CANADA
DEPARTMENT OF MINES

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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF PRAIRIEDALE No. 321 SASKATCHEWAN

BY

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

Water Supply Paper No. 219

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

Publication of Results

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

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

How to Use the Report

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

If one intends to sink a well and wishes to find the approximate depth to a water-bearing horizon, he must learn: (1) the elevation of the site, and (2) the probable elevation of the water-bearing bed. The elevation of the well site is obtained by marking its position on the map, Figure 2, and estimating its elevation with respect to the two contour lines between which it lies and whose elevations are give 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 coteau. The thickness of the formation seldom exceeds 40 feet.

Bearpaw Formation. The Bearpaw consists mostly of incoherent dark grey to dark brownish grey, partly bentonitic shales, weathering light grey, or, in places where much iron is present, buff. Beds of sand occur in places in the lower part of the formation. It forms the uppermost bedrock formation over much of western and southwestern Saskatchewan and has a maximum thickness of 700 feet or somewhat more.

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The Rural Municipality of Prairiedale, No. 321 comprises an area of 216 square miles and consists of six townships described as tps. 31, 32, and 33, ranges 25 and 26, W. 3rd, mer. The southern four townships, an area of 144 square miles, were investigated by the field party in 1935 and are covered in this report. The centre of the area under discussion lies approximately 19½ miles east of the Alberta boundary and 186 miles north of the International Boundary line. A branch line of the Canadian National railways runs across the southern part of the area, and on it are located the village of Smiley and the hamlet of Dewar Lake.

The lowest elevation of approximately 2,200 feet above sea-level occurs in the valley in the southeastern corner of the municipality. From this point the elevation rises rapidly to 2,275 feet at the top of the valley and then more gradually to over 2,400 feet in the northeastern and western parts of the area. Coulées and small gullies are present in the southern part of the municipality. The surface of the township is rolling. A number of small lakes or sloughs are encountered in the northern half of the area. Recent deposits of lake silts and sands mantle a narrow area in the southeastern corner. Moraine covers narrow strips of territory in the southern, central, and northwestern parts of the municipality. The remainder of the municipality is overlain by boulder clay or glacial till.

It has been impossible to outline any general and continuous water-bearing horizons in this area. If the report is studied in close conjunction with the accompanying map and table of well records it should be possible, however, to select a well-site where the possibilities of obtaining water are fairly good.

Water-bearing Horizons in the Unconsolidated Deposits

The deposits of Recent lake silts that form the floor of a small valley in the southeastern corner of the area have been prospected to some extent, and they are believed to contain a considerable supply of water. The water is encountered in deposits of sand and gravel that underlie 10 to 15 feet of silt. Springs are also common in this area. The water varies from moderately soft to hard and some of it is too highly mineralized to be used for domestic purposes.

No difference can be noted in the ground water conditions in the areas covered by moraine and those covered by boulder clay or glacial till. These glacial deposits contain water-bearing deposits of sand and gravel in the weathered or oxidized zone, and also in the unweathered, compact clay that underlies the oxidized zone.

A number of wells have been sunk near sloughs or undrained depressions and in years of normal rainfall this type of well may yield a supply that is sufficient for local needs. The yield, however, is easily affected by drought conditions and in seasons of little precipitation the supply from such wells may decrease until it is adequate only for domestic needs. The supply available from such wells in dry periods can be increased slightly by deepening the well to offset any lowering of the water table and furnish a reservoir in which the available water may collect. A small dam or a dugout to retain sufficient run-off water for stock needs can be advantageously employed in conjunction with the seepage wells mentioned above. In this manner it should be possible to obtain sufficient water for local needs.

A few wells in the area are obtaining their supplies from pockets of sand and gravel that occur at or near the base of the weathered or oxidized zone of the glacial drift. No continuity in the occurrence of the pockets can be noted and dry holes may be dug before a producing well is obtained. The deposits appear to be more numerous in some areas than in others as indicated by the wells shown on Figure 2 of the accompanying map and in the table of well records. Considerable time and expense can be saved if the upper part of the drift is prospected by means of a small auger, as in this way it is often possible to locate a water-bearing deposit before a final choice of a well-site is made. The yield from the shallow wells varies considerably, as does the quality of the water.

Most of the wells in the area under discussion draw their supplies from deposits of sand and gravel that occur in the lower or unweathered zone of the drift, at depths ranging from 40 to 130 feet or more below the surface. These deposits may form continuous horizons over very small areas. a few holes have been dug without encountering this water-bearing horizon, but it should be possible to obtain water from these depths throughout most of the municipality. The water is hard and that from a few wells contains such a concentration of mineral salts in solution that it cannot be used for drinking. The yield from the different wells varies considerably and in some localities the supply must be supplemented by the use of dams or dugouts, or by hauling water from wells yielding an abundant supply.

Water-bearing Horizons in the Bedrock

The Bearpaw formation is assumed to immediately underlie the drift in the area to the northeast of the geological boundary shown on Figure 1, and the Belly River formation underlies the drift to the southwest of the boundary, and also underlies the Bearpaw formation. The Bearpaw formation is probably very thin in this area and in some wells it may have been passed through. The surface of the bedrock is apparently very uneven as it is encountered at depths varying from 75 to at least 150 feet below the surface, which is only slightly rolling.

Most of the wells in this area that are assumed to be drawing their supply from the bedrock probably tap aquifers in the lower part of the Bearpaw or in the upper part of the Belly River formation. It is very difficult to establish the position of the contact between the two formations. The aquifers in the bedrock do not appear to be of large areal extent, and no definite areas can be outlined in which it is possible to obtain water from the bedrock.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 31, Range 25

The water supply in this township is obtained from dams, springs, and sloughs and from wells that are sunk into the Recent and glacial deposits and also into the underlying bedrock. Recent deposits of sand and silt occur in the ravine in the southeastern corner of the township. Small areas in the northwestern and southwestern parts are mantled by moraine and the remainder of the area is covered by boulder clay. The ground surface is gently rolling and the elevation rises from the southeast to the northwest.

The Recent deposits along the floor of the ravine in the southeastern corner of the township have not been extensively prospected, but a few wells dug in these deposits obtain small amounts of highly mineralized water from depths of less than 20 feet below the surface. The water has been used for domestic purposes, but it is generally only used for stock. No difficulty should be experienced in obtaining small supplies of water from these deposits. A number of springs are found along the ravine and they are also used for stock. The quantity of water from these springs can be increased by means of collecting galleries, and by digging out and cribbing the springs.

The moraine and boulder clay consists of a few feet of top soil containing boulders; 20 to 30 feet or more of weathered boulder clay in which a few pockets of sand and gravel occur; and a compact, unweathered, blue boulder clay that contains numerous pockets of sand and gravel and extends to the bedrock. Undrained depressions are present in the moraine-covered areas. Shallow wells sunk in the vicinity of these depressions often yield a sufficient supply of water for domestic needs and a few head of stock.

No wells in this township are deriving water from the weathered zone of the glacial drift. Pockets of sand or gravel doubtless occur in this zone, but they have not been encountered by any wells. Farmers contemplating digging shallow wells are advised to prospect with a small hand auger before selecting a well site, as by so doing a pocket of water-bearing sand or gravel may be located at a minimum of expense.

Most of the wells in this township derive their supply of water from pockets of sand and gravel in the unweathered zone of the glacial drift. The wells vary in depth from 45 to 150 feet. In an area that includes parts of sections 19, 20, 21, 22, and 28, the pockets appear to be of common occurrence, but over the remainder of the area they are of local distribution. The wells located on sections 23, 31, and 35 may be obtaining part of their supply from the upper part of a bedrock formation, but the remainder of the wells included in this group are thought to obtain their supplies from the unconsolidated deposits. No great difficulty should be experienced in obtaining water in this township as no dry holes deeper than 40 feet have been recorded. The water from most of the wells is hard, highly mineralized, and under some hydrostatic pressure. In the southern half of the area some of the water is used only for stock, but in the northern half there is only one well that is not being used for domestic purposes.

A few dams have already been built and other sites exist where they could be advantageously erected. A supply of water that is often sufficient for stock use throughout the year can be impounded by these dams. In many places it is possible to obtain sufficient water for domestic purposes by digging a shallow well close to the body of water impounded by the dam. Care must be taken, however, to see that the water does not become polluted.

The Bearpaw formation immediately underlies the drift over most of this township, but a small area in the southwestern corner is underlain by the Belly River formation. The Bearpaw formation is not thought to be of great thickness. It is thought that sand deposits of the Belly River formation form the aquifers of the three wells located in sections 2, 3, and 10. These wells are sunk to depths of 125, 107, and 125 feet, respectively, and the aquifers are tapped at elevations of 2, 155, 2, 167, and 2,155 feet above sea-level. Coal was reported in the well on section 2, but it was not encountered in the others. The same aquifer, however, appears to be common to the three wells. Its areal extent is not defined, but it should be encountered by other wells sunk in the vicinity of the producing wells. The yield from the individual wells is more than sufficient for local needs and although the water is hard and highly mineralized it has been found suitable for domestic purposes as well as for stock.

A well located on the NW.$\frac{1}{4}$, section 23, was sunk to a depth of 150 feet below the surface and encountered an aquifer at an elevation of 2,145 feet above sea-level. The well may be drawing its water supply from the Bearpaw formation or it may tap an aquifer in the underlying Belly River formation. The areal extent of this aquifer is unknown, but it should be encountered in the vicinity of the producing well. The hydrostatic pressure is sufficient to raise the water 140 feet above the top of the aquifer and the yield is more than sufficient for local requirements. The water is hard and highly mineralized, but it is suitable for domestic purposes.

Township 31, Range 26

The chief source of ground water in this township is from wells sunk into the glacial drift and into the underlying bedrock. Sloughs, dams, dugouts, springs, and seepage wells are not uncommon and they are used to supplement the supply from the wells.

The greater part of this township is covered by boulder clay or glacial till, two small areas in the south-east corner and along the eastern border being mantled by moraine. The ground surface of the glacial till-covered area is fairly level, but in the southern part of the township a depression, bounded approximately by the 2,300-foot contour line and in some places attaining a depth of 50 feet, trends in a southeast and south direction to cross the southern boundary of the township at its centre. Several ravines drain into this main depression.

The springs that are found along the valley and ravines yield small supplies of water that can be used for stock. The yield can be appreciably increased by digging small reservoirs around the springs.

A number of wells in this township obtain small amounts of water from shallow seepage wells that are sunk in the vicinity of sloughs or undrained depressions. The supply from these wells varies with the amount of water contained in the slough, but in years of normal rainfall the yield is sufficient for domestic purposes and a few head of stock. It is advisable to test with a small hand auger in the vicinity of the depressions before sinking a well, although a water-bearing pocket can almost always be encountered if the depression contains water.

The boulder clay and moraine deposits are very similar. A general section consists of 2 to 4 feet of dark, heavy loam; a weathered deposit of light-coloured boulder clay that in the southern part of the area contains a fairly large number of boulders; and a dark-coloured, compact, unweathered boulder clay that extends to the bedrock. A few wells derive water from pockets of sand that occur in the weathered zone of the drift. The pockets are not numerous and they do not form a continuous water-bearing horizon.

Wells sunk in or near the small valleys should tap deposits of sand and gravel at shallow depths, but these areas have not been fully investigated. Considerable time and expense can be saved if the upper part of the drift is prospected for water-bearing deposits by means of a small auger before a well-site is finally selected. The supply from wells sunk into the weathered zone of the drift varies widely and depends upon the size of the pocket tapped, the size of the well, and the amount of annual precipitation. The yield is generally sufficient for local needs and the water has been found suitable for domestic purposes.

Most of the wells in this township obtain their water supply from pockets of sand that are scattered throughout the unweathered zone of the glacial drift at depths of 45 to 115 feet. These pockets do not form a continuous water-bearing horizon and holes have been made on section 10 to depths of 75 and 125 feet below the surface without encountering water. Little trouble should be experienced, however, in obtaining water at depths of 45 to 115 feet. The yield from the wells tapping these pockets of sand and gravel varies and a number of the wells must have their supply supplemented by a second well, a dam or by hauling. The water is hard and highly mineralized and that from a few wells is used only for stock.

Four wells located in the SW.$\frac{1}{4}$, section 1, the SE.$\frac{1}{4}$, section 2, the SW.$\frac{1}{4}$, section 9, and the SW.$\frac{1}{4}$, section 12, are assumed to be drawing at least part of their water supply from aquifers in the bedrock. In this part of the township the bedrock immediately underlying the glacial deposits is thought to be the Belly River formation. The wells are sunk to depths of 60 to 150 feet below the surface and the aquifers are tapped at elevations varying from 2,184 to 2,250 feet above sea-level. It does not appear probable that one aquifer is common to the four wells, but there does appear to be some correlation in the aquifers of the two wells in sections 1 and 2. The remaining two wells are probably drawing their supply from aquifers of small areal extent. The number of wells sunk into the bedrock is not large enough to allow the outlining of continuous water-bearing horizons, but the possibilities of obtaining water for stock use from the bedrock in this township are considered good.

The topography in the southern part of the township offers favourable locations for the construction of small dams, and the character of the soil throughout the township is suitable for the retention of water in dugouts. By these means surface water can be conserved for stock use. To insure a supply of water that will last during drought periods and winters, the dams and dugouts should be made large, and of sufficient depth to hold 12 feet of water. Shallow seepage wells can be sunk beside the dugouts or dams, and if protected from contamination the water from them can be used for domestic purposes.

Township 32, Range 25

Water supplies in this township are obtained from wells, springs, dams, and sloughs. The supply is fairly abundant and the water from most of the wells can be used for domestic purposes. The wells have been sunk in both the moraine and boulder clay. Small areas in the northeastern and southwestern parts of the area are mantled by moraine, and the remainder of the township is covered by boulder clay. In the northeastern and western parts of the township the ground surface is somewhat rolling, whereas that of the central and southern areas is comparatively level. The deposits of moraine and boulder clay generally consist of a few feet of sandy or clayey top-soil containing boulders; a weathered zone of light-coloured clay in which may occur a few pockets of sand and gravel; and non-weathered, blue clay that is known to extend in some areas to a depth of 150 feet below the surface, and in which occur pockets of sand and gravel at varying depths.

A few wells probably derive water from the sand and gravel pockets in the weathered zone of the glacial drift, but most of the wells are obtaining their supply from the scattered pockets of sand and gravel that occur in the unweathered clay. The wells range from 40 to 140 feet in depth. The aquifers tapped by four wells located in sections 20, 28, and 29, show some correlation and one aquifer may be common to these wells, but in general no relationship is evident in the occurrence of the pockets and no general or continuous water-bearing horizons can be outlined. It should not be difficult, however, to obtain water in this township as no dry holes have been recorded, but since the pockets of water-bearing sand or gravel are discontinuous dry holes may be dug before a producing well is obtained. In general the supply from these wells is adequate and usually more than sufficient for local needs. The water is usually under some hydrostatic pressure. It varies from moderately soft to hard and in most instances it can be used for domestic purposes as well as for stock.

One well located on section 10 obtains water from fine, yellowish grey sand at a depth of 66 feet below the surface, or at an elevation of 2,218 feet above sea-level. It is not known if this well is deriving its water from the glacial drift or from the upper part of the Bearpaw formation. The areal extent of this aquifer is undefined, but it is not thought to be large. The water is reported soft and of good quality, and is suitable for domestic needs. The supply is adequate for domestic needs and 20 head of stock. Another well, located on section 12, tapped an aquifer at a depth of 130 feet below the surface or an elevation of 2,180 feet above sea-level. Fragments of coal were encountered in this well, but the aquifer is formed by gravel. This well is assumed to be deriving its water from the base of the glacial drift and not from the bedrock. The aquifer is not thought to be of large areal extent. The yield from the well is more than sufficient for local requirements, and the water is under sufficient hydrostatic pressure to rise to a point 80 feet above the aquifer. The water is hard, but it is suitable for domestic needs as well as for stock.

In most places where the supply from the wells is inadequate for local requirements small dams can be constructed or dugouts excavated at reasonable cost. In this way surface water may be stored and used for stock. It may be found necessary to build the dam to a height of 12 feet or excavate the dugout to the same depth in order to retain a supply of water that will last throughout the year.

Township 32, Range 26

The chief source of water supply in this township is from wells that are sunk in the glacial drift and from a few springs. Small lakes and sloughs supply water for stock during part of the year.

The wells have been sunk into both the moraine that mantles the northern part of the township and into the boulder clay that covers the remainder of the area. The ground surface of the moraine-covered area is rolling and is characterized by undrained depressions or "alkali" flats, whereas that of the boulder clay or glacial till-covered area is fairly level. A shallow valley trends in an east to west direction throughout the township, and it is joined near the centre of the township by a deep, wide ravine that trends in a northeasterly direction. The possibilities of obtaining water appear to be somewhat better in the area covered by moraine than elsewhere, but the materials forming the moraine and the glacial till are quite similar in character. The top soil in the western part is sandy, in the central part a heavy clay loam, and in the eastern part a lighter clay loam. Stones are not uncommon throughout the area. Below the top soil a weathered or oxidized, light-coloured clay occurs and it contains a few scattered pockets of sand at or near its base. This in turn is underlain by unweathered blue clay that also contains pockets of sand and gravel. Throughout this township the Bearpaw formation is thought to immediately underlie the glacial drift.

Along the main depression or valley and its tributaries, a number of springs occur and they yield highly mineralized water that is suitable for stock but which cannot be used for domestic purposes. The supply from these springs can be appreciably increased by digging out and cribbing the spring. It should be possible to obtain water from the deposits in the floors of the ravines, but it is probable that the waters would be too highly mineralized for domestic use. The same would probably be true of a few of the wells dug near the depressions or "alkali" flats.

A few wells tap the scattered pockets of sand that occur at or near the base of the weathered zone of the drift. These pockets do not form a continuous water-bearing horizon and dry holes will no doubt be dug before a producing pocket is encountered. The supply from these wells varies considerably and two of the four wells included in this group yield an insufficient supply. A well in the NE.$\frac{1}{4}$, section 32, is used for both domestic needs and stock, but the water from the other wells is too highly mineralized for domestic purposes. Farmers who contemplate digging a shallow well are advised to prospect the upper part of the drift with a small auger before selecting a well-site.

Most of the wells in this township draw their supplies from scattered pockets of sand and gravel at depths of 40 to 130 feet. Dry holes were dug to depths of 30, 100, and 126 feet on section 20 without encountering water-bearing deposits. It should be possible, however, to obtain water in most localities in this township at depths of less than 100 feet. The supply of water from the wells is not abundant and the waters vary considerably in quality. The water from some of the wells is too highly mineralized to be used for domestic purposes, but it is suitable for stock. In a number of localities drinking water is hauled. In certain areas where the supply is inadequate, water for stock use must also be hauled. It would appear advisable to excavate dugouts for the storage of surface water for stock. In some areas the topography may be more favourable for the construction of small dams.

Two wells, one located on section 14 and the other on section 24, are sunk to depths of 100 and 75 feet below the surface, respectively, and tap aquifers at elevations of 2,289 and 2,250 feet above sea-level. It is possible that this water-bearing deposit lies within the upper part of the Bearpaw formation, but it is more probable that the aquifers occur at the contact of the drift and bedrock. It is not known if the same aquifer is common to both wells or if they tap individual pockets of sand. The well on section 24 yields 60 barrels a day, whereas the well on section 14 yields only 4 barrels a day. This well may be partly clogged by sand. The water is highly mineralized and that from the well on section 14 is not used for domestic purposes.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF PRAIRIEDALE, NO.321, SASKATCHEWAN

Township	31	31	32	32	Total No. in municipality
West of 3rd meridian — Range	25	26	25	26	
Total No. of Wells in Township	46	47	27	32	152
No. of wells in bedrock	3	4	0	0	7
No. of wells in glacial drift	43	43	27	32	145
No. of wells in alluvium	0	0	0	0	0
Permanency of Water Supply					
No. with permanent supply	46	44	27	29	146
No. with intermittent supply	0	0	0	0	0
No. dry holes	0	3	0	3	6
Types of Wells					
No. of flowing artesian wells	0	0	0	1	1
No. of non-flowing artesian wells	27	25	17	16	85
No. of non-artesian wells	19	19	10	12	60
Quality of Water					
No. with hard water	43	42	22	25	132
No. with soft water	3	2	5	4	14
No. with salty water	0	0	0	0	0
No. with "alkaline" water	19	21	7	12	59
Depths of Wells					
No. from 0 to 50 feet deep	17	18	11	9	55
No. from 51 to 100 feet deep	19	20	11	20	70
No. from 101 to 150 feet deep	10	9	5	3	27
No. from 151 to 200 feet deep	0	0	0	0	0
No. from 201 to 500 feet deep	0	0	0	0	0
No. from 501 to 1,000 feet deep	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0
How the Water is used					
No. usable for domestic purposes	35	26	24	21	106
No. not usable for domestic purposes	11	18	3	8	40
No. usable for stock	44	43	27	28	142
No. not usable for stock	2	1	0	1	4
Sufficiency of Water Supply					
No. sufficient for domestic needs	46	44	27	29	146
No. insufficient for domestic needs	0	0	0	0	0
No. sufficient for stock needs	35	28	24	21	108
No. insufficient for stock needs	11	16	3	8	38

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 Prairiedale, No.321, Saskatchewan

LOCATION						Depth of	Total dis'vd	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.	well Ft.	solids	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.	NW.	23	31	25	3	150	3,490												(2)		(3)	(4)	(1)	(5)	x1(?)
2.	NW.	23	32	26	3	27	2,740												(2)		(3)	(4)	(1)	(5)	x1

Water samples indicated thus, x 1, are from glacial drift.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analyses Nos. 1, and 2, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

No samples of water from the municipality of Prairiedale were taken by the field party, but the results of two samples analysed by the Provincial Analyst at Regina are recorded on the accompanying table. Sample 2 is known to be from the unconsolidated deposits, but sample 1 may be from the base of the glacial drift, or partly or wholly from the upper part of the bedrock.

The water from wells sunk in the Recent deposits and from springs along the valley in which the Recent deposits occur, varies greatly in quality. Some of the waters are used for domestic purposes with no apparent ill effects, but generally they contain a large amount of mineral salts in solution and are used only for stock. Those waters probably contain a high concentration of sodium sulphate and magnesium sulphate.

The two samples listed in the accompanying table have a relatively high total dissolved solid content and are hard. The mineral salts occur in the same order of abundance in both samples. The waters are suitable for stock use, but they may have a strong laxative effect on people not accustomed to their use. A number of wells throughout the municipality are recorded as yielding water that is laxative. These waters probably contain a relatively large amount of sodium sulphate (Glauber's salt) and Magnesium sulphate (Epsom salts).

Although the waters from the glacial drift in this municipality are as a rule highly mineralized many of them can be used for drinking, and they are suitable for stock.

Water from the Bedrock

No samples of the water derived from the bedrock were taken for analyses. As the water-bearing horizons in the bedrock in this municipality lie near the contact of the drift, the waters will probably be similar to those obtained from the unconsolidated deposits. They may contain a higher percentage of sodium salts and may not be as hard as the waters from the drift. They are suitable for stock use and can be used for drinking in most instances without any apparent ill effects.

WELL RECORDS—Rural Municipality of PRAIRIEDALE, NO. 321, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	NW.	1	31	25	3	Dug	12	2,180	- 7	2,173	7	2,173	Glacial gravel and sand	Soft, clear	42	D, S	Sufficient for 4 head stock.
2	SE.	2	"	"	"	Bored	125	2,280	- 38	2,242	125	2,153	Belly River (?)	Hard, clear, "alkaline"	42	D, S	Sufficient for 6 head stock. Also a spring in pasture.
3	SE.	3	"	"	"	Bored	107	2,270	- 30	2,240	103	2,167	Belly River coal	Hard, clear, iron, "alkaline"	42	D, S	Oversufficient for 35 head stock.
4	NE.	6	"	"	"	Bored	80	2,325	- 75	2,250	75	2,250	Glacial sand	Hard, clear, iron, "alkaline"	42	D, S	Sufficient for only 6 head stock.
5	NW.	6	"	"	"	Bored	55	2,360	- 40	2,320	55	2,305	Glacial gravel	Hard, clear, iron	41	D, S	Sufficient for 50 head stock. Also a 16-foot well with small supply.
6	NW.	8	"	"	"	Bored	85	2,330			85	2,245	Glacial drift	Hard, clear, iron, "alkaline"	41	S	Sufficient for 20 head stock; 27-foot seepage well for house and two wells 75 and 95 feet deep.
7	SE.	8	"	"	"	Bored	59	2,295	- 20	2,275	59	2,236	Glacial gravel and sand	Hard, clear		D, S	Sufficient for 33 head stock.
8	SW.	9	"	"	"	Bored	45	2,298	- 30	2,268	45	2,253	Glacial sand	Hard, clear, iron	41	D, S	Oversufficient for local needs.
9	SW.	10	"	"	"	Bored	125	2,280			125	2,155	Belly River (?)	Hard, clear, "alkaline"	42	D, S	Sufficient for local needs.
10	SE.	12	"	"	"	Bored	70	2,240	- 50	2,190	70	2,170	Glacial sand	Hard, clear, "alkaline", iron	42	S	Sufficient for 14 head stock.
11	NE.	12	"	"	"	Dug	14	2,210	- 10	2,200	10	2,200	Glacial gravel and sand	Hard, clear, "alkaline"	42	D, S	Sufficient for 15 head stock.
12	NW.	12	"	"	"	Dug	16	2,210	- 12	2,198	12	2,198	Glacial sand	Hard, clear, "alkaline"	43	D, S	Has a spring for stock; total supply sufficient for local needs.
13	NE.	14	"	"	"	Bored	73	2,275	- 38	2,237	73	2,202	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for 50 head stock.
14	SW.	15	"	"	"	Bored	120	2,310	-104	2,206	104	2,206	Glacial drift	Hard, clear, "alkaline"	41	S	Sufficient for 40 head stock.
15	SW.	16	"	"	"	Bored		2,338					Glacial clay	Hard, clear, iron, "alkaline"	42	N	Usable for stock.
16	SW.	17	"	"	"	Bored	96	2,340	- 36	2,304	96	2,244	Glacial drift	Hard, clear, iron, "alkaline"	41	S	Sufficient for local needs.
17	SE.	18	"	"	"	Bored	47	2,370			47	2,323	Glacial sand	Hard, clear, iron, "alkaline"	41	S	Sufficient for 10 head stock.
18	SE.	19	"	"	"	Bored	70	2,350	- 38	2,312	70	2,280	Glacial sandy clay	Hard, clear, iron	42	D, S	Sufficient for 35 head stock.
19	NW.	20	"	"	"	Bored	90	2,370	- 45	2,325	90	2,280	Glacial sandy clay	Hard, clear	41	D, S	Oversufficient for 10 head stock.
20	NE.	20	"	"	"	Bored	55	2,380	- 45	2,335	65	2,315	Glacial gravel	Hard, clear, iron	41	D, S	Also has a 95-foot well; total supply sufficient for local needs.
21	NE.	21	"	"	"	Bored	88	2,350	- 40	2,310	88	2,262	Glacial drift	Hard, clear, iron, "alkaline"	41	S	Sufficient for local needs.
22	NW.	22	"	"	"	Bored	121	2,372	- 50	2,322	121	2,251	Glacial drift	Hard, clear, iron		D, S	Sufficient for 60 head stock.
23	SE.	22	"	"	"	Bored	120	2,310	- 60	2,250	100	2,210	Glacial gravel	Hard, clear, iron	42	D, S	Sufficient for 20 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 PRAIRIEDALE, NO. 321, 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	HEIGHT TO WHICH WATER WILL RISE 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
24	NW.	23	31	25	3	Bored	150	2,295	- 10	2,285	150	2,145	Belly River (?)	Hard, clear, iron, "alkaline"	42	D, S	Sufficient for local needs. #.
25	SE.	28	"	"	"	Bored	62	2,370	- 60	2,310	82	2,288	Glacial drift	Hard, clear, iron	41	D, S	Sufficient for 25 head stock.
26	SE.	30	"	"	"	Bored	80	2,385	- 66	2,319	80	2,305	Glacial sandy clay	Hard, clear	42	D, S	Sufficient for only 10 head stock. Also two wells 150 and 67 feet deep; small supply.
27	NW.	31	"	"	"	Bored	110	2,425	-100	2,325	110	2,315	Glacial sand	Hard, clear, "alkaline"	40	D, S	Sufficient for 30 head stock. Also an 80-foot well with small supply.
28	SE.	32	"	"	"	Bored	50	2,353	- 35	2,318	50	2,303	Glacial sand	Hard, clear	41	D, S	Sufficient for 12 head stock.
29	SE.	33	"	"	"	Bored	110	2,315	- 50	2,265	110	2,205	Glacial drift	Hard, clear, iron, "alkaline"	41	S	Sufficient for local needs. Also a 30-foot seepage well.
30	NE.	33	"	"	"	Bored	50	2,270	- 25	2,245	50	2,220	Glacial clay	Hard, clear	42	D, S	Sufficient for only 4 head stock.
31	SW.	34	"	"	"	Sand-point	20	2,250	- 15	2,235	15	2,235	Glacial sand	Hard, clear, "alkaline"	42	D, S	Sufficient for local needs.
32	NW.	34	"	"	"	Spring		2,250					Glacial drift			S	Good supply.
33	SW.	35	"	"	"	Bored	62	2,255	- 59	2,196	59	2,196	Glacial sand	Soft, clear	42	D, S	Sufficient for 4 head stock. Also a 48-foot well with small supply.
34	SW.	36	"	"	"	Bored	65	2,285	- 58	2,227	65	2,220	Glacial sand	Hard, clear, "alkaline"	41	D, S	Sufficient for 8 head stock.
1	SW.	1	31	26	3	Bored	106	2,350	- 90	2,260	106	2,244	Belly River (?) sand	Hard, clear, iron, sulphur	46	D, S	Sufficient for 30 head stock.
2	NW.	1	"	"	"	Bored	60	2,360	- 40	2,320	60	2,300	Glacial drift	Hard, clear, iron, "alkaline"	48	D, S	Sufficient for 25 head stock.
3	SE.	2	"	"	"	Bored	60	2,310	- 35	2,275	60	2,250	Belly River (?) black sand	Hard, clear, iron, "alkaline"	45	S	Sufficient for 35 head stock. Also a 30-foot well for domestic use.
4	SW.	2	"	"	"	Bored	35	2,340	- 27	2,313	35	2,305	Glacial sand	Hard, clear, sulphur	48	S	Yields 5 barrels per day. Also two seepage wells, one used for house.
5	NW.	2	"	"	"	Bored	30	2,315	- 10	2,305	30	2,285	Glacial drift	Hard, clear	48	D, S	Oversufficient for local needs.
6	NW.	4	"	"	"	Bored	90	2,322	- 50	2,272	90	2,232	Glacial drift	Hard, clear, iron, "alkaline"		N	Not usable; good supply.
7	NW.	4	"	"	"	Bored	70	2,322	- 45	2,277	70	2,252	Glacial drift	Hard, clear, iron, "alkaline"	43	S	Yields 8 barrels per day.
8	SE.	4	"	"	"	Bored	60	2,315	- 40	2,275	60	2,255	Glacial drift	Hard, clear, iron, "alkaline"	46	D, S	Yields only 2 barrels per day.
9	SE.	6	"	"	"	Bored	80	2,355	- 60	2,295	80	2,275	Glacial drift	Hard, clear, iron	45	D, S	Sufficient for 15 head stock.
10	NE.	6	"	"	"	Bored	70	2,360	- 55	2,305	70	2,290	Glacial drift	Hard, clear, iron	45	D, S	Sufficient for 50 head stock.
11	NW.	7	"	"	"	Dug	10	2,310	- 4	2,306	10	2,300	Glacial sand	Soft, clear	48	D, S	Oversufficient for local needs.
12	NE.	7	"	"	"	Dug	4	2,310	0	2,310	0	2,310	Glacial drift	Soft, clear	48	S	Oversufficient for local needs.

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

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

WELL RECORDS—Rural Municipality of PRAIRIEDALE, NO. 321, 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
13	SE.	8	31	26	3	Bored	110	2,322	- 90	2,232	110	2,212	Glacial clay	Hard, clear, iron, "alkaline"	40	S	Insufficient for 15 head stock.
14	SW.	9	"	"	"	Bored	138	2,322	- 68	2,254	138	2,284	Belly River (?) sand	Hard, clear, iron, "alkaline"	40	S	Sufficient for 40 head stock. Also a 90-foot well with small supply.
15	NW.	10	"	"	"	Bored	52	2,355	- 44	2,311	44	2,311	Glacial clay	Hard, clear, iron, "alkaline"	46	N	Has two seepage wells 14 and 25 feet deep, and a 48-foot well; also three dry holes.
16	NE.	12	"	"	"	Bored	50	2,360	- 35	2,325	50	2,310	Glacial drift	Hard, clear, iron, "alkaline"	46	D, S	Sufficient for 17 head stock. Also a 40-foot well not used.
17	SW.	12	"	"	"	Bored	150	2,350	- 70	2,280	150	2,200	Belly River (?) sand	Hard, clear, iron, "alkaline"	38	S	Yields 70 barrels per day. Also two wells 35 and 26 feet deep.
18	SE.	13	"	"	"	Bored	110	2,360	- 70	2,290	110	2,250	Glacial drift	Hard, clear, iron, "alkaline"	38	D, S	Sufficient for 20 head stock.
19	SE.	14	"	"	"	Bored	60	2,390	- 45	2,345	60	2,330	Glacial sand	Hard, clear, iron, "alkaline"	46	D, S	Yields 100 gallons per hour.
20	SW.	16	"	"	"	Bored	80	2,310	- 60	2,250	80	2,230	Glacial yellow clay	Hard, clear, iron, "alkaline"	40	S	Sufficient for 12 head stock.
21	SW.	22	"	"	"	Bored	117	2,355	- 47	2,308	117	2,238	Glacial drift	Hard, clear, iron, "alkaline"	40	S	Oversufficient for local needs.
22	NE.	24	"	"	"	Bored	86	2,400	- 35	2,365	86	2,314	Glacial sand	Hard, clear, iron	40	D, S	Sufficient for local needs. Also a 60-foot hole caved in.
23	SE.	25	"	"	"	Bored	86	2,400	- 35	2,365	86	2,314	Glacial drift	Hard, clear, iron		D, S	Yields 8 barrels per day.
24	NE.	25	"	"	"	Bored	115	2,400	-113	2,287	113	2,287	Glacial sand	Hard, clear, iron	42	D, S	Sufficient for only 3 head stock. Also a 60-foot well with small supply.
25	NE.	26	"	"	"	Bored	60	2,380	- 23	2,357	60	2,320	Glacial sand	Hard, clear, iron, "alkaline"	46	D, S	Sufficient for 40 head stock.
26	SW.	28	"	"	"	Bored	45	2,420	- 39	2,381	39	2,381	Glacial sandy clay	Hard, clear, iron, "alkaline"	46	D, S	Sufficient for 18 head stock.
27	SE.	28	"	"	"	Bored	96	2,390	- 56	2,334	96	2,294	Glacial drift	Hard, clear, iron, "alkaline"	45	S	Sufficient for 75 head stock. Also a 40-foot well not used.
28	NW.	30	"	"	"	Bored	37	2,300	- 21	2,279	37	2,263	Glacial sand	Hard, clear, iron		D, S	Yields 16 barrels a day.
29	E½.	33	"	"	"	Bored	90	2,465	- 65	2,400	90	2,375	Glacial drift	Hard, clear, "alkaline"	46	S	Yields 64 barrels per day.
30	NW.	36	"	"	"	Bored	60	2,390	- 40	2,350	60	2,330	Glacial sand	Hard, clear, iron, "alkaline"	46	D, S	Sufficient for 40 head stock.
31	NE.	36	"	"	"	Bored	98	2,390	- 91	2,299	91	2,299	Glacial sand	Hard, clear, iron, "alkaline"	46	D, S	Yields 5 barrels per day. Also a 30-foot seepage well.

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 PRAIRIEDALE, NO. 321, 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	SW.	1	32	25	3	Dug	50	2,295	− 48	2,247	48	2,247	Glacial sand	Hard, clear	41	D, S	Sufficient for 20 head stock.
2	SW.	2	"	"	"	Bored	65	2,280	− 25	2,255	61	2,219	Glacial sand	Soft, clear	42	D, S	Sufficient for 25 head stock.
3	SW.	3	"	"	"	Bored	40	2,270					Glacial clay	Hard, clear, "alkaline"	41	D	Sufficient only for domestic needs. Also two wells 40 and 50 feet deep.
4	NE.	4	"	"	"	Bored	35	2,272	− 23	2,249	35	2,237	Glacial sand	Hard, clear, iron, "alkaline"	40	D, S	Sufficient for 30 head stock.
5	SE.	6	"	"	"	Bored	62	2,405	− 48	2,357	62	2,343	Glacial gravel	Hard, clear, iron	41	D, S	Sufficient for 20 head stock.
6	NE.	10	"	"	"	Bored	66	2,280	− 25	2,255	62	2,218	Glacial(?) sand	Soft, clear	42	D, S	Sufficient for 30 head stock.
7	NE.	12	"	"	"	Bored	130	2,310	− 50	2,260	130	2,180	Glacial(?) gravel	Hard, clear, iron	41	S, D	Sufficient for local needs. Also an 80-foot well not used.
8	SE.	14	"	"	"	Bored	80	2,305	− 40	2,265	80	2,225	Glacial drift	Soft, clear	41	D, S	Sufficient for local needs.
9	NW.	14	"	"	"	Bored	50	2,305	− 40	2,265	50	2,255	Glacial drift	Hard, clear	41	D, S	Sufficient for 40 head stock.
10	SW.	14	"	"	"		40	2,300	− 25	2,275	40	2,260	Glacial drift	Hard		N	
11	SW.	16	"	"	"	Bored	40	2,270	− 36	2,234	36	2,234	Glacial sand	Hard, clear, "alkaline"	41	D, S	Sufficient for 30 head stock.
12	SW.	17	"	"	"	Bored	108	2,360	− 30	2,330	108	2,252	Glacial gravel	Soft, clear, iron	41	D, S	Sufficient for local needs.
13	SE.	19	"	"	"	Bored	66	2,350	− 54	2,296	66	2,284	Glacial gravel	Hard, clear	41	D, S	Sufficient for local needs. Was a 60-foot well now filled in.
14	SE.	20	"	"	"	Bored	50	2,285	− 26	2,259	50	2,235	Glacial gravel	Hard, clear, iron	41	D, S	Sufficient for 50 head stock.
15	NE.	22	"	"	"	Bored	52	2,310	− 47	2,263	47	2,263	Glacial sand	Hard, clear	41	D, S	Sufficient for 8 head stock.
16	SW.	23	"	"	"	Bored	75	2,340	− 40	2,300	75	2,265	Glacial sand	Soft, clear	41	D, S	Sufficient for local needs.
17	NE.	28	"	"	"	Bored	52	2,292	− 42	2,250	42	2,250	Glacial sand	Hard, clear, iron	41	D, S	Sufficient for 30 head stock.
18	SW.	28	"	"	"	Bored	45	2,275	− 25	2,250	45	2,230	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for 30 head stock.
19	SW.	29	"	"	"	Bored	60	2,295	− 48	2,247	60	2,235	Glacial gravel	Hard, clear, iron, "alkaline"	41	D, S	Sufficient for 20 head stock.
20	NW.	29	"	"	"	Spring		2,290					Glacial drift				Supply has decreased in last few years.
21	NE.	32	"	"	"	Bored	125	2,310					Glacial gravel	Hard, clear		D, S	Sufficient for local needs. Also a 60-foot well, good supply.
22	NW.	35	"	"	"	Bored	125	2,345					Glacial gravel	Hard, clear, iron	41	D, S	Sufficient for 26 head stock.
23	NE.	36	"	"	"	Bored	140	2,388	−128	2,260	140	2,248	Glacial drift	Hard, clear, iron, "alkaline"	42	S	Sufficient for 30 head stock.
1	SE.	4	"	26	"	Bored	100	2,320	− 76	2,244	100	2,220	Glacial sand	Hard, clear, iron, "alkaline"	40	D, S	Sufficient for 25 head stock.
2	SE.	6	"	"	"	Bored	40	2,250	− 34	2,216	40	2,210	Glacial sand	Hard, clear, iron	46	D, S	Yields 20 barrels per day.
3	SE.	7	"	"	"	Bored	55	2,350	− 18	2,332	55	2,295	Glacial sand	Soft, clear		D, S	Sufficient for 20 head stock. Also a spring 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 PRAIRIEDALE, NO. 321, 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.	10	32	26	3	Bored	65	2,400	- 55	2,345	65	2,335	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
5	NW.	10	"	"	"	Bored	60	2,400					Glacial drift	Hard, "alkaline"		D, S	Sufficient for local needs.
6	NE.	11	"	"	"	Bored	60	2,380	- 48	2,332	60	2,320	Glacial sand	Hard, clear, iron, "alkaline"		S	Sufficient for 20 head stock.
7	SW.	12	"	"	"	Bored	60	2,350	- 30	2,320	60	2,290	Glacial gravel	Hard, clear, iron, "alkaline"	46	D, S	Sufficient for 35 head stock.
8	NW.	12	"	"	"	Bored	65	2,380	- 63	2,317	63	2,317	Glacial sand	Hard, cloudy, iron, "alkaline"		S	Sufficient for only 2 head stock.
9	SE.	14	"	"	"	Bored	60	2,380	- 40	2,340	60	2,320	Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient for only 40 head stock. Was two 60-foot wells now filled in.
10	NW.	14	"	"	"	Bored	100	2,385	- 96	2,289	96	2,289	Glacial(?) sand	Hard, clear, iron, "alkaline"	36	D, S	Yields 4½ barrels a day.
11	SE.	16	"	"	"	Bored	100	2,345	- 80	2,265	100	2,245	Glacial sand	Hard, clear, iron		N	
12	NE.	17	"	"	"	Bored	40	2,370	- 34	2,336	40	2,330	Glacial sand	Hard, clear, iron	48	D, S	Yields only 3 barrels a day.
13	NW.	17	"	"	"	Bored	20	2,370	- 12	2,358	12	2,358	Glacial drift	Soft, cloudy		S	Yields only 3 barrels a day.
14	SE.	17	"	"	"	Dug	20	2,370	- 17	2,353	17	2,353	Glacial drift	Hard, clear, iron	48	D, S	Yields 6 barrels a day.
15	SE.	18	"	"	"	Bored	65	2,315	- 53	2,262	65	2,250	Glacial sand	Hard, clear, iron	45	D, S	Sufficient for 40 head stock.
16	NW.	20	"	"	"	Bored	130	2,385	-127	2,258	127	2,258	Glacial drift	Soft, clear	40	D	Sufficient only for domestic needs. Three dry holes 30, 100 and 126 feet deep.
17	SE.	20	"	"	"	Bored	60	2,400	- 20	2,380	60	2,340	Glacial sand	Hard, clear, iron	46	D, S	Oversufficient for local needs. Was a 91-foot well now filled in.
18	SW.	21	"	"	"	Bored	80	2,385	- 66	2,319	66	2,319	Glacial gravel	Hard, clear, iron	46	D, S	Yields 5 barrels a day. Also an 80-foot well used only in summer.
19	SW.	22	"	"	"	Bored	125	2,345	- 95	2,250	125	2,220	Glacial sand	Soft, clear	38	D, S	Yields 40 barrels a day. Also a 100-foot well with same supply.
20	NW.	23	"	"	"	Dug	27	2,330	- 25	2,305	25	2,305	Glacial drift	Hard, cloudy, iron, "alkaline"	48	D	Yields only 6 barrels a day. #.
21	SW.	24	"	"	"	Bored	75	2,325	- 59	2,266	75	2,250	Glacial drift	Hard, clear, iron, "alkaline"	46	D, S	Yields 60 barrels a day.
22	SW.	27	"	"	"	Bored	80	2,360	- 57	2,303	80	2,280	Glacial gravel	Hard, clear, iron	45	D, S	Yields 30 barrels a day.
23	NE.	28	"	"	"	Bored	96	2,355	- 66	2,289	96	2,259	Glacial sand	Hard, clear, iron	38	D, S	Sufficient for 8 head stock.
24	NE.	32	"	"	"	Dug	30	2,385	- 25	2,360	25	2,360	Glacial sand	Hard, clear, "alkaline"		D, S	Yields 20 barrels a day.
25	SE.	33	"	"	"	Spring		2,330	+ 5	2,335			Glacial drift	Hard, clear		S	Oversufficient for local needs.
26	SW.	34	"	"	"	Bored	90	2,345	- 80	2,265	90	2,255	Glacial sand	Hard, clear, "alkaline"	43	D, S	Yields 20 barrels a day.

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.