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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF REDBURN No. 130 SASKATCHEWAN

BY

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

Water Supply Paper No. 124

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF REDBURN, NO. 130, 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 colleced 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 of

all of the contour lines on the figure.

If one intends to sink a well and wishes to find the approximate depth to a water-bearing horizon, he must learn: (1) the elevation of the site, and (2) the probable elevation of the water-bearing bed. The elevation of the wellsite 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 wellsite 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 wellsite.[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 wellsite 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 Province 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 area.

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 rest 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 Redburn occupies an area of 324 square miles in the central part of southern Saskatchewan. It is nearly square in outline and consists of nine townships described as tps. 13, 14, and 15, ranges 22, 23, and 24, W. 3rd mer. The central point of the municipality lies about 28 miles southwest of Regina and 25 miles southeast of Moose Jaw.

Two railway lines serve the area. The "Soo Line" of the Canadian Pacific railway crosses the northeastern quarter of the municipality. The village of Drinkwater, the hamlet of Pitman, and the town of Rouleau are situated on this line. The village of Briercrest and the hamlet of Hearne are located on the Moose Jaw section of the Canadian National railway, which extends in a northwest-southeast direction across the southwestern quarter of the municipality.

Moosejaw creek crosses the area in a northwesterly direction from township 13, range 22, to township 15, range 24. Avonlea creek flows northward through township 13, range 22, to join Moosejaw creek in section 4 of the township to the north. These creeks do not flow in dry seasons. The valley of Moosejaw creek lies at an approximate elevation of 1,850 feet above sea-level. A level plain lying at elevations at or near 1,900 feet above sea-level occupies the greater part of the municipality. Toward the southwest corner the surface rises gradually to elevations exceeding 2,050 feet along the northwestern slopes of Dirt hills, forming a part of Missouri coteau.

Water conditions are variable within the municipality. Throughout the greater part of the area satisfactory water supplies are obtained from wells. In the southern part of the municipality ground water is more difficult to locate, and in the north-central

area in the vicinity of Drinkwater extensive prospecting has not as yet encountered water-bearing beds. Moosejaw and Avonlea creeks serve for watering stock during all but the dry seasons. Many farmers harvest ice from Moosejaw creek in winter and store it in cisterns to provide drinking water during the summer. Dugouts have been excavated on many of the farms to conserve water for stock, and domestic supplies are derived from shallow seepage wells dug close to these surface reservoirs. A few small dams have been constructed in the southern area where the topography is more irregular.

Water-bearing Horizons in the Unconsolidated Deposits

Many thousands of years ago a great ice-sheet advanced in a southwesterly direction across the province of Saskatchewan. The moving mass of ice picked up and reworked the existing surface deposits and carried large quantities of rock debris for long distances. Part of this load, consisting of intermixed clay, gravel, and boulders, was dropped in irregular fashion over the surface of the bedrock on this as well as on many other municipalities. Even greater thickness of this material, referred to as glacial till or boulder clay, was left by the ice-sheet as its fron melted back towards the north. This boulder clay is exposed at the surface, forming a gently rolling till plain in the southwest corner of the municipality, but at all other points it is concealed beneath later lake deposits. Owing to the damming of the existing northward drainage channels by the ice, large lakes were formed in the low-lying areas. Water entering the lakes by streams issuing from the ice-sheet and running off the higher land carried considerable quantities of fine sand and silts. The sands were deposited near the lake shores and the finer material was carried farther into the lake. A layer of these fine sediments gradually accumulated on the lake bottom and

when the lakes eventually drained deposits of glacial lake clay and sands were left covering large areas. One of the larger glacial lakes occupied an area extending from near Weyburn to Qu'Appelle valley north of Regina and Moose Jaw. All except the southwestern corner of this municipality lies within this lake area, and is covered by a layer of glacial lake clay, as shown on Figure 1 of the map accompanying this report. These deposits are very thin in the vicinity of Briercrest and Hearne, but increase to 10 to 15 feet over most of the area. In the north they may reach thicknesses as great as 30 feet. The sandy phases of the lake deposits found near the shores of the extinct lake are too thin and lie too close to the surface to form good aquifers for ground water accumulation. The clay throughout the remainder of the area is very fine-grained and is almost entirely impervious to the passage of water. No more than very small seepages of water are obtained from the lake clay. Because of its impermeability the lake clay permits little or no loss of water by seepage from dugouts excavated into it.

The glacial till that forms the surface deposits in the southwest and which underlies the lake clay is the chief source of water in the municipality. The boulder clay varies considerably in composition. In places it is very compact and largely impervious to the passage of ground water. In other places, however, it is more sandy and is water bearing. Several wells in the southwestern part of the area derive their water from sandy phases of the boulder clay, but the boulder clay itself is only very sparingly productive. Pockets or beds of sand and gravel occurring irregularly interspersed through the clay form the principal source of water. These pockets are evidently sufficiently numerous to form fairly continuous aquifers over a

large part of this municipality as well as in those municipalities lying immediately to the east, north, and west. The "A" lines on the map, Figure 1, mark the approximate northern and southern boundaries of the area within which this general horizon is known to be productive. The aquifer is most commonly a bed of fine sand, but grades laterally into coarser sands and even gravels. The depths at which it is encountered varies in different parts of the municipality, but over large areas it lies at depths of 60 to 120 feet. The depth to this water-bearing horizon appears to increase slightly in the vicinity of Rouleau, where drilling to depths as great as 225 feet was necessary before water was obtained. Most of the wells yielded good supplies of water when first sunk, but the yields of many of these have been reduced considerably by the fine sand filling up the lower part of the well. In some the yields have so diminished that the wells are now useless. The quality of the water varies greatly from place to place. Water that is only slightly hard is reported from a few wells, but usually it is very hard and the content of dissolved mineral salts is high. At several scattered points the water contains sulphate salts in sufficient concentration to render it unfit for drinking, and water with such a high dissolved sulphate salt content that it cannot be used even for stock has been found at isolated locations. However, water that is satisfactory at least for stock is to be expected in most localities. Considerably more water than is at present being drawn from this aquifer could be obtained. A few dry holes are scattered over the area, but are considered to represent only local conditions and not that the horizon is dry over any large area within the "A" line.

The wells at Rouleau and a few others scattered through the northern townships have gone deeper and have tapped water-bearing horizons at lower elevations. These wells range in depth

from 200 to 268 feet. The sands and gravels encountered are believed to lie in the beds of now buried stream channels that were carved into the bedrock before the advance of the ice-sheet and have been subsequently filled with drift. A system of streams draining towards the southeast is believed to have crossed the area, but their exact position cannot be traced from the scattered deep wells that have encountered them. The wells in this municipality have probably tapped more than one branch of the buried drainage system. The wells at Rouleau appear to be located on one of the main channels on account of the depth at which the aquifer was encountered, and the large quantity of water obtained.

To the south of the lower "A" line no continuous water-bearing horizons are known to exist in the boulder clay. The glacial deposits become thinner towards the south and the sands and gravels occur only as isolated pockets of very limited lateral extent. Such pockets as have been found lie within 30 feet of the ground surface. The yield from some of the wells is small owing to the restricted size of the water-bearing pockets, but from other wells enough water is obtained for 10 to 20 head of stock. By means of extensive prospecting additional supplies should be located on most farms in the southern area.

In the north-central part of the municipality, in an area embracing most of township 15, range 23, and parts of township 15, ranges 22 and 24, practically no ground water has been found. The only water obtained is seepage from surface sources. Dry holes have been sunk in many parts of this area, but indicate only an absence of aquifers. Further search for ground water supplies would appear useless, and efforts should be concentrated on the collection and storage of surface water either

by means of dugouts or small dams on the creek.

Water-bearing Horizons in the Bedrock

The Ravenscrag and Eastend formations, and the Marine Shale series are considered to form the uppermost bedrock formations in different parts of this municipality. The uppermost of these, the Ravenscrag, and the immediately underlying Eastend formation, probably extended over the Marine Shale series throughout the greater part of the municipality at one time, but erosion prior to the advance of the ice-sheet has greatly reduced the extent of the two upper formations so that they are now confined to the higher land of the southwest corner. Great breaks or faults occurred in the bedrock causing much of the bedrock to tilt slightly to the southwest in the southwest corner. Further erosion took place after the faulting, so that the Eastend occurs as a thin layer over the marine shales along the southern border and becomes slightly thicker where it is overlain by a thin remnant of the Ravenscrag formation in the southern part of township 13, range 24. On the accompanying geological map, Figure 1, is shown the approximate present areal extent of these two formations within the municipality. The marine shales underlie the Eastend formation wherever it is present and occur immediately beneath the glacial drift throughout the remainder of the municipality. The Ravenscrag formation is of little importance as a source of water in the municipality as its occurrence is limited to a small part of township 13, range 24. The character of the beds comprising the formation and its water-bearing properties will be discussed later in the section of this report dealing with that particular township.

The Eastend formation consists of coarse sand beds grading downward into finer sands, and at lower levels it becomes

shaly and quite compact. Wells in township 13, range 23, and the eastern part of township 13, range 24, are drawing water from sand beds believed to be in this formation. Water from this source is variable in quality, but usually suitable for domestic use. Individual wells produce enough water for local requirements. Although the formation becomes slightly thicker from east to west it seems evident from the number of dry holes that have been sunk that the sand beds are absent in the western sections. Several holes have been sunk sufficiently deep in township 13, range 24, to tap the formation, but no water was obtained.

The Marine Shale series consists of compact, dark grey shales locally referred to as "soapstone". The shales may be differentiated from the overlying boulder clay by their darker colour, the absence in them of stones or boulders, the occasional occurrence of fossil shells, the soapy feel of the clay, and the small, roughly cubical fragments into which they crumble when exposed to the air. Due to the very limited porosity of the shales very little water can be expected from them. A few wells in the southern sections appear to have penetrated the shales, but it is difficult to determine whether the small amounts of water obtained are derived from the zone of contact between the boulder clay and the shales, or from the shales themselves. The supplies are small and the water is highly mineralized and of very poor quality. No water is found in most holes penetrating the shales. Water is obtainable at depths of several hundred feet, but it is not usable owing to its high, dissolved, mineral salt content. No further attempts should be made to obtain water from the marine shales in the municipality, and residents are strongly advised to cease drilling when the shales are known to have been reached. They lie at depths of 60 to

80 feet from the surface in the southeast corner and at depths up to 120 feet over the greater part of the southwestern half of the municipality. Toward the eastern border and in the northeastern corner wells have encountered gravels at depths of 160 feet or more, suggesting that they are either in the drift or have reached the contact of the drift and the bedrock. It is probable that the normal level of the bedrock below the surface is in the neighbourhood of 160 feet, but where the stream channels were cut into the bedrock it may lie as much as 200 feet below the present ground surface.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 13, Range 22

The water supplies of this township are obtained from Moosejaw and Avonlea creeks, from dugouts, and from wells. Not all the farms can be considered to have a satisfactory supply of water.

A covering of glacial lake clay varying from 10 to 15 feet in thickness extends over the whole township. Little or no water is obtainable from the clay owing to its compact texture. The wells of the township derive their water from sand and gravel pockets in the boulder clay beneath the lake clay. In the southern part of the township the thickness of the glacial deposits overlying the bedrock is 30 to 40 feet, and it increases to the north to 80 feet and possibly slightly more along the northern border. A number of wells have been dug encountering only boulder clay. The clay is evidently fairly sandy and porous in this area, as several wells are reported to be drawing good supplies of water from it at depths of 14 to 25 feet. Sands and gravels occurring as beds and pockets in the boulder clay serve as aquifers in the greater number of the wells. In the southern half of the township, south of the "A" line on the accompanying map, Figure 1, individual aquifers extend over only small areas. Isolated pockets of sand and gravel have been found at depths ranging from 4 to 26 feet. These aquifers yield sufficient water for local requirements in most places and the water is of good quality. Further prospecting in the southern half of the township at depths not exceeding 50 feet probably would locate additional sand and gravel pockets from which water supplies could be obtained. Similar aquifers have been located on a few sections in the northern half of the area. A more continuous horizon of water-bearing sands and gravels

is found at or near the base of the drift at depths of 70 to 85 feet. This aquifer is reported only in wells on sections 21, 22, 23, 24, 32, and 35, but is believed to underlie the whole of the area to the north of the "A" line. Sufficient water for local needs can be obtained from this aquifer in most places, but it has been found difficult to maintain production from several of the existing wells owing to the fine sand blocking the flow of the water into the wells. Most of the water from the glacial deposits is suitable for domestic use. The water is hard, and although the degree of mineralization varies from place to place from only one well is the water reported to be too highly mineralized for drinking. On sections 25 and 36 no water has been found, although tests have been made to depths of 80 and 100 feet. Aquifers may not be present on these sections, but it would be advisable to conduct further tests in the glacial deposits to locate any isolated water-bearing pockets that may occur.

The Eastend formation is believed to underlie the glacial drift over most of the southern part of the township, the area being approximately as shown on the geological map, Figure 1. The 29-foot well on section 2 appears to be drawing water from a thin sand bed at the top of the formation. The water here obtained is of good quality, but the supply available is small. The formation where it occurs in this area is probably thin, and extensive water-producing horizons may be absent. Any water to be found in the formation will be located within 40 feet of the surface. Much deeper drilling will penetrate through the Eastend into the compact, nearly impervious shales of the Marine Shale series, which extends throughout the entire township. Dry holes drilled into the shales on several sections testify to the absence of aquifers in the upper part of the series. On sections 5 and 33 very small amounts of water have been found in the shales,

at depths of approximately 100 feet from the surface. The water is very salty and cannot be considered satisfactory for domestic use. No water can be expected at greater depths in the shale with the possible exception of an horizon that has proved to be productive of salty water at depths between 700 and 900 feet. Drilling to such depths is not recommended to farm residents. All prospecting for ground water supplies in the township should be confined to the porous beds in the boulder clay and to the Eastend bedrock formation.

Township 13, Range 23

Considerable difficulty has been experienced in obtaining satisfactory water supplies in parts of this township, owing to the poor quality of water obtained from many of the wells and to fine sand continually accumulating in them and shutting off the flow of water. On a number of farms the drinking water must be hauled from the wells, producing drinkable water. Numerous dugouts have been excavated to supplement the supply of well water available for stock.

A thin layer of glacial lake clay overlies the boulder clay, or glacial till, over all except the southwestern corner of the township. The lake clay, although possibly more sandy and porous in this area than in other townships of the municipality, is nevertheless not productive of water. The boulder clay overlying the bedrock appears to be less than 20 feet thick in the southwestern part of the township, but increases to 100 feet or more in the north. Water-bearing sands and gravels occur only sparingly in the thin deposits in the southwestern part. It is difficult to distinguish between the sands of the glacial drift and those of the underlying Eastend formation, but in a few of the wells in the southern half of the township the sand beds are believed to be of glacial origin. Gravel is also reported in two

of the wells. The supplies of water obtained from aquifers in the boulder clay are not large, but they are generally ample for local requirements. The water is of suitable quality for domestic use. In that part of the township lying to the south of the "A" line on the map, Figure 1, water supplies should be obtained from sand or gravel pockets in the glacial drift or from sand beds at the top of the underlying Eastend formation. Extensive prospecting may be necessary to locate the aquifers in some localities, as they do not form continuous water-bearing horizons, but they should be found on nearly every section at depths not greater than 40 feet.

Another aquifer, at a lower elevation, is found in the area to the north of the "A" line. Wells 60 to 100 feet deep have tapped beds of fine sand, and occasionally gravel, that form this water-bearing horizon lying at the base of the glacial drift. Fairly large quantities of water are usually found in this aquifer, but owing to the difficulty of keeping the fine sand out of the wells, the yield from individual wells drops off rapidly. Some of the wells will water 30 to 50 or more head of stock, but in a few places the yields have been greatly reduced. The water is hard and the content of dissolved mineral salts apparently varies considerably from place to place within the township. Of the nine wells reported to be tapping this aquifer in the township, five produce water that is unfit for drinking. Water that is too highly mineralized even for stock use is obtained on section 21. This horizon is expected to yield water at practically any point in the township north of the "A" line. In the greater part of the area, water at least usable for stock should be obtained and in many places the water will be drinkable.

The Eastend formation occurs immediately beneath the glacial drift in the southern and southwestern parts of the township. Its probable areal extent is indicated on Figure 1 of the accompanying map. Several wells scattered over the southern sections appear to have tapped the upper sand beds of the Eastend formation at depths of 12 to 30 feet. There is considerable lateral variation in the productivity of the sand beds, and on sections 1 and 15, 90-foot wells passed through dry sand beds in the Eastend formation and into the underlying marine shales before finding water. From most of the wells the water is of good quality and is only moderately hard. In a few of the deeper wells, presumably those that have entered the marine shales, the water is too highly charged with dissolved mineral salts to be used for drinking. The water from these wells is satisfactory for stock. Several wells in the hamlet of Hearne are drawing water from this horizon. The water from some of these wells is unfit for use, but sufficient good water is obtained from the other wells to satisfy the present local demand. The Eastend formation is thin in parts of the area and may be entirely absent in small sections within the area in which it is known to occur. As a result, water-bearing sands may not be found at all points.

The Marine Shale series occurs beneath the Eastend formation, and immediately below the glacial drift in the remaining parts of the township. Thin beds of fine sands are included with the shales at isolated points. The 80-foot well on section 12 appears to have tapped such a bed near the top of the shales, but is not now producing water owing to the filling in of the lower part of the well with sand. Highly mineralized water that is usable only for stock is found in the shales on sections 1, 2, and 15. On section 13 no water was obtained in

holes penetrating the shales to depths of 50 feet or more. A typical water supply from the Marine Shale series was found at a depth of 200 feet on section 22. This water has a very salty taste and is available only in small quantities. This formation cannot be considered as a good source of water, and further deep drilling into it is not advisable; all prospecting for ground water should be confined to the glacial drift and the Eastend formation.

Township 13, Range 24

A large number of wells have been dug in this township, but only in very few have satisfactory water supplies been obtained. No aquifers are known to be continuous over any large area. Some of the wells are located close to dams or dugouts and derive their water as seepage from these surface reservoirs. Much of the ground water is of poor quality, so that water for domestic use on some farms must be hauled. The dams and dugouts provide water for stock.

Glacial lake clay overlies the boulder clay only in the northeastern part of the township. The lake clay is fairly sandy and thus allows downward passage of water, but as it is only a few feet thick it does not act as a reservoir for water. Glacial till, or boulder clay, that underlies the lake clay, forms the surface covering over the remainder of the township. The boulder clay is not well suited for the storage of water as it is not very permeable, but sand and gravel deposits included in the clay are mostly water bearing. In places the boulder clay itself is more sandy and will yield small supplies of water. The pockets of sand and gravel are scattered irregularly through the clay and have been encountered at depths of 10 to 30 feet. The lateral extent of these aquifers is variable and the quantity of water available is correspondingly variable. A few wells

obtain supplies of water ample for local requirements from sand or gravel pockets, but in other places the yield is very small. The quality of the water is also variable. Soft, or only moderately hard, water is obtained from a few of the shallower wells, whereas in others the water is too highly mineralized to be used for drinking.

The line "A", shown on the map, Figure 1, passing through section 36, marks the approximate southern boundary of a fairly continuous aquifer, which has been traced through the glacial drift in adjoining townships. Wells 75 and 80 feet deep on section 36 have tapped the water-bearing sand bed, and although considerable water is present it is of very poor quality. From one well the water is not usable and from the other it is suitable only for stock. The 35-foot well on the SE. $\frac{1}{4}$, section 35, may be tapping this same aquifer. The water in this well is also of poor quality. Additional supplies of water that should be usable at least for stock could be obtained from this horizon on section 36. Throughout the remainder of the township untapped sand and gravel pockets no doubt exist at many places. From these could be obtained small supplies of water. Further prospecting in hollows, at the foot of slopes, and on gravel ridges is advisable where satisfactory water supplies have not as yet been found. Depths of prospecting should not exceed 30 or 40 feet.

On the accompanying geological map, Figure 1, the Ravenscrag and Eastend bedrock formations and the Marine Shale series are shown to be underlying the glacial drift in various parts of the township. Little is known of the Ravenscrag formation in this area. In the municipality to the south wells have penetrated the formation and found water-bearing horizons in sand beds or coal seams. In this township, however, the 100-foot

dry hole on section 9 is the only reported hole that has penetrated the formation. A dry hole on section 3 may also have reached the Ravenscrag beds. The log of this well is not available. It is probable that the formation is very thin in this area and that the upper sandy beds have been removed leaving only the shaly, impervious layers from which water supplies cannot be expected.

The Eastend formation, which underlies a large part of the township, is yielding water in wells on sections 24 and 25. The sand aquifer here encountered is a continuation of the beds tapped by several wells in the township immediately to the east. The exact extent of the formation is not known and the boundary shown on the map must be regarded as only approximate. In any case the formation is probably quite thin within the township and the sandy members of this formation have probably also been removed by erosion. Sand beds may occur in some sections, but probably do not form continuous water-bearing horizons through the area; they can be located only by testing. Test holes should be made to depths of 40 to 50 feet.

The marine shales underlie the Eastend formation and occur immediately beneath the glacial drift in the southwestern corner and in the northern sections of the township. In the southwest the shales are overlain by about 50 feet of boulder clay and in the north the glacial covering varies from 70 to 100 feet. Little or no water is to be expected from the shales except at considerable depths, and this water will probably be too highly mineralized to be used even for stock. Hence, drilling into the shales is not recommended.

As aquifers, both in the glacial drift and in the bedrock formations, are of limited areal extent and occurrence in the township, prospecting for water supplies should be done very carefully. Test holes should be so spaced as to cover as

large an area as possible. One, or even several, dry holes on a quarter section do not indicate the entire absence of aquifers. Dams and dugouts should be utilized where possible to supplement the available supply of well water for stock.

Township 14, Range 22

Water supplies in the township are derived from wells, and from Moosejaw and Avonlea creeks. On nearly every farm sufficient water for local requirements is obtained.

Water is not found in the deposit of 10 to 20 feet of glacial lake clay, which covers the area, owing to the fineness of the clay and to the absence in it of porous sand beds. Water occurs however, in gravel and sand beds, and pockets in the boulder clay that underlies the lake clay throughout the area. In the vicinity of the creeks, water-bearing pockets are found in wells ranging in depth from 12 to 47 feet. A part of the water in these wells is derived as seepage from the creek. Each well produces sufficient water for local requirements, and from a few of the wells water is hauled by farmers who are not as adequately supplied. Short distances away from the creek the aquifers are found to lie at greater depths below the surface. The wells range in depth from 70 to 225 feet. Throughout the greater part of the township a water-bearing bed of fine sand should be found at depths of 70 to 125 feet. Wells tapping this horizon yield sufficient water for local requirements. The water, although hard and highly mineralized, can as a rule be used for domestic purposes and for watering stock. On section 25, however, the water from a 100-foot well cannot be used for drinking, and a 96-foot well on section 35 produces water that is too highly mineralized to be used even for stock. Water of such poor quality is not to be expected in most places.

Deeper wells on sections 23 and 24 have encountered a water-bearing horizon at elevations of 1,680 to 1,690 feet above sea-level. Sands and gravels lying on the bottom of a buried stream channel are believed to form the aquifer in these wells. Similar wells in the municipality to the east appear to be tapping this same channel, but lack of deep drilling in the area makes the tracing of this channel impossible. A dry hole, 225 feet deep on section 21, shows that the channel does not continue directly west from Rouleau. Large quantities of water are obtained from the deep wells. Single wells in the town of Rouleau yield 3,000 gallons an hour or a little more. The water is hard and is of good quality for both domestic and stock use.

A few dry holes have penetrated the underlying marine shales in the township. No water is to be found in the upper part of the bedrock and that occurring at greater depths is too highly mineralized for use. No further drilling into the bedrock should be attempted. The bedrock is to be expected at depths of 100 to 125 feet over most of the area, but in the valleys of the buried stream channels wells may pass through 200 or even 225 feet of drift before entering the shales.

Township 14, Range 23

The water supplies of this township are obtained from Moosejaw creek, which crosses the northeast corner of the area; from dugouts excavated in the compact surface clay; and from wells sunk into the glacial deposits. Many farms in the township are not satisfactorily supplied with water.

The lake clay is too compact to yield supplies of water. Owing to its impermeability, however, dugouts excavated into the clay hold water for considerable periods of time. With the exception of a few shallow seepage wells, all the wells draw water from sands and gravels occurring in the boulder clay that underlies

the lake clay. The wells range in depth from 70 to 106 feet. The sand and gravel aquifers encountered may form a fairly continuous horizon through the township. A few dry holes, however, indicate that it is not water-bearing at all points. Nevertheless, from existing well data it would appear that water can be expected in most parts of the township at depths within the range of existing wells. The supply from a few of the wells is sufficient only for about 10 head of stock, but from other wells larger quantities are available. Dugouts supply additional water for stock where the well supplies are inadequate. A few of the wells reported are not in use. The water is hard and contains considerable amounts of dissolved mineral salts. These are sufficiently concentrated to render the water from two wells located on section 6, and section 32, undrinkable. In general, however, the water is satisfactory for domestic use.

The thickness of the glacial drift in this township is not definitely known, but it is believed to range from 125 to 150 feet. Beneath these deposits are the Marine Shales series from which no usable water is to be derived. Drilling for water in the area should not be continued below the base of the glacial deposits. Several wells have penetrated the shale bedrock to depths as great as 500 feet and obtained no water.

Township 14, Range 24

Satisfactory supplies of water have been obtained from wells in nearly all parts of the township. A few dugouts supplement the available supply from wells in order to ensure enough water for stock requirements. Some farmers haul drinking water, as the water in their wells is too highly mineralized for household use.

Glacial lake clay occurs over all of the township except a small portion in the southwest corner. The lake clay does not greatly exceed 10 feet in thickness and it is not water bearing. Boulder clay underlies the lake clay and in the southwest corner where the lake clay is absent boulder clay occurs at the surface. Aquifers in the boulder clay are the source of the greater part of the local water supply. In the southwestern part of the township a few pockets of gravel or sand are encountered within 20 feet of the surface on the plain and in shallow coulées. Sufficient water for local requirements is obtained from these wells and the water is of good quality. Generally, however, wells of greater depth are necessary to tap the water-bearing beds. This is partly attributable to the layer of lake clay covering most of the area. The wells range in depth from 65 to 116 feet. The aquifers may form a continuous water-bearing horizon throughout the area, or they may form several distinct horizons each extending over a small area. In any case, water-bearing beds appear to underlie the whole township within this range of depths. In the extreme southwest corner, on section 6, the deep aquifers may be absent, but water should be obtainable from water-bearing pockets at shallower depths in the boulder clay. The exact depth of well required at any particular locality cannot be accurately predetermined, but it will be within the range from 65 to 120 feet. Typical variations exist in the quality of the water derived from the boulder clay from place to place. All the water is hard and contains varying amounts of dissolved mineral salts. The water from the greater number of wells is usable for the households, although it may be at least slightly "alkaline". From other wells scattered over the township the water is too highly charged with sulphate salts in solution to be used for drinking. In most places this water is satisfactory

for stock use. A few wells yield only small quantities of water insufficient for local domestic and stock requirements. In a few wells this is due to sand filling in the lower part of the well and cutting off the flow of water. The greater number of the wells, however, supply ample water and more water than is needed is available in a few wells.

The water supply of the village of Briercrest is derived from wells tapping the sands in the lower part of the boulder clay. Seven wells are reported from the village, but all are not in use. The depth of these wells is from 40 to 80 feet. One well, 46 feet deep, supplies the greater part of the village.

No attempts to obtain water from the underlying Marine Shale series have been reported. The shales probably occur within 150 feet of the surface throughout the township, but in all wells water was obtained before reaching the bedrock. Any water present in the shales will probably be too salty to be used for any purpose, so that drilling into the bedrock in this area is not advisable.

Township 15, Range 22

Adequate supplies of water for domestic and stock requirements have been obtained from wells on nearly every farm in this township. Several of the wells, however, have become plugged with fine sand and are not now in use.

The glacial lake clay that forms the surface deposit over the township does not exceed 15 feet in thickness and is not productive of water. No porous sands or gravels have been found in the lake clay. They do, however, occur in the underlying boulder clay in the form of isolated pockets. On sections 9, 13, and 34, water-bearing gravels were tapped at depths of 45, 30, and 50 feet, respectively, but they are not usually to be

expected at such shallow depths. In other wells the aquifers lie from 80 to over 200 feet below the ground surface, with the majority of wells reaching water-bearing beds betwen 100 and 150 feet. The deep wells ranging between 200 and 250 feet are located in section 7 in Pitman, and on sections 8 and 32, and have probably tapped the buried stream channels referred to in the general discussion of the municipality. That these lower aquifers are not continuous beneath the area is evidenced by the deep dry holes on sections 6, 8, 28, and 33. Although water-bearing beds are not expected to extend over the entire area, water is obtainable from wells throughout the greater part of the township. On section 28 several dry holes were sunk. Dry holes were also reported from sections 15 and 16, but these were not deep enough to reach any possibly existing aquifer. The area in township 15, range 23, in which, apparently, no water-bearing beds exist, may extend into the west-central part of this township, approximately as shown on the accompanying map, Figure 1. Future drilling in this area may, however, disprove this theory. Throughout the remainder of the township water supplies should be obtainable despite the evidence of the few existing dry holes. Many of the deep wells that are thought to have reached the base of the stream channels have become blocked with sand and do not produce sufficient water for local requirements. These deeper aquifers may also be present in sections 22 and 28. Several wells that now yield little water were large producers when first sunk. The water from the drift contains considerable amounts of mineral salts in solution and is hard. From the deep wells the water is satisfactory for household use, but from the shallow wells on sections 9 and 34 it is unfit for drinking.

The marine shales underlie the glacial deposits throughout the area. Two dry holes are reported to have penetrated the bedrock

in section 8 and section 33. No water is to be expected from this source in most places and where water does occur it will be too highly mineralized to be used even for stock. All future prospecting for water should be confined to the glacial drift and the construction of dugouts to collect and store surface water should be encouraged.

Township 15, Range 23

Moosejaw creek follows a meandering course along the southern and western borders of the township from section 1 to section 30. The creek valley forms the only appreciable depression in the almost level plain extending over the remainder of the township. The valley bottom lies 20 to 50 feet below the level of the surrounding plain. Thin layers of fine silts have been deposited by the creek during periods of flood at many points along the valley, but the sediments are probably too fine and thin to be water-bearing. Shallow seepage wells dug close to the creek will yield some water. The creek is the main source of water in the township. It is used for watering stock and in the winter furnishes ice to be stored in cisterns for summer drinking supplies.

Little water is derived from wells in the township. The glacial lake clay that covers the township is not in itself water bearing, and is so impervious that it prevents surface water from entering the underlying boulder clay in most parts of the township. Water-bearing sands and gravels have been located in the boulder clay in the southern sections at depths of 80 to 165 feet. Water was obtained in a well on section 12, but this well is not in use. In sections 5, 6, and 7 supplies of hard water are obtained from an aquifer at a depth of 80 feet. This aquifer appears to be a continuation of one observed in adjacent townships. It is doubtful, however, if it extends farther north in this township.

Throughout the remainder of the township all attempts to obtain water by boring and drilling wells have failed. A number of holes were sunk in the vicinity of Drinkwater and in other parts of the township. No attempts have been made on some sections owing to the repeated failure in nearby localities. It seems apparent that no water supplies are to be found in the glacial drift in the township except in the southern sections.

Deep drilling into the Marine Shale series that underlies the entire township apparently offers no solution to the problem of finding water. Wells 200 feet deep or more have entered the shales in the vicinity of Drinkwater and in the southern sections, and none of these wells produced water. The 268-foot well on section 12 obtained water in gravel at a depth of 166 feet. This well may have tapped a buried channel that may extend northwestward into the central part of the township, but in the absence of definite data this possibility remains unproved.

Water should be obtainable by sinking wells in the south, and particularly in the area south of the creek. The creek water and other surface water stored in dugouts, dams, and cisterns must remain the chief source of water supply of this township.

The village of Drinkwater obtains its water supply from a well dug adjacent to a reservoir created by building a dam across a shallow coulée just outside the village.

Township 15, Range 24

Supplies of ground water have been obtained from wells on nearly every farm in the township. Moosejaw creek, which crosses the northern part of the township, is used for watering stock. Ice is taken from the creek in winter and stored in cisterns for drinking.

The fine silts deposited along the valley by the creek probably do not include more permeable sand beds. Seepages of water will be derived from these beds only where the wells are dug in close proximity to the creek. This water should be suitable for household use unless polluted by surface water containing sewage.

A layer of glacial lake clay, 20 feet or less in thickness, covers the township. This clay is too compact to yield water supplies. All the producing wells in the township derive their water from sands and gravels included in the boulder clay that underlies the lake clay throughout the township. The aquifers encountered appear to form a fairly continuous horizon throughout the township at depths of 65 to 150 feet below the surface. Only on sections 2 and 31 have wells been sunk that failed to obtain water in the lower part of the drift. In the northeastern corner of the township difficulty will be experienced in finding water. The area in township 15, range 23, in which water-bearing beds appear to be absent, may continue into a small portion of this township. As a 60-foot well is the deepest reported from this locality the presence or absence of aquifers at greater depths cannot be definitely stated, but prospecting to depths of 150 to 200 feet seems a worth-while venture. Sufficient water has been obtained on nearly every farm to satisfy local requirements, but the flow of water into several of the wells has been greatly reduced by fine sand filling in the lower part of the casings. This condition is particularly prevalent in the southwestern sections. Other wells have fallen into disrepair and are not used. The water derived is hard and contains considerable amounts of mineral salts in solution. In the central part of the township much of the water

is too highly charged with the sulphate salts to be used for drinking. For this reason some of the wells have been filled in. Water on these farms is obtained from the creek and from dugouts. The water from wells in other parts of the township is usable for domestic purposes. Additional supplies of water should be obtainable from wells in almost any part of the township.

Only one dry hole is reported to have penetrated the underlying marine shales. Either no water, or water that is unfit for use owing to excess mineralization, will be found in the bedrock. Future drilling should not be continued into the shales.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF REDBURN, NO. 130, SASKATCHEWAN

Township	13	13	13	14	14	14	15	15	15	Total No. in municipality
West of 2nd meridian Range	22	23	24	22	23	24	22	23	24	
Total No. of Wells in Township	55	69	88	59	23	78	44	44	37	497
No. of wells in bedrock	9	18	5	6	2	1	6	13	1	61
No. of wells in glacial drift	46	51	83	53	21	77	38	30	36	435
No. of wells in alluvium	0	0	0	0	0	0	0	1	0	1
Permanency of Water Supply										
No. with permanent supply	42	46	46	36	13	68	24	5	32	312
No. with intermittent supply	2	4	14	1	1	1	0	1	0	24
No. dry holes	11	19	28	22	9	9	20	38	5	161
Types of Wells										
No. of flowing artesian wells	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells	3	10	6	15	6	26	12	1	13	92
No. of non-artesian wells	41	40	54	22	8	43	12	5	19	244
Quality of Water										
No. with hard water	42	47	56	37	14	68	22	6	32	324
No. with soft water	2	3	4	0	0	1	2	0	0	12
No. with salty water	1	2	3	0	1	2	0	0	0	9
No. with "alkaline" water	10	20	10	15	6	30	10	3	14	118
Depths of Wells										
No. from 0 to 50 feet deep	41	46	68	34	7	32	12	12	5	257
No. from 51 to 100 feet deep	13	20	19	8	12	35	8	9	24	148
No. from 101 to 150 feet deep	1	2	1	3	3	9	1	9	3	41
No. from 151 to 200 feet deep	0	1	0	6	0	2	10	5	4	28
No. from 201 to 500 feet deep	0	0	0	8	0	0	4	9	1	22
No. from 501 to 1,000 feet deep	0	0	0	0	1	0	0	0	0	1
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is Used										
No. usable for domestic purposes	40	33	42	24	9	42	14	3	19	226
No. not usable for domestic purposes	4	17	18	13	5	27	10	3	13	110
No. usable for stock	41	40	49	27	12	51	17	4	20	261
No. not usable for stock	3	10	11	10	2	18	7	2	12	75
Sufficiency of Water Supply										
No. sufficient for domestic needs	37	37	38	26	12	55	19	3	25	252
No. insufficient for domestic needs	7	13	22	11	2	14	5	3	7	84
No. sufficient for stock needs	22	25	29	20	7	50	16	3	25	197
No. insufficient for stock needs	22	25	31	17	7	19	8	3	7	139

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 hardness to the sulphates and chlorides of calcium and magnesium. The permanent hardness can be partly

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

Analyses of Water Samples from the Municipality of Redburn, No. 130, 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	NW.	5	13	22	2nd	100	3,840	100	50	50	780	1,155	30	18	795	1,850	3,674	54		38		1,119	1,176	1,287		* 2
2	NE.	20	13	22	2	14	3,370											(4)	(1)		(2)		(3)		(5)	* 1
3	SE.	30	13	24	2	22	350											(1)	(2)	(3)					(4)	* 1
4	NE.	9	14	22	2	37	2,170	125	35	90	200	520														* 1
5	SE.	22	14	22	2	70	1,840	400	160	240	135	565														* 1
6	SE.	23	14	22	2	155	1,840	360	200	160	130	585														* 1
7	NE.	23	14	22	2	219	1,920	250	90	160	141	585														* 1
8	NE.	23	14	22	2	225	1,930												(3)		(5)	(2)	(1)	(4)		* 1
9	NE.	15	14	23	2	98	2,110	440	80	300	590	780														* 1
10	SE.	7	14	24	2	16	1,690											(3)	(1)		(2)				(4)	* 1
11	SW.	7	14	24	2	80	1,290																			* 1
12	NW.	26	14	24	2	95	2,470												(2)		(4)	(5)	(1)	(3)		* 1
13	NW.	5	15	22	2	163	2,480	350	120	230	172	685	100	40	972	1,030	2,418	179		84		431	1,440	284		* 1
14	NW.	8	15	22	2	200	2,200	450	100	350	184	685	20	61	820	998	2,209	36		127		528	1,214	304		* 1
15	SW.	32	15	23	2	village well	590											(2)	(1)		(3)				(4)	* 1
16	NE.	12	15	24	2	172	2,820	850	500	350	364	705	220	144	959	902	2,654	394		261	57		1,350	592		* 1

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

Analyses Nos. 2, 3, 8, 10, 11, 12 and 15, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

No analyses have been made of surface waters either from the streams or from the dugouts in this area. Analysis 15, on the accompanying table of analyses, is of water derived from a well sunk beside a dam in the vicinity of Drinkwater. This well derives its supply by seepage from the dam and is used by many residents of the village. This water is low in dissolved mineral salts, containing only 590 parts per million of total solids. Calcium sulphate is in the greatest concentration of the salts present. Such water is only moderately hard and well suited to domestic use. Waters derived by seepage from dugouts throughout the area should be of similar quality and if not contaminated by polluted surface water should be quite satisfactory for domestic use. Waters from the streams or from porous beds near the streams should be of similar quality. Analysis No. 3 is of water from a shallow well located beside a slough. As far as its mineral salt content is concerned the water is of excellent quality for domestic use. Considerable variations are to be noted in the character of the glacial deposits, both laterally and with increasing depths. Corresponding variations are to be expected in the quality of the waters they contain. The lake clay is more uniform in composition than the boulder clay and over wide areas does not yield water. It does, however, contain inherently small amounts of readily soluble mineral salts and small seepages derived from the lake clay are accordingly appreciably mineralized. Even sandy beds occurring in the lake clay in hollows may yield water highly charged with dissolved sulphate salts because of the concentration of the salts present in the surface water by evaporation before it percolates down into the sandy beds.

The boulder clay that comprises the greater part of the drift is the source of the large amount of mineral salts found in

ground waters in this municipality. Water percolating down from the surface through the clay dissolves quantities of mineral salts in amounts depending on the depth of percolation, and the porosity of the clay. The less porous the clay the longer the water is in contact with it, and a better opportunity for dissolving large quantities of mineral salts is provided. Water collecting in sand or gravel beds at shallow depths usually has a low mineral content. However, if the overlying clay is highly charged with salts, then the water will be correspondingly highly mineralized even at shallow depths. As the water percolates to greater depths the content of dissolved salts increases, and water from deep wells in the boulder clay is in many places of poor quality. Sodium sulphate (Na_2SO_4) is predominant among the dissolved salts present in most of the waters. The sulphates of magnesium ($MgSO_4$) and calcium ($CaSO_4$) are usually also present in considerable amounts. Sodium chloride and the carbonates of calcium, magnesium, and sodium are found in varying proportions.

Upon examination of the analyses given on the accompanying table it will be noted that many of the wells reaching the porous beds in the lower part of the drift at depths not exceeding 100 feet yield water of similar quality. The total solid content of the waters does not greatly exceed 2,000 parts per million, and the waters are not excessively hard, the total hardness being generally less than 500 parts per million. The greater part of the hardness is temporary and removable by boiling. The total solids are composed largely of the sulphate salts with sodium sulphate commonly predominating. To persons unaccustomed to the use of mineralized waters these waters would tend to have laxative effects, but are being used on many farms with no apparent ill effects.

Even shallow wells ~~not~~ encountering the porous beds, but deriving their supply as direct seepage from the boulder clay, yield a much more highly mineralized water. Analysis No. 2 is of water from a 14-foot well tapping only a thin bed of sand in the boulder clay. The water contains 3,370 parts per million of dissolved salts largely comprised of sulphates. Such water should not be used if better supplies are available. Larger sand deposits encountered at shallow depths yield a much less highly mineralized water.

Waters represented by analyses Nos. 6, 7, and 8 are believed to have been derived from a buried stream channel and show a similarity in the dissolved solid content and hardness. These waters presumably circulate readily through the extensive porous beds and hence are not excessively mineralized. Analyses Nos. 13, 14, and 16, are also from deep wells tapping sand or gravel in the drift, but the water, although being used for drinking, is of poorer quality. These waters all contain sufficient amounts of common salt to give the water an appreciably salty taste.

Water from the Bedrock

No water is being obtained from the Ravenscrag formation where it occurs in the municipality, nor is much water to be expected from this source. Any water that may be present should be of good quality.

Several wells are drawing water from the Eastend formation, but no samples were taken of water from these wells. The water from the various wells shows considerable variation in quality. From some the water is soft or only moderately hard, but from a few others it is very hard and highly charged with sulphate salts. Water of good quality for domestic use is to be expected from the Eastend sand beds in most places.

Water from the marine shales is usually of poor quality. The water found near the top of the formation is similar to water found at depths in the boulder clay. It is highly charged with dissolved mineral salts, of which sodium sulphate and magnesium sulphate predominate. At greater depths in the shales the water is of a different type. The content of mineral salts is still high, but the calcium salts are present in only small amounts, and the water is quite soft. Sodium carbonate and sodium chloride are predominant. The sodium chloride is usually sufficiently concentrated to make the water unfit for use. Analysis 1 in the table is typical of waters from the upper part of the marine shales. This water is of poor quality owing to the high concentration of sodium sulphate and sodium chloride. No analyses were made of any water from greater depths in the formation.

WELL RECORDS—Rural Municipality of REDBURN, NO. 130, SASKATCHEWAN.

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WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SW.	2	13	22	2	Dug	29	1,865	- 16	1,849	16	1,849	Eastend sand	Hard, clear		D,S	Small supply.
2	SW.	2	"	"	"	Bored	90	1,865									Dry hole in Marine Shale.
3	NW.	4	"	"	"	Bored	30	1,900									Two dry holes in glacial drift.
4	NE.	4	"	"	"	Dug	14	1,895	- 10	1,885	18	1,877	Glacial drift	Hard, clear "alkaline"		D, S, I	Sufficient supply; 2 similar wells.
5	NW.	5	"	"	"	Bored	100	1,900	- 60	1,840	60	1,840	Marine Shales	Soft, clear, "alkaline", salty	42	S	Insufficient supply; #.
6	NE.	5	"	"	"	Dug	16	1,905	- 8	1,897	8	1,897	Glacial drift	Hard, clear		D, S	Sufficient supply.
7	NW.	5	"	"	"	Dug	20	1,900					Glacial drift	Hard, clear, "alkaline"	42	D	Insufficient supply.
8	NW.	5	"	"	"	Dug	10	1,900	- 6	1,894	6	1,894	Glacial drift	Hard, clear, "alkaline"	42	D, S	Insufficient for 12 head stock.
9	SW.	7	"	"	"	Dug	16	1,910	- 12	1,898	16	1,894	Glacial sand	Hard, clear	43	D, S	Good supply.
10	NW.	7	"	"	"	Dug	13	1,900	- 10	1,890	10	1,890	Glacial sand	Hard, clear		D, S	Sufficient supply.
11	NE.	7	"	"	"	Dug	15	1,885	- 12	1,873	12	1,873	Glacial sand	Hard, clear	45	D	Sufficient supply.
12	NW.	8	"	"	"	Dug	16	1,890	- 4	1,886	4	1,886	Glacial gravel	Hard, iron		D, S, I	Intermittent supply.
13	SE.	8	"	"	"	Dug	25	1,880	- 20	1,860	20	1,860	Glacial drift	Hard, clear		D, S	Sufficient supply.
14	SE.	9	"	"	"	Bored	22	1,900	- 16	1,884	16	1,884	Glacial drift	Hard, clear, "alkaline"	41	D, S	Supplies 16 head stock.
15	SW.	10	"	"	"	Dug	18	1,890	- 11	1,879	11	1,879	Glacial drift	Hard, clear		D, S, I	Waters 12 head stock and garden; another similar well.
16	NW.	15	"	"	"	Bored	27	1,865	- 9	1,856	9	1,856	Glacial sand	Hard, clear		D, S	Sufficient supply.
17	SW.	16	"	"	"	Dug	8	1,860	- 4	1,856	4	1,856	Glacial sand	Hard, clear		S	Sufficient supply; 3 similar wells used only for stock.
18	NW.	16	"	"	"	Bored	28	1,900	- 16	1,884	16	1,884	Glacial sand	Hard	41	D	Sufficient for house; another well for stock.
19	NW.	16	"	"	"	Bored	14	1,900	- 12	1,888	12	1,888	Glacial quicksand	Hard, clear		S	Waters 22 head stock.
20	NE.	16	"	"	"	Bored	29	1,860	- 20	1,840	20	1,840	Glacial drift	Hard, clear, "alkaline"		D, S, I	Insufficient supply; 2 similar wells; waters 14 head stock from each well.
21	NE.	17	"	"	"	Bored	20	1,860	- 14	1,846	19	1,841	Glacial sand	Hard, clear		S	Insufficient supply.
22	NW.	18	"	"	"	Dug	15	1,890	- 9	1,881	9	1,881	Glacial quicksand	Hard, clear		D, S	Sufficient supply.
23	NE.	20	"	"	"	Dug	14	1,870	- 11	1,859	11	1,859	Glacial gravel quicksand	Hard, clear		D, S	Insufficient for 10 head stock; #.
24	NE.	20	"	"	"	Bored	80	1,870	- 20	1,850	20	1,850	Glacial drift	Hard, "alkaline"		N	Filled with quicksand.
25	NE.	21	"	"	"	Bored	23	1,865	- 8	1,857	8	1,857	Glacial sand gravel	Soft, clear	48	D, S	House supply only.
26	NE.	21	"	"	"	Bored	80	1,865	- 57	1,808	80	1,785	Glacial	Hard, clear	44	S	Supplies at least 40 head stock.
27	NW.	22	"	"	"	Bored	35	1,860	- 27	1,833	27	1,833	Glacial drift	Hard, clear	43	D, S, I	Insufficient supply; several dry holes quicksand at 30 feet.

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 REDBURN, NO. 130, SASKATCHEWAN.

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WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
28	NE.	22	13	22	2	Bored	60	1,860	- 65	1,795	65	1,795	Glacial drift	Hard			Insufficient supply.
29	SE.	24	"	"	"	Bored	85	1,800	- 65	1,775	85	1,775	Glacial sand and gravel	Hard, clear		N	1 barrel a day.
30	SE.	24	"	"	"	Bored	86	1,860	- 66	1,774	66	1,774	Glacial quick-sand	Hard		N	Good supply.
31	SE.	25	"	"	"	Bored	60	1,865									Dry hole in Bearpaw soapstone.
32	SW.	30	"	"	"	Dug	32	1,870	- 16	1,854	16	1,854	Glacial sand	Hard, clear, "alkaline"		D, S	Insufficient supply.
33	NE.	30	"	"	"	Dug	14	1,870	- 11	1,859	11	1,859	Glacial sand	Hard, clear, "alkaline"	43	D	Sufficient for house use.
34	SW.	32	"	"	"	Bored	70	1,870			70	1,800	Glacial drift	Hard, iron	46	D	Sufficient for house.
35	NW.	33	"	"	"	Bored	98	1,880	- 96	1,784	96	1,784	Marine Shale series	Hard, clear, "alkaline"		D, S	Insufficient supply.
36	SE.	34	"	"	"	Bored	32	1,860	- 16	1,844	16	1,844	Glacial sand	Hard, clear		D, S	Supplies 2 barrels a day.
37	SW.	35	"	"	"	Bored	142	1,860	- 72	1,788	72	1,788	Glacial sand	Hard			Supplies 2 barrels a day.
38	SW.	36	"	"	"	Bored	100	1,870									Dry holes in Marine Shale.
1	SW.	1	13	23	2	Bored	90	1,940	+ 70	1,870	90	1,850	Marine Shale	Soft, iron		S	Sufficient for 20 head stock; 3 dry holes 50 feet deep.
2	NE.	2	"	"	"	Bored	45	1,905	- 34	1,871	34	1,871	Marine Shale	Hard, "alkaline"		S	Insufficient supply; laxative.
3	SE.	3	"	"	"	Dug	20	1,925	- 17	1,908	17	1,908	Glacial gravel and quicksand	Hard, iron	43	D, S	Sufficient supply.
4	SE.	3	"	"	"	Bored	28	1,925	- 25	1,900	25	1,900	Eastend sand	Hard, iron		D, S	Sufficient supply; several dry holes.
5	SE.	4	"	"	"	Dug	16	1,950	- 12	1,838	12	1,838	Glacial sand	Hard, "alkaline"		S	Sufficient for 15 head stock.
6	NW.	4	"	"	"	Dug	18	1,930	- 16	1,914	16	1,914	Eastend sand	Hard, iron	43	D, S	Sufficient for 40 head stock.
7	NW.	5	"	"	"	Dug	28	1,940	- 26	1,914	26	1,914	Eastend sand	Hard, clear	42	D, S	Sufficient supply.
8	SW.	6	"	"	"	Bored	85	2,000	- 84	1,916	84	1,916	Eastend			N	Insufficient supply; several shallow dry holes.
9	SE.	7	"	"	"	Dug	22	1,950	- 20	1,930	20	1,930	Eastend sand	Soft, clear	43	D, S	Sufficient supply; 20-foot dry hole.
10	SW.	7	"	"	"	Bored	40	1,980	- 20	1,960	40	1,940	Glacial sand	Hard, "alkaline"	42	S	Sufficient supply.
11	NW.	7	"	"	"	Bored	30	1,965	- 24	1,941	24	1,941	Eastend sand	Hard, "alkaline"		N	Too "alkaline" for use.
12	SW.	8	"	"	"	Bored	23	1,945	- 21	1,924	21	1,924	Eastend sand	Hard	43	D, S	Sufficient for 16 head stock.
13	NE.	12	"	"	"	Bored	20	1,900	- 10	1,890	10	1,890	Glacial sand	Hard	43	D, S	Sufficient supply.
14	NW.	12	"	"	"	Bored	80	1,900	- 70	1,830	70	1,830	Marine Shale	Hard, "alkaline"		N	Insufficient supply.
15	NE.	13	"	"	"	Dug	13	1,870					Glacial quick-sand	Hard, clear	42	D, S	Sufficient supply.
16	SW.	13	"	"	"	Bored	30	1,880	- 20	1,860	20	1,860	Glacial drift	Hard		D	Sufficient for house only; dry hole 100 feet in bedrock.
17	SE.	15	"	"	"	Bored	55	1,900					Eastend sand	Hard, 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 REDBURN, NO. 130, SASKATCHEWAN.

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WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
18	SE.	15	13	23	2	Bored	90	1,900	- 69	1,831	69	1,831	Marine Shale	Hard, "alkaline"	43	S	Insufficient supply.
19	SE.	15	"	"	"	Dug	14	1,900	- 7	1,893	7	1,893	Glacial drift	Hard, "alkaline"	43	D	Insufficient supply; two dry holes, 115 and 70 feet deep in Eastend formation.
20	NW.	16	"	"	"	Bored	22	1,880	- 19	1,861	19	1,861	Glacial sand	Hard		D, S, I	Sufficient supply; dry hole 80 feet.
21	NW.	17	"	"	"	Dug	16	1,925	- 14	1,911	14	1,911	Glacial gravel	Hard	43	D, S	Insufficient supply.
22	NW.	17	"	"	"	Dug	30	1,925	- 15	1,910	15	1,910	Glacial drift	Hard	42	S	Insufficient supply.
23	NW.	18	"	"	"	Dug	19	1,950	- 15	1,935	19	1,931	Glacial gravel	Hard	42	D, S	Good supply; several dry holes.
24	NE.	18	"	"	"	Bored	29	1,920	- 21	1,899	21	1,899	Eastend sand	Hard	43	D, S	Sufficient supply.
25	SE.	19	"	"	"	Dug	35	1,925	- 30	1,895	30	1,895	Glacial drift	Hard, very "alkaline"	43	S	Small supply; 3 wells supply 20 head stock.
26	SW.	19	"	"	"	Bored	30	1,935	- 20	1,915	20	1,915	Eastend sand	Hard		N	Small supply.
27	NW.	19	"	"	"	Bored	21	1,937	-17	1,920	17	1,920	Eastend sand	Hard	43	D, M	Insufficient; supply intermittent.
28	NW.	19	"	"	"	Dug	15	1,937					Glacial sand	Hard, "alkaline"		N	Another well not usable; both intermittent supplies.
29	NW.	19	"	"	"	Bored	21	1,937	- 17	1,920	17	1,920	Eastend sand	Soft, clear	43	D, M	Insufficient supply; intermittent.
30	SE.	20	"	"	"	Bored	100	1,880									Dry hole.
31	NE.	20	"	"	"	Bored	22	1,880	- 19	1,861	19	1,861	Glacial sand	Hard, "alkaline"		S	Good supply; too "alkaline" for humans.
32	NE.	21	"	"	"	Bored	60	1,890	- 54	1,836	54	1,836	Glacial sand	Hard, "alkaline"		N	Two wells 60 and 80 feet deep; not used.
33	S.½	22	"	"	"	Drilled	200	1,900					Bedrock sand	Soft, salty		S	Insufficient; laxative on humans.
34	NW.	22	"	"	"	Bored	70	1,920	- 64	1,856	64	1,856	Glacial sand	Hard, "alkaline"		S	Insufficient supply.
35	NW.	22	"	"	"	Bored	65	1,880	- 15	1,805	15	1,805	Glacial drift	Hard, "alkaline"; brown sediment		S	Insufficient supply.
36	NE.	24	"	"	"	Bored	84	1,805	- 64	1,801	64	1,801	Glacial drift	Hard, iron, cloudy		D, S	Sufficient supply.
37	SE.	25	"	"	"	Bored	85	1,870	- 40	1,830	85	1,785	Glacial gravel	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
38	SE.	28	"	"	"	Bored	70	1,870	- 50	1,820	70	1,800	Glacial sand	Hard, "alkaline"	43	S	Sufficient supply for 50 head stock; laxative on humans.
39	SW.	28	"	"	"	Bored	77	1,880	- 65	1,815	77	1,803	Glacial quicksand	Hard, "alkaline"; salty		S	Sufficient supply; 10 barrels a day.
40	NE.	30	"	"	"	Bored	30	1,900					Glacial drift	Hard, "alkaline"		S	Only used in winter; laxative.
41	SE.	31	"	"	"	Bored	110	1,905	- 95	1,810	95	1,810	Glacial sand	Hard, iron, "alkaline"		S	Insufficient supply.
42	SE.	32	"	"	"	Bored	100	1,880			100	1,780	Glacial sand	Hard, "alkaline"	42	S	Sufficient supply; another well abandoned.
43	SW.	32	"	"	"	Dug	50	1,890									Dry hole in glacial drift.

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

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

WELL RECORDS—Rural Municipality of REDBURN, NO. 130, SASKATCHEWAN.

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WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
44	NW.	33	13	23	2	Bored	85	1,860	- 55	1,805	85	1,775	Glacial sand	Hard, "alkaline"		D, S	Sufficient supply; laxative on humans; another well filled with quicksand.
1	NE.	1	13	24	2	Dug	12	1,970	- 8	1,962	8	1,962	Glacial drift				Intermittent supply.
2	SW.	3	"	"	"	Bored	85	2,050									Dry hole in glacial drift.
3	NE.	3	"	"	"	Dug	16	2,035	- 14	2,021	14	2,021	Glacial sand	Hard, "alkaline"		S	Intermittent supply; not fit for humans; several dry holes.
4	SE.	4	"	"	"	Dug	21	2,060	- 16	2,044	16	2,044	Glacial sand	Hard, salty		S	Probably sufficient.
5	NE.	5	"	"	"	Dug	16	2,055	- 10	2,045	10	2,045	Glacial drift	Hard, "alkaline"		N	Very poor quality of water.
6	SW.	6	"	"	"	Dug	14	2,080	- 6	2,074	6	2,074	Glacial sand	Soft	44	D, S	Sufficient supply; 3 barrels a day.
7	SW.	6	"	"	"	Dug	14	2,080	- 7	2,073	7	2,073	Glacial sand	Hard	43	D, S	Barely sufficient.
8	SE.	7	"	"	"	Dug	16	2,040	- 13	2,027	13	2,027	Glacial gravel	Hard, "alkaline"	43	S	Sufficient supply for 20 head stock.
9	NE.	9	"	"	"	Dug	16	2,000					Glacial drift	Hard, clear	44	D, S	Sufficient only in summer; intermittent supply; 100-foot dry holes.
10	NW.	10	"	"	"	Bored	57	2,000									Dry hole in bedrock.
11	SE.	12	"	"	"	Dug	14	1,975	- 10	1,965	10	1,965	Glacial drift	Hard		D, S	Sufficient supply; 3 dry holes; 100, 90, and 50 feet deep in bedrock.
12	SE.	13	"	"	"	Dug	8	1,970	- 4	1,966	4	1,966	Glacial drift	Medium hard		D	Intermittent supply; several dry holes.
13	SE.	14	"	"	"	Dug	6	1,960					Glacial drift	Salty, hard		N	No information.
14	SE.	14	"	"	"	Dug	30	1,970									Dry hole in glacial drift.
15	SW.	15	"	"	"	Dug	14	2,000	- 8	1,992	8	1,992	Glacial drift	Hard		D, S	Intermittent supply; several dry holes.
16	NW.	16	"	"	"	Dug	14	1,995	- 5	1,990	5	1,990	Glacial drift	Hard	44	D, S	Nearly sufficient supply.
17	SW.	17	"	"	"	Dug	25	2,000	- 10	1,990	10	1,990	Glacial drift	Hard	43	D, S	Sufficient supply.
18	NW.	18	"	"	"	Dug	22	2,015	- 20	1,995	20	1,995	Glacial drift	Hard	43	D, S	Insufficient supply.
19	NW.	18	"	"	"	Dug	30	2,015									Dry hole in glacial drift.
20	SW.	19	"	"	"	Dug	15	2,020	- 6	2,014	6	2,014	Glacial drift	Hard	44	D, S	Intermittent supply; several similar wells.
21	SE.	20	"	"	"	Dug	16	2,010	- 6	2,004	6	2,004	Glacial drift	Soft		D, S	Insufficient supply; intermittent; several dry holes.
22	NE.	20	"	"	"	Bored	12	1,980	- 8	1,972	8	1,972	Glacial gravel	Hard	43	D, S, I	Sufficient supply.
23	SE.	22	"	"	"	Dug	12	1,970	- 9	1,961	9	1,961	Glacial gravel and sand	Soft		D, S, I	Sufficient supply.
24	NE.	24	"	"	"	Bored	24	1,940	- 18	1,922	18	1,922	Eastend sand	Hard, salty, "alkaline"	43	D, S	Sufficient supply; two shallow seepage wells.
25	SE.	25	"	"	"	Dug	20	1,935	- 6	1,929	6	1,929	Glacial sand	Hard	43	D, S	Fair supply; another well with "alkaline" water; not used; several dry holes.

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 REDBURN, NO. 130, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
25	NW.	25	13	24	2	Dug	9	1,910	- 4	1,906	4	1,906	Glacial gravel	Hard		D	Sufficient supply; a 75-foot well in Marine Shale; too "alkaline" for use.
27	NE.	25	"	"	"	Bored	82	1,910	- 12	1,898	12	1,898	Glacial drift	Hard, "alkaline"		S	Sufficient supply; laxative.
28	SW.	26	"	"	"	Dug	20	1,900	- 16	1,944	16	1,944	Glacial gravel	Hard	43	D, S	Sufficient supply; three 60-foot wells too "alkaline" for use.
29	NE.	26	"	"	"	Dug	6	1,885	- 2	1,883	6	1,879	Glacial gravel	Hard, "alkaline"		S	Good supply; laxative on humans.
30	SE.	27	"	"	"	Bored	32	1,960	- 16	1,944	28	1,932	Glacial gravel	Hard, "alkaline"	42	S	Sufficient; two similar wells; too laxative for human use.
31	NW.	27	"	"	"	Dug	22	1,950	- 18	1,932	18	1,932	Glacial gravel	Hard		D, S, I	Sufficient; a seepage well also for stock; several dry holes 60 feet deep.
32	SE.	28	"	"	"	Dug	20	1,980					Glacial drift	Hard		D, S	Intermittent supply; sufficient in summer, not in winter.
33	SE.	29	"	"	"	Bored	15	1,980	- 8	1,972	8	1,972	Glacial gravel	Hard	43	D, S, I	Sufficient for 100 head stock.
34	NE.	29	"	"	"	Dug	12	1,990	- 7	1,983	7	1,983	Glacial drift	Soft		D, S	Sufficient supply; two dry holes 90 feet deep.
35	SE.	30	"	"	"	Dug	22	2,010					Glacial drift	Hard		D, S	Intermittent supply; 6 similar wells; #.
36	NW.	31	"	"	"	Drilled	70	1,960									Dry hole in glacial drift.
37	NE.	31	"	"	"	Dug	16	1,950					Glacial drift	Hard	43	D, S	Intermittent supply.
38	NE.	32	"	"	"	Bored	120	1,950									Dry hole in Marine Shale; a seepage well near slough.
39	NW.	33	"	"	"	Bored	45	1,950	- 35	1,915	35	1,915	Glacial drift	Hard, cloudy, black sediment		S, I	Sufficient supply; not good for stock; laxative on humans.
40	SE.	35	"	"	"	Bored	35	1,890	- 20	1,870	35	1,855	Glacial sand	Hard, "alkaline"		S	Insufficient supply; not fit for humans; several dry holes 20 feet deep.
41	SE.	36	"	"	"	Bored	80	1,900	- 66	1,834	66	1,834	Glacial sand	Hard, "alkaline"		N	Several similar wells not usable.
42	NE.	36	"	"	"	Bored	75	1,900	- 55	1,845	75	1,825	Glacial drift	Hard, "alkaline"		S	Sufficient supply; laxative on humans.
43	NE.	36	"	"	"	Dug	13	1,900	- 7	1,893	7	1,893	Glacial gravel	Hard	43	D, S	Sufficient supply; 2 to 3 tanks a day.
1	NW.	4	"	"	"	Dug	22	1,860	- 12	1,848	12	1,848	Glacial sand	Hard, "alkaline"	42	D, S	Waters 12 head stock.
2	NW.	4	"	"	"	Bored	45	1,865	- 15	1,850	15	1,850	Glacial drift	Hard, "alkaline"	42	S	Insufficient supply; a similar well.
3	SW.	5	"	"	"	Bored	?	1,865								N	No information.
4	NE.	7	"	"	"	Bored	66	1,865	- 63	1,802	63	1,802	Glacial drift	Stagnant		N	Deserted farm.
5	NE.	8	"	"	"	Drilled	200	1,900								N	Dry hole in Marine Shale.
6	NE.	9	"	"	"	Bored	37	1,855	- 17	1,838	37	1,818	Glacial quicksand	Hard, "alkaline"		D, S	Sufficient supply; #.
7	NW.	15	"	"	"		120	1,900	- 59	1,841			Glacial drift	Hard		N	Good well.
8	NE.	15	"	"	"	Drilled	70	1,885	- 52	1,833	52	1,833	Glacial quicksand	Hard, iron	42	D, S	Supplies 30 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 REDBURN, NO. 130, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
9	SE.	16	14	22	2	Dug	12	1,870	- 8	1,862	8	1,862	Glacial gravel	Hard	42	D, S	Supplies 8 tanks a day; well in SW.¼, section 16, could not be located.
10	NW.	16	"	"	"	Bored	40	1,885	- 36	1,839	36	1,849	Glacial sand	Hard	42	D, S	Sufficient supply.
11	NE.	19	"	"	"	Bored	40	1,800	- 30	1,830	40	1,820	Glacial sand	Hard	43	D, S	Sufficient supply; 4 dry holes 50 feet deep.
12	NE.	19	"	"	"		42	1,800					Glacial drift	Hard, sulphur, "alkaline"		N	Well filled in; 4 dry holes to 50 feet.
13	SE.	20	"	"	"	Dug	40	1,895	- 30	1,865	30	1,865	Glacial black sand	Hard	41	D, S	Sufficient supply.
14	NW.	20	"	"	"	Bored	47	1,850	- 20	1,830	20	1,830	Glacial quicksand	Hard, "alkaline"	42	D, S	Sufficient supply; laxative.
15	NE.	20	"	"	"	Bored	28	1,855	- 14	1,841	14	1,841	Glacial drift	Hard, "alkaline"	42	D,S	Probably waters 10 to 15 head stock; another well 18 feet deep.
16	SE.	21	"	"	"	Drilled	225	1,910									Dry hole in bedrock; well on SE.¼, section 22, 70 feet deep; could not be located;#.
17	SE.	23	"	"	"		155	1,890	- 40	1,850	100	1,790	Glacial sand	Hard			Also a dry hole. Fair quality; #.
18	SE.	23	"	"	"	Drilled	210	1,890	-120	1,770	210	1,680	Glacial sand	Hard, iron	42	D, S, M	Waters 75 head stock; #.
19		23	"	"	"											M	#. This data may apply to any of the Rouleau wells.
20	NE.	23	"	"	"	Drilled	219	1,888	- 65	1,813	207	1,681	Glacial sand	Hard, "alkaline"		D,S,I,M	2000 barrels a day; #.
21	NE.	23	"	"	"	Drilled	210	1,888	- 65	1,823	207	1,681	Glacial sand	Hard, "alkaline"		D,S,I,M	2000 barrels a day.
22	NE.	23	"	"	"	Drilled	225	1,888	- 65	1,823	207	1,681	Glacial sand	Hard, "alkaline"		D,S,I,M	3000 barrels a day; #.
23	NW.	24	"	"	"	Drilled	225	1,880	-195	1,685	195	1,685	?	Medium hard, black sediment	40	D, S	Sufficient supply; dry hole 90 feet deep.
24	NE.	24	"	"	"	Drilled	200	1,885	- 65	1,820	65	1,820	Glacial sand	Hard, "alkaline"		D, S, I	Sufficient for 45 head stock.
25	NE.	24	"	"	"	Drilled	197	1,885	- 65	1,820	65	1,820	Glacial drift			N	Well filled in.
26	NE.	24	"	"	"	Drilled	200	1,885	- 60	1,825	200	1,685	?	Hard, iron, "alkaline"			300 barrels a day.
27	NE.	24	"	"	"		114	1,885	- 65	1,820	114	1,771	Glacial sand	Hard		N	Well filled with sand.
28	SW.	25	"	"	"	Bored	100	1,890			40	1,850	Glacial gravel	Hard, "alkaline"		S	Intermittent; insufficient supply.
29	SE.	26	"	"	"		225	1,900									Dry hole in bedrock shale.
30	SE.	26	"	"	"	Drilled	300	1,890									Dry hole in bedrock.
31	SE.	28	"	"	"	Drilled	49	1,895									Dry holes in glacial drift.
32	SW.	29	"	"	"		30	1,855	- 26	1,829	26	1,829	Glacial sand	Hard, iron	42	D, S	Insufficient supply; laxative.
33	NE.	30	"	"	"	Bored	40	1,850	- 20	1,840	20	1,840	Glacial quicksand	Hard, "alkaline"	42	N	Deserted farm.
34	SW.	31	"	"	"	Bored	40	1,870	- 28	1,842	40	1,830	Glacial sand	Hard, "alkaline"		S	Supplies 6 horses only.

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 REDBURN, NO. 130, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
35		33/34	14	22	2		118	1,900					Glacial sand and gravel	Hard		N	
36	NE.	35	"	"	"	Bored	90	1,690	- 56	1,834	56	1,834	Glacial sand	Hard, "alkaline"		N	Too "alkaline" for use. Several dry holes.
37	NW.	35	"	"	"		185	1,90									Dry hole; base in bedrock.-
38	NE.	36	"	"	"	Bored	45	1,900	- 33	1,867	33	1,867	Glacial gravel	Hard	42	D, S	Sufficient for 50 head stock; dry hole on NW.¼, section 36, not located.
1	NW.	4	14	23	2	Bored	90	1,885			90	1,795	Glacial sand	Hard, "alkaline"		S	Insufficient supply.
2	S.½	4	"	"	"	Bored	85	1,880	- 65	1,815	65	1,795	Glacial drift	Hard, salty		D, S	
3	SE.	6	"	"	"	Bored	90	1,800	- 30	1,830	90	1,770	Glacial sand	Hard, iron		D, S, I	Sufficient supply for 30 head stock; 1 dry hole in glacial drift.
4	NW.	6	"	"	"	Dug	70	1,870	- 12	1,858	70	1,800	Glacial quicksand	Hard, cloudy	41	S	Not fit for humans; a shallow seepage well also used.
5	NE.	8	"	"	"	Bored	90	1,880	- 85	1,795	85	1,795	Glacial gravel	Hard, iron, "alkaline"	56	D, S, I	Sufficient for 12 head stock; also a dry hole.
6	NE.	8	"	"	"		115	1,880									Dry hole in glacial drift.
7	SE.	10	"	"	"	Bored	80	1,890					Glacial drift	Hard		N	A dry hole 600 feet deep.
8	NE.	15	"	"	"	Bored	98	1,870	- 88	1,782	88	1,782	Glacial sand	Hard, iron	42	D	Could water 10 head stock; #.
9	NW.	15	"	"	"	Bored	81	1,885	- 72	1,813			Glacial drift	Hard		N	Farm deserted.
10	SW.	23	"	"	"	Bored	85	1,870									Dry hole in glacial drift.
11	NE.	26	"	"	"	Drilled	120	1,875									Dry hole in glacial drift.
12	SW.	28	"	"	"	Bored	90	1,850					Bearpaw	Hard, sulphur, "alkaline"		N	Sufficient for 10 head stock when used.
13	SE.	29	"	"	"	Bored	90	1,850	- 86	1,764	86	1,764	Glacial quicksand	Hard	42	D, S	Insufficient supply; 3 barrels a day.
14	N.½	30	"	"	"	Bored	100	1,870	- 17	1,853	106	1,764	Glacial quicksand	Hard, "alkaline"	42	S	Sufficient supply.
15	SW.	32	"	"	"	Bored	94	1,875	- 82	1,793	90	1,785	Glacial sand	Hard, "alkaline"		S	Sufficient supply; laxative.
16	SW.	36	"	"	"		22	1,850	- 12	1,838	12	1,838	Glacial drift	Hard, "alkaline"	42	D, S	Seepage supply from creek.
17	NE.	36	"	"	"	Bored	30	1,870									Dry hole in glacial drift.
1	SE.	1	14	24	2	Bored	70	1,910	- 55	1,855	70	1,830	Glacial sand	Hard, "alkaline"	42	D, S	Sufficient supply.
2	NW.	1	"	"	"	Bored	95	1,895	- 75	1,820	95	1,800	Glacial drift	Hard, salty	42	S	Sufficient for 15 head stock.
3	SW.	2	"	"	"	Dug	10	1,910	- 4	1,906	4	1,906	Glacial gravel	Hard		D, S	Seepage supply.
4	NW.	2	"	"	"	Bored	42	1,895	- 24	1,871	42	1,853	Glacial gravel and sand	Hard		D, S	Sufficient supply.
5	NE.	2	"	"	"	Dug	20	1,895	- 15	1,880	15	1,880	Glacial sand	Hard		D, S	Intermittent supply; a 100-foot dry hole.
6	SE.	3	"	"	"	Bored	96	1,925					Glacial drift	Hard, "alkaline"		N	Too "alkaline" for use.

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

WELL RECORDS—Rural Municipality of REDBURN, NO. 130, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
7	SE.	3	14	24	2	Dug	26	1,925	- 16	1,909	26	1,899	Glacial gravel	Hard, "alkaline"		S	Sufficient for 40 head stock.
8	NE.	3	"	"	"	Bored	43	1,910	- 25	1,885	25	1,885	Glacial sand	Hard, iron, "alkaline"	42	S	Sufficient supply.
9	NW.	4	"	"	"	Drilled	70	1,930	- 70	1,860	70	1,800	Glacial sand	Hard, "alkaline"		D, S	Insufficient supply.
10	SW.	5	"	"	"	Dug	30	1,970					Glacial gravel	Hard, iron	43	D, S, I	Sufficient supply.
11	NW.	5	"	"	"	Bored	50	1,930	- 39	1,891	50	1,880	Glacial sand	Hard, iron, "alkaline"		S	Sufficient supply; laxative on humans.
12	SW.	7	"	"	"	Drilled	80	1,940	- 50	1,890	80	1,860	Glacial gravel	Hard, iron, rusty		D, S	Sufficient supply; #. Also a spring in coulée.
13	SE.	7	"	"	"	Dug	16	1,945	- 16	1,929	16	1,929	Glacial sand and gravel	Hard		D, S	Sufficient supply; #. 70 to 80 tanks a day.
14	NW.	8	"	"	"	Dug	6	1,905			6	1,899	Glacial sand and gravel	Hard, iron		N	Sufficient supply.
15	NW.	8	"	"	"	Drilled	75	1,930	- 30	1,900	30	1,900	Glacial sand	Hard, iron	42	D, S	Good supply; a 68-foot similar well.
16	NW.	10	"	"	"	Drilled	153	1,865	- 83	1,782	153	1,712	Glacial sand	Hard, "alkaline"	42	S	Sufficient supply; not usable for humans; 3 dry holes in glacial drift.
17	SW.	11	"	"	"	Dug	10	1,910	- 5	1,905	5	1,905	Glacial gravel	Soft		D, S	
18	SE.	11	"	"	"	Dug	16	1,930	- 14	1,916	14	1,916	Glacial sand	Hard, "alkaline"		D	Supplies house only.
19	SE.	11	"	"	"	Dug	100	1,930	- 60	1,870	100	1,830	Glacial sand	Hard, iron, "alkaline"		S	Sufficient for 15 head stock.
20	NW.	11	"	"	"	Dug	16	1,890	- 8	1,882	8	1,882	Glacial gravel	Hard	42	S	Sufficient supply; other similar wells not used.
21	NW.	12	"	"	"	Bored	80	1,920	- 60	1,860	80	1,840	Glacial drift	Hard, "alkaline"		S	Sufficient supply; laxative.
22	SE.	12	"	"	"	Dug	70	1,930	- 52	1,878	70	1,860	Glacial gravel, and sand	Hard, salty, iron	44	D, S	Strong supply for 30 head stock.
23	SW.	12	"	"	"	Bored	85	1,895	- 70	1,825	85	1,810	Glacial gravel	Hard, "alkaline"	42	S	Sufficient supply; poor water.
24	SW.	14	"	"	"	Drilled	90	1,910	- 80	1,830	90	1,820	Glacial quicksand	Hard, iron, "alkaline"	42	S	Insufficient supply; a shallow well went dry--filled in now.
25	NE.	14	"	"	"	Bored	91	1,895	- 80	1,815	91	1,804	Glacial gravel	Hard, iron		D, S	Sufficient supply.
26	SE.	16	"	"	"	Bored	90	1,870	- 60	1,810	90	1,780	Glacial sand	Hard, "alkaline"	42	S	8 barrels a day for 10 head stock; laxative.
27	NW.	16	"	"	"	Drilled	102	1,890	-102	1,788	102	1,788	Glacial gravel	Hard, "alkaline"		N	Sufficient supply; another well not used.
28	NW.	16	"	"	"	Bored	100	1,870			100	1,770	Glacial sand	Hard, "alkaline"		N	Sufficient supply;
29	NE.	16	"	"	"		100	1,870					Glacial drift	Hard, "alkaline"		N	Sufficient supply.
30	SE.	18	"	"	"	Drilled	80	1,920	- 40	1,880	40	1,880	Glacial sand	Hard		D, S, M	Sufficient supply; a 46-foot well supplies 225 people. 6 other wells, only 3 used.
31	SE.	19	"	"	"	Drilled	70	1,920	- 45	1,875	70	1,650	Glacial sand	Hard, "alkaline"	43	S, I	Sufficient supply; laxative.
32	NE.	20	"	"	"	Bored	70	1,860					Glacial drift and gravel	Hard			Insufficient supply.
33	NW.	21	"	"	"	Bored	104	1,920	- 84	1,836	104	1,816	Glacial sand and gravel	Hard, iron, "alkaline"	43	D, S	Sufficient for 60 head stock.

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

WELL RECORDS—Rural Municipality of REDBURN, NO. 130, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
34	NE.	21	14	24	2		105	1,890	- 77	1,813	105	1,785	Glacial gravel	Hard, "alkaline"		D, S	Sufficient supply.
35	NE.	22	"	"	"	Bored	110	1,900	- 15	1,885	100	1,800	Glacial quick sand	Hard, cloudy, "alkaline"		D, S	Insufficient supply; 6 wells, one 150 feet; small supply.
36	NE.	22	"	"	"		100	1,860								N	Dry holes in glacial drift, two.
37	SE.	24	"	"	"	Bored	93	1,870	- 77	1,793	93	1,777	Glacial sand	Hard, iron, "alkaline"		D, S	Sufficient for 30 head stock; dry hole.
38	NW.	26	"	"	"	Bored	95	1,880	- 80	1,800	80	1,800	Glacial gravel and sand	Hard, "alkaline"		S	Sufficient supply; not fit for humans; #.
39	SE.	27	"	"	"	Bored	92	1,880	- 60	1,820	60	1,820	Glacial quicksand	Hard, iron		D	Insufficient supply.
40	SW.	27	"	"	"	Drilled	100	1,880	- 70	1,810	70	1,810	Glacial sand and gravel	Hard, iron, "alkaline"		D, S	Supplies 10 barrels a day.
41	NW.	27	"	"	"	Drilled	116	1,900	- 76	1,824	76	1,824	Glacial gravel	Hard, "alkaline"			Insufficient supply.
42	NW.	28	"	"	"	Bored	116	1,900	- 100	1,800	116	1,784	Glacial sand	Hard, "alkaline"		N	Sufficient supply; several other wells; water not usable.
43	NE.	28	"	"	"	Bored	90	1,895			90	1,805	Glacial quicksand	Hard		N	Filled with quicksand; good supply.
44	SE.	30	"	"	"	Dug	10	1,890	- 6	1,884	6	1,884	Glacial sand	Hard		D	Sufficient supply.
45	SE.	30	"	"	"	Bored	67	1,890	- 64	1,826	64	1,826	Glacial sand	Hard, "alkaline"		S	Insufficient supply; not fit for humans; dry hole 165 feet deep in bedrock.
46	NE.	30	"	"	"	Bored	65	1,900	- 60	1,840	60	1,840	Glacial sand	Hard, "alkaline"		S	Sufficient supply; laxative; not fit for humans.
47	NW.	30	"	"	"	Dug	65	1,890	- 62	1,828	62	1,828	Glacial sand	Hard, "alkaline"		N	
48	SE.	32	"	"	"	Bored	105	1,900	- 61	1,839	105	1,795	Glacial sand and gravel	Hard, "alkaline"	43	N	Insufficient supply; a 110-foot dry hole.
49	SW.	32	"	"	"	Bored	60	1,900	- 54	1,846	54	1,846	Glacial gravel	Hard, "alkaline"		S	Supplies 5 tanks a day.
1	SW.	1	15	22	2	?	?	1,915					Glacial drift	Hard, very "alkaline"		N	Too "alkaline" for use.
2	NE.	2	"	"	"	Bored	100	1,920	- 85	1,835	85	1,835	Glacial drift	Hard, iron, "alkaline"		D, S	Sufficient supply.
3	NE.	5	"	"	"	Drilled	163	1,890	-100	1,790	127	1,763	Glacial sand and gravel	Hard, iron	41	D, S	Large supply; #.
4	NE.	5	"	"	"		101	1,895					Glacial sand	Hard		N	Several dry holes in glacial drift.
5	SE.	6	"	"	"		200	1,860									
6	NW.	7	"	"	"		200	1,895					Glacial drift	Hard, "alkaline"		D, S	Sufficient supply.
7	NW.	8	"	"	"	Drilled	200	1,900	-117	1,783	125	1,775	Glacial quicksand	Hard, iron, cloudy		D, S	Sufficient supply; #; Another well filled with quicksand; dry hole on section 8, 225 feet deep.
8	SE.	9	"	"	"	Bored	45	1,900	- 27	1,873	45	1,855	Glacial gravel	Hard, "alkaline"	42	S	Insufficient supply; not fit for humans.
9	N.½	10	"	"	"	Bored	125	1,925	- 85	1,840	125	1,800	Glacial sand	Soft, clear		D, S	Sufficient supply.
10	SW.	10	"	"	"	Drilled	160	1,925			100	1,765	Glacial gravel	Soft, clear	43	D, S	Sufficient supply for 50 head stock; also a dry hole, 200 feet deep.

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 REDBURN, NO. 130, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
11	SW.	11	15	22	2	Bored	130	1,925	-110	1,715	130	1,795	Glacial sand	Hard, "alk-aline"		D, S, I	Sufficient supply.
12	SE.	12	"	"	"	Bored	83	1,950	- 80	1,870	80	1,870	Glacial sand	Hard, "alk-aline"	42	S	Insufficient supply.
13	SW.	13	"	"	"	Dug	30	1,925					Glacial sand	Hard, "alk-aline"		D, S, I	Good supply.
14	SW.	14	"	"	"		101	1,920					Glacial drift	Hard		N	
15	NW.	14	"	"	"	Bored	105	1,920	-100	1,820	100	1,820	Glacial gravel	Hard, "alk-aline"		D, S	Sufficient supply.
16	NE.	14	"	"	"	Dug	35	1,920	- 25	1,895	35	1,885	Glacial drift	Hard, iron		D, S	Insufficient supply for 34 head stock.
17	NW.	15	"	"	"	Bored	30	1,910									Dry hole in glacial drift; also a seepage well beside dugout.
18	NE.	15	"	"	"	Bored	115	1,910					Glacial sand	Hard, "alk-aline"		N	Sufficient for house but not used now.
19	NE.	16	"	"	"		72	1,910									Dry hole in glacial drift; another dry hole 68 feet deep in glacial drift.
20	SE.	24	"	"	"			1,915									4 dry holes in glacial drift.
21	SW.	28	"	"	"		148	1,900									Dry hole in glacial drift.
22	SW.	28	"	"	"		100	1,900									Dry hole in glacial drift; also a 225-foot dry hole in glacial drift.
23	SE.	32	"	"	"	Drilled	200	1,910					Glacial quick-sand	Hard			No supply available because of quicksand.
24	NE.	32	"	"	"	Drilled	250	1,910					Glacial sand	Hard		N	Sufficient supply.
25	SE.	33	"	"	"	Drilled	260	1,910									Dry hole in Marine Shale; several other dry holes.
26	SW.	34	"	"	"	Bored	50	1,910	- 35	1,875	50	1,860	Glacial gravel	Hard, "alk-aline"		S	Sufficient supply; not fit for humans.
27	SE.	35	"	"	"	Drilled	160	1,915	-100	1,815	160	1,755	Glacial sand	Hard, iron		S	Good supply; not fit for humans.
28	SW.	36	"	"	"		150	1,915					Glacial sand	Hard		N	Well filled with sand.
1	NE.	2	15	23	2	Dug	25	1,870									Several dry holes in glacial drift.
2	SE.	4	"	"	"	Bored	50	1,870					Glacial drift	Hard	43	D, S	Intermittent supply.
3	NE.	5	"	"	"	Bored	80	1,875	- 78	1,797	78	1,797	Glacial gravel	Hard	42	D	Could water 10 head stock.
4	NE.	6	"	"	"	Bored	90	1,875	- 80	1,795	80	1,795	Glacial drift	Hard, "alk-aline"		S	Not suitable for humans.
5	SE.	7	"	"	"	Bored	113	1,875	- 80	1,795	80	1,795	Glacial drift	Hard, iron		D, S	Steady supply.
6		8	"	"	"		235	1,860									Several dry holes; base in bedrock.
7	NW.	12	"	"	"	Drilled	130	1,890									Dry hole in glacial drift; another dry hole 70 feet deep.
8		12	"	"	"		268	1,890	-115	1,775	166	1,724	Glacial gravel	Hard ?		N	No information.
9	SE.	19	"	"	"	Bored	120	1,870									3 dry holes in glacial drift.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of REDBURN, NO. 130, SASKATCHEWAN.

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
10	NE.	20	15	23	2	Dug	18	1,865	- 14	1,851	14	1,851	Recent alluvium	Hard, "alkaline"		N	Insufficient supply.
11	SW.	21	"	"	"		200	1,890									Dry hole in bedrock.
12	SW.	28	"	"	"		210	1,875									Dry hole in bedrock; also a 200-foot dry hole similar.
13	NW.	28	"	"	"	Drilled	200	1,875									Dry hole in bedrock.
14	SE.	32	"	"	"	Bored	30	1,875									Dry hole in glacial drift; another similar dry hole.
15	SE.	32	"	"	"	Dug		1,870									Filter well by dam; supplies village of Drinkwater; #.
16	SW.	32	"	"	"		240	1,876									2 dry holes 240 feet deep in bedrock; 11 dry holes from 90 to 110 feet deep all in glacial drift.
17	SW.	33	"	"	"		50?	1,865									Dry hole in glacial drift.
18	SW.	36	"	"	"			1,895									3 dry holes in glacial drift.
1	SE.	1	15	24	2	Bored	90	1,885					Glacial sand	Hard, "alkaline"		N	Small supply.
2	NW.	1	"	"	"		87	1,890					Glacial sand	Hard	42		Good supply for 10 to 12 horses.
3	SW.	2	"	"	"	Bored	111	1,885	-100	1,785	111	1,774	Glacial sand	Hard, iron, turns brown		N	Good supply.
4	NW.	2	"	"	"	Drilled	400	1,890									Dry hole in bedrock soapstone.
5	NW.	2	"	"	"	Bored	110	1,890	-110	1,780	110	1,780	Glacial sand	Hard		N	Insufficient supply.
6	NE.	2	"	"	"	Bored	82	1,890			82	1,808	Glacial sand	Hard, iron	43	D, S	Good supply.
7	NE.	4	"	"	"	Bored	72	1,860	- 71	1,789	71	1,789	Glacial quicksand	Hard, "alkaline"	42	D, S, I	Good supply.
8	NE.	5	"	"	"	Drilled	87	1,865	- 65	1,800	87	1,778	Glacial quicksand	Hard, "alkaline"		D, S, I	Sufficient supply; 4 other wells.
9	SW.	6	"	"	"	Drilled	80	1,860	- 74	1,786	80	1,780	Glacial sand	Hard, iron, "alkaline"		D, S, I	Sufficient supply; a 50-foot dry hole.
10	SW.	7	"	"	"	Drilled	78	1,865	- 61	1,804	61	1,804	Glacial sand	Hard, iron	43	D, S	Sufficient supply.
11	NW.	8	"	"	"	Drilled	80	1,860					Glacial sand	Hard, "alkaline"	46	D, S, I	Insufficient supply.
12	SE.	9	"	"	"	Drilled		1,900					Glacial drift	Hard		N	Good supply.
13	SW.	10	"	"	"	Drilled	80	1,840			80	1,760	Glacial sand	Hard, iron, "alkaline"		N	Sufficient supply.
14	SE.	11	"	"	"	Drilled	198	1,875	- 85	1,790	85	1,790	Glacial drift	Hard, iron	42	D, S	Good supply.
15	SE.	12	"	"	"	Drilled	190	1,850					Glacial drift	Hard, iron, "alkaline"		D, S	Sufficient supply.
16	NE.	12	"	"	"	Drilled	172	1,880	-102	1,778	172	1,708	Glacial sand and gravel	Hard, iron	42	D, S	275 barrels a day; #.
17	NE.	14	"	"	"		134	1,860	- 96	1,764	134	1,726	Glacial sand and gravel	Hard			200 barrels a day.
18	SE.	16	"	"	"	Drilled	80	1,860	- 62	1,798	80	1,780	Glacial sand	Hard, "alkaline"		N	Good supply.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of REDBURN, NO. 130, SASKATCHEWAN

B 4-4
1860—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
19	SE.	18	15	24	2	Drilled	87	1,860	- 60	1,800	67	1,793	Glacial quick-sand	Hard, iron	42	D, S	Supplies 14 head stock.
20	SW.	18	"	"	"	Drilled	88	1,850	- 61	1,789	88	1,762	Glacial quick-sand	Hard, iron, "alkaline"	42	D, S	Sufficient supply; 2 other wells not used.
21	NW.	20	"	"	"	Bored	68	1,850	- 60	1,790	60	1,790	Glacial drift	Hard, iron, "alkaline"		N	Insufficient supply; laxative.
22	SE.	21	"	"	"	Bored	65	1,845	- 65	1,780	65	1,780	Glacial drift	Hard, "alk-aline"		N	Small supply.
23	NE.	22	"	"	"	Bored	100	1,845					Glacial drift	Hard, "alk-aline"		N	Insufficient supply.
24	SE.	28	"	"	"	Bored	64	1,845	- 64	1,781	64	1,781	Glacial gravel	Hard, iron		N	Sufficient supply.
25	SW.	30	"	"	"		92	1,865					Glacial sand	Hard, "alk-aline"		N	Used to supply 30 head stock.
26	SE.	31	"	"	"			1,860									Several dry holes in glacial drift.
27	NE.	34	"	"	"	Drilled	166	1,880	-137	1,743	137	1,743	Glacial sand	Hard, iron, "alkaline"	42	D, S, I	Insufficient supply; could water 20 head stock.
28	SW.	36	"	"	"	Bored	60	1,875					Glacial drift	Hard		N	Small supply.

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(#) Sample taken for analysis.