CANADA
DEPARTMENT OF MINES

HON. T. A. CRERAR, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OE EXCELSIOR No. 166 SASKATCHEWAN

BY

B. R. MacKay & D. C. Maddox

Water Supply Papper No. 142

OTTAWA

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CONTENTS

Illustr tions

GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF EXCELSIOR, NO. 142, SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

is given on some or all of the contour lines on the figure.

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Cypress Hills Formation. The name given to a series of conglomerates and sand beds which occur in the southwest corner of Saskatchewan, and 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 Excelsior is in southern Saskatchewan, the centre being 63 miles west of the Third meridian and 102 miles north of the International Boundary. The centre of the municipality is located about 84 miles west of Moose Jaw, about 118 miles south of Saskatoon, and about 21 miles northeast of Swift Current. The area of the municipality is about 470 square miles. It comprises the whole of townships 16, 17, and 18, ranges 10, 11, and 12, and township 19, range 10, and that part of township 19, ranges 11 and 12, township 20, ranges 10 and 11, that is south of South Saskatchewan river, and that part of townships 18 and 19, range 13, that is east of Swiftcurrent creek. A very narrow strip of township 20, ranges 12 and 13, is included in this municipality, but the area of each township included is less than a square mile and any data pertaining to them are included in the description of the townships to the south.

The main line of the Canadian Pacific railway and No. 1 highway pass through the southern part of the municipality, and on them are situated the villages of Waldeck and Rush Lake. The Canadian National railway enters the municipality near the centre of township 19, range 10, and terminates 4 miles to the southwest at Main Centre, another important village in the municipality.

The land surface in the north and northeast back from the valleys of South Saskatchewan river and Swiftcurrent creek, and surrounding Rush lake in township 17, range 10, is comparatively flat. In range 16 most of the country is hilly and rises to over 2,600 feet above sea-level. In the greater part of ranges 17 and 18 the country is rolling to hilly. The ridges and valleys and the lakes or lake bottoms in this part trend in a general northwesterly direction.

South Saskatchewan river forms the northern boundary of the municipality. The river valley is about 600 to 700 feet deep, and the valley slopes extend back from 2 to 3 miles from water-level to prairie-level. Water-level in the river at the western boundary of the municipality is about 1,760 feet above sea-level and about 1,730 feet above sea-level at the eastern boundary.

Swiftcurrent creek near its mouth occupies a steep-sided valley which is about 500 to 600 feet deep. The valley becomes much shallower and wider towards the south. Within the municipality, water-level in the creek falls from an elevation of a little over 2,300 feet above sea-level to about 1,760 feet above sea-level. The average monthly flow of the creek for the period 1909 to 1931 was 80.3 cubic feet a second. The maximum flow was 1,351 cubic feet a second and in some months there was no flow.

Rushlake creek occupies a valley that within this municipality is about a mile in average width. The flow of the creek is small except seasonally and in wet years.

Rush lake, in township 17, range 10, lies about 2,295 feet above sea-level and is dry except in wet years. Several northwesterly trending lakes or dry lake bottoms occur in the eastern half of the municipality north of Rush lake. Drainage is to South Saskatchewan river and to undrained depressions.

The only permanent sources of surface waters available for farm use are South Saskatchewan river, Swiftcurrent creek, and Rushlake creek. The water in South Saskatchewan river and Swift-current creek is comparatively soft and can be used for all purposes except drinking. Contamination of the water of South Saskatchewan river by the sewage of the city of Medicine Hat and of other towns located on its banks makes this water unsuitable for drinking unless it is sterilized by boiling or by the use of chemicals such as chlorine.

The sewage of the city of Swift Current discharges into Swiftcurrent creek and the creek water should be sterilized before it is used for drinking. Some purification of the water of Swiftcurrent creek may occur in the lower part of its course as there are many rapids in this part, but it is always better to sterilize the water before drinking it!

The water of Rushlake creek in dry seasons becomes stagnant and under such conditions it is not suitable for drinking.

South Saskatchewan river is in a very deep valley and the distance from prairie-level to water-level in many places is over 2 miles. The slopes, however, are generally not too steep to prevent cattle being driven down to the water.

Water-bearing Horizons in the Unconsolidated Deposits

Alluvial deposits floor the upper parts of Swift-current Creek valley and cover a belt that is about $\frac{1}{2}$ mile wide in the northwestern part of township 17, range 12, but which widens out considerably upstream. In a number of wells 8 to 20 feet deep, small supplies of ground water that is hard but usable for all purposes are obtained from sands and silts in the alluvial deposits.

Glacial lake clays underlie Rush lake and the valley of Rushlake creek and extend eastward from Rush lake to the eastern boundary of the municipality. A belt of these clays underlies a narrow valley in the southern part of township 16, range 11, and the eastern part of township 16, range 12. A few wells from 6 to 16 feet deep obtain small supplies of water from sandy beds in the glacial lake clays, but most of the wells in the area underlain by these clays have passed through them and have found water, which in many wells is "alkaline", in the underlying boulder clay or moraine.

An area of about 4 square miles in the southeast corner of the municipality is underlain by glacial lake sands. In this area two wells, each 42 feet deep, passed through the lake sands and obtained hard water in the underlying gravel.

An area of about one-half square mile in sec. 30, tp. 16, range 12, is underlain by glacial outwash sands and gravels. No wells were put down in this area, but it is probable that ground water would be found at depths of less than 20 feet in these deposits.

Moraine and boulder clay underlie the remainder of the municipality. Ground water in these deposits is found only in irregularly distributed beds and pockets of sand and gravel. The depth of the wells in these deposits varies widely and no depth zones extending over wide areas can be outlined. In that part of township 16 underlain by boulder clay or moraine many of the wells are less than 50 feet deep and the water in most of them is hard but is usable for all purposes. In that part of range 10 north of Rush lake, which is underlain by boulder clay or moraine, most of the wells, and especially those in the north, are deeper than those in township 16, and the water in most of them is "alkaline". The upper part of the clay in this section of the municipality appears to contain very little sand or gravel.

A belt of country underlain by boulder clay and moraine, in which most of the wells in the drift yield "alkaline" water, is about 3 miles in width and extends northwestwards from Rush lake to the vicinity of Beaver Flat.

The drift is at least 150 feet thick in the lower part of the valley of Swiftcurrent creek. In the southwest part of township 16, range 10, it is about 20 to 30 feet thick. Elsewhere in the township the exact thickness is not known, but it seems probable that it is over 100 feet thick except in the higher parts of the municipality.

Water-bearing Horizons in the Bedrock

Three bedrock formations are known to underlie the drift in this municipality. They are, in descending order; the Cypress Hills formation, the Eastend formation, and the Bearpaw formation, and the approximate areas in which each of these formations is thought to immediately underlie the glacial drift are shown on Figure 1 of the accompanying map. The Cypress Hills formation is confined to a few small occurrences. The Eastend formation underlies a considerably larger area and the Bearpaw formation is believed to underlie the whole municipality.

Two small, detached areas of Cypress Hills formation occur in township 16, range 11. This formation is composed chiefly of sandstone and conglomerate, and here lies directly upon the Bearpaw formation. The Cypress Hills formation does not appear to be very thick and most of the wells in these areas seem to have passed into the underlying Bearpaw formation.

The Eastend formation covers most of the central and northeastern parts of the municipality. It contains a large proportion of sand and was laid down under conditions that were largely non-marine. The contact between the Bearpaw and the Eastend formations is not definitely known, as the only exposures found occur in the valleys of South Saskatchewan river and Swift-current creek. It is probable that some of the higher bedrock aquifers are in the Eastend formation.

The Bearpaw formation is exposed in the lower slopes of South Saskatchewan river and of Swiftcurrent creek, and underlies the glacial drift over the larger part of the municipality. The Bearpaw formation consists chiefly of dark grey marine shale that is either impervious to water or contains small quantities of water that is generally highly mineralized. Interbedded with the shales, however, are beds of sand that are generally fine-grained, but usually yield soft water to wells put down into them.

Sandy beds are known to occur near the base of the Bearpaw formation and are exposed at and near the confluence of South Saskatchewan river and Swiftcurrent creek at elevations above sea-level of about 1,752 to 1,854 feet and of 1,904 to 1,916 feet. In the valley of Swiftcurrent creek sandy beds are exposed near Stewart Valley bridge on the SE.¼, sec. 15, tp. 19, range 13, at about 2,100 to 2,125 feet above sea-level. Near the southwestern corner of secs. 2, tp. 19, range 13, there is an exposure of sandy beds in the Bearpaw formation from 2,044 to 2,108 feet above sea-level. Most of the beds are very fine-grained and silty, but a bed of pure, fine-grained sand occurs at elevations of 2,084 to 2,100 feet above sea-level. In sec.30, tp. 19, range 11, there is a bed of sand in the Bearpaw at about 1,896 to 1,922 feet above sea-level. There are doubtless other sandy beds in the Bearpaw formation in this municipality that lie immediately beneath the drift and form possible aquifers, which are concealed by the unconsolidated deposits. The deepest well in the municipality is the Imperial Oil Company's Rush Lake well, 2,355 feet deep, which was drilled on sec. 30, tp. 19, range 11, near South Saskatchewan river. The well site is about 1,762 feet above sea-level and water was obtained at an horizon about 1,652 feet above sea-level, and at other horizons from 1,481 feet above sea-level to 563 feet below sea-level. Salty water is now flowing from the well. None of the wells on prairie-level in this municipality has been drilled deep enough to reach the aquifers in this well.

Two wells, 600 and 621 feet deep, respectively, in the northern part of township 17, range 10, and the southern part of township 18, range 10, obtained soft water from an horizon that is about 1,729 feet to 1,750 feet above sea-level. In the southern well the water was unusable, in the northern well the water is used for all purposes and the supply is ample. A well in

sec. 9, tp. 18, range 11, was drilled to a depth of 760 feet, or to an elevation of about 1,760 feet above sea-level, and no water was encountered. A well on sec. 1, tp. 19, range 11, obtained soft water that was not usable at a depth of 600 feet or an elevation of 1,775 feet above sea-level. No other wells have been drilled into this aquifer and its limits are not known, but it appears probable that it underlies at least the eastern third of the municipality. The uncertainty as to the quality of the water in this aquifer would hardly justify the expense in drilling to it.

A well at Rush Lake village, 500 feet deep, obtained soft, yellowish water from an aquifer that is about 1,835 feet above sea-level. No other wells in the municipality were put down to this aquifer, and its extent is not known, although it does not appear toextend far towards the north and northeast as the wells of the previous group did not obtain water at or near 1,835 feet above sea-level.

Three wells 420 to 620 feet deep in tp. 16, range 11, and a well in sec. 2, tp. 18, range 10, obtain soft water that can be used for all purposes except irrigation, from an aquifer that is about 1,900 to 1,980 feet above sea-level. West of these wells aquifers at higher elevations supply water to wells and the extent of this aquifer westward is not known.

There are numerous other aquifers in the bedrock at elevations of about 2,000 to 2,486 feet above sea-level, but they seem to be limited in extent and are described in the reports of the townships.

No logs of the deep wells in this municipality are available and the distinction between wells in the bedrock and wells in the unconsolidated deposits is usually based on the character of the water in the wells, soft water being taken as evidence of a bedrock origin.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 16, Range 10

The topographical relief in this township is rather slight. Most of the township is rolling country and the slopes are comparatively gentle. At about the centre of the southern boundary elevations of over 2,550 feet above sea-level occur. In the northwest part of the township the eastern end of a ridge rises to over 2,600 feet above sea-level. From these elevated areas the land surface slopes generally northwards to the dry bed of Rush lake which is about 2,295 feet above sea-level, or to the low ground southeast of Rush lake. Another low area, marshy in wet seasons, occupies about 1 square mile in the southeast corner of the township. There are no streams in the township, but there is a very small lake in section 16.

An area of about 4 square miles in the southeast corner is underlain by glacial lake sands. Two wells in this area passed through 39 feet of sand into the underlying gravel.

About 3 square miles in the northeast of the township are underlain by glacial lake clays. No wells obtain water from these clays, but two wells on the margin of this area passed through the clay into the underlying moraine.

The depth of the wells in the unconsolidated deposits ranges from 5 to 104 feet, but in the western half of the township most of the wells are less than 50 feet deep. In the southeast there is an aquifer at about 2,405 to 2,420 feet above sea-level that supplies hard water to five wells 42 to 84 feet deep. In the most northerly well of the group, on section 13, however, the supply of water is small. This aquifer appears to feed a spring in section 18 at an elevation of about 2,400 feet above sea-level, and it probably underlies the southern half of the township.

In sections 24 and 25 an aquifer that is about 2,300 to 2,340 feet above sea-level supplies three wells, 60 to 80 feet deep, with a moderate supply of hard water, and this aquifer apparently supplies a small spring in section 26. It is not thought to extend far beyond sections 24 and 25.

In section 4 a layer of hard "rock" about 8 inches thick was encountered above the aquifer in three wells at an elevation of about 2,475 feet above sea-level. The well drillers record the presence of "grey clay" below the hard layer and the water from the wells is hard, so that the layer is probably a calcareous layer in the unconsolidated deposits. At a well on section 18, "soapstone" is recorded at a depth of 30 feet or 2,470 feet above sea-level, and in section 20 a well encountered a coal seam at a depth of 20 feet or at an elevation of 2,430 feet above sea-level. This coal seam is probably in the Bearpaw formation.

The supply of ground water in this township is generally satisfactory and in only one well is the water too highly mineralized for human use. Dams are used at two farms to supplement the supply of well water.

A well, 210 feet deep, on section 4, obtained a large supply of soft, brown water that can be used for all purposes. The aquifer is 2,290 feet above sea-level and is probably in the upper part of the Bearpaw formation. No other wells in the township or the adjacent townships have reached this aquifer and its extent is unknown.

Township 16, Range 11

The northeast and the southwest parts of the township are hilly, and rise to elevations of 2,600 feet or more. Rushlake creek, a permanent stream, passes through the township from a point

a little west of the southeast corner to a point a little east of the centre of the northern boundary. The creek valley within the township is less than 2,3 feet above sea-level, and lies between the two elevated areas mentioned. In the northwest part of the township the land surface is flat to gently rolling. Elevations in this part rise to a little over 2,400 feet above sea-level. From this divide the land slopes eastwards towards Rushlake creek and westwards towards Swiftcurrent creek.

A band of Recent stream alluvium covers about 2 square miles near the northern half of the western boundary. Glacial lake clays underlie the valley of Rushlake creek, and another dry valley, less than half a mile wide, in the southern part of the township.

Two wells, 16 and 28 feet deep, sunk in the area of glacial lake clay, obtain water from the underlying boulder clay. An area of about 1½ square miles lying east of Fauna is underlain by moraine, the remainder of the township is underlain by boulder clay.

Two areas, each about 2 square miles, located in the southwest and in the northeast parts of the township, with elevations of about 2,550 feet above sea-level, are underlain by the Cypress Hills formation. Elsewhere the Bearpaw formation is thought to underlie the unconsolidated deposits.

The depth of the wells in the unconsolidated deposits ranges from 10 to 125 feet. No well-defined aquifers of wide extent are known to occur in the unconsolidated deposits. In sections 1 to 6 the water in four wells 14 to 125 feet deep is too "alkaline" for human use, and in one well, 30 feet deep, the water is too "alkaline" for stock.

In the southeast corner of the township a well passed through 14 feet of sand. Elsewhere there appears to be a great

thickness of clay. Several dry holes up to 60 feet deep were put down in the southern half of the township. The supply of water at many farms is inadequate for local needs and dugouts and dams are used to supplement the supply from the wells. Several springs occur on the banks of Rushlake creek and the creek usually contains a small amount of water that is available for stock use.

Four wells in this township have been put down to bedrock. Three wells, 420 to 620 feet deep, obtain soft water from an horizon about 1,936 to 1,980 feet above sea-level. In the well 420 feet deep, on section 34, the water is brown. The aquifer from which this water is obtained is probably in the Bearpaw formation, and probably underlies the entire township.

An aquifer that is about 2,324 to 2,351 feet above sea-level supplies soft water to two wells, 99 and 189 feet deep, located in sections 10 and 15, respectively. This aquifer does not seem to extend far to the north or to the south as the wells of the previously mentioned group did not obtain water at or near the same elevation. Some of the springs in the valley of Rushlake creek are probably supplied by this aquifer.

Township 16, Range 12

Swiftcurrent creek follows a very sinuous course through the northern half of the township. The gradient of the creek is low and the flow is sluggish. Water-level in the creek about a mile east of Waldeck is 2,350 feet above sea-level. Within this township the valley of Swiftcurrent creek is about 2 miles wide. South of the creek the country rises to reach an elevation of over 2,650 feet above sea-level at and near the southwest corner of the township. The eastern slopes of this elevation are very gentle, but on the north the slopes are moderately steep. North of the creek the surface rises to reach

elevations of about 2,550 feet above sea-level at the northern boundary of the township.

The valley of Swiftcurrent creek below an elevation of about 2,400 feet above sea-level is floored with Recent deposits of sand and silt (alluvium) which yield moderate supplies of water to wells from 8 to 25 feet deep. Near the margin of the alluvium several wells, 40 to 50 feet deep, have passed into the underlying boulder clay. A narrow strip of glacial lake clays about one-half mile wide underlies a valley that parallels the eastern boundary of the township. No wells have been put down in these clays. An area of about one-half square mile, in section 30, is underlain by glacial outwash sands and gravels, but no wells have been sunk in these deposits. Moraine covers an area of about 7 square miles in the southwest corner and 1 square mile of the northwestern corner. Glacial till covers an irregular-shaped area in the southern half of the township to the north and east of the moraine, and a narrow strip fringes the moraine on the northwest corner. There is a great variation in the character and thickness of the drift as shown by the wells. In the northern half of the township the wells in the unconsolidated deposits are 14 to 60 feet deep. In the southern third of the township, three wells 80 to 108 feet deep tap an aquifer that is about 2,466 to 2,494 feet above sea-level, from which supplies of water that is slightly "alkaline" are obtained. In the southern part of the township several wells passed through 80 to 149 feet of clay. In the valley of Swift-current creek a well in the SE.$\frac{1}{4}$, section 32, penetrated 50 feet of sand.

Swiftcurrent creek provides a source of comparatively soft water. The flow of the creek varies greatly, but it is only in very dry seasons that the creek is dry. There are several springs on the valley slopes of the creek and there is a spring on section 8 at about 2,600 feet above sea-level.

The supply of ground water at most of the farms is adequate for local use. The water in a few of the wells in the valley of Swiftcurrent creek is soft. In the remaining wells in the drift the water is hard; in five wells the water is "alkaline", but in only three wells is the water too "alkaline" for human use.

An aquifer in the bedrock, about 2,410 to 2,433 feet above sea-level, supplies water to two wells, 50 and 149 feet deep, in sections 7 and 31, in this township. This aquifer probably underlies most of the higher parts of the southern half of the township and that part of the northwest of the township that lies over 2,400 feet above sea-level. The supply of water from this aquifer is not very large and in the well on section 8 the water is too salty for human use.

Township 17, Range 10

The topographical relief in this township is very slight, except in the southwest corner where the land rises to an elevation of over 2,450 feet above sea-level. Elevations elsewhere in the township range from a little less than 2,300 feet above sea-level to a little over 2,400 feet above sea-level. The dry bed of Rush lake, which is a little less than 2,300 feet above sea-level, occupies a large part of the southwestern quarter of the township. Rushlake creek, a permanent stream, enters this lake bed from the west and an intermittent stream enters it from the east. In the northern third of the township there are two small lakes of irregular shape, and several, low, flat areas that are in some places marshy. The western half of the township is rather thinly settled.

Glacial lake clays underlie and border Rush lake and extend to the eastern boundary of the township in a belt about $1\frac{1}{2}$ miles wide. Three wells, 6 to 14 feet deep, obtain small supplies of water from sandy beds in the lake clays.

The deeper wells pass through the lake clays into the underlying boulder clay. An aquifer, which is about 2,250 to 2,288 feet above sea-level, supplies three of these wells, 40 to 57 feet deep, in sections 1 and 2, with water. In two of the wells the water can be used for all purposes, but in the most northern one of the group, which is in the valley of an intermittent stream, the water is too highly mineralized for human use.

The producing wells in the area covered by boulder clay are 9 to 63 feet deep. In several of the shallow seepage wells the water supplies are intermittent. A large number of wells in the northern two-thirds of the township obtain water from an aquifer that is about 2,295 to 2,320 feet above sea-level. It is probable that this aquifer underlies the northern two-thirds of the township, although some of the wells have passed through it to tap a deeper aquifer. In the northern third of the township the supply of water from this aquifer is small and the water is "alkaline". Two dry holes were put down to 100 feet on section 29.

Well records show that the boulder clay in most of this township is 38 to 65 feet thick. A well on the SW.$\frac{1}{4}$, section 14, passed through sand between the depths of 16 and 32 feet, which probably is a pocket in the boulder clay.

In the southeast part of the township and the northern half of the township the water in many of the wells is "alkaline". The supply of ground water in this township is fairly satisfactory, but in a few of the shallow wells the supply is intermittent.

A well 68 feet deep, on section 15, obtains soft water from an aquifer that is about 2,267 feet above sea-level. This aquifer seems to be limited in extent, as wells to the southeast did not obtain soft water from this elevation.

A well 600 feet deep, in section 34, obtains water that is unusable for any purpose from an aquifer in the Bearpaw formation at about 1,700 feet above sea-level, and which probably underlies the whole township. It does not seem advisable to attempt to prospect for this aquifer.

Township 17, Range 11

In the western half of this township there is an elevated tract that rises to over 2,550 feet above sea-level, but the slopes are gentle and the area is well settled. North and east of this area the topographical relief is low, the land sloping both northeasterly and southeasterly towards the valley of Rushlake creek which is less than 2,350 feet above sea-level. In the southeast part of the township the land rises from Rushlake creek to over 2,450 feet above sea-level. Two shallow valleys, which extend in a generally northwestward direction for several miles from the valley of Rushlake creek, appear to offer favourable conditions for storage of surface run-off. Rushlake creek is a permanent stream, but the flow is small except in wet seasons.

The broad valley of Rushlake creek is floored with glacial lake clays for a distance of about a mile from the creek on either side. Two wells 25 and 60 feet deep in the lake clay area passed through the clays and obtain "alkaline" water in sandy beds in the underlying moraine. Areas underlain by boulder clay occur in the northeast, southeast, and southwest. The remainder of the township is covered by moraine.

In the southern third of the township all the producing wells in the unconsolidated deposits, except one, are less than 45 feet deep. In the northern two-thirds most of the wells are from 50 to 100 feet deep.

An aquifer about 2,400 feet above sea-level supplies several wells in the higher parts of the northern half of the township with hard water that in some wells is reported as "alkaline", although it is not too "alkaline" for drinking. This aquifer appears to supply water to several springs which discharge into the northwestward trending valleys in this part of the township.

The upper part of the unconsolidated deposits in the northern two-thirds of the township is largely composed of boulder clay and it contains little ground water. The depth of the yellow oxidized clay is reported as 5 to 20 feet. A well on the SE.$\frac{1}{4}$, section 35, passed through 20 feet of yellow clay and 6 feet of yellow sand, but the sand contained no water.

The supply of ground water from the drift in the southern half of the township is not very satisfactory. In the northern half of the township the supply is more satisfactory, however. The water in most of the wells in this township is "alkaline" or slightly "alkaline", but in only three wells is the water too "alkaline" for drinking.

A well at Rush Lake village, 500 feet deep, obtains soft, yellowish water from an aquifer in the Bearpaw formation, which is about 1,835 feet above sea-level. No other wells in this municipality obtain water from this aquifer and its areal extent is unknown, but it does not appear to continue far to the north or northeast, as several wells in these directions did not obtain water at or near the same elevation.

A well on the SE.$\frac{1}{4}$, section 31, obtains soft, brown water from an aquifer about 2,230 feet above sea-level, which is probably in the Bearpaw formation. This aquifer extends into the southern part of township 18, range 12, and probably underlies the northern part of township 17, range 11.

Township 17, Range 12

Swiftcurrent creek passes in a very winding course through the southwestern half of the township, the general direction of the creek being northwestward. The depth of the valley within the township ranges from about 150 feet to 250 feet. East of the creek the valley slopes are comparatively steep, and in a considerable area the land surface is over 2,600 feet above sea-level, west of the creek the slopes are comparatively gentle and the land rises to slightly over 2,550 feet above sea-level. A shallow valley crosses the eastern boundary of the township in sections 12 and 13, and heads northwestwards into the township for about 2 miles.

Recent deposits of sand, gravel, and silt floor the valley of Swiftcurrent creek. Three wells, 18 to 20 feet deep, obtain a moderate supply of water from these sediments.

The southeastern part of the township is underlain by boulder clay which covers an area of 5 square miles on the east side of Swiftcurrent creek. A belt of till about $\frac{1}{2}$ mile wide is exposed on the western side of the creek. Elsewhere in the township, moraine underlies the surface soil.

In sections 1 and 2, three wells, 100 to 148 feet deep, tap an aquifer at about 2,350 to 2,360 feet above sea-level and obtain from it water that is too "alkaline" for drinking. Elsewhere in the township the wells in the drift with one exception are less than 50 feet deep.

In the northeastern part of the township five wells obtain water from a gravel aquifer about 2,528 to 2,582 feet above sea-level. A spring on the NE.$\frac{1}{4}$, section 23, about 2,550 feet above sea-level, is probably fed by this aquifer. Three wells, 32 to 80 feet deep, in the southwestern part of this township, obtain soft water apparently from an aquifer in the

Bearpaw formation, which is about 2,420 to 2,468 feet above sea-level. This aquifer extends south at least as far as sec. 30, tp. 16, range 13, but does not extend into the next township north as several wells in sections 2 to 6 in this township did not obtain water at or near these elevations.

The supply of ground water in this township is generally sufficient for all purposes, but in several of the deeper wells in the southeast and the northeast the water is too "alkaline" for drinking. The water of Swiftcurrent creek can be used for stock and if well boiled or chlorinated can be used for drinking.

Township 18, Range 10

Most of the township is rolling country over 2,400 feet above sea-level. In the southwest there is a shallow valley slightly below this elevation in which there are several lakes or dry lake beds. Handsome lake extends into the southwest corner of the township, the water-level of which is 2,330 feet above sea-level. The lake is shallow, and is dry or nearly so during dry seasons. From this valley a narrow branch valley extends northward to a point about a mile south of Main Centre. A low, flat area occupies the southeastern corner of the township and the valley of an intermittent stream heads northwards from it nearly to the northern boundary of the township. In the elevated tract the land rises to over 2,500 feet above sea-level. Surface drainage is to the lakes and stream valleys mentioned.

The southeastern, southwestern, and western parts of the township are covered by boulder clay and the remainder of the township is underlain by moraine.

The depth of the wells in the glacial drift of this township ranges from 3 to 160 feet and most of the wells are 50 feet deep or over.

There are a number of aquifers from which the deeper wells in the drift obtain water. An aquifer that is about 2,335 to 2,370 feet above sea-level supplies many wells in this township. Another aquifer that is about 2,400 to 2,435 feet above sea-level also supplies many wells, but the wells obtaining water from these aquifers cannot be grouped regionally and some wells have passed through both these horizons to tap a deeper aquifer. A spring about 2,400 feet above sea-level occurs on section 13 on the western side of the valley of an intermittent stream. This spring may be supplied by the higher of the two above-mentioned aquifers.

In most of the wells in this township the water is "alkaline", and in several of the deeper wells in the northern half of the township the water is too "alkaline" for human consumption.

The boulder clay over a large part of this township appears to be from 50 to 110 feet thick. In a well on section 34 gravel was passed through at depths of 46 to 53 feet, and in some of the other wells beds of sand are reported to underlie the boulder clay at depths of 5[illegible] to 110 feet.

The supply of ground water is generally sufficient for local requirements. One dry hole, 60 feet deep, was put down on the SE.$\frac{1}{4}$, section 28. The upper part of the boulder clay in this township is generally free from sand, and shallow wells are found only in the lower areas of the township where sand or silt have been deposited in former lakes and river channels.

Bedrock aquifers supply seven wells in this township with soft water. A 621-foot well on section 2 obtained an ample supply of soft water from an aquifer in the Bearpaw formation at about 1,729 feet above sea-level. This aquifer probably supplies a well, 600 feet deep, in township 17, range 10, about 2 miles south, but the water from that well is unusable. No other wells in this township have reached this aquifer, but it probably underlies the entire township. A 450-foot well on section 2 obtained a large supply of soft water that is coloured yellow, probably by contact with a coal seam. The aquifer lies at about 1,900 feet above sea-level, but it probably does not extend far into the township, as the well 620 feet deep sunk on section 2 did not obtain much water at a point 1,900 feet above sea-level.

In the northern two-thirds of the township several bedrock aquifers supply soft water to wells 135 to 250 feet deep. There appear to be three water-bearing horizons that occur at elevations of about 2,250 feet, 2,300 feet, and 2,350 feet above sea-level. The aquifer at about 2,350 feet above sea-level probably underlies only the western half of this township. The aquifer at about 2,300 feet above sea-level probably underlies most of the northern two-thirds of this township and extends into the township north.

Township 18, Range 11

The topography in this township is rolling, the surface rises towards the southwest corner where a hill reaches an elevation of over 2,550 feet above sea-level. The drainage of the township is either into Handsome lake in the southeast corner, to the low, marshy, westerly-trending valley that extends through the centre of the township, or to some of the lake basins in the northeast, which are dry except in wet

seasons. Two, short, intermittent streams feed into the west end of Handsome lake, but there are no dependable permanent supplies of surface water in the township.

An area of about 4 square miles in the southwestern corner of the township is underlain by moraine, the remainder of the township is covered by boulder clay.

Several wells, 52 to 90 feet deep, located in the northern half of the township tap an aquifer that is about 2,350 to 2,375 feet above sea-level, from which they obtain water that is generally "alkaline". The distribution of the other aquifers is irregular.

The quality of the water in the wells in the drift in the southern half of the township is poor, and in all the wells except two the water is "alkaline". In four of these wells the water is too "alkaline" for drinking, and in two wells the water is bitter. In the northern half of the township the water in most of the wells is "alkaline", although it is not too "alkaline" for drinking.

Eleven wells in this township obtain soft water from aquifers in the bedrock. An aquifer that is about 2,168 feet above sea-level supplies a well 182 feet deep on the NW.$\frac{1}{4}$, section 18, with soft water. An aquifer that is about 2,220 to 2,268 feet above sea-level supplies four wells, 137 to 200 feet deep, in the northwest half of the township, with soft water. In three of these wells the water is brown, probably due to contact with coal beds. This aquifer is probably in the Bearpaw formation.

Aquifers that are 2,355 to 2,403 feet above sea-level supply five wells, 37 to 120 feet deep, with soft water. These aquifers are probably in the Eastend formation. The distribution of these bedrock aquifers in the township is irregular, and no well-defined areas can be assigned to any of them.

Township 18, Range 12

The relief of land surface in this township is low, except near the southern boundary where the surface rises to a little over 2,600 feet above sea-level. The valley of Swiftcurrent creek cuts through section 6. The drainage is to Swiftcurrent creek, or to several, low, marshy areas or lake beds in the southeastern and the northwestern parts of the township.

Boulder clay underlies the valley of Swiftcurrent creek, and most of the northern half of the township. The remainder of the township is underlain by moraine.

A curved line extending from the centre of the southern boundary of section 4 to the northeast corner of the township has been drawn on the plan as marking the approximate boundary separating the Eastend formation on the east from the Bearpaw formation on the west.

In the southern third of the township most of the wells are over 100 feet deep and obtain water from aquifers in the bedrock. In the northern two-thirds of the township the wells are over 60 feet deep, and with three exceptions they obtain water from the unconsolidated deposits.

An aquifer, which in the central third of the township is generally gravel, but which in the northwest part appears to consist chiefly of sand, supplies water to most of the deep wells in the unconsolidated deposits of this township. This aquifer lies about 2,300 to 2,350 feet above sea-level, and appears to slope towards the south. It probably occurs at or near the base of the drift.

A spring in the side of a valley in section 23 occurs at about 2,390 feet above sea-level, and a shallow well on section 23, and another on section 24, are apparently supplied by the same aquifer that supplies the spring.

The water in all the deeper wells in the drift of this township is "alkaline", but in two wells, 40 and 60 feet deep, located in sections 4 and 12, respectively, the water is too "alkaline" for drinking. The supply of water in the wells in the drift is generally adequate for all purposes.

In the southern third of the township, ten wells, 116 to 270 feet deep, obtain soft water from the bedrock. There appear to be at least four aquifers in the bedrock in this part of the township. An aquifer about 2,237 to 2,252 feet above sea-level supplies four wells 213 to 270 feet deep. An aquifer about 2,300 to 2,335 feet above sea-level supplies three wells, 200 to 265 feet deep. An aquifer about 2,356 to 2,390 feet above sea-level supplies two wells 119 to 170 feet deep and an aquifer in section 1 about 2,486 feet above sea-level supplies a well 64 feet deep with soft water.

The aquifer about 2,237 to 2,252 feet above sea-level probably underlies the entire township, as three wells 170 to 185 feet deep in sections 30 and 31 obtain water from an aquifer that is about 2,165 to 2,220 feet above sea-level, and a well in the NW.$\frac{1}{4}$, sec. 18, tp. 18, range 11, obtains water from an aquifer that is about 2,168 feet above sea-level. The other three bedrock aquifers do not appear to extend far north as the water derived from aquifers at or near the elevations stated is hard and "alkaline".

Township 18, Range 13

Only a small part of the western third of this township is included in the rural municipality of Excelsior. Swiftcurrent creek forms the western boundary of this part of the township. The creek valley is about 250 feet deep in section 35 and about 150 feet deep in section 1. East of the

creek valley the country is rather flat, rising gently to over 2,400 feet above sea-level.

The northern third of the township and the valley of Swiftcurrent creek are underlain by boulder clay. South and east of the boulder clay areas moraine mantles the surface. The Bearpaw formation underlies the drift over the entire township.

No well records were obtained from this township. Ground water conditions are probably on the whole similar to those in the western half of township 18, range 12.

Township 19, Range 10

The northern quarter of the township is dissected by numerous coulées. The remainder of the township is comparatively flat, with elevations ranging from about 2,350 to 2,500 feet above sea-level. In the western half of the township the land surface slopes very gently westwards. Drainage is to the valley of South Saskatchewan river or to a low, marshy area in the southeast.

Boulder clay underlies the slopes to the river and in the western part extends south in a belt about 2 miles in average width to beyond the southern township boundary. Moraine underlies most of the southeastern half of the township.

The Eastend formation underlies the glacial drift over the entire township except for a small area in the northwest corner where the Bearpaw formation is believed to underlie the drift.

The upper part of the drift in this township contains very little ground water and most of the producing wells are over 100 feet deep. An aquifer that is about 2,370 to 2,400 feet above sea-level supplies a number of wells 33 to 140 feet

deep, in the southern half of the township and in section 24, with sufficient supplies of hard, "alkaline" water for local use.

An aquifer that is about 2,300 to 2,335 feet above sea-level supplies water to a number of wells 63 to 144 feet deep, in the northern half of the township. The water from this aquifer is "alkaline", but in most wells the water is not too "alkaline" for drinking, and the supply at most farms is adequate for local requirements.

Several other aquifers occur, but they are of very limited extent.

Several springs located on the upper slopes to Saskatchewan river at elevations of about 2,400 feet above sea-level supplement the supply of well water.

The water in all the wells in the glacial drift is "alkaline" or slightly "alkaline", and in one well on the NW.$\frac{1}{4}$, section 30, the water is bitter and laxative. However, in most wells the water is not too "alkaline" for human use, and at most farms the supply of well water is sufficient for local needs. Dams are in use at two farms in section 28.

The logs of some of the deeper wells show a great thickness of boulder clay. A well on section 6 passed through yellow clay between the depths of 50 to 65 feet. This may be an interglacial weathered zone, but no water was obtained from it.

Nine wells in the southern half of this township obtain soft water from aquifers in the bedrock. An aquifer that is about 2,275 to 2,320 feet above sea-level supplies six of these wells 125 to 240 feet deep. An aquifer that is about 2,220 feet above sea-level supplies a well 260 feet deep on section 10. These bedrock aquifers do not appear to extend into the northern part of the township, as the wells in this part yield hard, "alkaline" water from aquifers at or below 2,220 to 2,315 feet above sea-level.

Township 19, Range 11

South Saskatchewan river, having here an elevation of about 1,744 feet above sea-level, passes through the northwest part of the township, and the land surface is deeply dissected by coulées, some of which extend back for several miles from the river. Near the southern boundary of the township, the land rises to over 2,400 feet above sea-level.

A line extending in a northeasterly direction from the centre of the southern boundary of section 6 to the northeast corner of section 24 is drawn as marking the boundary separating the Eastend formation on the southeast from the Bearpaw formation on the northwest. Boulder clay overlies the bedrock over the entire township except in the lower parts of the valley slopes of South Saskatchewan river where outcrops of the Bearpaw formation occur.

Two wells, 115 to 120 feet deep, in sections 24 and 25, respectively, obtain water that is of poor quality from an aquifer in the boulder clay that is about 2,230 feet above sea-level.

A 600-foot well on section 1 obtained soft water from an aquifer in the Bearpaw formation that is about 1,775 feet above sea-level. This well is not now used. The northern extent of this aquifer is not known, as no other wells in township 19, or in township 20, have been put down to it. Ground level at the Imperial Oil Company's well, 2,335 feet deep, located in section 30, in the valley of the river not far above water-level, is about 1,762 feet above sea-level. Salty water is flowing from the well, but it is not used. The water is probably derived from several aquifers.

Township 19, Range 12

and

Part Township 20, Range 12

Water-level in South Saskatchewan river is about 1,740 to 1,750 feet above sea-level. The slopes of South Saskatchewan river are steep and generally extend back for about 1½ miles from the river channel, whereas some of the coulées head back for distances of over 3 miles. Beyond the river slopes the country is comparatively flat. Prairie level at the edge of the slopes lies at about 2,300 to 2,350 feet above sea-level. In the southeast the land rises to about 2,450 feet above sea-level.

Boulder clay underlies the township except in the escarpment along the river valley where the Bearpaw formation is exposed. The Bearpaw formation underlies the unconsolidated deposits throughout the entire township.

Three wells in sections 2 and 3 obtain small supplies of "alkaline" water from an aquifer in the boulder clay that is about 2,310 to 2,337 feet above sea-level. Several other wells 48 to 110 feet deep, located in the southern third of the township, also obtain "alkaline" water from aquifers in the boulder clay. A dry hole 154 feet deep was put down on the SE.¼, section 10.

In the western third of the township seven wells, 216 to 360 feet deep, obtained soft or moderately hard water from aquifers that are thought to be in the bedrock.

An aquifer that is about 1,992 to 2,020 feet above sea-level supplied three wells, 318 to 360 feet deep, in section 20, and the SE.¼, section 30, with soft water. An aquifer that is about 2,094 feet above sea-level supplies a well 216 feet deep, in the SW.¼, section 30, with soft water. An aquifer that is

about 2,057 to 2,077 feet above sea-level supplies three wells 315 to 355 feet deep, with moderately hard water.

It is impossible to accurately indicate the areal extent of these aquifers. The aquifer that is about 2,057 to 2,077 feet above sea-level appears to extend into the northern part of the township to the west.

Township 19, Range 13

and

Part Township 20, Range 13

Swiftcurrent creek forms the western boundary of that part of this township included in the rural municipality of Excelsior. The sides of Swiftcurrent creek within this township are very steep. The valley of the creek is about 450 feet deep near South Saskatchewan river and about 250 feet deep at the southern boundary of the township. The slopes to South Saskatchewan river within this township extend for over a mile back from the river channel and are much less steep than are the slopes to Swiftcurrent creek. Back from these valleys the country is flat with elevations rising only slightly over 2,350 feet above sea-level.

Water-level in South Saskatchewan river is about 1,749 feet above sea-level at the eastern boundary of township 20, range 13. In the southwest of township 19 water-level in Swiftcurrent creek is about 2,040 feet above sea-level.

Boulder clay mantles the entire township. The Bearpaw formation underlies the boulder clay, and is exposed in the lower slopes of the valley of South Saskatchewan river and of Swiftcurrent creek.

Four wells 198 to 315 feet deep obtain soft water from aquifers in the Bearpaw formation. An aquifer that is about 2,050 feet above sea-level supplies soft water to a well 240 feet

deep on section 26. This aquifer seems to be continuous with that in the township to the east. An aquifer that is 2,110 to 2,132 feet above sea-level supplies soft water to the other three wells. It appears to be a northwestward continuation of an aquifer that occurs in the northwest part of township 18, range 12. This aquifer probably underlies the part of this township lying to the east of Swiftcurrent creek.

Township 20, Range 10

That part of this township included in the rural municipality of Excelsior is entirely within the southern valley slope of South Saskatchewan river. The surface is deeply dissected by coulées, some of which extend back as far as the southern boundary of the township. Between the numerous coulées and ravines there is little land surface that can be cultivated, but in the southern part there are a few farms. Most of the township is only adapted for ranching.

Boulder clay underlies the township. The Bearpaw formation is exposed in the lower slopes of South Saskatchewan river and underlies the glacial drift except in the extreme southeast corner where the Eastend formation is believed to underlie the drift.

Only three well records are available in this township. One of these, a well on the SE.$\frac{1}{4}$, section 6, obtains water from an aquifer in the bedrock that is about 2,213 feet above sea-level. It is improbable that this bedrock aquifer extends far northwards into this township, as a well in the northwest corner of the same section, 108 feet deep, obtained water from an aquifer in the boulder clay at about 2,152 feet above sea-level. There are doubtless numerous other drift-filled ravines in the district.

Township 20, Range 11

Only the southeastern part of this township is included in the rural municipality of Excelsior, the entire area being located in the valley of South Saskatchewan river. In section 1 the land surface is comparatively flat, but elsewhere the land slopes rather steeply towards the river, and the area is suitable only for ranching. Boulder clay underlies the area except along the valley escarpments where the Bearpaw formation, which underlies the boulder clay, is exposed at the surface.

No well records were obtained from this township. The ground water conditions are probably similar to those in the two adjacent townships previously described.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF EXCELSIOR, NO.166, SASKATCHEWAN

Township	16	16	16	17	17	17	18	18	18	18	19	19	19	19	20	20	Total No. in municipality
West of 3rd meridian Range	10	11	12	10	11	12	10	11	12	13	10	11	12	13	10	11	
Total No. of Wells in Township	33	41	23	43	36	26	57	53	43	0	48	5	17	4	3	0	432
No. of wells in bedrock	2	5	1	3	3	3	7	10	13	0	9	2	8	4	1	0	71
No. of wells in glacial drift	30	36	18	40	33	23	50	43	30	0	39	3	9	0	3	0	350
No. of wells in alluvium	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Permanency of Water Supply																	
No. with permanent supply	32	22	22	34	34	20	51	46	41	0	47	5	14	4	3	0	381
No. with intermittent supply	1	14	1	4	1	0	2	4	1	0	0	0	2	0	0	0	30
No. dry holes	0	5	0	5	1	0	4	3	1	0	1	0	1	0	0	0	21
Types of Wells																	
No. of flowing artesian wells	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells	8	11	8	13	18	13	34	27	34	0	39	5	12	4	1	0	227
No. of non-artesian wells	25	25	15	25	17	13	19	23	8	0	8	0	4	0	2	0	184
Quality of Water																	
No. with hard water	30	27	19	36	29	21	48	39	30	0	39	3	13	0	2	0	336
No. with soft water	3	9	4	2	0	5	5	11	12	0	8	2	3	4	1	0	75
No. with salty water	0	0	1	1	1	0	0	4	1	0	1	0	1	0	0	0	10
No. with "alkaline" water	4	7	7	15	12	11	28	26	20	0	35	1	8	1	1	0	170
Depths of Wells																	
No. from 0 to 50 feet deep	24	23	17	25	20	19	21	26	11	0	5	0	2	0	1	0	194
No. from 51 to 100 feet deep	7	13	4	14	11	4	24	17	10	0	11	0	3	0	0	0	118
No. from 101 to 150 feet deep	1	1	2	0	2	3	5	0	10	0	21	3	3	0	2	0	59
No. from 151 to 200 feet deep	0	1	0	1	1	0	3	3	7	0	0	0	1	0	0	0	23
No. from 201 to 500 feet deep	1	1	0	3	2	0	3	0	5	0	5	0	8	4	0	0	32
No. from 501 to 1,000 feet deep	0	2	0	0	0	0	1	1	0	0	0	1	0	0	0	0	5
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
How the Water is Used																	
No. usable for domestic purposes	28	30	20	20	29	21	28	35	40	0	35	3	11	4	1	0	321
No. not usable for domestic purposes	5	6	3	12	0	5	15	15	2	0	12	2	5	0	2	0	90
No. usable for stock	33	34	23	34	35	26	51	47	42	0	46	5	16	4	2	0	398
No. not usable for stock	0	2	0	4	0	0	2	3	0	0	1	0	0	0	1	0	13
Sufficiency of Water Supply																	
No. sufficient for domestic needs	32	22	20	30	27	20	49	46	40	0	45	3	14	4	3	0	361
No. insufficient for domestic needs	1	14	3	8	8	0	4	4	2	0	2	2	2	0	0	0	50
No. suffidient for stock needs	29	18	17	25	20	23	43	42	37	0	40	5	13	4	3	0	325
No. insufficient for stock needs	4	18	6	13	9	3	10	8	5	0	7	0	3	0	0	0	80

ANALYSES AND QUALITY OF WATER

General Statement

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

Total Dissolved Mineral Solids

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

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

Mineral Substances Present

Calcium and Magnesium

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

Sodium

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

Sulphates

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

Chlorides

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

Iron

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

Hardness

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

can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in 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 Excelsior, No. 166, Saskatchewan

LOCATION						Depth of Well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS								Source of Water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	SW.	5	1o	11	3	28	1,720	1,000	1,000		15	85	200	169	1,005	232	1,486	85	369		504		503	25		✱1
2	SW.	1o	1o	11	3	189	2,o8o	130		130	14	560	40	18	1,468	1,227	2,776	71		38		471	2,173	23		✱2
3	NW.	34	1o	11	3	420	1,000				125	750	20	4		544	99o	3o		8		746		206		✱3
4	W.½	25	1o	12	3	Dam												78	85	140			118	8		✱1
5	SW.	1	17	10	3	40	1,7o9											(3)	(1)		(2)		(4)		(5)	✱1
o	SW.	2	17	10	3	57	1,431											(4)	(1)		(2)		(3)		(5)	✱1
7	NE.	2	17	10	3	50	3,o54												(2)		(3)	(4)	(1)		(5)	✱1
8	NW.	8	17	11	3	25	2oo	240	100	140	8	195	60	40	45	28	258	61	64	84		36		13		✱1
9	SE.	31	17	11	3	280	1,o3o	35			80	595	20	7	184	524	1,028	36		15		573	272	132		✱2
10	SW.	22	18	10	3	21o	820	15			8	475	20		172	390	7o8	36				465	254	13		✱2
11	NW.	31	18	10	3	105	1,498											98		69		237	1,076	18		✱1
12	NE.	20	18	11	3	oo	1,557												(2)		(4)	(3)	(1)	(5)		✱1
13	SE.	5	19	10	3	169	900												(4)		(5)	(2)	(1)	(3)		✱2
14	NE.	o	19	10	3	100	2,047											131		139		105	1,o30	41		✱1
15	SE.	14	19	10	3	110	1,196											157	48	171			810	10		✱1
1o	NE.	4	19	12	3	110	1,511												(2)		(5)	(3)	(1)	(4)		✱1
17	NE.	2o	19	13	3	240	1,297												(4)		(5)	(2)	(1)	(3)		✱3

Water samples indicated thus, ✱1, are from glacial drift or other unconsolidated deposits
Water samples indicated thus, ✱2, are from bedrock, Eastend formation.
Water samples indicated thus, ✱3, are from bedrock, Bearpaw formation.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analyses Nos. 5, 6, 7, 12, 13, 16, and 17, by Provincial Analyst, Regina; Analysis No. 4 by Canadian Pacific Railway Company, 11, 14, 15 by Canadian National Railways Company.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The composition of ground water from the glacial drift is controlled by a number of conditions that are subject to great variation even within short distances. The composition of the drift is due to a number of factors, such as the original composition of the rocks from which the drift was derived, and the chemical processes, such as oxidation, solution, etc., to which it has been subjected both before and since its deposition.

The degree to which mineral salts are transferred from sediments to waters percolating through them is largely controlled by three conditions--the solubility of the sediments, the size of grain of the sediments, and the rapidity with which the ground water circulates through the sediments, this latter factor being largely dependant on the porosity of the sediments and the topographical conditions of the area in which the sediments occur.

Water derived from springs or spring fed wells, or from shallow wells in sand or gravel on the sides of valleys, generally contains less dissolved mineral matter than does water obtained from wells sunk in fine-grained sediments such as lake clays which are situated in low-lying, flat areas.

Most of the water from the drift is hard and in many cases is excessively hard. Calcium sulphate ($CaSO_4$), and magnesium sulphate ($MgSO_4$), usually form the chief salts in water of this type, and both of these salts impart permanent hardness to water. The carbonates of calcium ($CaCO_3$) and magnesium ($MgCO_3$), which impart temporary hardness to ground water, are usually present in smaller proportions than the corresponding sulphates. Sodium sulphate (Na_2SO_4) is usually present in these waters, but the proportion of this salt varies widely. Sodium chloride (NaCl) and sodium carbonate (Na_2CO_3)

are generally not present in sufficient amounts in ground water from the drift to affect the use or the taste of the water.

The amount of dissolved solids, the taste, and the laxative properties are the three most important considerations of ground water from the chemical standpoint.

Water No. 8 contains only 260 parts per million of total solids. The well from which the water was taken appears to be fed by the same aquifer that supplies a spring about a mile south of the well, and circulation of ground water in this aquifer is probably comparatively rapid as the well is located on the slope of a hill.

Water No. 4 was taken from a dam in which the water of Swiftcurrent creek was stored. The total dissolved solids are less than 500 parts per million. The water is moderately hard, but is much less hard than the water in most of the wells in the drift and boiling would soften it considerably.

Water No. 7 contains 3,654 parts per million of total solids. It is probably slightly laxative due to the sodium and magnesium sulphate it contains, and is better adapted for use by stock than for drinking.

The remaining waters from the drift contain 1,431 to 2,047 parts per million of total solids, and can be used for drinking, although water No. 14 contains 1,630 parts per million of sodium sulphate and is slightly laxative. In most of the drift waters in this municipality, sodium sulphate is more abundant than the sulphates of calcium and magnesium.

Water from the Bedrock

The waters from the bedrock can be grouped into three main classes, in which the relative abundance of the constituents is in the order given.

(1) The sodium - sulphate, carbonate, chloride type in which the sulphate or carbonate of calcium and magnesium are subordinate, as in waters Nos. 2, 13, and 17. These waters are comparatively soft.

(2) The sodium - carbonate, sulphate, chloride type which contains so little calcium and magnesium salts that the water is very soft, as waters Nos. 9 and 10. These waters are excellent for washing and can be used for drinking, but the sodium carbonate they contain would probably extract the colouring matter from organic matter such as tea or coffee.

(3) The sodium - carbonate, chloride type, as water No. 3, which is very soft but which contains a large proportion of sodium carbonate that colours organic matter and gives the water a "soda" taste that is particularly noticeable if the water is not quite cold.

Sodium carbonate, "black alkali", is the most harmful sodium salt in water when used for irrigation. The waters in the first class are better adapted for small class irrigation than the waters of the second and third class, as the waters of the first class contain some calcium and magnesium sulphates that tend to neutralize the deleterious effect of the sodium carbonate in the water. The waters of the second and third class are generally not good for irrigation, as they contain a large proportion of sodium carbonate.

WELL RECORDS—Rural Municipality of EXCELSIOR NO. 166, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	NE.	2	16	10	3	Dug	42	2,460	- 39	2,421	42	2,418	Glacial gravel	Hard, clear		D, S	Sufficient for house and 20 head stock.
2	NE.	3	"	"	"	Dug	45	2,450	- 39	2,411	45	2,405	Glacial gravel	Hard, clear, slightly "alkaline"		D, S	Sufficient for house and 13 head stock.
3	NE.	4	"	"	"	Dug	80	2,500			80	2,420	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for house and 3 head stock; also 25-foot seepage well; limited supply.
4	NW.	4	"	"	"	Dug	60	2,500	- 54	2,446	60	2,440	Glacial drift	Hard, clear		D, S	
5	SW.	4	"	"	"	Drilled	210	2,500	- 80	2,420	210	2,290	Eastend formation	Soft, brown colour		D, S	Abundant supply; waters 30 head stock.
6	NE.	7	"	"	"	Dug	28	2,480	- 20	2,460	28	2,452	Glacial drift	Hard, clear, objectionable odour		S	Sufficient, but usable only by stock.
7	NE.	8	"	"	"	Dug	30	2,500	- 27	2,473	30	2,470	Glacial drift	Hard, clear		D, S	Sufficient for household and 15 head stock; well on NW.¼, section 9, 28-foot well, ample supply.
8	NW.	10	"	"	"	Dug	26	2,450	- 21	2,429	26	2,424	Glacial gravel	Slightly hard, clear		D, S	Sufficient for household and 35 head stock.
9	SW.	12	"	"	"	Dug	42	2,450	- 39	2,411	42	2,408	Glacial gravel	Hard, clear		D, S	Sufficient supply; waters 13 head stock.
10	SE.	13	"	"	"	Bored	56	2,460	- 46	2,414	56	2,404	Glacial drift	Hard, clear		D, S	Intermittent; becoming dry in dry seasons; usually waters 12 head stock.
11	SW.	15	"	"	"	Dug	12	2,450	- 8	2,442	12	2,438	Glacial sand and gravel	Soft, clear		D, S	Sufficient; waters 20 head stock; also similar well, ample supply.
12	NW.	17	"	"	"	Dug	10	2,440	- 5	2,435	10	2,430	Glacial gravel	Hard, clear		D, S	Sufficient supply; waters 15 head stock.
13	SW.	17	"	"	"	Bored	46	2,500	- 25	2,475	46	2,454	Glacial sand	Hard, clear, iron		D, S	Sufficient supply; 2nd 31-foot well with 16 feet of water.
14	SE.	18	"	"	"	Dug	12	2,400	- 8	2,392	12	2,388	Glacial gravel	Hard, clear		D, S	Sufficient supply; waters 25 head stock; also dam for cattle; spring on SW.¼, section 18, ample supply.
15	NE.	19	"	"	"	Dug	7	2,450	- 3	2,447	7	2,443	Glacial gravel	Hard, clear		D, S	Sufficient; waters 13 head stock; seepage well.
16	NW.	20	"	"	"	Dug	30	2,450	- 26	2,424	30	2,420	Eastend ?	Hard, clear		D, S	Sufficient supply; waters 10 head stock, coal seam struck at 20. feet.
17	SE.	20	"	"	"	Dug	10	2,460	- 5	2,455	10	2,450	Glacial gravel	Hard, clear		D, S	Sufficient for house and 15 head stock.
18	NW.	23	"	"	"	Dug	10	2,340	- 5	2,335	10	2,330	Glacial sand	Soft, clear		D, S	Sufficient for house and 25 head stock; also small dam.
19	NW.	24	"	"	"	Bored	75	2,385	- 50	2,335	75	2,310	Glacial drift	Hard, "alkaline"		D, S	Sufficient supply; waters 20 head stock.
20	NE.	24	"	"	"	Dug	60	2,398	- 40	2,358	60	2,338	Glacial drift	Hard, clear		D, S	Ample supply; waters 5 head stock.
21	SW.	25	"	"	"	Bored	80	2,382	- 50	2,332	80	2,302	Glacial drift	Hard, clear		D, S	Sufficient supply; waters 15 head stock.
22	SW.	26	"	"	"	Bored	5	2,345	- 2	2,343	5	2,340	Recent sand	Hard, clear, "alkaline"		D, S	Sufficient supply; waters 16 head stock; also small spring.
23	SW.	30	"	"	"	Dug	8	2,500			8	2,492	Glacial drift			S	Waters 30 head stock.
24	NW.	32	"	"	"	Bored	40	2,400	- 34	2,366	40	2,360	Glacial drift	Hard, clear		D, S	Sufficient supply; dam also used.
25	NW.	34	"	"	"	Bored	104	2,350			104	2,246	Glacial drift				Second well 18-foot; aquifer in sand and gravel, ample supply, waters 75 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 EXCELSIOR NO. 166, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
26	NE.	36	16	10	3	Dug	84	2,348	- 80	2,268	84	2,264	Glacial sand	Hard, clear		D, S	Just dug, hence sufficiency not known.
1	NE.	1	16	11	3	Dug	14	2,395	- 12	2,383	14	2,381	Glacial sand	Hard, clear		D	Intermittent supply never more than enough for drinking and cooking.
2	SW.	1	"	"	"	Dug	16	2,350	- 11	2,339	14	2,336	Glacial sand	Hard, clear, "alkaline"	44	D, S	Intermittent; used for cooking but unsuitable for drinking.
3	SW.	2	"	"	"	Bored	125	2,452	-112	2,340	125	2,327	Glacial drift	Hard, clear, very "alkaline"	40	D, S	Ample for 50 head stock; used for cooking but unsuitable for drinking; a seepage 25-foot well on SE.¼, section 3, used for drinking.
4	SE.	5	"	"	"	Drilled	90	2,437	- 82	2,355	90	2,347	Glacial drift	Very hard, clear, very "alkaline"	44	S	Sufficient supply, but unfit for human consumption.
5	SW.	5	"	"	"	Dug	28	2,452	- 12	2,440	28	2,424	Glacial drift	Medium hard, clear	42	D	Sufficient supply. #
6	NW.	5	"	"	"	Dug	10	2,415	- 3	2,412	10	2,405	Glacial fine sand	Hard, clear	50	D, S	Sufficient; supplies 4 farms.
7	NE.	6	"	"	"	Drilled	30	2,525	- 28	2,497	30	2,495	Glacial drift	Very "alkaline"		N	Stock would not drink it.
8	SE.	7	"	"	"	Dug	30	2,560	- 28	2,532	30	2,530	Glacial drift	Hard, clear	40	D, S	Sufficient supply.
9	SE.	8	"	"	"	Dug	54	2,608	- 39	2,569	54	2,554	Glacial drift	Hard, clear	44	S	Intermittent supply; hauls water in dry seasons. Dugout also used.
10	SE.	8	"	"	"	Drilled	620	2,600			620	1,980	Bearpaw formation	Soft, cloudy		D, S	Sufficient supply; has not been in use lately.
11	SE.	8	"	"	"	Dug	50	2,594	- 25	2,569	50	2,544	Glacial drift	Slightly hard, clear	42	D	Intermittent supply.
12	NW.	8	"	"	"	Dug	30	2,556	- 27	2,529	30	2,526	Glacial sand		40	D, S	Not always sufficient.
13	NW.	8	"	"	"	Drilled	600	2,555			600	1,955	Bearpaw formation	Soft, clear		D, S	Sufficient; in need of repair.
14	SW.	9	"	"	"	Dug	25	2,565	- 20	2,545	25	2,540	Glacial drift	Hard, clear		D, S	Intermittent; insufficient supply.
15	SE.	9	"	"	"	Dug	25	2,540	- 0	2,540	25	2,515	Glacial drift	Hard, clear		D, S	Intermittent supply; two 60-foot dry holes.
16	NW.	10	"	"	"	Dug	99	2,450	- 94	2,356	99	2,351	Eastend formation ?	Soft, "alkaline"		N	When used ample supply; is now filled in.
17	SE.	10	"	"	"	Dug	67	2,450	- 64	2,386	67	2,383	Glacial drift	Soft, clear		D, S	Insufficient; waters 12 head stock.
18	SE.	10	"	"	"	Bored	98	2,416	- 92	2,324	98	2,318	Glacial drift	"Alkaline" white sediment		N	Originally abundant supply, at present a dugout is used, and well is filled in.
19	SE.	13	"	"	"	Dug	60	2,420									Dry hole; base in glacial drift.
20	SE.	16	"	"	"	Dug	30	2,472									Dry hole; base in glacial drift.
21	SW.	16	"	"	"	Drilled	189	2,513			189	2,324	Eastend formation ?	Soft, clear	38	D, S	Abundant supply. #
22	SE.	18	"	"	"	Dug	28	2,520			28	2,492	Glacial drift	Hard			Intermittent supply; also 100-foot dry hole.
23	NE.	20	"	"		Bored	55	2,410			55	2,355	Glacial drift	Very hard, clear	45	D	Sufficient supply; has no stock; also spring.
24	NE.	24	"	"	"	Dug	10	2,588			10	2,578	Glacial drift	Hard		N	Intermittent 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.

B 4-4

WELL RECORDS—Rural Municipality of EXCELSIOR NO. 166, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
25	SE.	25	16	11	3	Bored	43	2,555	- 25	2,530	43	2,512	Glacial drift	Hard, clear, "alkaline"		S	Insufficient; intermittent supply; dugout used.
26	NE.	25	"	"	"	Dug	30	2,550	- 10	2,540	30	2,520	Glacial drift	Hard, clear		D, S	Intermittent supply.
27	SW.	25	"	"	"	Bored	50	2,620	- 18	2,602	50	2,570	Glacial drift	Medium hard, clear	42	D, S	Sufficient supply.
28	NE.	26	"	"	"	Dug	12	2,580	0	2,580	12	2,568	Glacial drift	Hard	62	S	Sufficient supply; also used by neighbour another 24-foot intermittent well.
29	NE.	30	"	"	"	Dug	27	2,400	- 24	2,376	24	2,376	Glacial sand	Very soft, clear	42	D, S	Sufficient supply.
30	SW.	30	"	"	"	Dug	40	2,384	- 10	2,374	40	2,344	Glacial drift	Soft, clear	42	D, S	Insufficient supply; creek water also used.
31	NE.	32	"	"	"	Drilled	97	2,368	- 93	2,275	97	2,271	Glacial sand	Hard, cloudy, red sediment	48	D, S	Abundant supply.
32	NW.	33	"	"	"	Dug	27	2,350	- 10	2,340	27	2,323	Glacial sand	Hard, clear	38	D, S	Insufficient; intermittent supply.
33	NW.	33	"	"	"	Bored	67	2,350			67	2,283	Glacial drift	Very "alkaline"		N	Intermittent supply.
34	NW.	34	"	"	"	Drilled	420	2,356	-100	2,256	420	1,936	Bearpaw sand	Soft, slightly brown	46	D, S, I	Abundant supply.
35	NE.	34	"	"	"	Dug	16	2,374	- 6	2,368	16	2,358	Glacial drift	Hard, clear	39	D, S	Intermittent supply.
36	NE.	35	"	"	"	Dug	75	2,458			75	2,383	Glacial drift	Hard, clear, sulphur	42	D, S	Sufficient supply.
37	NE.	36	"	"	"	Dug	30	2,525	- 27	2,498	30	2,495	Glacial drift	Soft, clear	42	D, S	Intermittent supply.
1	SW.	2	16	12	3	Drilled	80	2,546	- 25	2,521	80	2,466	Glacial drift	Hard, cloudy, "alkaline" yellow sediment		S	Sufficient supply; 15-foot well supplies household.
2	SE.	4	"	"	"	Bored	90	2,584	- 30	2,554	90	2,494	Glacial drift	Hard, clear, slightly "alkaline"	42	D, S	Abundant supply; slightly laxative.
3	NE.	4	"	"	"	Drilled	108	2,584	- 85	2,499	108	2,476	Glacial drift	Hard, clear, slightly "alkaline"	42	D, S	Abundant supply.
4	SE.	8	"	"	"	Drilled	149	2,582	-132	2,450	149	2,433	Eastend	Soft, clear, salty	44	D, S	Sufficient supply; 39-foot well for house use.
5	SW.	8	"	"	"	Spring	7	2,600	- 3	2,597	7	2,593	Glacial drift				Pormanent supply of good water.
6	NW.	10	"	"	"	Bored	84	2,514	- 44	2,470	84	2,430	Glacial drift	Hard, clear, "alkaline"	42	D, S	Insufficient supply.
7	NE.	16	"	"	"	Bored	40	2,436	- 20	2,416	40	2,396	Glacial sand	Hard, clear		D, S	Insufficient supply.
8	SE.	20	"	"	"	Dug	15	2,354	- 12	2,342	15	2,339	Glacial sand and gravel	Hard, clear, white sediment, "alkaline"	42	S	Sufficient, but usable only by stock.
9	SE.	20	"	"	"	Dug	14	2,342	- 12	2,330	14	2,328	Glacial sand	Soft, clear	46	D	

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 EXCELSIOR NO.166, 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
10	NW.	21	16	12	3	Dug	14	2,350	- 8	2,342	14	2,336	Recent sand and gravel	Hard, clear, slightly "alkaline"	41	D	Intermittent supply.
11	SW.	21	"	"	"	Bored	60	2,404	- 40	2,364	60	2,344	Glacial drift	Hard, iron		S	Abundant supply.
12	NE.	26	"	"	"	Dug	16	2,350	- 14	2,336	14	2,336	Recent sand	Soft		D, S	Seepage well.
13	SW.	27	"	"	"	Dug	16	2,350	- 10	2,340	16	2,334	Recent sand	Hard, clear		D, S	Sufficient for local needs.
14	NW.	28	"	"	"	Dug	8	2,390	- 6	2,384	8	2,382	Glacial drift	Hard		D, S	Sufficient; will water 60 head stock a day; 2 similar wells.
15	SW.	28	"	"	"	Dug	25	2,350	- 22	2,328	25	2,325	Glacial drift	Moderately hard, slightly "alkaline"	42	D	Sufficient supply.
16	NW.	31	"	"	"	Dug	50	2,460	- 42	2,418	50	2,410	Glacial drift	Soft		D, S	Sufficient supply; waters 6 cows and 6 horses.
17	SE.	32	"	"	"	Bored	50	2,435	- 40	2,395	50	2,385	Glacial drift	Hard, clear		D, S	Good supply, at present unused.
18	SW.	33	"	"	"	Bored	35	2,400	- 28	2,372	35	2,365	Glacial drift			D, S	
19	NW.	34	"	"	"	Dug		2,375	- 8	2,367			Recent sand	Hard, clear,			
1	SW.	1	17	10	3	Bored	40	2,320	- 25	2,295	44	2,280	Glacial drift	Hard, clear, "alkaline"	44	S	Sufficient, but usable only for stock; # hauls drinking water; also second stock well.
2	NE.	2	"	"	"	Bored	50	2,300	- 26	2,274	50	2,250	Glacial sand	Hard, cloudy, iron, "alkaline"	44	S	Sufficient, but usable only for stock. #
3	SW.	2	"	"	"	Bored	57	2,345	- 42	2,303	57	2,288	Glacial sand	Hard, clear, iron	44	D, S	Sufficient for local needs; #
4	SE.	3	"	"	"	Dug	12	2,300	- 6	2,294	12	2,288	Glacial drift			S	
5	SE.	6	"	"	"	Dug	15	2,370	- 3	2,367	15	2,355	Glacial sand	Hard, clear	42	D, S	Intermittent; insufficient during summer, dugout for stock.
6	NE.	6	"	"	"	Bored	60	2,300	- 10	2,290	60	2,240	Glacial sand	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
7	SE.	10	"	"	"	Dug	14	2,310	- 9	2,301	14	2,296	Glacial gravel	Hard, clear	42	D, S	Sufficient supply.
8	SE.	12	"	"	"	Bored	71	2,300	- 15	2,285	71	2,229	Glacial sand	Hard, clear, iron, "alkaline"	42	D, S	Sufficient supply.
9	NW.	12	"	"	"	Dug	28	2,325	- 14	2,311	28	2,297	Glacial quicksand	Hard, clear, iron, "alkaline"		D, S	Sufficient supply; two 210-foot wells, filled in with quicksand, unused.
10	SW.	14	"	"	"	Dug	35	2,340	- 28	2,312	35	2,305	Glacial sand	Hard, clear	42	D, S	Sufficient supply; dugout used for cattle.
11	NW.	14	"	"	"	Dug	57	2,385	- 51	2,334	57	2,328	Glacial drift	Hard, clear	43	D, S	Sufficient supply.
12	SE.	15	"	"	"	Dug	68	2,335	- 60	2,275	68	2,267	Glacial drift	Soft, clear, iron	42	D, S	Sufficient supply; a second 65-foot well, unused.
13	NE.	15	"	"	"	Dug	70	2,385			70	2,315	Glacial drift				
14	SW.	15	"	"	"	Dug	40	2,335	- 38	2,297	40	2,295	Glacial drift	Hard, clear, iron	43	D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of EXCELSIOR NO.166, SASKATCHEWAN

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
15	SE.	17	17	10	3	Dug	6	2,300	0	2,300	6	2,294	Glacial sand	Hard, slightly yellow, iron, "alkaline"	42	D, S	Not always sufficient; intermittent.
16	SE.	17	"	"	"	Bored	40	2,315	- 39	2,276	40	2,275	Glacial sand	Hard		D	Used for drinking water; quicksand has interferred with supply.
17	NW.	20	"	"	"	Bored	63	2,370	- 50	2,320	63	2,307	Glacial sand	Hard, clear, iron, "alkaline"	42	D, S	Sufficient supply.
18	SW.	22	"	"	"	Dug	9	2,340	- 1	2,339	9	2,331	Glacial sand	Hard, clear, some iron	42	D, S	Intermittent; usually sufficient.
19	NE.	23	"	"	"	Dug	50	2,360	- 45	2,315	50	2,310	Glacial gravel	Hard, clear	44	D, S	Sufficient supply.
20	NW.	23	"	"	"	Bored	50	2,360	- 54	2,306	58	2,302	Glacial drift	Hard, clear, "alkaline"	44	D, S	Intermittent supply.
21	SE.	26	"	"	"	Bored	65	2,350	- 57	2,293	65	2,385	Glacial drift	Hard, clear, iron, "alkaline"	42	D, S	Sufficient for local needs.
22	SE.	26	"	"	"		30	2,350			30	2,320	Glacial drift			D, S	Sufficient supply.
23	NE.	26	"	"	"	Dug	54	2,350	- 40	2,310	54	2,296	Glacial drift	Hard, clear, slightly "alkaline"	42	D, S	Sufficient supply.
24	SW.	28	"	"	"	Bored	48	2,365	- 40	2,325	48	2,317	Glacial sand	Hard, clear, "alkaline" iron	42	D	Sufficient only for house use.
25	NW.	28	"	"	"	Dug	13	2,330	- 10	2,320	13	2,317	Glacial sand	Hard, clear		S	
26	SE.	29	"	"	"	Dug	50	2,350	- 48	2,302	50	2,300	Glacial sand	Hard, "alkaline"	42	D	Sufficient only for house use; also 5 dry holes to 100 feet deep; water for stock from 10-foot well.
27	NW.	32	"	"	"	Dug	8	2,330	- 4	2,326	8	2,322	Glacial sandy gravel	Soft, clear	44	D, S	Sufficient supply.
28	NE.	33	"	"	"	Dug	8	2,340	- 6	2,334	8	2,332	Glacial drift	Hard, salty, "alkaline"		S	
29	NW.	34	"	"	"	Bored	600	2,350			600	1,750	Bearpaw formation ?	"Alkaline"		N	Not suitable for domestic or stock use.
30	NW.	35	"	"	"	Dug	22	2,350	- 5	2,345	22	2,328	Glacial drift	Hard, clear, iron, "alkaline"	40	S	Sufficient for stock needs.
31	NW.	35	"	"	"	Dug	12	2,340			12	2,328	Glacial drift	Hard		D	
32	SW.	36	"	"	"	Bored	55	2,350	- 45	2,305	55	2,295	Glacial sand	Hard, clear, iron, "alkaline"	44	S	Insufficient; use 11 and 9-foot wells; intermittent supplies, used for household and stock.
1	SW.	1	17	11	3	Drilled	500	2,335	- 80	2,255	500	1,835	Bearpaw	Soft, yellowish	42		Sufficient supply; used for washing.
2	SE.	2	"	"	"	Dug	17	2,350	- 8	2,342	17	2,333	Glacial quicksand	Hard, clear		D	Limited supply.
3	NE.	4	"	"	"	Bored	25	2,330	- 10	2,320	25	2,305	Glacial sand	Very hard, "alkaline" odorous clear	41	D, S	Insufficient during winter.
4	SW.	4	"	"	"				0	2,330				Soft, salty, iron	40	D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of EXCELSIOR NO. 166, 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	NE	5	17	11	3	Dug	7	2,410	- 1	2,409	7	2,403	Glacial drift	Hard,clear, iron	44	D, S	Sufficient supply.
6	NW	5	"	"	"	Dug	40	2,400	- 35	2,365	40	2,460	Glacial drift	Hard,clear	44	D, S	Intermittent; also a spring.
7	NE	6	"	"	"	Dug	15	2,425	- 12	2,413	15	2,410	Glacial gravel	Hard,clear	42	D, S	Insufficient supply.
8	SE	7	"	"	"	Dug	20	2,400	- 18	2,382	20	2,380	Glacial gravel	Hard,clear, yellow sediment	44	D, S	Sufficient supply.
9	SW	7	"	"	"	Dug	20	2,440	- 7	2,433	20	2,420	Glacial red sand	Soft,clear	42	D, S	Sufficient; water coming from slough.
10	NW	8	"	"	"	Dug	25	2,510	0	2,510	25	2,485	Glacial sand	Hard,cloudy odour	41	D, S	Insufficient supply. #
11	NE	9	"	"	"	Dug	28	2,400	0	2,400	28	2,372	Glacial gravel	Hard,clear, slight odour	51	D, S	Insufficient supply.
12	NE	10	"	"	"	Dug	60	2,340	- 20	2,320	60	2,280	Glacial sand	Hard,clear, iron,"alkaline"	42	S	Sufficient supply; not used for drinking.
13	SE	16	"	"	"	Dug	14	2,330	- 3	2,327	14	2,316	Glacial sand	Hard,"alkaline"		D, S	Insufficient supply.
14		17	"	"	"	Bored	75	2,550	- 67	2,483	75	2,475	Glacial drift	Hard,clear			
15	SE	18	"	"	"	Dug	12	2,430	- 5	2,425			Glacial gravel	Hard,clear, slightly "alkaline"	44	D, S	Sufficient supply.
16	NW	19	"	"	"	Dug	46	2,460	- 38	2,422	46	2,414	Glacial drift	Hard,clear, some "alkali"	41	D, S	Sufficient with dam for stock; not used for drinking; tastes like coal oil.
17	SE	19	"	"	"	Dug	74	2,550	- 44	2,506	74	2,476	Glacial gravel	Hard,clear		D, S	Sufficient supply.
18	NE	21	"	"	"	Drilled	107	2,500	- 90	2,410	107	2,393	Glacial drift	Hard,clear, "alkaline"	42	D, S	
19	SW	26	"	"	"	Spring		2,400									Soft, water in ravine for stock.
20	SE	27	"	"	"	Dug	35	2,450			35	2,415	Glacial quicksand	Hard,"alkaline"		D, S	Sufficient supply; also spring.
21	NE	28	"	"	"	Dug	42	2,510			42	2,468	Glacial drift	Hard,clear	44	D, S	Sufficient supply.
22	SE	28	"	"	"	Drilled	97	2,500	- 93	2,407	97	2,403	Glacial drift	Soft,clear		D, S	Sufficient supply.
23	NW	28	"	"	"	Drilled	110	2,510	- 60	2,450	110	2,400	Glacial sand	Hard,clear, "alkaline"	48	D, S	Sufficient supply.
24	SE	30	"	"	"	Bored	53	2,450	- 15	2,435	53	2,397	Glacial drift	Hard,clear	41	D, S	Insufficient supply; also 10-foot well and dam.
25	NE	31	"	"	"	Dug	30	2,525	- 10	2,515	30	2,495	Glacial quicksand		42	S	Sufficient for stock needs.
26	SE	31	"	"	"	Drilled	280	2,510			280	2,230	Eastend formation ?	Soft, dark brown,some sediment	47	S	Sufficient for stock needs. #
27	SW	31	"	"	"	Drilled	91	2,550	- 20	2,530	91	2,459	Glacial drift	Medium hard, cloudy,rusty, some "alkaline"		D, S	Sufficient supply.
28	SE	32	"	"	"	Drilled	99	2,520	- 54	2,466	99	2,421	Glacial drift	Hard,clear, some "alkali		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 EXCELSIOR NO. 166, 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
29	NW.	34	17	11	3	Dug	50	2,500	- 45	2,455	50	2,450	Glacial drift	Hard,"alkaline",odour green	45	S	Insufficient supply.
30	SE.	34	"	"	"	Dug	90	2,490	- 74	2,416	90	2,400	Glacial gravel	Hard,clear, slightly "alkaline"		D, S	Sufficient supply.
31	SE.	35	"	"	"	Bored	75	2,460	- 68	2,392	75	2,385	Glacial gravel	Hard,clear, "alkaline"	43	D, S	Sufficient supply; also 75-foot dry hole.
32	SW.	35	"	"	"	Bored	68	2,475	- 58	2,417	68	2,407	Glacial sand	Hard,clear		D, S	Sufficient supply.
33	SE.	36	"	"	"	Dug	18	2,435	- 11	2,424	18	2,417	Glacial gravel	Soft,slight odour	41	D, S	Sufficieng for local needs.
1	NW.	1	17	12	3	Bored	148	2,500	-136	2,364	148	2,352	Glacial drift	Hard,clear, "alkaline"	42	S	Sufficient for stock needs.
2	SW.	1	"	"	"	Drilled	114	2,475	-100	2,375	114	2,361	Glacial drift	Hard,clear rusty,"alkaline"	42	S	Sufficient supply.
3	SE.	2	"	"	"	Bored	100	2,450	- 85	2,365	100	2,350	Glacial drift	Hard,clear, iron,"alkaline"	42	S	Sufficient supply.
4	NW.	2	"	"	"	Dug	20	2,410	- 8	2,402	20	2,390	Glacial sand	Hard,clear, slightly "alkaline"	42	D, S	Sufficient supply.
5	NE.	5	"	"	"	Dug	12	2,400	- 6	2,394	12	2,388	Glacial sand	Hard,clear	42	D, S	Sufficient supply.
6	SW.	5	"	"	"	Dug	20	2,500	- 17	2,483	20	2,480	Glacial sand	Hard,clear, "alkaline"	42	D, S	Sufficient supply.
7	SW.	6	"	"	"	Dug	12	2,475	- 8	2,467	12	2,463	Glacial sand	Hard,clear, "alkaline"	42	D, S	Sufficient supply.
8	NW.	7	"	"	"	Drilled	80	2,550	- 60	2,490	80	2,470	Eastend	Soft,clear	42	D, S	
9	SW.	9	"	"	"	Dug	19	2,350	- 16	2,334	19	2,331	Glacial gravel	Medium hard, iron	42	D, S	Sufficient supply.
10	NE.	12	"	"	"	Drilled	125	2,450			125	2,325	Glacial drift	Hard,iron, "alkaline"	42	S	
11	SW.	16	"	"	"	Dug	32	2,500	- 30	2,470	32	2,468	Eastend	Soft,clear	45	D, S	Insufficient supply.
12	NW.	18	"	"	"	Drilled	60	2,500	- 44	2,456	60	2,440	Eastend	Soft,clear	42	D, S	Sufficient supply.
13	SW.	20	"	"	"	Dug	18	2,350	- 9	2,341	18	2,332	Glacial sand	Hard,clear	46	D, S	
14	SE.	21	"	"	"	Dug	16	2,600	- 8	2,592	16	2,584	Glacial drift	Hard,clear, "alkaline"	44	D, S	Sufficient supply.
15	NE.	23	"	"	"	Dug	22	2,550	- 17	2,533	22	2,528	Glacial gravel	Hard,iron	42	D, S	Also spring with ample supply of hard water.
16	NW.	24	"	"	"	Dug	22	2,560	- 16	2,544	22	2,538	Glacial gravel	Hard,clear	44	D, S	Sufficient supply.
17	SE.	26	"	"	"	Dug	32	2,600	- 26	2,574	32	2,568	Glacial gravel	Hard,clear	42	D, S	
18	NW.	27	"	"	"	Dug	60	2,625	- 52	2,573	60	2,565	Glacial gravel	Medium hard, clear,	42	D, S	Sufficient supply.
19	NW.	28	"	"	"	Dug	14	2,575	- 5	2,570	14	2,561	Glacial drift	Soft,clear	42	D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of EXCELSIOR NO.166, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
20	NW.	30	17	12	3	Dug	20	2,325	- 15	2,310	20	2,305	Glacial sand	Soft,clear	42	D	
21	NE.	31	"	"	"	Dug	36	2,500	- 28	2,472	36	2,464	Glacial drift	Hard,clear, iron	44	D, S	Sufficient supply.
22	NW.	32	"	"	"	Dug	24	2,525	- 16	2,509	24	2,501	Glacial drift	Hard,clear, iron,bitter taste	44	S	
23	SE.	33	"	"	"	Dug	18	2,600	- 11	2,589	18	2,582	Glacial gravel	Hard,clear, some"alkali"	44	D, S	Sufficient supply.
24	NW.	35	"	"	"	Dug	45	2,565	- 25	2,540	45	2,520	Glacial sand	Hard,cloudy, "alkaline", iron	42	S	Insufficient supply.
25	SE.	36	"	"	"	Drilled	76	2,460	- 60	2,400	76	2,384	Glacial drift	Hard,clear, some"alkali"	42	D, S	
1	SE.	2	18	10	3	Drilled	450	2,350	- 80	2,270	450	1,900	Bearpaw formation	Soft,clear, yellow		D, S	Ample supply.
2	NE.	2	"	"	"	Drilled	621	2,350	- 80	2,270	621	1,729	Bearpaw ?fine sand	Soft,clear		D, S	Ample supply.
3	NE.	3	"	"	"	Bored	32	2,430	- 22	2,408	32	2,398	Glacial sand	Hard,clear, iron,"alkaline"	40	D, S	Sufficient supply.
4	SE.	4	"	"	"	Dug	21	2,345	- 19	2,326	21	2,324	Glacial sand	Slightly hard,clear	41	D	Insufficient supply; also dry hole; had ample supply until 1924.
5	SW.	6	"	"	"	Dug	15	2,340			15	2,325	Glacial drift	Hard,"alkaline"	42	D, S	Sufficient supply.
6	NW.	7	"	"	"	Bored	86	2,450			86	2,364	Glacial drift	Hard,clear, "alkaline"	44	D, S	Sufficient for household and 12 head stock.
7	NE.	7	"	"	"	Bored	50	2,400	- 30	2,370	50	2,350	Glacial drift	Hard,clear, "alkaline"	42	D, S	Sufficient supply; a similar well on SW.¼, section 7, farm vacant.
8	NW.	9	"	"	"	Dug	11	2,395			11	2,384	Glacial drift	Hard,clear, "alkaline" iron	43	D	Insufficient supply.
9	NW.	10	"	"	"	Bored	70	2,500	- 50	2,450	70	2,430	Glacial sand	Hard,clear, "alkaline"	42	S	Sufficient for stock needs.
10	SW.	10	"	"	"	Bored	68	2,485	- 65	2,420	68	2,417	Glacial sand	Hard,clear, "alkaline"	42	D, S	Sufficient for house and 10 horses.
11	SE.	10	"	"	"	Dug	51	2,455	- 41	2,414	51	2,404	Glacial sand	Hard,clear "alkaline"	41	S	Ample for stock needs; 12-foot well for drinking.
12	SE.	12	"	"	"	Bored	65	2,330	- 35	2,295	65	2,265	Glacial sand	Hard,clear, "alkaline"	42	D, S	Sufficient for local needs; also 3-foot well in pasture.
13	SW.	13	"	"	"	Bored	64	2,400	- 54	2,346	64	2,336	Glacial drift	Hard,"alkaline"	42	D, S	Sufficient supply; also spring.
14	NE.	14	"	"	"	Bored	30	2,400	- 12	2,388	30	2,370	Glacial sand	Hard,clear, slightly "alkaline"	40	D, S	Sufficient supply.
15	NW.	14	"	"	"	Bored	60	2,495	- 44	2,351	60	2,435	Glacial sand	Hard,clear	41	D, S	Sufficient supply; second 200-foot well in bedrock with soft water.
16	SW.	14	"	"	"	Bored	160	2,460			160	2,300	Glacial drift	Hard,clear, "alkaline"	42	D, S	Sufficient supply.
17	NE.	17	"	"	"	Bored	115	2,400	- 90	2,310	115	2,285	Glacial drift	Hard,clear		S	Sufficient supply for stock.
18	NE.	19	"	"	"	Bored	56	2,470	- 25	2,445	56	2,414	Glacial drift	Hard,clear, "alkaline"	42	D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of EXCELSIOR NO. 166, 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
19	NW.	20	18	10	3	Bored	52	2,450	- 37	2,413	52	2,398	Glacial drift	Hard,clear, iron	44	D, S	Sufficient supply.
20	SE.	20	"	"	"	Bored	87	2,450	- 59	2,391	87	2,363	Glacial drift	Hard,clear	43	D, S	Insufficient supply.
21	NE.	21	"	"	"	Bored	110	2,475	-102	2,373	110	2,365	Glacial sand	Hard,clear, "alkaline"	42	S	Sufficient, but suitable only for stock.
22	SE.	21	"	"	"	Bored	56	2,475	- 51	2,424	56	2,419	Glacial drift	Hard,clear	42	D, S	Sufficient for local needs.
23	SW.	22	"	"	"	Drilled	216	2,530	-196	2,334	216	2,314	Eastend formation	Soft,brown clear		D, S	Sufficient supply. #
24	NW.	24	"	"	"	Bored	69	2,430	- 39	2,391	69	2,361	Glacial drift	Hard,"alkaline"	42	D, S	Supplies house and 12 to 15 head stock; also 74-foot intermittent well.
25	SE.	28	"	"	"	Bored	43	2,500	- 37	2,463	43	2,457	Glacial sand	Hard,clear, slightly "alkaline"	41	D, S	Sufficient supply; also 10-foot seepage well.
26	SW.	25	"	"	"	Bored	60	2,425	- 35	2,390	60	2,365	Glacial sand	Hard,clear, "alkaline"	42	S	Sufficient for local needs; also 12-foot well of hard water.
27	SE.	26	"	"	"	Bored	90	2,445	- 70	2,375	90	2,355	Glacial drift	Hard,clear, "alkaline"	42	S	Sufficient for stock needs; 100-foot well filled in.
28	SE.	28	"	"	"	Dug	62	2,500	- 53	2,447	62	2,438	Glacial sand	Hard,clear, "alkaline"	42	D, S	Sufficient supply; dugout for stock in summer; several dry holes 50 to 60 feet deep; 250-foot well with soft water, caved in.
29	NE.	28	"	"	"	Dug	32	2,500	- 17	2,483	32	2,468	Glacial sand	Slightly hard,clear	41	D, S	Sufficient supply.
30	SW.	28	"	"	"	Bored	37	2,460	- 34	2,426	37	2,423	Glacial drift	Hard,clear, iron,"alkaline"	42	D, S	Insufficient supply; second 40-foot well, ample supply for stock use.
31	NW.	28	"	"	"	Bored	22	2,460	- 10	2,450	22	2,438	Glacial drift	Hard,clear, iron,"alkaline"	42	D	Sufficient; used only for domestic use.
32	SW.	30	"	"	"	Bored	125	2,475	- 75	2,400	125	2,350	Glacial drift	Hard,clear, "alkaline"	43	D, S	Sufficient supply.
33	NW.	31	"	"	"	Bored	105	2,475	- 50	2,425	105	2,370	Glacial sand	Hard,clear, slightly "alkaline"	42	D, S	Sufficient supply. #
34	NW.	32	"	"	"	Bored	45	2,475			45	2,430	Glacial drift	Hard,clear, "alkaline"	42	D, S	Sufficient supply.
35	SW.	32	"	"	"	Bored	135	2,490			135	2,355	Eastend formation	Soft,clear	42	D, S	Sufficient supply.
36	SW.	33	"	"	"		189	2,481	- 79	2,402	189	2,292	Eastend formation	Soft			
37	NE.	33	"	"	"	Bored	85	2,500	- 76	2,424	85	2,415	Glacial sand	Hard,clear, iron,"alkaline"	42	S	Sufficient for stock needs; 32-foot seepage well for drinking.
38	SW.	34	"	"	"	Bored	53	2,540	- 46	2,494	53	2,487	Glacial gravel	Hard,clear, "alkaline" iron	42	D, S	Sufficient supply; also similar well.
39	SW.	35	"	"	"	Bored	92	2,470	- 82	2,388	92	2,378	Glacial drift	Hard,clear, "alkaline"	42	S	Sufficient supply for stoc needs; rain water used for drinking.
40	NW.	36	"	"	"	Bored	52	2,500	- 38	2,462	52	2,448	Glacial drift	Hard,clear, "alkaline"	41	S	Intermittent supply; usually waters 10 head stock; also dam for stock.
1	NW.	2	18	11	3	Dug	28	2,400	0	2,400	28	2,372	Glacial drift	Hard,clear, salty,odour, "alkaline"	42	D, S	Sufficient supply; probably comes from spring.

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 EXCELSIOR NO.166, SASKATCHEWAN

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
2	SE.	4	18	11	3	Dug	43	2,485	- 28	2,457	43	2,442	Glacial gravel	Hard,clear	44	D, S	Sufficient supply; also 30-foot dry hole.
3	SE.	5	"	"	"	Dug	40	2,500	- 10	2,490	40	2,460	Glacial sand	Hard,clear, "alkaline"	39	D, S	Sufficient supply; water comes from sloughs.
4	NW.	6	"	"	"	Bored	65	2,525	- 55	2,470	65	2,460	Glacial drift	Hard,clear, salty,odour, "alkaline"		S	Sufficient,but usable only for stock; also 40-foot well with usable water.
5	SE.	7	"	"	"	Dug	30	2,500	- 15	2,485	30	2,470	Glacial drift	Hard,bitter, odour,yellow,"alkaline"	43	S	Sufficient for stock needs.
6	NW.	9	"	"	"	Bored	30	2,460	- 15	2,445	30	2,430	Glacial sand	Hard,clear, "alkaline"	43	D, S	Also 700-foot dry holes; base in bedrock.
7	NE.	9	"	"	"	Dug	34	2,400	- 30	2,370	34	2,366	Glacial quick-sand	Hard,clear, "alkaline"	42	D, S	Sufficient supply.
8	SE.	9	"	"	"	Dug	30	2,460	- 27	2,433	30	2,430	Glacial sand	Hard,bitter, odour,"alkaline"	42	S	Sufficient supply.
9	SW.	10	"	"	"	Drilled	110	2,475			110	2,365	Glacial drift	Hard,clear, "alkaline"		D, S	Sufficient supply.
10	SE.	11	"	"	"	Bored	61	2,325	- 30	2,295	61	2,264	Glacial sand	Hard,clear	43	D, S	Sufficient supply.
11	NW.	13	"	"	"	Drilled	68	2,425			68	2,357	Glacial drift	Hard,"alkaline"		D, S	
12	SE.	13	"	"	"	Bored	65	2,450	- 57	2,393	65	2,385	Eastend formation	Soft,clear	42	D, S	Sufficient supply.
13	SE.	16	"	"	"	Dug	30	2,375	- 10	2,365	30	2,345	Glacial drift	Hard,"alkaline"	41	S	Sufficient for local needs; also a dam, a dugout and a shallow well.
14	SW.	16	"	"	"	Dug	20	2,400	- 14	2,386	20	2,380	Glacial sand	Hard,clear, "alkaline"	42	D, S	Sufficient supply.
15	SE.	17	"	"	"	Dug	30	2,450	- 15	2,435	30	2,420	Glacial drift	Hard,clear, "alkaline"	42	D, S	
16	SE.	18	"	"	"		120	2,475			120	2,355	Eastend formation	Soft,brown			
17	SE.	18	"	"	"	Dug	27	2,450	- 23	2,427	27	2,423	Glacial sand	Medium hard, slightly "alkaline"	40	D, S	Sufficient supply.
18	NW.	18	"	"	"	Drilled	182	2,350			182	2,168	Bearpaw formation	Soft,brown	42	S	Sufficient for stock needs; also 20-foot dry hole, base in glacial drift.
19	NE.	18	"	"	"	Drilled	137	2,400	- 90	2,310	137	2,263	Bearpaw formation	Soft,brown iron	43	S	Sufficient for local needs.
20	SW.	18	"	"	"	Drilled	182	2,450	-132	2,318	182	2,268	Bearpaw formation	Soft,brown	44		Abundant supply.
21	SW.	19	"	"	"	Dug	6	2,350	- 4	2,346	6	2,344	Glacial sand	Soft,clear	45	D	
22	NE.	20	"	"	"	Drilled	66	2,445	- 26	2,419	66	2,379	Glacial drift	Hard,cloudy odour,sediment,"alkaline"	44	D, S	#
23	SW.	20	"	"	"	Dug	10	2,350	- 2	2,348	10	2,340	Glacial sand	Hard,"alkaline",odour	46	D, S	Sufficient supply; has a dam.
24	NW.	21	"	"	"	Dug	16	2,400	0	2,400	16	2,384	Glacial drift	Medium hard	42	D, S	Insufficient for local needs; intermittent supply.
25	NW.	22	"	"	"	Bored	52	2,425	- 38	2,387	52	2,373	Glacial drift	Hard,clear	44	N	Not usable by man or stock; a spring yielding soft water is present 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 EXCELSIOR NO.166, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
26	NE.	22	18	11	3	Bored	38	2,450	- 4	2,446	38	2,412	Glacial sand and gravel	Soft, muddy, odour	38	D, S	
27	SW.	22	"	"	"	Drilled	60	2,420	- 50	2,370	60	2,360	Glacial sand	Hard, clear, "alkaline"	43	S	A second 200-foot well in Eastend, yielded black foamy water unfit for use.
28	NW.	23	"	"	"	Bored	103	2,460	- 35	2,425	103	2,322	Glacial drift	Hard, clear	44	D, S	Sufficient supply.
29	NE.	23	"	"	"	Drilled	50	2,450	- 40	2,410	50	2,400	Glacial drift	Hard, clear, "alkaline" rusty		D, S	Sufficient supply.
30	NW.	24	"	"	"	Drilled	86	2,425	- 76	2,349	86	2,339	Glacial drift	Hard, clear, "alkaline"	47	S	Two gallons a minute; also 13-foot well in hollow which sometimes overflows.
31	SE.	25	"	"	"	Bored	84	2,450	- 72	2,378	84	2,366	Eastend	Soda	46	D, S	Small supply; usually sufficient.
32	SW.	27	"	"	"	Bored	85	2,435	- 78	2,357	85	2,350	Glacial drift	Hard, cloudy, "alkaline"	42	N	Needs new casing; has 15-foot dam.
33	SE.	27	"	"	"	Bored	106	2,450	- 76	2,374	106	2,344	Eastend formation	Medium hard, clear	44	D, S	Sufficient supply.
34	SW.	28	"	"	"	Bored	37	2,440	- 22	2,418	37	2,403	Glacial drift	Soft, clear	42	D, S	Sufficient supply.
35	SW.	29	"	"	"	Bored	83	2,450	- 48	2,402	83	2,367	Glacial drift	Hard, clear, salty, "alkaline"	43	D, S	Sufficient supply.
36	SW.	30	"	"	"	Dug	20	2,450	- 3	2,447	20	2,430	Glacial sand	Soft, clear	40	D, S	
37	NE.	30	"	"	"	Bored	81	2,450	- 65	2,385	81	2,369	Glacial sand	Hard, clear, "alkaline"	44	D, S	Sufficient supply.
38	SE.	30	"	"	"	Dug	16	2,450	0	2,450	16	2,434	Glacial drift	Soft, clear, odour	44	D, S	Intermittent; insufficient supply.
39	SW.	31	"	"	"	Bored	79	2,445	- 45	2,400	79	2,366	Glacial drift	Medium hard	41	S	Sufficient for local needs.
40	SE.	32	"	"	"	Bored	90	2,450	- 50	2,400	90	2,360	Glacial drift	Hard, clear, "alkaline"	41	D, S	Sufficient supply.
41	SW.	33	"	"	"	Drilled	75	2,450	- 40	2,410	75	2,375	Glacial drift	Hard, clear, "alkaline"	44	D, S	Sufficient for local needs.
42	NE.	33	"	"	"	Dug	12	2,435	- 8	2,427	12	2,423	Glacial gravel	Hard, salty, "alkaline", grey	48	D, S	Insufficient supply; also a dam; well probably seepage.
43	SW.	36	"	"	"	Borod	150	2,410	-143	2,367	150	2,260	Eastend ? formation	Soft, clear yellow	46	D, S	Sufficient supply.
44	NE.	36	"	"	"	Drilled	65	2,425	- 10	2,415	65	2,360	Glacial drift	Hard, clear, "alkaline"	41	D, S	Intermittent supply; second 82-foot well.
1	SE.	1	18	12	3	Bored	64	2,550			64	2,486	Eastend	Soft, clear	43	D, S	Sufficient supply.
2	NE.	2	"	"	"	Drilled	200	2,500			200	2,300	Eastend ?formation	Soft	43		
3	NW.	2	"	"	"	Drilled	270	2,522	-180	2,342	270	2,252	Eastend ? formation	Soft			
4	SW.	3	"	"	"	Dug	35	2,600	- 25	2,575	35 2	2,565	Glacial gravel	Soft, odour	42	D, S	Sufficient supply; 265-foot dry hole; base in eastend formation.
5	NE.	4	"	"	"	Drilled	40	2,500	- 8	2,492	40	2,460	Glacial sand	Hard, clear, "alkaline" odour	44	S	Sufficient for local needs; 10-foot well for domestic use.
6	SW.	4	"	"	"	Drilled	270	2,550	-250	2,300	270	2,280	Bearpaw formation	Soft, clear	42	D, S	Sufficient supply.

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

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

B 4-4

WELL RECORDS—Rural Municipality of EXCELSIOR NO.166, 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
7	NE.	5	18	12	3	Drilled	240	2,480	-160	2,320	240	2,240	Bearpaw formation	Soft, salty, sulphur	42	D, S	Sufficient supply.
8	SE.	6	"	"	"	Drilled	213	2,450	-201	2,249	213	2,237	Glacial drift	Hard, clear		D, S	Sufficient supply.
9	SW.	7	"	"	"	Dug	20	2,450	- 10	2,440	20	2,430	Glacial drift	Soft, clear	43	D, S	Sufficient supply.
10	SE.	9	"	"	"	Drilled	170	2,460			170	2,390	Eastend formation	Soft, clear, sulphur	42	D, S	Sufficient supply.
11	NE.	10	"	"	"	Drilled	116	2,438	-100	2,338	116	2,322	Eastend formation	Very soft			
12	SE.	10	"	"	"	Drilled	145	2,473			145	2,328	Eastend formation	Soft			
13	NW.	10	"	"	"		119	2,475			119	2,356	Eastend formation				
14	NW.	10	"	"	"	Dug	25	2,485	- 15	2,470	25	2,460	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
15	SE.	12	"	"	"	Bored	60	2,500	- 45	2,455	60	2,440	Glacial drift	Hard, cloudy, "alkaline" yellow odourous	42	S	Sufficient supply.
16	SW.	13	"	"	"	Dug	16	2,400			16	2,384	Glacial drift	Hard, clear, "alkaline"	42	D, S	Insufficient supply.
17	NW.	14	"	"	"	Bored	70	2,390	- 50	2,340	70	2,320	Glacial sand	Hard, clear	44	D, S	Sufficient supply.
18	NE.	15	"	"	"	Dug	30	2,405	- 22	2,383	30	2,375	Glacial sand	Hard, clear, "alkaline" sediment	42	D, S	Insufficient supply.
19	SE.	16	"	"	"	Dug	10	2,460	- 4	2,456	10	2,450	Glacial sand	Hard, clear	44	D, S	Sufficient supply.
20	NE.	16	"	"	"	Drilled	120	2,415	- 15	2,400	120	2,295	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
21	NW.	16	"	"	"	Drilled	120	2,420	-105	2,315	120	2,300	Glacial gravel	Hard, clear, slightly "alkaline"	43	D, S	Sufficient supply.
22	SW.	17	"	"	"	Drilled	170	2,430			170	2,260	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
23	SW.	18	"	"	"	Drilled	130	2,415			130	2,285	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient supply; not used for drinking, but used for cooking.
24	NE.	19	"	"	"	Drilled	120	2,400	-100	2,3[illegible]	120	2,280	Glacial gravel	Hard, "alkaline"		D, S	Sufficient supply.
25	SE.	20	"	"	"	Drilled	100	2,415	- 75	2,340	100	2,315	Glacial gravel	Hard, clear, "alkaline"	42	D, S	
26	NE.	20	"	"	"	Bored	150	2,415	- 75	2,340	150	2,265	Glacial gravel	Hard, clear, "alkaline"		D, S	
27	SE.	22	"	"	"	Bored	80	2,400	- 65	2,335	80	2,320	Glacial gravel	Hard, clear "alkaline"		D, S	
28	NW.	22	"	"	"	Bored	90	2,400	- 70	2,330	90	2,310	Glacial sand	Hard, clear, some "alkali"		D, S	Sufficient supply.
29	NE.	23	"	"	"	Dug	15	2,390	- 10	2,380	15	2,375	Glacial sand	Hard, clear	44	D, S	Sufficient supply; derives its water from spring at ground level.
30	NE.	24	"	"	"	Dug	12	2,400	- 8	2,392	12	2,388	Glacial drift	Soft, clear	41	D, S	Sufficient supply.
31	NW.	25	"	"	"	Bored	90	2,425	- 80	2,345	90	2,335	Glacial sand	Hard, clear, some "alkali"	44	D, S	Intermittent 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 EXCELSIOR NO.166, 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
32	NW.	28.	18	12	3	Bored	120	2,375	-100	2,275	120	2,355	Glacial gravel	Hard,clear, some"alkali"	43	D, S	Sufficient supply.
33	SE.	28	"	"	"	Bored	80	2,355	- 65	2,290	80	2,275	Glacial sand	Hard,clear, some sediment	42	D, S	Insufficient supply.
34	SE.	30	"	"	"	Bored	180	2,400	-140	2,260	180	2,220	Eastend formation	Soft,clear	42	D, S	Sufficient supply.
35	NE.	31	"	"	"	Drilled	170	2,350	-150	2,200	170	2,180	Glacial sand	Hard,clear, rusty,"alkaline"	42	D, S	Sufficient supply.
36	NW.	31	"	"	"	Drilled	185	2,350	-100	2,250	185	2,165	Eastend formation	Soft,clear	42	D, S	Sufficient supply.
37	SW.	31	"	"	"	Drilled	55	2,350			55	2,295	Glacial sand	Hard,clear, soda	42	D, S	
38	SE.	33	"	"	"	Drilled	160	2,350	-135	2,215	160	2,190	Glacial sand	Hard,clear, "alkaline"	42	D, S	Sufficient supply.
39	NE.	33	"	"	"	Dug	110	2,325	-100	2,225	110	2,215	Glacial sand	Hard,rusty, odour,"alkaline"	41	D, S	Insufficient supply.
40	NE.	34	"	"	"	Bored	70	2,400	- 45	2,355	70	2,330	Eastend	Soft,clear	41	D, S	Sufficient supply.
41	NE.	36	"	"	"	Bored	100	2,450	- 75	2,375	100	2,350	Glacial gravel	Hard,clear, some"alkali"	42	D, S	Sufficient supply.
1	SE.	1	19	10	3	Bored	62	2,435	- 49	2,386	62	2,373	Glacial drift	Hard,clear, "alkaline"	40	S	Ample supply.
2	NW.	1	"	"	"	Bored	104	2,490	- 86	2,404	104	2,386	Glacial drift	Hard,clear, slightly "alkaline"	42	D, S	Sufficient supply.
3	SW.	1	"	"	"	Drilled	140	2,510	-115	2,395	140	2,370	Glacial drift	Hard,slightly"alkaline"	44	D, S	Ample supply.
4	SW.	2	"	"	"	Drilled	140	2,525			140	2,385	Glacial drift	Hard,clear, slightly "alkaline"	42	D, S	Ample supply.
5	SE.	3	"	"	"	Drilled	225	2,517	- 80	2,437	225	2,292	Eastend formation	Soft			
6	SW.	3	"	"	"	Drilled	240	2,515	-170	2,345	240	2,275	Eastend formation	Very soft			
7	SW.	4	"	"	"	Drilled	240	2,520	-170	2,350	240	2,280	Eastend formation	Soft,clear, brown	42	D, S	Sufficient supply; similar well.
8	SE.	5	"	"	"	Bored	169	2,489	-100	2,389	169	2,320	Eastend formation	Soft,clear, brown	43	D, S	Sufficient supply; 6 barrels a day. #
9	NW.	5	"	"	"	Bored	33	2,425	- 13	2,412	33	2,392	Glacial sand	Hard,iron, slightly "alkaline"	43	D, S	Insufficient supply.
10	NE.	6	"	"	"	Bored	100	2,425	- 60	2,365	100	2,325	Glacial sand	Hard,clear, "alkaline"	43	D, S	Sufficient supply. #
11	NE.	8	"	"	"	Drilled	175	2,460			175	2,285	Eastend formation	Slightly hard,"alkaline"	42	D, S	Sufficient supply.
12	SW.	10	"	"	"	Bored	72	2,480	- 66	2,414	72	2,408	Glacial drift	Hard,iron, "alkaline"	43	D, S	Sufficient supply.
13	SW.	10	"	"	"	Drilled	260	2,480	-150	2,330	260	2,220	Eastend formation	Soft		N	This and similar well gave ample supplies but filled in with quicksand.

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 EXCELSIOR NO. 166, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
14	NW.	10	19	10	3	Drilled	165	2,476	-100	2,376	165	2,291	Eastend formation	Soft		D, S	Sufficient supply.
15	NW.	10	"	"	"	Drilled	155	2,480	- 95	2,385	155	2,325	Eastend formation	Soft	43	D, S	Sufficient supply.
16	SE.	10	"	"	"			2,475					Glacial drift	Hard, clear, "alkaline"	42	S	This is a shallow well used for stock; rain water used for house.
17	SW.	11	"	"	"	Bored	92	2,490	- 85	2,405	92	2,398	Glacial drift	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
18	SW.	12	"	"	"	Bored	80	2,450	- 66	2,384	80	2,370	Glacial drift	Hard, clear, slightly "alkaline"	42	S	Sufficient supply; second 16-foot well in dry slough used for house.
19	NW.	12	"	"	"	Bored	121	2,510	-111	2,399	121	2,389	Glacial drift	Hard, clear, slightly "alkaline"	42	D, S	Sufficient supply.
20	SE.	14	"	"	"	Bored	110	2,485	- 85	2,400	110	2,375	Glacial drift	Hard, clear, "alkaline"	42	D, S	Ample supply. #
21	SE.	14	"	"	"	Bored	126	2,505	-114	2,391	126	2,379	Glacial drift	Hard, clear, iron, "alkaline"	42	D, S	Sufficient supply.
22	NE.	16	"	"	"	Drilled	125	2,440	-110	2,330	125	2,315	Eastend formation	Soft, clear, "alkaline"	43	D, S	Sufficient supply.
23	NW.	16	"	"	"	Drilled	118	2,440	-103	2,337	118	2,322	Glacial sand	Hard, iron, "alkaline"		D, S	Sufficient supply.
24	NE.	19	"	"	"	Bored	150	2,390	-122	2,268	150	2,240	Glacial drift	Hard, clear, "alkaline"	42	D, S	Sufficient supply; 135-foot dry hole; base in glacial drift.
25	SW.	19	"	"	"	Bored	63	2,360	- 54	2,306	63	2,297	Glacial sand and gravel	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
26	NW.	20	"	"	"	Bored	80	2,420	- 60	2,360	80	2,340	Glacial gravel	Hard, clear, iron, "alkaline"	43	D, S	Sufficient supply.
27	SE.	20	"	"	"	Bored	115	2,430	-100	2,330	115	2,315	Glacial sand	Hard, clear, iron, "alkaline"	42	D, S	Sufficient supply.
28	SW.	20	"	"	"	Drilled	102	2,420	- 82	2,338	102	2,318	Glacial drift	Slightly hard, clear, "alkaline"	43	D, I	Sufficient supply.
29	NE.	21	"	"	"	Bored	135	2,460	-130	2,330	135	2,325	Glacial drift	Hard, clear, "alkaline"	42	D, S	Insufficient; waters 10 head stock.
30	NE.	22	"	"	"	Bored	113	2,460	-106	2,354	113	2,347	Glacial drift	Hard, clear, iron, "alkaline"	42	S	Insufficient supply.
31	SE.	22	"	"	"	Drilled	170	2,450			170	2,280	Glacial drift	Hard, clear, iron, "alkaline"	42	S	Insufficient supply.
32	SW.	24	"	"	"	Bored	136	2,520	-125	2,395	136	2,384	Glacial drift	Hard, clear, iron, "alkaline"	42	D, S	Sufficient supply.
33	SE.	24	"	"	"	Bored	109	2,480	-103	2,377	109	2,371	Glacial drift	Hard, clear, slightly "alkaline"		D, S	Sufficient supply.
34	NE.	24	"	"	"	Bored	113	2,490	-100	2,390	113	2,377	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of EXCELSIOR NO. 166, 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
35	NE.	26	19	10	3	Bored	144	2,460	-127	2,333	144	2,316	Glacial drift	Hard, clear, iron, "alkaline"	42	S	Sufficient supply; 15-foot seepage well of soft water used for drinking.
36	NW.	28	"	"	"	Bored	80	2,405	- 60	2,345	80	2,325	Glacial drift	Hard, clear, slightly "alkaline"	42	D, S	Sufficient supply; good supply; also from spring, hard, "alkaline" water.
37	SE.	28	"	"	"	Drilled	140	2,450			140	2,310	Glacial drift	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
38	NE.	28	"	"	"	Drilled	100	2,410	- 75	2,335	100	2,310	Glacial drift	Hard, clear, iron, "alkaline"	42	D, S	Ample supply.
39	NW.	30	"	"	"	Bored	112	2,350	- 97	2,253	112	2,238	Glacial sand	Hard, salty, "alkaline" bitter	43	S	Sufficient; uses water only in winter; also 5-foot dam for stock.
40	SE.	31	"	"	"	Drilled	130	2,300			130	2,170	Glacial drift	Hard, iron, "alkaline"	43	S	Sufficient supply; also 5-foot dam.
41	SW.	32	"	"	"	Bored	175	2,350			175	2,175	Glacial drift	Hard, brown, "alkaline"	42	S	Insufficient supply.
42	SE.	34	"	"	"	Bored	65	2,400	- 47	2,353	65	2,335	Glacial drift	Hard, clear, iron, "alkaline"	42	D, S	Sufficient supply; also spring with hard "alkaline" water.
1	NE.	1	19	11	3	Drilled	600	2,375			600	1,775	Bearpaw	Soft		N	
2	NE.	24	"	"	"	Drilled	115	2,350			115	2,235	Glacial drift	Hard, "alkaline"			Also 116-foot well.
3	SE.	25	"	"	"	Drilled	120	2,350			120	2,230	Glacial drift	Very hard, brown sediment			Cattle dislike it.
4	SE.	30	"	"	"	Drilled	2,335	1,761					Many horizons				Salty water, not used.
1	SE.	1	19	12	3	Bored	60	2,425			60	2,365	Glacial drift	Hard, salty, "alkaline" odorous		S	Sufficient supply.
2	SW.	1	"	"	"	Drilled	48	2,450	- 28	2,422	48	2,402	Glacial drift	Hard, clear, slightly "alkaline"	44	S	Sufficient supply.
3	SW.	2	"	"	"	Bored	73	2,410	- 66	2,344	73	2,337	Glacial drift	Hard, clear, "alkaline" odorous	42	D, S	Intermittent supply.
4	NE.	2	"	"	"	Bored	65	2,375			65	2,310	Glacial quicksand	Hard, clear, "alkaline"		D, S	Insufficient supply.
5	SW.	3	"	"	"	Dug	23	2,350	- 12	2,338	23	2,327	Glacial sand and gravel	Hard, clear, "alkaline" odorous	42	D, S	Sufficient supply.
6	NE.	4	"	"	"	Bored	110	2,350	-100	2,250	110	2,240	Glacial gravel	Hard, cloudy, brown sediment	47	D, S	#
7	NW.	8	"	"	"	Drilled	355	2,412	-200	2,212	355	2,057	Bearpaw	Hard, clear		D, S	Sufficient supply.
8	SE.	10	"	"	"	Bored	154	2,360									Dry hole; base in glacial drift.
9	SW.	10	"	"	"	Bored	140	2,350			140	2,210	Glacial drift	Hard, clear, "alkaline"	48	S	Intermittent 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 EXCELSIOR NO.166, SASKATCHEWAN

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (—) Surface	Elev.	Depth	Elev.	Geological Horizon				
10	SW.	17	19	[illegible]	3	Drilled	336	2,406	-170	2,236	330	2,076	Bearpaw	Hard, clear, slight sediment	50	D, S	Sufficient supply.
11	SW.	18	"	"	"	Drilled	136	2,380			136	2,244	Glacial sand and gravel	Hard	40	D, S	Sufficient supply
12	NW.	18	"	"	"	Drilled	315	2,392	-200	2,192	315	2,077	Bearpaw				
13	SW.	20	"	"	"	Drilled	360	2,358	-160	2,198	360	1,998	Bearpaw	Hard			Abundant supply.
14	SW.	20	"	"	"	Drilled	330	2,350	-230	2,120	330	2,020	Bearpaw	Soft, slightly "alkaline"		D, S	Sufficient supply.
15	NE.	30	"	"	"	Drilled	280	2,313	-210	2,103	280	2,033	Bearpaw	Slightly hard			
16	SE.	30	"	"	"	Drilled	318	2,310	-143	2,167	318	1,992	Bearpaw	Soft			
17	SE.	30	"	"	"	Drilled	216	2,310			216	2,094	Bearpaw	Soft, slightly "alkaline"	41	D, S	Sufficient supply.
1	NE.	2	19	13	3	Drilled	198	2,330	-163	2,167	198	2,132	Bearpaw	Soft, clear	42	D, S	Sufficient supply.
2	SE.	14	"	"	"	Drilled	315	2,345	-200	2,145	315	2,130	Bearpaw	Soft, clear, "alkaline"	43	D, S	Sufficient supply.
3	SE.	24	"	"	"	Drilled	265	2,375			265	2,110	Bearpaw	Soft, clear, brown	43	D, S	Sufficient supply.
4	NE.	26	"	"	"	Drilled	240	2,290			240	2,050	Bearpaw	Soft, clear	41	D, S	Sufficient supply.
1	SE.	6	20	10	3	Bored	112	2,325	- 70	2,255	112	2,213	Bearpaw	Soft, clear, distasteful	42	S	Insufficient supply.
2	NW.	6	"	"	"	Bored	108	2,260	- 50	2,210	108	2,152	Glacial sand	Hard, cloudy, "alkaline" iron	43	N	
3	SW.	24	"	"	"	Bored	26	1,800	- 5	1,795	26	1,774	Glacial drift				

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

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