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 PITTVILLE No. 169 SASKATCHEWAN

BY

B. R. MacKay, H. H. Beach & R. Johnson

Water Supply Paper No. 145

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF PITTVILLE, NO.169 SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

If one intends to sink a well and wishes to 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

[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 rests upon the Ravenscrag or older formations. The formation is 30 to 125 feet thick.

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

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

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

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

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Pittville covers an area of 324 square miles in the western part of southern Saskatchewan. The municipality consists of nine townships described as tps. 16, 17, and 18, ranges 19, 20, and 21, W. 3rd mer. The central point of the area lies 40 miles west, and 9 miles north, of Swift Current. The Pennant-Verlo branch of the Canadian Pacific railway enters the municipality at Roseray in sec. 25, tp. 17, range 19, and extends in a southwesterly and southerly direction to its terminus just beyond the village of Verlo, in the southwest corner of township 16, range 19. The village of Hazlet is also situated on this line approximately half-way between Verlo and Roseray.

The three southern townships of the area are irregularly rolling. Elevations over most of the area range from approximately 2,260 feet, the level of some of the small lakes filling the many undrained depressions, to upwards of 2,450 feet on some of the hill-tops along the southern border. Local irregularities exist in the dune sand area along the western border. To the north and east, the land surface becomes less irregular and grades into flat plains in the north-central township, and in the area east of Hazlet where surface elevations do not greatly exceed 2,300 feet above sea-level. In places in the extreme northeast corner of the municipality the surface elevation does not exceed 2,125 feet. To date, only the three southern townships have been topographically mapped. Hence, contours indicating the variation in relief appear only on the lower third of Figure 2, on the accompanying map. Several, long, narrow depressions of the plains areas contain water during periods of ample precipitation. Snakehole lake, located in township 18, range 19, is the largest of these "alkaline" sloughs. There is no well-defined drainage in the area.

The water in most of the sloughs and lakes is too highly mineralized for watering stock, but a few springs occurring along the valley sides provide water for stock pasturing in the valleys. Most of the water used in the municipality is obtained from wells. Adequate supplies of ground water can be obtained generally throughout the area from the unconsolidated glacial deposits. Only three wells have been sunk into the underlying bedrock in the area. The bedrock is regarded as being unproductive of ground water in most parts. In places where prospecting has failed to obtain adequate supplies in the glacial drift, residents have been obliged to excavate dugouts, or construct dams in coulées to conserve the surface water for stock use.

Water-bearing Horizons in the Unconsolidated Deposits

The unconsolidated deposits consist of two general types, namely: Recent dune sands, accumulated by the action of the prevailing winds; and glacial drift laid down by a great continental ice-sheet that many thousands of years ago advanced and retreated over the province of Saskatchewan. The ice-sheet deposited an irregular layer of bluish grey clay, in which are interspersed, with no apparent regularity of arrangement, stones and boulders, and irregular beds, lenses, and pockets of well-sorted sands and gravels. This boulder clay covers the surface of the bedrock throughout the entire area, but is concealed by later deposits, except in a few small areas in township 16, range 20, and along the northern boundary. This boulder clay is generally referred to as till. On the highlands of the southern parts where the retreating ice-front paused for a considerable period of time there was deposited a more porous form of drift known as moraine. The surface of the moraine is generally more irregular than the till-covered areas, being characterized by many low knolls and gravel ridges, and intervening, undrained depressions. Waters issuing from the melting ice-sheet collected in the lower land to form a large lake into which fine sediments were washed from the uplands. The area covered by this glacial lake is marked by a deposit of 10 to 20 feet of blue-grey, compact lake clays covering all of townships 17 and 18, ranges 19 and 20, and the eastern halves of townships 17 and 18, range 21. These clays have a tendency to become sticky when wet, and cause roads in this part of the area to be nearly impassable after heavy rains. Along the borders of this lake, coarser sediments were deposited. These lake sands mantle much of township 16, range 19, and extend westward as a narrow belt over township 16, range 20, and thence northward over much of the western halves of townships 16, 17, and 18, range 21. When the lake dried the prevailing winds blew much of the lake sand into dunes that form the Great Sand Hills. The approximate areal extent of each of these different types of unconsolidated deposits is indicated on Figure 1 of the accompanying map. The recent dune sands occurring in this municipality are confined to a narrow belt along the western border, and mark the eastern border of the Great Sand Hills which cover a large area to the west of this municipality. They do not greatly exceed 25 feet in thickness, and everywhere overlie the glacial lake sands. Surface water readily percolates down through the sands, and is trapped by more compacted sand beds or in depressions occurring in the surface of the glacial lake sands or of the underlying boulder clay. The position of these depressions conforms to some extent with the undulations in the present ground surface. Hence, residents upon digging wells to depths not generally exceeding 25 feet in both the dune and lake sand areas have been able to obtain adequate supplies of soft to moderately hard, drinkable water, in sufficient amounts for domestic use, and for a few head of stock. The Glacial lake sands are about similar in texture and porosity to the dune sand. It is probable that many of the wells in the dune area are actually deriving their supplies from the lake sands, rather than from the mantle of dune sand. Dugouts excavated in depressions become gradually filled with water seeping from the sands and provide a source of stock water of good quality on several farms.

In some places, the nderlying glacial clays are not sufficiently impervious to retain water in the sand lenses and to obtain water in close proximity to the farm dwellings residents are obliged to sink wells into the underlying glacial drift. The lake sands occurring at the surface in the south-eastern part of the municipality are generally too thin to contain ground water, and all the wells in the area have been sunk into the glacial drift.

Little or no water can be obtained from the thin deposit of glacial lake clays that overlie most of the northern part of the municipality, and wells must be sunk into the underlying glacial drift.

Scattered pockets of water-bearing sand and gravel occur interspersed in the upper 30 to 40 feet of the moraine and glacial till, both where these deposits occur at the surface and where they underlie the gl cial lake sands. The sand and gravel pockets will generally be found to be more numerous and productive of larger supplies in the moraine than in the glacial till. The supplies from the shallow wells are not generally large and, in some places, two or more wells are necessary to satisfy local stock requirements. Where the boulder clay is overlain by glacial lake clays the supplies from these shallow pockets are generally sufficient only for household needs, and the residents are obliged to sink wells to tap deeper aquifers.

The water from these wells varies from soft to hard and is highly mineralized, but most of it can be used for drinking. It may be necessary to sink s veral shallow test holes in order to locate a productive sand or gravel pocket. In many places, hand augers can be advantageously employed for this purpose.

Wells sunk to depths between 50 and 250 feet in this municipality indicate the presence of extensive beds of sand and gravel in the lower part of the glacial drift. These beds, when penetrated, generally yield ample supplies of water for local farm requirements. The water is hard and highly mineralized, and contains appreciable quantities of sulphate salts and iron in solution. In several places the water cannot be used for drinking, but it is, in all places, reported to be suitable for stock.

The most extensive water-bearing horizon in the lower part of the glacial drift is believed to occur at the contact of the glacial drift with the underlying Bearpaw shales. In the area of relatively low surface elevation, in the northeastern part of the municipality, practically all of the water supplies are being obtained from wells between 50 and 170 feet deep that penetrate such sand and gravel pockets at elevations between 2,230 and 2,180 feet above sea-level. On the uplands in the southern and western parts of the municipality, a few wells have reached water-bearing sands and gravels, at the same approximate elevations, but due to the greater surface elevations the depths range between 160 and 250 feet. In this upland area, however, adequate supplies of water have generally been obtained from less extensive beds at depths of 50 to 140 feet. More detailed discussions of these horizons are given in the sections of the report dealing with the individual townships.

Water-bearing Horizons in the Bedrock

The Bearpaw formation underlies the glacial drift throughout the entire municipality. This formation is composed almost entirely of compact, dark grey Marine shales, from which only small seepages of highly mineralized water can be obtained. However, in the northern part of this municipality, wells 300 and 308 feet deep in secs. 19 and 31, tp. 18, range 19, are yielding large supplies of water from sand beds in the lower part of the formation at elevations of 1,995 and 2,000 feet. A 242-foot well on sec. 13, tp. 18, range 20, is also believed to be drawing its supply from a sand bed in this formation, at an approximate elevation of 2,053 feet. These wells are located in an area of low surface elevations, and water might possibly be obtained at similar depths in the adjacent lowland areas. In most parts of the municipality, it would be necessary to sink wells to depths between 350 and 400 feet to reach this horizon, and no assurance can be given that it would be productive over the greater part of the area.

In the southern part of the adjoining municipality to the north, several wells have been sunk through the Bearpaw formation, and are yielding fairly large supplies of water from sand beds in the Belly River formation, at depths between 400 and 600 feet. Water might also be obtained from the same formation at similar depths, in the area of low elevation, in the northern part of this municipality.

Except for these small areas of low surface elevation, drilling should be terminated when the shales are reached. The shales are readily distinguished from the boulder clay, by their darker colour, their soapy feeling when wet, the absence in them of stones or boulders, the occasional occurrence of fossil shells, and by the small, roughly cubical fragments into which the shale breaks upon weathering.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 16, Range 19

Springs located along the valley extending through sections 24, 26, and 27, provide water for stock pasturing in the valley. All other water supplies of the township are being obtained from wells.

With the exception of the moraine-covered areas along the southern and western boundaries of the township, the greater part of the township is mantled by glacial lake sands. These sands and sandy clays are seldom more than 20 feet thick in depressions and valleys, and on the higher lands do not exceed 10 feet in thickness. These sandy deposits do not, generally, yield ground water supplies in this township, but they are sufficiently porous to permit the seepage of surface water down into the sand and gravel pockets that occur in the upper 30 to 40 feet of the glacial drift.

Several residents of the township are obtaining small supplies of hard, drinkable water from these pockets. The supplies are, in a few places, adequate for local farm requirements, but generally they are sufficient only for household needs and for 5 to 10 head of stock. For this reason, most residents have sunk wells to greater depths in the glacial drift, to obtain water for stock, and they employ the shallow wells for household supplies only. Due to the irregular distribution of these productive pockets in the drift, several test holes may be necessary to locate them. Where the drift is exposed at the surface as moraine along the southern and western boundaries of the township, water-bearing pockets of sand and gravel are more numerous, and yield larger supplies of water. Most of the residents of these areas are obtaining adequate supplies of only moderately hard, drinkable water from shallow wells.

Below depths of 30 to 40 feet in this township, the blue boulder clay of the glacial drift becomes more compact and the pockets of sand and gravel occur only sparingly. However, a few scattered well are drawing supplies from localized pockets, at depths of 40 to 60 feet.

The greater part of the ground water supply in this township is being obtained from wells, between 70 and 160 feet deep, that have penetrated fairly extensive beds of sand and gravel, occurring near the base of the glacial drift. In the southern half of the township, wells between 78 and 120 feet deep have penetrated water-bearing sands and gravels, at elevations between 2,340 and 2,280 feet above sea-level. Wells located in areas of low surface elevation, as in the NE.$\frac{1}{4}$, section 6, and the NE.$\frac{1}{4}$, section 10, reached productive gravels at this horizon, at depths of 40 and 50 feet. With the exception of wells located on the NE.$\frac{1}{4}$, section 6, the SW.$\frac{1}{4}$, section 12, and the SE.$\frac{1}{4}$, section 13, all wells tapping the sands and gravels of this horizon yield ample supplies of water. The water is hard and highly mineralized, but can generally be used for drinking. Water is also present in the lower part of the drift, in the northern half of the township, at slightly lower elevations. In this area wells between 70 and 160 feet deep have penetrated water-bearing beds at elevations between 2,300 and 2,250 feet above sea-level. The springs along the valley in sections 24 and 27 are probably fed from water-bearing beds in this horizon.

These water-bearing beds are regarded as being more or less continuous over the area, and can be expected to be productive in most parts of the township. The 100-foot dry hole, in the SW.$\frac{1}{4}$, section 31, is down to an approximate elevation of 2,290 feet, and may indicate that the productive beds are not present here; but it is more probable that the well was not sunk sufficiently deep to reach this horizon at this point.

Should this horizon not be productive, the only probable source of supply, at greater depth, is at the contact between the glacial drift and the underlying bedrock. The contact is believed to occur at elevations near 2,200 feet in this township, or at depths varying from 100 feet in the bottoms of the deep valleys to 250 feet on the uplands near the southern boundary of the township.

It is inadvisable to drill wells below the base of the glacial drift, as only small seepages of water can be expected from the compact Marine shales of the Bearpaw formation.

Township 16, Range 20

Small lakes and springs occurring in the deep valleys that cut through this township provide some water for stock, but most supplies in the area are obtained from wells.

A wide, deep valley extends from the southeastern corner of the township in a northerly direction to section 35. This valley branches in section 11, and the western arm in turn branches into two valleys that extend to the southwestern and northwestern corners of the township. Glacial lake sands floor this valley and its several branches. At places where there is a sufficient thickness of sand, and the underlying glacial clays form impervious basins in which downward percolating surface waters can collect, moderately large supplies of water can be obtained at shallow depths in the sand. An 18-foot well, located on the SE.$\frac{1}{4}$, section 17, and a 10-foot well on the SE.$\frac{1}{4}$, section 9, are the only wells known to be producing from this horizon at the present time. Adequate supplies of hard, drinkable water could probably be obtained from the sand in other places in the valleys, but since the conditions are not favourable at all places for water accumulation considerable prospecting may be necessary. Several residents, finding it impossible to obtain satisfactory supplies from the glacial lake sands in close proximity to farm buildings, have been obliged to sink wells into the underlying glacial drift.

As shown on Figure 1 of the accompanying map a small area along the northern boundary of the township is mantled by glacial lake clays. These clays are compact, and largely impervious, so that little or no water is likely to occur in them. They are rarely more than 20 feet thick, however, and are underlain by glacial sands and boulder clay, from which practically all of the ground water supplies used in the township are being obtained.

Glacial drift, consisting chiefly of blue-grey boulder clay, underlies the glacial lake sands and clays in the valleys at depths seldom exceeding 20 feet below the surface. On the upland areas the drift occurs at the surface as a till plain in the north-central part of the township, and as moraine in the southwestern sections, and in a small strip located on the eastern boundary of the township. Most residents of the township derive their water supplies from wells between 20 and 40 feet deep, tapping sand and gravel pockets in the upper part of the glacial drift. The supplies being obtained from the shallow wells vary considerably from place to place and in many places are not always adequate for local requirements. The water is generally hard, but not too highly mineralized to be used for drinking.

Several wells have been sunk to depths between 40 and 100 feet in the glacial drift but do not indicate the presence of any extensive aquifers. Only five out of twelve wells, reported within this range of depth, are yielding sufficient water for local requirements. The water from wells of this type is generally hard and "alkaline", but suitable for household use.

Fairly large supplies of water are being obtained from sand and gravel beds, at elevations between 2,300 and 2,260 feet, in adjoining townships on the north and east. It seems probable that water-bearing beds will occur at similar elevations in at least the northeastern part of this township. A 133-foot well, bored on the NW.$\frac{1}{4}$, section 24, is yielding an adequate supply of hard, drinkable water from an aquifer at an approximately elevation of 2,307 feet. The depths of wells necessary to reach this horizon will vary from 70 feet in the valleys to over 150 feet on the uplands.

One 235-foot well on the SW.$\frac{1}{4}$, section 28, did not encounter water at this horizon, but is yielding a fairly large supply of water from a sand or gravel bed, at an approximate elevation of 2,225 feet. This water-bearing bed is believed to occur at the contact between the glacial drift, and the underlying Bearpaw shales. This horizon may be productive over a considerable area in this township. Water-bearing gravels were encountered at elevations of 2,237 feet and 2,235 feet in a 167-foot well sunk in section 36 of the adjoining township to the west, and in a 190-foot well in section 10, of the adjoining township to the north. These wells and the 235-foot well in this township may be tapping a continuous water-bearing bed. The 235-foot well is on high land, so that over most of the township the water-bearing bed, if present, should be reached at depths of less than 200 feet.

It is not advisable to sink wells into the compact Marine shales of the Bearpaw formation, which underlie the glacial drift. These shales will probably be encountered at depths of less than 250 feet in the upland areas, and at depths of less than 100 feet in the lower parts of the valleys.

In this township it seems advisable to do considerable prospecting in the glacial drift, at depths of less than 40 feet, before sinking wells to greater depths. One hole bored to the base of the drift should be sufficient to determine the presence or absence of productive beds over considerable areas, since in areas where these beds exist at all they seem to be quite continuous.

Township 16, Range 21

In the northern part of the township, "alkali" sloughs, shallow dugouts, and a spring on section 25 provide water for range stock. All other water supplies in the township are being obtained from wells.

As shown on Figure 1 of the accompanying map, the drift covering over most of the northern half of the township is glacial lake sand and recent dune sand. The thickness of the sand is rarely more than 20 feet, and in many places it is only 2 to 3 feet. Where the sand is sufficiently thick, and the underlying glacial clays sufficiently impervious to retain water, shallow wells sunk to the base of the sand will yield moderately large supplies of hard, drinkable water. Shallow dugouts in the sand, on section 29, 31, and 34 of this township, provide ample supplies of water for the range stock of the vicinity. A 13-foot well on section 20 yields only a small supply of hard, highly mineralized water from the sand, but most of the wells located a short distance away from the "alkali" sloughs yield water that is not too highly charged with dissolved mineral salts to be used for domestic purposes. In the dune sand area in the northwest corner of the township little difficulty should be experienced in obtaining sufficient water from the sand for local stock requirements. In the glacial lake sand area, however, the sand is generally thinner, and most of the residents have sunk wells through it into the underlying glacial drift. The drift is composed essentially of blue-grey boulder clay. Sand and gravel pockets occur interspersed in the upper part of the boulder clay, from which small supplies of hard, drinkable water can be obtained. Wells, ranging in depth between 18 and 28 feet in the NE. $\frac{1}{4}$, section 21, the NE.$\frac{1}{4}$, section 24, and the SE.$\frac{1}{4}$, section 28, are yielding adequate supplies of water for local requirements, from sand and gravel pockets in the upper part of the glacial drift underlying the lake sands.

Moraine covers most of the southern half of the township. It consists mostly of blue-grey boulder clay, which near the surface weathers to a yellow brownish colour. Pockets and thin beds of sand and gravel are quite general in the upper 30 to 40 feet of the moraine, and most residents of the area have been able to obtain adequate supplies of ground water from dug wells at depths not exceeding 35 feet.

Several test holes may be necessary to locate productive sand or gravel pockets within 40 feet of the surface, in this township, but the slight possibilities of obtaining water at greater depths do not warrant sinking deeper wells, unless the supplies from the shallow wells are altogether inadequate.

A few residents in the southern part of the township have sunk wells to depths between 57 and 110 feet, and are obtaining adequate supplies of water from small beds of sand and gravel, interspersed through the boulder clay. The quality of the water from these wells varies from soft to hard. It is generally highly mineralized, but in all cases is reported to be suitable for drinking. These wells do not indicate the presence of any extensive water-bearing beds, and no assurance can be given that water will be obtained by sinking wells to similar depths in other parts of the township.

Wells 135 and 167 feet deep, in sections 35 and 36, reached productive sands and gravels at elevations of approximately 2,240 feet above sea-level. The well on section 35 was very nearly dry when visited, but the well in section 36 was yielding a fairly large supply of water from gravels that are thought to occur at the contact of the glacial drift and the underlying Bearpaw shales. The contact, lthough not a certain source of water supply, has proved productive in many places in this municipality, and will probably prove to be the most dependable deep source of water in this township. The depths of wells necessary to reach the contact will vary from about 100 feet in the lower parts of the valleys in the northern part of the township to 250 feet on the southern uplands.

It is inadvisable to continue wells below the depths given above, as the compact, dark grey arine shales of the Bearpaw formation will then be encountered. These shales are not expected to be water bearing.

Extensive prospecting within 40 feet of the surface seems advisable to deep drilling in this township, but should a reasonable amount of prospecting at shallow depths fail to yield a satisfactory water supply, boring or drilling to the lower part of the drift, or to the ntact, should yield water suitable at least for stock raising in most places.

Township 17, Range 19

A few springs along the valley sides in the north-eastern corner of the township provide water for stock. All other supplies are being obtained from wells. The water in Snakehole lake is too highly mineralized to be used for drinking, and of recent years the increased concentration of the salts in solution through evaporation of the water tends to make it unsatisfactory for stock use.

A deposit of glacial lake clay ranging in thickness from 5 to 20 feet overlies the entire township with the exception of small areas along the extreme southern boundary where glacial lake sands and moraine occur. The lake clays are underlain by glacial drift composed mostly of boulder clay. Water cannot as a rule be obtained from the lake clay due to its impervious nature, but scattered pockets of sand and gravel occur interspersed in the upper part of the underlying boulder clay, from which small supplies of hard, drinkable water are being obtained at depths not exceeding 30 feet from the surface. The supplies from the shallow wells are not generally sufficient for stock requirements, but are being used for domestic needs where the water from deeper wells is highly mineralized.

The glacial boulder clay becomes more compact at greater depths and the pockets of sand and gravel are more scattered in their occurrence. Wells between 40 and 73 feet deep, located on the NE.$\frac{1}{4}$, section 2, the SE.$\frac{1}{4}$, section 3, the SE.$\frac{1}{4}$, section 6, and the SW.$\frac{1}{4}$, section 20, derive their supplies from such pockets and small beds of sand and gravel in the drift. Of these wells only the 73-foot well on section 6 yields an adequate supply of water. At many places throughout the area only blue clay will be encountered within this range of depths.

At lower levels in the glacial drift more extensive beds of sand and gravel occur and yield adequate supplies of water for local requirements. Throughout the southwestern part of the township productive sand and gravel beds have been encountered at elevations between 2,290 and 2,240 feet above sea-level. A continuous water-bearing bed may occur between these elevations in this part of the township. Wells sunk on sections 9, 13, 14, 15, 16, 29, and 31 have reached the horizon at depths between 50 and 108 feet depending upon the elevation of the well site. Along the southern boundary of the township, surface elevations are higher and in the NW.$\frac{1}{4}$, section 4, a well was drilled to a depth of 160 feet before reaching the horizon. With the exception of the 82-foot well in the SW.$\frac{1}{4}$, section 16, all the wells drawing their supplies from this horizon yield sufficient water for local requirements. The water is hard, iron-bearing, and highly mineralized, but can generally be used for drinking. The water from most of these wells, however, is used only for stock and shallow wells provide household supplies.

Further deposits of glacial boulder clay will probably be encountered below the sand and gravels of this horizon. The 174-foot well in the SW.$\frac{1}{4}$, section 2, is believed to have passed through the horizon to reach water-bearing gravels at an approximate elevation of 2,226 feet. These gravels probably occur at the contact between the glacial drift and the underlying Bearpaw shales. Whether water-bearing beds will occur at the contact in all of the southwestern part of the township is not definitely known. However, should adequate supplies not be obtained from the horizon occurring at elevations between 2,290 and 2,240 feet, the contact offers the best possibility of obtaining water at greater depths.

In the northeastern part of the township, several wells have penetrated water-bearing sands and gravels at elevations between 2,230 and 2,190 feet. These water-bearing sands and gravels are also believed to occur at the contact between the drift and the shales. On sections 14, 22, 23, 32, and 34, this horizon was reached at depths between 80 and 115 feet. The horizon was encountered at depths of 75 and 50 feet on sections 25 and 26 where surface elevations are lower, and on the slope of the lake valley in section 5 springs occur at the level of the horizon and probably derive their water from it. The water from this horizon is hard, iron-bearing, and highly mineralized, but in most places is used for drinking.

A 143-foot well on section 33 has been sunk to an elevation of 2,132 feet, but is probably drawing its supply from the same horizon as described above since the water rises to the same approximate level as in other wells in the same vicinity. The water rose above the surface in a 96-foot well and an 80-foot well, which tap the horizon in section 22. However, no widespread artesian area is expected to occur in this vicinity; the pressure causing the water to rise above the aquifer results from the water seeping down from the neighbouring uplands.

It is not advisable to sink wells into the compact, dark grey Marine shales of the Bearpaw formation, as only small seepages of highly mineralized water can be expected from them. The depths at which these shales will be encountered are not expected to exceed 200 feet near the southern boundary of the township and will gradually decrease to less than 100 feet toward the northeastern corner of the area.

Township 17, Range 20

Springs near the "alkaline" lakes in sections 14 and 34 provide water for stock in the vicinity. The water supply of the remainder of the township is obtained from wells.

Very little water can be obtained from the glacial lake clays that overlie practically the entire township to depths between 10 and 20 feet. The glacial drift, underlying the lake clays, is composed chiefly of a bluish grey boulder clay. Interspersed in the upper part of this boulder clay are scattered pockets of sand and gravel from which small supplies of hard, drinkable water are being obtained at depths not exceeding 30 feet from the surface. Several test holes may be required to locate a productive sand or gravel pocket in the upper part of the glacial drift, and in some localities these pockets may be entirely absent. Shallow wells in the NE.$\frac{1}{4}$, section 6, and the SE.$\frac{1}{4}$, section 36, are yielding adequate supplies of water for farm requirements. Other shallow wells visited in the township give supplies sufficient only for household requirements and a few head of stock.

Sand and gravel pockets are much less plentiful in the boulder clay immediately underlying the upper productive zone of the drift, but at greater depths they are sufficiently numerous to form more or less continuous productive horizons over considerable areas. Wells between 50 and 132 feet in depth sunk in the lower part of the drift yield adequate supplies of water.

In the western half of the township wells between 50 and 90 feet deep have penetrated water-bearing sands and gravels at elevations between 2,319 and 2,284 feet above sea-level, and in the eastern half, wells ranging between 60 and 132 feet in depth have reached similar aquifers at elevations between 2,285 and 2,255 feet. It is possible that porous beds form a continuous water-bearing horizon with a slight dip to the east throughout the greater part of the township. The water obtained from this horizon is hard and iron-bearing, but is rarely so highly mineralized that it is unfit for drinking. Only from the wells located on the NW.$\frac{1}{4}$, section 17, and the NW.$\frac{1}{4}$, section 31, is the water from this horizon reported to be unfit for domestic use. With the exception of wells on sections 6, 7, and 22 the wells tapping this horizon yield adequate supplies of water for stock. It is probable that surface elevations are too low in the valley along the eastern margin of the township to allow the horizon to extend into this part of the area.

A few wells have been sunk below the level of this horizon and have penetrated sands and gravels considered to be at the contact between the glacial drift and the underlying Bearpaw shale. In the SW.$\frac{1}{4}$, section 17, and the SW.$\frac{1}{4}$, section 20, and the NW.$\frac{1}{4}$, section 22, wells were drilled to depths of 180, 120, and 160 feet, respectively. Quicksand was encountered in all of these wells, but no water could be obtained from the fine sand. The sand near the base of the 180- and 160-foot wells lies at elevations of 2,195 feet above sea-level and probably marks the contact of the drift and the shale. It is probable that the 120-foot well has not been sunk sufficiently deep to reach the contact at this point. A 190-foot well on the NE.$\frac{1}{4}$, section 10, is yielding a large supply of water from gravel which is probably at the contact at an approximate elevation of 2,235 feet. Information available on these wells does not indicate whether or not water-bearing beds were penetrated at the level of the upper horizon occurring at other points between elevations of 2,319 and 2,255 feet above sea-level. A 90-foot well on the NE.$\frac{1}{4}$, section 25, derives its supply from sand which may be at the contact at an approximate elevation of 2,210 feet. The upper horizon is not expected to occur at this site due to the low surface elevation. It would appear that water-bearing beds do occur in most places at the contact, but fine sands may be encountered that will yield only small seepages of water.

No satisfactory supplies of water are to be expected from the Marine shales of the Bearpaw formation that underlies the glacial drift of this township. The drift probably does not exceed 200 feet in thickness in any part of the township and is probably less than 100 feet thick in the lower parts of the valley along the eastern boundary. Drilling should be discontinued as soon as the shales are reached.

Township 17, Range 21

Water supplies of this township are obtained largely from wells less than 50 feet in depth. A few residents, however, have sunk wells to depths between 94 and 137 feet in order to obtain a sufficient water supply for stock.

As shown on Figure 1 the surface material over the western part of the township is recent dune sand and glacial lake sand. Blue-grey lake clays cover much of the eastern half and may extend for a short distance under the more recent sand deposits of the western area. The dune sands have been redeposited by wind action and are not generally of sufficient thickness to form reservoirs for ground water accumulation. However, several residents are obtaining supplies of soft, or only moderately hard, water from shallow wells sunk into the glacial lake sands and sandy clays, both where they underlie the dune sands and where they occur at the surface. The lake sands are rarely more than 25 feet thick and are underlain by glacial drift. The glacial drift is composed chiefly of bluish boulder clay. In many places the boulder clay forms impervious basins below the lake sands, from which water can be obtained by sinking shallow wells down to the base of the sand.

Water can seldom be obtained from the glacial lake clays that overlie the eastern part of the township down to depths between 10 and 20 feet. These lake clays are also underlain by glacial drift.

Localized pockets of sand and gravel occur interspersed in the boulder clay of the upper part of the glacial drift, and yield small supplies of mostly hard, drinkable water. Several residents in the eastern part of the township are obtaining water from wells between 16 and 50 feet deep, which tap these pockets. In the western part of the township, water is generally obtained from the lake sands and only a few wells have been sunk into the underlying boulder clay. The water from the surface sand is usually of better quality for domestic use than the water from the boulder clay.

The supplies from the shallow wells in this township are, in many cases, inadequate for stock requirements. Larger supplies of more highly mineralized water have been obtained by sinking wells to greater depths in the drift. Wells between 94 and 137 feet deep on sections 9, 14, 15, and 22 have penetrated water-bearing sands and gravels at elevations between 2,295 and 2,255 feet above sea-level. Wells 103 and 98 feet deep, on sections 17 and 19, are drawing supplies from sand and gravel aquifers at elevations of 2,305 and 2,330 feet. The supplies being derived from these wells are fairly large, and the water, although hard, and iron bearing, is seldom too highly mineralized to be used for drinking. However, water of better quality can usually be obtained from shallow wells in sufficient quantities for household use. The sands and gravels encountered in the deep wells may occur in a continuous bed, and it seems probable that ample supplies of water will quite generally be obtained in this township at depths of less than 140 feet.

Should this horizon prove unproductive the most probable source of supply at greater depths is at the contact between the glacial drift and the underlying Bearpaw formation. No wells have been sunk to sufficient depth in this township to reach the contact, but a 167-foot well on section 36 of the adjoining township to the south and 172- and 252-foot wells on sections 1 and 4 of the township to the north are believed to be drawing their supplies from gravels at the contact. These wells penetrated the gravels at elevations between 2,238 and 2,198 feet. This horizon is not a certain source of supply and drilling to depths between 150 and 250 feet to reach the contact is not advisable unless the supplies available at shallow depths are altogether inadequate.

Wells should not be continued into the Marine shales of the Bearpaw formation, which underlie the glacial drift at depths generally between 150 and 250 feet in this township.

Township 18, Range 19

Water supplies are being obtained from springs situated on the valley slopes along the "alkali" lake in sections 2 and 12, from small dams in the northeastern corner of the township, and from wells throughout the remainder of the area.

A thin layer of glacial lake clay overlies the entire township with the exception of a small, till-covered area along the northern boundary as shown on Figure 1 of the accompanying map. Glacial drift underlies the lake clays at depths seldom exceeding 25 feet from the surface. The glacial drift is composed mainly of bluish-grey boulder clay which weathers to a yellow or brownish colour near the surface. Water can seldom be obtained from the lake clays, but localized pockets of sand and gravel occur sparingly in the upper part of the boulder clay, from which small supplies of water can often be obtained. Two shallow wells on section 36 are yielding small supplies of hard, highly mineralized water which is unfit for drinking. Water suitable for drinking could probably be obtained at depths not exceeding 30 feet in other parts of the township, but the slight possibility of obtaining adequate supplies hardly warrants the sinking of further test holes to locate a productive sand or gravel pocket.

Except in the valley along the eastern boundary of the township, wells between 80 and 172 feet deep have penetrated sands and gravels at elevations between 2,230 and 2,170 feet above sea-level. These sands and gravels are believed to occur in a more or less continuous bed at the contact between the glacial drift and the underlying Bearpaw shales. The wells tapping these beds generally yield adequate supplies of water for local stock requirements. However, due to the fineness of the water-bearing sand, a 105-foot well on section 4 and a 170-foot well on section 33 yield only small supplies of water. The water obtained from this horizon is generally hard, iron-bearing, and highly mineralized, but can, in most places, be used for drinking. The water from wells on sections 5, 7, and 8, is not being used for domestic purposes.

The surface elevations in the valley along the eastern boundary of the township are below the level of this horizon and the springs along its western bank are probably fed from the water-bearing sands and gravels encountered in wells on the uplands to the west. The glacial drift is probably relatively thin in the valley and the 75-foot well on section 13 may be drawing its supply from sand at the contact at an approximate elevation of 2,089 feet. This well and others in the adjoining township to the east indicate that water supplies will generally be obtained in the valley at depths of less than 100 feet.

Near the western boundary of the township on sections 19 and 31 wells drilled to depths of 300 and 308 feet are yielding large supplies of hard, iron-bearing water from a sand bed in the Bearpaw formation encountered at elevations of 1,995 and 2,000 feet. These wells probably reach the Bearpaw shales at depths of approximately 100 feet and pass through 150 feet of shale before reaching the sandy beds that were reported to have been encountered at depths between 255 and 308 feet in the well on section 31. This sandy horizon in the Bearpaw may extend over a considerable area, but no other wells in the municipality have been sunk to sufficient depths to prove or disprove its presence. Due to higher surface elevation in the central part of this township it would be necessary to drill to depths between 350 and 400 feet to reach the level of this horizon.

Township 18, Range 20

Water supplies in the township are being obtained almost entirely from wells not exceeding 100 feet in depth.

Very little water can be obtained from the glacial lake clays that mantle practically the entire township to depths as a rule between 10 to 20 feet. However, scattered pockets and thin beds of sand and gravel occur interspersed in the upper part of the underlying boulder clay, from which several residents of the township are deriving water supplies. The pockets of sand and gravel occurring within 30 feet of the surface are generally of small areal extent, and the supplies obtained from them will usually be sufficient only for a few head of stock and household requirements. Most of the water obtained from the shallow wells is less highly mineralized than from greater depths in the drift and hence is more satisfactory for domestic use. Several test holes may be necessary in order to locate a productive sand or gravel pocket at shallow depths, and in some localities these may be altogether absent. Nevertheless, where the water from the deeper wells is too highly mineralized for drinking it is usually possible to obtain small supplies for household use from shallow wells.

In the southwestern half of the township, wells between 35 and 65 feet deep generally yield adequate supplies of water for local requirements. The supply from a 65-foot well on section 2 is inadequate, due to the fine sand plugging the well. The sand and gravel beds encountered in these wells do not appear to be extensive, but no dry holes have been reported in the area. This would indicate that the water-bearing beds are quite general and that water will usually be obtained in the area at depths not exceeding 75 feet from the surface. The water from these wells contains large amounts of sulphate salts in solution, but it can be used for drinking by persons accustomed to the use of highly mineralized water. In the northeastern half of the township water is being obtained from sands and gravels occurring at elevations between 2,230 and 2,200 feet. These beds probably occur as a more or less continuous water-bearing horizon, and although definite confirmation is not available they may lie at the contact of the glacial drift and the underlying Bearpaw shales. The wells penetrating this horizon vary from 45 to 100 feet deep, depending on the surface elevation at the well site. With the exception of wells located in the NE.$\frac{1}{4}$, section 25, and the SE.$\frac{1}{4}$, section 33, all wells tapping the sands and gravels yield adequate supplies of water. The water, although highly mineralized, is generally suitable for drinking. A few residents, however, are hauling their domestic supplies or are obtaining them from shallow wells. The above horizon will probably be productive in the southwestern part of the township at greater depths than in the lower lands in the northeastern parts. Wells located in the SE.$\frac{1}{4}$, section 1, the SE.$\frac{1}{4}$, section 30, and the NW.$\frac{1}{4}$, section 31, are 92, 65, and 50 feet deep, respectively, and are down to elevations of approximately 2,240 feet. These wells may be drawing their supplies from the same horizon as the wells in the northeastern part of the township. At some locations in the southwestern corner of the township it would be necessary to drill to depths between 150 and 200 feet to reach this horizon. However, in this area, water might be encountered at elevations between 2,260 and 2,290 feet at the horizon tapped by two 130 foot wells on sections 12 and 13 of the adjoining township to the west.

A well, reported to be 242 feet deep, on section 13 of this township, is yielding a large supply of hard, highly mineralized water which is unfit for drinking but suitable for stock.

This well is probably drawing its supply from a sand bed in the Bearpaw formation. This well, and other wells, 300 and 308 feet deep, on sections 19 and 31 of the adjoining township to the east, indicate the possibility of obtaining water from sand beds in the lower part of the Bearpaw formation at similar depths in the northeastern half of this township. There is no certainty of obtaining water at this level as the continuity of the sand over large areas has not been proved. It is inadvisable to sink wells to these depths unless the supplies from wells less than 100 feet deep are altogether inadequate. In the southwestern corner of the township the sand beds in the Bearpaw, if present, would lie at least 400 feet below the surface.

Township 18, Range 21

Light blue-grey, glacial lake clays, 10 to 20 feet thick, overlie the glacial boulder clay throughout the eastern third of the township. These lake clays are non-water-bearing, but are underlain by glacial drift from which water is obtained. They become more sandy in a westerly direction and the western half of the area is covered with glacial lake sands. Along the extreme western border of the township dune sand marking the eastern edge of the Great Sand Hills overlies the lake sands. The dune sands are generally not sufficiently thick to form reservoirs for any satisfactory supplies of ground water. Wells sunk in them to the base of the underlying lake sands might be productive in areas where basins occur in the surface of the underlying glacial drift. Only a few wells have been sunk in the area. At these places the surface sands were unproductive and the wells were continued into the underlying glacial drift.

Scattered pockets of sand and gravel are interspersed in the boulder clay forming the upper part of the glacial drift.

A few residents have shallow wells tapping these pockets, which yield small supplies of drinkable water sufficient for household requirements and for a few head of stock. Several test holes may be necessary to locate a productive pocket in any locality and unless stock requirements are small or a supply for household use only is required, it is advisable to sink wells to greater depths in the glacial drift.

Water-bearing sands and gravels were encountered at elevations between 2,290 and 2,260 feet above sea-level in the east-central part of the township. It is possible that a fairly extensive water-bearing bed may occur between these elevations throughout this part of the area. Water is being obtained from this horizon in two 130-foot wells on sections 12 and 13, and at depths of 74, 60, and 43 feet in sections 21, 23, and 24, where surface elevations are lower. The supplies from the wells on sections 13 and 24 are small, but from the others they are reported to be adequate for local requirements. The water obtained from this horizon is hard and generally iron-bearing, but is being used for drinking.

In the northern part of the township surface elevations are in many places lower than the level of this horizon and the aquifer will, therefore, not be present. However, water-bearing gravels are encountered at elevations of 2,228 and 2,198 feet in wells 92 and 72 feet deep in sections 25 and 36. These gravels may occur at the contact between the glacial drift and the underlying Bearpaw shales and will probably be encountered at increasing depths toward the southern part of the township. On sections 1 and 4, wells 17[illegible] and 252 feet deep are yielding large supplies of water from gravels probably occurring at the contact at elevations of 2,238 and 2,198 feet. The water being obtained from the four wells referred to above is hard and contains appreciable quantities of mineral salts, but can be used for drinking.

Drilling into bedrock is not advisable in this township unless the supplies now obtained are altogether inadequate. In the area of low elevation in the northern part of the township water might be obtained at depths between 300 and 500 feet from sand beds in the lower part of the Bearpaw formation or in the underlying Belly River formation. In the southern part of the township the depths necessary to reach the level of the productive beds in these formations would be 200 to 250 feet greater. Since the water-producing conditions of the Belly River formation have not been proved even in the northern part of the township it seems inadvisable to sink wells to these depths before the glacial drift has been carefully prospected.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF PITTVILLE, NO.169, SASKATCHEWAN

Township	16	16	16	17	17	17	18	18	18	Total No. in municipality
West of 3rd meridian Range	19	20	21	19	20	21	19	20	21	
Total No. of Wells in Township	88	53	47	32	29	25	20	26	18	338
No. of wells in bedrock	0	0	0	0	0	0	2	1	0	3
No. of wells in glacial drift	88	53	47	32	29	25	18	25	18	335
No. of wells in alluvium	0	0	0	0	0	0	0	0	0	0
Permanency of Water Supply										
No. with permanent supply	79	37	38	32	28	25	20	26	16	301
No. with intermittent supply	0	1	1	0	0	0	0	0	0	2
No. dry holes	9	15	8	0	1	0	0	0	2	35
Types of Wells										
No. of flowing artesian wells	0	0	0	1	0	0	0	0	0	1
No. of non-flowing artesian wells	22	6	4	19	17	7	9	18	10	112
No. of non-artesian wells	57	32	35	12	11	18	11	8	6	190
Quality of Water										
No. with hard water	71	31	32	32	28	18	20	25	14	271
No. with soft water	8	7	7	0	0	7	0	1	2	32
No. with salty water	0	0	0	2	0	0	1	0	0	3
No. with "alkaline" water	5	2	14	8	5	2	5	6	0	47
Depths of Wells										
No. from 0 to 50 feet deep	42	32	39	11	7	19	5	9	12	176
No. from 51 to 100 feet deep	37	19	5	14	16	3	5	16	6	121
No. from 101 to 150 feet deep	6	1	3	5	3	3	5	0	0	26
No. from 151 to 200 feet deep	3	0	0	2	3	0	3	0	0	11
No. from 201 to 500 feet deep	0	1	0	0	0	0	2	1	0	4
No. from 501 to 1,000 feet deep	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
How the Water is Used										
No. usable for domestic purposes	55	24	29	26	20	23	14	21	13	225
No. not usable for domestic purposes	24	14	10	6	8	2	6	5	3	78
No. usable for stock	71	38	37	31	25	25	19	26	15	287
No. not usable for stock	8	0	2	1	3	0	1	0	1	16
Sufficiency of Water Supply										
No. sufficient for domestic needs	72	31	33	31	24	21	19	25	15	271
No. insufficient for domestic needs	7	7	6	1	4	4	1	1	1	32
No. sufficient for stock needs	65	22	30	22	20	19	17	19	9	223
No. insufficient for stock needs	14	16	9	10	8	6	3	7	7	80

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 excesss 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 Pittville, No.169, 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.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	
1	SE.	14	17	19	3rd	40	940	650	500	150	27	310	00	151	496	238	1,020	107		171	206		491	45	ж1
2	SW.	22	17	19	3rd	90	2,120	1,300	1,200	100	35	130	130	241	1,131	327	1,725	130	139		718		680	58	ж1
3	NW.	31	17	20	3rd	91	1,840	1,600	1,400	200	58	320	290	238	935	165	1,656	320	270		709		261	96	ж1

Water samples indicated thus, ж1, are from glacial drift.
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

Since only three samples of ground water were collected for analyses in this municipality, by the Geological Survey, the following generalizations are based largely upon observations at well sites, opinions of residents, and analysis of waters in adjoining areas in which the source beds are similar. Water occurring in the sloughs is generally "alkaline". This condition is noted particularly in sloughs occurring in undrained depressions in the lake clays. It is assumed that soluble salts occurring in the lake clays are washed into the depressions by surface waters. Evaporation of the water tends to concentrate the salts to such an extent that some of the supplies are rendered unfit even for watering stock. Other supplies are usable in the spring, but become too "alkaline" for use as summer progresses. Water from shallow wells sunk beside sloughs in the glacial drift-covered area is generally hard, and drinkable, but where the water in the sloughs is "alkaline", as is common in the lake clay area, it may prove to be unsatisfactory for domestic use.

Ground water occurring in porous dune and lake sands is not generally highly mineralized. This is due to the fact that the sands contain only minor amounts of readily soluble salts. Hence the waters in them are soft or only moderately hard, and are quite suitable for domestic use. No wells are known to be deriving their supply from the compact, blue-grey lake clays that cover a large part of the central and north-eastern townships. Such small seepages as do come from the clay are usually highly charged with dissolved sulphate salts, but are not as highly mineralized as waters from the compact boulder clay forming the till. Water derived from sand and gravel pockets occurring at the contact of the lake clay and boulder clay, or in the upper few feet of the boulder clay, is generally of good quality. The first analysis given on the accompanying table is of water from a 40-foot well that taps a gravel pocket underlying the lake clay on the SE.$\frac{1}{4}$, sec. 14, tp. 17, range 19. This water contains 940 parts per million of total solids, an amount much lower than many waters from the drift, but probably somewhat higher than for waters from the dune and lake sands. The hardness likewise is not excessive. Sodium sulphate (Na_2SO_4) and magnesium sulphate ($MgSO_4$) when present together in amounts greatly exceeding 1,000 parts per million cause a laxative effect upon persons using the water. Water having a concentration of approximately 700 parts per million of the combined salts would have no ill effects and would not have a perceptibly "alkaline" taste. The other salts present, calcium and magnesium carbonate ($CaCO_3$) and ($MgCO_3$) are not in sufficient concentration to have any harmful effects, but they contribute to the hardness of the water. This water is considered to be representative of supplies obtained from coarse sand and gravel pockets occurring in this upper drift zone below the lake clays or in the upper 30 feet of the till and moraine-covered area of the southern parts.

The boulder clay is regarded as being the source of the sulphate salts that create the "alkaline" taste in waters from the drift. Hence waters derived entirely from the boulder clay or from porous beds of only limited areal extent are apt to be highly mineralized with total dissolved solid contents occasionally exceeding 7,500 parts per million. Such waters are strongly laxative and cannot be used even for watering stock. Even in thick beds of gravel and sand, where covered by any considerable thickness of boulder clay, the water will be highly mineralized. The effects on the water of increased depth in the drift and the greater opportunity offered for downward percolating waters to absorb salts are seen in analyses 2 and 3, given on the analysis table. It will be noted that the sulphate salts predominate as in analysis No. 1, but in much greater concentrations. These wells, located on the SW.$\frac{1}{4}$, sec. 22, tp. 17, range 19, and the NW.$\frac{1}{4}$, sec. 31, tp. 17, range 20, are 96 and 91 feet deep. The waters show, respectively, 2,120 and 1,840 parts per million of total dissolved solids. The waters would probably prove objectionable to persons unaccustomed to highly mineralized waters, but are being used by the residents for both domestic and stock purposes with no reported ill effects. It is possible that these waters occur at the contact of the drift and the underlying Bearpaw formation, but in places where water is known to have been in contact with the shale even greater total solid contents have been observed.

Analyses 2 and 3 are believed to be fairly representative of waters from the lower part of the glacial drift in this municipality. The same mineral salts in approximately the same relative quantities will be present in most of the waters obtained from this source. In some places, however, the waters will have higher concentration of the mineral salts and be altogether unfit for domestic use.

Most of the waters obtained from the lower part of the glacial drift contain iron salts in solution, which form stains on pails and kitchen utensils. However, these salts are seldom present in sufficient quantities to affect the quality of the water for drinking.

Water from the Bedrock

No analyses were made of waters from any of the three wells in this municipality that derive their supplies from sand beds in the Bearpaw formation. However, waters from sand beds in the lower part of the Bearpaw in the adjoining municipality to the east were found to contain high concentrations of sodium sulphate and sodium chloride (common salt). These salts will probably be the predominant mineral salts in the waters from the sand beds in the lower part of the Bearpaw formation in this municipality. The waters from the 300- and 308-foot wells in secs. 19 and 31, township 18, range 19, are reported to be hard and iron-bearing, but suitable for domestic use. The water from the 242-foot well on sec. 13, tp. 18, range 20, is more highly mineralized and is not being used for drinking.

Any seepages of water obtained from the compact Marine shales, which comprise the greater part of the Bearpaw formation, would probably contain very large quantities of sodium sulphate and sodium chloride and would be unfit for drinking, and might cause scour in stock.

WELL RECORDS—Rural Municipality of PITTVILLE, NO. 169, 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	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SW.	1	16	19	3	Bored	120	2,400	− 60	2,340	120	2,280	Glacial drift	Hard, clear, iron		S	Abundant supply; a second 20-foot well; aquifer in quicksand; hard, drinking water.
2	SW.	2	"	"	"	Dug	30	2,360	− 10	2,350	10	2,350	Glacial sand	Hard, clear		D, S	Sufficient supply.
3	SE.	3	"	"	"	Bored	34	2,400	− 16	2,384	16	2,384	Glacial drift	Hard, clear		D, S	Insufficient; 3 to 4 pails a day; 75-foot dry holes; 16-foot well in slough gives good supply.
4	NW.	3	"	"	"	Bored	85	2,410	− 75	2,335	75	2,335	Glacial drift	Hard, clear		D, S	Supplies household and 10 head stock.
5	SE.	4	"	"	"	Dug	96	2,440	− 92	2,348	92	2,348	Glacial sand	Hard, clear, "alkaline"		D, S	Barely sufficient; also two similar wells.
6	SE.	5	"	"	"	Dug	15	2,410	− 8	2,402	8	2,402	Glacial sand	Soft, clear		S	Fair supply.
7	NE.	5	"	"	"	Dug	20	2,440	− 0	2,440	10	2,430	Glacial sand	Hard, clear		D, S	Sufficient supply; test hole near slough gave 15 feet water.
8	NW.	5	"	"	"	Dug	16	2,400	− 12	2,388	12	2,388	Glacial sand	Soft, clear		D, S	Supplies household and 20 head stock; also a similar well and a third 96-foot well yielding a small supply of hard water.
9	NE.	6	"	"	"	Bored	87	2,400	− 71	2,329	87	2,313	Glacial gravel	Hard, clear		D, S	Sufficient but used only in winter; second 40-foot well has 16 feet of soft water.
10	NE.	6	"	"	"	Dug	40	2,400	− 32	2,368	40	2,360	Glacial sand	Hard, clear, sulphur?		D, S	Sufficient supply; also 42-foot similar well.
11	SW.	9	"	"	"	Bored	75	2,420	− 48	2,372	82	2,338	Glacial sand	Hard, clear, iron		D, S	Abundant supply.
12	NE.	9	"	"	"	Bored	78	2,390	− 58	2,332	78	2,312	Glacial sand	Hard, clear, iron		D, S	Supplies household and 50 head stock. Second 37-foot well with 28 feet of water.
13	NE.	10	"	"	"	Dug	50	2,350	− 28	2,322	50	2,300	Glacial gravel	Hard, clear, iron		D, S	Supplies household and 50 head stock.
14	SW.	11	"	"	"	Dug	50	2,400	− 46	2,354	46	2,354	Glacial sand	Clear		N	This well is out of repair.
15	SW.	12	"	"	"	Bored	90	2,400	− 82	2,318	82	2,318	Glacial gravel	Hard, clear, iron		N	Hauls all water.
16	SE.	13	"	"	"	Dug	96	2,400	− 93	2,307	93	2,307	Glacial gravel	Hard, clear, iron		D, S	Insufficient; greatest yield 3 barrels a day. Other similar wells with small yield.
17	NW.	13	"	"	"	Dug	60	2,400	− 57	2,343	57	2,343	Glacial drift	Hard, clear		D, S	Sufficient for household and 8 head stock.
18	SW.	14	"	"	"	Dug	35	2,390	− 31	2,359	31	2,359	Glacial sand	Clear		D, S	Sufficient supply.
19	SW.	15	"	"	"	Dug	22	2,350	− 22	2,328	18	2,332	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for household and 10 head stock.
20	SE.	17	"	"	"	Bored	100	2,400	− 60	2,340	100	2,300	Glacial sand	Hard, clear, iron		D, S	Sufficient supply.
21	SW.	17	"	"	"	Dug	15	2,410	− 10	2,400	10	2,400	Glacial gravel	Soft, clear		S	Supplies 30 head stock.
22	NW.	17	"	"	"	Bored	119	2,420	−115	2,305	115	2,305	Glacial gravel	Hard, clear, iron		S	Supplies 12 head stock; another 35-foot well with 5 feet of soft water.
23	NW.	18	"	"	"	Dug	22	2,450	− 17	2,433	17	2,433	Glacial sand	Soft, clear		D, S	Supplies household and 25 head stock; second 45-foot well with 25 feet hard water.
24	SW.	19	"	"	"	Bored	38	2,380	− 20	2,360	28	2,352	Glacial sand			S	Sufficient for stock.
25	NW.	19	"	"	"	Bored	32	2,400			28	2,372	Glacial sand	Hard, cloudy		D	Used for house only.
26	NE.	19	"	"	"	Dug	21	2,380	− 17	2,363	17	2,363	Glacial sand	Hard		D, S	Supplies household and 22 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 PITTVILLE, NO. 169, 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
27	NE.	20	16	19	3	Bored	50	2,410	− 29	2,381	50	2,360	Glacial gravel	Hari, clear		D, S	Supplies household and 30 head stock.
28	SW.	21	"	"	"	Bored	135	2,400	− 85	2,315	135	2,265	Glacial drift	Hard, clear, iron		S	Abundant supply for stock; second 55-foot well supplies hard water for house use.
29	SW.	22	"	"	"	Bored	85	2,400	− 75	2,325	85	2,315	Glacial gravel	Hard, iron		D, S	Supplies household and 40 head stock.
30	SE.	22	"	"	"	Bored	80	2,370	− 58	2,312	80	2,290	Glacial gravel	Soft, clear		D, S	Abundant supply.
31	SW.	23	"	"	"	Bored	70	2,360	− 50	2,310	50	2,310	Glacial gravel	Hard, clear, iron, red sediment		D, S	Sufficient supply.
32	SE.	23	"	"	"	Bored	32	2,300	− 23	2,277	23	2,277	Glacial gravel	Soft, clear		D, S	Abundant supply; also similar well.
33	NW.	23	"	"	"	Bored	65	2,350					Glacial sand	Hard, clear		D, S	Insufficient supply.
34	NW.	24	"	"	"	Spring	0	2,300	− 0	2,300	0	2,300	Glacial sand	Hard, clear		S	Insufficient supply.
35	SE.	25	"	"	"	Dug	45	2,375	− 42	2,333	42	2,333	Glacial sand	Soft, clear		D, S	Supplies household and 12 head stock.
36	NE.	25	"	"	"	Bored	90										Practically no water; buildings moved to the SE.¼, section 25; also 80-foot similar well.
37	SE.	27	"	"	"	Spring		2,300	0	2,300	0	2,300	Glacial gravel	Hard, clear, "alkaline"		S	Abundant supply for stock.
38	SW.	27	"	"	"	Bored	120	2,400	−100	2,300	120	2,280	Glacial gravel	Hard, clear		D, S	Sufficient and constant supply.
39	NW.	27	"	"	"	Drilled	157	2,420	− 87	2,333	157	2,263	Glacial gravel	Soft, clear		N	60-foot hard water well yields 1 barrel a day. 19-foot well, "alkaline" water, for stock.
40	SE.	28	"	"	"	Bored	46	2,420	− 26	2,394	46	2,374	Glacial gravel	Hard, clear		D, S	Sufficient supply; second 20-foot well; also 70-foot dry hole.
41	NE.	28	"	"	"	Dug	40	2,410	− 34	2,376	34	2,376	Glacial sand	Hard, sediment		D, S	Supplies household and 30 head stock; second 40-foot well, large supply of similar water.
42	SW.	29	"	"	"	Bored	35	2,415	− 21	2,394	35	2,380	Glacial gravel	Hard, clear		D, S	Sufficient supply; 60-and 70-foot wells unused.
43	SE.	30	"	"	"	Dug	42	2,400	− 39	2,361	39	2,361	Glacial drift	Hard, clear		D, S	Sufficient supply; also 60-foot well in quicksand; filled in.
44	NW.	30	"	"	"	Bored	35	2,400	− 29	2,371	29	2,371	Glacial sand	Hard, clear		D, S	Supplies household and 15 head stock.
45	SW.	31	"	"	"	Bored	50	2,390	− 25	2,365	25	2,365	Glacial drift	Hard, clear, "alkaline"		S	Insufficient; hauls water; also 6 dry holes from 60 to 100 feet deep.
46	NE.	31	"	"	"	Bored	135	2,530	−125	2,305	136	2,294	Glacial gravel	Hard, clear, iron		D, S	Supplies household and 200 head stock. second 18-foot well with 6 feet soft water.
47	SW.	32	"	"	"	Bored	60	2,430	− 60	2,370	45	2,385	Glacial drift	Hard, clear, iron, "alkaline"		D, S	Insufficient supply; hauls water.
[illegible]	SE.	32	"	"	"	Drilled	128	2,410	−128	2,282	128	2,282	Glacial sand	Hard, clear, iron, black sediment		D, S	Sufficient supply; also 17-foot well in ravine with 5 feet soft water.
49	NW.	33	"	"	"	Drilled	160	2,420	−140	2,280	160	2,260	Glacial sand	Hard, clear, iron		D, S	Sufficient supply; 3 barrels an hour. Also 70-foot well and 25-foot well.
50	SE.	33	"	"	"	Bored	91	2,420	− 66	2,354	91	2,329	Glacial gravel	Hard, clear, iron		D, S	Supplies household and 30 head stock.
51	NW.	35	"	"	"	Bored	62	2,400	− 49	2,351	62	2,338	Glacial gravel	Hard, clear		D, S	Supplies household and 50 head stock.
52	[illegible]	35	"	"	"	Bored	160	2,410	−150	2,260	160	2,250	Glacial sand	Hard, clear, iron		S	Supplies 11 head stock; 30-foot well for household.

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 PITTVILLE, NO. 169, 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	16	20	3	Dug	18	2,350	− 11	2,339	11	2,339	Glacial sand	Soft, clear		S	Sufficient for 17 head stock.
2	SW.	2	"	"	"	Bored	30	2,400	− 30	2,370	30	2,370	Glacial drift	Hard, clear		S	Sufficient but little used.
3	NE.	2	"	"	"	Dug	35	2,420	− 32	2,388	32	2,388	Glacial gravel	Hard, clear		D, S	Insufficient; supplies house and 4 horses.
4	SW.	4	"	"	"	Bored	81	2,420	− 53	2,367	81	2,339	Glacial sand	Hard, cloudy, iron		D, S	Supplies household and 50 head stock.
5	SW.	7	"	"	"	Dug	40	2,445			40	2,405	Glacial sand	Hard, clear		D, S	Sufficient supply.
6	SE.	9	"	"	"	Dug	27	2,350	− 18	2,332	18	2,332	Glacial gravel	Hard, clear		D, S	Insufficient; waters 15 head stock; 10-foot seepage well in slough.
7	NW.	9	"	"	"	Dug	27	2,390	− 21	2,369	21	2,369	Glacial gravel	Soft, clear		D, S	Supplies household and 25 head stock.
8	SE.	10	"	"	"	Dug	50	2,400	− 48	2,352	48	2,352	Glacial sand	Hard, clear		D	Insufficient; supplies house; second well 8 feet deep.
9	SW.	14	"	"	"	Dug	24	2,360					Glacial drift				Intermittent supply.
10	NE.	15	"	"	"	Bored	60	2,400	− 54	2,346	54	2,346	Glacial sand	Hard, clear, iron		D, S	
11	NW.	15	"	"	"	Dug	85	2,400	− 85	2,315	79	2,321	Glacial drift	Hard, clear, iron		D, S	Insufficient; waters 18 head stock.
12	SE.	17	"	"	"	Dug	18	2,350	− 12	2,338	12	2,338	Glacial sand	Hard, clear		D, S	Sufficient supply.
13	NE.	21	"	"	"	Dug	45	2,400	− 20	2,380	45	2,355	Glacial gravel	Hard, clear		D, S	Sufficiant supply.
14	SE.	22	"	"	"	Bored	29	2,425	− 26	2,399	26	2,399	Glacial sand	Hard, clear		D	Sufficient only for household; second 23-foot well, hard water, supplies 15 head stock.
15	NE.	22	"	"	"	Dug	25	2,420	− 22	2,398	22	2,398	Glacial sand	Soft, clear		S	Sufficient for stock; also 48-foot well; poor supply, very hard water; third 24-foot well.
16	SW.	23	"	"	"	Dug	30	2,380	− 27	2,353	27	2,353	Glacial sand	Hard, clear		D, S	Insufficient; waters only 6 head stock; hauls water.
17	SE.	24	"	"	"	Bored	50	2,390	− 45	2,345	45	2,345	Glacial sand	Hard, clear		D, S	Insufficient supply; hauls water.
18	NW.	24	"	"	"	Bored	133	2,440	−100	2,340	133	2,307	Glacial drift	Hard, clear, iron		D, S	Sufficient supply.
19	SE.	25	"	"	"	Bored	30	2,460	− 28	2,432	28	2,432	Glacial drift	Hard, clear		D	Sufficient for local needs.
20	SW.	25	"	"	"	Dug	18	2,450	−16	2,434	16	2,434	Glacial sand	Hard, clear		S	Sufficient for 12 head stock.
21	NW.	25	"	"	"	Bored	30	2,450	− 22	2,428	22	2,428	Glacial drift	Soft, clear		D,S	Sufficient supply; 15 dry holes from 70 to 100 feet deep.
22	SW.	28	"	"	"	Drilled	235	2,460	− 90	2,370	235	2,225	Glacial sand	Hard, clear		D, S	Sufficient supply; also 30-foot well with hard water, poor supply.
23		30	"	"	"	Dug	27	2,400	− 25	2,375	25	2,375	Glacial sand	Hard, clear, "alkaline"		D, S	Does not come in very quickly; also two springs.
24	SE.	31	"	"	"	Dug	30	2,410	− 20	2,390	30	2,380	Glacial sand	Hard, clear		D, S	Sufficient supply.
25	NE.	31	"	"	"	Dug	20	2,420	− 10	2,410	10	2,410	Glacial drift	Soft, clear		D	Sufficient for household; stock watered on the NW.¼, section.

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

WELL RECORDS—Rural Municipality of PITTVILLE, NO. 169, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
26	NW.	32	16	20	3	Dug							Glacial drift	Soft, clear		S	
27	SE.	32	"	"	"	Dug	45	2,420	- 35	2,385	35	2,385	Glacial drift	Hard, clear		D,S	Insufficient supply.
28	SW.	34	"	"	"	Bored	48	2,450	- 34	2,416	34	2,416	Glacial sand	Soft, clear		S	Insufficient supply.
29	NW.	35	"	"	"	Bored	48	2,350	- 38	2,312	38	2,312	Glacial sand	Hard, clear, "alkaline"		S	Sufficient for stock.
30	SE.	36	"	"	"	Dug	23	2,380	- 20	2,360	20	2,360	Glacial sand	Hard, clear		D, S	Abundant supply.
1	NW.	1	16	21	3	Bored	33	2,400	- 23	2,377	23	2,377	Glacial gravel	Hard, clear	41	D, S	Sufficient supply; 6 dry holes 40 to 50 feet deep.
2	SE.	2	"	"	"	Bored	30	2,450	- 24	2,426	24	2,426	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
3	SE.	2	"	"	"	Dug	32	2,450	- 26	2,424	26	2,424	Glacial sand	Hard	42	D, S	Sufficient supply.
4	SE.	3	"	"	"	Dug	57	2,425	- 50	2,375	50	2,375	Glacial sand	Soft, clear	42	D, S	Sufficient supply.
5	SE.	5	"	"	"	Dug	27	2,400	- 25	2,375	25	2,375	Glacial sand	Hard, cloudy	43	D, S	Sufficient supply.
6	SW.	6	"	"	"	Dug	29	2,400	- 24	2,376	24	2,376	Glacial drift	Soft, clear	43	D, S	Insufficient supply; also 75-foot dry hole.
7	NW.	6	"	"	"	Bored	60	2,375	- 52	2,323	52	2,323	Glacial gravel	Hard, clear	42	S	Sufficient supply.
8	SE.	9	"	"	"	Dug	31	2,375	- 21	2,354	21	2,354	Glacial sand	Hard, clear, "alkaline"	44	D, S	Sufficient supply; laxative.
9	SW.	9	"	"	"	Dug	27	2,425	- 22	2,403	22	2,403	Glacial drift	Hard, clear	44	D, S	Sufficient supply.
10	SW.	10	"	"	"	Dug	28	2,450	- 21	2,429	26	2,424	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Another similar well but nearly dry.
11	SE.	11	"	"	"	Dug	25	2,450	- 17	2,433	17	2,433	Glacial sand	Hard, clear	42	S	Sufficient for local needs.
12	SE.	12	"	"	"	Dug	23	2,450	- 18	2,432	18	2,432	Glacial gravel	Hard, clear	43	S	Sufficient for local needs.
13	NW.	12	"	"	"	Bored	110	2,450	- 93	2,357	93	2,357	Glacial sand	Hard	42	D, S	Sufficient for local needs.
14	NW.	13	"	"	"	Dug	18	2,450	- 15	2,435	15	2,435	Glacial sand	Soft, clear		D, S	Sufficient for local needs.
15	SW.	14	"	"	"	Dug	19	2,425	- 12	2,413	12	2,413	Glacial drift	Hard, clear	43	D, S	Sufficient for local needs.
16	NW.	14	"	"	"	Dug	21	2,425	- 18	2,407	18	2,407	Glacial sand	Soft, clear	43	D, S	Sufficient for local needs.
17	SW.	15	"	"	"	Dug	83	2,425	- 43	2,382	43	2,382	Glacial sand	Hard, clear, "alkaline"	43	N	Not in use at present.
18	NW.	15	"	"	"	Dug	20	2,450	- 5	2,445	15	2,435	Glacial gravel	Soft, clear	42	D, S	Sufficient for local needs.
19	NE.	15	"	"	"	Dug	75	2,475	- 45	2,430	75	2,400	Glacial gravel	Hard, clear, "alkaline"	44	D, S	Sufficient for local needs.
20	SE.	16	"	"	"	Dug	30	2,425	- 23	2,402	23	2,402	Glacial sand	Hard, clear, "alkaline"	44	S	Sufficient for local needs.
21	NE.	17	"	"	"	Dug	23	2,400	- 20	2,380	20	2,380	Glacial sand	Hard, clear, "alkaline"	42	D, S	Insufficient for local needs; also a dry hole.
22	NE.	20	"	"	"	Dug	13	2,438	- 9	2,429	9	2,429	Glacial sand	Hard, "alkaline"	45	D, S	Insufficient supply; laxative.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PITTVILLE, NO. 169, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
23	SE.	21	16	21	3	Dug	13	2,450	- 12	2,438	12	2,338	Glacial drift	Hard, "alkaline"	45	D, S	Insufficient supply; another 16-foot well unfit for use.
24	SW.	21	"	"	"	Dug	18	2,450	- 13	2,437	13	2,437	Glacial drift	Hard, clear	42	D, S	Sufficient along with three similar wells.
25	NE.	21	"	"	"	Dug	18	2,400	- 16	2,384	16	2,384	Glacial sand	Hard, clear	42	S	Barely sufficient for local needs.
26	SE.	23	"	"	"	Dug	20	2,450	- 18	2,432	18	2,432	Glacial sand	Soft, clear	43	D, S	
27	NE.	24	"	"	"	Dug	25	2,375	- 11	2,364	11	2,364	Glacial sand	Hard, clear, "alkaline"	44	D, S	Sufficient for local needs; laxative.
28	SE.	25	"	"	"	Spring		2,285	- 0	2,285	0	2,285	Glacial drift	Hard, clear, "alkaline"	50		600 barrels of water a day; very useful in dry years; laxative.
29	SE.	28	"	"	"	Dug	28	2,400	- 24	2,376	24	2,376	Glacial sand	Soft		D, S	Sufficient for local needs.
30	SW.	29	"	"	"	Dugout							Glacial sand	Hard, "alkaline"		S	Sufficient supply.
31	SE.	31	"	"	"	Dugout							Glacial sand	Hard, "alkaline"		S	Sufficient supply.
32	NW.	34	"	"	"	Dugout							Glacial sand	Hard, "alkaline"		S	Sufficient supply.
33	SE.	35	"	"	"	Bored	135	2,375					Glacial sand	Hard, clear		D	Intermittent supply; now dry.
34	NE.	36	"	"	"	Bored	167	2,400	-155	2,245	162	2,238	Glacial gravel	Hard, "alkaline"	42	S	
1	NE.	2	17	19	3	Bored	65	2,436					Glacial drift	Hard, clear		D, S	Insufficient; supplies 8 head stock.
2	SW.	2	"	"	"	Bored	174	2,400	--134	2,266	174	2,226	Glacial gravel	Hard, clear, iron		D, S	Abundant supply.
3	SE.	3	"	"	"	Bored	47	2,390	- 43	2,347	43	2,347	Glacial drift	Hard, clear		D, S	Insufficient; waters 3 head stock.
4	NW.	4	"	"	"	Bored	160	2,420	- 70	2,350	120	2,300	Glacial gravel	Hard, clear, iron		D, S	Supplies household and 50 head stock.
5	SW.	4	"	"	"	Dug	40						Glacial drift				Small supply.
6	SE.	6	"	"	"	Bored	73	2,425	- 53	2,372	73	2,352	Glacial gravel	Hard, clear, iron		D, S	Abundant supply.
7	NE.	9	"	"	"	Bored	70	2,355	- 35	2,320	70	2,285	Glacial sand	Hard, clear, iron		D, S	Supplies household and 12 head stock.
8	W.½	9	"	"	"								Glacial drift				Shallow well.
9	NW.	13	"	"	"	Dug	80	2,320			80	2,240	Glacial sand	Hard, clear		D, S	Supplies household and 20 head stock.
10	SE.	14	"	"	"	Bored	40	2,285	- 10	2,275	40	2,245	Glacial gravel	Hard, clear, "alkaline"		D, S	Abundant supply; #.
11	NE.	14	"	"	"	Bored	115	2,325			115	2,210	Glacial sand	Hard, clear, iron		D, S	Supplies household and 30 head stock; second 60-foot well.
12	NW.	15	"	"	"	Bored	65	2,335	- 60	2,275	60	2,275	Glacial drift	Hard, clear		D, S	Supplies household and 20 head stock.
13	SW.	16	"	"	"	Bored	82	2,354	- 72	2,282	72	2,282	Glacial drift	Hard, clear, iron		D, S	Insufficient; will not water 15 head stock.
14	NW.	16	"	"	"	Bored	108	2,360			108	2,252	Glacial drift	Hard, clear, iron, "alkaline"		D, S	Ample supply.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PITTVILLE, NO. 169, 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
14	NW.	22	17	21	3	Drilled	94	2,370	- 32	2,338	90	2,280	Glacial gravel	Hard, clear, iron, "alkaline"		S	Sufficient for stock; second 16-foot well, good supply.
15	SE.	23	"	"	"	Dug	40	2,400	- 38	2,362	38	2,362	Glacial sand	Hard, clear		D, S	Insufficient; 4 pails a day.
16	NW.	23	"	"	"	Dug	27	2,380	- 20	2,360	20	2,360	Glacial drift	Hard, clear		D, S	Sufficient supply.
17	SE.	24	"	"	"	Dug	50	2,390	- 42	2,348	42	2,348	Glacial sand	Soft, clear		D, S	Sufficient supply.
18	SE.	28	"	"	"	Dug	20	2,360	- 14	2,346	14	2,346	Glacial sand	Hard, clear		D, S	Sufficient supply.
19	NE.	32	"	"	"	Dug	19	2,410	- 15	2,395	15	2,395	Glacial sand	Hard, clear		D, S	Insufficient supply.
20	NE.	34	"	"	"	Dug	30	2,405	- 23	2,382	30	2,375	Glacial sand	Soft, clear		D, S	Insufficient supply.
21	SE.	36	"	"	"	Dug	26	2,410	- 23	2,387	23	2,387	Glacial gravel	Hard, cloudy, grey sediment		D, S	Insufficient supply.
22	SE.	36	"	"	"	Dug	30	2,410	- 27	2,383	27	2,383	Glacial sand	Hard, rusty		D	Insufficient supply; hauls water.
1	NW.	2	18	19	3	Spring	4	2,190	0	2,190	0	2,190	Glacial sand	Hard, clear, iron		D, S	Ample supply.
2	SW.	4	"	"	"	Bored	105	2,315	-100	2,215	100	2,215	Glacial sand	Hard, clear, iron, "alkaline"		D, S	Insufficient; enough for 5 head stock.
3	SE.	5	"	"	"	Bored	108	2,318	-100	2,218	100	2,218	Glacial gravel	Hard, iron, salty, clear, "alkaline"		S	Ample for stock.
4	NE.	7	"	"	"	Bored	80	2,292			80	2,212	Glacial sand	Hard, iron		S	Ample supply for stock.
5	NE.	8	"	"	"	Bored	90	2,320			90	2,230	Glacial sand	Hard, clear, iron		D, S	Ample supply.
6	NE.	9	"	"	"	Bored	140	2,330	-135	2,195	135	2,195	Glacial gravel	Hard, clear, iron		D, S	Ample supply.
7	NW.	12	"	"	"	Springs	2	2,180	0	2,180	0	2,180	Glacial sand	Hard, clear		D, S	Supplies household and 16 head stock.
8	NW.	13	"	"	"	Bored	75	2,164					Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply.
9	NE.	16	"	"	"	Bored	145	2,340	-140	2,200	140	2,200	Glacial sand	Hard, clear, iron		D, S	Ample supply.
10	NE.	18	"	"	"	Bored	91	2,300					Glacial sand	Hard, clear		D, S	Ample supply.
11	NE.	19	"	"	"	Drilled	300	2,295			300	1,995	Bearpaw sand	Hard, clear, iron		D, S	Ample supply.
12	SE.	21	"	"	"	Bored	172	2,358			172	2,186	Glacial sand	Hard, clear, iron		D, S	Ample supply.
13	NW.	22	"	"	"	Bored	164	2,346	-156	2,190	164	2,182	Glacial gravel	Hard, clear, iron		D, S	Ample supply.
14	SE.	25	"	"	"								Glacial drift				Seepage well; dam for stock.
15	NW.	28	"	"	"	Bored	112	2,335	- 80	2,255	112	2,223	Glacial sand	Hard, clear, iron		D, S	Ample supply

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WELL RECORDS—Rural Municipality of PITTVILLE, NO. 169, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
12	SW.	20	17	20	3	Drilled	120						Glacial fine sand				No water due to quicksand filling in.
13	NW.	22	"	"	"	Dug	25	2,325	− 23	2,302	23	2,302	Glacial sand	Hard, clear, "alkaline"		D, S	Insufficient; supply limited to 10 head stock; also 160-foot well; no water due to quicksand.
14	NE.	22	"	"	"	Bored	70	2,355			70	2,285	Glacial sand	Hard, clear		D, S	Insufficient supply; second 30-foot well completes supply.
15	SW.	23	"	"	"	Bored	94	2,350	− 74	2,276	94	2,256	Glacial drift	Hard, clear, iron, "alkaline"		D, S	Ample supply.
16	NE.	25	"	"	"	Bored	90	2,300	− 25	2,275	90	2,210	Glacial drift	Hard, clear, "alkaline"		S	Ample supply; unfit for man.
17	SW.	30	"	"	"	Dug	60	2,375	− 53	2,322	53	2,322	Glacial gravel	Hard, clear, iron		D, S	Ample supply.
18	NW.	31	"	"	"	Dug	91	2,380	− 60	2,320	91	2,289	Glacial gravel	Hard, iron, cloudy, "alkaline"		S	Ample for stock. #.
19	SE.	32	"	"	"	Bored	64	2,348	− 46	2,302	64	2,284	Glacial sand	Hard, clear		D, S	Supplies household and 125 head stock.
20	NE.	32	"	"	"	Bored	64	2,350			64	2,286	Glacial sand	Hard, iron		D, S	Ample supply.
21	NE.	33	"	"	"	Dug	24	2,330	− 23	2,307	23	2,307	Glacial sand	Hard, clear		D	Insufficient.
22	NW.	35	"	"	"	Bored	110	2,385			110	2,275	Glacial gravel	Hard, clear, iron		D, S	Ample supply.
23	SE.	36	"	"	"	Dug	23	2,350					Glacial sand	Hard, clear		D, S	Supplies household and 12 head stock.
1	NE.	2	17	21	3	Dug	25	2,340					Glacial drift	Hard, clear		D, S	Supply insufficient.
2	NE.	4	"	"	"	Bored	36	2,395	− 20	2,375	32	2,363	Glacial gravel	Hard, clear		D, S	Sufficient supply; laxative.
3	SE.	7	"	"	"	Dug	22	2,390	− 18	2,372	18	2,372	Glacial sand	Soft, clear		D, S	Insufficient supply.
4	SE.	9	"	"	"	Dug	14	2,395	− 9	2,386	9	2,386	Glacial sand	Hard, clear		D, S	Sufficient supply.
5	NE.	9	"	"	"	Drilled	135	2,390	−105	2,285	135	2,255	Glacial sand	Hard, iron		D, S	Sufficient supply.
6	NE.	10	"	"	"	Dug	24	2,390	− 18	2,372	18	2,372	Glacial drift	Soft, clear		D, S	Sufficient supply.
7	SE.	14	"	"	"	Drilled	135	2,430	− 85	2,345	135	2,295	Glacial sand	Hard, clear, iron		D, S	Sufficient supply; used by neighbours.
8	SW.	15	"	"	"	Bored	48	2,400	− 38	2,362	38	2,362	Glacial sand	Soft, clear		D, S	Sufficient supply.
9	NW.	15	"	"	"	Drilled	137	2,390	− 77	2,313	130	2,260	Glacial sand	Hard, clear, iron		D, S	Sufficient for local needs.
10	NE.	17	"	"	"	Drilled	103	2,400	− 53	2,347	95	2,305	Glacial sand	Hard, clear		S	Sufficient for stock; second 23-foot well for household.
11	NW.	19	"	"	"	Drilled	98	2,420	− 48	2,372	90	2,330	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient supply; a second well used for household.
12	SW.	20	"	"	"	Dug	16	2,410			12	2,398	Glacial sand	Soft, clear		D, S	Sufficient supply.
13	NW.	20	"	"	"	Dug	23	2,420	− 19	2,401	19	2,401	Glacial sand	Soft, clear		D, S	Sufficient supply.

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WELL RECORDS—Rural Municipality of PITTVILLE, NO. 169, 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
14	NW.	22	17	21	3	Drilled	94	2,370	- 32	2,338	90	2,280	Glacial gravel	Hard, clear, iron, "alkaline"		S	Sufficient for stock; second 16-foot well, good supply.
15	SE.	23	"	"	"	Dug	40	2,400	- 38	2,362	38	2,362	Glacial sand	Hard, clear		D, S	Insufficient; 4 pails a day.
16	NW.	23	"	"	"	Dug	27	2,380	- 20	2,360	20	2,360	Glacial drift	Hard, clear		D, S	Sufficient supply.
17	SE.	24	"	"	"	Dug	50	2,390	- 42	2,348	42	2,348	Glacial sand	Soft, clear		D, S	Sufficient supply.
18	SE.	28	"	"	"	Dug	20	2,360	- 14	2,346	14	2,346	Glacial sand	Hard, clear		D, S	Sufficient supply.
19	NE.	32	"	"	"	Dug	19	2,410	- 15	2,395	15	2,395	Glacial sand	Hard, clear		D, S	Insufficient supply.
20	NE.	34	"	"	"	Dug	30	2,405	- 23	2,382	30	2,375	Glacial sand	Soft, clear		D, S	Insufficient supply.
21	SE.	36	"	"	"	Dug	26	2,410	- 23	2,387	23	2,387	Glacial gravel	Hard, cloudy, grey sediment		D, S	Insufficient supply.
22	SE.	36	"	"	"	Dug	30	2,410	- 27	2,383	27	2,383	Glacial sand	Hard, rusty		D	Insufficient supply; hauls water.
1	NW.	2	18	19	3	Spring	4	2,190	0	2,190	0	2,190	Glacial sand	Hard, clear, iron		D, S	Ample supply.
2	SW.	4	"	"	"	Bored	105	2,315	-100	2,215	100	2,215	Glacial sand	Hard, clear, iron, "alkaline"		D, S	Insufficient; enough for 5 head stock.
3	SE.	5	"	"	"	Bored	108	2,318	-100	2,218	100	2,218	Glacial gravel	Hard, iron, salty, clear, "alkaline"		S	Ample for stock.
4	NE.	7	"	"	"	Bored	80	2,292			80	2,212	Glacial sand	Hard, iron		S	Ample supply for stock.
5	NE.	8	"	"	"	Bored	90	2,320			90	2,230	Glacial sand	Hard, clear, iron		D, S	Ample supply.
6	NE.	9	"	"	"	Bored	140	2,330	-135	2,195	135	2,195	Glacial gravel	Hard, clear, iron		D, S	Ample supply.
7	NW.	12	"	"	"	Springs	2	2,180	0	2,180	0	2,180	Glacial sand	Hard, clear		D, S	Supplies household and 16 head stock.
8	NW.	13	"	"	"	Bored	75	2,164					Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply.
9	NE.	16	"	"	"	Bored	145	2,340	-140	2,200	140	2,200	Glacial sand	Hard, clear, iron		D, S	Ample supply.
10	NE.	18	"	"	"	Bored	91	2,300					Glacial sand	Hard, clear		D, S	Ample supply.
11	NE.	19	"	"	"	Drilled	300	2,295			300	1,995	Bearpaw sand	Hard, clear, iron		D, S	Ample supply.
12	SE.	21	"	"	"	Bored	172	2,358			172	2,186	Glacial sand	Hard, clear, iron		D, S	Ample supply.
13	NW.	22	"	"	"	Bored	164	2,346	-156	2,190	164	2,182	Glacial gravel	Hard, clear, iron		D, S	Ample supply.
14	SE.	25	"	"	"								Glacial drift				Seepage well; dam for stock.
15	NW.	28	"	"	"	Bored	112	2,335	- 80	2,255	112	2,223	Glacial sand	Hard, clear, iron		D, S	Ample supply

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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
16	SW.	30	18	19	3	Dug	92	2,283	- 83	2,205	93	2,195	Glacial sand	Hard, clear, iron		D, S	Ample for household and 65 head stock.
17	SW.	31	"	"	"	Drilled	308	2,285	-108	2,177	285	2,000	Bearpaw sand	Hard, clear, iron		D, S	Abundant supply.
18	SW.	33	"	"	"	Drilled	170	2,335					Glacial fine sand				No water due to filling in of quicksand.
19	SE.	36	"	"	"	Dug	29	2,130	- 20	2,110	29	2,101	Glacial gravel	Hard, clear, "alkaline"		S	Sufficient for 25 head stock; dam used in summer.
20	NE.	36	"	"	"	Dug	20	2,120	- 15	2,105	15	2,105	Glacial sand	Hard, clear, "alkaline"		S	Insufficient; supplies 10 head stock.
1	SE.	1	18	20	3	Bored	92	2,333	- 62	2,271	92	2,241	Glacial drift	Hard, clear, iron, yellow		D, S, I	Sufficient supply; used by neighbours.
2	SW.	2	"	"	"	Bored	65	2,340	- 35	2,305	65	2,275	Glacial sand	Hard, clear		D, S	Insufficient; filling in with quicksand; waters stock at spring, NE.¼, section 34, township 17, range 20.
3	NE.	4	"	"	"	Dug	35	2,315	- 30	2,285	30	2,285	Glacial gravel	Hard, clear, "alkaline"		D, S	Supplies house and 10 head stock.
4	SE.	9	"	"	"	Bored	45	2,315	- 15	2,300	45	2,270	Glacial gravel	Hard, clear, "alkaline"		D, S	Waters 75 head stock.
5	SE.	12	"	"	"	Bored	100	2,320			100	2,220	Glacial drift	Hard, clear		D, S	Sufficient for local needs.
6	SE.	13	"	"	"	Bored	242	2,295	- 30	2,265	242	2,053	Bearpaw sand?	Hard, "alkaline"		S, I	Sufficient for stock; not usable for man.
7	NW.	14	"	"	"	Bored	65	2,273	- 40	2,233	61	2,212	Glacial gravel	Hard, "alkaline"		D, S	Waters 20 head stock.
8	SE.	15	"	"	"	Bored	70	2,295	- 48	2,247	70	2,225	Glacial drift	Hard, iron, red sediment		D, S	Sufficient supply.
9	SW.	17	"	"	"	Dug	30	2,400	- 28	2,372	28	2,372	Glacial sand	Hard, clear		D, S	Insufficient; waters 5 head stock.
10	NW.	17	"	"	"	Dug	20	2,365	- 15	2,350	15	2,350	Glacial sand	Hard, clear		D, S	Sufficient supply.
11	SE.	18	"	"	"	Bored	48	2,400	- 41	2,359	48	2,352	Glacial sand	Hard, clear		D, S	Sufficient; waters 4 head stock; also 20-foot well with 9 feet water, unused.
12	SW.	23	"	"	"	Dug	45	2,268	- 43	2,225	45	2,223	Glacial sand	Hard, "alkaline"		D, S	Sufficient for local needs.
13	NE.	24	"	"	"	Bored	65	2,290	- 61	2,229	63	2,227	Glacial sand	Soft, clear		D, S	Sufficient supply.
14	SE.	25	"	"	"	Bored	100	2,305	- 60	2,245	100	2,205	Glacial gravel	Hard, clear, "alkaline"		S	Also 60-foot household well with 20 feet water.
15	NE.	25	"	"	"	Bored	75	2,300	- 55	2,245	75	2,225	Glacial sand	Hard, clear		S	Insufficient; waters only 25 head stock. also 45-foot well for house use.
16	SW.	27	"	"	"	Bored	60	2,265	- 51	2,214	60	2,205	Glacial sand	Hard, iron, "alkaline", red sediment		D, S	Sufficient; waters 12 head stock.
17	SE.	28	"	"	"	Bored	70	2,278	- 60	2,218	68	2,210	Glacial sand	Hard, clear		D, S	Sufficient supply.
18	SE.	30	"	"	"	Bored	65	2,305	- 22	2,283	65	2,240	Glacial drift	Hard, clear, iron, red sediment		S	Sufficient and used only for stock.
19	NW.	31	"	"	"	Bored	50	2,293	- 45	2,248	45	2,248	Glacial gravel	Hard, clear		D, S	Sufficient supply.
20	SE.	33	"	"	"	Bored	54	2,265	- 46	2,219	46	2,219	Glacial gravel	Hard, clear		D, S	Insufficient; filling in with quicksand; also 60-foot well with 4 feet of water.

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 PITTVILLE, NO. 169, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
21	NE.	33	18	20	3	Bored	72	2,280			72	2,208	Glacial drift	Hard		D, S	Sufficient supply.
22	SE.	35	"	"	"	Dug	80	2,290	- 76	2,214	80	2,210	Glacial sand	Hard, clear		D, S	Sufficient supply; waters 15 head stock.
1	SE.	1	18	21	3	Drilled	172	2,410	- 90	2,320	172	2,238	Glacial gravel	Hard, clear		D, S	Sufficient supply.
2	NE.	4	"	"	"	Drilled	252	2,450	- 60	2,390	252	2,198	Glacial gravel	Hard, clear		S	Insufficient supply; a second 40-foot well with 3 feet water, supplies household with soft, clear water.
3	SE.	12	"	"	"	Drilled	130	2,420	- 80	2,340	130	2,290	Glacial sand	Hard, clear, iron		D, S	Sufficient supply.
4	NE.	12	"	"	"	Dug	21	2,360	- 11	2,349	21	2,339	Glacial gravel	Hard, clear		D, S	Sufficient supply.
5	SE.	13	"	"	"	Drilled	130	2,390	- 80	2,310	130	2,260	Glacial sand	Hard, clear, iron		D,S	Insufficient supply.
6	SE.	16	"	"	"	Dug	30	2,430	- 27	2,403	27	2,403	Glacial gravel	Soft, clear		D, S	Insufficient supply; other wells on property, complete supply for stock.
7	NE.	21	"	"	"	Drilled	74	2,340	- 19	2,321	74	2,266	Glacial gravel	Hard, clear		D, S	Sufficient supply; another 60-foot well gives "alkaline" water.
8	SE.	23	"	"	"	Bored	60	2,320	- 30	2,290	60	2,260	Glacial gravel	Hard, clear, iron		D, S	Sufficient supply.
9	SW.	24	"	"	"	Bored	43	2,330	- 18	2,312	18	2,312	Glacial sand	Hard, clear		D, S	Insufficient supply; also 2 dry holes; hauls water.
10	NW.	25	"	"	"	Bored	92	2,320	- 42	2,278	92	2,228	Glacial gravel	Hard, clear, "alkaline"		D, S	Supplies household and 30 head stock.
11	NE.	34	"	"	"	Bored	27	2,315	- 18	2,297	18	2,297	Glacial drift	Soft, clear		D, S	Sufficient supply.
12	NW.	36	"	"	"	Dug	72	2,270	- 58	2,212	72	2,198	Glacial gravel	Hard, clear, iron		D, S	Sufficient supply.

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

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