MC82+8C212

This document was produced by scanning the original publication.

Ce document est le produit d'une numérisation par balayage de la publication originale.

CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 63

PRELIMINARY REPORT

# GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF CARMICHAEL NO. 109 SASKATCHEWAN

By

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

DISCARD
ELIMINER
LIBRARY
NATIONAL MUSEUM
OF CANADA

OTTAWA

1936

CANADA

DEPARTMENT OF MINES

BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

# GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF CARMICHAEL NO. 109 SASKATCHEWAN

BY

B.R. MacKAY, H.H. BEACH and R. JOHNSON

WATER SUPPLY PAPER NO. 63

CONTENTS


| | Page |
|---|---|
| Introduction | 1 |
| Glossary of terms used | 5 |
| Names and descriptions of geological formations referred to. | 9 |
| Water-bearing horizons of the municipality | 10 |
| Water-bearing horizons in the unconsolidated deposits | 11 |
| Water-bearing horizons in the bedrock | 14 |
| Ground water conditions by townships: | |
| Township 10, Range 19, west of 3rd meridian | 17 |
| Township 10, Range 20, " " " " | 18 |
| Township 10, Range 21, " " " " | 20 |
| Township 11, Range 19, " " " " | 21 |
| Township 11, Range 20, " " " " | 22 |
| Township 11, Range 21, " " " " | 24 |
| Township 12, Range 19, " " " " | 25 |
| Township 12, Range 20, " " " " | 27 |
| Township 12, Range 21, " " " " | 28 |
| Statistical summary of well information | 31 |
| Analyses and quality of water | 32 |
| General statement | 32 |
| Table of analyses of water samples | 36 |
| Water from the unconsolidated deposits | 37 |
| Water from the bedrock | 39 |
| Well records | 42 |


Illustrations


Map of the municipality.

Figure 1. Map showing surface and bedrock geology that affect the ground water supply.

Figure 2. Map showing relief and the location and types of wells.

# GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF CARMICHAEL NO. 109, 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

---

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

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

## GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Water Table. The upper limit of the part of the ground wholly saturated with water. This may be very near the surface or many feet below it.

Wells. Holes sunk into the earth so as to reach a supply of water. When no water is obtained they are referred to as dry holes. Wells in which water is encountered are of three classes.

(1) Wells in which the water is under sufficient pressure to flow above the surface of the ground. These are called Flowing Artesian Wells.

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

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

## NAMES AND DESCRIPTIONS OF GEOLOGICAL FORMATIONS, REFERRED TO IN THESE REPORTS

Wood Mountain Formation. The name given to a series of gravel and sand beds which have a maximum thickness of 50 feet, and which occur as isolated patches on the higher parts of Wood Mountain. This is the youngest bedrock formation and, where present, overlies the Ravenscrag formation.

Cypress Hills Formation. The name given to a series of conglomerates and sand beds which occur in the southwest corner of Saskatchewan, and rests upon the Ravenscrag or older formations. The formation is 30 to 125 feet thick.

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

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

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

Bearpaw Formation. The Bearpaw consists mostly of incoherent dark grey to dark brownish grey, partly bentonitic shales, weathering light grey, or, in places where much iron

is present, buff. Beds of sand occur in places in the lower part of the formation. It forms the uppermost bedrock formation over much of western and southwestern Saskatchewan and has a maximum thickness of 700 feet or somewhat more.

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

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

## WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Carmichael covers an area of 324 square miles in the southwestern part of Saskatchewan. It is described as tps. 10, 11, and 12, ranges 19, 20, and 21, W. 3rd mer. The village of Carmichael, on the main line of the Canadian Pacific railway, is located near the centre of the north boundary of the municipality, on the NE. $\frac{1}{4}$, sec. 34, tp. 12, range 20,

The ground surface of the northwestern part of the municipality is gently rolling and is dotted with many low hills and undrained depressions. From an approximate elevation of 2,600 feet above sea-level along the northern boundary the ground rises gradually in a southeasterly direction to approximately 2,750 feet at the base of an escarpment extending from the southwest corner, township 11, range 21, to the northeast corner, township 12, range 19. The escarpment is very steep and forms the most prominent topographic feature of the municipality. The crest of the escarpment has an average elevation of 3,050 feet near the northeast corner of the municipality, but rises uniformly to the southwest to reach elevations exceeding 3,450 feet at the western boundary. The upland or plateau lying to the southeast of the escarpment has a general elevation of 3,450 feet along the southern part of the western border of the municipality, but falls off gradually in an easterly direction to approximately 2,950 feet above sea-level, along the eastern boundary. Many small streams have carved valleys at intervals along the face of the escarpment. The largest of these valleys extends about 4 miles back from the escarpment in township 11, ranges 20 and 21 and is occupied by a small, intermittent stream that flows northwest to join Bridge creek, which is also intermittent and flows in a northeasterly direction parallel to the face of the escarpment. Bone creek flows north in a deep valley in township 10, range 20, and enters the upper part of the valley that trends northwest. From there it flows east for 4 miles and then south to

join Swiftcurrent creek flowing northeast in sec. 18, tp. 10, range 19. Swiftcurrent creek leaves the municipality in the northeast corner of township 10, range 19. Many springs feed Bone creek with the result that it flows throughout the year. Figure 2 of the map accompanying this report shows the topographic relief by means of contours.

Ground water supplies of this municipality are derived from lake deposits, the glacial drift, and from the underlying bedrock formations. The escarpment divides the municipality into two areas differing markedly in ground water conditions. To the northwest of the escarpment water is derived almost entirely from the lake sand and clay and from glacial drift; southeast of the escarpment the bedrock formations are the main source.

Water-bearing Horizons in the Unconsolidated Deposits

Many thousands of years ago a great continental ice-sheet moved in a generally southwesterly direction across the province of Saskatchewan. As the ice-sheet advanced and retreated it deposited a layer of glacial drift composed largely of boulder clay over the bedrock throughout the greater part of the municipality. In the northern lowland part the till, together with lake deposits, reaches a thickness of 300 feet in a buried channel that extends along the base of the escarpment. Bridge creek flows along what is thought to be the central part of the area in which the buried channel occurs. The lower part of the glacial drift in this area is composed largely of sand believed to have been washed down from the uplands into the valley in early glacial times.

The glacial drift seldom exceeds 60 feet in thickness over the upland regions. It is very thin along the valley slopes, and along the face of the escarpment; at many places it is entirely absent, and the bedrock is exposed at the surface.

During the gradual melting and retreat of the front of the ice-sheet there was deposited at places where the ice front stood for some time a greater accumulation and a more porous type of drift known as moraine. This type of deposit is characterized by a rough, irregularly rolling surface of low hills and undrained depressions. Such a moraine occurs in this municipality as an extensive area along the northern part of the western boundary and in three, small, isolated areas located in the northwestern part of township 10, range 21, the south-central part of township 10, range 20, and the central part of township 11, range 20.

Water from the melting ice formed a lake that covered a large area in the northern lowlands. The existence of this lake is now marked by an area of compact, bluish grey lake clays extending as a belt of approximately 4 miles in width along the base of the escarpment. A part of the material deposited in the lake basin was sand and much of the sand has been redeposited by stream action. These glacial sands cover an extensive area in this municipality in the northeastern part of township 12, range 21 and the northwestern part of township 12, range 20. The deposits are usually less than 20 feet thick. In some places reasonably good supplies of water can be obtained in the sand where basins in the underlying impervious glacial lake clay retain the water percolating down from the surface.

A few water-bearing quicksand pockets are encountered in the lake clay covering the surface of the area along Bridge creek. Only small supplies of usually highly mineralized water are obtained in this material. Along the southern boundary of the lake clay area several wells have tapped gravels at the base of the clay at a depth of approximately 20 feet. These gravels yield supplies of drinkable water ample for local farm requirements. Along the northern part of this area the gravels are thinner and in many places are absent. Most of the wells derive their water supply from isolated sand pockets

scattered through the clay at depths generally not exceeding 20 feet. The water is hard and although containing a large concentration of dissolved mineral salts is usually drinkable. The yield from individual wells is small and at many places two or more wells are necessary to fully satisfy local requirements. At many places throughout the lowlands residents have found it advisable to sink wells to tap sand and gravel beds interspersed through the underlying boulder clay filling the pre-glacial channel. In the northeastern part of the area these beds are encountered at depths ranging from 50 to 110 feet from the surface. The yield is generally sufficient for local requirements. In a few places, however, the water is too highly mineralized to be used in the households. In the central part sand beds are tapped at depths of 40 to 50 feet from the surface. The supply varies in different parts; several of the wells yield adequate supplies, whereas others give only small seepages. The water is suitable for drinking. Farther west the depths to these sand beds increase. The majority of the wells reach production at 65 to 95 feet from the surface. One well located on the NW. $\frac{1}{4}$, sec. 16, tp. 12, range 21, was drilled to a depth of 320 feet; 220 feet of quicksand having been passed through beneath 110 feet of till. This sand contains water, but considerable difficulty is experienced in keeping the wells free from sand.

The glacial drift over the plateau occupying the southeast part of the municipality seldom exceeds 60 feet in thickness. Supplies of water of varying quality are obtained from a few scattered sand and gravel pockets in the boulder clay at depths not exceeding 40 feet, and in some localities from sand or gravel aquifers in the lower part of the drift or at the contact with the underlying bedrock formations. Productive pockets of sand and gravel are more likely to be encountered at shallow depths in the moraine covered areas than on the till plains.

As fairly large supplies of ground water

of good quality are readily obtainable from the bedrock formations at reasonable depths in the upland area, residents are better advised to sink wells to the productive aquifers of these formations rather than dig the number of test holes that are usually necessary to locate a water-bearing pocket in the drift.

Water-bearing Horizons in the Bedrock

Four distinct bedrock formations are known to immediately underlie the glacial drift in different areas in this municipality. These formations are, in their descending order, the Cypress Hills, the Ravenscrag, the Eastend, and the Bearpaw formations. The areal distribution of these formations beneath the drift is indicated on Figure 1 of the accompanying map.

The Cypress Hills formation is confined to the upland areas of the southern half of the municipality. It is composed largely of conglomerate deposited on the eroded surface of the older bedrock formations by streams flowing across wide areas. Hence the thickness and porosity of the Cypress Hills formation varies considerably in different parts. It overlies the Ravenscrag formation in the southwestern part of the area and covers the Eastend formation generally throughout the central and eastern parts of the municipality. The conglomerate is made up chiefly of rounded quartzite boulders 2 to 5 inches in diameter cemented with a calcareous matrix. Interbedded with the consolidated conglomerate are beds of loose sand, clay, and gravel. Due to the variation in texture and porosity both laterally and at different depths, individual aquifers are difficult to trace. Ample supplies of drinkable water are obtainable generally, however, at depths ranging from 20 to 130 feet throughout the area underlain by this formation.

The Ravenscrag formation underlies the Cypress Hills formation and glacial drift of the southwestern part of the municipality down to an elevation between 3,050 and 3,000 feet above sea-level. The upper part of this formation is composed of yellow to

brown shales and clays, and beds of soft sandstone, with a few thin seams of lignite coal. A thick bed of soft, coarse, yellowish brown sandstone comprises the greater part of the formation below the lowest coal seam. The Ravenscrag formation has a maximum thickness of approximately 150 feet in the area of high elevation along the west boundary of the municipality, but thins in an easterly direction to negligible thicknesses near the east border of range 20.

Although it is seldom necessary to sink wells through the Cypress Hills formation in the southwestern part of the municipality water supplies are to be expected from the sand beds and coal seams of the upper Ravenscrag. The massive sand bed of the lower Ravenscrag is an almost certain source of water supply in any area where the formation is present. The thin parts of Ravenscrag present in parts of townships 10 and 11, range 20, are composed chiefly of this sand and a few wells obtain water from it. No supplies are definitely known to come from the Ravenscrag in the small area extending along the eastern edge of township 10, range 19. The residents of the area have sunk wells through the Ravenscrag to tap the large supplies of soft water existing in the underlying Eastend formation.

The Eastend formation is believed to underlie the glacial drift and the Cypress Hills and Ravenscrag formations of the entire area south and east of the escarpment, with the exception of a small area of low elevation in Swiftcurrent Creek valley at the southeast, where the underlying Bearpaw shales are exposed. The silts, clays, and beds of soft sandstone comprising the Eastend formation extend down to an approximate elevation of 2,800 feet. Many wells obtain water of varying quality from the sand beds of this formation, particularly in areas where the Cypress Hills and Ravenscrag formation are absent. An extensive water-bearing sand bed is encountered at elevations between 2,800 and 2,830 feet in the Eastend in the municipality adjoining this on the east. This bed also extends into this municipality in a small area lying to the east of Rock and Swiftcurrent

creeks in the southeastern corner of this municipality. Large supplies of soft water are obtained from this aquifer at depths of approximately 130 feet. Although numerous wells in other areas yield reasonably good supplies of water from sand in the Eastend, no other aquifers traceable over any large area are known to exist in the formation in this municipality.

The Bearpaw formation underlies the glacial drift and the younger bedrock formations of the entire municipality. The formation consists largely of dark grey to black, compact shale. These shales are easily recognized by their colour and by their decidedly "soapy" feel when wet. They are generally too compact to form reservoirs suitable for the retention of any large supplies of groundwater. In the area southeast of the escarpment the upper part of the formation, lying above an approximate elevation of 2,650 feet above sea-level, is believed to contain fairly extensive sand beds from which moderately large supplies of soft water might be obtained. Except in the areas of low elevation in creek valleys and the eastern part of the municipality the depths necessary to reach these beds are prohibitive and since the overlying horizons are usually productive it is not generally necessary to drill to this horizon. One well sunk to a depth of 265 feet in the southeast corner of the municipality yields a moderate supply of soft, brownish coloured water from a sand bed occurring at an approximate elevation of 2,700 feet. Drilling below an elevation of 2,650 feet, at any place in the southeastern part of the municipality, is not advised. Only small supplies of highly mineralized water can be expected from the dark marine shales that will be encountered below this elevation. In the buried stream valley lying to the northwest of the escarpment the upper, sandy part of the Bearpaw is completely eroded away and there is no hope of obtaining water supplies from the dark marine shales that underlie the glacial drift at depths ranging between 100 and 300 feet from the surface. Similar conditions obtain in the extreme northwest corner of the municipality where the drift is probably less than 100 feet thick.

## GROUND WATER CONDITIONS BY TOWNSHIPS

### Township 10, Range 19

The glacial drift is thicker over this township than over other parts of the uplands. It is believed to lie upon an uneven bedrock surface, as the drift varies considerably in thickness from place to place. Several shallow wells, less than 20 feet deep, have been dug into the drift. Most of these are located in valleys and due to the large catchment area they yield large supplies of soft to moderately hard, drinkable water. On the uplands remote from the valleys and coulées the practice has been to sink wells to the gravel beds that occur generally at the contact between the glacial drift and the underlying bedrock. The depth to this horizon varies in different areas, but at most of the wells it is between 50 and 90 feet. This horizon has been tapped at many places, but mainly in the northwestern half of the township. In the other half of the area most of the wells have penetrated horizons in the bedrock. The water from the gravels is usually hard and only slightly mineralized and hence quite suitable for household purposes. In one 50-foot well located on the SW. $\frac{1}{4}$, section 20, the water is derived from clay and is so highly charged with mineral salts in solution as to be unfit for farm use. The yield from individual wells tapping the gravels is in most places amply sufficient for local requirements.

A thin layer of Ravenscrag sand is considered to underlie the glacial drift in the small area between the east boundary of the township and Rock and Swiftcurrent creeks. No wells are definitely known to be drawing their supply from the sand bed at this horizon. It is possible, however, that the 88-foot well sunk to a sand bed at an elevation of 2,962 feet above sea-level in the SE. $\frac{1}{4}$, section 25, derives its large supply of water from this basal sand bed.

The Eastend formation underlies the Ravenscrag of this small area and the glacial drift throughout the greater part of the remainder of the township down to an approximate elevation of 2,800 feet

above sea-level. Springs along the west side of Bone and Swiftcurrent Creek valleys yield large supplies of usually hard water from sand aquifers in the upper part of the Eastend at elevations of approximately 2,900 feet above sea-level. Wells located on the NW. ¼, sections 4, 10, and 16, the SE. ¼, section 17, and the NE. ¼, section 31, have tapped what is considered to be the same horizon at depths ranging from 70 to 90 feet. These wells yield large supplies of hard, drinkable water. Similar supplies of soft water are obtained from wells sunk to depths of approximately 130 feet along the eastern boundary of the township. The water comes from a sand bed near the base of the formation. Since the wells on the NE. ¼, section 9, and the SW. ¼, section 10, were sunk to depths exceeding 100 feet without encountering a productive bed, it is probable that this sand bed is confined largely to the area east of Bone creek and west of Swiftcurrent creek.

Should wells fail to obtain an adequate water supply from either the base of the drift, the Ravenscrag, or the Eastend bedrock formations there still remains the possibility of obtaining water from sandy beds in the upper part of the Bearpaw formation. Two wells located on the NE. ¼, section 9, and the SW. ¼, section 10, have been sunk to depths of 265 and 206 feet, respectively, and penetrate blue sand beds in the shales at elevations of 2,696 and 2,748 feet above sea-level. The water from the first well is soft and brownish coloured but that from the latter is hard. In each well the supply is sufficient for the household and stock requirements of the residents. Drilling below an elevation of 2,650 feet above sea-level is inadvisable in this township as it is improbable that the sandy beds of the upper part of the Bearpaw formation extend below this elevation.

Township 10, Range 20

Only small supplies of hard, and in many places "alkaline", water are obtained from scattered sand and gravel pockets in the thin layer of glacial drift covering the township. Most wells obtain

water from the Cypress Hills, Ravenscrag, and Eastend bedrock formations. Generally, large supplies of soft, or only slightly hard, drinkable water are available from beds of sand and loose gravel interspersed in the conglomerate of Cypress Hills formation which underlie the glacial drift over slightly more than the western half of the township, with the exception of a small area in Bone and Jones Creeks valleys. The depths necessary to obtain water from the Cypress Hills in this area vary from 30 to 130 feet. Although individual aquifers are not traceable over extensive areas, little difficulty should be experienced in obtaining an adequate water supply throughout the area covered by this formation within the range of the depths given. Water-bearing sand beds and coal seams probably occur in the Ravenscrag formation which underlies the glacial drift and the Cypress Hills conglomerate throughout the greater part of the township with the exception of the two eastern rows of sections where, in the absence of these formations, the Eastend is the uppermost bedrock formation. Springs along the west side of Jones and Bone creeks yield good supplies of water of varying hardness from sand aquifers in the Ravenscrag formation.

Two wells, located on the NE.$\frac{1}{4}$, section 17, and the NW.$\frac{1}{4}$, section 20, have been sunk through the Cypress Hills conglomerate. These wells yield large supplies of hard water from a sand aquifer near the top of the Ravenscrag formation at an approximate depth of 125 feet. In most parts of this area, however, it has not been necessary as yet to sink wells through the Cypress Hills formation into the underlying Ravenscrag beds.

In the southeastern part of the township where the Ravenscrag is the uppermost bedrock formation, wells 20 to 60 feet deep can be expected to reach water-bearing sand beds.

The Eastend formation underlies the drift in a small area along the east boundary of the township and underlies the Ravenscrag formation throughout the remaining parts of the township. The contact

between the Ravenscrag and Eastend formations is believed to occur at an approximate elevation of 3,000 feet above sea-level. Although no wells have been sunk into the Eastend formation it is quite probable that supplies of water can be obtained from the sand beds of the formation.

Water may also be obtained from sand beds in the upper Bearpaw as discussed above under the heading "Water-bearing Horizons of the Municipality". The depths necessary to obtain water from this formation would be prohibitive except in areas of low elevation.

Township 10, Range 21

The glacial drift covering the township seldom exceeds 60 feet in thickness. Whereas small supplies of hard, in many cases, quite highly mineralized water can be obtained from scattered sand and gravel pockets in the glacial drift at depths not exceeding 40 feet, most residents have sunk wells into the underlying Cypress Hills bedrock formation. Water-bearing sand and gravel pockets in the drift will be found to be more numerous and generally more productive in the northwestern part of the township where the glacial material is of the porous moraine type.

With the exception of a small area along Bone Creek valley the drift of the entire township is underlain by the Cypress Hills bedrock formation. The Ravenscrag is the uppermost bedrock formation along the creek valley. Large supplies of soft, or only slightly hard, water are obtained from beds of sand, gravel, and loose cobblestones in the Cypress Hills formation at depths between 50 and 135 feet. The average depth of wells ranges from 60 to 90 feet and in only four localities was it found necessary to sink wells deeper than 100 feet.

Springs along Bone creek and at the edge of the escarpment at the northwest corner of the township yield large supplies of medium hard water from aquifers in the same formation.

Should the Cypress Hills formation prove unproductive in any locality, water will undoubtedly be encountered in the coal seams and sand beds of the underlying Ravenscrag formation.

Township 11, Range 19

Throughout the greater part of this township little difficulty has been experienced in finding adequate supplies of ground water at depths of 50 feet or less. The aquifers at these depths are generally sand and gravel pockets interspersed through the glacial drift or at the contact of the drift with the underlying Cypress Hills formation. The water from these wells is usually hard and in many places is reported to be slightly "alkaline", but not unfit for use.

The Cypress Hills formation is considered to underlie the drift of the greater part of the township with the exception of small areas at the southeast and southwest corners where the Eastend formation underlies the drift. Many wells have been sunk to beds of sand, loose gravel, and cobblestones in the Cypress Hills formation. Fairly large supplies of hard water have been obtained at depths ranging from 60 to 80 feet. The water contains Glauber's salt ($Na_2SO_4$), in solution, and iron. These salts are rarely present in sufficient quantities, however, to render the water unfit for domestic use.

The Eastend formation underlies the Cypress Hills formation and the glacial drift in places where the Cypress Hills is absent. It is believed that the Ravenscrag formation was completely eroded away in this area and that the Eastend beds were exposed before the conglomerate of the Cypress Hills formation were deposited.

Two wells sunk through the Cypress Hills formation in section 34 encountered small supplies of hard, "alkaline" water in sand beds in the Eastend at approximate elevations of 2,940 feet above sea-level. A well located on section 5 yields a large supply of hard water from the Eastend at a depth of 137 feet. Another well on section 2 yielded only a very small quantity of water at a depth of

200 feet, or an elevation of 2,800 feet above sea-level. It thus appears that some supplies of water can be expected from sand beds in the Eastend. Due probably to the fine-grained, compact nature of the beds of this formation no extensive aquifers are considered to exist in it in this area. The Eastend has been penetrated at a depth of 82 feet in the NE. $\frac{1}{4}$, section 12, but here again only a small supply of water was obtained.

There are also some prospects of obtaining supplies of soft water from sand in the upper part of the Bearpaw at elevations between 2,650 and 2,700 feet, or depths between 300 and 400 feet.

It is inadvisable to sink wells to these depths unless supplies from shallower wells are altogether unsatisfactory. No definite assurance can be given that water will be obtained as no wells have been sunk as yet to this level in the township.

Township 11, Range 20

The mantle of glacial till overlying this township probably nowhere exceeds 50 feet in thickness. It is very thin and even absent in places along Bone Creek valley and along the escarpment in the northwest corner of the area. A few wells in the upland parts have struck isolated gravel and sand pockets in the till at depths not exceeding 25 feet. The very shallow wells located in coulées yield soft water suitable for household use and adequate for watering 30 or more head of stock. The greater part of the ground water supplies used, however, are obtained from the Cypress Hills and Ravenscrag bedrock formations which underlie the greater part of the township as shown on Figure 1 of the accompanying map.

Several residents in the widely scattered areas north of Bone creek obtain large supplies of hard, usually iron-bearing water from sand or gravel beds in the Cypress Hills formation, at depths between 15 and 60 feet. In many parts, however, the Cypress Hills formation is either thin or is so porous that it allows the downward seeping water to pass through it into the underlying Ravenscrag

formation. Hence, should water not be obtained in the gravel beds of the Cypress Hills formation, there remains a very good assurance of obtaining large supplies of water of good quality from the sand beds of the Ravenscrag formation. Throughout the northeast corner wells sunk to depths ranging from 90 to 160 feet have encountered what is in all probability a continuous sand horizon. This aquifer may be represented by the sand bed tapped at 92 feet in the well on section 28. It was, however, found necessary, on sections 21 and 22, to sink to depths of 198 and 210 feet before this aquifer was encountered. The aquifer seems to extend throughout the central plateau region at an approximate elevation of 3,050 to 3,000 feet above sea-level. The differences in the depths of the various wells tapping this horizon are due largely to variations in the surface elevations at the different well sites. Springs along the north bank of Bone Creek valley yield large supplies of water from the Ravenscrag sand at an approximate elevation of 3,000 feet. The quality of water varies considerably; it usually contains iron and sulphate salts, but seldom in sufficient quantities to render the water unfit for domestic use. The small areas south of Bone creek that are underlain by the Cypress Hills and Ravenscrag bedrock formations probably will have ground-water conditions similar to those discussed above.

The Eastend formation underlies the Ravenscrag formation in the upland areas. Along the escarpment and in the valley of Bone creek, where the younger bedrock formations are absent, the Eastend is either exposed at the surface or immediately underlies the thin mantle of glacial drift. No definite information can be given regarding water horizons in the Eastend, as no wells have as yet been sunk into it in this area. The nature of the formations as encountered in other areas would indicate good prospects of obtaining at least small supplies from its sand beds.

The upper part of the Bearpaw formation, which underlies the Eastend at an approximate elevation of 2,800 feet above sea-level, is believed to contain fairly extensive sand beds at elevations between 2,700 and 2,650 feet above sea-level, from which good supplies of soft water are to be expected. It would be necessary to sink wells to depths of 400 to 600 feet to encounter this horizon, except at low elevations in creek valleys.

It is inadvisable to sink deep wells in the small area at the foot of the escarpment in the extreme northwest corner of the township. The upper, sandy part of the Bearpaw is absent and the dark marine shales that will be encountered cannot be expected to yield a supply of water suitable for any farm use.

Township 11, Range 21

A thin layer of glacial lake clay covers a small area along Bridge creek down to depths probably nowhere greatly exceeding 20 feet. Very little water can be expected from these compact sediments. The lake clay is underlain by glacial till. The till covers the bedrock and fills what is believed to be a pre-glacial channel extending along the base of the escarpment. It varies in thickness from 10 feet or less in the valleys carved into the escarpment to thicknesses of 100 feet or more in the northwestern corner of the township. The few residents located along Bridge creek have sunk wells through the lake clays to tap beds of sands and gravels lying at the contact of the clay and the till. These wells range in depth from 16 to 38 feet. The water obtained is hard and slightly mineralized, but used for drinking. The yield from this source is generally small and not sufficient for more than a few head of stock. Water has been obtained at greater depths in the till in the NE.¼, sections 28 and 31. These wells are respectively 66 and 103 feet deep. The water is believed to come from isolated pockets of sand or gravel rather than from extensive beds, as the supply from both wells is small. It is improbable that materially

larger supplies will be found by deeper drilling in this part of the area. Due to the irregularity of the occurrence of the productive pockets, the striking of an adequate water supply is largely a matter of chance. It would seem advisable to do considerable prospecting at shallow depths before sinking deeper holes. Drilling into the marine shales of the underlying Bearpaw formation is not advisable in this area.

The greater part of the ground water used in the upland parts is obtained from springs issuing from aquifers in the Cypress Hills and Ravenscrag bedrock formations. Although no wells have been sunk into the bedrock, prospects are very good of obtaining moderately large supplies of water at depths less than 150 feet from either the Cypress Hills or Ravenscrag formations in the areas of high elevation, and from 30 to 60 feet in the Eastend formation in areas of lower elevation where the two upper formations are absent.

Township 12, Range 19

Small supplies of hard, usually "alkaline", water are obtained from sand pockets in the thin layer of glacial lake clay that covers a small area in the northwest corner of the township. This deposit seldom exceeds 20 feet in thickness and is underlain by glacial till similar to the drift that mantles the surface of the remainder of the township. In the area extending along the escarpment, some wells obtain small supplies of hard, mineralized, iron-bearing water from sand or gravel pockets in the drift at depths not exceeding 20 feet. Two or three of these wells are usually necessary to satisfy local stock requirements. The water obtained from these shallow wells is generally suitable for domestic use. Reasonably large supplies of water are obtained from quicksand aquifers at greater depths in the glacial drift throughout the northwestern lowland parts of the township. Wells have been sunk to depths of 40 to 85 feet in sections 18, 32, 33, and 34. One well

put down to a depth of 104 feet in the SE. $\frac{1}{4}$, section 35, yielded very highly mineralized water which is unfit for farm use. This well is recorded as drawing its water from the glacial drift, but it may have penetrated through the drift into the underlying compact marine shales of the Bearpaw formation. From the other wells the water, although quite highly mineralized, is being used in the households.

In the area of high elevation in the southeastern part of the township a few residents obtain adequate supplies of ground water from sand in the glacial drift at depths between 30 and 100 feet. The water is hard and contains varying amounts of dissolved mineral salts, but in all places is reported to be suitable for drinking. The aquifers in the drift do not appear to form continuous horizons. In areas where wells have failed to encounter productive pockets or beds in the drift, drillers are advised to continue wells into the underlying Cypress Hills formation. This formation underlies the drift throughout the entire uplands area. The majority of the wells in this part of the township have penetrated productive sand and gravel beds in this formation. The wells vary in depth from 60 to 140 feet, the average in the eastern sections being over 100 feet deep. The supply from individual wells is generally sufficient for 50 or more head of stock. The water is hard and contains iron, but is suitable for drinking.

The Eastend formation underlies the Cypress Hills down to an approximate elevation of 2,800 feet. Wells sunk to depths of 180 and 142 feet. in sections 22 and 26 are believed to have penetrated sand aquifers in the Eastend formation. These wells may be producing from the same aquifer, but the yield from the well on section 26, producing at an elevation of 2,860 feet above sea-level, is much larger than from the well on section 22, which encountered water at an elevation of 2,890 feet. Water is to be expected as a rule from the Eastend in this township, but the quantity obtainable and the quality will

undoubtedly be found to vary considerably throughout the area.

There is also some prospect of obtaining soft water from sand beds in the upper part of the Bearpaw formation at elevations between 2,650 and 2,700 feet.

In the low area northwest of the escarpment the upper, sandy part of the Bearpaw is completely eroded away and only small supplies of highly mineralized water, unfit for any farm use, can be expected from the dark marine shales of the Bearpaw formation which underlies the area at depths between 100 and 200 feet from the surface.

Township 12, Range 20

A layer of glacial lake sands probably nowhere exceeding 30 feet in thickness, covers the northwest part of the township. Shallow wells are sunk into these sands in sections 28, 30, and 34. The water is soft or moderately hard and quite suitable for household use. The wells on sections 28 and 34 yield large supplies of water, but farther west the yield is much smaller and insufficient for local requirements. In places where the sands have proved to be unproductive, residents have deepened the wells through the sands to tap sand and gravel pockets in the upper part of the underlying glacial till, at depths of 40 to 50 feet. The yields from these wells are small. It seems advisable to prospect more extensively in the sands, particularly in coulées and depressions on the plains, rather than to sink wells into the underlying till. In a southeasterly direction, the sands grade into lake clays which cover a belt of territory 3 miles in width extending southeasterly to the base of the escarpment. These clays contain a few scattered pockets of sand from which small supplies of hard, usually "alkaline", water are obtained. Here, again, several residents have sunk wells into the underlying glacial till. Quicksand was encountered at depths of 110 and 85 feet in the SW. $\frac{1}{4}$ and NE. $\frac{1}{4}$ of section 24, respectively. The water is highly mineralized in both wells, and in one well is unfit even for stock use.

One well located on the SE. $\frac{1}{4}$, section 20, was sunk to a depth of 185 feet, and penetrated 155 feet of quicksand below 30 feet of lake clay.

At the foot of the escarpment, in the southeast corner of the township, the few residents have obtained sufficient supplies of water for local requirements from wells sunk to gravel pockets in the glacial drift at depths between 10 and 20 feet. The water is hard and mineralized, but is being used for drinking as well as stock watering. The glacial drift is believed to be approximately 50 feet thick on the upland area at the southeast corner of the township, and small supplies of water can be expected from scattered sand and gravel pockets in it.

In the southeastern part of the township the drift is underlain by the Cypress Hills, Ravenscrag, and Eastend bedrock formations. One well sunk to a depth of 160 feet yields a good supply of hard, iron-bearing, but drinkable, water from what is believed to be gravel in the Cypress Hills formation. The character of the bedrock formations suggests that little difficulty should be experienced in obtaining water at similar depths in this area. The dark grey, compact shales of the Bearpaw formation underlie the glacial drift throughout the entire area northwest of the escarpment. Near the foot of the slope the bedrock is believed to be within a few feet of the surface, but over most of the northwest part of the township it will not be encountered at depths less than 200 to 300 feet. Drilling in the Bearpaw formation is not advisable, as only small supplies of highly mineralized water, which are unfit for either human or stock use, can be expected.

Township 12, Range 21

Small supplies of water are obtained from the sands covering the northeast and east-central parts of the township. This material seldom extends down more than 20 feet from the surface and in most places it has been necessary for residents to deepen wells into the

underlying glacial till. Glacial lake clay covers the surface of a small area in the southeastern corner of the township. It contains a few isolated sand pockets from which small supplies of usually "alkaline" water are obtained.

Glacial drift in the form of moraine and boulder clay mantles the surface over the remainder of the township, and underlies the more recently deposited sands and clays at shallow depths. A 320-foot well on the NW. $\frac{1}{4}$, section 16, did not reach the underlying Bearpaw formation, indicating a thickness of glacial material in excess of this depth.

Most of the water supplies in the township are obtained from wells, not exceeding 40 feet in depth, drawing water from sand pockets interspersed in the drift, or by seepage from sloughs. The water is hard and usually contains sulphate salts in solution. Slightly greater supplies of water of similar quality have been obtained from sand beds at depths between 60 and 90 feet in the north-central part of the township. Although the aquifers encountered at these depths do not appear to be continuous prospects of obtaining suitable supplies of water at depths of less than 100 feet are reasonably good throughout the greater part of the township.

In the NW. $\frac{1}{4}$, section 16, a 320-foot well taps a massive deposit of sand and gravel that underlies 100 feet of lake clay and boulder clay. Water stands in the well at a depth of 180 feet below the surface. Whereas no definite information can be given as to the extent of this massive sand bed, it is possible that water could be obtained from it over a considerable area extending to the west and east of this location, at depths of approximately 200 feet. No wells have been sunk into the Bearpaw shale that underlies the entire township. In the southern half of the township the bedrock lies at depths of more than 300 feet below the surface. However, this depth becomes shallower in a northerly direction until in the northern parts of the township the bedrock lies within 100 feet of the surface and

finally outcrops in the ravine on the boundary between sections 33 and 34. The Bearpaw formation is composed almost entirely of compact, dark grey shale in this area, and it cannot be expected to yield more than small seepages of water that are likely to be so highly charged with dissolved mineral salts as to be unfit for any use.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF CARMICHAEL, NO. 109, SASKATCHEWAN

| West of 3rd meridian — Township | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | Total No. in municipality |
|---|---|---|---|---|---|---|---|---|---|---|
| Range | 19 | 20 | 21 | 19 | 20 | 21 | 19 | 20 | 21 | |
| Total No. of Wells in Township | 48 | 33 | 23 | 54 | 33 | 23 | 38 | 47 | 45 | 344 |
| No. of wells in bedrock | 20 | 29 | 15 | 21 | 19 | 0 | 11 | 1 | 0 | 116 |
| No. of wells in glacial drift | 28 | 4 | 8 | 33 | 14 | 23 | 27 | 46 | 45 | 228 |
| No. of wells in alluvium | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Permanency of Water Supply | | | | | | | | | | |
| No. with permanent supply | 47 | 33 | 23 | 54 | 31 | 22 | 38 | 47 | 41 | 336 |
| No. with intermittent supply | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 |
| No. dry holes | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 4 |
| Types of Wells | | | | | | | | | | |
| No. of flowing artesian wells | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. of non-flowing artesian wells | 21 | 2 | 11 | 16 | 2 | 0 | 5 | 9 | 5 | 71 |
| No. of non-artesian wells | 27 | 31 | 12 | 38 | 29 | 22 | 33 | 38 | 39 | 269 |
| Quality of Water | | | | | | | | | | |
| No. with hard water | 39 | 25 | 16 | 49 | 23 | 18 | 37 | 35 | 37 | 279 |
| No. with soft water | 9 | 8 | 7 | 5 | 8 | 4 | 1 | 12 | 7 | 61 |
| No. with salty water | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. with "alkaline" water | 10 | 2 | 2 | 17 | 5 | 6 | 15 | 15 | 9 | 81 |
| Depths of Wells | | | | | | | | | | |
| No. from 0 to 50 feet deep | 28 | 22 | 6 | 40 | 21 | 20 | 19 | 43 | 39 | 238 |
| No. from 51 to 100 feet deep | 14 | 6 | 13 | 11 | 7 | 1 | 10 | 2 | 5 | 69 |
| No. from 101 to 150 feet deep | 3 | 5 | 4 | 3 | 2 | 2 | 8 | 1 | 0 | 28 |
| No. from 151 to 200 feet deep | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 5 |
| No. from 201 to 500 feet deep | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 4 |
| No. from 501 to 1,000 feet deep | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. over 1,000 feet deep | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| How the Water is Used | | | | | | | | | | |
| No. usable for domestic purposes | 40 | 30 | 22 | 48 | 24 | 21 | 28 | 38 | 41 | 292 |
| No. not usable for domestic purposes | 8 | 3 | 1 | 6 | 7 | 1 | 10 | 9 | 3 | 48 |
| No. usable for stock | 47 | 33 | 23 | 54 | 31 | 22 | 37 | 47 | 44 | 338 |
| No. not usable for stock | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| Sufficiency of Water Supply | | | | | | | | | | |
| No. sufficient for domestic needs | 47 | 33 | 23 | 54 | 31 | 22 | 38 | 47 | 41 | 336 |
| No. insufficient for domestic needs | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 |
| No. sufficient for stock needs | 40 | 31 | 22 | 50 | 26 | 17 | 35 | 34 | 23 | 278 |
| No. insufficient for stock needs | 8 | 2 | 1 | 4 | 5 | 5 | 3 | 13 | 21 | 62 |

## ANALYSES AND QUALITY OF WATER

### General Statement

Samples of water from representative wells in surface deposits and bedrock were taken for analyses. Except as otherwise stated in the table of analyses the samples were analysed in the laboratory of the Borings Division of the Geological Survey by the usual standard methods. The quantities of the following constituents were determined; total dissolved mineral solids, calcium oxide, magnesium oxide, sodium oxide by difference, sulphate, chloride, and alkalinity. The alkalinity referred to here is the calcium carbonate equivalent of all acid used in neutralizing the carbonates of sodium, calcium, and magnesium. The results of the analyses are given in parts per million--that is, parts by weight of the constituents in 1,000,000 parts of water; for example, 1 ounce of material dissolved in 10 gallons of water is equal to 625 parts per million. The samples were not examined for bacteria, and thus a water that may be termed suitable for use on the basis of its mineral salt content might be condemned on account of its bacteria content. Waters that are high in bacteria content have usually been polluted by surface waters.

### Total Dissolved Mineral Solids

The term "total dissolved mineral solids" as here used refers to the residue remaining when a sample of water is evaporated to dryness. It is generally considered that waters that have less than 1,000 parts per million of dissolved solids are suitable for ordinary uses, but in the Prairie Provinces this figure is often exceeded. Nearly all waters that contain more than 1,000 parts per million of total solids have a taste due to the dissolved mineral matter. Residents

accustomed to the waters may use those that have much more than 1,000 parts per million of dissolved solids without any marked inconvenience, although most persons not used to highly mineralized water would find such waters highly objectionable.

## Mineral Substances Present

### Calcium and Magnesium

The calcium (Ca) and magnesium (Mg) content of water is dissolved from rocks and soils, but mostly from limestone, dolomite, and gypsum. The calcium and magnesium salts impart hardness to water. The magnesium salts are laxative, especially magnesium sulphate (Epsom salts, $MgSO_4$), and they are more detrimental to health than the lime or calcium salts. The calcium salts have no laxative or other deleterious effects. The scale found on the inside of steam boilders and tea-kettles is formed from these mineral salts.

### Sodium

The salts of sodium are next in importance to those of calcium and magnesium. Of these, sodium sulphate (Glauber's salt, $Na_2SO_4$) is usually in excess of sodium chloride (common salt, NaCl). These sodium salts are dissolved from rocks and soils. When there is a large amount of sodium sulphate present the water is laxative and unfit for domestic use. Sodium carbonate ($Na_2CO_3$) "black alkali", sodium sulphate "white alkali", and sodium chloride are injurious to vegetation.

### Sulphates

Sulphates ($SO_4$) are one of the common constituents of natural water. The sulphate salts most commonly found are sodium sulphate, magnesium sulphate, and calcium sulphate ($CaSO_4$). When the water contains large quantities of the sulphate of sodium it is injurious to vegetation.

## Chlorides

Chlorides are common constituents of all natural water and are dissolved in small quantities from rocks. They usually occur as sodium chloride and if the quantity of salt is much over 400 parts per million the water has a brackish taste.

## Iron

Iron (Fe) is dissolved from many rocks and the surface deposits derived from them, and also from well casings, water pipes, and other fixtures. More than 0.1 part per million of iron in solution will settle as a red precipitate upon exposure to the air. A water that contains a considerable amount of iron will stain porcelain, enamelled ware, and clothing that is washed in it, and when used for drinking purposes has a tendency to cause constipation, but the iron can be almost completely removed by aeration and filtration of the water.

## Hardness

Calcium and magnesium salts impart hardness to water. Hardness of water is commonly recognized by its soap-destroying powers as shown by the difficulty of obtaining lather with soap. The total hardness of a water is the hardness of the water in its original state. Total hardness is divided into "permanent hardness" and "temporary hardness". Permanent hardness is the hardness of the water remaining after the sample has been boiled and it represents the amount of mineral salts that cannot be removed by boiling. Temporary hardness is the difference between the total hardness and the permanent hardness and represents the amount of mineral salts that can be removed by boiling. Temporary hardness is due mainly to the bicarbonates of calcium and magnesium and iron, and permanent hardness to the sulphates and chlorides of calcium and magnesium. The permanent hardness

can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in excess of 300 parts per million; when the total hardness exceeded 3,000 parts per million no exact hardness determination was made. Also no determination for temporary hardness was made on waters having a total hardness less than 50 parts per million. As the determinations of the soap hardness in some cases were made after the samples had been stored for some time, the temporary hardness of some of the waters as they come from the wells probably is higher than that given in the table of analyses.

Analyses of Water Samples from the Municipality of Carmichael, No. 109, Saskatchewan.

| LOCATION | | | | | | Depth of Well, Ft. | Total dis'vd solids | HARDNESS | | | CONSTITUENTS AS ANALYSED | | | | | | CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS | | | | | | | | | Source of Water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Qtr. | Sec. | Tp. | Rge. | Mer. | | | Total | Perm. | Temp. | Cl. | Alkalinity | CaO | MgO | $SO_4$ | $Na_2O$ | Solids | $CaCO_3$ | $CaSO_4$ | $MgCO_3$ | $MgSO_4$ | $Na_2CO_3$ | $Na_2SO_4$ | NaCl | | |
| 1 | SW | 13 | 11 | 20 | 3 | spring | 920 | 850 | 800 | 50 | 7 | 105 | 150 | 126 | 545 | 62 | 843 | 105 | 221 | | 376 | | 129 | 12 | | * 3 |
| 2 | NW | 12 | 12 | 19 | 3 | 112 | 840 | 700 | 700 | nil | 13 | 85 | 140 | 115 | 429 | 49 | 760 | 85 | 224 | | 343 | | 87 | 21 | | * 2 |
| 3 | NW | 16 | 12 | 21 | 3 | 320 | 1,209 | | | | | | | | | | | | (3) | | (5) | (2) | (1) | (4) | | * 1 |

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

## Water from the Unconsolidated Deposits

The water obtained at shallow depths from the sands in the northwest part of the municipality has been found to be satisfactory for both domestic and stock use. No analysis has been made of waters from these sands in this municipality, but water from a 12-foot well sunk into these deposits in sec. 3, tp. 13, range 20, in the municipality to the north, is believed to be representative of the ground water from the sands. As is characteristic of many of the waters obtained at shallow depths in porous material the total dissolved mineral solid content is low, being 520 parts per million. The water has a total hardness of 450 parts per million, 300 parts of which are permanent. This water is softer than waters generally obtained at shallow depths in the glacial drift, and is of exceptionally good character. Glauber's salt ($Na_2SO_4$), magnesium carbonate ($MgCO_3$), and calcium carbonate ($CaCO_3$) are the predominent salts present in solution. The ($Na_2SO_4$) is 213 parts per million, but such a small concentration cannot be considered to be at all harmful to persons using the water. The other two salts are found in lesser amounts and contribute to the hardness of the water. These mineral salts are believed to be present in similar relative proportions in all the waters found in the sands. In some of the waters sodium sulphate ($Na_2SO_4$) is present in solution in larger quantities than indicated by this analysis , but not in sufficient amounts to render the water unfit for use in the household.

Water derived from both the glacial lake clays that occur in a long, narrow area extending along the base of the escarpment and from the glacial till or boulder clay is somewhat similar in mineral character, but is more highly mineralized than water from the sands.

An analysis of water from a 320-foot well sunk on the NW. $\frac{1}{4}$, sec. 16, tp. 12, range 21, is given on the accompanying table (Analysis No. 3). It indicates the relative proportions in which the mineral salts are present in the water. The total solid content of

this water is 1,209 parts per million and the water is used for drinking with apparently no ill effects. It will be noted that Glauber's salt ($Na_2SO_4$) is found in the greatest concentration. This salt and magnesium sulphate ($MgSO_4$) are the more objectionable salts present due to their laxative effect. The other mineral salts present do not detract from the use of the water in the household, although the presence of sodium carbonate ($Na_2CO_3$) (black alkali) may render the water harmful where used to water house and garden plants.

The mineral salts found in solution in this water are present generally in all water from the lake clays and the drift. Shallow wells penetrating extensive gravel pockets yield moderately hard but not highly mineralized water. Supplies from such beds at greater depths in the drift show a higher concentration of sulphate salts in solutions. This concentration seems to depend upon the thickness of clay overlying the aquifer. In wells in which sandy beds are small or absent and the supply is derived from the lake clay or boulder clay, the water is generally so high in dissolved sulphate salts that it is rendered unfit for drinking on account of the decidedly laxative effect of the salts and in a few wells is unfit even for watering stock.

Ground waters obtained from the glacial drift covering the uplands vary so greatly in the relative amounts in which the mineral salts are present that it is difficult to make generalizations. The sulphate salts are almost invariably present in solution. Water from porous gravel beds near the surface, particularly in the moraine-covered areas, is hard, but not so highly mineralized as to be unfit for drinking. The character of the water at greater depths depends partly upon the areal extent, porosity, and thickness of the aquifer and the thickness of the overlying boulder clay. The larger and more porous the aquifer the better the quality of the contained water in general. Variations are found in the character of the drift over small areas and corresponding variations in the character of the water

are to be expected. It must not be inferred, therefore, that if water of poor quality is found in one well supplies of similar quality must of necessity exist over any large area.

Water from the Bedrock

The character of the water derived from aquifers in the Cypress Hills formation varies considerably in different localities. This variation in the mineral salts present and their quantities is probably due to variation in thickness and porosity of the overlying glacial drift through which the water percolates before reaching the bedrock aquifers. In general, however, water obtained from the formation in the southwestern part of the municipality is reported to be of very good quality for farm use. The water is soft or only moderately hard, and analysis would probably show calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$) as the predominant mineral salts in solution. In the northeastern part of the municipality, the water from the Cypress Hills formation is usually much harder and has a higher total solid content. Sulphate salts are present in solution and many of the waters are reported to be "alkaline". This condition is due undoubtedly to the greater thickness of drift overlying the Cypress Hills formation in this part of the municipality. The greater the thickness of the drift the more opportunity is offered for surface waters percolating downward through it to dissolve the mineral salts inherent in the boulder clay. The waters of poorer quality in this formation are confined particularly to townships 11 and 12, range 19, and township 11, range 20. Analysis No. 2 in the accompanying table is representative of the water commonly obtained from the formation in this area. The total dissolved solid content is 840 parts per million, made up chiefly of magnesium sulphate ($MgSO_4$), calcium sulphate ($CaSO_4$), and sodium sulphate ($Na_2SO_4$). These salts are not present in sufficient quantities to render the water unfit for domestic

use. However, the water from this particular well is not being used for domestic purposes, due to the high concentration of iron. Many of the water supplies obtained from the Cypress Hills formation of this area have sufficient quantities of iron in solution to be precipitated on exposure to the air and prove objectionable when the water is used for laundry purposes. In only a few places, however, are these waters considered unsuitable for drinking.

Analysis No. 1 is of water from a spring having its aquifer in the thin layer of Ravenscrag sand underlying the Cypress Hills formation in township 11, range 20. This water is very similar to water obtained from the Cypress Hills as shown by analysis No. 2. This is to be expected as there is undoubtedly a free passage of water between the two formations. Water obtained from the upper part of the Ravenscrag formation in the southwestern part of the municipality will generally contain greater quantities of dissolved sulphate salts than the water from the overlying Cypress Hills formation. These salts will not be present in sufficient quantities, however, to render the water undesirable for household use. No wells have been sunk into the massive sand beds in the lower part of the Ravenscrag formation in this area. Information from adjoining municipalities suggests, however, that this part of the formation will probably yield a soft water containing appreciable amounts of sodium sulphate ($Na_2SO_4$) and sodium carbonate ($Na_2CO_3$).

The ground water derived from the upper part of the Eastend formation varies greatly in mineral salt content. The water is usually hard and quite often contains sufficient quantities of sulphate salts to have a decidedly laxative effect on persons unaccustomed to its use.

The soft waters obtained from the lower Eastend and upper sandy beds of the Bearpaw formation can be expected generally to have

a total dissolved solid content of less than 1,000 parts per million, as indicated by analysis of water from these horizons in adjoining municipalities. The predominant mineral salts are sodium sulphate ($Na_2SO_4$) and sodium carbonate ($Na_2CO_3$). These salts are not present in sufficient quantities to affect the quality of the water for household or stock use, but they may in some cases be injurious to vegetation if the water is used for irrigation. However, many residents of adjoining municipalities have used these soft water supplies for irrigating gardens and have reported no noticeable ill effects.

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, SASKATCHEWAN.

| WELL No. | LOCATION ¼ | Sec. | Tp. | Rge. | Mer. | TYPE OF WELL | DEPTH OF WELL | ALTITUDE WELL (above sea level) | HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface | Elev. | PRINCIPAL WATER-BEARING BED Depth | Elev. | Geological Horizon | CHARACTER OF WATER | TEMP. OF WATER (in °F.) | USE TO WHICH WATER IS PUT | YIELD AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | NE. | 1 | 10 | 19 | 3 | Drilled | 130 | 2,950 | - 66 | 2,884 | 130 | 2,820 | Eastend fine black sand | Soft, clear | | D, S | Sufficient for local needs. 50 and 80-foot wells gave hard poor water. |
| 2 | SW. | 2 | " | " | " | Dug | 33 | 2,890 | - 30 | 2,860 | 30 | 2,860 | Eastend sand rock | Hard, clear, "alkaline" | | D, S | Insufficient for local needs. |
| 3 | SE. | 3 | " | " | " | Bored | 40 | 2,920 | - 36 | 2,884 | 36 | 2,884 | Eastend sand | Hard, clear | | D, S | Sufficient for 20 head stock. |
| 4 | NW. | 3 | " | " | " | Dug5 | 26 | 2,890 | - 19 | 2,871 | 19 | 2,871 | Glacial blue clay shale | Hard, clear, "alkaline" | | S | Insufficient supply. Will water 8 head stock. |
| 5 | NW. | 4 | " | " | " | Dug | 86 | 2,990 | - 84 | 2,906 | 84 | 2,906 | Eastend? sand | Soft, clear | | D, S | Sufficient for local needs. |
| 6 | NE. | 5 | " | " | " | Dug | 90 | 2,990 | - 86 | 2,904 | 86 | 2,904 | Glacial sand | Hard, clear, "alkaline" | | S | Sufficient for 15 head stock. |
| 7 | NW. | 5 | " | " | " | Bored | 115 | 2,960 | - 75 | 2,885 | 85 | 2,875 | Glacial gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 8 | NW. | 7 | " | " | " | Dug | 45 | 3,000 | - 42 | 2,958 | 40 | 2,960 | Glacial sand | Hard, iron, clear, "alkaline" | | D, S | Sufficient for 8 to 10 head stock. Springs in valley at elevation of 2,910. |
| 9 | NE. | 9 | " | " | " | Drilled | 265 | 2,955 | -205 | 2,750 | 259 | 2,696 | Bearpaw blue sand | Soft, brown | | D, S | Sufficient for local needs. |
| 10 | NW. | 10 | " | " | " | Dug | 90 | 2,910 | - 84 | 2,826 | 90 | 2,820 | Eastend brown sand | Soft, clear | | D, S | Sufficient for local needs. |
| 11 | SW. | 10 | " | " | " | Drilled | 206 | 2,950 | - 68 | 2,882 | 206 | 2,744 | Bearpaw? sand | Hard, clear | | D, S | Sufficient for local needs. |
| 12 | NE. | 12 | " | " | " | Drilled | 120 | 2,960 | -100 | 2,860 | 120 | 2,840 | Eastend sand | Soft, clear | | D, S | Insufficient for 10 head stock. |
| 13 | NW. | 15 | " | " | " | Dug | 50 | 2,880 | - 15 | 2,865 | 15 | 2,865 | Glacial gravel | Soft, clear | | D, S | Sufficient for local needs. |
| 14 | NW. | 16 | " | " | " | Dug | 72 | 2,900 | - 68 | 2,832 | 60 | 2,840 | Eastend hard sand | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 15 | SE. | 17 | " | " | " | Dug | 90 | 2,900 | - 85 | 2,815 | 85 | 2,815 | Eastend hard blue sand | Hard, clear | | D, S | Insufficient for local needs. |
| 16 | SW. | 17 | " | " | " | Dug | 34 | 2,800 | - 28 | 2,772 | 25 | 2,775 | Glacial gravel | Hard, clear | | N | Sufficient supply but not used. |
| 17 | SW. | 18 | " | " | " | Spring | | 2,950 | 0 | 2,950 | 0 | 2,950 | Eastend sand | Hard, clear | | S | Sufficient for local needs. |
| 18 | NW. | 18 | " | " | " | Spring | | 2,925 | 0 | 2,925 | 0 | 2,925 | Eastend sand | Hard, clear | | D, S | Sufficient for local needs. |
| 19 | SW. | 19 | " | " | " | Spring | | 2,900 | 0 | 2,900 | 0 | 2,900 | Eastend sand-stone | Soft, clear | | D, S | Sufficient for local needs. |
| 20 | SW. | 20 | " | " | " | Dug | 52 | 2,850 | - 40 | 2,810 | 40 | 2,810 | Glacial clay | Hard, clear, "alkaline" | | S | Supply good but could not be used. |
| 21 | SE. | 21 | " | " | " | Bored | 62 | 2,930 | - 35 | 2,895 | 62 | 2,868 | Glacial clay, gravel | Hard, clear | | | |
| 22 | NE. | 22 | " | " | " | Dug | 65 | 2,920 | - 45 | 2,875 | 65 | 2,855 | Glacial blue clay? | Hard, clear | | D, S | Sufficient for local needs. |
| 23 | NE. | 23 | " | " | " | Drilled | 180 | 2,920 | -105 | 2,815 | 180 | 2,740 | Bearpaw black sand | Hard, clear | | D, S | Sufficient for local needs. |
| 24 | SE. | 25 | " | " | " | Dug | 88 | 2,950 | - 20 | 2,930 | 88 | 2,862 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |
| 25 | NE. | 28 | " | " | " | Dug | 19 | 2,960 | - 6 | 2,954 | 18 | 2,942 | Glacial sand | Soft, clear | | D, S | Sufficient for local needs. |
| 26 | NW. | 28 | " | " | " | Dug | 35 | 2,960 | - 12 | 2,948 | 12 | 2,948 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |

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

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

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, 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 | SW. | 29 | 10 | 19 | 3 | Dug | 8 | 2,950 | - 4 | 2,946 | 6 | 2,944 | Glacial gravel | Hard, clear | | D, S | Sufficient for local needs. Another similar well. |
| 28 | NE. | 31 | " | " | " | Dug | 75 | 2,950 | - 55 | 2,895 | 60 | 2,890 | Eastend blue sandstone | Hard, clear | | D, S | Sufficient for 50 head stock. |
| 29 | SE. | 34 | " | " | " | Dug | 48 | 2,940 | - 15 | 2,925 | 45 | 2,895 | Glacial clay, gravel | Hard, clear | | D, S | Sufficient for local needs. Other wells of same type. |
| 30 | SW. | 34 | " | " | " | Bored | 65 | 2,960 | - 40 | 2,920 | 65 | 2,895 | Glacial drift | Hard, clear | | D, S | Sufficient for local needs. |
| 31 | SE. | 36 | " | " | " | Dug | 16 | 2,910 | 0 1 | 2,909 | 16 | 2,894 | Glacial sand | Hard, clear | | S | Sufficient for local needs. Other similar wells. |
| 1 | SE. | 4 | 10 | 20 | 3 | Dug | 122 | 3,350 | -119 | 3,231 | 119 | 3,231 | Cypress Hills gravel | Soft, clear | | D, S | Sufficient for local needs. |
| 2 | SW. | 4 | " | " | " | Dug | 123 | 3,350 | -121 | 3,229 | 121 | 3,229 | Cypress Hills cobblerock, gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 3 | SE. | 6 | " | " | " | Spring | | 3,180 | 0 | 3,180 | 0 | 3,180 | Ravenscrag sand | Hard, clear | | D, S | Sufficient for local needs. Other springs along creek. |
| 4 | SW. | 9 | " | " | " | Dug | 86 | 3,290 | - 82 | 3,208 | 82 | 3,208 | Cypress Hills bluesand cobble | Soft, clear | | D, S | Sufficient for local needs. |
| 5 | NE. | 9 | " | " | " | Dug | 47 | 3,260 | - 40 | 3,220 | 23 | 3,237 | Cypress Hills sand | Soft, clear | | D, S | Sufficient for local needs. |
| 6 | NW. | 10 | " | " | " | Spring | | 3,240 | 0 | 3,240 | 0 | 3,240 | Cypress Hills, sandy cobble-stone | Hard, clear | | D, S | |
| 7 | SW. | 12 | " | " | " | Dug | 60 | 3,020 | - 58 | 2,962 | 58 | 2,962 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |
| 8 | SE. | 13 | " | " | " | Dug | 8 | 2,960 | 0 | 2,960 | 0 | 2,960 | Eastend blue sandrock | Soft, clear | | D, S | Sufficient for local needs. |
| 9 | NW. | 13 | " | " | " | Dug | 54 | 3,025 | - 51 | 2,974 | 51 | 2,974 | Ravenscrag sand-stone | Hard, clear | | D, S | Sufficient for 30 head stock. |
| 10 | SW. | 15 | " | " | " | Spring | | 3,140 | 0 | 3,140 | 0 | 3,140 | Cypress Hills clay, cobble-stones | Hard, clear | | D, S | Sufficient for local needs. |
| 11 | NE. | 15 | " | " | " | Spring | | 3,150 | 0 | 3,150 | 0 | 3,150 | Cypress Hills gravel | Soft, clear | | D, S | Sufficient for local needs. |
| 12 | NE. | 17 | " | " | " | Dug | 125 | 3,280 | -121 | 3,159 | 121 | 3,159 | Ravenscrag?sand | Hard, clear | | N | Caved in; was good supply and quality. |
| 13 | NW. | 18 | " | " | " | Spring | | 3,180 | 0 | 3,180 | | | Ravenscrag sand | Soft, clear | | S | Sufficient for local needs. |
| 14 | SW. | 20 | " | " | " | Bored | 80 | 3,270 | - 66 | 3,204 | 66 | 3,204 | Cypress Hills? sandstone | Hard, clear | | D, S | Sufficient for local needs. |
| 15 | SE. | 20 | " | " | " | Dug | 84 | 3,270 | - 80 | 3,190 | 80 | 3,190 | Ravenscrag hard sand | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 16 | NW. | 20 | " | " | " | Drilled | 113 | 3,280 | - 97 | 3,183 | 111 | 3,169 | Ravenscrag sand | Hard, clear | | D, S | Sufficient for local needs. |
| 17 | SE. | 21 | " | " | " | Dug | 70 | 3,240 | - 67 | 3,173 | 30 | 3,210 | Cypress Hills sand, cobble-stones | Hard, clear | | D, S | Sufficient for local needs. |
| 18 | SW. | 21 | " | " | " | Dug | 32 | 3,270 | - 27 | 3,243 | 32 | 3,238 | Glacial sand | Hard, clear, iron | | D, S | Sufficient for 75 head stock. |
| 19 | NW. | 21 | " | " | " | Dug | 68 | 3,260 | - 63 | 3,197 | 63 | 3,197 | Cypress Hills, sand, gravel | Hard, clear | | D, S | Sufficient for local needs. |

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

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

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, SASKATCHEWAN.

| WELL No. | LOCATION ¼ | Sec. | Tp. | Rge. | Mer. | TYPE OF WELL | DEPTH OF WELL | ALTITUDE WELL (above sea level) | HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface | Elev. | PRINCIPAL WATER-BEARING BED Depth | Elev. | Geological Horizon | CHARACTER OF WATER | TEMP. OF WATER (in °F.) | USE TO WHICH WATER IS PUT | YIELD AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | SW. | 22 | 10 | 20 | 3 | Dug | 18 | 3,240 | - 13 | 3,227 | 13 | 3,227 | Cypress Hills gravel | Soft, clear | | D, S | Supply sufficient for local needs. Spring in ravine. |
| 21 | NW. | 22 | " | " | " | Spring | | 3,220 | 0 | 3,220 | 0 | 3,220 | Cypress Hills, boggy clay | Hard, clear, iron | | D, S | Sufficient for 30 head stock. 50-foot well, large supply, not used. |
| 22 | SW. | 23 | " | " | " | Dug | 22 | 3,100 | - 20 | 3,080 | 18 | 3,082 | Ravenscrag sand | Hard, clear | | D, S | Sufficient for local needs. |
| 23 | NW. | 23 | " | " | " | Bored | 27 | 3,100 | | | | | Ravenscrag sand | Hard, clear | | D | Sufficient for local needs. Another similar well. |
| 24 | SW. | 27 | " | " | " | Spring | | 3,150 | 0 | 3,150 | 0 | 3,150 | Cypress Hills sand | Hard, clear | | D, S | Sufficient for local needs. |
| 25 | SW. | 28 | " | " | " | Bored | 38 | 3,270 | - 45 | 3,225 | 45 | 3,225 | Cypress Hills sand | Hard, clear | | D, S | Sufficient for 10 head stock. |
| 26 | NW. | 28 | " | " | " | Dug | 127 | 3,275 | | | | | Cypress Hills sand | Hard, iron, reddish | | D, S | Sufficient for local needs. |
| 27 | SW. | 35 | " | " | " | Dug | 25 | 3,050 | - 21 | 3,029 | 21 | 3,029 | Glacial blue clay | Hard, clear | | D, S | Insufficient for local needs. |
| 1 | SW. | 1 | 10 | 21 | 3 | Drilled | 60 | 3,550 | - 42 | 3,508 | 42 | 3,508 | Cypress Hills gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 2 | NE. | 1 | " | " | " | Drilled | 61 | 3,500 | - 47 | 3,453 | 57 | 3,443 | Cypress Hills, sand, gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 3 | NW. | 3 | " | " | " | Dug | 85 | 3,450 | - 55 | 3,395 | 55 | 3,395 | Cypress Hills gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 4 | NE. | 4 | " | " | " | Dug | 90 | 3,460 | - 80 | 3,380 | 85 | 3,375 | Cypress Hills gravel | Soft, clear | | D, S | Sufficient for local needs. |
| 5 | SE. | 6 | " | " | " | Dug | 80 | 3,510 | - 72 | 3,438 | 72 | 3,438 | Cypress Hills gravel | Soft, clear | | D, S | Sufficient for local needs. |
| 6 | SE. | 7 | " | " | " | Dug | 48 | 3,460 | - 42 | 3,418 | 42 | 3,418 | Glacial blue clay | Hard, clear, "alkaline" | | S | Sufficient for local needs. |
| 7 | NE. | 7 | " | " | " | Drilled | 76 | 3,490 | - 60 | 3,430 | 74 | 3,416 | Cypress Hills gravel | Soft, clear | | D, S | Sufficient for local needs. |
| 8 | NE. | 8 | " | " | " | Dug | 18 | 3,450 | - 17 | 3,433 | 17 | 3,433 | Glacial gravel | Soft, clear | | D | Sufficient for local needs. |
| 9 | SE. | 9 | " | " | " | Drilled | 73 | 3,450 | - 60 | 3,390 | 60 | 3,390 | Cypress Hills gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 10 | NW. | 9 | " | " | " | Drilled | 108 | 3,400 | - 50 | 3,350 | 108 | 3,292 | Ravenscrag sand | Hard, clear | | D | Sufficient for local needs. |
| 11 | NW. | 10 | " | " | " | Drilled | 34 | 3,400 | - 20 | 3,380 | 20 | 3,380 | Glacial gravel | Soft, clear | 46 | D, S | Sufficient for local needs. |
| 12 | SE. | 12 | " | " | " | Dug | 73 | 3,360 | - 62 | 3,298 | 70 | 3,290 | Cypress Hills gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 13 | NE. | 12 | " | " | " | Dug | 57 | 3,350 | - 50 | 3,300 | 55 | 3,295 | Cypress Hills gravel | Hard | | D, S | Sufficient for local needs. |
| 14 | NE. | 14 | " | " | " | Dug | 27 | 3,350 | - 25 | 3,325 | 25 | 3,325 | Glacial gravel | Soft, clear | | D, S | Insufficient for local needs. Uses spring. |
| 15 | SE. | 15 | " | " | " | Dug | 55 | 3,360 | - 52 | 3,308 | 52 | 3,308 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |
| 16 | SW. | 15 | " | " | " | Drilled | 82 | 3,400 | - 65 | 3,335 | 65 | 3,335 | Cypress Hills sand | Hard, clear | | D, S | Sufficient for local needs. |
| 17 | SW. | 18 | " | " | " | Drilled | 135 | 3,540 | - 60 | 3,480 | 127 | 3,413 | Cypress Hills gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 18 | SW. | 19 | " | " | " | Dug | 30 | 3,550 | - 15 | 3,535 | 28 | 3,522 | Glacial gravel | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 19 | NE. | 23 | " | " | " | Drilled | 123 | 3,400 | -103 | 3,297 | 118 | 3,282 | Cypress Hills sand | Hard, clear | | D, S | Sufficient for local needs. 65-foot well similar. |

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 CARMICHAEL, NO. 109, SASKATCHEWAN.

| WELL No. | LOCATION ¼ | Sec. | Tp. | Rge. | Mer. | TYPE OF WELL | DEPTH OF WELL | ALTITUDE WELL (above sea level) | HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface | Elev. | PRINCIPAL WATER-BEARING BED Depth | Elev. | Geological Horizon | CHARACTER OF WATER | TEMP. OF WATER (in °F.) | USE TO WHICH WATER IS PUT | YIELD AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | NE. | 35 | 10 | 20 | 3 | Drilled | 139 | 3,425 | -100 | 3,325 | 131 | 3,294 | Cypress Hills sand | Hard, clear | | D, S | Sufficient for local needs. |
| 21 | NW. | 36 | " | " | " | Drilled | 64 | 3,350 | - 55 | 3,295 | 55 | 3,295 | Glacial sand, gravel | Hard, clear | | D, S, I | Sufficient for local needs. |
| 1 | SE. | 2 | 11 | 19 | 2 | Dug | 50 | 3,000 | - 44 | 2,956 | 44 | 2,956 | Glacial sand | Soft, clear | | D, S | Sufficient for local needs. |
| 2 | SW. | 2 | " | " | " | Bored | 52 | 2,980 | - 32 | 2,948 | 52 | 2,928 | Glacial clay | Hard, clear, "alkaline" | | S | Sufficient for local needs. Two wells drilled gave little water at 200 feet. |
| 3 | NW. | 2 | " | " | " | Bored | 42 | 2,970 | 0 | 2,970 | 28 | 2,942 | Cypress Hills cobblestone | Hard, clear | | D, S | Sufficient for 12 head stock. |
| 4 | SW. | 3 | " | " | " | Bored | 52 | 3,006 | - 44 | 2,962 | 52 | 2,954 | Glacial sand | Hard, clear, iron | | D, S | Sufficient for 20 head stock. |
| 5 | NE. | 5 | " | " | " | Drilled | 137 | 2,980 | - 62 | 2,918 | 137 | 2,843 | Eastend sandstone | Hard, clear | | D, S | Sufficient for local needs. |
| 6 | NE. | 8 | " | " | " | Dug | 40 | 3,000 | - 9 | 2,991 | 40 | 2,960 | Cypress Hills gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 7 | SW. | 10 | " | " | " | Dug | 53 | 3,045 | - 48 | 2,997 | 40 | 3,005 | Cypress Hills sand | Hard, clear | | D, S | Sufficient for local needs. |
| 8 | NW. | 10 | " | " | " | Dug | 50 | 3,048 | - 47 | 3,001 | 18 | 3,030 | Cypress Hills cobblestones | Hard, clear | | D, S | Sufficient for local needs. |
| 9 | NE. | 12 | " | " | " | Dug | 82 | 2,880 | - 37 | 2,843 | 82 | 2,798 | Bearpaw blue clay? | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 10 | SE. | 13 | " | " | " | Dug | 22 | 2,920 | - 12 | 2,908 | 12 | 2,908 | Glacial clay | Hard, clear, "alkaline" | | D, S | Insufficient for local needs. Another similar well. |
| 11 | SW. | 13 | " | " | " | Dug | 48 | 2,930 | - 13 | 2,917 | 13 | 2,917 | Glacial sand | Hard, clear, iron | | S | Sufficient for 50 head stock. 14-foot well, soft water. |
| 12 | NE. | 15 | " | " | " | Dug | 30 | 2,990 | - 25 | 2,965 | 25 | 2,965 | Glacial clay | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 13 | NW. | 16 | " | " | " | Dug | 45 | 3,030 | - 37 | 2,993 | 37 | 2,993 | Glacial drift | Hard, clear | | D, S | Sufficient for household needs only. |
| 14 | NW. | 17 | " | " | " | Dug | 20 | 3,020 | - 13 | 3,007 | 13 | 3,007 | Glacial clay, sand | Hard, clear | | D, S | Sufficient for local needs. Another 12-foot well. |
| 15 | SE. | 18 | " | " | " | Dug | 35 | 2,945 | - 21 | 2,924 | 35 | 2,910 | Glacial sand | Hard, clear, iron | | D, S | Sufficient for local needs. Spring in ravine. |
| 16 | NE. | 18 | " | " | " | Spring | | 2,930 | 0 | 2,930 | 0 | 2,930 | Glacial gravel | Hard, clear | | D, S | Sufficient for local needs. Other springs in same valley. |
| 17 | SW. | 19 | " | " | " | Dug | 54 | 3,000 | - 38 | 2,962 | 54 | 2,946 | Glacial blue sand | Hard, clear, Glauber's salts | | D, S | Sufficient for 15 head stock. 14-foot well and springs in ravine. |
| 18 | NW. | 19 | " | " | " | Dug | 10 | 3,000 | 0 | 3,000 | 0 | 3,000 | Glacial gravel, stone | Soft, clear | | D, S | Sufficient for local needs. |
| 19 | NE. | 19 | " | " | " | Dug | 75 | 3,040 | - 64 | 2,976 | 64 | 2,976 | Cypress Hills cobblestone | Soft, clear | | D, S | Sufficient for local needs. |
| 20 | SW. | 20 | " | " | " | Dug | 42 | 3,045 | - 39 | 3,006 | 20 | 3,025 | Cypress Hills cobblestone | Hard, clear, iron | | S | Sufficient for 80 head stock. |
| 21 | SE. | 20 | " | " | " | Dug | 53 | 3,040 | - 50 | 2,990 | 15 | 3,025 | Cypress Hills cobblestone, sand | Hard, clear | | D, S | Sufficient for 80 head stock. |
| 22 | NE. | 21 | " | " | " | Dug | 40 | 3,045 | - 37 | 3,008 | 5 | 3,040 | Cypress Hills cobblestone | Hard, clear | | D, S | Sufficient for 5 head stock. |
| 23 | SW. | 22 | " | " | " | Dug | 32 | 3,035 | - 26 | 3,009 | 15 | 3,020 | Cypress Hills cobblestone | Hard, clear | | D, S | Sufficient for 20 head stock. |
| 24 | SW. | 23 | " | " | " | Dug | 25 | 3,010 | - 18 | 2,992 | 25 | 2,985 | Glacial sand | Hard, clear, "alkaline" | | D, S | Sufficient for 40 head stock. |
| 25 | NW. | 23 | " | " | " | Dug | 48 | 3,010 | - 38 | 2,972 | 38 | 2,972 | Cypress Hills | Hard, iron, "alkaline", clear | | S | Sufficient for local needs. |

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

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

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, SASKATCHEWAN.

| WELL No. | LOCATION ¼ | Sec. | Tp. | Rge. | Mer. | TYPE OF WELL | DEPTH OF WELL | ALTITUDE WELL (above sea level) | HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface | Elev. | PRINCIPAL WATER-BEARING BED Depth | Elev. | Geological Horizon | CHARACTER OF WATER | TEMP. OF WATER (in °F.) | USE TO WHICH WATER IS PUT | YIELD AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | SE. | 25 | 11 | 19 | 3 | Dug | 30 | 2,945 | -.20 | 2,925 | 20 | 2,925 | Glacial clay | Hard, clear, "alkaline" | | D, S | Sufficient for 10 head stock. |
| 27 | SW. | 26 | " | " | " | Dug | 23 | 3,000 | - 3 | 2,997 | 23 | 2,977 | Glacial drift | Hard, clear, iron | | S | Sufficient for local needs. |
| 28 | SW. | 27 | " | " | " | Dug | 30 | 3,050 | - 25 | 3,025 | 20 | 3,030 | Cypress Hills cobblestone | Hard | | D, S | Sufficient for local needs. |
| 29 | NE. | 27 | " | " | " | Drilled | 90 | 3,030 | - 32 | 2,998 | 90 | 2,940 | Cypress Hills gravel | Hard, clear, iron | | D, S | Sufficient for local needs. |
| 30 | NW. | 28 | " | " | " | Dug | 33 | 3,050 | - 7 | 3,043 | 33 | 3,017 | Glacial gravel | Hard, clear, iron | | D, S | Sufficient for 20 head stock. |
| 31 | SW. | 28 | " | " | " | Dug | 56 | 3,060 | - 53 | 3,007 | 20 | 3,040 | Cypress Hills cobblestone | Hard, clear | | D, S | Sufficient for local needs. |
| 32 | NE. | 28 | " | " | " | Dug | 17 | 3,012 | - 12 | 3,000 | 15 | 2,997 | Glacial gravel | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 33 | SE. | 31 | " | " | " | Dug | 82 | 3,090 | -79 | 3,011 | 82 | 3,008 | Cypress Hills hard sands | Hard, clear | | D, S | Sufficient for local needs. |
| 34 | NE. | 32 | " | " | " | Dug | 37 | 3,030 | - 33 | 2,997 | 33 | 2,997 | Glacial sand | Hard, clear | | D, S | Sufficient for 50 head stock. 7-foot well, large supply of soft water. |
| 35 | SW. | 34 | " | " | " | Dug | 67 | 3,056 | - 57 | 2,999 | 67 | 2,989 | Glacial sand | Hard, clear, iron | | D, S | Sufficient for local needs. |
| 36 | NE. | 34 | " | " | " | Dug | 118 | 3,070 | -106 | 2,964 | 118 | 2,952 | Eastend black sand | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 37 | NW. | 34 | " | " | " | Dug | 120 | 3,050 | - 90 | 2,960 | 120 | 2,930 | Eastend blue clay | "Alkaline" | | S | Sufficient for 13 head stock. |
| 38 | NW. | 36 | " | " | " | Dug | 52 | 2,990 | - 44 | 2,946 | 48 | 2,942 | Cypress Hills gravel | Hard, clear, iron | | D, S | Insufficient for local needs. Dam for stock use. |
| 39 | SE. | 36 | " | " | " | Dug | 37 | 2,965 | - 34 | 2,931 | 34 | 2,931 | Cypress Hills gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 40 | NE. | 36 | " | " | " | Dug | 33 | 2,965 | - 17 | 2,948 | 30 | 2,935 | Cypress Hills sand, gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 1 | SE. | 1 | 11 | 20 | 3 | Dug | 28 | 2,910 | - 11 | 2,899 | 28 | 2,882 | Eastend blue sandstone | Hard, clear, "alkaline" | | S | Sufficient for local needs. |
| 2 | SW. | 1 | " | " | " | Spring | | 2,950 | 0 | 2,950 | 0 | 2,950 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. Other similar springs. |
| 3 | NE. | 2 | " | " | " | Dug | 12 | 2,990 | - 9 | 2,981 | 12 | 2,978 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |
| 4 | SW. | 2 | " | " | " | Dug | 20 | 3,050 | - 18 | 3,032 | 18 | 3,032 | Glacial sand | Hard, clear | | D, S | Insufficient for 7 head stock. Another 20-foot hole--very "alkaline" water. |
| 5 | NW. | 2 | " | " | " | Dug | 40 | 3,050 | | | | | Cypress Hills at base | | | | Dry hole. |
| 6 | NE. | 10 | " | " | " | Spring | | 3,000 | 0 | 3,000 | 0 | 3,000 | Ravenscrag sand | Hard, clear | | | Sufficient for local needs. |
| 7 | SW. | 13 | " | " | " | Spring | | 3,000 | 0 | 3,000 | 0 | 3,000 | Ravenscrag sandstone | Hard, clear, iron | | D, S | Sufficient for local needs. #. |
| 8 | NE. | 16 | " | " | " | Dug | 15 | 3,190 | - 13 | 3,177 | 13 | 3,177 | Cypress Hills cobblestone sand | Soft, clear | | D, S | Insufficient for local needs. |
| 9 | NW. | 16 | " | " | " | Dug | 24 | 3,200 | - 4 | 3,196 | 4 | 3,196 | Glacial sand | Soft, clear | | D | |
| 10 | SW. | 17 | " | " | " | Dug | 8 | 3,240 | - 5 | 3,235 | 5 | 3,235 | Glacial sand | Soft, clear | | D | Sufficient for local needs. |
| 11 | NW. | 17 | " | " | " | Spring | | 3,150 | 0 | 3,150 | 0 | 3,150 | Cypress Hills cobblestone sand | Soft, clear | | D, S | Not large supply. |
| 12 | SE. | 18 | " | " | " | Dug | 8 | 3,250 | 0 | 3,250 | 0 | 3,250 | Glacial sand | Soft, clear | | D, S | Sufficient for local needs. |

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

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

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, SASKATCHEWAN.

| WELL No. | LOCATION ¼ | Sec. | Tp. | Rge. | Mer. | TYPE OF WELL | DEPTH OF WELL | ALTITUDE WELL (above sea level) | HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface | Elev. | PRINCIPAL WATER-BEARING BED Depth | Elev. | Geological Horizon | CHARACTER OF WATER | TEMP. OF WATER (in °F.) | USE TO WHICH WATER IS PUT | YIELD AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | NE. | 18 | 11 | 20 | 3 | Dug | 54 | 3,325 | - 54 | 3,271 | 54 | 3,271 | Cypress Hills sand | Soft, clear | | D, S | Sufficient for 75 head stock. 27- and 6-foot wells, same aquifer. |
| 14 | SE. | 20 | " | " | " | Dug | 24 | 3,230 | - 20 | 3,210 | 20 | 3,210 | Glacial sand | Hard, clear | | D | Insufficient; about 1 barrel a day. |
| 15 | NW. | 21 | " | " | " | Bored | 198 | 3,250 | -194 | 3,056 | 194 | 3,056 | Ravenscrag blue sand | Hard, clear | | D, S | |
| 16 | NW. | 22 | " | " | " | Dug | 210 | 3,250 | -201 | 3,049 | 210 | 3,040 | Ravenscrag sand | Hard, clear, iron | | ~~S~~ | ~~Sufficient for local needs.~~ 30-foot well. |
| 17 | SE. | 23 | " | " | " | Dug | 52 | 3,100 | | | | | Cypress Hills at base | | | | Dry hole. |
| 18 | SE. | 24 | " | " | " | Dug | 62 | 3,050 | - 59 | 2,991 | 59 | 2,991 | Cypress Hills sand, gravel | Hard, clear, iron | | D, S | Sufficient for local needs. |
| 19 | NE. | 25 | " | " | " | Dug | 92 | 3,150 | - 84 | 3,066 | 84 | 3,066 | Ravenscrag blue sand | Hard, clear, iron | | D, S | Sufficient for local needs. |
| 20 | SW. | 25 | " | " | " | Dug | 102 | 3,130 | - 97 | 3,033 | 97 | 3,033 | Ravenscrag sand (cemented) | Hard, clear, iron | | S | Sufficient for local needs. |
| 21 | NE. | 26 | " | " | " | Dug | 96 | 3,120 | - 92 | 3,028 | 92 | 3,028 | Ravenscrag blue sand | Hard, clear, iron, "alkaline" | | S | Sufficient for 100 head stock. |
| 22 | NW. | 27 | " | " | " | Spring | | 3,100 | 0 | 3,100 | 0 | 3,100 | Glacial sand | Hard, clear | | S | Sufficient for local needs. |
| 23 | SE. | 28 | " | " | " | Dug | 93 | 3,150 | - 88 | 3,062 | 10 | 3,062 | Ravenscrag sandstone | Hard, clear, iron | | D, S | Sufficient for 30 head stock. |
| 24 | SW. | 36 | " | " | " | Dug | 115 | 3,150 | -100 | 3,050 | 100 | 3,050 | Ravenscrag hard blue sand | Hard, clear | | D, S | Sufficient for 50 head stock. |
| 25 | NW. | 36 | " | " | " | Dug | 160 | 3,160 | -155 | 3,005 | 90 | 3,070 | Ravenscrag blue sandstone | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 26 | NE. | 36 | " | " | " | Dug | 34 | 3,150 | - 30 | 3,120 | 30 | 3,120 | Glacial sand | Hard, clear, iron, "alkaline" | | S | Sufficient for 10 head stock. |
| 1 | SW. | 5 | 11 | 21 | 3 | Dug | 8 | 3,200 | - 2 | 3,198 | 2 | 3,198 | Glacial gravel | Soft, clear | | D, S | Sufficient for local needs. |
| 2 | NE. | 6 | " | " | " | Dug | 25 | 3,050 | - 20 | 3,030 | 20 | 3,030 | Glacial boulder clay | Soft, clear | | D, S | Sufficient for local needs. |
| 3 | SE. | 7 | " | " | " | Dug | 12 | 2,950 | - 8 | 2,942 | 8 | 2,942 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. Several small springs. |
| 4 | NE. | 10 | " | " | " | Spring | | 3,150 | 0 | 3,150 | 0 | 3,150 | Glacial gravel | Soft, clear | | | |
| 5 | NW. | 14 | " | " | " | Spring | | 2,900 | 0 | 2,900 | 0 | 2,900 | Glacial gravel | Soft | | | |
| 6 | NW. | 14 | " | " | " | Dug | 40 | 2,900 | -32 | 2,868 | 32 | 2,868 | Glacial clay | Hard, clear | | D, S | Sufficient for local needs. |
| 7 | NW. | 14 | " | " | " | Dug | 6 | 2,950 | - 6 | 2,944 | 6 | 2,944 | Glacial clay | Hard | | D, S | Sufficient for 1,500 sheep. |
| 8 | NE. | 18 | " | " | " | Bored | 38 | 2,825 | - 26 | 2,799 | 26 | 2,799 | Glacial sand | Hard, clear | | D, S | Insufficient for local needs. |
| 9 | SE. | 20 | " | " | " | Dug | 12 | 2,770 | - 7 | 2,763 | 7 | 2,763 | Glacial clays | Hard, clear, "alkaline" | | D, S | Insufficient for local needs. |
| 10 | NW. | 20 | " | " | " | Dug | 14 | 2,750 | - 10 | 2,740 | -10 | 2,740 | Glacial sands | Hard, clear, "alkaline" | | D | Insufficient for local needs. Also springs. |
| 11 | NW. | 28 | " | " | " | Dug | 23 | 2,725 | - 20 | 2,705 | 20 | 2,705 | Glacial sand | Hard, clear, "alkaline" | 48 | D, S | Insufficient for local needs. |
| 12 | NE. | 28 | " | " | " | Dug | 66 | 2,800 | - 63 | 2,737 | 63 | 2,737 | Glacial sand | Hard, clear | | S | Insufficient for local needs. |
| ~~13~~ | ~~SE.~~ | ~~31~~ | ~~"~~ | ~~"~~ | ~~"~~ | ~~Dug~~ | ~~7~~ | ~~2,810~~ | ~~- 7~~ | ~~2,803~~ | ~~7~~ | ~~2,803~~ | ~~Glacial clay~~ | ~~Hard, clear~~ | ~~44~~ | ~~S~~ | ~~Sufficient for local needs.~~ |

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

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

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, SASKATCHEWAN.

| WELL No. | LOCATION ¼ | Sec. | Tp. | Rge. | Mer. | TYPE OF WELL | DEPTH OF WELL | ALTITUDE WELL (above sea level) | HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface | Elev. | PRINCIPAL WATER-BEARING BED Depth | Elev. | Geological Horizon | CHARACTER OF WATER | TEMP. OF WATER (in °F.) | USE TO WHICH WATER IS PUT | YIELD AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | NE. | 31 | 11 | 21 | 3 | Drilled | 103 | 2,800 | -100 | 2,700 | 100 | 2,700 | Glacial sand | Hard, iron | | S | Sufficient for local needs. Shallow well-soft water. |
| 15 | SE. | 34 | " | " | " | Dug | 103 | 2,750 | | | | | | | | | Dry hole. (Base may be in Bearpaw) |
| 1 | NE. | 1 | 12 | 19 | 3 | Dug | 80 | 3,000 | - 75 | 2,925 | 75 | 2,925 | Cypress Hills gravel | Hard, clear | | D, S | Sufficient for 40 head stock. |
| 2 | NW. | 2 | " | " | " | Dug | 86 | 3,008 | - 76 | 2,932 | 76 | 2,932 | Cypress Hills gravel | Hard, clear, soda | | S | Sufficient for 30 head stock. |
| 3 | SW. | 4 | " | " | " | Dug | 30 | 2,990 | - 20 | 2,970 | 20 | 2,970 | Glacial sand | Hard, clear, iron, "alkaline" | | D, S | Sufficient for 20 head stock. |
| 4 | NE. | 5 | " | " | " | Dug | 84 | 3,050 | - 80 | 2,970 | 80 | 2,970 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |
| 5 | NW. | 6 | " | " | " | Dug | 29 | 3,130 | - 11 | 3 119 | 21 | 3,109 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |
| 6 | NE. | 10 | " | " | " | Dug | 60 | 3,070 | - 55 | 3,015 | 55 | 3,015 | Cypress Hills sand | Hard, clear, iron, "alkaline" | | D, S | Sufficient for 60 head stock. |
| 7 | SW. | 12 | " | " | " | Dug | 106 | 3,030 | -100 | 2,930 | 35 | 2,995 | Cypress Hills cobblestone | Hard, clear | | D, S | Sufficient for local needs. |
| 8 | NW. | 12 | " | " | " | Dug | 12 | 3,090 | -108 | 2,982 | 108 | 2,982 | Cypress Hills | Hard, clear, iron | | S | Sufficient for local needs. #. |
| 9 | NE. | 13 | " | " | " | Dug | 130 | 3,050 | -121 | 2,929 | 130 | 2,920 | Cypress Hills | Hard, clear | | D, S | Sufficient for 40 head stock. |
| 10 | SE. | 16 | " | " | " | Dug | 125 | 3,060 | -118 | 2,942 | 118 | 2,942 | Glacial clay | Hard, clear | | D, S | Sufficient for 50 head stock. |
| 11 | SW. | 17 | " | " | " | Dug | 14 | 2,740 | - 8 | 2,732 | 8 | 2,732 | Glacial gravel | Hard, clear, iron | | D, S | Sufficient for 20 head stock. |
| 12 | SW. | 18 | " | " | " | Dug | 38 | 2,850 | - 16 | 2,834 | 16 | 2,834 | Glacial clay | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. Another 21-foot well. |
| 13 | NW. | 18 | " | " | " | Bored | 73 | 2,740 | - 38 | 2,702 | 73 | 2,667 | Glacial drift | Hard, iron, "alkaline" | | S | Sufficient for local needs. 34-foot well gives drinking water. |
| 14 | SW. | 20 | " | " | " | Dug | 8 | 2,785 | - 2 | 2,783 | 2 | 2,783 | Glacial fine gravel | Hard, clear | | D, S | Sufficient for local needs. |
| 15 | SW. | 22 | " | " | " | Bored | 180 | 3,070 | -170 | 2,900 | 170 | 2,900 | Eastend clay | Hard, clear, "alkaline" | | D, S | Insufficient for 10 head stock. |
| 16 | SW. | 23 | " | " | " | Dug | 142 | 3,070 | -139 | 2,931 | 70 | 3,000 | Cypress Hills sandstone. | Hard, clear, iron | | S | Sufficient for local needs. |
| 17 | SE. | 23 | " | " | " | Dug | 125 | 3,055 | -120 | 2,935 | 50 | 3,005 | Cypress Hills sand | Hard, clear, iron | | D, S | Sufficient for local needs. |
| 18 | SE. | 24 | " | " | " | Dug | 85 | 3,020 | - 73 | 2,947 | 85 | 2,935 | Cypress Hills sand | Soft, clear | | D, S | Sufficient for local needs. |
| 19 | SE. | 26 | " | " | " | Dug | 142 | 3,000 | -141 | 2,859 | 140 | 2,860 | Eastend sand | Hard, clear | | D, S | Sufficient for 100 head stock. |
| 20 | NE. | 26 | " | " | " | Spring | | 2,820 | 0 | 2,820 | 0 | 2,820 | Glacial sand | | | S | Sufficient for local needs. |
| 21 | SW. | 27 | " | " | " | Dug | 14 | 2,800 | - 7 | 2,793 | 7 | 2,793 | Glacial drift | Hard, clear, iron | | D, S | Sufficient for local needs. |
| 22 | SW. | 28 | " | " | " | Dug | 25 | 2,795 | - 23 | 2,772 | 23 | 2,772 | Glacial sand, gravel | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. Two similar wells |
| 23 | NW. | 30 | " | " | " | Dug | 20 | 2,630 | - 15 | 2,615 | 15 | 2,615 | Glacial sand | Hard, clear | | D, S | Sufficient for 6 head stock. |
| 24 | NE. | 30 | " | " | " | Dug | 16 | 2,640 | - 10 | 2,630 | 16 | 2,624 | Glacial sand | Hard, clear, "alkaline" | | D, S | Insufficient for local needs. Dugouts in cree for stock. |

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

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

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | NW. | 31 | 12 | 19 | 3 | Dug | 14 | 2,610 | - 7 | 2,603 | 12 | 2,598 | Glacial sand | Hard, cloudy, iron | | D, S | Sufficient for 6 head stock. |
| 26 | SE. | 32 | " | " | " | Dug | 70 | 2,675 | - 46 | 2,629 | 46 | 2,629 | Glacial clay | Hard, "alkaline" | | S | Sufficient for local needs. Two 100-foot wells and a 50-foot well—water not fit for drinking. |
| 27 | NW. | 32 | " | " | " | Dug | 16 | 2,640 | - 10 | 2,630 | 10 | 2,630 | Glacial drift | Hard, clear, "alkaline" | | D | Sufficient for household needs only. Another 12-foot well. |
| 28 | NW. | 33 | " | " | " | Dug | 85 | 2,755 | - 73 | 2,682 | 85 | 2,670 | Glacial sand | Hard, iron, "alkaline" | | D, S | Sufficient for 25 head stock. |
| 29 | NW. | 34 | " | " | " | Dug | 50 | 2,710 | - 20 | 2,690 | 43 | 2,662 | Glacial sand | Hard, clear, "alkaline" | | S | Sufficient for 8 head stock. |
| 30 | SE. | 35 | " | " | " | Dug | 104 | 2,760 | - 80 | 2,680 | 80 | 2,680 | Glacial clay | Hard, clear, "alkaline" | | N | Unfit for man or beast . |
| 1 | NW. | 1 | " | " | " | Dug | 160 | 3,150 | -154 | 2,996 | 154 | 2,996 | Cypress Hills gravel | Hard, clear, iron | | S | ~~Sufficient for 30 head stock. 32-foot well—~~ soft water. |
| 2 | SW. | 3 | " | " | " | Dug | 8 | 2,900 | - 4 | 2,896 | 4 | 2,896 | Glacial clay | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. 2 barrels a day. |
| 3 | NE. | 7 | " | " | " | Dug | 30 | 2,650 | - 26 | 2,624 | 26 | 2,624 | Glacial blue clay | Hard, clear, "alkaline" | | D, S | Another 20-foot well. |
| 4 | NW. | 9 | " | " | " | Dug | 23 | 2,675 | - 19 | 2,656 | 19 | 2,656 | Glacial fine sand | Hard, clear, "alkaline" | | S | Sufficient for 30 head stock. |
| 5 | NE. | 10 | " | " | " | Dug | 20 | 2,710 | - 14 | 2,696 | 14 | 2,696 | Glacial ~~sandy~~ gravel | Hard, clear, iron | | S | With other well there is sufficient supply. |
| 6 | SE. | 12 | " | " | " | Dug | 12 | 3,100 | - 10 | 3,090 | 10 | 3,090 | Glacial gravel | Hard, clear | | D, S | Sufficient for local needs. Another 20-foot well. |
| 7 | NW. | 13 | " | " | " | Dug | 10 | 2,770 | - 5 | 2,765 | 8 | 2,762 | Glacial gravel | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 8 | SE. | 14 | " | " | " | Dug | 12 | 2,690 | - 0 | 2,690 | 0 | 2,690 | Glacial gravel | Hard, clear, "alkaline" | | S | Sufficient for local needs. 12-foot well used for house. |
| 9 | NW. | 14 | " | " | " | Dug | 20 | 2,650 | - 10 | 2,640 | 20 | 2,630 | Glacial gravel | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. Another 12-foot well. |
| 10 | NE. | 18 | " | " | " | Dug | 60 | 2,650 | - 54 | 2,596 | 54 | 2,596 | Glacial drift | Hard, clear | | D | Sufficient for household needs only. Another 14-foot well used for stock. |
| 11 | SW. | 19 | " | " | " | Dug | 40 | 2,650 | - 38 | 2,612 | 38 | 2,612 | Glacial sand | Hard, clear | | D, S | Insufficient supply. Hauls water for stock. |
| 12 | SE. | 20 | " | " | " | Dug | 46 | 2,650 | - 36 | 2,614 | 36 | 2,614 | Glacial sand | Hard | | D, S | Sufficient for 50 head stock. 185-foot well was drilled through 155 feet of sand. |
| 13 | NE. | 20 | " | " | " | Dug | 46 | 2,650 | - 36 | 2,614 | 36 | 2,614 | Glacial sand | Hard | | S | Sufficient for local needs. |
| 14 | SE. | 22 | " | " | " | Dug | 30 | 2,640 | - 20 | 2,620 | 20 | 2,620 | Glacial clay | Hard, clear, iron, "alkaline" | | S | Insufficient for local needs. Another 18-foot well. |
| 15 | NE. | 22 | " | " | " | Dug | 16 | 2,650 | - 10 | 2,640 | 16 | 2,634 | Glacial sand | Hard, clear, "alkaline" | | S | Sufficient for 100 head stock. |
| 16 | SW. | 24 | " | " | " | Bored | 110 | 2,660 | -100 | 2,560 | 100 | 2,560 | Glacial sand | Hard, cloudy, Glauber's salts. | | S | Sufficient for local needs. Unfit for man or beast. |
| 17 | NE. | 24 | " | " | " | Dug | 85 | 2,670 | - 40 | 2,630 | 85 | 2,585 | Glacial drift | Hard, clear, iron, "alkaline" | | D, S | Sufficient for 30 head stock. |
| 18 | SE. | 25 | " | " | " | Bored | 42 | 2,660 | - 4 | 2,656 | 42 | 2,618 | Glacial sand, gravel | Soft, clear | | D, S | Insufficient for local needs. |
| 19 | SW. | 25 | " | " | " | Dug | 18 | 2,660 | - 15 | 2,645 | 18 | 2,642 | Glacial sand | Soft, clear | | D, S | Yields 2 barrels a day. |

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

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

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, SASKATCHEWAN.

| WELL No. | LOCATION ¼ | Sec. | Tp. | Rge. | Mer. | TYPE OF WELL | DEPTH OF WELL | ALTITUDE WELL (above sea level) | HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface | Elev. | PRINCIPAL WATER-BEARING BED Depth | Elev. | Geological Horizon | CHARACTER OF WATER | TEMP. OF WATER (in °F.) | USE TO WHICH WATER IS PUT | YIELD AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | NE. | 26 | 12 | 20 | 3 | Dug | 12 | 2,650 | - 8 | 2,642 | 8 | 2,642 | Glacial sand | Hard, clear | | D, | Sufficient supply. No stock. |
| 21 | SE. | 27 | " | " | " | Dug | 14 | 2,640 | - 8 | 2,632 | 14 | 2,626 | Glacial sand | Soft, clear | | D, S | Sufficient for local needs. |
| 22 | NW. | 28 | " | " | " | Dug sand-point | 20 | 2,650 | - 14 | 2,636 | 14 | 2,636 | Glacial sand | Soft, clear | | D, S | Sufficient for local needs. |
| 23 | SW. | 30 | " | " | " | Dug | 17 | 2,660 | - 15 | 2,645 | 15 | 2,645 | Glacial sandy clay | Soft, clear | | D, S | Sufficient with another well for 14 head stock. Another 16-foot well. |
| 24 | NE. | 30 | " | " | " | Dug | 44 | 2,640 | - 42 | 2,598 | 44 | 2,596 | Glacial sand | Hard, clear | | D | Sufficient for household needs only. 24- and 7-foot wells. |
| 25 | NW. | 31 | " | " | " | Dug | 31 | 2,650 | - 25 | 2,625 | 25 | 2,625 | Glacial sand | Hard, "alkaline" | | S | Insufficient for 4 head stock. Also 21- and 15-foot wells. |
| 26 | SE. | 32 | " | " | " | Dug | 43 | 2,650 | - 40 | 2,610 | 40 | 2,610 | Glacial sand | Soft, clear | | D | Sufficient for household needs only. |
| 27 | SE. | 34 | " | " | " | Dug | 27 | 2,650 | - 20 | 2,630 | 27 | 2,623 | Glacial sand | Hard, clear | | D, S | Sufficient for 350 head sheep and 16 head stock |
| 28 | NE. | 34 | " | " | " | Dug | 18 | 2,650 | - 15 | 2,635 | 15 | 2,635 | Glacial sand | Soft, clear | | D | Sufficient for local needs. Other similar wells in village of Carmichael. |
| 29 | NW. | 35 | " | " | " | Dug | 16 | 2,645 | - 13 | 2,632 | 13 | 2,632 | Glacial sand | | | D, S | |
| 30 | SW. | 36 | " | " | " | Dug | 8 | 2,640 | - 3 | 2,637 | 3 | 2,637 | Glacial sand | Hard, clear | | D, S | Sufficient for 12 head stock. |
| 1 | NE. | 1 | 12 | 21 | 3 | Dug | 14 | 2,700 | - 9 | 2,691 | 14 | 2,686 | Glacial sand | Hard | | D, S | Insufficient for local needs. |
| 2 | NE. | 4 | " | " | " | Dug | 25 | 2,800 | - 20 | 2,780 | 25 | 2,775 | Glacial sand | Hard, clear, "alkaline" | | D, S | Insufficient for local needs. |
| 3 | NE. | 8 | " | " | " | Dug | 25 | 2,750 | - 19 | 2,731 | 25 | 2,725 | Glacial fine sand | Hard, clear | | D, S | Insufficient for local needs. Another similar well. |
| 4 | NE. | 9 | " | " | " | Dug | 38 | 2,750 | - 25 | 2,725 | 38 | 2,712 | Glacial clay | Hard, clear | | D, S | Sufficient for local needs. |
| 5 | SE. | 10 | " | " | " | Dug | 40 | 2,750 | - 30 | 2,720 | 40 | 2,710 | Glacial clay | Hard, clear | | D, S | Sufficient for local needs. |
| 6 | SE. | 10 | " | " | " | Dug | 18 | 2,750 | - 13 | 2,737 | 18 | 2,732 | Glacial clay | Soft, clear | | D, S | Insufficient for local needs. Another similar well. |
| 7 | SW. | 10 | " | " | " | Dug | 18 | 2,750 | | | 18 | 2,732 | Glacial sand | Soft | | D, S | Sufficient for 7 persons; 25 head stock. |
| 8 | NW. | 12 | " | " | " | Dug | 17 | 2,700 | - 8 | 2,692 | 17 | 2,683 | Glacial clay | Hard, clear, "alkaline" | | D, S | Sufficient for local needs. |
| 9 | SE. | 13 | " | " | " | Bored | 80 | 2,700 | | | | | Glacial clay at base | | | | Dry hole. |
| 10 | NE. | 13 | " | " | " | Dug | 33 | 2,680 | - 25 | 2,655 | 33 | 2,647 | Glacial fine sand | Hard, clear, iron, "alkaline" | | D, S | Insufficient for local needs. Another shallow well. |
| 11 | NW. | 13 | " | " | " | Dug | 32 | 2,700 | - 29 | 2,671 | 32 | 2,668 | Glacial clay, sand | Hard, "alkaline" | | D, S | Sufficient for 36 head stock. |
| 12 | SW. | 14 | " | " | " | Dug | 25 | 2,750 | - 22 | 2,728 | 25 | 2,725 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. Another shallow well. |
| 13 | SE. | 16 | " | " | " | Dug | 35 | 2,625 | - 31 | 2,594 | 35 | 2,590 | Glacial sand | Hard, clear | | D, S | Insufficient for local needs. |
| 14 | SW. | 16 | " | " | " | Dug | 35 | 2,750 | - 30 | 2,720 | 35 | 2,715 | Glacial clay | Hard, clear | | D, S | Sufficient for local needs. |
| 15 | NW. | 16 | " | " | " | Drilled | 320 | 2,725 | -180 | 2,545 | 200 | 2,525 | Glacial sand, gravel | Hard, clear, iron, "alkaline" | | D, S | Sufficient for local needs. #. |

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

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

# WELL RECORDS—Rural Municipality of CARMICHAEL, NO. 109, 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | SE. | 18 | 12 | 21 | 3 | Dug | 30 | 2,725 | - 25 | 2,700 | 30 | 2,695 | Glacial clay | Hard, clear | | D, S | Sufficient for local needs. |
| 17 | NE. | 18 | " | " | " | Dug | 20 | 2,750 | - 18 | 2,732 | 20 | 2,730 | Glacial fine sand | Hard, clear, "alkaline" | | D, S | Insufficient for local needs. Another similar well. |
| 18 | SW. | 19 | " | " | " | Dug | 10 | 2,710 | - 4 | 2,706 | 10 | 2,700 | Glacial sand | Soft, clear | | D, S | Sufficient for local needs. 2 other similar wells. |
| 19 | NW. | 20 | " | " | " | Dug | 20 | 2,750 | 0 | 2,750 | 0 | 2,750 | Glacial fine sand | Hard, clear | | S, | ~~Sufficient for local needs. Springs.~~ |
| 20 | NE. | 22 | " | " | " | Dug | 35 | 2,700 | - 32 | 2,668 | 35 | 2,665 | Glacial clay | Hard, dark | | S | Insufficient for local needs. |
| 21 | SW. | 23 | " | " | " | Dug | 37 | 2,750 | - 31 | 2,719 | 37 | 2,713 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |
| 22 | NW. | 23 | " | " | " | Dug | 25 | 2,700 | - 20 | 2,680 | 25 | 2,675 | Glacial fine sand | Soft, clear | | D, S | Sufficient for local needs. |
| 23 | SW. | 24 | " | " | " | Dug | 21 | 2,700 | - 12 | 2,688 | 21 | 2,679 | Glacial clay | Hard, clear | | D, S | Sufficient for local needs. |
| 24 | NW. | 25 | " | " | " | Dug | 32 | 2,750 | - 24 | 2,726 | 32 | 2,718 | Glacial clay | Hard, clear | | D, S | Insufficient for local needs. |
| 25 | NW. | 27 | " | " | " | Dug | 60 | 2,700 | - 55 | 2,645 | 60 | 2,640 | Glacial clay | Hard, clear | | D, S | Sufficient for local needs. |
| 26 | SE. | 28 | " | " | " | Dug | 22 | 2,700 | - 17 | 2,683 | 22 | 2,678 | Glacial clay | Hard, clear | | D, S | Insufficient for local needs. |
| 27 | SE. | 28 | " | " | " | Dug | 20 | 2,750 | - 16 | 2,734 | 20 | 2,730 | Glacial clay, sand | Hard, "alkaline" | | D, S | Sufficient for 16 horses. |
| 28 | NW. | 28 | " | " | " | Dug | 92 | 2,700 | - 89 | 2,611 | 92 | 2,608 | Glacial sand | Hard, clear | | D, S | Insufficient for local needs. |
| 29 | NE. | 28 | " | " | " | Dug | 32 | 2,700 | - 17 | 2,683 | 32 | 2,668 | Glacial fine sand | Hard, clear, iron | | D, S | Insufficient for local needs. Two similar wells. |
| 30 | NE. | 34 | " | " | " | Dug | 90 | 2,700 | - 70 | 2,630 | 90 | 2,610 | Glacial sand | Hard, clear | | D, S | Sufficient for local needs. |
| 31 | SW. | 35 | " | " | " | Dug | 65 | 2,700 | - 57 | 2,643 | 65 | 2,635 | Glacial sand | Hard, iron, "alkaline" | | D, S | Sufficient for local needs. |

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

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