	Sufficient supply.
9	SE.	22	"	"	"	Dug	30	2,205	- 29	2,176	29	2,176	Glacial quick-sand	Soft, clear		D, S	Insufficient supply. Hauls water for all purposes.
10	SW.	24	"	"	"	Dug	20						Glacial sand	Soft			Probably sufficient supply.
11	SE.	25	"	"	"	Dug	23	2,250	- 8	2,242	8	2,242	Glacial gravel	Soft, clear		D, S	Sufficient supply.
12	NE.	25	"	"	"	Dug	32	2,250	- 0	2,250			Glacial drift	Hard, clear		S	Sufficient supply. Uses spring also.
13	SE.	26	"	"	"	Bored	20	2,210	- 11	2,199	11	2,199	Glacial quick-sand	Hard, clear		D, S	Sufficient for 25 head stock. Another well 9 feet deep in quicksand.
14	SW.	27	"	"	"	Bored	30	2,230	- 18	2,212	30	2,200	Glacial quick-sand	Hard, clear		D, S	Sufficient supply. 2 similar wells used. All 3 to supply 60 head stock.
15	SE.	28	"	"	"	Spring	0	2,185					Glacial drift	Hard		S	Steady flow.
16	SW.	34	"	"	"	Bored	125	2,310	- 85	2,225	95	2,215	Glacial drift	Hard, "alkaline"		D, S	Sufficient, fair 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 MANTARIO, NO. 262, 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	NE.	34	24	29	3	Bored	95	2,340	- 93	2,247	93	2,247	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for stock. Unfit for human consumption.
1	SW.	14	25	27	3	Dug	13	2,235	- 15	2,220	15	2,220	Glacial quick-sand	Soft, clear	42	D, S	Just supplies 8 head stock.
2	SW.	22	"	"	"	Drilled	300	2,255	-200	2,055	300	1,955	Belly River black sand	Hard, iron, clear	42	D, S	Supplies 20 head stock.
3	SW.	24	"	"	"	Dug	25	2,285	- 22	2,263	22	2,263	Glacial sand	Hard, clear	42	D, S	Supplies 20 head stock only.
4	SE.	24	"	"	"	Bored	103	2,280	- 88	2,192	103	2,177	Glacial drift	Hard, clear, "alkaline"	42	D, S	Only sufficient for house.
5	NE.	24	"	"	"	Bored	47	2,280	- 45	2,235	45	2,235	Glacial sand	Hard, clear, strongly "alkaline"	42	S	Insufficient supply. Laxative. Two other wells insufficient.
6	NE.	28	"	"	"	Drilled	365	2,280					Bedrock	Hard, clear, iron	42	D, S	Supplies 20 head stock.
7	NE.	32	"	"	"	Dug	28	2,225	- 26	2,199	26	2,199	Glacial drift	Hard, clear	43	D, S	Insufficient supply.
8	NW.	34	"	"	"	Drilled	370	2,325	-198	2,127	370	1,955	Bedrock sand	Hard, clear, "alkaline"	43	D, S	Large supply. #.
9	NE.	36	"	"	"	Drilled	311	2,275	-151	2,124	311	1,964	Belly River quicksand	Soft, clear	42	D, S	Supplies house and 30 head stock. #.
1	NW.	3	25	28	3	Dug	2	2,400	0	2,400			Glacial drift	Hard, clear	42	D, S	Sufficient for 100 head stock.
2	SE.	6	"	"	"	Dug	29	2,300	- 20	2,280	29	2,271	Glacial sand	Hard, clear	42	D, S	Supplies 15 head stock. A bored well 30 feet deep. Not used now.
3	SW.	7	"	"	"	Dug	35	2,395	- 29	2,266	35	2,260	Glacial sand	Soft, clear	41	D, S	Sufficient supply.
4	SW.	9	"	"	"	Dug	8	2,375	- 6	2,369	6	2,369	Glacial sand	Soft, clear	41	D, S	Supplies 20 head stock.
5	NE.	9	"	"	"	Dug	15	2,430	- 13	2,417	13	2,417	Glacial gravel and sand	Medium hard, clear	41	D, S	Insufficient supply for 8 head stock. Another well with small supply.
6	NW.	15	"	"	"	Bored	35	2,465	- 29	2,436	35	2,430	Glacial quicksand	Hard, clear, "alkaline"	42	D, S	Sufficient for 35 head stock.
7	NE.	16	"	"	"	Dug	19	2,465	- 16	2,449	16	2,449	Glacial sand	Hard, clear	43	D	Just sufficient for house use. Another well for stock.
8	SW.	18	"	"	"	Dug	13	2,405	- 8	2,397	8	2,397	Glacial sand and gravel	Medium hard, clear	41	D, S	Sufficient for 50 head stock.
9	SW.	19	"	"	"	Dug	28	2,475	- 20	2,455	20	2,475	Glacial sand	Hard, clear, "alkaline"	43	D, S	Insufficient for 6 head stock. Laxative on humans.
10	SE.	33	"	"	"	Bored	68	2,510	- 66	2,444	66	2,444	Glacial gravel	Hard, clear	42	D, S	Insufficient supply for more than 5 head stock.
11	NE.	33	"	"	"	Bored	85	2,500	- 71	2,429	85	2,415	Glacial drift	Hard, clear	42	D, S	Sufficient for 15 head stock.
12	NW.	33	"	"	"	Dug	19	2,510	- 10	2,500	19	2,491	Glacial quick-sand	Hard, clear	41	D, S	Just water 23 head stock. A similar well.
1	NE.	1	25	29	3	Bored	40	2,290	- 30	2,260	40	2,250	Glacial sand	Soft, clear	42	D, S	Sufficient for 40 head stock.
2	SE.	2	"	"	"	Bored	18	2,335	- 10	2,325	10	2,325	Glacial grey sand	Hard, clear	42	D, S	Sufficient for 10 head stock.
3	SW.	3	"	"	"	Bored	85	2,390	- 60	2,330	85	2,305	Glacial drift	Hard, clear		D, S	Sufficient for 30 head stock.
4	NE.	4	"	"	"	Bored	51	2,380	- 43	2,337	51	2,329	Glacial black sand	Hard, clear, "alkaline"	43	D, S	Sufficient for 50 head stock.

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 MANTARIO, NO. 262, 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
5	NW.	9	25	29	3	Bored	30	2,470	- 28	2,442	28	2,442	Glacial gravel	Soft, clear	43	D, S	Insufficient supply for 5 head stock.
6	SE.	9	"	"	"	Dug	9	2,385	- 5	2,380	5	2,380	Glacial drift	Hard, clear	41	D, S	Sufficient for 20 head stock.
7	SW.	10	"	"	"	Bored	100	2,470	- 90	2,380	100	2,370	Glacial drift	Hard, clear, "alkaline"	42	D, S	Insufficient supply; a 12-foot well with small supply of soft water.
8	NE.	10	"	"	"	Dug	11	2,530	- 9	2,521	9	2,521	Glacial sand	Hard, clear	42	D	Insufficient supply. A 90-foot well with small supply not used.
9	SW.	12	"	"	"	Bored	70	2,390	- 58	2,332	70	2,320	Glacial drift	Hard, clear	42	D, S	Sufficient for 20 head stock. A bored well 90 feet deep. Water "alkaline";used for stock.
10	SW.	15	"	"	"	Dug	7	2,447	- 4	2,443	4	2,443	Glacial sand	Soft, clear	41	D, S	Sufficient for 40 head stock.
11	SW.	16	"	"	"	Bored	65	2,485	- 62	2,423	62	2,423	Glacial gravel	Hard, clear		D, S	Just sufficient for house. Several dry holes 120 feet deep.
12	SE.	24	"	"	"	Dug	13	2,460	- 9	2,451	9	2,451	Glacial sand	Soft, clear		S	Sufficient for 13 head stock. A 16-foot well, small supply for house.
1	NE.	1	26	27	3	Drilled	288	2,271	- 75	2,196	288	1,983	Belly River fine white sand	Soft, clear	41	D, S	Sufficient supply.
2	SW.	2	"	"	"	Dug	16	2,276	- 12	2,264	12	2,264	Glacial sand	Hard, clear	44	D	Sufficient for house. A 14-foot well; insufficient. Used for stock.Several dry holes.
3	NE.	5	"	"	"	Dug	21	2,269	- 20	2,249	20	2,249	Glacial drift	Hard, clear	44	D, S	Insufficient supply. A 21-foot well with small supply. Water hauled.
4	SE.	5	"	"	"	Dug	18	2,200	- 15	2,185	15	2,185	Glacial quick-sand	Hard, clear		D, S	Barely sufficient for 8 head stock. An intermittent well dry at present.
5	SE.	7	"	"	"		26										Dry hole.
6	NE.	8	"	"	"	Drilled	300	2,232			300	1,932	Belly River				Small supply; 3 other wells 17, 20 and 15 feet deep; small supplies of water.
7	SE.	8	"	"	"		50										Dry hole 50 feet deep also a dry hole 20 feet deep, All water hauled.
8	NE.	9	"	"	"	Dug	22	2,332	- 14	2,318	14	2,318	Glacial sand and gravel	Hard, iron, clear	42	D, S	Sufficient for house and 20 head stock. Dugout used on SE.¼, sec. 16, twp.26,rge 27.
9	SE.	9	"	"	"	Dug	18	2,359	- 16	2,343	16	2,343	Glacial quick-sand	Hard, clear		D, S	Insufficient supply.
10	NW.	14	"	"	"	Bored	100	2,232					Glacial sand	Hard, clear		D, S	Insufficient supply. Waters 14 head stock.
11	NE.	15	"	"	"		192	2,250			192	2,058	Glacial drift			D, S	Probably sufficient supply. #.
12	NW.	19	"	"	"		90	2,257					Glacial drift			S	Large supply.
13	SE.	19	"	"	"		17	2,267	- 15	2,252	15	2,252	Glacial sand	Hard, iron, clear	43	D, S	Sufficient for house and 15 head stock.
14	SW.	20	"	"	"	Dug	28	2,240	- 25	2,215	25	2,215	Glacial quick-sand	Soft, clear	40	D, S	Sufficient for 12 head stock. Several dry holes to 47 feet near house.
15	NE.	22	"	"	"	Drilled	274	2,249	-100	2,149	274	1,975	Belly River	Soft, clear	41	D, S	Large supply for 50 head stock. #.
16	SW.	25	"	"	"	Dug	56	2,271			56	2,215	Glacial drift	Hard, clear		D, S	Sufficient for 15 head stock. Also use a spring.
17	NW.	26	"	"	"	Drilled	266	2,267			266	2,001	Belly River(?) sand	Hard, rusty		D, S	Sufficient for 10 head stock. #. 7 dry holes up to 132 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 MANTARIO, NO. 262, 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
18	NE.	27	26	27	3		30										Dry hole in glacial drift.
19	SE.	28	"	"	"	Dug	115	2,225	-107	2,118	115	2,110	Glacial fine blue sand	Hard, iron, clear	42	D, S	Sufficient supply.
20	NE.	30	"	"	"	Bored	36	2,289	- 35	2,254	35	2,254	Glacial quicksand	Hard, clear	40	D, S	Sufficient supply. Neighbours haul from here.
21	NW.	30	"	"	"	Dug	32	2,266	- 26	2,240	26	2,240	Glacial quicksand	Hard, clear	40	D, S, I	Sufficient for house and 10 head stock.
22	SE.	30	"	"	"	Dug	18	2,258	- 16	2,242	16	2,242	Glacial drift	Hard, clear	40	D, S	Insufficient supply. A 112-foot well for stock. Water very "alkaline".
23	NW.	31	"	"	"	Dug	27	2,250	- 24	2,226	24	2,226	Glacial quicksand	Hard, clear	41	D, S	Sufficient for house and 15 head stock.
24	SW.	32	"	"	"	Dug	45	2,340	- 42	2,298	42	2,298	Glacial drift	Soft, clear	42	D, S	Insufficient for 5 head stock.
25	NE.	33	"	"	"	Drilled	328	2,265	-228	2,037	328	1,937	Belly River sand	Hard, clear, soda taste	42	D, S	Sufficient for 15 head stock. Laxative on humans. #.
26	NW.	33	"	"	"	Bored	150										Dry hole. 7 other dry holes.
27	SW.	34	"	"	"	Drilled	294	2,250	- 90	2,160	294	1,956	Belly River quicksand	Medium hard, iron, clear, soda		S	Sufficient supply. Water has been condemned. #.
28	NE.	36	"	"	"	Drilled	339	2,360	- 72	2,288	339	2,021	Belly River	Soft, clear		D, S	Sufficient supply. #.
1	NE.	2	26	28	3	Dug	6	2,240	- 1	2,239	1	2,239	Glacial sand	Hard, clear	42	D, S	Sufficient for 100 head stock.
2	NE.	3	"	"	"	Dug	12	2,300	- 4	2,296	4	2,296	Glacial gravel	Hard, clear	42	D, S	Sufficient for 5 head stock.
3	SW.	11	"	"	"	Dug	9	2,240	- 2	2,238	2	2,238	Glacial sand	Hard, clear, "alkaline"	42	D, S	Large supply.
4	NW.	14	"	"	"	Dug	6	2,220	+ 1	2,221	6	2,214	Glacial sand	Medium hard, clear	41	D, S	Sufficient; large supply.
5	NE.	20	"	"	"	Dug	4	2,220	- 1	2,219	1	2,219	Glacial sand	Hard, clear	42	D, S	Sufficient for 25 head stock. A flowing spring also.
6	SE.	22	"	"	"	Dug	9	2,230	- 6	2,224	6	2,224	Glacial drift	Hard, clear		D	Sufficient for house. Spring for stock.
7	SE.	24	"	"	"	Bored	90	2,240	- 88	2,152	88	2,152	Glacial quicksand	Hard, iron, cloudy, "alkaline"		D, S	Insufficient supply. Several springs.
8	SE.	25	"	"	"	Bored	90	2,260			90	2,170	Glacial quicksand	Hard, clear		N	Sufficient for 10 head stock.
9	E.½	30	"	"	"	Dug	16	2,220	- 8	2,212	8	2,212	Glacial sand	Hard, clear	42	D, S	Good supply. Use a spring to water most of stock.
10	SW.	33	"	"	"	Dug	3	2,190	- 1	2,189	1	2,189	Glacial sand	Hard, clear	42	D	Sufficient for house. A spring on side of a hill flows 3 gallons a minute.
11	NE.	36	"	"	"	Dug	42	2,275					Glacial sand	Hard, clear		D, S	Only sufficient for house. 18 dry holes, two 130 feet deep.
12	SW.	36	"	"	"		24						Glacial drift	Hard, clear			Large supply.
1	NW.	4	26	29	3	Bored	70	2,530	- 40	2,490	70	2,460	Glacial sand	Hard, clear	42	D, S	Sufficient for 50 head stock.
2	SW.	9	"	"	"	Dug	16	2,500	- 12	2,488	12	2,488	Glacial quicksand	Hard, clear	41	D, S	Sufficient for 30 head stock.
3	SE.	13	"	"	"	Dug	22	2,400	- 20	2,380	20	2,380	Glacial quicksand	Hard, clear		D	Insufficient supply. A 12-foot well used for stock.

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 ONTARIO, NO. 262, 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
4	SW.	15	26	29	3	Dug	18	2,470	- 15	2,455	15	2,455	Glacial drift	Hard, clear	42	D	Only sufficient for house.
5	NW.	15	"	"	"	Dug	16	2,420	- 14	2,406	14	2,406	Glacial sand	Hard, clear	42	D	Only sufficient for house use.
6	NE.	22	"	"	"	Bored	60	2,390	- 50	2,340	60	2,330	Glacial sand	Medium hard, clear	42	D	Only sufficient for house.
7	SW.	24	"	"	"	Bored	140	2,397	-125	2,272	140	2,257	Glacial sand	Hard, clear, soda	42	D, S	Sufficient supply.
8	SW.	27	"	"	"	Dug	15	2,365	- 10	2,355	10	2,355	Glacial sand	Hard, clear, "alkaline"	42	D, S	Sufficient for 24 head stock.
9	SE.	28	"	"	"	Bored	65	2,430	- 43	2,387	65	2,365	Glacial sand	Hard, clear	43	D, S	Sufficient for 18 head stock.
10	NE.	28	"	"	"	Drilled	365	2,435	-185	2,250	365	2,070	Belly River sand	Soft, clear, soda	44	D, S	Large supply.
11	SW.	35	"	"	"	Bored	135	2,385	-125	2,260	125	2,260	Glacial sand and gravel	Hard, clear, "alkaline"	42	S	Insufficient supply. Only supplies 10 head stock.
1	NW.	2	27	27	3	Bored	76	2,258	- 56	2,202			Glacial drift	Hard, clear	41	D, S, I	Just sufficient for house and 17 head stock. A 108-foot well. Several dry holes.
2	NE.	3	"	"	"	Drilled	328	2,258					Belly River	Hard, iron, clear		D, S	Sufficient for stock and house.
3	NW.	5	"	"	"	Dug	22	2,250					Gladail quick-sand	Hard, clear	40	D, S	Sufficient for 15 head stock.
4	NE.	7	"	"	"	Drilled	328	2,315					Belly River	Medium hard, clear		D, S	Sufficient for 21 head stock.
5	NE.	11	"	"	"	Bored	57	2,289	- 42	2,247			Glacial drift	Hard, clear	41	D, S, I	Sufficient for 20 head stock.
6	SE.	14	"	"	"	Drilled	300	2,261	- 90	2,171			Belly River	Hard, brown		S, I	Sufficient for stock. #.
7	SE.	14	"	"	"	Bored	65	2,266	- 62	2,204			Glacial drift	Hard, clear		D, S	Sufficient for house.
8	NW.	16	"	"	"	Bored	100	2,400	- 97	2,303	97	2,303	Glacial black sand	Hard, clear, iron		D, S	Sufficient for 50 head stock. A 17-foot well also. Several wells in quicksand.
9	NE.	15	"	"	"		65		- 35				Glacial drift	Hard, clear	41	D, S	Sufficient for house and 25 head stock. Well in old lake bed. Water enters quickly.
10	SE.	16	"	"	"	Dug	20	2,374	- 16	2,358	16	2,358	Glacial sand	Hard, clear	41	D, S	Sufficient for 25 head stock.
11	SE.	18	"	"	"	Dug	14	2,372	- 12	2,360	12	2,360	Glacial sand	Hard, clear	45	D, S	Large supply. Another well in valley for stock use only.
12	NE.	20	"	"	"	Bored	30	2,363	- 26	2,337	26	2,337	Glacial drift	Hard			House abandoned.
13	NE.	23	"	"	"	Dug	35	2,261	- 30	2,231			Glacial quick-sand	Hard	41	D	Sufficient for house.
14	NE.	23	"	"	"	Bored	65	2,266	- 35	2,231			Glacial gravel and coarse sand	Hard, clear	40	D, S	Sufficient for 35 head stock.
15	SW.	24	"	"	"	Dug	14	2,284	- 10	2,274	10	2,274	Glacial drift	Very hard	43		
16	NE.	26	"	"	"	Bored	90	2,256	- 60	2,196			Glacial gravel	Hard, clear, "alkaline"	41	D, S	Sufficient for 30 head stock. A 27-foot well. Fair supply of poor water.
17	NW.	27	"	"	"	Dug	20	2,270	- 19	2,251	19	2,251	Glacial quick-sand	Soft, clear	42	D, S	Sufficient for house and 40 head stock. Another well with small supply.
18	NE.	28	"	"	"	Dug	65	2,300					Glacial gravelly sand	Hard, clear		D, S	Sufficient for 35 head stock.
19	NE.	29	"	"	"	Spring							Glacial drift	Hard		S	Large supply from spring.

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 MANTARIO, NO. 262, 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	SW.	30	27	27	3	Dug	23	2,378	- 21	2,357			Glacial drift	Hard, clear	43		Sufficient supply.
21	NW.	32	"	"	"	Dug	28	2,405	- 27	2,378			Glacial gravel	Hard, "alkaline"		S	Sufficient for house and 4 head stock. A 62-foot well and a 12-foot well; fair supply. A 115-foot dry hole.
22	NW.	34	"	"	"	Dug	30	2,367									Dry hole in glacial drift.
23	SW.	34	"	"	"	Dug	42	2,259	- 30	2,229			Glacial drift	Hard, "alkaline"	50	D, S	Sufficient for 15 head stock. A 9-foot well supplies here.
24	SE.	35	"	"	"	Bored	30	2,269	- 24	2,245	24	2,245	Glacial gravelly sand	Very hard, clear	42	D, S	Sufficient for house and 20 head stock.
25	NW.	36	"	"	"	Bored	110	2,330	- 80	2,250	110	2,220	Glacial gravel	Hard, iron, clear		D,S	Sufficient for house and stock. Another 110-foot well.
1	NE.	6	27	28	3	Bored	70	2,300	- 68	2,232	68	2,232	Glacial sand	Hard, cloudy	50	D, S	Insufficient supply.
2	NW.	14	"	"	"	Dug	3	2,170	+ 1	2,171	3	2,167	Glacial drift	Hard, clear, iron		D, S	Sufficient supply. 3 gallons a minute.
3	NW.	17	"	"	"	Dug	2	2,160	0	2,160			Glacial sand	Hard, iron, clear	43	D,S	Oversufficient. 3 gallons a minute.
4	NE.	18	"	"	"	Dug	9	2,240	- 4	2,236	4	2,232	Recent Alluvium quicksand	Hard, iron, clear	41	D, S	Insufficient in winter for 18 head stock.
5	NW.	18	"	"	"	Dug	30	2,280	- 27	2,253	36	2,244	Glacial sand	Soft, clear	42	D, S	Sufficient supply.
6	NE.	27	"	"	"	Dug	26	2,140	- 16	2,124	16	2,124	Glacial sand	Medium hard, clear	41	D, S	Insufficient supply. Also a number of small springs.
7	NE.	31	"	"	"	Dug	3	2,190	+ 1	2,191	3	2,187	Glacial sand	Hard, clear	43	D, S	14 gallons a minute.
8	NE.	31	"	"	"	Dug		2,190	0	2,190			Glacial sand	Medium hard, clear	43	D, S	32 gallons a minute.
9	NW.	36	"	"	"	Dug	15	2,205	- 7	2,198	7	2,198	Glacial sand	Soft, clear	41	D, S	Sufficient for 16 head stock.
1	SW.	2	27	29	3	Bored	120	2,370	-118	2,252	118	2,252	Glacial quicksand	Hard, clear	43	D	Insufficient supply. Only enough for house.
2	SW.	11	"	"	"	Dug	55	2,320	- 50	2,160	50	2,160	Glacial quicksand	Soft, clear	43	D, S	Insufficient supply. Supplies 18 head stock.
3	NW.	23	"	"	"	Dug	10	2,310	- 7	2,303	7	2,303	Glacial sand	Hard, clear	41	D, S	Waters 16 head stock. Insufficient.
4	SW.	25	"	"	"	Dug	105	2,355	-102	2,253	102	2,253	Glacial sand	Hard, clear	41	D, S	Insufficient . Waters 8 head stock.
5	NE.	27	"	"	"	Dug	24	2,300	- 22	2,278	22	2,278	Glacial sand	Hard, clear, "alkaline"	43	D	Only sufficient for house.
6	SE.	34	"	"	"	Dug	9	2,265	- 6	2,259	6	2,259	Glacial sand	Hard, clear	43	D, S	Only waters 6 head stock.

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.