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. 182

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF WILLNER NO. 253 SASKATCHEWAN

By
B. R. MacKay and D. C. Maddox

OTTAWA
1936

CANADA

DEPARTMENT OF MINES

BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF WILLNER NO. 253 SASKATCHEWAN

BY

B.R. MacKAY and D.C. MADDOX

WATER SUPPLY PAPER NO.182

CONTENTS

	Page
Introduction	1
Glossary of terms used	5
Names and descriptions of geological formations referred to	8
Water-bearing horizons of the municipality	10
Water-bearing horizons in the unconsolidated deposits	11
Water-bearing horizons in the bedrock	13
Ground water conditions by townships:	
Township 25, Range 1, west of 3rd meridian	16
Township 25, Range 2, " " " "	18
Township 25, Range 3, " " " "	19
Township 26, Range 1, " " " "	21
Township 26, Range 2, " " " "	23
Township 26, Range 3, " " " "	24
Township 27, Range 1, " " " "	25
Township 27, Range 2, " " " "	27
Township 27, Range 3, " " " "	28
Statistical summary of well information	30
Analyses and quality of water	31
General statement	31
Table of analyses of water samples	35
Water from the unconsolidated deposits	36
Water from the bedrock	38
Well records	39

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 WILLNER, NO. 182 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 Willner, No. 253, covers 324 square miles in southern Saskatchewan and comprises nine townships, described as tps. 25, 26, and 27, ranges 1, 2, and 3, W. 3rd. mer. There are no towns or villages within the municipality. The town of Davidson is about 1 mile east of the eastern boundary of the municipality and Bladworth village is about half a mile north of the northern boundary. The municipality is about midway between Saskatoon and Moose Jaw. The Saskatoon and Duck Lake branch of the Canadian National railways passes in a northwesterly direction diagonally across the northeastern part of the municipality. Bladworth and Davidson are on this railway.

Topographical relief in this municipality is low. Most of the country is flat to gently rolling. Elevations range from a little less than 1,900 feet above sea-level in the valley areas to a little more than 2,100 feet above sea-level in the bordering areas. The upper part of Brightwater Creek valley extends southward a short distance into township 27, range 3, and this depression defines an area of flowing artesian wells. The greater part of township 25, range 3, is occupied by a similar, wide, shallow, southward-draining valley less than 1,900 feet above sea-level in which occur several depressions, marshy in wet seasons. There are no streams or lakes in the municipality, but the direction of surface drainage is mainly to the southward-sloping depression or northwards towards the valley of Brightwater creek.

A belt of boulder clay or till from 2 to 6 miles wide extends diagonally in a northwest-southeast direction across the municipality. Another belt of boulder clay having an average width of about 1½ miles borders the eastern boundary of the municipality. An irregular area of boulder clay underlies most of the southern half of township 26, range 3, and most of the

northern third of township 25, range 3, and extends southeastward in a belt about a mile wide into the western part of township 25, range 2. South of this area of boulder clay there is an area of glacial lake clays that occupies a large part of the central third of township 25, range 3, and extends into the northern third for a short distance. The glacial lake clays merge on the south into an area of glacial lake sands which underlies the southern third of township 25, range 3, and extends for a short distance to the east and north. Moraine covers a little less than half of the municipality and occurs in two northwesterly trending belts lying between the three above-defined areas of boulder clay or till. Small, detached areas of glacial outwash sands and gravels, none of them over a half square mile in extent, occur in the boulder clay areas in the northeast corner of the municipality, and along the northern and eastern boundaries of the municipality.

There are no exposures of bedrock in the municipality, but the Marine Shale series is believed to underlie the glacial drift. The series consists principally of dark grey shale interbedded with which are layers of sand that usually contain soft water.

The glacial drift in the northern half of township 26, range 1, is at least 483 feet thick, and in the northeast quarter of township 27, range 2, is at least 335 feet thick. At other places the thickness is less than 100 feet. The great variation in thickness of the drift suggests the presence of pre-glacial bedrock depressions possibly buried stream valleys.

Water-bearing Horizons in the Unconsolidated Deposits

Water of good quality is generally found in the glacial outwash sands in this general region within about 25 feet of the surface. In this municipality, however, the areas underlain by

glacial outwash sands are very small and the sands are thin, and most of the wells in these areas have passed through the sands and have obtained water in the underlying boulder clay or moraine.

The glacial lake sands usually contain enough water to supply comparatively shallow wells. In this municipality wells from 15 to 30 feet deep obtain fairly large supplies of good water from these lake sands, but several wells have passed through the lake sands into the underlying boulder clay or moraine.

The glacial lake clays generally yield less water than the glacial lake sands. In this municipality most of the wells in the area underlain by glacial lake clays have passed through them into the underlying boulder clay. One well, however, 20 feet deep, obtains its water from an aquifer in the glacial lake clays.

In the moraine and boulder clay water is found only in pockets, lenses, or beds of sand and gravel that are enclosed in the boulder clay which forms the largest proportion of the glacial drift. Ground water conditions in the eastern belt of moraine are generally less favourable than in the western belt, as water is obtained at greater depths in the eastern belt. In the southern half of the eastern belt the wells are less than 100 feet deep, and the average depth is about 50 feet. In the northern half of the eastern belt most of the wells are comparatively deep, the average depth being probably nearly 100 feet.

In the western belt of moraine all the wells except five are less than 100 feet deep, and in the northern part the wells are less than 25 feet deep.

In the eastern belt of boulder clay many of the wells are over 100 feet deep, and in the central belt of boulder clay

all the producing wells in the glacial drift are less than 100 feet deep. In the western area of boulder clay two wells in the glacial drift are over 100 feet deep, but in this area most of the deeper wells have passed into the Marine Shale series which underlies the glacial drift.

The glacial drift is formed by the deposits of two or more advances and retreats of the continental ice-sheet, and the distribution of most of the aquifers is very irregular. The aquifers are of three general types: the pre-glacial aquifers such as sand and gravel deposited in old river valleys, or in other depressions in the surface of the bedrock; the aquifers in interglacial deposits formed prior to the last ice advance; and aquifers in the glacial drift deposited by the last ice-sheet. The pre-glacial aquifers generally extend over much wider areas than do the aquifers in the interglacial and glacial deposits. It is usually impossible to prove the continuity of aquifers in such a heterogeneous accumulation of drift, but if the wells of a group obtain water from aquifers that are at about the same elevation above sea-level it is assumed that these wells are supplied by a common aquifer; and where wells have encountered no water much below the elevation at which water is found in the group of wells the aquifer is assumed to be absent in these areas.

Water-bearing Horizons in the Bedrock

Aquifers in the bedrock are thought to supply twenty-five wells, 30 to 731 feet deep, in this municipality. No logs of the wells are available. The water in all the wells except one that is 731 feet deep, is soft, and in the absence of logs of the wells the softness of the water in the deeper wells is taken as evidence of bedrock origin.

An aquifer that is about 1,288 to 1,303 feet above sea-level supplies two wells 667 and 731 feet deep, located in sec. 36,

tp. 26, range 3, and sec. 35, tp. 26, range 1, respectively. In the western well the water can be used for all purposes, but in the deeper well the water is highly mineralized and salty. The extent of the aquifer is not known nor what part of it contains salty water, but it probably underlies at least the northern half of the municipality.

An aquifer that is about 1,383 to 1,405 feet above sea-level supplies four wells 496 to 560 feet deep in townships 26 and 27, range 3, with soft water. The aquifer does not extend into range 2, as the well on sec. 36, tp. 26, range 3, did not obtain water at this elevation. The aquifer is known to extend north and west of this municipality, however.

An aquifer that is 1,493 feet above sea-level supplies a well 403 feet deep on sec. 32, tp. 27, range 3, with soft water. This aquifer does not extend far east or south of the well, but is known to extend north and west of this municipality.

An aquifer that is about 1,582 to 1,605 feet above sea-level supplies two wells, 300 and 335 feet deep, in the western third of township 25, range 3, with soft water. This aquifer apparently extends a short distance westward into township 25, range 4. It does not extend far north of township 25 and its eastward extent is not known.

Two wells, 137 and 210 feet deep, in township 25, range 3, tap an aquifer that is about 1,705 to 1,761 feet above sea-level. This aquifer was not tapped in wells to the north and west. Its eastward extent is not known.

In townships 26 and 27, range 2, an aquifer, about 1,835 to 1,850 feet above sea-level, was encountered by two wells 100 and 230 feet deep. The aquifer does not extend far west of these townships, but it may extend into township 27, range 1, and township 25, range 2.

Township 25, range 1, is underlain by an aquifer that is apparently in the bedrock and is about 1,993 to 2,010 feet above sea-level. This aquifer is tapped by five wells 30 to 90 feet deep. It has not been encountered in wells elsewhere in the municipality.

A few other aquifers which supply soft water to wells occur in the municipality, but the wells that they supply are not very deep and the aquifers are apparently of small extent.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 25, Range 1

Topographical relief in this township is very low. The slopes nowhere exceed 50 feet to the mile. In sections 10, 15, 16, 20, and 21 a northwesterly trending area about 2 miles long and ½ mile wide is over 2,100 feet above sea-level. From this area the surface slopes downwards in every direction, and is a little less than 2,000 feet above sea-level in a small area in the eastern half of section 36, and in the northwestern corner of the township.

Glacial outwash sands and gravels underlie a low area in section 36, and extend a short distance south into section 25.

Boulder clay borders the eastern boundary and most of the southern and western boundaries of the township in a belt that varies in width from a few hundred yards to about 2 miles. Moraine underlies the southwest half of section 6, and most of the central and northern parts of the township.

The wells in this township range from 20 to 90 feet deep, but most of them are from 30 to 50 feet deep. One well, 22 feet deep, was put down in the area underlain by glacial outwash sands and gravels, but it probably passed through this deposit into the underlying boulder clay. In this township ground water conditions in the moraine are similar to those in the boulder clay and no zones of depth to water can be outlined in either deposit.

A well on the NE.¼, section 31, passed through a sand aquifer between depths of 40 and 60 feet (elevation between 1,965 and 1,985 feet above sea-level). This aquifer probably supplies the well, 56 feet deep, on the SE.¼, section 34, and it appears to underlie sections 31 to 36 and to extend north and west from these sections. In sections 19 and 24 several wells

obtain water from an aquifer that is about 2,000 to 2,010 feet above sea-level. In sections 20 to 22, all the wells obtain water from aquifers that are about 2,005 to 2,055 feet above sea-level. A well on the NW.$\frac{1}{4}$, section 6, encountered a bed of sand between 13 and 40 feet deep (elevation between 2,030 and 2,057 feet above sea-level). This aquifer appears to underlie most of the southern half of the township, but it apparently does not extend to its eastern boundary nor into the township to the west. The three above-mentioned aquifers may be part of a continuous bed of sand or gravel that slopes gently northwards and may represent an interglacial deposit.

In this township six wells, 30 to 90 feet deep, obtain soft water from aquifers thought to be in the bedrock. Five of these wells in the SE.$\frac{1}{4}$, section 2, SW.$\frac{1}{4}$, section 2, SW.$\frac{1}{4}$, section 3, NE.$\frac{1}{4}$, section 20, and SW.$\frac{1}{4}$, section 30, obtain soft water from an aquifer that is about 1,990 to 2,010 feet above sea-level. This aquifer appears to be close to the bedrock-glacial drift contact as several wells in this township, thought to be wholly in drift, obtain hard water from aquifers that are at about the same elevation. For example, two wells on the eastern half of section 20 are 40 feet deep. The water in the northern well is reported as soft and salty, whereas the water in the southern well is reported as hard. If the waters are accurately described, the explanation seems to be that the northern well is in bedrock and the southern well is in unconsolidated deposits in a pre-glacial valley cut in the Marine Shale.

The water supply at all the farms is sufficient for domestic needs, but on seven farms the supply is inadequate for stock requirements. The water in all the bedrock wells and in a drift well, 20 feet deep, on section 6 is soft. In three wells, 35 to 90 feet deep, the water is "alkaline", but

in only the deepest of these wells is the water too "alkaline" for drinking. The water in the remaining wells is hard, but is not "alkaline".

There are no natural supplies of surface water and no dams or dugouts are reported in use at the farms.

Township 25, Range 2

This township is mainly a rolling plain that slopes gently westwards from elevations of a little over 2,050 feet above sea-level near the southern half of the eastern boundary to a little less than 1,900 feet above sea-level in the southwest corner. The western half of the township is cut by a shallow, northward-trending valley and in the southeastern part a low, narrow, sinuous, gravel ridge extends northwards for about 1½ miles into the township from its southern boundary.

Boulder clay covers approximately 9 square miles of the township lying to the east of a line that passes in a generally northwest direction from the southeast corner of section 12 to the centre of the northern boundary of section 33. Boulder clay also underlies the greater parts of sections 18 and 19. A belt of glacial lake sand extends eastward into the southwest part of the township and underlies most of the western halves of sections 6 and 7. Moraine mantles 24 square miles in the central part of the township.

The aquifers in this township are not clearly defined, but the deep aquifers appear to slope westward. In the till-covered area in the northeast four wells, 25 to 65 feet deep, obtain water from an aquifer that is about 1,985 to 1,965 feet above sea-level. In the moraine-covered part of the township seven wells, 32 to 105 feet deep, obtain water from aquifers that lie at 1,916 to 1,928 feet above sea-level on the east and at about 1,877 to 1,853 feet above sea-level on the west.

Two wells in boulder clay on the SW.$\frac{1}{4}$, section 19, and the SW.$\frac{1}{4}$, section 6, tap aquifers at 1,820 and 1,865 feet above sea-level, respectively.

The quality of the water also varies greatly. In four wells, on sections 10 and 12, 18 to 27 feet deep, the water is soft, In four other wells, 36 to 90 feet deep, the water is "alkaline", but fit for drinking, whereas in a 35-foot well, on section 2, the water is too laxative for use. In the 18-foot well on the NE.$\frac{1}{4}$, section 10, a little coal was reported, but it appears to be in the glacial drift as a well 56 feet deep on the same section did not encounter any coal.

The supply of ground water in this township is generally sufficient for local needs, although at three farms in the southern part of the township the supply is small.

Township 25, Range 3

Topographical relief in this township is very low. From the northeast corner where the ground surface is a little over 1,950 feet above sea-level the land slopes southwestwards towards a broad, low, flat plain that is slightly below 1,900 feet above sea-level.

Glacial lake sands and gravel underlie the southern third of the township and extend north for a short distance, where they merge into glacial lake clays that occupy an oval-shaped area of 10 square miles. This area is about three-fourths of a mile wide at the western boundary of the township, nearly 3 miles wide at the centre line of the township, and terminates just west of the eastern boundary. About 1$\frac{1}{2}$ square miles in sections 25, 35, and 36 are underlain by moraine. Boulder clay underlies the remaining 8 square miles in the northern and eastern parts of the township.

Well records show that the thickness of the sand and sandy clay in the southern third of the township ranges from about 3 feet in the SW.$\frac{1}{4}$, section 1, to at least 20 feet in the western part. Several wells, 12 to 30 feet deep, obtain water from the glacial lake sands, but a number of the wells have passed through them to the underlying boulder clay. The glacial lake clays in this township appear to contain little water, and most of the wells in this area have passed into the underlying boulder clay.

In the area underlain by glacial lake clay there are two flowing wells, 120 and 160 feet deep. These tap two aquifers in the boulder clay which lie at about 1,730 and 1,775 feet above sea-level. The water from the 160-foot well is intermediate in composition between a typical bedrock water and a typical water from the glacial drift. When the well was visited in 1935 the water was flowing at the rate of about 2 gallons a minute. This aquifer is probably at the base of the glacial drift. The flow in the 120-foot deep well was 4 gallons a minute in 1928, but in 1935 had declined to $\frac{1}{2}$ gallon a minute, which decline may have been caused by the sanding-up of the well. As no other wells in the vicinity reached either of these aquifers, the limit of the area of artesian flow is not known. The area of artesian flow probably does not extend more than a few miles south of the wells.

Five wells in this township are thought to obtain water from aquifers in the bedrock. An aquifer that lies between 1,582 and 1,605 feet above sea-level is tapped by two wells in the NW.$\frac{1}{4}$, section 6, and NW.$\frac{1}{4}$, section 32, 300 and 335 feet deep, respectively. No other wells in this township have reached this aquifer, but it probably underlies at least the western half of the township. Two wells, 137 and 210 feet deep, on section 30 obtain soft water from aquifers in the bedrock that are about

1,761 and 1,710 feet above sea-level. The remaining bedrock well, on the NE.$\frac{1}{4}$, section 12, 61 feet deep, obtains soft water from an aquifer that is about 1,839 feet above sea-level. The extents of the three last mentioned aquifers are not known.

The water from the five bedrock wells and from two shallow wells in sections 1 and 2 is soft, and in the 300-foot bedrock well, in section 6, the water is laxative. In five drift wells, 30 to 140 feet deep, the water is "alkaline", and in four of these wells is too "alkaline" for drinking.

Four of the bedrock wells yield large supplies of water and the fifth well originally yielded a large supply, but its supply is now insufficient due to the blocking of the pipe by sand. Several of the drift wells also yield large supplies of water.

Township 26, Range 1

This township is very flat. Most of the surface is between 2,000 and 2,050 feet above sea-level, but in the northern third of the township an area of about 4$\frac{1}{2}$ square miles lies over 2,050 feet above sea-level.

Glacial outwash sands and gravels underlie two small areas in the eastern half of sections 1 and 12. A belt of boulder clay with an average width of a little less than 2 miles borders the eastern boundary of the township and another belt of boulder clay less than $\frac{1}{2}$ mile in average width extends for about 3 miles northwards from the southwest corner of the township. Moraine underlies approximately 24 square miles in the central part of the township, in a belt 4 miles wide.

In the southern half of the township all the wells except two are less than 100 feet deep. In the northern half a large proportion of the wells are over 100 feet deep, and four are over 200 feet. The glacial drift in the northern half of

this township appears to be very thick, as two wells, 483 feet and 401 feet deep, contain hard, iron-bearing water that is quite unlike any soft water found in the bedrock.

Three wells, 250, 240, and 235 feet deep, on sections 23, 26, and 29, respectively, obtain water from an aquifer that is about 1,790 to 1,810 feet above sea-level.

Most of the wells over 30 feet deep in this township obtain water from three aquifers that lie at approximately 1,925, 1,950, and 1,975 feet above sea-level. The aquifers are not continuous over the township, however, as several wells in the northern half have passed below them to deeper aquifers.

The well 731 feet deep, on section 35, obtains water from an aquifer in the bedrock that is about 1,303 feet above sea-level. The water is highly mineralized and salty. This aquifer may be the same as that which supplies soft water, which can be used for all purposes except irrigation, to a well 667 feet deep, located 11 miles to the west in the SE.$\frac{1}{4}$, sec. 36, tp. 26, range 3. If so, the aquifer probably underlies the entire township, and the quality of the water probably improves westwards from the well on section 35.

In view of the great depth of many of the wells in this township the quality of the well water is unusually good. In three shallow wells in the drift, 11 to 15 feet deep, the water is soft. In a well 401 feet deep, on section 21, the water is reported as sulphurous. In two wells 78 and 87 feet deep, on sections 17 and 22, the water is laxative and is too "alkaline" for drinking.

The supply of water at all the farms except one is adequate for local needs. No dry holes were reported.

Township 26, Range 2

This township is a plain that slopes very gently westwards and southwestwards from a little over 2,050 feet above sea-level in the northeast corner to a little less than 1,950 feet above sea-level on the western border. A belt of boulder clay with an average width of about 4 miles crosses the township in a northwesterly direction. Moraine covers an area of about 4 square miles in the northeast corner of the township and about 7 square miles in the southwest corner.

The depth of all the wells except two in the glacial drift of this township ranges from 15 to 56 feet. These two wells are located near the western boundary, in sections 7 and 30, are 126 and 100 feet deep, respectively, and are fed by an aquifer that is about 1,920 to 1,925 feet above sea-level. The well on section 7 yields a large supply of water that can be used for all purposes, but the well on section 30 yields only a small supply of "alkaline" water that is unfit for drinking. The well on section 30 is probably near the northern limit of the aquifer, where circulation of water is slow and the sediment is fine grained.

In the eastern half of the township aquifers that are about 1,927 to 1,971 feet above sea-level supply seven wells, 29 to 80 feet deep. In the western half of the township the aquifers decrease in elevation, and the wells tapping them are deeper. Three dry holes 60 to 132 feet deep were put down on the SE.$\frac{1}{4}$, section 30.

A well 100 feet deep, on section 19, is thought to obtain water from an aquifer in the bedrock that is about 1,850 feet above sea-level. This aquifer probably underlies the northern half of the township. A bedrock aquifer that is about 1,280 feet above sea-level was not tapped by any wells in this township, but it probably underlies at least the northern part of the township.

In section 24 two drift wells, 20 and 25 feet deep, and a bedrock well in section 19, yield soft water. In sections 13 and 30 two drift wells, 40 and 100 feet deep, respectively, yield water that is too "alkaline" for drinking. The water in the remaining wells is hard, but can be used for all purposes.

On all farms but one the water supplies are adequate for local needs, but on this farm water for drinking must be hauled.

Township 26, Range 3

This township is very flat. In the southeast the land surface rises to slightly over 1,950 feet above sea-level, but elsewhere the surface is between 1,900 and 1,950 feet above sea-level. Boulder clay covers about 17 square miles of this township. It underlies the southwestern quarter of the township and extends eastward to within three-fourths of a mile of its eastern boundary and northward to within $1\frac{3}{4}$ miles of its northern boundary. It also underlies a triangular area of approximately 2 square miles in the northeastern and northern parts of the township, the southern boundary of which area passes from about the centre of the eastern boundary of section 25 to the northwest corner of section 33. Moraine mantles the remaining 16 square miles of the township.

All the producing wells in the glacial drift in this township except one are less than 40 feet deep. Most of the deeper wells do not obtain supplies of good water. Two wells, 64 and 160 feet deep, in section 12, and a 64-foot well in section 30, failed to obtain water. A well 48 feet deep, in section 13, and one 27 feet deep, in section 7, encountered water that was too highly mineralized for use. The supplies of water in four wells, 13 to 20 feet deep, are small, being either

insufficient or barely sufficient for local needs. In another 19-foot well the water was too "alkaline" for drinking.

Four wells, 270 to 667 feet deep, obtain water from aquifers in the bedrock. An aquifer that is about 1,283 feet above sea-level supplies a well 657 feet deep, on section 36, with a large supply of soft water. This aquifer is probably in the Belly River formation, and probably underlies at least the northern part of the township. An aquifer that is about 1,385 to 1,390 feet above sea-level, and that probably underlies the western two-thirds of the township and extends into the township north, supplies two wells, 530 and 540 feet deep, located in sections 17 and 19. The well on section 17 is plugged with sand, but the well on section 19 yields a large supply of soft water.

An aquifer that is about 1,655 feet above sea-level supplies a well 270 feet deep, on section 6. This aquifer probably does not extend far north of the southern third of this township as the wells on sections 17 and 19, 530 and 540 feet deep, respectively, did not obtain water at about 1,655 feet above sea-level.

Township 27, Range 1

This township is flat to gently rolling. Most of the ground surface lies at approximately 2,050 feet above sea-level. There are low areas in the southern half of sections 17 and 18, and of sections 25 and 26, that are marshy in wet seasons. Glacial outwash sands and gravels underlie about one-quarter square mile in the northeast corner of the township. Boulder clay mantles an area of about 12 square miles in the east. Moraine covers about 24 square miles in the central and western part of the township.

An aquifer that is about 1,741 to 1,760 feet above sea-level supplies three wells, 270, 296 and 300 feet deep, on

sections 1, 2, and 8, respectively. The water in the wells is "alkaline", and in two of the wells the water is no longer used. It does not seem advisable to attempt to reach this aquifer elsewhere in the township. An aquifer that is about 1,875 feet above sea-level supplies two wells, 168 and 180 feet deep, in the western halves of sections 6 and 19, respectively, with large supplies of hard water. This aquifer has not been tapped elsewhere in this township.

Two wells, 103 and 140 feet deep, on sections 2 and 6, respectively, obtained water, which can be used only for stock, from an aquifer that is about 1,925 to 1,932 feet above sea-level. Aquifers that are about 1,943 to 1,964 feet above sea-level supply six wells, 81 to 120 feet deep, with water. These wells are scattered and it is probable that the aquifers do not form a continuous water-bearing horizon.

An aquifer that is about 1,966 to 1,983 feet above sea-level supplies thirteen wells, 55 to 114 feet deep, in the eastern half of the township. This aquifer does not appear to extend into sections 31 to 36. An aquifer that is about 1,994 to 2,020 feet above sea-level supplies twelve wells, 35 to 72 feet deep, in the northern third of the township. The limits of the last two aquifers mentioned cannot be exactly defined, but their distribution seems to be about as given.

Very few logs of the wells are available, but three wells in the northern third of the township are known to have passed through clay for 55 to 80 feet from the surface. One well in section 35 obtained soft water from an aquifer, 2,014 feet above sea-level, that is thought to be in the bedrock. If this is the case the bedrock there must be higher in elevation than in the bottoms of several adjacent wells that obtain hard water from the glacial drift. Two wells, 17 and 35 feet deep, obtain soft water from aquifers in the glacial drift. In seven other wells,

54 to 140 feet deep, the water is too "alkaline" for drinking. In the remaining wells the water is hard and can be used for all purposes.

The supply of water in all the wells except one is sufficient for local use, and in the wells on the SW.$\frac{1}{4}$, section 28, and the NE.$\frac{1}{4}$, section 29, the supply is very large.

Township 27, Range 2

This township is gently rolling country. Elevations range from about 1,950 feet to a little over 2,100 feet above sea-level. A low, northwesterly-trending ridge over 2,100 feet above sea-level extends for about 3 miles through the eastern half of the township. Moraine underlies the surface east of a line that extends in a generally northwest direction from the southeast corner of section 3 to the northwest corner of the township. West of this line boulder clay underlies the surface.

All the wells in the glacial drift that are over 100 feet deep are in the northeastern part of the township. An aquifer about 1,710 feet above sea-level supplies a well 335 feet deep on the NE.$\frac{1}{4}$, section 24, and an aquifer about 1,790 feet above sea-level supplies the well 280 feet deep on the SW.$\frac{1}{4}$, section 24. These aquifers were not tapped by other wells in this township, nor in adjacent townships. Two wells, 183 and 205 feet deep, in sections 27 and 28, respectively, tap an aquifer that is about 1,855 to 1,867 feet above sea-level. Four wells, 26 to 60 feet deep, in sections 5 and 6 reach an aquifer that is about 1,890 to 1,925 feet above sea-level. In section 22, an aquifer that is about 2,016 to 2,035 feet above sea-level supplies water to three wells 60 to 74 feet deep. There appear to be other aquifers in this township, but they cannot be traced continuously over considerable distances, and they are probably small pockets of sand or gravel in the glacial drift.

Aquifers in the bedrock are thought to supply four wells, 47 to 318 feet deep, with soft water. The aquifer that is tapped by the well 47 feet deep in section 9, and by the well 126 feet deep in section 15, is about 1,931 to 1,941 feet above sea-level. It is not tapped by any other wells in this township nor in adjacent townships. An aquifer about 1,835 feet above sea-level is tapped by a well in section 12. This aquifer was not tapped by other wells in this township, but it probably extends southeastwards beyond the township, as a well on the SW.$\frac{1}{4}$, sec.28, tp. 26, range 1, obtained soft water at about 1,810 feet above sea-level. An aquifer about 1,777 feet above sea-level supplies a well 318 feet deep on section 21, but was not tapped elsewhere in this township.

In the northeast part of the township the bedrock appears to have been deeply eroded, for the wells in this part are deep and appear to be in drift, as they yield water that is hard.

Township 27, Range 3

Over most of this township the land surface is very flat and does not rise much over 1,950 feet above sea-level except in the northeast corner, where it is a little over 2,000 feet above sea-level. The upper part of the depression in which the valley of Brightwater creek lies extends for a few miles southwards into the township. West of a slightly sinuous line that runs north and west from the southeast corner of section 4 to the northwest corner of section 30 the country is underlain by moraine. Boulder clay mantles that part of the township east of this line.

The wells in the boulder clay of this township are all less than 50 feet deep, and in the moraine-covered area the wells are less than 20 feet deep.

There are not enough deep wells in the glacial drift to outline aquifers over any considerable distances. An aquifer about

1,900 to 1,910 feet above sea-level was tapped by two wells, 45 and 40 feet deep, on the SW.$\frac{1}{4}$'s, sections 3 and 24, respectively. Three wells, 30 and 40 feet deep, on sections 24 and 25 obtain water from an aquifer about 1,910 to 1,935 feet above sea-level. In the well on the SE.$\frac{1}{4}$, section 24, the supply of water is very large, but the water is used only for stock. The westward continuation of these aquifers is not known, as no wells in the western half of the township were deep enough to reach them.

Three wells, 403 to 567 feet deep, have tapped aquifers in the bedrock that contain soft water. The well, 496 feet deep, on section 33, and the 560-foot well on section 9, derive soft water from an aquifer about 1,383 to 1,406 feet above sea-level. This aquifer probably underlies most of the township, as two wells in the western half of township 26, range 3, obtained water from it. It may not extend into the southeastern part of the township, however, as a well on sec. 36, tp. 26, range 3, did not obtain water at or near 1,400 feet above sea-level.

The well 406 feet deep, in section 32, obtained soft water from an aquifer about 1,493 feet above sea-level. This aquifer does not appear to extend far east of section 32, as it was not encountered in the deep well on section 33, and it apparently does not underlie the southeastern quarter as the well on section 9 did not obtain water at or near 1,493 feet above sea-level.

An area of flowing artesian wells in bedrock occupies a large part of the northern half of this township. The exact limits of this area are not known, but the direction of the hydraulic gradient or fall in the water-level in the wells is known to be southwards, and the water did not rise to the surface in the well on section 9.

The water supply from wells in the glacial drift in this township is less satisfactory than in the other townships in this municipality. In six wells the water is not used for domestic purposes and in ten wells the supply is insufficient either for the house or the stock. In two shallow wells the water is soft.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF WILLNER, NO. 253, SASKATCHEWAN

West of 3rd mer. Township / Range	25 / 1	25 / 2	25 / 3	26 / 1	26 / 2	26 / 3	27 / 1	27 / 2	27 / 3	Total No. in municipality
Total No. of Wells in Township	45	28	36	41	22	26	47	40	34	319
No. of wells in bedrock	6	0	5	1	1	4	1	4	3	25
No. of wells in glacial drift	39	28	31	40	21	22	46	36	31	294
No. of wells in alluvium	0	0	0	0	0	0	0	0	0	0
Permanency of Water Supply										
No. with permanent supply	45	28	35	39	19	22	47	39	28	302
No. with intermittent supply	0	0	1	2	0	1	0	1	1	6
No. dry holes	0	0	0	0	3	3	0	0	5	11
Types of Wells										
No. of flowing artesian wells	0	0	2	0	0	0	0	0	2	4
No. of non-flowing artesian wells	26	16	19	28	10	6	28	22	4	159
No. of non-artesian wells	19	12	15	13	9	17	19	18	23	145
Quality of Water										
No. with hard water	38	26	27	38	20	18	43	33	24	267
No. with soft water	7	2	9	3	2	5	4	7	5	41
No. with salty water	4	11	12	12	0	0	0	0	0	39
No. with "alkaline" water	1	0	0	2	6	1	13	9	6	38
Depths of Wells										
No. from 0 to 50 feet deep	35	13	22	15	14	20	14	21	31	185
No. from 51 to 100 feet deep	10	13	3	17	5	2	22	11	0	83
No. from 101 to 150 feet deep	0	2	6	2	3	0	6	2	0	21
No. from 151 to 200 feet deep	0	0	2	1	0	0	2	2	0	7
No. from 201 to 500 feet deep	0	0	3	5	0	1	3	4	2	18
No. from 501 to 1,000 feet deep	0	0	0	1	0	3	0	0	1	5
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	39	26	31	31	17	19	42	29	23	257
No. not usable for domestic purposes	6	2	5	10	2	4	5	11	6	51
No. usable for stock	43	27	34	39	19	21	47	38	29	297
No. not usable for stock	2	1	2	2	0	2	0	2	0	11
Sufficiency of Water Supply										
No. sufficient for domestic needs	45	28	35	40	18	20	44	39	27	296
No. insufficient for domestic needs	0	0	1	1	1	3	3	1	2	12
No. sufficient for stock needs	38	24	30	33	17	15	42	37	21	257
No. insufficient for stock needs	7	4	6	8	2	8	5	3	8	51

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 Willner, No. 253, Saskatchewan

LOCATION						Depth of Well Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of water
No.	qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alka-linity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	NW.	22	25	3	3rd	160	1,580	540	240	300	22	450	40	79	845	678	1,717	72		165		193	1,251	36		*1 ?
2	NW.	32	25	3	3	335	1,900	20			59	570	10	7	886	952	2,010	18		18		566	1,311	97		*2
3	NE.	25	2o	1	3	178	3,600	1,800	1,600	200	75	475	160	277	1,910	986	3,285	286		159	600		2,116	124		*1
4	SE.	3o	2o	1	3	80	5,840	2,700	2,700		136	400	630	558	3,494	1,064	5,439	400	987		1,663		2,165	224		*1
5	NE.	35	2o	1	3	731	5,811														$MgCl_2$ (5)	(2)	(4)	(1)	(3)	*2
o	SE.	9	27	3	3	5o0	1,800	15			101	590	16	7	779	933	1,940	18		15		589	1,153	167		*2

Water samples indicated thus, *1, are from glacial drift or other unconsolidated deposits.
Water samples indicated thus, *2, are from bedrock, Marine Shale Series.
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 No. 5 by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The composition of water in the glacial drift varies very widely. The variations in the nature of the original material from which the glacial drift was derived, in the processes that have acted upon the material during transportation and after deposition, and in the nature of the circulation of the ground water, are all reflected in the composition of the water.

The water of springs in the glacial drift is usually much less highly mineralized than is the water in the drift wells. The water of the deeper wells and of wells in low, flat areas where ground water circulation is slow is generally more highly mineralized than the water in shallow wells located on slopes where circulation of water is probably more rapid than on the plains.

The size of grain of the material that forms the aquifer usually influences the nature of the water in the aquifer. Coarse-grained sediments such as gravel permit rapid passage of water, and most gravels are largely made up of hard, resistant rocks that are comparatively insoluble in water. Fine sand that contains a certain proportion of clay offers a much larger surface to the percolating ground water, and the minerals of clay are usually more soluble in water than are the minerals of the coarser sediments.

Most waters from the glacial drift contain a large proportion of sulphate of calcium ($CaSO_4$) and sulphate of magnesium ($MgSO_4$). Both these salts give permanent hardness to water. Calcium sulphate is tasteless, but magnesium sulphate makes water both bitter and laxative. Calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$) are usually present in ground water from the glacial drift in smaller amounts than are the corresponding sulphates.

Sodium sulphate (Na_2SO_4) is laxative, but it is not as bitter as magnesium sulphate. It is present in most waters in the glacial drift, and in many such waters it is the predominant salt.

Sodium chloride (NaCl) is present in most ground waters, but in waters from the glacial drift it is very seldom present in amounts sufficient to give the water a salty taste. Calcium chloride ($CaCl_2$) is very occasionally present in water from the glacial drift. It makes water permanently hard.

Sodium carbonate (Na_2CO_3) is present in some ground water from the glacial drift, but in most of these waters the amount is not sufficient to affect the taste or the use of the water. Sodium carbonate is the most detrimental constituent in ground water that is to be used for irrigation. Most ground waters from the glacial drift contain calcium sulphate that tends to counteract the detrimental effect of sodium carbonate on plant growth.

The upper limit of the total dissolved solids in water that is fit to drink varies with the nature of the solids, the length of time that the water has been used for drinking, and the effect that certain constituents have on individual users. The upper limit of 1,000 parts per million is often exceeded with impunity in water from the glacial drift. If the water contains much over 2,000 parts per million, however, it is generally advisable to attempt to secure a less highly mineralized source of drinking water. The upper limit of dissolved solids in water for stock use is generally considered to be about twice that of water for drinking, and a mildly laxative water is often used to advantage for stock, especially with dry food.

As regards the laxative action of ground water, the full purgative dose of dried sodium sulphate and of dried magnesium sulphate is about 240 grains. A water that contains 1,000 parts per million contains 70 grains per gallon of these salts. Analysis No. 4 represents water that is extremely hard and decidedly laxative, due to the high concentration of the sulphates of sodium and magnesium. It contains so large a proportion of dissolved solids

that its use even for stock is not recommended. Water No. 3 is extremely hard, and is decidedly laxative, although it is less laxative than water No. 4, as it contains much less magnesium sulphate.

Water from the Bedrock

Waters Nos. 2, 5, and 6 are from the bedrock. Waters 2 and 6 are very soft and represent a type that is very common in the Marine Shale series, and in which the relative abundance of sodium sulphate, sodium carbonate, and sodium chloride is in the order given. The total solids in these two waters, 1,800 to 1,900 feet per million, are slightly more than the average in the Darmody-Riverhurst artesian area to the south. The waters are slightly laxative, due to the content of sodium sulphate in solution, but can be drunk without ill effects by most persons who are accustomed to their use. The sodium carbonate that they contain makes them unsuitable for irrigation, and the presence of a large proportion of sodium sulphate (white alkali) and the absence of calcium sulphate also tend to make them detrimental to plant growth.

Water No. 5 represents a type that is thought to occur near the margins of artesian areas where circulation of the water is slow and where there is little admixture with surface water. These waters contain a large proportion of dissolved solids, most of which is sodium chloride. Water No. 5 is hard, due to the calcium chloride it contains. It is salty and quite unfit for irrigation, and its continuous use for stock is not recommended.

Water No. 1 is intermediate between the typical water in the glacial drift and in the bedrock. It contains sodium sulphate, sodium carbonate, and sodium chloride, but it is quite hard and the proportion of sodium chloride it contains is unusually small for a bedrock water. This water is probably largely derived from an aquifer in the lower part of the glacial drift near the contact with the bedrock.

WELL RECORDS—Rural Municipality of WILLNER, NO.253, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	~~Tp.~~ Twp	~~Rge.~~ Rge	~~Mer.~~ Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	1	SE.	1	25	1	3	Bored	90	2,080			90	1,990	Glacial drift	Hard, "alkaline"	43	S	Sufficient supply; poor quality.
	2	NE.	1	"	"	"	Bored	37	2,013	− 11	2,002	37	2,976	Glacial sand	Hard, stagnant	43		Also a 37-foot well, used for stock; hard and somewhat stagnant.
	3	SE.	2	"	"	"	Dug	90	2,080	− 87	1,993	87	1,993	Bearpaw	Soft	44	D, S	Insufficient; supplies house and 12 head stock only.
	4	SW.	2	"	"	"	Bored	60	2,060	− 55	2,005	55	2,005	Bearpaw	Soft	43	D, S	Ample supply for 20 head stock.
	5	SW.	3	"	"	"	Bored	52	2,060	− 49	2,011	52	2,008	Bearpaw	Soft	42	D, S	Ample supply.
	6	NE.	4	"	"	"	Bored	42	2,094	− 39	2,055	42	2,052	Glacial drift				
	7	NW.	5	"	"	"	Bored	24	2,075	− 21	2,054	24	2,051	Glacial drift	Hard	42	D, S	Ample for 30 head stock.
	8	SW.	6	"	"	"	Dug	20	2,065	− 16	2,049	20	2,045	Glacial drift	Soft	42	D, S	Ample for 17 head stock.
	9	NW.	6	"	"	"	Bored	40	2,070	− 30	2,040	40	2,030	Glacial sand	Hard	43	D, S	Ample for 15 head stock.
	10	SW.	8	"	"	"	Dug	21	2,080	− 10	2,070	21	2,059	Glacial drift	Hard	42	D, S	Supply ample.
	11	NE.	9	"	"	"	Bored	35	2,096	− 29	2,067	35	2,061	Glacial drift	Hard, "alkaline"		D	More than sufficient for house use; 35-foot well for stock.
	12	SE.	12	"	"	"	Bored	41	2,050	− 17	2,033	41	2,009	Glacial drift	Hard	43		
	13	NE.	13	"	"	"	Bored	30	2,055	− 26	2,029	30	2,025	Glacial quicksand	Hard, slightly "alkaline"	43	D, S	Ample for 11 head stock; supplies neighbours.
	14	SE.	15	"	"	"	Bored	50	2,090	− 42	2,048	50	2,040	Glacial drift	Hard, iron	43	D, S	Sufficient for 11 head stock.
	15	SW.	16	"	"	"	Bored	33	2,100	− 31	2,069	33	2,067	Glacial sand	Hard	43	D, S	Oversufficient for 6 head stock.
	16	NW.	16	"	"	"	Bored	40	2,115	− 30	2,085	40	2,075	Glacial drift	Hard	43	D, S	Sufficient ; waters 6 head stock.
	17	NE.	17	"	"	"	Bored	39	2,095	− 12	2,083	39	2,056	Glacial drift				
	18	NE.	19	"	"	"	Bored	45	2,055	− 30	2,025	45	2,010	Glacial drift	Hard	43	S	Sufficient supply.
	19	SE.	20	"	"	"	Bored	40	2,095	− 36	2,059	40	2,055	Glacial drift	Hard	43	D, S	Sufficient only for 16 head stock.
	20	NE.	20	"	"	"	Dug	40	2,090	− 32	2,058	40	2,050	Bearpaw	Soft, salty	43	D, S	Sufficient for 12 head stock.
	21	SE.	21	"	"	"	Dug	42	2,060	− 25	2,035	42	2,018	Glacial sand	Hard	43	D, S	More than sufficient for 20 head stock.
	22	NE.	21	"	"	"	Dug	30	2,055	− 20	2,035	30	2,025	Glacial drift	Hard		S	
	23	SE.	22	"	"	"	Bored	63	2,090	− 25	2,065	63	2,027	Glacial drift	Hard, "alkaline"	44	D, S	Sufficient supply.
	24	NE.	22	"	"	"	Drilled	60	2,065	− 35	2,030	60	2,005	Glacial sand	Hard	44	D, S	Oversufficient for 40 head stock; 30-foot household well.
	25	NW.	22	"	"	"	Bored	30	2,065	− 21	2,044	30	2,035	Glacial sand	Hard, iron	44	D, S	Oversufficient for 30 head stock.
	26	SE.	24	"	"	"	Bored	32	2,035	− 17	2,018	32	2,003	Glacial drift	Hard	42	N	Not used due to pollution; all water hauled.
	27	SW.	24	"	"	"	Bored	60	2,060	− 45	2,015	60	2,000	Bearpaw	Soft	43	S	Ample for 20 head stock; 28-foot well for domestic 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 WILLNER, NO. 253, 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
28	NE.	24	25	1	3	Bored	24	2,010	− 20	1,990	24	1,986	Glacial drift	Hard	43	D, S, I	Oversufficient for 12 head stock.
29	SE.	25	"	"	"	Bored	30	2,000	− 18	1,982	30	1,970	Glacial drift	Hard	44	D, S	Sufficient for 7 head stock; 45-foot well, stagnant, unused.
30	SW.	25	"	"	"	Drilled	65	2,020			65	1,955	Glacial drift	Hard, iron	42	D	Sufficient only for house use.
31	SE.	26	"	"	"	Bored	25	2,044	− 10	2,034	25	2,019	Glacial drift	Hard, slightly "alkaline"	43	D, S	Sufficient; waters 16 head stock.
32	NE.	28	"	"	"	Bored	31	2,060	− 20	2,040	31	2,029	Glacial drift		43		
33	NE.	28	"	"	"	Bored	32	2,053	− 22	2,031	32	2,021	Glacial sand	Hard	43	D, S	Oversufficient for 30 head stock.
34	NE.	28	"	"	"	Dug	22	2,054	− 17	2,037	22	2,032	Glacial drift	Hard	42	D, S	Abundant supply.
35	SE.	29	"	"	"	Bored	30	2,052	− 15	2,037	30	2,022	Glacial sand	Hard	44	D, S	Oversufficient supply.
36	SW.	30	"	"	"	Bored	30	2,040	− 20	2,020	30	2,010	Bearpaw	Soft	42	D, S	Sufficient for 8 head stock.
37	NE.	31	"	"	"	Bored	50	2,025	− 40	1,985	50	1,965	Glacial drift	Hard	42	D, S	Oversufficient supply; also 35-foot well.
38	SE.	34	"	"	"	Dug	56	2,030	− 52	1,978	56	1,974	Glacial sand and gravel	Slightly hard	42	D, S	
39	SE.	36	"	"	"	Bored	22	2,000	− 9	1,991	22	1,978	Glacial drift	Hard, stagnant	43	D	
1	NE.	2	25	2	3	Bored	35	2,040	− 15	2,025	35	2,005	Glacial drift	Hard, iron, "alkaline"	43	N	Not suitable for use; too "alkaline".
2	SE.	4	"	"	"	Bored	90	1,970	− 62	1,908	90	1,880	Glacial drift	Hard, "alkaline"	43	D, S	Oversufficient for 30 head stock.
3	SE.	5	"	"	"	Bored	65	1,970	− 56	1,914	65	1,905	Glacial drift	Hard, iron	43	D, S	Insufficient; waters only 6 head stock.
4	NE.	5	"	"	"	Bored	59	1,975	− 39	1,936	59	1,916	Glacial sand	Hard, iron	42	D, S	Sufficient for 12 head stock.
5	SW.	6	"	"	"	Bored	32	1,907	− 16	1,891	32	1,865	Glacial drift	Hard	43	D, S	Oversufficient supply.
6	SW.	10	"	"	"	Bored	22	2,010	− 19	1,991	22	1,988	Glacial drift		43	S	
7	NE.	10	"	"	"	Bored	18	1,955	− 9	1,946	18	1,937	Glacial drift	Soft, dark sediment	42	D, S	Small supply; a little coal in well.
8	NE.	10	"	"	"	Bored	56	1,980	− 26	1,954	56	1,924	Glacial drift	Hard, iron, "alkaline"	43	D, S	Sufficient for 24 head stock; 18-foot well yields small supply soft water.
9	SW.	12	"	"	"	Bored	27	2,048	− 21	2,027	27	2,021	Glacial sand	Soft	42	D, S	Sufficient for 13 head stock; also 20-foot similar well.
10	NE.	14	"	"	"	Bored	25	2,010	− 13	1,997	25	1,985	Glacial drift	Hard, slightly "alkaline"		N	Also 80-foot well of hard water; sufficient for 30 head stock.
11	NW.	14	"	"	"	Bored	90	1,970	− 60	1,910	90	1,880	Glacial drift	Hard, iron, "alkaline"	44	D, S	Sufficient only for 20 head stock.
12	SE.	16	"	"	"	Bored	80	2,000	− 60	1,940	80	1,920	Glacial drift	Hard	44	D, S	Sufficient for 30 head stock.
13	NE.	17	"	"	"	Bored	10	1,950	− 8	1,942	10	1,940	Glacial drift	Hard	43	D, S	Insufficient supply; 18-foot well yields fair supply.
14	SW.	19	"	"	"	Bordd	110	1,930	− 33	1,897	110	1,820	Glacial drift	Hard		D, S	Ample supply.

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

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

WELL RECORDS—Rural Municipality of WILLNER, NO. 253, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
15	NE.	19	25	2	3	Bored	63	1,940	− 44	1,896	63	1,877	Glacial drift	Hard, iron, slightly "alkaline"	43	D, S	Oversufficient for 30 head stock.
16	SW.	20	"	"	"	Bored	105	1,958	−100	1,858	105	1,853	Glacial drift	Hard	44	D, S	Sufficient supply.
17	NE.	22	"	"	"	Bored	60	1,960	− 29	1,931	60	1,900	Glacial drift	Hard, iron, slightly "alkaline"	43	D, S	Sufficient for 20 head stock.
18	NE.	24	"	"	"	Bored	60	2,020	− 20	2,000	60	1,960	Glacial drift	Stagnant	41	S	
19	SE.	26	"	"	"	Bored	65	2,050	− 45	2,005	65	1,985	Glacial drift	Hard, iron, slightly "alkaline"		D, S	Sufficient for 10 head stock.
20	SE.	27	"	"	"	Bored	39	1,935	− 21	1,914	39	1,896	Glacial drift	Hard, "alkaline"		D, S	Sufficient for 35 head stock.
21	SW.	28	"	"	"	Bored	32	1,960	− 24	1,936	32	1,928	Glacial drift	Hard	42	D, S	Ample supply.
22	SW.	30	"	"	"	Bored	36	1,950	− 20	1,930	36	1,914	Glacial drift	Hard, "alkaline"		D, S	Sufficient for 6 head stock.
23	NE.	32	"	"	"	Bored	56	1,975	− 32	1,943	56	1,919	Glacial drift	Hard, slightly "alkaline"	43		Was used for all purposes.
24	NE.	36	"	"	"	Bored	40	2,005	− 22	1,983	40	1,965	Glacial drift	Hard, iron	42	D, S	Oversufficient for 20 head stock.
1	SW.	1	25	3	3	Bored	25	1,890	− 22	1,888	25	1,865	Glacial drift	Soft, slightly "alkaline"	43	D, S	Sufficient for 115 head stock; similar well caved in.
2	SW.	2	"	"	"	Bored	20	1,895	− 19	1,876	19	1,876	Glacial quicksand	Soft	45	N	Insufficient; intermittent.
3	NW.	2	"	"	"	Dug	22	1,900	− 15	1,885	22	1,878	Glacial quicksand	Hard, iron, slightly "alkaline"	42	D, S	Sufficient for 10 head stock.
4	NW.	3	"	"	"	Bored	20	1,878	− 19	1,859	20	1,858	Glacial drift	Hard		D, S	Insufficient for 20 head stock; some water hauled.
5	NE.	4	"	"	"	Dug	22	1,880	− 17	1,863	22	1,841	Glacial quicksand	Hard, iron	42	D, S	Oversufficient for 12 head stock.
6	SE.	6	"	"	"	Dug	15	1,890	− 10	1,880	15	1,875	Glacial sand	Hard, "alkaline"	42	D, S	Sufficient for 10 head stock; also 12-foot well; good supply; unused.
7	SW.	6	"	"	"	Bored	34	1,885	− 10	1,875	34	1,851	Glacial sand	Hard, soda	44	D, S	Sufficient only for 10 head stock.
8	NW.	6	"	"	"	Drilled	300	1,905	− 30	1,875	300	1,605	Bearpaw	Soft, soda	44	S	Abundant for 40 head stock; laxative; 15-foot well, fair supply.
9	SW.	9	"	"	"	Bored	20	1,880	− 19	1,861	20	1,860	Glacial drift	Hard	43		
10	NW.	9	"	"	"	Dug	15	1,875	− 12	1,863	15	1,860	Glacial sand	Hard, iron	42	D, S	Sufficient for 11 head stock; also 30-foot well, stagnant.
11	SE.	10	"	"	"	Bored	34	1,885	− 18	1,867	34	1,851	Glacial drift	Hard, iron, "alkaline"		D, S	Oversufficient for 9 head stock.
12	NE.	10	"	"	"	Bored	23	1,885	− 16	1,869	23	1,857	Glacial drift	Hard, iron			
13	NW.	11	"	"	"	Bored	104	1,906	− 90	1,816	104	1,802	Glacial drift	Hard, brown colour, "alkaline"	44	S	Good supply; water unfit for human consumption.
14	NW.	12	"	"	"	Bored	30	1,890	− 27	1,863	30	1,860	Glacial gravel	Hard, "alkaline"	42	S	Sufficient for 6 head stock.
15	NE.	12	"	"	"	Bored	61	1,910	− 6	1,904	61	1,839	Glacial drift	Soft	43	D, S	Oversufficient for 40 head stock.

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

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

WELL RECORDS—Rural Municipality of 4 WILLNER, No. 253, 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	SW.	13	25	3	3	Bored	132	1,896	− 1	1,895	132	1,764	Glacial drift	Hard, iron, slightly "alkaline"	43	D, S	Oversufficient for 30 head stock.
17	NW.	16	"	"	"	Bored	50	1,880	− 30	1,850	50	1,830	Glacial drift	Hard, "alkaline"	43	S	Sufficient for 5 head stock; laxative; 16-foot well yields good supply of soft water.
18	SE.	17	"	"	"	Dug	15	1,885	− 12	1,873	15	1,870	Glacial quicksand	Hard	43	D, S	Sufficient for 40 head stock.
19	NW.	20	"	"	"	Dug	20	1,900	− 16	1,884	20	1,880	Glacial sand	Hard, iron	42	D, S	Limited supply; several similar wells.
20	NW.	21	"	"	"	Bored	140	1,900	− 30	1,870	140	1,760	Glacial sand	Hard, "alkaline"	44	S	Abundant supply.
21	NW.	22	"	"	"	Drilled	160	1,890	+ 8	1,898	160	1,730	Glacial drift(?)	Hard, soda	43	D, S	Abundant supply; #.
22	NW.	23	"	"	"	Drilled	120	1,895	+ 8	1,903	120	1,775	Glacial sand	Hard, iron, soda	43	D, S	Abundant supply.
23	SE.	30	"	"	"	Bored	137	1,898	− 25	1,873	137	1,761	Bearpaw	Soft, soda	44	D, S	Oversufficient for 90 head stock.
24	NW.	30	"	"	"	Drilled	210	1,915	−195	1,720	210	1,705	Bearpaw	Soft, soda	44	D, S	Oversufficient for 30 head stock.
25	NW.	32	"	"	"	Drilled	335	1,917			335	1,582	Bearpaw	Soft	46	D, S	Insufficient; will water 2 head stock; originally very large supply, but piping is thought to be broken; #.
26	SE.	34	"	"	"	Bored	90	1,935	− 30	1,905	90	1,845	Glacial drift	Hard, slightly "alkaline"	43	D, S	Oversufficient for 16 head stock.
27	NW.	35	"	"	"	Bored	200	1,925	− 43	1,882	200	1,725	Glacial drift	Hard, iron, "alkaline"	44	D, S	Oversufficient for 15 head stock.
28	NE.	36	"	"	"	Bored	85	1,965	− 40	1,925	85	1,880	Glacial drift	Hard, iron, slightly "alkaline"	43	S	Sufficient for 50 head stock.
1	NE.	1	26	1	3	Bored	46	2,020	− 9	2,011	46	1,974	Glacial drift	Hard	44	S	Sufficient for 15 head stock; also 26-foot well.
2	NE.	1	"	"	"	Dug	29	2,018	− 26	1,992	29	1,989	Glacial drift	Hard		D, S	Insufficient for stock in winter.
3	NW.	2	"	"	"	Bored	90	2,010	− 76	1,934	90	1,920	Glacial drift	Hard, "alkaline"	43	D, S	Oversufficient for 15 head stock,
4	E.½	3	"	"	"	Bored	86	2,035	− 56	1,979	86	1,949	Glacial sand	Hard	44	D, S	Ample supply.

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

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

WELL RECORDS—Rural Municipality of WILLNER, NO. 253, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
5	SE.	5	26	1	3	Bored	50	2,070	− 40	1,990	50	1,980	Glacial drift	Hard, iron	43	D, S	Insufficient for 14 head stock.
6	NE.	6	"	"	"	Bored	34	2,010	− 20	1,990	34	1,976	Glacial drift			D, S	Also 50-foot well of stagnant water.
7	SE.	9	"	"	"	Bored	75	2,025	+ 33	1,992	75	1,950	Glacial drift				
8	NW.	10	"	"	"	Bored	28	2,020	− 12	2,008	28	1,992	Glacial drift	Hard			A second well in slough.
9	NE.	12	"	"	"	Bored	26	2,031	− 12	2,019	26	2,005	Glacial drift	Hard	42	D	Oversufficient for domestic needs; 10-foot well near slough for stock.
10	NE.	13	"	"	"	Bored	110	2,040	− 80	1,960	110	1,930	Glacial drift	Hard, "alkaline"	42	D, S	Ample; waters 14 head stock.
11	NE.	14	"	"	"	Drilled	100	2,045	− 60	1,985	100	1,945	Glacial gravel	Hard, iron	44	D, S	Oversufficient for 25 head stock.
12	NW.	16	"	"	"	Bored	65	2,045	− 35	2,010	65	1,980	Glacial drift			N	Needs cleaning.
13	NW.	17	"	"	"	Bored	78	2,042	− 66	1,976	78	1,964	Glacial drift	Hard	43	S	Laxative; intermittent.
14	NE.	18	"	"	"	Bored	68	2,024	− 47	1,976	68	1,956	Glacial sand	Hard, slightly "alkaline"	43	D, S	Oversufficient for 29 head stock.
15	NW.	19	"	"	"	Bored	60	2,015	− 30	1,985	60	1,955	Glacial drift	Hard, iron, slightly "alkaline"	43	D, S	Oversufficient for 35 head stock.
16	SE.	20	"	"	"	Bored	40	2,030	− 37	1,993	40	1,990	Glacial sand	Hard, "alkaline"	43	D, S	Oversufficient for 25 head stock.
17	SW.	20	"	"	"	Bored	53	2,028	− 18	2,010	53	1,975	Glacial drift	Hard, stagnant	42	S	Was sufficient.
18	NE.	21	"	"	"	Drilled	401	2,040	− 60	1,980	401	1,639	Glacial drift	Iron, sulphur	45		Abundant supply.
19	NE.	22	"	"	"	Bored	87	2,055	− 62	1,993	87	1,968	Glacial drift	Hard, "alkaline"	44	S	Insufficient, intermittent supply.
20	SE.	23	"	"	"	Drilled	483	2,060	− 75	1,985	483	1,577	Glacial drift	Hard, iron	43	D, S	Oversufficient for 10 head stock.
21	SW.	23	"	"	"	Dug	12	2,050	− 7	2,043	12	2,038	Glacial drift	Soft			
22	NE.	23	"	"	"	Drilled	250	2,040	− 80	1,960	250	1,790	Glacial drift	Hard, slightly "alkaline"	45	D, S	Ample supply.
23	NE.	24	"	"	"	Bored	110	2,034	− 50	1,984	110	1,924	Glacial sand	Hard, "alkaline"	42	D, S	Ample supply; also 65-foot well unused.
24	NE.	25	"	"	"	Drilled	178	2,033	−100	1,943	178	1,865	Glacial drift	Hard, iron, "alkaline"		D, S	Ample supply for 20 head stock; #.
25	SE.	26	"	"	"	Drilled	240	2,034	− 70	1,964	240	1,794	Glacial drift	Hard, iron, "alkaline"		S	Ample supply.
26	NE.	27	"	"	"	Dug	11	2,050	− 7	2,043	11	2,039	Glacial drift	Soft	42	D, S	Not always sufficient for 6 head stock.
27	SE.	28	"	"	"	Bored	100	2,035	− 63	1,972	100	1,935	Glacial drift	Hard, iron, "alkaline"	44	D, S	Sufficient for 14 head stock.

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

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

WELL RECORDS—Rural Municipality of WILLNER, NO. 253, SASKATCHEWAN.

B 4-4
1860—10,000

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
28	SW.	23	26	1	3	Dug	15	2,040	- 9	2,031	15	2,025	Glacial drift	Soft	43	D, S	Sufficient supply.
29	SE.	29	"	"	"	Drilled	235	2,045	- 60	1,985	235	1,810	Glacial quick-sand	Hard, iron, "alkaline"	44	D, S	Oversufficient for 40 head stock.
30	SE.	31	"	"	"	Bored	98	2,060	- 83	1,977	98	1,962	Glacial drift	Hard		D, S	
31	SW.	31	"	"	"	Dug	96	2,045	- 93	1,952	96	1,949	Glacial drift	Hard, iron	44	D, S	Sufficient for 16 head stock; also 25-foot well of soft water.
32	NE.	33	"	"	"	Drilled	125	2,056	-105	1,951	125	1,931	Glacial sand and gravel	Hard, iron, slightly "alkaline"	43	D, S, I	Oversufficient for 20 head stock.
33	SE.	34	"	"	"	Dug	56	2,045	- 29	2,016	56	1,989	Glacial drift				
34	NE.	35	"	"	"	Drilled	731	2,034	-100	1,934	731	1,303	Belly River(?)	Hard, salty	46	S	Abundant supply; suitable only for stock needs; #.
35	SE.	36	"	"	"	Bored	80	2,030	- 40	1,990	80	1,950	Glacial drift	Hard, salty	40	S	Insufficient supply; drinking water hauled; #.
1	SE.	1	26	2	3	Bored	50	1,995	- 20	1,975	50	1,945	Glacial drift	Hard	43		
2	SW.	3	"	"	"	Bored	53	1,990	- 42	1,9[illegible]2	53	1,937	Glacial drift	Hard	43		
3	SW.	4	"	"	"	Bored	35	1,980	- 30	1,950	35	1,945	Glacial drift	Hard, iron, slightly "alkaline"	42	D, S	Sufficient for 20 head stock.
4	NW.	7	"	"	"	Bored	129	1,965	- 40	1,925	129	1,836	Glacial gravel and sand	Hard, iron, sola	44	D, S	Oversufficient for 40 head stock; 45 foot well, small supply, good water.
5	SW.	8	"	"	"	Bored	43	1,965	- 45	1,920	48	1,917	Glacial drift	Slightly hard	42	D, S	Sufficient for 10 head stock.
6	NE.	13	"	"	"	Bored	40	2,000	- 31	1,969	40	1,960	Glacial drift			S	
7	SW.	14	"	"	"	Bored	23	2,015	- 5	2,010	28	1,987	Glacial drift	Hard, slightly "alkaline"	42	D, S	Oversufficient for 30 head stock.
8	SE.	16	"	"	"	Dug	15	1,960	- 9	1,951	15	1,945	Glacial drift	Hard	43	D, S	Sufficient for 40 head stock.
9	NE.	19	"	"	"	Bored	100	1,950	- 5	1,945	100	1,850	Marine Shale	Soft	42	D, S	Sufficient for 25 head stock.
10	NW.	20	"	"	"	Bored	50	1,945	- 11	1,934	50	1,895	Glacial drift				
11	NE.	22	"	"	"	Dug	29	1,975	- 14	1,961	29	1,946	Glacial drift	Hard, slightly "alkaline"	42	D, S	Oversufficient for 25 head stock.
12	NE.	24	"	"	"	Bored	80	2,007	- 50	1,957	80	1,927	Glacial drift	Hard		D, S	Ample supply; 25-foot well, clear, soft water in gravel.
13	NE.	24	"	"	"	Bored	20	2,005	- 18	1,987	20	1,985	Glacial sand	Soft	42	D, S	Oversufficient for 20 head stock.
14	SE.	28	"	"	"	Dug	22	1,965	- 11	1,954	22	1,943	Glacial gravel	Hard, slightly "alkaline"	42	D, S	Sufficient for 75 head stock.
15	SE.	30	"	"	"	Bored	34	1,960	- 28	1,932	34	1,926	Glacial sand	Hard, iron	42	D, S	Sufficient for 20 head stock; 60-,117-,132-foot dry holes.
16	SW.	30	"	"	"	Bored	100	1,950	- 30	1,920	100	1,850	Glacial drift	Hard, iron, "alkaline"	44	S	Sufficient for 15 head stock; household water hauled.
17	SE.	34	"	"	"	Bored	34	2,005	- 31	1,974	34	1,971	Glacial drift	Hard, slightly "alkaline"	43	D, S	Sufficient for 14 head stock.

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

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

WELL RECORDS—Rural Municipality of WILLNER, NO. 253, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SE.	2	26	3	3	Dug	36	1,950	- 34	1,916	36	1,914	Glacial drift	Hard, iron		D, S	Sufficient for house and garden.
2	NE.	4	"	"	"	Dug	15	1,910	- 9	1,901	15	1,895	Glacial drift				
3	NW.	4	"	"	"	Dug	14	1,920	- 9	1,911	14	1,906	Glacial drift	Hard	42	D, S	Sufficient for 17 head stock; 14-foot well; stagnant.
4	SE.	6	"	"	"	Drilled	270	1,925	-260	1,665	270	1,655	Bearpaw	Soft			
5	NE.	7	"	"	"	Bored	27	1,945	- 23	1,922	27	1,918	Glacial sand			N	Intermittent supply; strongly laxative; 17-foot well waters 24 head stock.
6	NW.	9	"	"	"	Dug	13	1,940	- 11	1,929	13	1,927	Glacial drift	Hard, iron, slightly "alkaline"	42	D, S	Insufficient for 17 head stock.
7	SW.	12	"	"	"	Bored	160	1,960			160	1,800					Dry hole; also another dry hole 60 feet deep.
8	SE.	13	"	"	"	Bored	48	1,960	- 36	1,924	48	1,912	Glacial drift	Hard, "alkaline", black		N	Unusable.
9	SE.	14	"	"	"	Bored	19	1,950	- 16	1,934	19	1,931	Glacial drift		42	S	Sufficient supply.
10	SE.	15	"	"	"	Bored	90	1,925	- 75	1,850	90	1,835					
11	NE.	17	"	"	"	Drilled	540	1,925	- 25	1,900	540	1,385	Belly River(?)	Soft		N	Plugged with sand.
12	NW.	17	"	"	"	Dug	14	1,942	- 8	1,934	14	1,928	Glacial drift	Hard	44	D, S	Sufficient for 20 head stock.
13	NE.	19	"	"	"	Drilled	530	1,940	- 40	1,900	530	1,410	Belly River(?)	Soft	46	D, S	Oversufficient for 50 head stock.
14	NE.	21	"	"	"	Dug	24	1,945	- 17	1,928	24	1,921	Glacial blue sand	Hard	44	S	Just sufficient for 12 head stock; 23-foot well for drinking.
15	SW.	24	"	"	"	Dug	20	1,940	- 15	1,925	20	1,920	Glacial drift	Soft		D, S	Sufficient; waters 25 head stock.
16	SW.	29	"	"	"	Dug	16	1,935	- 13	1,922	16	1,919	Glacial drift	Hard	43	D, S	Barely sufficient for 10 head stock.
17	SE.	30	"	"	"	Bored	64										Several dry holes to 64 feet; bases in glacial drift.
18	NE.	32	"	"	"	Dug	11	1,945	- 8	1,937	11	1,934	Glacial drift	Soft	45	D	Insufficient supply; stock use dugout; second well with small supply; waters pigs.
19	NW.	32	"	"	"	Dug	14	1,945	- 11	1,934	14	1,931	Glacial drift	Hard	45	S	
20	NW.	34	"	"	"	Bored	32	1,945	- 16	1,929	32	1,913	Glacial drift	Hard, iron	44	D, S	Oversufficient for 10 head stock.
21	NW.	36	"	"	"	Dug	20	1,945	- 16	1,929	20	1,925	Glacial drift	Hard	45	D, S	Insufficient; waters only 4 head stock; water hauled.
22	SE.	36	"	"	"	Drilled	647	1,935	- 3	1,932	647	1,288	Belly River(?)	Soft	47	D, S	Abundant supply.
1	SE.	1	27	1	3	Drilled	270	2,030	- 60	1,970	270	1,760	Glacial gravel			N	Plugged; all water hauled.
2	SE.	2	"	"	"	Bored	103	2,035	- 98	1,937	103	1,932	Glacial sand	Hard, iron, slightly "alkaline"	43	S	Insufficient for 5 head stock; laxative; 25-foot well almost dry.
3	SE.	2	"	"	"	Drilled	296	2,037	- 50	1,987	296	1,741	Glacial sand	Hard, iron, "alkaline"	44	S	Casing broken; no supply at present; was laxative.
4	NE.	3	"	"	"	Dug	17	2,040	- 6	2,034	17	2,023	Glacial drift	Soft		D, S	Sufficient for house; 15-foot well in slough waters 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 WILLNER, NO. 253, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
5	SW.	3	27	1	3	Dug	10	2,052					Glacial drift				Intermittent supply; dry at present.
6	SE.	4	"	"	"	Bored	112	2,065	− 60	2,005	112	1,953	Glacial drift	Hard, slightly "alkaline"	42	D, S	Sufficient for 22 head stock.
7	SE.	5	"	"	"	Drilled	115	2,068	− 65	2,003	115	1,953	Glacial drift	Hard, iron, "alkaline"	41	D, S	Oversufficient for 15 head stock.
8	NE.	6	"	"	"	Drilled	140	2,065	− 90	1,975	140	1,925	Glacial drift	Hard, iron, slightly "alkaline"	40	S	Oversufficient for 35 head stock; 30-foot well for house use.
9	NW.	6	"	"	"	Drilled	168	2,056	− 80	1,976	168	1,888	Glacial drift	Hard, "alkaline"	43	D, S	Oversufficient for 20 head stock.
10	SW.	8	"	"	"	Drilled	300	2,060			300	1,760	Glacial drift	Hard, "alkaline"	44	D, S	Oversufficient for 10 head stock; water-level unknown.
11	SE.	9	"	"	"	Bored	80	2,043	− 34	2,009	81	1,962	Glacial sand	Hard	43	D, S	Ample supply for 200 head stock.
12	SE.	10	"	"	"	Bored	71	2,043	− 31	2,012	71	1,972	Glacial drift	Hard	43	S	Sufficient supply.
13	SE.	12	"	"	"	Bored	57	2,040	− 37	2,003	57	1,983	Glacial drift	Hard, iron	43	D, S	Oversufficient for 35 head stock.
14	SW.	13	"	"	"	Bored	56	2,051	− 50	2,001	65	1,986	Glacial drift	Hard	42	D, S	Oversufficient for 25 head stock.
15	SE.	14	"	"	"	Drilled	96	2,050	− 76	1,974	96	1,954	Glacial gravel	Hard, iron, slightly "alkaline"	42	D, S	Abundant supply.
16	SE.	15	"	"	"	Bored	55	2,040	− 25	2,015	55	1,985	Glacial drift	Hard	43	D, S	Oversufficient for 30 head stock.
17	SE.	16	"	"	"	Dug	31	2,042	− 26	2,016	31	2,011	Glacial sand	Hard	4	D, S	Sufficient for 12 head stock.
18	SW.	16	"	"	"	Bored	45	2,067	− 43	2,024	45	2,022	Glacial drift	Stagnant	43	S	
19	SE.	17	"	"	"	Bored	25	2,067	− 17	2,050	25	2,042	Glacial drift	Hard, stagnant			Sufficient supply.
20	SW.	18	"	"	"	Drilled	114	2,080	− 80	2,000	114	1,966	Glacial gravel	Hard, iron, slightly "alkaline"	40	D, S	Oversufficient for 40 head stock.
21	NW.	19	"	"	"	Drilled	180	2,054	− 80	1,974	180	1,874	Glacial drift	Hard		D, S	Oversufficient for 150 head stock.
22	SE.	22	"	"	"	Bored	68	2,050	− 44	2,006	68	1,982	Glacial drift	Hard, "alkaline"	44	D, S	Oversufficient for 7 head stock.
23	SW.	22	"	"	"	Bored	45	2,045	− 30	2,015	45	2,000	Glacial sand	Hard	43	D, S	Good supply; good quality.
24	NE.	23	"	"	"	Drilled	80	2,056	− 25	2,031	80	1,976	Glacial drift	Hard, iron	42	D, S	Oversufficient for 22 head stock.
25	NE.	24	"	"	"	Bored	65	2,048	− 55	1,993	65	1,983	Glacial drift	Hard	43	D, S	Sealed now, but was sufficient for 25 head stock.
26	SE.	25	"	"	"	Bored	90	2,050	− 70	1,980	90	1,960	Glacial drift	Hard, iron, slightly "alkaline"	43	D, S	Barely sufficient for 25 head stock.
27	NW.	26	"	"	"	Bored	87	2,055	− 78	1,977	87	1,968	Glacial drift	Hard, iron, "alkaline"	43	D, S	Oversufficient for 9 head stock.
28	SW.	27	"	"	"	Bored	80	2,057	− 45	2,012	80	1,977	Glacial drift	Hard	43	D, S	Oversufficient for 25 head stock; farm vacant; water has become stagnant.
29	NW.	27	"	"	"	Bored	87	2,055	− 70	1,985	87	1,968	Glacial drift	Hard, slightly "alkaline"	42	D, S	Oversufficient for 12 head stock.
30	NE.	28	"	"	"	Bored	80	2,058	− 50	2,008	80	1,978	Glacial drift	Hard	43	D, S	Oversufficient for 18 head stock.

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

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

WELL RECORDS—Rural Municipality of WILLNER, NO. 253, 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
31	SW.	26	27	1	3	Bored	36	2,057	- 33	2,024	36	2,021	Glacial gravel	Hard	41	D, S	Ample for 50 head stock.
32	NE.	29	"	"	"	Bored	50	2,055	- 35	2,020	50	2,005	Glacial sand	Hard	42	D, S	Sufficient for 80 head stock.
33	SE.	30	"	"	"	Bored	55	2,055	- 35	2,020	55	2,000	Glacial drift	Hard, iron, "alkaline"	41	D, S	Sufficient only for 6 head stock; not used for drinking; too laxative.
34	NE.	30	"	"	"	Bored	45	2,054	- 40	2,014	45	2,009	Glacial drift	Hard		D, S	Just sufficient for 20 head stock.
35	NW.	31	"	"	"	Drilled	120	2,080	- 80	2,000	120	1,960	Glacial sand	Hard, "alkaline"	42	D, S	Oversufficient for 50 head stock.
36	SW.	32	"	"	"	Dug	35	2,055	- 31	2,024	35	2,020	Glacial sand	Soft	44	D, S	Sufficient for 50 head stock.
37	NW.	32	"	"	"	Bored	72	2,066	- 62	2,004	72	1,994	Glacial sand	Hard	43	D, S	Sufficient for more than 25 head stock.
38	NW.	33	"	"	"	Dug	60	2,062	- 52	2,010	60	2,002	Glacial sand	Hard	43	D, S	Sufficient for 14 head stock.
39	NE.	33	"	"	"	Dug	71	2,052	- 56	1,996	71	1,981	Glacial drift	Hard	44	D, S	Sufficient for 20 head stock.
40	NW.	34	"	"	"	Bored	54	2,055	- 36	2,019	54	2,001	Glacial drift	Hard, stagnant	44	S	Sufficient for 20 head stock.
41	NE.	34	"	"	"	Dug	50	2,055	- 47	2,008	50	2,005	Glacial drift	Hard	41	D, S	Sufficient for 30 head stock.
42	NW.	35	"	"	"	Bored	61	2,075	- 51	2,024	61	2,014	Glacial drift	Soft	44	D, S	Oversufficient for 30 head stock.
43	NE.	36	"	"	"	Drilled	90	2,048			90	1,958	Glacial drift	Hard		S	Sealed and no further information.
44	SW.	36	"	"	"	Dug	54	2,054	- 42	2,012	54	2,000	Glacial drift	Hard	42	D, S	Oversufficient for 25 head stock.
1	SW.	1	27	2	3	Bored	90	2,045	- 12	2,033	90	1,955	Glacial drift	Hard	42	D, S	Oversufficient for 50 head stock; 67-foot well waters 15 head stock.
2	SW.	2	"	"	"	Bored	31	2,015	- 29	1,986	31	1,984	Glacial drift	Soft	43	D, S	Oversufficient for 10 head stock.
3	SE.	5	"	"	"	Bored	60	1,950			60	1,890	Glacial drift	Hard, "alkaline	43	S	Insufficient supply; laxative; drinking water hauled.
4	SE.	6	"	"	"	Bored	40	1,965	- 27	1,938	40	1,925	Glacial sand	Hard, salty, "alkaline"	42	S	Sufficient for 5 head stock; domestic water hauled.
5	NE.	6	"	"	"	Bored	50	1,948	- 35	1,913	50	1,898	Glacial drift	Hard	44	D, S	Sufficient for 30 head stock.
6	NW.	6	"	"	"	Dug	26	1,935	- 17	1,918	26	1,909	Glacial drift	Hard	43	D, S	Sufficient supply.
7	NW.	7	"	"	"	Dug	12	1,940	- 8	1,932	12	1,928	Glacial gravel	Hard	45	S	Intermittent supply.
8	SE.	9	"	"	"	Bored	47	1,988	- 18	1,970	47	1,941	Marine Shale	Soft	43	D, S	Ample supply.
9	NE.	11	"	"	"	Dug	32	2,100	- 30	2,070	32	2,068	Glacial gravel	Soft		D, S	Sufficient for 10 head stock.
10	SE.	12	"	"	"	Drilled	230	2,065	-100	1,905	230	1,835	Marine Shale	Soft	47	D, S	Oversufficient supply.
11	SW.	13	"	"	"	Drilled	120	2,088	- 80	2,008	120	1,968	Glacial drift	Hard, iron	42	D, S	Oversufficient for 20 head stock.
12	SE.	15	"	"	"	Drilled	126	2,057			126	1,931	Marine Shale	Soft, iron	44	D, S	Insufficient supply; 35-foot well for stock use.
13	NE.	16	"	"	"	Bored	77	2,050	- 64	1,986	77	1,973	Glacial gravel	Hard, lime	43	D, S	Sufficient for 12 head stock.

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

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

WELL RECORDS—Rural Municipality of 9 10 WILLNER, NO. 253, 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	SE.	17	27	2	3	Bored	24	1,990	− 2	1,988	24	1,966	Glacial drift	Hard	42	N	Not suitable for use.
15	NE.	17	"	"	"	Bored	40	2,000	− 30	1,970	40	1,960	Glacial drift	Hard, iron	43	D, S	Sufficient supply.
16	NE.	18	"	"	"	Dug	20	1,960	− 18	1,942	20	1,940	Glacial drift	Hard, "alkaline"	42	D	Sufficient for domestic use; 56-foot well supplies 10 head stock.
17	SW.	18	"	"	"	Bored	25	1,950	− 22	1,928	25	1,925	Glacial drift	Hard	44	S	
18	SE.	19	"	"	"	Bored	39	1,980	− 24	1,956	39	1,941	Glacial drift	Hard, slightly "alkaline"	43	D, S	Sufficient for 8 head stock; an unused 23-foot well; contaminated.
19	SE.	20	"	"	"	Dug	24	2,040	− 18	2,022	24	2,016	Glacial sand and gravel	Hard, iron	42	D, S	Sufficient for 20 head stock.
20	NE.	21	"	"	"	Drilled	318	2,095	−100	1,995	318	1,777	Marine Shale	Soft, iron	46	D, S	Oversufficient for 150 head stock.
21	SE.	22	"	"	"	Bored	60	2,085	− 52	2,033	60	2,025	Glacial drift	Hard	43	D, S	Ample supply.
22	SW.	22	"	"	"	Bored	65	2,100	− 35	2,065	65	2,035	Glacial drift	Hard, iron	44	D	Sufficient for domestic use; 44-foot well supplies 5 head stock.
23	NE.	22	"	"	"	Bored	74	2,090	− 70	2,020	74	2,016	Glacial grey sand	Hard, iron	43	D, S	Sufficient for 13 head stock.
24	NW.	22	"	"	"	Dug	40	2,100	− 37	2,063	40	2,060	Glacial grey sand	Hard, slightly "alkaline"	41	S	Sufficient for 30 head stock; 20-foot well for domestic uses.
25	NE.	23	"	"	"	Drilled	90	2,075	− 78	1,997	90	1,985	Glacial quicksand	Hard, iron	44	D, S	Oversufficient for 25 head stock.
26	SW.	24	"	"	"	Drilled	280	2,070	−100	1,970	280	1,790	Glacial drift	Hard, iron	44	D, S	Abundant supply.
27	NE.	24	"	"	"	Drilled	335	2,045	− 30	2,015	335	1,710	Glacial drift	Hard, iron	45	D, S	Oversufficient for 60 head stock.
28	NE.	25	"	"	"	Bored	60	2,063	− 50	2,013	60	2,003	Glacial sand	Hard	42	D, S	Sufficient for 40 head stock.
29	NE.	27	"	"	"	Drilled	183	2,050	− 55	1,995	183	1,867	Glacial sand	Hard, iron, slightly "alkaline"	44	D, S	Oversufficient for 30 head stock; 20-foot well unused.
30	NE.	28	"	"	"	Drilled	205	2,060	− 30	2,030	205	1,855	Glacial black sand	Hard, iron	45	D, S	Oversufficient for 50 head stock.
31	SW.	29	"	"	"	Bored	42	2,020	− 37	1,983	42	1,978	Glacial drift	Hard, slightly "alkaline"	43	D, S	Oversufficient for 16 head stock.
32	SE.	30	"	"	"	Dug	19	1,990	− 14	1,976	19	1,971	Glacial sand	Soft	42	D, S	Sufficient for 6 head stock.
33	NE.	30	"	"	"	Bored	87	2,020	− 38	1,982	87	1,933	Glacial drift	Hard, iron, slightly "alkaline"	44	D, S	Oversufficient for 60 head stock.
34	SW.	31	"	"	"	Dug	12	1,992	− 3	1,989	12	1,980	Glacial sand	Hard, "alkaline"	42	S	Oversufficient for 50 head stock; laxative.
1	SW.	1	27	3	3	Dug	12	1,945	− 9	1,936	11	1,934	Glacial sand	Soft	44	D, S	Sufficient; good for 40 head stock.
2	SE.	2	"	"	"	Dug	18	1,940	− 12	1,928	18	1,922	Glacial drift	Hard	46	S	Insufficient; supplies 4 head stock; 28-foot well used for stock.
3	NE.	2	"	"	"	Dug	14	1,940	− 12	1,928	14	1,926	Glacial drift	Hard	44	S	
4	SW.	3	"	"	"	Bored	45	1,945	− 10	1,935	45	1,900	Glacial sand	Hard, iron	45	D, S	Oversufficient for 40 head stock.
5	NW.	4	"	"	"	Dug	16	1,945	− 10	1,935	16	1,929	Glacial drift	Very hard	45	D	Insufficient supply; dugout and 18-foot well for stock; poor supply, poor quality.

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 VILLNEP, NO. 253, SASKATCHEWAN.

B 4-4
1860—10,000

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
6	SE.	9	27	3	3	Drilled	560	1,923	− 3	1,920	540	1,383	Belly River	Soft, soda	47	D, S	Abundant supply.
7	NW.	10	"	"	"	Dug	24	1,925	− 14	1,911	24	1,901	Glacial drift	Soft, slightly "alkaline"			Insufficient for house and 8 head stock; dugout used; 5 dry holes to 35 feet.
8	SW.	12	"	"	"	Dug	20	1,946	− 18	1,928	20	1,926	Glacial sand	Hard, "alkaline"	44	D, S	Ample for 100 head stock.
9	SE.	13	"	"	"	Dug	18	1,939	− 12	1,927	18	1,921	Glacial drift	Stagnant	45	S	Sufficient supply.
10	SE.	14	"	"	"	Dug	18	1,915	− 13	1,902	18	1,897	Glacial sand	Hard, iron, slightly "alkaline"	43	D, S	Sufficient for 15 head stock.
11	SW.	14	"	"	"	Dug	40	1,920	− 30	1,890	40	1,880	Glacial quicksand	Hard, iron, "alkaline"	43	S	Sufficient for only 7 head stock; laxative; 15-foot well for domestic use.
12	SE.	15	"	"	"	Dug	15	1,915	− 10	1,905	16	1,899	Glacial drift	Hard			Intermittent supply.
13	SE.	18	"	"	"	Dug	17	1,930	− 11	1,919	17	1,913	Glacial drift	Stagnant			
14	SW.	18	"	"	"	Dug	13	1,925	− 11	1,914	13	1,912	Glacial drift	Hard	44		
15	NE.	23	"	"	"	Dug	12	1,948	− 11	1,937	12	1,936	Glacial sand	Hard	43	D	Insufficient; waters only 15 head stock.
16	SE.	24	"	"	"	Bored	30	1,965	− 18	1,947	30	1,935	Glacial sand	Hard, "alkaline"	45	S	Sufficient for 100 head stock; 10-foot seepage well for house use; 30-foot well also used for stock.
17	SW.	24	"	"	"	Bored	40	1,950	− 33	1,917	40	1,910	Glacial drift	Hard, stagnant, "alkaline"	45	S	Used to water 40 head stock.
18	SE.	25	"	"	"	Bored	35	1,965	− 29	1,936	35	1,930	Glacial drift	Hard			
19	NE.	26	"	"	"	Dug	12	1,950	− 8	1,942	12	1,938	Glacial sand	Hard		S	Oversufficient for 40 head stock; used by neighbours.
20	NW.	30	"	"	"	Dug	22	1,937	− 16	1,921	22	1,915	Glacial drift	Hard	43		Beside slough.
21	NW.	32	"	"	"	Drilled	403	1,887	+ 50	1,937	394	1,493	Marine Shale	Soft, soda	47	D, S	Flows 20 barrels an hour; has supplied neighbours.
22	NE.	33	"	"	"	Drilled	496	1,882	+ ?	1,902+	476	1,406	Marine Shale	Soft, soda	47	D, S	Flows; abundant supply.
23	NE.	35	"	"	"	Dug	13	1,950	− 9	1,941	13	1,937	Glacial drift	Stagnant	45	S	
24	NE.	36	"	"	"	Dug	10	2,000	− 6	1,994	10	1,990	Glacial drift	Hard, "alkaline"	45	S	Sufficient for stock; also dam in use; domestic supply hauled.

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.