CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 136

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF PENSE NO. 160 SASKATCHEWAN

By

B. R. MacKay, H. H. Beach and E. L. Ruggles

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF PENSE, NO. 160, SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

<u>Water Table.</u> 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.

<u>Wells.</u> 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 <u>Flowing Artesian Wells.</u>

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

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

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 Pense is a square block of land covering an area of 324 square miles in the central part of southern Saskatchewan. The municipality comprises nine townships described as tps. 16, 17, and 18, ranges 22, 23, and 24, W. 2nd mer. The centre of the municipality lies about 21 miles almost due west of the city of Regina. The main line of the Canadian Pacific railway crosses the area in an east-west direction through the southern part of township 17, ranges 22 and 23, and the northern part of township 16, range 24. On it are situated the villages of Pense and Belle Plaine, and the sidings of Rufus and Madrid. The "Soo line" of the Canadian Pacific railway passes in a northwest-southeast direction through the southwest corner of the municipality. The hamlet of Stelcam is located on this line. The Stony Beach line of the Canadian National railways runs parallel to and about one mile south of the border of township 17, ranges 22 and 23, then turns southwest through township 17, range 24, to leave the municipality at the northwest corner of section 7. The sidings of Pattee and Eastview, and the hamlets of Keystown and Stony Beach are situated on this line. No. 1 highway runs along the township line separating townships 16 and 17.

The southern two-thirds and the north-central part of the municipality form an almost level plain lying at an average elevation of 1,900 feet above sea-level. The land rises almost imperceptibly to the northwest, reaching an elevation of about 1,950 feet at the top of a low, elongated hill situated in secs. 23 and 24, tp. 18, range 24. Farther to the west in this township, elevations decrease gradually at first, then more abruptly to form the eastern slope of the valley of Moosejaw creek which flows in a northerly direction along the western border. At the point where Moosejaw creek joins Qu'Appelle river, in section 31, the valley floor has an elevation slightly less than 1,700 feet above sea-level.

Similar elevations are reached in the bottom of Cottonwood Creek valley in the northeastern corner of the municipality. Parts of the northern third of the municipality are gently rolling and small, undrained depressions are not uncommon. Two, small, shallow lakes, Stonybeach and Rocky, occupy two of the larger depressions in township 18, ranges 23 and 24. Cottonwood creek, an intermittently flowing stream, rises in the central part of township 16, range 22, from whence it flows northeasterly to sec. 1, tp. 17, range 22, where it leaves the municipality. It re-enters this same township in section 24 and flows north along the eastern edge of the municipality. High-hill creek, a smaller stream, rises in township 18, range 23, and follows a northeasterly course through the township. Moosejaw creek enters the municipality in sec. 18, tp. 17, range 24, and follows the western border of the municipality to sec. 31, tp. 18, range 24, where it joins Qu'Appelle river. The river is present in this municipality only on secs. 31 and 32, tp. 18, range 24.

Producing wells are largely confined to the areas of rolling topography in the northern part of the municipality. Water is usually obtained with little difficulty from shallow wells. Except in the valley of Cottonwood creek in the southeast, shallow wells throughout the southern half of the municipality are unproductive. A water-bearing horizon has been encountered in the glacial drift at depths greater than 120 feet, in small areas in the southeast and southwest corners of the municipality. In the remaining districts very few wells have obtained water, and farmers have been obliged to resort to the use of cisterns and dugouts for the storage of surface water. Shallow seepage wells sunk beside dugouts provide household supplies on many farms. During the spring, and periods of ample precipitation, some of the sloughs provide water for stock. Cottonwood creek and High-hill creek do not flow throughout the year, but small dams in the valleys might be used advantageously for storing water over longer periods of time.

Water-bearing Horizons in the Unconsolidated Deposits

Recent alluvial deposits occur in the valley of Cottonwood creek in township 16, ranges 22 and 23, and in the valleys of Moosejaw creek and Qu'Appelle river. The deposits consist largely of fine silts, but sands and gravels occur interbedded with the silts and form aquifers. A number of shallow wells have been dug in Cottonwood Creek valley and derive water either from sandy phases of the silt or from sand or gravel beds. The wells range in depth from 12 to 25 feet. The yield from individual wells in many places is sufficient for 10 to 30 head of stock. Water from the silts is usually more highly mineralized than water from the sand or gravel aquifers, and from a few wells is usable only for stock. The alluvial deposits in Moosejaw Creek valley and Qu'Appelle valley have not been well prospected for water, but they probably include water-bearing sands and gravels at shallow depths similar to those encountered at Cottonwood creek.

The bedrock of the entire municipality is covered by a mantle of glacial deposits varying in different areas, not only in composition and water-bearing properties, but in the character of the surface it presents. These differences may be attributed to the different ways in which the glacial deposits were laid down. The areal distribution of each type occurring at the surface within the municipality is indicated by means of symbols on Figure 1 of the accompanying map. Many thousands of years ago a great ice-sheet advanced in a southwesterly direction over western Canada. The moving mass of ice picked up and reworked the existing surface deposits and carried large quantities of material for long distances. Part of this material, consisting of clay, sand, gravel, and boulders, was dropped in irregular fashion over the surface of the bedrock, not only of this municipality, but of most of the province. A great thickness of this material was left by the ice-sheet as it melted back towards the north. This deposit, termed boulder clay or glacial till, is exposed at the surface in this municipality only in the valleys of Cottonwood and Moosejaw creeks, and in narrow belts trending in a northeasterly direction in township 18, range 24. Sands and gravels carried from the higher land to the north and east by waters issuing from the melting ice were deposited in places over the surface of the till plain. Many isolated deposits of these materials are encountered in wells in the northern part of the municipality, and in two small areas along the northern boundary they are exposed at the surface, and are shown on the map as glacial outwash sands and gravels. Owing to the damming of the existing drainage channels by the ice, large lakes were formed in the low-lying areas. Water entering the lakes from the rivers and running off the higher land carried considerable quantities of fine sands and silts. The sands were deposited near the lake shores and the finer material was carried farther into the lakes. A layer of these fine materials gradually accumulated on the lake bottoms and when the lakes eventually drained away the glacial lake clay, silt, and sand were left covering large areas. One of the larger lakes covered an area extending from near Weyburn to Qu'Appelle valley north of Regina and Moose Jaw. Except in the valleys and in small isolated areas in the northern parts, the boulder clay of this municipality is overlain by glacial lake clay. The thickness of this covering ranges from about 20 to 40 feet in the southern townships and decreases towards the north. In township 18, the thickness of the clay does not exceed 20 feet and is probably less than 10 feet in many places. The character of the lake clay also changes from south to north. In the southern townships it is very fine-grained and compact and prevents the seepage of water from the surface. In the northern sections of township 17, and in section 18, where the surface becomes rolling the lake clay is more sandy and less compact, and thus is more permeable to the passage of water from the surface. Water is not obtained from the lake clay and, as a result of its impermeability in the southern half of the municipality, little or no opportunity is afforded for surface water to enter porous beds that might exist either in the underlying boulder clay or in the bedrock.

In the northern area, however, the occurrence of sandy phases in the lake clay permits the entrance of water into the underlying sediments. In many places sands and gravels lie at the zone of contact between the glacial lake clay and the underlying boulder clay, and were probably laid down at the same time as the glacial outwash sands and gravels that are exposed at the surface in the two small areas near the northern border of the municipality.

At points in the northern half of the municipality, where sand and gravel aquifers are not encountered at the base of the lake clay, pockets of sand or gravel are found in the upper part of the boulder clay. Wells ranging in depth from less than 10 feet to 60 feet are drawing water from porous beds at one or the other of these horizons. These aquifers are not individually continuous over large areas and their capacity as reservoirs for water depends on their thickness, porosity, and areal extent. A few wells in the area obtain only small supplies that are not adequate for both domestic and stock requirements, but the yield from the greater number of the wells in the northern third of the municipality is ample for local requirements. The hardness and the degree of mineralization of the water varies from place to place, but only from a few isolated wells is the water unsuited for drinking. Water is derived from sands and gravels buried deeper in the glacial drift on a few farms. A continuous aquifer extends through the southeastern part of township 18, range 22. Its approximate areal extent has been outlined by means of a line marked "A" on Figure 1 of the accompanying map. Wells tapping this aquifer range in depth from 60 to 96 feet. The water is of good quality and each well yields a sufficient supply for 10 to 15 head of stock. Additional water could undoubtedly be obtained from the aquifer by sinking more wells within this area. Deeper wells have been sunk in the glacial drift at points scattered over the municipality and range from 100 to 235 feet deep. In townships 17 and 18, isolated water-bearing sands or gravels have been encountered in some of the wells, but the greater number of the deep holes have been unproductive. The yield from the few deep wells that have proved productive is sufficient for local requirements, but the water is of poor quality and from many of the wells is unfit for use. The sinking of deep wells throughout the greater part of the municipality is not advisable owing to the uncertainty of finding water and to the poor quality of the supplies that might be found.

In the southern part of township 16, range 22, and the southwestern half of township 16, range 24, an aquifer has been located that extends over a large area embracing several townships to the east, south, and west. The two areas have been indicated approximately by the "A" lines on Figure 1 of the accompanying map. Wells in these areas range in depth from 120 to 235 feet. Individual wells produce sufficient quantities of water for household use and 20 to 40 head of stock. The water is highly mineralized, but is being used for both domestic purposes and for stock. Considerably more water could be obtained within these areas by sinking additional wells. That these aquifers are not more extensive in this municipality is substantiated by the large number of dry holes that have penetrated through the drift into the bedrock, not only just beyond the "A" lines but throughout the central and northern parts.

Water-bearing Horizons in the Bedrock

The Marine Shale series occurs immediately below the glacial drift throughout the municipality. The covering of unconsolidated deposits is over 200 feet thick in the southern townships, but decreases to about 100 feet in the central parts. Toward the northern border the drift covering is much thinner. In places the bedrock is not more than 50 feet below the surface and on Waskana creek in the northwest corner of the municipality to the east the bedrock is exposed at the surface. The shales are also reported to be exposed on the side of a coulée extending from Cottonwood creek in sec. 25, tp. 18, range 22. The bedrock has been penetrated in a number of holes scattered over the municipality, but the point of contact between the drift and the bedrock has been difficult to determine owing to the similarity between the dark, compact clay in the lower part of the glacial drift and the shales of the Marine Shale series. The shales may be distinguished by the absence in them of stones or pebbles, by their soapy feel when wet, by the small, roughly cubical fragments into which they crumble when dry, and by the light grey or buff colour to which they weather. The upper part of the Marine Shale series is usually unproductive of water in this area. However, wells 258 and 350 feet deep on sec. 28, tp. 17, range 22, and sec. 24, tp. 18, range 24, respectively, appear to tap water-bearing beds of sand in the upper part of the bedrock. Water from the first well is too highly mineralized to be used, but the water in the other well is of good quality although it is not being used at present. The aquifers encountered in these wells represent only isolated sand beds in the bedrock. They are by no means of common occurrence and are undoubtedly absent over large areas within the municipality. Water is obtainable at depths of about 500 feet, as evidenced by the wells drilled at Pense, but the water is too salty to be used. Hence, future drilling into the bedrock at any point in the municipality is not advisable. All prospecting for ground water in the northern half of the municipality and in the southeastern and southwestern corners should be confined to the glacial drift. In the remaining area little water can be obtained from wells unless they are located beside sloughs or other surface water accumulations.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 16, Range 22

The areas in which water has been found in the township are confined to the southern row of sections and to the valley and tributary coulées of Cottonwood creek, which crosses the central and northeastern parts of the township. Little or no water can be obtained from wells on the remaining parts of the plain.

Recent stream deposits occur in Cottonwood Creek valley and in the bottoms of the major tributary coulées. They consist largely of sandy clay, but in some localities include thin beds and pockets of sand and gravel. The sandy clay and the gravels and sands are quite permeable and are found to contain water. Wells have been dug at many points along the valley and nearly all have obtained water, either from the clay or from sand or gravel pockets. The yield from wells tapping the more porous aquifers is usually greater than from those penetrating only the clay. Individual wells supply ample water for 20 to 30 head of stock or more. The dissolved mineral salt content of the water is high, particularly in the water from the clay. From six of the wells the water is reported to be unsuitable for drinking, and from one of these, located on section 16, the water is unfit even for stock. The water derived from the clay in other wells can be used for domestic purposes, and supplies from sand or gravel beds are of good quality. The "Syndicate" well, located on the road allowance on the east side of section 25 is worthy of special notice. This 8-foot well was dug in the bottom of a coulée leading towards Cottonwood creek and tapped a water-bearing gravel bed. A number of farmers in the district haul water from this well, and water is hauled to the village of Ponso in the township to the north; the water is of exceptionally good quality.

Compact, fine-grained glacial lake clay from which no water is obtained forms the surface deposit over the remaining parts of the township. Boulder clay occurs beneath the lake clay to depths of at least 200 feet and is also unproductive of water. Sand and gravel pockets are probably scattered through the boulder clay, but are not water-bearing owing to lack of percolation through the overlying clay. On sections 1, 2, and 4, wells have been drilled and bored, 120 to 213 feet deep, and have encountered a water-bearing horizon of sand and gravel at depths of 100 to 175 feet. The aquifer here encountered appears to be a part of a continuous water-bearing horizon extending through several townships to the east and south. The line "A" shown on Figure 1 of the accompanying map is the approximate northern boundary of this aquifer. Deep holes on sections 12, 18, and 30 failed to encounter any productive horizon. It is probable, however, that further drilling on the sections adjoining those in which the aquifer has been encountered would locate water. A well drilled 400 feet deep on section 12 by the Saskatchewan Government yielded water and probably encountered this same aquifer in the glacial drift before reaching the bedrock. Dry holes as deep as 500 feet were also sunk on this same section. The producing wells each yield sufficient water for 40 to 100 head of stock. The water is hard and has a high dissolved mineral salt content, but is apparently satisfactory for household use. A low ridge extends southeasterly through sections 10, 2, and 3. Water has been obtained from wells located on the ridge in the township to the south and prospecting in this area is advisable.

The Marine Shale series underlies the glacial drift throughout the area. Dry holes on section 12 have penetrated the shales and a 250-foot dry hole on section 18 probably also reached the bedrock. No water is to be expected from the shales except at great depths and this water is too highly mineralized to be of use. Further drilling into the bedrock in this township will be of no value. Additional drilling in the glacial drift in the southern sections, 1 to 12, is recommended. Water could also be obtained by digging more shallow wells in the valley of Cottonwood creek and the adjacent creeks. In other parts of the township dugouts are the most reliable source of water.

Township 16, Range 23

The surface of the township is a very gently rolling plain. A shallow coulée crosses the southeastern part of the township from section 4 to section 13. The whole of the area has not been well prospected for water, and many of the farms are without good supplies. A few wells are producing water, but a number of holes sunk were dry. Dugouts are used extensively for stock watering.

Recent alluvial deposits, consisting of sandy clay in which are interbedded lenses of sand and gravel, occur in the bottom of the coulée in section 13. Three wells dug 14 to 24 feet deep on this section derive water from these deposits. Sufficient water for local requirements is obtained from these wells. The water is hard and highly mineralized, but is usable in the households. Additional water should be found by digging shallow wells at other points in the coulée.

The glacial lake clay that mantles the remainder of the area to a depth of about 30 feet is too compact to yield water. The boulder clay underlying the lake clay is likewise unproductive and dry holes have been sunk as deep as 225 feet on several sections. Sand and gravel pockets buried in the boulder clay and penetrated in some of these holes were dry. On other sections, however, these pockets were found to be water bearing. Wells 74 to 230 feet deep on sections 1, 21, 26, 32, and 35, obtained water from sands and gravels in the drift. The wells on sections 26 and 32 were never used, but the others are yielding good supplies of water. More than 30 head of stock can be watered from the well on section 35. Water from the three wells that are in use is of good quality. The areal extent of aquifers in the township cannot be determined from the records of the few deep wells. It is probable that each of the producing wells taps an isolated aquifer of limited extent. Productive beds may be encountered by drilling at other points, but their location cannot be determined except by sinking holes.

The well on section 1 appears to have encountered a water-bearing horizon at a depth of 230 feet, which extends through the southern part of the township to the east and through several townships to the south. This aquifer may underlie several sections in the south-eastern corner of the township and deep drilling in the sections adjacent to section 1 might be advisable.

A well drilled 1,551 feet deep on section 31, by the Canadian Pacific Railway Company, is the only reported attempt to obtain water from the Marine Shale series, which underlies the glacial drift throughout the township. Water was obtained at depths of 894 and 914 feet, but had a "salty" taste and could not be used. Only water of this nature is to be expected from the bedrock in the area, so that drilling below the base of the glacial drift will be of no value.

The village of Belle Plaine, situated on section 31, has no supply of ground water. Residents in the village obtain water from cisterns that are filled with ice in winter, and from the Canadian Pacific Railway Company, which hauls water from Moose Jaw. Many deep holes have been drilled both in and on all sides of the village, but none produced water. Aquifers are probably absent not only in the drift but in the bedrock, and adequate supplies can hardly be expected by further prospecting.

Township 16, Range 24

Several wells in the southwestern part of the township produce good supplies of water, but throughout the remainder of the township no water has been obtained from wells. Sloughs occur in shallow depressions scattered over the almost level plain. Stock are watered from the sloughs as well as from dugouts excavated in the clay.

Glacial lake clay that forms a covering over the entire township probably nowhere exceeds 30 feet in thickness. Wells sunk into this deposit do not obtain water owing to the compact nature of the clay, but on the other hand little water is lost by seepage from dugouts excavated into the clay. Wells penetrating the boulder clay that underlies the lake clay are also unproductive. In the northern part of the township several wells have passed completely through the glacial drift into the underlying bedrock without finding water. A water-bearing sand and gravel horizon has been traced through the townships immediately to the south and west and extends into the southwestern part of this township. Wells, 120 to 148 feet deep on sections 3, 4, 5, 7, 8, and 16, have tapped this aquifer. Two of the wells were not in use in 1935, but each of the others produces ample water for domestic use and 25 to 40 or more head of stock. The water is hard and has a fairly high content of mineral salts in solution, but is satisfactory for household use. The line "A" has been drawn on the accompanying map, Figure 1, to indicate the approximate northern limits of the aquifer in this township. Lateral variations in the beds themselves may render them unproductive at some points within this area, as on section 6 where a 220-foot hole failed to obtain water. Dry holes 132 and 100 feet deep on sections 9 and 10 may not have been quite deep enough to reach the water-bearing horizon. Additional water should be obtainable by sinking wells at almost all points in the southwestern part of the township.

The glacial drift appears to be at least 200 feet thick over the area. The dark grey, compact, Marine Shale series immediately underlies the drift. Several holes 220 to 417 feet deep have penetrated the bedrock, but no water was obtained. Water may occur in the bedrock at depths over 800 feet, but would be too highly mineralized to be used. Further drilling of wells into the shales should not be attempted. In the northeastern half of the township there appears to be little prospect of obtaining usable water from wells either in the glacial drift or the bedrock, and future efforts to increase the available supply of water should be confined to storing surface water by means of cisterns or dugouts.

Township 17, Range 22

The surface of the southern half of the township is an almost level plain, but it becomes more rolling in the northern sections. The small knolls do not rise to heights greater than 10 to 15 feet above the surrounding plain. Cottonwood creek flows in a valley about 50 feet deep across the northeastern corner of the township. Water is obtained from wells on the plains in the northern half of the township and in the valley of Cottonwood creek. Very little water has been found in the southern sections, although prospecting has been extensive, particularly in the vicinity of the village of Pense on section 9. Dugouts are used extensively for stock watering and water is also obtained from Cottonwood creek by farmers in that locality.

Glacial lake clay covers the whole of the township except in the valley of Cottonwood creek. The thickness of this deposit ranges from about 20 to 40 feet, being greater in the south than in the north. The clay in the southern part of the township is very compact and fine-grained and is almost entirely impervious to the downward percolation of surface water. Wells dug into the clay in this part of the township do not obtain water. The clay becomes more sandy and porous towards the north, however, and permits water to seep from the surface to the underlying deposits. The more irregular topography in the north tends to collect surface water in the hollows from where it seeps into the ground. Water is not obtained from the surface deposits even in the northern sections.

A thick layer of glacial till, or boulder clay, underlies the lake clay and appears at the surface in Cottonwood Creek valley. The boulder clay itself yields only small seepages of highly mineralized water. Aquifers in the boulder clay consist of sand and gravel deposited as isolated pockets of various thicknesses and areal extents, and lying at irregularly varying depths in different localities. In the southern part of the township these pockets do not contain water owing to the impervious nature of the overlying lake clay and boulder clay, but in the northern sections water percolating through the more permeable surface deposits collects in the pockets. The sands and gravel have been tapped in wells at depths ranging from 14 to 172 feet. The yield from a few of the wells is small, but from others enough water is obtained for local domestic and stock requirements. The dissolved mineral salt content of the water is high and the water is hard, but from most of the shallow wells it is satisfactory for drinking. Three of the deep wells yield water that is too highly mineralized for drinking and from two of these wells the water is not even fit for stock. The gravels and sands are not found at all points in the northern part of the township, but with a little testing they should be located on nearly every farm. Dugouts are used for stock watering where adequate supplies of ground water have not been located. Shallow seepage wells dug close to the dugouts provide good drinking water on a few of the farms.

The Marine Shale series lies beneath the glacial drift throughout the township. The covering of unconsolidated deposits varies irregularly in thickness from about 130 to 200 feet over most of the township, but toward the northern border it may be less than 100 feet thick. The upper part of the Marine Shale is generally unproductive of water in this area, as evidenced by dry holes sunk to depths of 130 to 600 feet, but on section 28 a water-bearing sand bed was encountered near the base of a well 258 feet deep and is probably in the bedrock. The water is too highly mineralized to be used even for stock. Water of a similar nature was obtained in wells drilled at Pense on section 9, the deepest of which was 1,250 feet. Good water is not to be expected from the bedrock anywhere in the township and drilling should be discontinued when the compact shales are reached.

Township 17, Range 23

Few wells in the township are producing satisfactory supplies of water. On the greater number of farms no water has been obtained, although boring and drilling have been fairly extensive. Dugouts form the main source of supply on many of the farms. Drinking water is obtained from shallow wells dug near the dugouts, and from concrete cisterns that are filled with ice in winter or with rain water collected on the roofs of farm buildings. Some farmers haul water from the producing wells in the district.

The glacial lake clay that mantles the whole of the township is, for the most part, almost impermeable to the passage of water. In the northeastern corner it becomes more porous and water seeps downward from the surface to collect in pockets of sand in the underlying boulder clay. Gravels and sands in the boulder clay have been penetrated at various depths in the holes in other parts of the township, but owing to the impermeability of the surface clay they do not contain water. A 22-foot well located near a slough on section 15 derives a small amount of water from a sand bed. The water in this aquifer probably seeps from the slough. On section 2 a well was drilled 165 feet deep and tapped a water-bearing bed of fine sand. The aquifer here encountered is probably a continuation of one tapped in the 155-foot well on section 35 of the township immediately to the south and may extend over an area of several square miles. Its extent cannot be determined, however, from the available information. Water has been obtained with little difficulty on sections 34, 35, and 36 in wells, 20 to 35 feet deep, from sand beds in the boulder clay. Individual wells yield ample water for local requirements. From the well on the SE.$\frac{1}{4}$, section 35, the water is too highly charged with sulphate salts in solution to be used for drinking, but it is satisfactory for watering stock. The water from the other wells is suitable for household use. Other water-bearing sand or gravel pockets doubtless could be located on these sections by sinking shallow wells. Deep, dry holes sunk on sections 25 and 26 indicate that these aquifers do not continue southward.

The compact, dark grey shales forming the Marine Shale series underlie the glacial drift throughout the township at depths of 100 to 200 feet. Dry holes have been drilled on farms in various localities. The deepest of these holes is 450 feet and is located on section 22. Only at depths of at least 500 feet is water to be found in the bedrock and this water is unsuitable for use owing to its high degree of mineralization. No drilling should be continued beyond the base of the glacial drift. Aquifers in the drift occur only very sparingly in the township and it is doubtful if further prospecting is justified except in the northeastern sections. The storing of surface water in dugouts and cisterns appears to be the only means of procuring water in the greater part of the township.

Township 17, Range 24

The valley of Moosejaw creek occupies the western part of sections 18, 19, 30, and 31. The land in the vicinity of the valley is rolling and is dissected by a number of shallow coulées leading into the valley. The remainder of the township is a gently undulating plain. A few wells in the western sections of the township produce satisfactory water supplies, but throughout the remainder of the township all holes sunk have been unproductive. Water is stored in dugouts and cisterns on these sections, and some water is hauled from the few producing wells. Moosejaw creek also provides water for stock in the vicinity.

Recent alluvial deposits cover the bottom of the valley of Moosejaw creek. The alluvium consists of fine silts in which are imbedded thin layers of sand and gravel. These beds are probably water-bearing, but no reports have been received of wells having been dug in the valley bottom. Shallow wells sunk in the valley should find water in sand or gravel aquifers. The water might be highly mineralized, but will be suitable for stock and in most places should also be satisfactory for drinking.

Glacial lake clay forms a covering over the remainder of the township. It is probably at least 20 or 30 feet thick over the southern sections, but decreases towards the north. The clay in the south is very fine-grained and almost impervious to the passage of water, but in the north it is more sandy and water readily seeps through it into the underlying deposits. Water supplies are not obtainable from the glacial lake clay.

Boulder clay occurs immediately below the lake clay to depths of approximately 200 feet. Owing to the impervious covering of lake clay the sands and gravels occurring as pockets near the top of the boulder clay are non-water bearing except in the northern sections. Wells, 7 to 25 feet deep on sections 30, 31, and 32, are deriving water from these isolated aquifers. The yield from individual wells is ample for local requirements and the water is of good quality. On section 34 a well, 178 feet deep, encountered a sand bed near its base, but the water obtained was of poor quality and the yield was so small that the well was filled in. Wells, 207 to 235 feet deep on sections 6, 7, and 20, tapped gravel aquifers near their bases. The water rises 30 to 40 feet above the aquifer in two of the wells, but is not under pressure in the well on section 20. Good supplies of water for local use are obtained from each well. The water is hard and from the well on section 20 has a slight laxative effect. The water-bearing gravels encountered on sections 6 and 7 appear to be a continuation of an aquifer lying at about the same depth and extending through several townships to the south. The area underlain by the aquifer in this township is apparently very limited. On the accompanying map, Figure 1, the line "A" has been drawn to indicate the approximate boundary of the aquifer. That it does not extend farther east is indicated by a dry hole sunk 255 feet deep on the SW.$\frac{1}{4}$, section 5, but it may extend northward to include section 20. Until deep drilling is conducted on sections 17 and 18 this fact cannot be established. Deep wells have been drilled on several other sections scattered throughout the area, but they have been unproductive. Additional water should be obtainable from shallow wells in the northwestern sections and from deep wells in the southwest, but in the remainder of the township water is not to be expected from the glacial drift at any depths.

The dry holes drilled 240, 255, and 285 feet deep on sections 1, 5, and 22, respectively, have probably penetrated the upper part of the Marine Shale series that forms the bedrock underlying the glacial drift throughout the township. Water is to be expected from the bedrock only at depths of several hundred feet and this water is mostly too highly mineralized to be used. Attempts to obtain ground water should be confined to the glacial drift in the western part of the township and in the remaining parts well drilling appears to be useless. Efforts should be confined to storing surface water in dugouts and cisterns.

Township 18, Range 22

The valley of Cottonwood creek passes in a northerly direction through the township from section 2 to section 36 and several, smaller, tributary valleys enter it from the east and west. The surface of the remaining parts of the township is quite rolling. Wells throughout the township are producing water, but the yield from a number of the wells is inadequate for both domestic and stock requirements. Dugouts have been excavated to collect and store surface water for stock, and the creek is also utilized for stock watering.

Three types of glacial deposits occur at the surface in different parts of the township and their approximate areal distribution is shown on Figure 1 of the geological map. They are glacial lake sands, glacial lake clay, and glacial till or boulder clay.

Glacial lake sands are found in a small area in the central part of the township on the west side of Cottonwood Creek valley. The lake sands themselves are too thin to act as reservoirs for ground water storage, but they readily transmit water to the underlying till where it is stored in sand and gravel pockets. The wells in the lake sand-covered area are shallow and have tapped small aquifers in the boulder clay from which they derive limited quantities of water. It is probable that more adequate supplies could be found by sinking a series of test holes to locate the more extensive aquifers.

The glacial lake clay in this area is sandy and hence permeable. It is probably not more than 20 feet thick throughout its extent in the township. Sandy phases in the lake clay are found to be water bearing at some localities. The yields from many of the wells are not large and in some places are only sufficient for household requirements. From other wells a few head of stock can also be watered. Where water is not found in the lake clay, water-bearing sand or gravel pockets are usually encountered at the base of the lake clay or in the upper few feet of the underlying boulder clay. The greater number of the wells in the lake clay-covered area range in depth from 8 to 42 feet. Many of these yield ample water for both household and stock requirements, but others do not provide sufficient water for stock. Dugouts are used for stock watering on farms where the yield from wells is inadequate. The water is variable in quality and, although hard, is usually suitable for drinking. From a few isolated wells, however, the water is usable only for stock. Deeper wells have been sunk on the sections in the southeastern part of the township and on sections 29 and 34. Five wells on sections 9, 10, 11, 14, and 24 are 60 to 96 feet deep and are deriving water from beds of sand and gravel. A fairly continuous aquifer appears to underlie this part of the township, and its approximate areal extent is indicated by the line "A" on Figure 1 of the accompanying map. The sands and gravels here encountered lie in an horizon that has been traced through several townships in the municipality adjoining on the east. Individual wells in the area produce enough water for household use and 10 to 15 head of stock. This amount is not sufficient on some farms where larger herds of stock are kept. The water is of good quality. Within the area bounded by the "A" line additional water no doubt could be obtained by sinking wells to this horizon. Prospecting at shallower depths within the area before sinking deep wells is advisable. A 100-foot well on section 29 and a 185-foot well on section 33 have also encountered water-bearing beds in the lower part of the glacial drift, but these are probably only local in occurrence. The aquifer in the deeper well probably lies close to the zone of contact between the drift and the underlying bedrock. Water from both wells is highly mineralized and is usable only for stock. Sinking wells to these depths is not advisable as water of better quality can be more economically obtained at shallower depths. A few test holes should be sunk through the lake clay into the boulder clay to locate an aquifer before wells are dug.

The Marine Shale series directly underlies the glacial drift throughout the township and has been penetrated by one dry hole 350-feet deep on section 36. The upper part of the formation is non-water bearing, and the water found in the lower part is not usable owing to its high, dissolved mineral salt content. Drilling for water should not be continued below the base of the glacial drift. The shales may lie at depths of 100 feet or more below the surface in the southern parts, but the outcrop in the valley in section 25 indicates that they may lie at depths considerably less than 100 feet even on the level plain of the northern parts.

Township 18, Range 23

Water supplies on most of the farms in this township are derived from shallow wells. A few springs occur in the valley of High-hill creek which crosses the township in a northeasterly direction from section 5 to section 35. Stock are watered from the creek in seasons in which it flows. Sloughs occurring in some of the numerous, undrained depressions in the rolling land surface are also used for stock watering.

Glacial outwash sands and gravels, and glacial till are exposed at the surface in small areas in the northern part of the township, and glacial lake clay forms the surface deposits over the remaining sections as shown on the geological map, Figure 1. The lake clay varies in its composition, and thus its porosity, in different parts of the township. It is found to be less sandy and more compact on the southeastern sections than in other parts of the township. Water is not obtained from the lake clay, but occurs in pockets of sand and gravel lying near the contact of the lake clay and the underlying boulder clay, or in the upper part of the boulder clay. The thickness of the lake clay varies from place to place, from less than 10 feet to about 20 feet. Aquifers are found within a few feet of the surface in some wells, but as a rule at depths of 20 to 55 feet. Sufficient water for local requirements is obtained from sand or gravel pockets in the greater number of wells, but where pockets of very limited extent are tapped the yield is small. Sandy phases of the boulder clay yield water in several wells. A number of the wells in the sections lying to the east of High-hill creek do not produce enough water for local requirements, probably due to the more compact nature of the overlying lake clay in the eastern than in the western part of the township. The water is hard and is quite highly charged with mineral salts in solution, but only from a few wells is it unsuitable for drinking. Very few dry holes have been sunk in the township. Additional wells dug at almost any point in the township, and particularly in the hollows or at the bases of slopes, should obtain water.

No wells have been dug in the small areas in the northwestern sections, which are covered by glacial sands and gravels. These deposits, although very porous, are too thin to serve as reservoirs for ground water, but they readily transmit water from the surface to the underlying till where it collects in sand and gravel pockets. Water should be found without difficulty by digging shallow wells in these areas.

As no deep wells have been sunk in the township, the depth of the Marine Shale series in the township has not been determined. This formation probably underlies the whole of the township and may be covered by at least 150 feet of glacial deposits. The upper part of the bedrock is unproductive of water and as the glacial deposits are water bearing at shallow depths deep drilling in this township is not warranted.

Township 18, Range 24

Water supplies in the township are largely derived from shallow wells. Springs occur on the slopes of the valley of Moosejaw creek which occupies the western sections 6, 7, 18, 19, and 30, in Qu'Appelle valley in sections 31 and 32, on the slopes to Stonybeach lake on sections 11 and 12, and Rocky lake on sections 26, 34, and 35. Additional water for stock is obtained from the creek and the lakes, and from dugouts.

Recent alluvial deposits consisting of silts and interbedded sands and gravels floor the valley of Moosejaw creek and Qu'Appelle valley. Water should be obtained at most points in the valleys by sinking shallow wells into the sands and gravels. As these do not form continuous beds they may not be encountered at all points, but should be readily located by sinking a few test holes. A 27-foot well in Qu'Appelle valley, on section 32, has tapped water-bearing gravel. An abundant supply of water is available in this well and the water is relatively soft and of excellent quality.

On Figure 1 of the accompanying map three types of glacial deposits are shown occurring at the surface in various parts of the township, namely, glacial lake clay, glacial outwash sands and gravels, and glacial till or boulder clay. Lake clay covers the greater part of the township, being absent only in the valleys in the western part, and in four narrow belts in the south, central, and northeastern parts. The lake clay is fairly porous and permits the seepage of surface water into the underlying deposits. Water supplies are not found in the lake clay, but occur in isolated sand or gravel pockets at the base of the lake clay or in the upper part of the underlying till. The sands and gravels lying at the zone of contact between the lake clay and the till were probably laid down as outwash deposits from the moraine to the north. On the north side of Rocky lake, on section 36, they appear at the surface and although they are not sufficiently thick to serve as reservoirs for water they are sufficiently porous to permit water to pass rapidly to the underlying till. Shallow wells dug in the vicinity of these deposits on section 36 should readily obtain water. Throughout the remainder of the township wells 10 to 46 feet deep are drawing water from the sands and gravels beneath the lake clay. As the thickness of the lake clay is not definitely known it is impossible to determine whether the sands and gravels occur at the zone of contact or in the till. The yield from nearly every well is ample for local requirements. Where production is small additional wells could be dug to augment the supply. The water is hard and highly mineralized, but only from two or three wells is it reported to be unsuitable for drinking. On sections 9, 14, and 15 it appears to be more difficult to obtain water at shallow depths, and wells have been sunk 100 to 164 feet deep in the boulder clay. Considerable quantities of water were available in two of the wells, but the yield from the well on section 9 was very limited. The water, however, is very highly mineralized from these deep wells and is unfit for either household or stock use. Throughout the township the depth of wells should not exceed 50 to 60 feet. Springs occurring on the banks of the valleys and the slopes to the lakes have their source in sands and gravels buried in the boulder clay. Considerable amounts of water flow from some of the springs. Careful prospecting may be found necessary to locate aquifers on some sections, but usually they will be found with little difficulty at shallow depths.

The Marine Shale series directly underlies the glacial drift throughout the township at probable depths of about 200 feet below the surface on the plains and correspondingly lesser depths in the valleys. A well 350 feet deep on section 24 penetrated the bedrock and encountered water in a bed of quicksand. Although this aquifer may occur in the upper part of the bedrock, it may be in the lower part of the glacial drift, but this cannot be determined from the log of the well. This well was never used owing to difficulty experienced in keeping it free from inflowing sand. Water is not to be expected from the upper part of the marine shales in most localities. A 380-foot hole drilled on section 3 was dry. The lower part of the formation is productive of water, but the expense of drilling deep wells and the poor quality of the water make it undesirable as a source of farm water.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL
MUNICIPALITY OF PENSE, NO. 160, SASKATCHEWAN

West of 2nd meridian — Township / Range	16 / 22	16 / 23	16 / 24	17 / 22	17 / 23	17 / 24	18 / 22	18 / 23	18 / 24	Total No. in municipality
Total No. of Wells in Township	62	21	19	53	24	25	70	86	55	415
No. of wells in bedrock	3	1	4	15	6	3	1	0	3	36
No. of wells in glacial drift	44	17	15	38	18	22	69	86	49	358
No. of wells in alluvium	15	3	0	0	0	0	0	0	3	21
Permanency of Water Supply										
No. with permanent supply	25	7	7	36	8	14	54	81	45	277
No. with intermittent supply	1	0	0	0	0	0	11	1	0	13
No. dry holes	26	14	12	17	16	11	5	4	10	125
Types of Wells										
No. of flowing artesian wells	0	0	0	0	0	0	0	0	1	1
No. of non-flowing artesian wells	7	4	4	11	0	1	5	2	4	38
No. of non-artesian wells	19	3	3	25	8	13	60	80	40	251
Quality of Water										
No. with hard water	24	7	7	35	8	14	58	74	42	269
No. with soft water	2	0	0	1	0	0	7	8	3	21
No. with salty water	0	0	1	6	1	1	1	0	0	10
No. with "alkaline" water	12	1	2	10	2	3	17	8	4	59
Depths of Wells										
No. from 0 to 50 feet deep	46	6	3	23	9	11	60	85	40	283
No. from 51 to 100 feet deep	5	6	3	8	6	3	7	1	10	49
No. from 101 to 150 feet deep	3	1	7	11	3	3	0	0	1	29
No. from 151 to 200 feet deep	4	4	1	2	2	1	2	0	1	17
No. from 201 to 500 feet deep	4	3	5	7	4	7	1	0	3	34
No. from 501 to 1,000 feet deep	0	0	0	1	0	0	0	0	0	1
No. over 1,000 feet deep	0	1	0	1	0	0	0	0	0	2
How the Water is used										
No. usable for domestic purposes	19	5	5	15	7	13	54	77	38	233
No. not usable for domestic purposes	7	2	2	21	1	1	11	5	7	60
No. usable for stock	24	5	6	30	7	14	61	82	43	272
No. not usable for stock	2	2	1	6	1	0	4	0	2	18
Sufficiency of Water Supply										
No. sufficient for domestic needs	26	7	7	34	7	13	49	77	41	261
No. insufficient for domestic needs	0	0	0	2	1	1	16	5	4	29
No. sufficient for stock needs	22	7	7	24	5	13	32	46	37	193
No. insufficient for stock needs	4	0	0	12	3	1	33	36	8	97

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 ban be removed by boiling. Temporary hardness is due mainly to the bicarbonates of calcium and magnesium and iron, and permanent hardness to the sulphates and chlorides of calcium and magnesium. The permanent hardness can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in 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 Pense, No. 160, Saskatchewan

No.	LOCATION					Depth of well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of Water
	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	SE.	1	16	22	2	213	2,540	1700	1400	300	40	790	210	263	1214	671	2,535	376		349	286		1,458	66		x 1
2	NW.	16	16	22	2	25	8,680	3000+	3000+		37	150	550	814	5,884	2058	8415	150	1132		2,396		4,646	61		x 1
3	SE.	25	16	22	2	8	520	240	190	50	24	270	90	47	66	59	389	151		92	9		87	40		x 1
4	SE.	1	16	23	2	230	1,880	400	100	300	144	650	110	50	697	780	1,920	197		105		348	1,032	238		x 1
5	SW.	13	16	23	2	14	970											(3)	(1)		(2)		(4)		(5)	x 1
6	NE.	13	16	23	2	14	680											(3)	(1)		(2)				(4)	x 1
7	SE.	6	17	24	2	207	1,680	1,200	600	600	18	630	50	158	604	535	1,569	90		330		156	983	30		x 1
8	NW.	2	18	22	2	14	1,750												(3)		(4)	(2)	(1)	(5)		x 1
9	SE.	18	18	23	2	60	400	320	200	120	8	250	130	43	86	7	3366	233		14	108			13		x 1
10	NW.	31	18	23	2	25	320											(1)		(2)					(3)	x 1
11	NE.	24	18	24	2	42	540	400	280	120	15	145	80	61	107											x 1

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

Analyses Nos. 5, 6, 8, and 10, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

Water occurring in the Recent stream deposits is derived in part as run-off from the higher land and in part as seepage from the creek. In passing over the lake clay and till the waters take into solution the sulphate salts inherent in these deposits. The concentration may not be large and if these waters enter beds of porous gravels or sands little opportunity for further concentration of the salts is afforded. Wells tapping these pockets yield a soft or moderately hard water that may be appreciably "alkaline", but is, in most places, drinkable. Surface waters accumulating in depressions in the valleys and finally seeping into the finer silts are more highly mineralized due to the action of long-continued surface evaporation.

Analysis No. 2 in the accompanying table is of water from the silts. The very high concentration of the laxative-acting sulphates of sodium and magnesium (Na_2SO_4 and $MgSO_4$) makes this water unfit for either domestic or stock use. It will be noted that this water is excessively hard, having a total and permanent hardness exceeding 3,000 parts per million. Analyses Nos. 3, 5, and 6 are typical of the much less highly mineralized water from the sand and gravel beds in the Recent deposits. The total dissolved solids content of each is low, ranging from 520 to 970 parts per million. The waters are moderately hard due to the calcium and magnesium salts that are present, but are of excellent quality for drinking. These samples were taken from wells in the valley of Cottonwood creek. Water from the Recent deposits in the valley of Moosejaw creek and in Qu'Appelle valley will display similar characteristics. The water from the well in the latter valley, on sec. 32, tp. 18, range 24, is reported to be soft and of good quality.

Soluble mineral salts are present inherently in the glacial lake clay that mantles the greater part of the municipality, and any water percolating through the clay carries with it a portion of these salts in solution. The boulder clay underlying the lake clay varies in composition from place to place. The boulder clay and lake clay are usually considered to be the source of the greater part of the mineral salts found in solution in waters from the glacial drift. The amount of salts dissolved by the water depends on the porosity of the clays and the depth of percolation. The proportions in which the various salts are present depends on the nature of the clay in the particular locality. Water collecting in porous sand or gravel pockets at shallow depths is not usually highly mineralized, but if the overlying layer of clay is highly charged with mineral salts then the water will be highly mineralized even at shallow depths. Most of the deep wells in the boulder clay yield water that is too highly charged with dissolved salts to be used. The mineral salts most commonly found in waters from the glacial drift are, in the decreasing order of their relative abundance: sodium sulphate (Na_2SO_4), magnesium sulphate ($MgSO_4$), calcium sulphate ($CaSO_4$), and varying amounts of the carbonates of sodium, magnesium, and calcium, and sodium chloride (common salt).

Analyses Nos. 8, 9, 10, and 11 are of waters from wells 14 to 60 feet deep in the glacial drift. Sodium sulphate is predominant in No. 8, but is not sufficiently concentrated to have any harmful effects when this water is used for drinking. Calcium carbonate is present in the largest amounts in Nos. 9 and 10, but has no other effect than to cause hardness of the water. Each of these waters is considered to be of good quality for domestic use. Analyses Nos. 1, 4, and 7 in the table are of water from wells, 213, 230, and 207 feet deep, respectively, drawing water from porous beds at or near the base of the drift within the areas in which extensive aquifers have been found. The content of dissolved solids is higher than in the water from the shallower wells and ranges from 1,680 to 2,540 parts per million. Sodium sulphate is present in considerable amounts in each sample, but apparently has no ill effects on persons using the water. No. 1 may have a slightly laxative effect on some persons unaccustomed to drinking highly mineralized water, but if uncontaminated by surface pollution such waters could be used for drinking. Sulphate salt contents greatly exceeding those found in the first analysis might prove detrimental to the health of persons using the water, and such waters should not be used if supplies of better quality are available.

Water from the Bedrock

What little water occurs in the upper part of the dark grey marine shales is usually highly mineralized and is of inferior quality to water even from the lower part of the glacial drift. It is usually hard and highly charged with sulphate salts. These salts are in part inherent in the shales, and a part is brought down from the boulder clay by percolating waters. The more impervious character of the shale tends to the concentration of these salts in the water from the upper part of the shale. Water of this nature was found in a 258-foot well on sec. 28, tp. 17, range 22, and it is too highly mineralized to be used for any farm purpose.

The water from lower levels in the shales exhibits different characteristics from that of the upper part. Magnesium sulphate is present in smaller concentrations and larger amounts of the carbonates are present. Sodium chloride (common salt) is usually sufficiently concentrated in the water to make it unusable. The deep wells at Ponse obtained highly mineralized, unusable water.

WELL RECORDS—Rural Municipality of PENSE, NO. 160, 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	SE.	1	16	22	2	Drilled	213	1,905	-100	1,805	100	1,805	Glacial fine sand and gravel	Hard, clear, iron, brown sediment	42	D, S	Sufficient supply; two similar wells filled with sand; #.
2	SW.	2	"	"	"	Drilled	175	1,915	-115	1,800	175	1,740	Glacial fine sand and gravel	Hard, clear, iron	40	D, S	Sufficient for more than 45 head stock; similar well filled with sand.
3	SE.	4	"	"	"	Drilled	168	1,900					Glacial drift	Hard			Yields 50 barrels a day.
4	SW.	4	"	"	"	Bored	120	1,910	-105	1,805	120	1,790	Glacial gravel	Hard, clear, iron	44	D, S	Sufficient for 40 head stock; also supplies neighbours.
5	NE.	10	"	"	"			1,920									Dry hole in glacial drift.
6	E½.	11	"	"	"	Bored	60	1,920									Dry hole in glacial drift; haul water from coulée; use dugout.
7	NE.	12	"	"	"			1,900									18 dry holes 80 to 500 feet deep in glacial drift and Bearpaw formation.
8	NE.	12	"	"	"	Drilled	400	1,900					Marine shale series				Formerly supplied good water; not used for many years.
9	SE.	13	"	"	"	Dug	24	1,875	- 20	1,855	20	1,855	Glacial drift	Hard, clear	44	D, S	Sufficient for 10 head stock.
10	SW.	14	"	"	"	Dug	25	1,890					Glacial drift	Hard, "alkaline"		S	Insufficient supply; several similar wells not in use; water from one well too "alkaline" for use.
11	N.½	14	"	"	"	Dug	18	1,870	- 13	1,857	13	1,857	Recent alluvium	Hard, clear, "alkaline"	42	S	Sufficient for 20 head stock; haul drinking water.
12	NE.	15	"	"	"	Dug	25	1,870	- 20	1,850	20	1,850	Recent alluvium	Hard, clear, "alkaline"		D, S	
13	NE.	15	"	"	"	Dug	20	1,870	- 11	1,859	11	1,859	Recent alluvium	Soft, "alkaline"		S	Sufficient supply.
14	NW.	16	"	"	"	Dug	20	1,875	- 10	1,865	10	1,865	Recent alluvium	Hard, clear, "alkaline"	42	S	Sufficient supply; 10 dry holes.
15	NW.	16	"	"	"	Dug	20	1,875	- 15	1,860	15	1,860	Recent alluvium	Hard, clear, "alkaline"		S	Several shallow dry holes; 2 dams in coulée.
16	NW.	16	"	"	"	Dug	25	1,875	- 10	1,865	10	1,865	Recent alluvium	Hard, clear, strongly "alkaline"	44	N	Waternot usable; #.
17	NE.	17	"	"	"	Dug	22	1,880	- 5	1,875	5	1,875	Recent sand	Hard		D, S	Supplied 80 head stock; well caved in.
18	NE.	17	"	"	"	Dug	11	1,880	- 3	1,877	11	1,869	Recent sand	Hard, clear	42	D, S	Abundant supply.
19	NE.	18	"	"	"	Drilled	50	1,885	- 25	1,860	50	1,835	Glacial gravel	Hard, clear	39	D, S	Sufficient for 20 head stock; dry hole 250 feet deep in Bearpaw; 2 dry holes 25 feet deep in coulée.
20	E.½	23	"	"	"	Dug	20	1,870	- 10	1,860	10	1,860	Recent alluvium	Hard, clear, "alkaline"	40	S	Similar well 20 feet deep; sufficient supply from two wells for 60 head stock.
21	NW.	24	"	"	"	Dug	20	1,865	- 10	1,855	10	1,855	Recent gravel	Hard, clear, "alkaline"		D, S	Sufficient supply; a similar well 24 feet deep for stock.
22	SE.	25	"	"	"	Dug	8	1,865	- 4	1,861	4	1,861	Recent gravel	Hard, clear		D, S	Municipal well; supplies a number of farmers; #.
23	SW.	25	"	"	"	Dug	30	1,865									4 dry holes in glacial drift.
24	SW.	25	"	"	"	Dug	17	1,900	- 5	1,895	15	1,885	Recent gravel	Hard, clear, "alkaline"	45	D, S	Sufficient supply.
25	NE.	25	"	"	"	Dug	10	1,860	- 4	1,856	8	1,852	Recent sand	Soft, clear		D, S	Sufficient supply.
26	SW.	30	"	"	"		160	1,900									Dry hole in glacial drift.

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 PENSE, NO. 160, 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	SE.	36	16	22	2	Dug	18	1,855	- 8	1,847	8	1,847	Recent sand	Hard, clear, "alkaline"	45	D, S, I	Two other wells in coulée; sufficient water from 2 wells for 30 head stock.
28	NE.	36	"	"	"	Dug	18	1,850	- 8	1,842	8	1,842	Recent gravel	Hard, clear, iron	46	D, S	
29	NE.	36	"	"	"	Dug	16	1,850	- 6	1,844	6	1,844	Recent alluvium	Hard, clear, "alkaline"	46	D, S	Sufficient for 12 head stock.
1	SE.	1	16	23	2	Drilled	230	1,900	-210	1,690	230	1,670	Glacial drift	Hard, clear, iron		D, S	Sufficient supply; #.
2	SW.	2	"	"	"		60	1,900									Two dry holes in glacial drift.
3	SW.	4	"	"	"		200	1,890									Several dry holes in glacial drift.
4	SE.	13	"	"	"	Dug	24	1,895	- 19	1,876	19	1,876	Recent alluvium	Hard, clear, "alkaline"		D, S	Sufficient for 8 head stock.
5	SW.	13	"	"	"	Dug	14	1,900	- 8	1,892	8	1,892	Recent sand and gravel	Hard, clear	38	D, S	Sufficient supply; used by neighbours for drinking; #.
6	NE.	13	"	"	"	Dug	14	1,895	- 2	1,893	14	1,881	Recent gravel	Hard, clear	40	D, S	Sufficient for 14 head stock; #.
7	SW.	18	"	"	"	Bored	60	1,910									Dry hole in glacial drift.
8	NW.	18	"	"	"	Drilled	225										Dry hole in glacial drift; another hole 165 feet deep.
9	SE.	26	"	"	"	Bored	80	1,915									Three dry holes in glacial drift.
10	SW.	26	"	"	"	Drilled	165	1,910	-135	1,775	165	1,745	Glacial drift			N	Well filled in and was never used.
11		31	"	"	"	Drilled	1,551	1,915									Dry hole in bedrock.
12	S[illegible].	32	"	"	"	Bored	112	1,915			112	1,803	Glacial sand			N	Quicksand filled well; never used.
13	NW.	33	"	"	"		215	1,920									Dry hole in glacial drift; another dry hole 200 feet deep.
14	NE.	35	"	"	"	Bored	155	1,930	-150	1,780	150	1,780	Glacial sand and gravel	Hard, iron	42	S	Sufficient for 30 head stock.
1	SE.	3	16	24	2	Drilled	133	1,880	-103	1,777	103	1,777	Glacial sand and gravel	Hard, iron	42	D, S	Sufficient supply.
2	SW.	4	"	"	"	Drilled	134	1,865	- 74	1,791	100	1,765	Glacial fine sand	Hard, clear, iron, white sediment		D, S	Sufficient for 25 head stock.
3	NE.	5	"	"	"	Drilled	138	1,865	-118	1,747	138	1,727	Glacial gravel	Hard, clear		D, S	Sufficient for 40 head stock.
4	SE.	6	"	"	"	Drilled	220	1,865									Dry hole in Marine Shale series.
5	NE.	7	"	"	"	Drilled	146	1,880					Glacial drift	Hard, "alkaline"		S	Well not in use now.
6	NE.	8	"	"	"	Drilled	148	1,875	-135	1,740	135	1,740	Glacial sand and gravel	Hard	40	D, S, I	Sufficient for more than 120 head stock.
7		9	"	"	"		132	1,875									Dry hole in glacial drift.
8	SE.	10	"	"	"	Drilled	100	1,880									Three dry holes in glacial drift.
9	SW.	16	"	"	"	Drilled	120	1,865	- 90	1,775	120	1,745	Glacial sand and gravel	Hard, iron, "alkaline"		N	Well filling with sand.
10	NE.	25	"	"	"	Drilled	350	1,900									Dry hole in Marine Shale series.

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 PENSE, NO. 160, 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				
11	NE.	26	16	24	2			1,905									Several dry holes in glacial drift.
12	NW.	29	"	"	"	Drilled	320	1,875									Dry hole in Bearpaw shale; another hole 280 feet deep.
13	SE.	30	"	"	"	Drilled	200	1,875									Seven dry holes in glacial drift.
14	S.½	34	"	"	"	Drilled	417	1,905			400	1,505	Marine Shale series	Salty		N	Very small yield of water; never used.
1	SE.	1	17	22	2	Dug	28	1,855	- 12	1,843	28	1,815	Glacial gravel	Soft, clear, iron, odour, rusty sediment	40	D, S	Sufficient supply.
2	NE.	9	"	"	"	Drilled	300	1,890									Dry hole in Marine Shale series.
3	SW.	9	"	"	"	Bored	150	1,892									Dry hole reaching Marine Shale series.
4	SW.	9	"	"	"	Drilled	1,250	1,890					Marine Shale series	Salty		N	Some gas and water obtained at about 300 feet.
5	SW.	9	"	"	"	Drilled	500	1,890					Marine Shale series	Hard, salty		N	Two wells the same; water unfit for use.
6	SE.	15	"	"	"	Drilled	300	1,880									Several test-holes in Marine Shale series.
7	SE.	18	"	"	"	Drilled	150	1,880									Dry hole reaching Marine Shale series; a 275-foot hole penetrated the shale.
8	NW.	19	"	"	"	Drilled	600	1,890									Dry hole in Bearpaw shale.
9	NE.	20	"	"	"	Bored	90	1,875									Dry hole in glacial drift.
10	NW.	21	"	"	"	Drilled	172	1,865	- 75	1,790	165	1,700	Glacial sand	Hard, salty, "alkaline"		N	Small supply; well filled in.
11	SE.	22	"	"	"	Bored	128	1,865	-116	1,749	128	1,737	Glacial gravel	Hard, clear, iron, sulphur, brown sediment, "alkaline"	40	S	Abundant supply.
12	NW.	24	"	"	"	Drilled	150	1,850									Several dry holes in Marine Shale series.
13	SW.	25	"	"	"	Bored	130	1,850									Dry hole in glacial drift.
14	SW.	25	"	"	"	Dug	25	1,850	- 23	1,827	23	1,827	Glacial drift	Hard, clear	40	D	Only sufficient for house use; a 25-foot well yields small supply.
15	NW.	27	"	"	"	Bored	56	1,875	- 48	1,827	48	1,827	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply.
16	NW.	27	"	"	"	Bored	34	1,865	- 25	1,840	25	1,840	Glacial sand	Hard, clear, "alkaline",	40	S	Sufficient supply; several similar wells.
17	SW.	27	"	"	"	Dug	32	1,870	- 23	1,847	23	1,847	Glacial sand	Hard, clear		N	Sufficient supply; never used.
18	NW.	28	"	"	"	Drilled	258	1,870	- 58	1,812	258	1,612	Marine Shale series	Hard, clear, salty	40	N	Well never used; also a dry hole 248 feet deep in Marine Shale series.
19	NW.	28	"	"	"	Bored	45	1,870	- 40	1,830	40	1,830	Glacial sand	Hard, clear	40	D	Sufficient for household use.
20	SE.	28	"	"	"	Bored	110	1,860	- 60	1,800	100	1,760	Glacial sand	Hard, clear, "alkaline"	40	S	Abundant supply.
21	SE.	29	"	"	"	Drilled	100	1,860	- 72	1,788	98	1,762	Glacial sand	Hard, clear, "alkaline", iron		S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of PENSE, NO. 160, 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
22	SE.	31	17	22	2	Dug	30	1,880	- 15	1,865	30	1,850	Glacial gravel	Hard, clear, "alkaline"	40	D, S	Sufficient supply.
23	NW.	31	"	"	"	Dug	20	1,870	- 17	1,853	17	1,853	Glacial drift	Hard, clear		D, S	Insufficient supply; 4 wells 20 and 22 feet deep.
24	SE.	32	"	"	"	Bored	150	1,875	-100	1,775			Glacial drift	Hard, very "alkaline"		N	Good flow of water but never used; well filled in; other wells 75 feet deep with similar water.
25	NW.	32	"	"	"	Dug	30	1,870	- 15	1,855	-15	1,855	Glacial drift	Hard, clear, slight odour, "alkaline"		S	Sufficient supply; a 25-foot well supplies good water for household.
26	SW.	33	"	"	"	Dug	25	1,860	- 22	1,838	22	1,838	Glacial sand	Hard, clear		D	Insufficient supply; an 80-foot well yields poor water.
27	NW.	33	"	"	"	Drilled	100	1,890	- 42	1,848			Glacial sand	Hard, clear, "alkaline", salty		S	Sufficient supply; 3 wells 45 and 50 feet deep with poor water; seepage well by dugout for household.
28	NW.	34	"	"	"	Bored	72	1,800									Four dry holes 44 to 72 feet deep in glacial drift.
29	SW.	34	"	"	"	Bored	14	1,875	- 7	1,868	14	1,861	Glacial gravel	Hard, clear, sediment		D	Sufficient for household use.
30	SE.	34	"	"	"	Bored	106	1,875	- 70	1,805	106	1,769	Glacial sand	Hard, clear, sulphur, iron		D, S	Sufficient supply; not used now.
31	SW.	35	"	"	"	Bored	60	1,858	- 55	1,803	55	1,803	Glacial sand	Hard, salty, brown sediment		D	Only sufficient for household; also a 14-foot well.
32	SW.	36	"	"	"	Bored	130	1,840									Dry hole reaching Marine Shale series.
1	SW.	2	17	23	2	Drilled	165	1,905					Glacial sand	Salty		N	Well plugged with quicksand; a dry hole 30 feet deep.
2	NW.	5	"	"	"	Drilled	200	1,910									Dry hole in Marine Shale series.
3	SW.	8	"	"	"	Drilled	250	1,915									Dry hole in Marine Shale series; also a dry hole 150 feet deep.
4	SW.	14	"	"	"	Bored	65	1,900									Dry hole in glacial drift.
5	NE.	15	"	"	"	Dug	22	1,870	- 16	1,854	16	1,854	Glacial sand	Hard, clear	40	D	Sufficient for household use.
6	NW.	20	"	"	"	Bored	150	1,910									Dry hole in Marine Shale series.
7	NE.	22	"	"	"	Drilled	450	1,890									Dry hole in Marine Shale series.
8	NW.	22	"	"	"		100	1,890									Dry hole in glacial drift; similar hole 65 feet deep.
9	SE.	25	"	"	"	Drilled	214	1,890									Dry hole in Marine Shale series; also a 75-foot dry test hole in glacial drift.
10	NE.	26	"	"	"	Dug	150	1,890									Dry hole in Marine Shale series.
11	NW.	30	"	"	"	Drilled	300	1,905									Dry hole in Marine Shale series; also 90- and 100-foot dry holes in glacial drift.
12	NW.	34	"	"	"	Dug	35	1,890	- 30	1,860	30	1,860	Glacial sand	Hard, clear		S	Sufficient supply; also 30-foot well.
13	NE.	35	"	"	"	Bored	33	1,875	- 17	1,858	17	1,858	Glacial drift	Hard, clear, iron		S	Sufficient supply; 20-foot well gives good supply of drinking water.
14	SE.	35	"	"	"	Dug	35	1,875	- 29	1,846	29	1,846	Glacial sand	Hard, clear, "alkaline", iron		S	Sufficient for over 40 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PENSE, NO. 160, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
15	SE.	36	17	23	2	Dug	35	1,875	- 22	1,853	35	1,840	Glacial gravel	Hard, clear, sulphur		S	Sufficient supply.
16	SW.	36	"	"	"	Dug	50	1,899									Three dry holes in glacial drift.
17	NE.	36	"	"	"	Bored	45	1,875	- 20	1,855	45	1,830	Glacial drift	Hard, clear, "alkaline"		S	Sufficient supply; a 20-foot well yields good drinking water.
1	SE.	1	17	24	2	Drilled	240	1,910									Dry hole in Marine Shale series.
2	SE.	3	"	"	"	Drilled	220	1,910									Dry hole in glacial drift.
3	SW.	5	"	"	"	Drilled	225	1,905									Dry hole in Marine Shale series.
4	SE.	6	"	"	"	Drilled	207	1,900	-175	1,725	175	1,725	Glacial gravel	Hard, clear, iron, red sediment	40	D, S	Sufficient supply; #.
5	SW.	7	"	"	"	Drilled	235	1,890	-155	1,735	195	1,695	Glacial quick-sand	Hard, clear, iron	38	D, S	Yields 3 barrels a minute.
6	SE.	12	"	"	"	Dug	100	1,910									Two dry holes in glacial drift.
7	SW.	17	"	"	"	Bored	30	1,895	- 28	1,867	28	1,867	Glacial gravel	Hard, clear, "alkaline"	43	D	Insufficient supply.
8	SW.	18	"	"	"	Dug	10	1,890					Glacial drift	Hard, clear, iron	40	D, S	Sufficient supply.
9	NE.	19	"	"	"	Spring		1,670					Glacial drift				
10	NW.	20	"	"	"	Drilled	220	1,910	-204	1,706	204	1,706	Glacial gravel	Hard, clear, "alkaline", salty		D, S	Sufficient supply.
11	NE.	22	"	"	"	Drilled	285	1,910									Dry hole in Marine Shale series.
12	SE.	24	"	"	"			1,910									Dry holes in glacial drift.
13	SE.	30	"	"	"	Dug	25	1,890					Glacial drift			N	Well never used.
14	SE.	31	"	"	"	Dug	18	1,890	- 11	1,879	11	1,879	Glacial sand	Hard, clear, iron	45	D, S	Sufficient supply; 18-foot well has gone dry.
15	SE.	31	"	"	"	Drilled	125	1,890									Dry hole in glacial drift.
16	NE.	32	"	"	"	Dug	22	1,900	- 20	1,880	20	1,880	Glacial gravel	Hard, clear	40	D, S	Abundant supply; a 7-foot well also yields good supply.
17	NE.	32	"	"	"	Dug	18	1,900	- 10	1,890	10	1,890	Glacial sand	Hard, clear, iron		D, S	Sufficient supply.
18	NW.	32	"	"	"	Dug	13	1,900	- 10	1,890	10	1,890	Glacial quick-sand	Hard, clear	40	D, S	Sufficient supply.
19	NE.	34	"	"	"	Bored	178	1,910					Glacial sand	Hard, clear, "alkaline"		D, S	Yielded ½ barrel a day; well now filled in.
20	NE.	36	"	"	"	Bored	150	1,904									Three dry holes in glacial drift.
1	NW.	2	18	22	2	Dug	14	1,830	- 8	1,822	8	1,822	Glacial gravel	Hard, "alkaline"	42	D, S	Sufficient supply; #.
2	SW.	3	"	"	"	Bored	18	1,835	- 13	1,822	13	1,822	Glacial sand	Hard, "alkaline"	40	S	Sufficient supply; bitter.
3	NW.	4	"	"	"	Dug	26	1,850					Glacial drift	Soft		D, S	Intermittent supply; several shallow wells; "alkaline".

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

WELL RECORDS—Rural Municipality of PENSE, NO. 160, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE: Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
4	NW.	6	18	22	2	Dug	25	1,860	- 22	1,838	22	1,838	Glacial sand	Hard, iron	40	D, S	Sufficient supply; two similar wells.
5	NW.	6	"	"	"	Dug	12	1,860	- 12	1,848	12	1,848	Glacial sand	Soft	40	D, S	Insufficient supply.
6	SW.	6	"	"	"	Bored	28	1,860	- 18	1,842	18	1,842	Glacial drift	Hard, "alkaline"	40	D, S	Insufficient supply.
7	NW.	8	"	"	"	Dug	18	1,860	- 15	1,845	15	1,845	Glacial drift	Hard, "alkaline"		D, S	Insufficient supply.
8	SW.	9	"	"	"	Dug	25	1,860	- 13	1,847	13	1,847	Glacial drift	Soft	40	D, S	Sufficient supply; another 18-foot well.
9	SW.	9	"	"	"	Bored	61	1,860	- 56	1,804	80	1,780	Glacial sand	Soft, iron, salty	40	S	Sufficient supply.
10	SE.	10	"	"	"	Dug	24	1,855					Glacial drift	Hard, drift	40	D	Intermittent supply; also a spring.
11	SW.	10	"	"	"	Bored	96	1,855	- 65	1,790	65	1,790	Glacial gravel	Hard, iron, "alkaline"	40	D, S	Intermittent supply.
12	SW.	11	"	"	"	Bored	60	1,845	- 20	1,825	55	1,790	Glacial sand	Hard	40	D, S	Sufficient supply.
13	NW.	14	"	"	"	Dug	25	1,825	- 10	1,815	10	1,815	Glacial sand	Hard, "alkaline"	40	S	Insufficient supply.
14	NW.	14	"	"	"	Bored	60	1,835	- 20	1,815	60	1,775	Glacial drift	Hard.	40	D, S	Sufficient supply.
15	NW.	16	"	"	"	Dug	27	1,860	- 17	1,843	17	1,843	Glacial sand	Hard, iron		D, S	Intermittent supply; several similar wells.
16	SW.	17	"	"	"	Dug	20	1,860	- 15	1,845	15	1,845	Glacial drift	Hard, "alkaline"	40	S	Insufficient supply; another well 40 feet deep.
17	SW.	18	"	"	"	Dug	20	1,860	- 15	1,845	15	1,845	Glacial sand	Hard		D, S	Intermittent supply.
18	SE.	20	"	"	"	Bored	24	1,860	- 18	1,842	18	1,842	Glacial sand	Hard, iron, "alkaline"	40	D, S	Intermittent supply; another well similar.
19	NE.	20	"	"	"	Dug	16	1,855	- 10	1,845	10	1,845	Glacial sand	Hard		D, S	Sufficient supply for 25 head stock; another well not usable.
20	NW.	21	"	"	"	Dug	12	1,850	— 8	1,842	8	1,842	Glacial sand	Soft	40	D, S	Insufficient supply; 3 other similar wells; one had good supply.
21	SE.	21	"	"	"	Dug	25	1,845					Glacial drift	Hard, "alkaline"		D	Insufficient supply.
22	SE.	22	"	"	"	Dug	12	1,830	- 11	1,829	11	1,829	Glacial sand	Hard	40	D	Insufficient supply; 3 other shallow wells.
23	NE.	22	"	"	"	Dug	25	1,840	- 20	1,820	20	1,820	Glacial sand	Hard, "alkaline"	40	D, S	Insufficient supply; several wells filled in.
24	SW.	24	"	"	"	Bored	60	1,800	- 72	1,728	72	1,728	Glacial gravel	Hard, iron, "alkaline"	40	S	Sufficient supply; also an 18-foot well; several springs along creek.
25	NW.	24	"	"	"	Drilled	170	1,750									Dry hole in Marine Shale series; a well near creek; good supply.
26	SE.	25	"	"	"	Dug	12	1,750					Glacial sand	Hard, "alkaline"		D	Sufficient for house use.
27	SW.	26	"	"	"	Dug	16	1,805					Glacial drift	Hard		D, S	Intermittent supply; a 14-foot well also.
28	NE.	27	"	"	"	Dug	18	1,830	- 12	1,818	12	1,818	Glacial drift	Hard		S	Intermittent supply.
29	SW.	28	"	"	"	Dug	8	1,845	- 7	1,838	7	1,838	Glacial quicksand	Hard		N	Filled in.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PENSE, NO. 160, 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
30	NW.	29	18	22	2	Dug	24	1,840	- 8	1,832	8	1,832	Glacial sand	Hard, "alkaline"	40	D, S	Intermittent supply; laxative. Another well; "alkaline".
31	NE.	30	"	"	"	Dug	30	1,850	- 21	1,829	21	1,829	Glacial drift	Hard, "alkaline"	40	S	Sufficient supply.
32	NW.	30	"	"	"	Dug	30	1,850	- 16	1,834	16	1,834	Glacial sand	Hard		D, S	Sufficient supply.
33	NE.	31	"	"	"	Drilled	42	1,860	- 24	1,836	24	1,836	Glacial sand	Soft, iron	40	D, S	Sufficient supply.
34	NE.	32	"	"	"	Dug	16	1,850	- 14	1,836	14	1,836	Glacial sand	Soft	46	D, S	Sufficient supply; another well similar.
35	NE.	32	"	"	"	Bored	40	1,850	- 6	1,844	40	1,810	Glacial sand	Hard, "alkaline"	42	D, S	Sufficient supply.
36	NW.	34	"	"	"	Dug	35	1,825	- 10	1,815	10	1,815	Glacial drift	Hard	40	D, S	Sufficient supply.
37	NW.	34	"	"	"	Bored	185	1,825	-170	1,655	170	1,655	Glacial drift	Hard, "alkaline"	40	S	Sufficient supply.
38	NE.	34	"	"	"	Dug	28	1,825	- 19	1,806			Glacial sand	Hard, iron	40	D, S	Sufficient supply.
39	SW.	36	"	"	"	Drilled	350	1,800									Dry hole in Marine Shale series; several other dry holes.
40	SW.	36	"	"	"	Dug	15	1,725	- 10	1,715	10	1,715	Glacial gravel	Hard, "alkaline"		D, S	Sufficient supply.
41	NE.	36	"	"	"	Bored	100	1,800									Dry hole in Marine Shale series(?); also a 20-foot well.
1	NW.	1	18	23	2	Dug	22	1,875	- 10	1,865	10	1,865	Glacial drift	Hard, "alkaline"	43	S	Insufficient supply; another well.
2	SE.	1	"	"	"	Dug	19	1,875	- 14	1,861	14	1,861	Glacial drift	Hard	40	S	Insufficient supply.
3	SW.	1	"	"	"	Dug	15	1,875					Glacial drift	Hard			Insufficient supply.
4	SE.	2	"	"	"	Dug	13	1,875	- 9	1,866	9	1,866	Glacial drift	Soft	42	D, S	Sufficient supply; also a 26-foot well.
5	SW.	2	"	"	"	Dug	32	1,875	- 20	1,855	32	1,843	Glacial drift	Hard, "alkaline"	41	S	Sufficient supply; another well.
6	SE.	3	"	"	"	Dug	32	1,880	- 13	1,867	13	1,867	Glacial drift	Hard, iron	45	D, S	Insufficient supply; 2 other similar wells.
7	NE.	3	"	"	"	Dug	20	1,875	- 8	1,867	8	1,867	Glacial drift	Soft	42	D, S	Sufficient supply; also a 35-foot well.
8	SE.	4	"	"	"	Dug	42	1,880	- 24	1,856	24	1,856	Glacial drift	Hard, "alkaline"		D, S	Sufficient supply.
9	NW.	4	"	"	"	Dug	10	1,875	- 2	1,873	2	1,873	Glacial gravel	Hard, iron, "alkaline"	40	D, S	Sufficient supply; another well, soft water.
10	NE.	5	"	"	"	Dug	27	1,880	- 25	1,855	25	1,855	Glacial quicksand	Hard	41	D, S	Insufficient supply; 49-foot well also.
11	SE.	5	"	"	"	Dug	30	1,880	- 16	1,864	16	1,864	Glacial gravel	Hard, iron	42	D, S	Sufficient supply; other shallow wells.
12	NW.	5	"	"	"	Dug	20	1,870	- 15	1,855	15	1,855	Glacial gravel	Hard	40	D, S	Sufficient supply.
13	SW.	5	"	"	"	Bored	25	1,875	- 15	1,860	15	1,860	Glacial drift	Hard, iron	40	D, S	Sufficient supply; another 22-foot well.
14	SW.	7	"	"	"	Dug	15	1,870	- 13	1,857	13	1,857	Glacial sand	Hard	45	D, S	Sufficient supply; also a 6-foot well for house.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PENSE, NO. 160, 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
15	NE.	9	18	23	2	Dug	40	1,860	- 25	1,835	25	1,835	Glacial drift	Soft	39	D, S	Sufficient supply; also a 14-foot well.
16	NW.	10	"	"	"	Dug	17	1,880	- 13	1,867	13	1,867	Glacial gravel	Hard		D	Just sufficient for house use.
17	NW.	10	"	"	"	Dug	7	1,880	- 1	1,879	1	1,879	Glacial gravel	Hard	40	D, S	Sufficient supply.
18	SE.	10	"	"	"	Dug	20	1,880	- 15	1,865	15	1,865	Glacial drift	Hard	40	D, S	Insufficient supply; also a soft well, intermittent supply.
19	SW.	10	"	"	"	Dug	40	1,870	- 36	1,834	36	1,834	Glacial drift	Hard, "alkaline"		S	Insufficient supply; laxative; two other shallow wells.
20	NW.	11	"	"	"	Dug	8	1,875	- 6	1,869	6	1,869	Glacial gravel	Soft	41	D, S	Insufficient supply; other shallow wells.
21	SE.	12	"	"	"	Dug	15	1,875	- 7	1,868	7	1,868	Glacial gravel	Hard	43	D, S	Sufficient for 20 head stock.
22	NE.	12	"	"	"	Dug	30	1,870	- 19	1,851	30	1,840	Glacial drift	Hard	42	D, S	Sufficient supply; another old well.
23	NE.	13	"	"	"	Dug	28	1,860	- 21	1,839	21	1,839	Glacial sand	Hard		D, S	Sufficient supply; a 14-foot well also.
24	NW.	14	"	"	"	Dug	20	1,860	- 16	1,844	16	1,844	Glacial sand	Hard	42	D, S	Steady supply.
25	NE.	15	"	"	"	Dug	26	1,860	- 22	1,838	22	1,838	Glacial gravel	Hard, "alkaline"		S	Sufficient supply.
26	SW.	15	"	"	"	Dug	10	1,860	- 6	1,854	6	1,854	Glacial sand and gravel	Hard		D, S	Sufficient supply.
27	NW.	17	"	"	"	Dug	22	1,900	- 10	1,890	10	1,890	Glacial black sand	Hard	45	D, S	Sufficient supply; 3 other seepage wells all in clay.
28	SE.	17	"	"	"	Bored	30	1,900	- 26	1,874	26	1,874	Glacial sand	Hard	43	D, S	Sufficient supply; another well 30 feet deep.
29	NE.	18	"	"	"	Bored	48	1,940	- 46	1,894	46	1,894	Glacial quicksand	Hard, iron	43	D, S	Sufficient supply.
30	SE.	18	"	"	"	Bored	60	1,920	- 42	1,878	42	1,876	Glacial sand	Hard, cloudy	42	D, S	Sufficient supply; #.
31	SE.	19	"	"	"	Dug	11	1,900	- 7	1,893	7	1,893	Glacial sand	Soft	43	D, S	Sufficient supply; dry hole also.
32	SE.	21	"	"	"			1,850									No information.
33	NW.	22	"	"	"	Dug	20	1,850	- 14	1,836	14	1,836	Glacial gravel and sand	Hard		D, S	Sufficient supply; 2 other wells similar.
34	SW.	22	"	"	"	Dug	24	1,850	- 16	1,834	16	1,834	Glacial sand	Hard	40	S	Sufficient supply; a 24-foot well for house use.
35	NW.	24	"	"	"	Dug	18	1,850	- 16	1,834	16	1,834	Glacial sand	Hard		D, S	Insufficient supply.
36	SE.	25	"	"	"	Dug	25	1,855	- 15	1,840	15	1,840	Glacial drift	Soft, iron	44	D, S	Sufficient supply; 2 similar wells.
37	NW.	26	"	"	"	Dug	27	1,840	- 25	1,815	25	1,815	Glacial drift	Hard	42	D	Insufficient supply; a 21-foot well also.
38	SW.	26	"	"	"	Dug	16	1,850	- 14	1,836	14	1,836	Glacial sand	Soft	41	D, S	Intermittent supply.
39	SE.	26	"	"	"	Dug	30	1,850	- 26	1,824	26	1,824	Glacial sand	Hard, "alkaline"		D, S	Insufficient supply; also a 25-foot well, "alkaline" water.
40	NE.	27	"	"	"	Dug	18	1,850	- 3	1,847	3	1,847	Glacial drift	Hard		D, S	Sufficient supply.
41	SW.	30	"	"	"	Dug	25	1,875	- 21	1,854	21	1,854	Glacial gravel	Hard		D, S	Sufficient supply; 3 dry holes.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PENSE, NO. 160, 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
42	NW.	31	18	23	2	Dug	25	1,850	- 2	1,848	2	1,848	Glacial quick-sand	Hard, "alk-aline"	44	D, S	Sufficient supply;#. Several similar wells.
43	SE.	33	"	"	"	Dug	14	1,860	- 12	1,848	12	1,848	Glacial quick-sand	Hard, iron	40	D, S	Insufficient supply; a 24-foot and a 7-foot well.
44	NW.	34	"	"	"	Dug	20	1,850					Glacial quick-sand	Hard, iron	40	D, S	Insufficient supply; also a similar well.
45	SE.	34	"	"	"	Dug	7	1,840	- 5	1,835	5	1,835	Glacial gravel	Soft	42	D	Sufficient supply; also a 12-foot well.
1	NE.	1	18	24	2	Dug	12	1,890	- 8	1,882	8	1,882	Glacial gravel	Hard		D, S	Sufficient supply; another 30-foot well.
2	NW.	1	"	"	"	Dug	40	1,890	- 28	1,862	28	1,862	Glacial drift	Hard, clear, "alkaline"		S	Sufficient supply; laxative.
3	NE.	2	"	"	"	Bored	46	1,890	- 36	1,854	46	1,844	Glacial sand	Hard, iron, iodine	40	D, S	Sufficient; other holes; water too poor for drinking.
4	SE.	3	"	"	"	Bored	380	1,900									Dry hole in Marine Shale series; another dry hole 80 feet deep.
5	SE.	3	"	"	"	Dug	32	1,900									Dry hole in Glacial drift.
6	SW.	5	"	"	"	Dug	22	1,900	- 19	1,881	19	1,881	Glacial sand	Hard, "alk-aline"		S	Sufficient supply; laxative; a 10-foot well, soft water.
7	NE.	6	"	"	"	Dug	14	1,900	- 7	1,893	7	1,893	Glacial sand	Hard, iron	43	D, S	Sufficient supply; flowing spring, good water.
8	NE.	9	"	"	"	Bored	100	1,900	-100	1,800	100	1,800	Glacial drift	Hard, yellow, "alkaline"	45		Poor supply; numerous dry holes up to 100 feet deep.
9	SE.	10	"	"	"	Dug	27	1,900					Glacial drift	Hard, iron, cloudy		N	Poor supply; several dry holes.
10	NE.	10	"	"	"	Drilled	205	1,900									Dry hole in Marine Shale series. Dugout.
11	SE.	12	"	"	"	Dug	12	1,890	- 8	1,882	8	1,882	Glacial sand	Hard, clear	45	D, S	Sufficient supply; two similar wells.
12	SE.	12	"	"	"	Dug	18	1,890	- 15	1,875	15	1,875	Glacial sand	Hard, clear	45	D	Sufficient for domestic needs.
13	NW.	12	"	"	"	Dug	35	1,900	- 20	1,880	35	1,865	Glacial sand	Hard, clear		D, S	Insufficient; spring gives good supply for stock.
14	SW.	14	"	"	"	Dug	130	1,900	-100	1,800	100	1,800	Glacial drift	Hard, iron, cloudy	40	N	Water unfit for any use; a 15-foot well.
15	SW.	15	"	"	"	Drilled	164	1,910	-134	1,776	160	1,750	Glacial drift	Hard, iron, "alkaline"	40	S	Insufficient supply; hauls water.
16	SW.	22	"	"	"	Dug	21	1,900	- 17	1,883	17	1,883	Glacial sand and gravel	Hard, clear	45	D, S	Sufficient supply; 21-foot well used for house 60-foot well not in use.
17	NE.	23	"	"	"	Bored	60	1,920					Glacial gravel	Hard, clear	42		Sufficient supply.
18	NE.	24	"	"	"	Bored	42	1,920	- 39	1,881	39	1,881	Glacial gravel	Hard, clear	42		Sufficient supply; #.
19	SE.	24	"	"	"	Drilled	350	1,950	-275	1,675	350	1,600	Marine Shale series, fine sand	Soft, clear		D, S	Too much sand in water; uses a 32-foot well.
20	NE.	25	"	"	"	Dug	10	1,860	- 6	1,854	6	1,854	Glacial gravel	Hard, clear	43	D, S	Sufficient supply.
21	SE.	26	"	"	"	Dug	35	1,890	- 31	1,859	31	1,859	Glacial sand	Hard, clear	45	D, S	Sufficient supply; also a 15-foot well.
22	NE.	27	"	"	"	Dug	20	1,850	- 13	1,837	13	1,837	Glacial sand and gravel	Hard, clear		D, S	Sufficient supply; several springs on slopes to Rocky lake.
23	SE.	28	"	"	"	Dug	28	1,900	- 26	1,874	26	1,874	Glacial quick-sand	Hard, clear	40	D, S	Sufficient supply; a 10-foot well has caved in; also 2 similar wells.

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 PENSE, NO. 160, 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
24	NW.	29	18	24	2	Spring		1,700					Recent alluvium				Sufficient supply.
25	SW.	31	"	"	"	Spring		1,680					Recent alluvium			D, S	Sufficient for 400 head stock.
26	NW.	32	"	"	"	Dug	27	1,700	− 22	1,678	22	1,678	Recent gravel	Soft clear		D, S	Abundant supply.
27	SE.	32	"	"	"	Spring		1,850					Glacial drift				Good water.
28	NW.	34	"	"	"	Dug	32	1,860	− 31	1,829	31	1,829	Glacial drift	Soft, clear		D, S	Sufficient supply,
29	NE.	34	"	"	"	Dug	11	1,860	− 9	1,851	9	1,851	Glacial quick-sand	Hard, clear		D, S	Sufficient supply.
30	SE.	34	"	"	"	Dug	17	1,870	− 13	1,857	13	1,857	Glacial gravel	Hard, clear	42	D, S	Sufficient supply; a similar well caved in.

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

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