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PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF ESTEVAN No. 5 SASKATCHEWAN

BY

B. R. Mackay & H. N. Hainstock

Water Supply Paper No. 6

OTTAWA

1936

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B.R. MacKAY and H.N. HAINSTOCK

WATER SUPPLY PAPER NO.6

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF ESTEVAN, NO. 5, 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 purposes and the smaller supplies of ground water required for domestic and stock-raising purposes by settlers, villages, and Indian reserves. The drought conditions resulted in repeated crop failures, and in a large number of farms in the acute drought areas of Saskatchewan and Alberta being abandoned. In an effort to relieve the serious situation a number of special studies of the water problem were begun by both Federal and Provincial Governments and allied organizations. The Federal Department of Agriculture undertook among other phases of the drought problem an investigation into the existing supplies of surface water, their conservation by means of dams and dug-outs, and how they could be made more generally available for irrigation. The Geological Survey of the Federal Department of Mines began an extensive study of the underground water conditions of southern Saskatchewan, this water being used principally for domestic and stock-raising purposes. For many years past the water problem in this and other provinces of Canada have engaged the attention of the Geological Survey, and considerable information had already been collected. A number of short reports dealing with the ground water conditions of special areas in Manitoba, Saskatchewan and Alberta have been published by both the Federal and Provincial Geological Surveys, but no systematic study of the ground water resources has been made up to the present.

Field Work

The senior author was in charge of this investigation and was instructed to cover as much of the territory as possible in the season. To effect this it was decided to maintain an

office at Regina and to have a large party consisting of twenty-six units, each to consist of three men who would cover their respective areas and visit every farm. In order that the information gathered by these different party units would be as complete and uniform as possible a questionnaire was prepared on which could be tabulated answers to all the essential questions required for a detailed study of the ground water conditions. An effort was made in the field by each party unit to fill in the questionnaire as completely as possible. In many instances, however, it was found that wells had either been abandoned, or the resident had little or no knowledge of the character of the water-bearing horizon and associated beds. When a party unit had completed the survey of a township the set of questionnaires and a report describing the characteristic features pertaining to the underground water conditions were mailed to the field office. Messrs. D.C. Maddox, F.H. Edmunds, H.H. Beach, H.N. Hainstock, R.D. MacDonald, and D.P. Goodall acted as supervisors in inspecting the work of the field units.

During the field season an area of 80,000 square miles, comprising 2,200 townships, was systematically examined, and records of approximately 60,000 wells were obtained, together with water samples for analyses obtained from 720 representative wells. These are systematically classified so that information pertaining to any well may be readily consulted. These records are supplemented by a set of 24 sectional sheets which cover all of southern Saskatchewan north to include township 32. Each sectional sheet comprises 120 townships. On these are indicated by symbol the location, type, and source of water of each of the 60,000 wells.

Publication of Results

The publication of such a great mass of detailed information is out of the question. This forms the permanent record of the Geological Survey. It is highly desirable, however, that a digest of the essential information pertaining to the ground water conditions of each municipality be furnished in convenient form to the municipality offices, to certain Provincial and Federal departments, and to allied organizations, at which centres it will be possible for any resident of the municipality or other party interested in any particular area to consult these reports. Should anyone find that he requires more detailed data than that contained in the report such additional information as the Geological Survey possesses can be procured on application to the Director, Bureau of Economic Geology, Department of Mines, Ottawa. In making such request the applicant should indicate the exact location of the area by giving the quarter section, township, range and meridian.

The reports have been prepared principally for farm residents, municipal bodies, and well drillers who are either contemplating sinking a well for the first time or considering deepening their well to a lower horizon in order to obtain a more abundant supply of water. In describing the water and geological conditions a certain number of technical terms must of necessity be used, and in case the reader should not be familiar with them their meanings have been defined in the glossary.

How to Use the Report

It is advisable that anyone desiring water information pertaining to a particular section of the municipality read over first the section dealing with the municipality as a whole, as by so doing he will be in a much better position to understand the section of the report dealing with the ground water conditions of

the area in which he is particularly interested. As he reads the text he should keep open before him for constant reference the accompanying map of the municipality on which are two figures, one showing the surface and bedrock geology of the area as they affect the ground water supply, and the other the relief and the location and type of water wells. The land relief is shown by means of lines of equal elevation, termed "contours", which lie generally at vertical intervals of 50 feet. The elevation above sea-level of each fourth line is indicated on the map. The statistical summary that follows the text gives at a glance the main characteristics of the wells in each township of the municipality and of the municipality as a whole as listed under the various sub-headings. This is followed by a section dealing with the analyses and quality of the water derived from the unconsolidated deposits and from bedrock. The table of well records gives the detailed information pertaining to each well. In this are tabulated the altitude of the well, its depth, the height to which the water will rise, and the elevation of the water horizon. The wells are grouped in the table by townships and are numbered from the lower right corner of the township westward and northward, and the location of each well by its quarter section is given. The elevations used were determined by aneroid barometer and were checked frequently by elevations on the published maps or by instrument surveys.

Where the ground surface of an area is comparatively flat an effort has been made to indicate the position of the water-bearing horizon in feet below the surface. In rolling country where there is a considerable difference of elevation within short distances a uniform figure for the depth to the water horizon is not generally possible. It then becomes necessary to indicate the position in terms of the elevation of a water-bearing bed in feet above sea-level.

Should one desire to ascertain at any location at which no well has as yet been sunk, the approximate depth at which a particular water-bearing horizon can be reached it is necessary to know two things--first, the elevation of the land surface, and second, the probable elevation of the water-bearing bed, or aquifer. The elevation of the land surface can be obtained by noting the position of the well site on the map, Figure 2, with respect to the two bounding contour lines of known elevation, and estimating either how far above the lower, or how far below the upper, control elevation line the well site lies. The approximate elevation of the water-bearing horizon at the well site can be obtained by noting on the table, of well records the elevation of the horizon in the wells adjacent to the proposed location and from the range of elevations given and the relative positions of the wells shown on the map to select what appears to be its most probable elevation at the new well site. Having determined this elevation the depth that it is necessary to sink in order to tap it is the difference between its elevation and the elevation of the land surface. This method is especially applicable when the water-bearing horizon is in bedrock. In unconsolidated deposits the water horizon either conforms to the rolling land surface or occurs in isolated sand beds at various horizons that do not form a continuous water-bearing bed over a large area. Care should be taken in making any calculations for depth of water-bearing horizons to be sure that the elevations selected for the determinations occur in the same geological horizon, that is they should be either all in glacial drift or in the same bedrock formation.

The table of well records also contains notes on the temperature, quality, and quantity of the water being obtained from the various wells, and from this it is possible to draw reasonable conclusions as to the character and quantity of the water likely to be encountered at the proposed well site.

Glossary of Terms Used

Alluvium. Deposits of earth, silt, sand and gravel, and other transported material laid down by rivers, floods, or other causes upon land that has been submerged beneath the waters of lakes or rivers.

Aquifer. Layers or pockets of water-bearing sand or gravel that occur in unconsolidated deposits or as beds forming part of a bedrock formation.

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 deposits of gravel, sand, silt, and marl that have been laid down by the agency of water and which through a long period of time and the weight of the overlying sediments have become cemented into a solid rock.

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

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

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

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

Flood-plain. A flat section in a river valley that is 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 exerted by the water at any given point. It is due mainly to the weight of the column of water occurring at higher levels in the same aquifer or water-bearing bed.

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

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

Potable. Suitable for drinking.

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.

Water-bearing Horizon. A layer in either unconsolidated deposits or in bedrock formations that is water-bearing; same as aquifer.

Zone of Saturation. An area in which the permeable rocks are saturated with water that will move under ordinary hydrostatic pressure.

Names and Descriptions of Geological Formations, Referred to in These Reports

Wood Mountain Formation. The local name given to a series of gravel and thin sand beds which have a maximum thickness of 50 feet, and which occurs as isolated patches on the higher elevations of Wood mountain. They are the youngest of the consolidated rocks and, where present, rest upon the beds of the Ravenscrag formation.

Cypress Hills Formation. The local name given to a series of conglomerates and sand beds occurring in the southwest corner of Saskatchewan, which rests upon the Ravenscrag or older formations. The thickness of this formation varies from 30 to 125 feet.

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

Whitemud Formation. The local name given to a series of white, grey, and buff coloured clays and sands that varies in thickness from 10 to 75 feet. The base of this formation grades in places into a coarse, limy sand having a maximum thickness of 40 feet.

Eastend Formation. The local 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 eastern escarpment of the Missouri coteau. The The thickness of the formation seldom exceeds 40 feet.

Marine Shale Formation. The general name given to the thick deposit of incoherent, dark grey to dark brownish grey, plastic shales, which weather light grey to buff in places. It forms the uppermost bedrock formation over the greater part of eastern and central Saskatchewan. In the western part of the province it consists of a series of dark shales termed the Bearpaw formation. This is underlain by a series of sands, shales, and coal seams, known as the Belly River formation.

Water-bearing Horizons of the Municipality

The rural municipality of Estevan is an area of 324 square miles in the southeastern corner of Saskatchewan. It consists of nine townships described as townships 1,2, and 3, ranges 7, 8, and 9, west of the 2nd meridian. It is covered by a mantle of unconsolidated deposits. Recent deposits of fine sand and silt occur along the flood-plain of Souris river, and in township 1, ranges 7 and 8, there is an old lake basin in which extensive deposits of fine lake sands occur. The remainder of the municipality is covered by glacial drift. Along the southern edge of the municipality the glacial deposits are in the form of an undulating belt of gravel knolls and depressions termed a terminal moraine, and it was this moraine that blocked the drainage and caused the glacial lake to form to the north of it. Along both sides of Souris river the glacial deposits have been modified by water, the fine materials having been washed away and the coarser material exposed on the surface. This is especially true in the vicinity of Tableland. At this locality the valley is quite wide and is strewn with large water-worn boulders. It is thought that the waters of the old Regina lake, which occurred to the north, drained out through this channel. Elsewhere the glacial deposits are in the form of unmodified till.

The thickness of the glacial drift varies greatly throughout the municipality. The maximum thickness of 180 to 300 feet is attained in the northwestern corner. To the east and south the thickness decreases and in the vicinity of Estevan it is only from 10 to 30 feet, the bedrock outcropping along the valley of Souris river. From this point to the International Boundary the thickness increases to 80 to 100 feet.

The upper 10 to 50 feet of the drift is composed of yellow boulder clay. In the areas where the drift is fairly

thick, this zone is underlain by blue clay, but where there is only a thin mantle of drift, bedrock immediately underlies the yellow clay. Pockets and layers of sand and gravel occur within the yellow clay, between the yellow and blue clays, or within the upper few feet of the blue clay. Along the eastern edge of township 3, range 7, a deposit of sand is found between the blue clay and the Ravenscrag formation. There appears to be a depression here in the bedrock surface, in which this sand was deposited. Similar deposits also occur in township 1, range 9.

Water-bearing Horizons in the Unconsolidated Deposits

The sand and gravel of the Recent flood-plain and lake deposits, and the pockets and layers of sand within the glacial drift, constitute a water-bearing horizon. Most of the shallow wells in the municipality derive their supply of water from this horizon, the best supply being from the Recent deposits. The sand pockets and layers within the clay, however, yield only a small supply of hard water, which is often "alkaline" in character. In years of normal rainfall the wells tapping this horizon usually supply sufficient water for local needs, but in drought periods, and the autumn and winter months, their supply is inadequate, and it is necessary to haul water from wells that yield a permanent supply.

The sand and gravel that occur below the blue clay and above the Ravenscrag formation form a second water-bearing horizon. This horizon is confined to the northern part of township 1, range 9, and to the eastern edge of township 3, range 7. In the former locality the aquifer is encountered at depths of 70 to 80 feet and the water obtained from it is hard and "alkaline" in character, fairly abundant in quantity, and rises only a few feet in the wells. In township 3, range 7, however, the horizon is encountered at depths of 125 to 200 feet, and yields an abundant supply of hard water which rises to within 30 feet of the surface.

The water from both horizons in the unconsolidated deposits is usable for stock, and unless it is too "alkaline", it can be used for domestic purposes.

Water-bearing Horizons in the Bedrock

The Ravenscrag formation underlies the mantle of unconsolidated sediments throughout the municipality. Outcrops of this formation can be seen in the vicinity of Estevan where Souris river has cut its channel into the bedrock, and in the open pit of the Truax-Traer coal mine. The thickness of this formation is not definitely known, but is over 600 feet. It is composed of a series of soft sandstone, shale, sandy clay and sandy shale beds, and contains a number of lignite coal seams, several of which are of minable thickness.

The porous sandstone and sandy shale beds, and the coal seams, constitute a number of water-bearing horizons at varying depths. Throughout the municipality three horizons are fairly general. The uppermost is a coal seam and its enclosing sandy beds, and it is encountered at depths of 11 to 60 feet over most of the central part of the municipality. It yields a fairly abundant supply of medium soft water, which may be slightly "alkaline" due to contamination by the seepage water from the overlying clay. The second water-bearing horizon is also a coal seam and its associated sandy beds. It is encountered at depths of 90 to 125 feet over most of the municipality, and wells tapping this horizon yield an abundant supply of soft usable water. The third horizon that is fairly continuous throughout the municipality, is formed by sandy shale beds which are encountered at depths of from 250 to 350 feet. It contains an abundant supply of soft, usable water which is under sufficient pressure to rise to within 50 feet of the surface. In one instance, where the well tapping this horizon was located in the Souris valley, the pressure was sufficient to cause the water to

flow 1 foot above the surface. In township 2, range 7, one well is obtaining an abundant supply of soft, salty water from a sandy shale bed at a depth of 440 feet. The areal distribution of this horizon is not known. In township 3, range 8, soft, salty water is being obtained from a sandy shale bed encountered at a depth of 550 feet, but the areal distribution of this horizon also is not known.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 1, Range 7

The major part of the township is covered by Recent deposits of sand and silts. These deposits occur as alluvium on the flood-plain of Souris river, and as lake sands in two areas that are shown on the accompanying map of the municipality. The remainder of the township is mantled by glacial drift, which is in the form of a terminal moraine in sections 3, 4, 5, and 6, but elsewhere as ground moraine or till. To the north of Souris river, and to the east of Short creek, the till or boulder clay had been modified by the run-off waters.

The flood-plain deposits, the glacial lake sand, and the pockets of gravel within the morainic material, constitute a water-bearing horizon. In years of normal rainfall the shallow wells tapping this horizon yield an adequate supply of hard, usable water, but in drought periods the supply diminishes and is barely sufficient for local needs. Springs are common along Souris river and Short creek, and they are used for both stock and domestic purposes.

Ground water is obtained from three horizons in the Ravenscrag formation. In sections 12, 13, 22, 25, and 33, a coal seam, occurring at a depth of 15 to 32 feet, forms the upper horizon. It yields an adequate supply of soft, usable water, and its outcrops along the coulées commonly have springs issuing from them. In sections 10 and 16, a coal seam lying at a depth

of 100 to 115 feet forms a second water-bearing horizon. Water is also obtained from a sandy bed at a slightly greater depth. The water is soft in character, abundant in quantity, and the hydrostatic pressure is sufficient to cause it to rise to within 30 to 60 feet of the surface. A sandstone or sandy clay bed forms the third horizon, at a depth of from 240 to 300 feet or at an elevation of 1,600 to 1,650 feet. This horizon has been tapped by a number of wells in the southeastern corner of the township and it yields an abundant supply of soft, usable water. The water rises to within 50 to 150 feet of the surface. Throughout the township these horizons, or others that may occur in the Ravenscrag formation, will yield an abundant supply of usable water should they be tapped by other wells.

Township 1, Range 8

The Recent and glacial deposits of this township contain one water-bearing horizon. This horizon comprises the alluvium along Long creek, the lake sands, and the pockets of sand and gravel that occur within the glacial deposits. In the terminal moraine, which covers the southern row of sections, shallow wells yield only a small supply of water, but elsewhere no difficulty is experienced in obtaining a sufficient supply from shallow wells tapping this horizon. As a rule the water is hard in character, and usable for both humans and stock.

The Ravenscrag formation has been pierced by a number of wells in the southern part of the township, and two water-bearing horizons were encountered. The upper horizon occurs at depths of from 90 to 125 feet and is formed by a coal seam and its enclosing sandy beds. The water is soft and is fairly abundant in quantity. The hydrostatic pressure is not great and the water rises only 10 to 15 feet above the top of the water-bearing bed or aquifer. The second horizon is a sandy bed, which is encountered at a depth of 230 feet. The water is abundant in

quantity, soft, and slightly salty in character, and usable for both humans and stock. The hydrostatic pressure is sufficient to cause the water to rise to within 25 to 80 feet of the surface. These horizons, or others that may occur within the Ravenscrag sediments, will yield a fairly abundant supply of water should they be tapped by other wells.

Township 1, Range 9

The glacial drift of this township contains two water-bearing horizons. The upper 10 to 50 feet of the drift is composed of yellow clay, and the gravel and sand pockets within this clay deposit form a water-bearing horizon. This horizon is not extensive and only a few wells are deriving a small supply of hard, "alkaline" water from it. The second water-bearing horizon in the glacial drift occurs at an elevation of from 1,800 to 1,840 feet, or at depths of from 75 to 100 feet. This horizon is formed by a deposit of sand and gravel that lies below the impervious blue clay. It has been tapped throughout the northern part of the township, and it yields a fairly abundant supply of hard, "alkaline" water. In some instances the water is so "alkaline" that it is not usable for drinking. The hydrostatic pressure is sufficient to cause the water to rise to within 10 to 20 feet above the top of the sand aquifer. This water cannot be used for irrigation as its high content of "alkali" salts is detrimental to plant life.

The Ravenscrag formation of this township, contains at least two water-bearing horizons. The upper horizon is a coal seam and it is encountered at depths of 80 to 100 feet. The water from it is hard and "alkaline", and rises to within 30 to 50 feet of the surface. The writer is of the opinion that this coal seam immediately underlies the sand bed that forms the lower aquifer in the glacial drift. A sand bed occurring at a depth of 180 to 225 feet forms a second water-bearing horizon. The

water from this horizon is soft in character, abundant in quantity, and rises to within 60 feet of the surface. An abundant supply of usable water can be obtained from these horizons or from others that may occur in the Ravenscrag formation.

Township 2, Range 7

The thin deposit of glacial drift contains very little water. A few wells are deriving a small supply of hard, slightly "alkaline" water from small sand pockets in the clay, or from the clay itself. Springs occur along Souris River valley in the southwestern corner of the township, and the flood-plain deposits in that locality yield a fairly abundant supply of water.

The Ravenscrag formation yields an abundant supply of water throughout the township. A coal seam occurring at a depth of 30 to 40 feet forms the uppermost water-bearing horizon. Shallow wells located in sections 12, 13, 14, 15, 16, 20, and 21 are deriving an adequate supply of hard water from this horizon. The water is slightly "alkaline", the "alkali" being derived from the overlying clays. A fairly thick sand bed occurring at a depth of 150 to 190 feet, forms a second horizon. This horizon has been tapped by wells located in sections 12, 23, 24, 25, and 26, and it yields an abundant supply of soft water. The hydrostatic pressure is not great and the water rises to within 80 to 120 feet of the surface. In the SW.$\frac{1}{4}$, section 30, a well is deriving an abundant supply of soft water from a depth of 300 feet, but no definite information as to the character or extent of the water-bearing horizon could be obtained. In this township the lowest known water-bearing horizon in the Ravenscrag formation is a sandstone bed that has been struck at a depth of 440 feet in NE.$\frac{1}{4}$, section 4, and NW.$\frac{1}{4}$, section 17. The water is medium soft, and slightly salty in character. It rises to within 50 feet of the surface and is abundant in quantity.

Throughout the township an ample supply of usable water can be obtained from these horizons in the Ravenscrag formation.

Township 2, Range 8

The mantle of glacial drift is very thin and only a small amount of ground water is obtained from the scattered sand and gravel pockets that occur within it. The water is hard and potable, and in most cases it is sufficient only for domestic purposes and a few head of stock. The majority of shallow wells in this township derive their water from the deposits of sand and silt on the flood-plain of Souris river. These wells yield a fairly abundant supply of medium hard, usable water.

The Ravenscrag formation contains a number of water-bearing horizons, and an adequate supply of usable water can be obtained from them throughout the township. The uppermost horizon is formed by a small coal seam that underlies a blue, sandy clay at depths of from 11 to 40 feet. It yields a moderate supply of soft water, which in a few instances is slightly "alkaline," due to its contamination by "alkaline" seepage water from the overlying clay. Wells tapping this horizon are located in sections 2, 6, 16, 20, 22, 26, 34, and 35. A well located in NE.$\frac{1}{4}$, section 32, is deriving an abundant supply of soft water from a blue sand of the Ravenscrag formation, at a depth of 100 feet. This sand bed was noted to occur above the coal seam in the Truax-Traer mine, and at this locality water was seeping from it. An abundant supply of soft, usable water, which is high in soda, is also derived from a water-bearing horizon encountered at depths of 220 to 300 feet. The hydrostatic pressure is sufficient to cause the water to rise to within 2 to 50 feet of the surface in wells drilled on the uplands, and to flow 1 foot above the surface in a well drilled in the Souris valley at the plant of the Dominion Electric Power Company. In the town of Estevan a well was drilled to a depth

of 2,000 feet, but the water was salty and the well was abandoned. In this locality any water that occurs below a depth of 600 to 700 feet probably will be salty in character.

Township 2, Range 9

The sand pockets that occur in the thin mantle of glacial drift in this township form a water-bearing horizon. The northern three-quarters of the township is composed of modified glacial till, the surface being strewn with large boulders, and in this area no farming is carried on. The above-mentioned water-bearing horizon should occur in this modified area, however, but only a moderate supply of water will be obtained from it. During the drought period the wells that were drawing their supply from this horizon became practically dry.

Four wells are deriving a moderate supply of water from a coal seam encountered at 15 to 30 feet below the surface, or at an elevation of 1,845 feet. The water is soft, often slightly "alkaline," and it does not rise far above the aquifer. An abundant supply of water is also being obtained from a sandstone bed at a depth of 76 feet in SW.$\frac{1}{4}$, section 2. The water is hard and "alkaline," and rises to within 32 feet of the surface. Water is also derived from a sand bed at a depth of 120 to 160 feet. The hydrostatic pressure in this lower horizon is sufficient to cause the water to rise to within 50 feet of the surface. The best supply of water, both from the standpoint of quantity and quality, should be obtained at depths of from 150 to 300 feet in the Ravenscrag formation.

Township 3, Range 7

Two water-bearing horizons occur in the glacial drift of this township. The upper horizon is formed by the pockets and layers of sand and gravel that occur within, or at the base of, the yellow clay, or within the upper few feet of the blue clay. In sections 1 to 22 shallow wells obtain an abundant

supply of water from a sand bed lying at the base of the yellow clay or separated from it by a few feet of blue clay. All these wells are usually between 28 and 40 feet in depth and the water supply from them remained fairly constant during the drought period. The water is hard, often slightly "alkaline", and is sufficient for local needs. In sections 22 to 36 the water-bearing sand horizon is encountered below the yellow clay, at depths of 15 to 20 feet. The supply from shallow wells in this locality, however, is dependant upon the amount of rainfall, and during the drought period water for stock use had to be hauled from wells yielding a permanent supply. The water is hard and in a few instances "alkaline" in character. In years of normal rainfall this horizon should yield an adequate supply of water, but it may be necessary to dig several dry holes before a suitable supply is obtained.

Along the eastern side of the township three wells located in SE.$\frac{1}{4}$, section 12, NE.$\frac{1}{4}$, section 13, and SE.$\frac{1}{4}$, section 25, are deriving an abundant supply of water from a thick sand bed occurring at the base of the blue clay or at depths of 113, 125, and 207 feet, respectively. It appears that here there is a deep channel in the bedrock surface in which the glacial debris has been deposited, as in SW.$\frac{1}{4}$, section 12, a coal seam is encountered at a depth of 60 feet. The water is medium hard and contains some "alkali" and iron salts. The hydrostatic pressure is sufficient to cause the water to rise to within 30 to 100 feet of the surface. This horizon is only of narrow width, but lack of information does not permit the tracing of its exact areal distribution.

Information obtained on four wells drilled into the Ravenscrag formation shows that there are at least two water-bearing horizons in these sediments. In the SW.$\frac{1}{4}$, section 12 and SW.$\frac{1}{4}$, section 16, a sandy bed lying below a coal seam at

depths of 60 and 20 feet, respectively, yields a fairly abundant supply of hard, usable water. An abundant supply of soft, usable water is also derived from a sandy strata at a depth of 350 feet, or at an elevation of 1,573 feet. The hydrostatic pressure is sufficient to cause the water to rise to within 100 feet of the surface. These horizons, and others that may occur in the Ravenscrag formation throughout the township, will provide an adequate supply of usable water should they be tapped by other deep wells.

Township 3, Range 8

The pockets and layers of sand that occur in the upper 60 feet of the glacial drift form its only known water-bearing horizon. This horizon is encountered at depths of from 20 to 60 feet and most of the wells obtain a sufficient supply of hard, usable water from it. In a number of wells the water is too "alkaline" for house use and drinking water must be hauled from wells that yield water suitable for domestic purposes. A number of dry holes are often dug before a suitable supply of water is obtained.

Four water-bearing horizons have been encountered in the Ravenscrag formation. In the south-central part of the township a coal seam and its overlying sandy beds form the uppermost horizon at a depth of from 35 to 70 feet, or at an elevation of 1,850 feet.

The water is hard and slightly "alkaline" in character, being contaminated by "alkaline" seepage water from the overlying blue clay. This horizon yields a supply of water that is sufficient for farm needs, and wells tapping it were not affected by the drought conditions. In the SE.$\frac{1}{4}$, section 6, a coal seam lying at a depth of 129 feet forms a second horizon. The water from it is soft in character, brownish in colour, and rises to within 30 feet of the surface. In SW.$\frac{1}{4}$,

section 35, a sandstone bed at a depth of 175 feet may represent this same aquifer. A third water-bearing horizon occurs at a depth of 360 feet, or at an elevation of 1,550 feet. In sections 23 and 34 this horizon is formed by a sandstone bed, but in section 31 the water is being derived from a coal seam. The water is soft and slightly salty in character, abundant in quantity, and rises to within 3 to 80 feet of the surface. The lowest water-bearing horizon is encountered by a well located in SE.$\frac{1}{4}$, section 34. This well is deriving a fairly abundant supply of hard, salty water from a sandy shale bed at a depth of 550 feet, or at an elevation of 1,355 feet. The water rises to within 120 feet of the surface. No trouble should be experienced in obtaining an abundant supply of usable water from the horizons in the Ravenscrag formation.

Township 3, Range 9

The glacial drift of this township does not yield a large supply of ground water. The sand and gravel found between the yellow and blue clays form a water-bearing horizon, but as these deposits occur as pockets or narrow layers, the supply of water derived from them is dependant on the amount of rainfall. The shallow wells tapping this horizon are from 10 to 60 feet in depth and often as many as twenty-five dry holes are dug before a sand pocket is located. The water is hard and often too "alkaline" for domestic purposes. During drought periods, and the autumns and winters of most years, it is necessary for the majority of the farmers to haul water from deep wells in their respective neighbourhoods. Small dugouts are used, but they were not large enough to retain a sufficient supply over the autumn and early winter months.

The Ravenscrag formation yields an abundant supply of soft, usable water and the seven wells that obtain their water from its horizons supplied practically all the farmers in the

township during the drought period. Three water-bearing horizons have been tapped. The upper horizon is a thick sand bed underlying the blue clay and overlying a coal seam at a depth of 180 to 215 feet, or at an elevation of 1,700 to 1,730 feet. The water is medium soft in character and rises to within 60 feet of the surface. The second horizon is also a sandy bed, which occurs at a depth of 280 to 300 feet. The water from this horizon is soft and tastes of soda. The hydrostatic pressure is sufficient to cause the water to rise to within 60 feet of the surface. One well is deriving its supply of soft, usable water from a sandy bed at a depth of 370 feet. The pressure in this aquifer, however, is not great, and the water rises to 185 feet from the surface. Throughout the township these horizons, or others that may be encountered in the Ravenscrag formation, will provide an abundant supply of water should they be tapped by other wells.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF ESTEVAN, NO. 5, SASKATCHEWAN

West of 2nd mer. Township / Range	1 / 7	1 / 8	1 / 9	2 / 7	2 / 8	2 / 9	3 / 7	3 / 8	3 / 9	Total No. in municipality
Total No. of Wells in Township	70	38	42	59	59	30	89	86	84	557
No. of wells in bedrock	13	6	10	28	20	9	6	19	8	119
No. of wells in glacial drift	53	29	32	31	27	20	83	67	75	417
No. of wells in alluvium	4	3			12	1			1	21
Permanency of Water Supply										
No. with permanent supply	33	28	27	31	46	16	34	45	30	290
No. with intermittent supply	2	1	2	5	2		4	35	2	53
No. dry holes	35	9	13	23	11	14	51	6	52	214
Types of Wells										
No. of flowing artesian wells					1					1
No. of non-flowing artesian wells	8	5	8	12	5	5	6	19	7	75
No. of non-artesian wells	27	24	21	24	42	11	32	61	25	267
Quality of Water										
No. with hard water	26	25	25	27	38	11	35	70	27	284
No. with soft water	9	4	4	9	10	5	3	10	5	59
No. with salty water		2		2	1			2	1	8
No. with alkaline water	2	2	24	10	11	4	4	42	10	109
Depths of wells										
No. from 0 to 50 feet deep	60	31	16	46	53	23	80	68	73	450
No. from 51 to 100 feet deep	2	4	20	1	1	3	4	11	3	49
No. from 101 to 150 feet deep	2	1	2	4	1	3	3	1		17
No. from 151 to 200 feet deep	2		3	4		1		1	1	12
No. from 201 to 500 feet deep	4	2	1	3	4		2	4	7	27
No. from 501 to 1,000 feet deep				1				1		2
No. over 1,000 feet deep										
How the Water is used										
No. usable for domestic purposes	32	28	22	31	41	14	36	45	27	276
No. not usable for domestic purposes	3	1	7	5	7	2	2	35	5	67
No. usable for stock	35	29	28	36	46	16	38	49	32	309
No. not usable for stock			1		2			31		34
Sufficiency of Water Supply										
No. sufficient for domestic needs	35	29	29	36	48	16	38	80	32	343
No. insufficient for domestic needs										
No. sufficient for stock needs	28	24	26	28	38	12	24	36	19	235
No. insufficient for stock needs	7	5	3	8	10	4	14	44	13	108

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 and unless the figure is very high it does not imply that the water is too alkaline for irrigation purposes. The analyses are given in parts per million--that is, in parts by weight of the constituents in 1,000,000 parts by volume 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 practically all rocks, but in larger amounts 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 teakettles 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, and waters that contain a large amount of them cannot be used for irrigation.

Sulphates

Sulphates (SO_4) are one of the common constituents of natural water. The sulphate salts most commonly found are sodium sulphate (Glauber's Salt, Na_2SO_4), magnesium sulphate (Epsom

Salts, $MgSO_4$) and calcium sulphate ($CaSO_4$). Waters that contain these sulphate salts are called "sulphated waters". When the water contains large quantities of the sulphate of sodium ("White Alkali") it is injurious to vegetation and cannot be used for irrigation. According to Thresh and Beale, London, the continued use of water that contains 1,200 parts or more per million of magnesium sulphate and 500 parts or more per million of sodium sulphate causes diarrhoea and scour among stock, and one half this quantity makes the water unfit for domestic use.

Chlorides

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

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 out 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 had 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 to the bicarbonates of calcium and magnesium, 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. The following table from "The Examination of Water and Water Supplies" by Thresh and Beale, London, 1925 , can be used for determining the relative hardness of a water.

Total Hardness				Character
Less than 50	parts	per	million.	Very soft
50 - 100	"	"	"	Moderately soft
100 - 150	"	"	"	Slightly hard
150 - 200	"	"	"	Moderately hard
200 - 300	"	"	"	Hard
Over 300	"	"	"	Excessively hard

Many of the Saskatchewan water samples analysed by the Geological Survey 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.

The term "alkaline" has been applied rather loosely to some ground waters. Its original meaning was a chemical one and it implied that the substance in question would neutralize acids. The carbonates of calcium, magnesium, and sodium are the only compounds found in ground water that would make it alkaline chemically. A later application of the term "alkaline" was to soils that contain sufficient "black alkali" or "white alkali" to make them unfit for vegetation. In the Prairie Provinces a water is usually considered to be alkaline when it contains so much dissolved solids that it is not very suitable for human consumption; except that 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".

Analyses of Water Samples from the Municipality of Estevan, No. 5, Saskatchewan

LOCATION						Depth of Well, Ft	Total dis'vd solids	Cl.	HARDNESS			CONSTITUENTS AS ANALYSED					CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of Water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.				Total	Perm.	Temp.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl		
1	SW.	4	1	7	2	280	1,760	159	15	not	det.	1,415	20	7	37	1,007	1,811	36		15		1,443	45	262		x 2
2	NE.	35	1	9	2	72	1,700	35	400	200	200	635	90	54	731	713	1,772	161		113		359	1,081	58		x 2
3	SW.	12	2	7	2	225	1,860	31	20	not	det.	710	20	7	759	924	1,920	36		15		695	1,123	51		x 2
4	SW.	16	2	7	2	21	13,860	105	3,000	3,000	not det.	805	310	853	8590	4,478	13,240	555		211	2,241		10,060	173		x 2
5	NW.	23	2	8	2	16	1,600	140	1,200	1,200	not det.	300	240	180	599	153	1,310	300	172		536		71	231		x 1
6	SW.	17	3	7	2	37	920	12	520	400	120	370	130	90	377	201	907	233		115	104		435	20		x 1

Water samples indicated thus, x 1 , are from glacial drift.
Water samples indicated thus, x 2, are from bedrock, Ravenscrag formation.
Analyses are reported in parts per million.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

In general, the water that is obtained from the glacial drift in this municipality, varies greatly in quality. Water that is derived wholly, or in a large part from the blue clay is usually higher in total dissolved mineral salts, and contains more sulphate salts than the waters that are derived from the sands and gravels within the yellow clay and from the recent stream gravels. The striking of water unfit for use at shallow depth in one locality, however, does not necessarily mean that similar conditions are widespread in any locality.

Most of the waters from the glacial drift in the municipality of Estevan are reported as being slightly "alkaline". They are usable, however, for drinking as well as for stock. The water that is derived from the stream gravels along the flood-plain of Souris river, and from the lake sands in the southeastern part of the municipality, is of better quality than that derived from other deposits forming the glacial drift. Two samples of water from the glacial drift were analysed and the results are listed in the accompanying table. The samples analysed are relatively low in dissolved solids, having 920 and 1,600 parts per million respectively. The waters are excessively hard, the total hardness being 400 and 1,200 parts per million. They contain a considerable amount of magnesium sulphate (Epsom salts) and sodium sulphate (Glauber's Salt), but their combined content is not great enough to render the water unsuitable for drinking for those who are accustomed to its use. It may have a slight laxative effect on those unaccustomed to the use of highly mineralized water.

Water from the Bedrock

Four samples of water from the Ravenscrag formation were analysed. Some of the waters from the Ravenscrag formation in this municipality are soft and others are hard. The water analysed from a depth of 21 feet has a total hardness of over 3,000 parts per million; that from a depth of 72 feet, 400 parts per million; and from depths of 225 and 280 feet, less than 25 parts per million. Two of the waters, samples Nos. 1 and 3 are soft because they contain small amounts of calcium and magnesium salts; the other two waters, samples Nos. 2 and 4 are hard because they contain fairly large amounts of calcium and magnesium salts. Samples Nos. 1, 2 and 3 contain fairly large amounts of sodium salts but can be used for drinking as well as for stock although they are not very satisfactory. The water represented by sample No. 1, is preferable to the other two as it contains chiefly sodium carbonate which is not so injurious as is the sodium sulphate present in samples Nos. 2 and 3. Sample No. 4, has so high a content of salts in solution that it is unfit for use even for stock.

WELL RECORDS—RURAL MUNICIPALITY OF ESTEVAN, NO. 5, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	NE.	3	1	7	2	Dug	18	1,890	− 3	1,887	7	1,883	Glacial gravel	Hard, clear, alkaline	43	S	Insufficient supply.
2	SE.	4	"	"	"	Drilled	244	1,900	− 69	1,831	244	1,656	Ravenscrag sandstone	Soft, clear	44	D, S	Abundant supply.
3	SW.	4	"	"	"	"	280	1,880	− 50	1,830	278	1,602	Ravenscrag sandstone	" "	44	D, S, I	" " ; #.
4	SW.	5	"	"	"	Dug	32	1,905	− 26	1,879	20	1,885	Glacial gravel	Hard, "		D, S	Poor supply.
5	SW.	6	"	"	"	Drilled	178	1,900	−106	1,794	178	1,722	Ravenscrag sand	" reddish		D, S	Sufficient supply.
6	NE.	8	"	"	"	Dug	10	1,880	− 7	1,873	9	1,871	Glacial gravel	" , clear	46	D, S	" " .
7	NW.	9	"	"	"	"	14	1,900	− 11	1,889	12	1,888	" "	" "	44	D, S	" " .
8	SW.	10	"	"	"	Drilled	125	1,900	− 60	1,840	125	1,775	Ravenscrag coal	Soft, "	46	D, S	" " .
9	NE.	10	"	"	"	"	300	1,905	− 140	1,765	300	1,605	" sandy clay	" , " , sulphur	46	S	" " .
10	SW.	12	"	"	"	"	222	1,860	−132	1,728	222	1,638	" sand	Soft, "	47	D, S	" " .
11	SE.	12	"	"	"	Dug	32	1,860	− 6	1,854	32	1,828	" coal	Hard, "	45	D, S	" " .
12	NE.	12	"	"	"	"	22	1,910	− 13	1,897	19	1,891	" sand	Soft, "	43	D	" for house use only.
13	NE.	13	"	"	"	"	13	1,860	− 9	1,851	9	1,851	" gravel	" "	44	D, S	Abundant supply.
14	SE.	14	"	"	"	Drilled	185	1,900			135	1,765	" sandstone	" sulphur	46	D, S	" " .
15	SE.	16	"	"	"	"	125	1,900	− 35	1,865	100	1,800	" clay	" soda, clear	44	S	Sufficient supply.
16	NW.	18	"	"	"	Dug	10	1,900	− 6	1,894	6	1,894	Glacial gravel	Hard, "	45	D, S	" " .
17	SE.	20	"	"	"	"	20	1,880	− 10	1,870	5	1,875	" sand	" "	44	D, S	Insufficient " .
18	NW.	22	"	"	"	"	20	1,850	− 10	1,840	15	1,835	Ravenscrag coal	alkaline Hard, clear	43	D, S	Sufficient " .
19	SE.	22	"	"	"	"	12	1,860	− 6	1,854	2	1,858	Glacial sand	" "	47	D, S	" " .
20	NE.	22	"	"	"	"	12	1,850	− 6	1,844	2	1,848	" "	" "	44	D, S	" " .
21	SE.	25	"	"	"	"	17	1,800	− 14	1,786	16	1,784	Ravenscrag sand	Soft, "	44	D	Abundant " .
22	NE.	25	"	"	"	"	20	1,750	− 15	1m735	16	1,734	River deposits	" "		D	Sufficient " .
23	SW.	25	"	"	"	"	34	1,760	− 31	1,729	6	1,754	" "	Hard, "	41	D	Insufficient supply.
24	NW.	26	"	"	"	"	25	1,750	− 23	1,727	6	1,744	" "	" "	43	D	Sufficient " .
25	SW.	28	"	"	"	"	12	1,860	− 2	1,858	2	1,858	Glacial lake sands	" "		D, S, I	Abundant " .
26	SE.	29	"	"	"	"	6	1,860	− 4	1,856	4	1,856	" "	" "	46	D, S, I	Sufficient " .
27	SW.	29	"	"	"	"	12	1,900	− 4	1,896	9	1,891	" lake gravel	" "	46	D, S	" " .

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 ESTEVAN, NO. 5, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
28	SE.	33	1	7	2	Dug	16	1,800	− 13	1,787	16	1,784	Ravenscrag coal	Hard clear	41	D, S	Sufficient supply.
29	SW.	35	"	"	"	"	24	1,750	− 20	1,730	24	1,726	River deposits	" "	46	D	" " .
1	NE.	1	1	8	2	Dug	12	1,900	− 7	1,893	12	1,888	Glacial gravel	" "	46	D	Very poor supply.
2	NW.	1	"	"	"	Drilled	215	1,890	− 25	1,865	215	1,675	Ravenscrag sand	Soft, " salt	45	D, S, I	Sufficient supply.
3	SE.	2	"	"	"	Dug	9	1,880	− 7	1,873	9	1,871	Glacial gravel	" "	52	D, S	Abundant " .
4	SW.	2	"	"	"	"	16	1,885	− 12	1,873	16	1,869	" clay	" "		D, S	Small " .
5	SE.	3	"	"	"	Drilled	127	1,900	−112	1,788	120	1,780	Ravenscrag sand	" "	44	D, S	Sufficient when not plugged with sand.
6	NW.	4	"	"	"	Bored	94	1,900	− 79	1,821	91	1,809	" "	Hard, "	43	D, S	15 bbls. a day.
7	NE.	6	"	"	"	Dug	14	1,890	− 7	1,883	4	1,886	Glacial gravel	" "	45	D, S, I	Sufficient supply.
8	SE.	7	"	"	"	"	20	1,880	− 16	1,864	16	1,864	River sand	Soft, "	48	D, S	Insufficient " .
9	SE.	8	"	"	"	"	90	1,890	− 80	1,810	90	1,800	Ravenscrag sand	" "	44	D, S	" " .
10	NE.	9	"	"	"	"	12	1,890	− 8	1,882	12	1,878	Glacial gravel	" "	45	D, I	House supply only.
11	NE.	10	"	"	"	"	45	1,890	− 44	1,846	30	1,860	Ravenscrag	Hard, "	43	D, S	Sufficient supply.
12	SW.	11	"	"	"	Drilled	243	1,900	− 80	1,820	241	1,659	" sandy clay	Soft, salty, soda	44	D, S	Abundant " .
13	NW.	16	"	"	"	Dug	60	1,890	− 44	1,846	60	1,830	Glacial sand	Hard, clear	46	N	Caved in.
14	NW.	18	"	"	"	Bored	65	1,890	− 62	1,828	63	1,827	Ravenscrag	" "	46	D, S, I	Abundant supply.
15	SE.	20	"	"	"	Dug	40	1,900	− 32	1,868	36	1,864	Glacial sand	Soft, "	46	D, S	Sufficient " .
16	SW.	24	"	"	"	"	12	1,870	− 9	1,861	9	1,861	" gravel	Hard, "	50	D	" " .
17	NW.	26	"	"	"	"	12	1,870	− 9	1,861	9	1,861	" "	" "	46	D, S	" " .
18	NW.	28	"	"	"	"	18	1,790	− 6	1,784	12	1,778	River sands	" " alkaline	43	D	" " .
19	SW.	33	"	"	"	"	12	1,815	− 4	1,811	4	1,811	" "	Hard, clear	43	D, I	" " .
20	NW.	34	"	"	"	"	27	1,850	− 20	1,830	26	1,824	Glacial sand	Soft, "	42	D	" " .
21	SE.	34	"	"	"	"	10	1,875	− 5	1,870	3	1,872	" "	Hard, "	45	D, S, I	Abundant " .
22	SW.	35	"	"	"	"	16	1,875	− 12	1,863	16	1,859	" "	" "	46	D, S	Good supply; 2 other wells.
23	NW.	36	"	"	"	"	30	1,850	− 25	1,825	30	1,820	" clay and Boulders	" " alkaline		S	Insufficient supply.
1	SE.	4	1	9	2	Bored	68	1,890	− 60	1,830	56	1,834	Glacial clay	Hard, clear, alkaline	46	S	Poor supply; non-potable for humans.
2	SE.	6	"	"	"	Dug	14	1,900	− 9	1,891	1	1,899	" sand	Soft, clear	42	D, S	Sufficient supply.

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

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

WELL RECORDS—RURAL MUNICIPALITY OF ESTEVAN, NO. 5, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
3	SW.	7	1	9	2	Drilled	180	1,895	−60	1,835	140	1,755	Ravenscrag sand	Soft, soda, clear	45	D, S	Sufficient supply; laxative for humans.
4	NW.	8	"	"	"	"	133	1,895	− 61	1,834	133	1,862 1,762	" gravel	Hard, iron, alkaline	44	D, S	Sufficient supply.
5	SE.	9	"	"	"	Dug	72	1,900	− 68	1,832	50	1,850	Glacial sand	Hard, clear, alkaline	46	D, S, I	" " .
6	SW.	10	"	"	"	Drilled	225	1,900	−175	1,725	225	1,675	Ravenscrag	Soft, clear	46	S, I	" " .
7	SW.	12	"	"	"	Bored	75	1,900	− 35	1,865	72	1,828	" coal	Hard, brown, alkaline	43	D, S	Abundant " .
8	NW.	12	"	"	"	Drilled	210	1,900	− 50	1,850	210	1,690	" sand	Soft, soda, brown	46	S	Sufficient " .
9	SE.	12	"	"	"	Bored	80	1,900	− 60	1,840	80	1,820	" coal	Hard, clear, alkaline	46	S	Too alkaline for house use; sufficient for stock.
10	SW.	14	"	"	"	Dug	16	1,900	− 13	1,887	13	1,887	Glacial gravel	Soft, clear, alkaline	41	D, S	Insufficient supply.
11	sw.	15	"	"	"	"	67	1,890	− 65	1,825	64	1,826	" sand	Hard, cloudy, alkaline	44	D, S	Moderate supply; very laxative.
12	NE.	16	"	"	"	Drilled	100	1,900	− 50	1,850	100	1,800	Ravenscrag ?	Hard, clear, alkaline	45	D, S	Abundant supply of very alkaline water.
13	SW.	16	"	"	"	Dug	86	1,895	− 81	1,814	80	1,815	Glacial gravel	Hard, clear, alkaline	45	D, S	Sufficient supply.
14	SE.	18	"	"	"	Bored	45	1,900	− 42	1,858	42	1,858	" "	Hard, brown, alkaline		S	Very poor supply.
15	NE.	21	"	"	"	Dug	73	1,900	− 53	1,847	72	1,828	" "	Hard, clear, alkaline	45	D, S	Sufficient " .
16	NW.	22	"	"	"	Drilled	70	1,900	− 65	1,835	67	1,833	" sand	Hard, clear, alkaline	42	D, S	Moderate supply; laxative for humans.
17	SW.	24	"	"	"	Dug	70	1,890	− 67	1,823	66	1,824	Ravenscrag sand?	Hard, clear, alkaline	48	D, S	Sufficient " .
18	SE.	26	"	"	"	"	80	1,890	− 58	1,832	81	1,809	Glacial sand	Hard, clear, alkaline	44	D, S, I	Abundant supply.
19	SE.	28	"	"	"	Bored	110	1,900	− 83	1,817	106	1,794	Ravenscrag coal	Soft, clear	44	D, S, I	" " .
20	NW.	28	"	"	"	Dug	10	1,900	− 4	1,896	9	1,891	Glacial gravel	Hard, " , alkaline		D, S	Sufficient " .
21	SW.	29	"	"	"	Bored	74	1,900	− 72	1,828	73	1,827	" sand	Hard, clear, alkaline		D, S	Abundant " .
22	SW.	30	"	"	"	Drilled	80	1,900	− 40	1,860	79	1,821	" "	Hard, clear, alkaline	47	D, S	" " .
23	NW.	32	"	"	"	Bored	85	1,890	− 60	1,830	83	1,807	" "	Hard, clear, alkaline	44	S	Sufficient " .
24	NW.	34	"	"	"	Drilled	114	1,880	− 54	1,826	111	1,769	" "	Hard, clear, alkaline	42	D, S	" " .
25	SE.	35	"	"	"	Bored	65	1,880	− 49	1,831			" clay	Hard, clear, alkaline	44	D, S, I	" " .
26	NE.	35	"	"	"	"	72	1,880	− 22	1,858	41	1,839	Ravenscrag clay	Hard, clear, alkaline	43	D, S, I	Abundant supply.
27	NW.	36	"	"	"	"	55	1,875	− 25	1,850	43	1,832	" "	Hard, reddish alkaline	43	S	Sufficient " .
1	NW.	1	2	7	2	Dug	25	1,860	− 22	1,838	24	1,836	Glacial sand	Hard, clear	44	D	House supply only.
2	SE.	4	"	"	"	"	10	1,830	− 9	1,821	9	1,821	" clay	" , cloudy, alkaline	48	N	Unfit 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 ESTEVAN, NO. 5, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
3	NE.	4	2	7	2	Drilled	512	1,850	− 50	1,800	448	1,402	Ravenscrag sandstone	Hard, clear, salty	48	D, S, M	Abundant supply.
4	SW.	4	"	"	"	Dug	14	1,800	− 10	1,790	1	1,799	Ravenscrag sandstone	Soft, "	46	D	House supply.
5	SW.	7	"	"	"	"	22	1,775	− 19	1,756	20	1,755	River sands	Hard, "	46	D, I	Sufficient supply.
6	SE.	8	"	"	"	"	10	1,840	− 4	1,836	5	1,835	Glacial sand	" "	48	D, S, I	" " .
7	SW.	10	"	"	"	Drilled	138	1,860	− 68	1,792	135	1,725	Ravenscrag coal	" "		N	Test hole for coal.
8	SE.	10	"	"	"	Dug	40	1,875			40	1,835	" ?	salty Hard, "	42	D, S	Insufficient supply.
9	SW.	11	"	"	"	"	28	1,860			28	1,832	?	" "	46	D, S	" " .
10	SW.	12	"	"	"	Drilled	225	1,870	−115	1,755	225	1,645	Ravenscrag sandstone	Soft, "	47	D, S	Sufficient " .
11	NW.	12	"	"	"	Dug	18	1,875	− 14	1,861	18	1,857	Ravenscrag coal	Hard, alkaline	48	N	Unfit for house use.
12	SE.	12	"	"	"	"	38	1,890	− 22	1,868	30	1,860	" "	Hard, clear, alkaline	45	S	Moderate supply.
13	NE.	12	"	"	"	"	22	1,880	− 12	1,868	22	1,858	" "	Hard, clear	44	S	Sufficient for stock.
14	NE.	13	"	"	"	"	28	1,880	− 8	1,872	25	1,855	"	Soft, "		D, S	Insufficient supply.
15	SE.	14	"	"	"	"	35	1,885	− 10	1,875	33	1,852	" "	Hard, " alkaline	46	D, S	Sufficient " .
16	SW.	14	"	"	"	"	35	1,870	− 18	1,852	4	1,866	Glacial gravel	Hard, clear	46	D	" for house use only.
17	NW.	14	"	"	"	"	15	1,900	− 12	1,888	12	1,888	?	" "	43	D, S, I	" supply.
18	SW.	16	"	"	"	"	21	1,880	− 7	1,873	21	1,859	Ravenscrag coal	" alkaline	39	D, S	" " ; less alkaline in summer.
19	NW.	17	"	"	"	Drilled	435	1,890	− 50	1,840	435	1,465 1,455	"	Soft, soda, salty	48	D, S	Abundant supply.
20	NE.	18	"	"	"	Dug	27	1,885	− 13	1,872	23	1,862	Glacial sand	Hard, clear, alkaline	47	D, S	Sufficient supply.
21	NW.	18	"	"	"	"	48	1,875	− 16	1,859	40	1,835	" "	Hard, clear, alkaline	42	S	" " .
22	SE.	20	"	"	"	"	30	1,885	− 20	1,865	20	1,865	Ravenscrag sand	Hard, clear	50	D, S	Abundant " .
23	SE.	21	"	"	"	"	26	1,900	− 10	1,890	26	1,874	" coal	Soft, brown		D, S	Insufficient " .
24	NE.	23	"	"	"	Drilled	190	1,900	− 60	1,840	190	1,710	"	" , clear	45	D, S	Abundant supply.
25	NW.	24	"	"	"	"	176	1,895	−131	1,764	161	1,734	"	" "	45	D, S, I	Sufficient supply.
26	NE.	24	"	"	"	"	183	1,900	−103	1,797	164	1,736	" sand	" "	43	D, S, I	Abundant " .
27	NE.	25	"	"	"	"	150	1,910	−100	1,810	150	1,760	" "	" "		D, S	Sufficient " .
28	SE.	26	"	"	"	"	185	1,900	− 80	1,820	185	1,715	" "	", reddish	45	D, S	" " .
29	NE.	30	"	"	"	Dug	25	1,900	− 23	1,877	12	1,888	Glacial "	" , clear	47	D, S	Very poor " .

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 ESTEVAN, NO. 5, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
30	SW.	30	2	7	2	Drilled	300	1,900	− 12	1,888	300	1,600	Ravenscrag	Soft, soda	49	D, S	Abundant supply.
31	SE.	32	"	"	"	Dug	27	1,900	− 11	1,889	18	1,882	Glacial sand	Hard, clear	48	D, S, I	Sufficient " .
32		33	"	"	"	Drilled	107	1,900	− 37	1,863	90	1,810	Ravenscrag sand	" "	44	D, S	Abundant " .
33	SE.	34	"	"	"	Bored	78	1,900	− 22	1,878	32	1,868	" "	"0 "		S	Sufficient " .
34	NW.	35	"	"	"	Dug	20	1,900	− 15	1,885	20	1,880	Glacial "	" "	42	D, S	" " .
35	NW.	36	"	"	"	"	45	1,900						" "	48	D, S	" " .
1	NE.	1	2	8	2	Dug	26	1,780	− 16	1,764	22	1,758	River sands	" "	42	D, S, I	" for 24 head stock and 19 people.
2	NW.	1	"	"	"	"	15	1,780	− 12	1,768	12	1,768	" "	Soft, "	44	D, S	" " 5 " " " house use.
3	NE.	2	"	"	"	"	16	1,800	− 2	1,798			Glacial yellow clay	Hard, " , alkaline	48	D, S	Only waters 8 head stock.
4	SW.	2	"	"	"	"	28	1,845	− 23	1,822	23	1,822	Ravenscrag coal	Soft, cloudy	48	D, S	Sufficient for house use and 9 head stock.
5	NW.	2	"	"	"	"	23	1,840	− 9	1,831	6	1,834	Glacial sandy clay	Hard, clear, alkaline	44	D, S	" " 9 head stock.
6	SE.	3	"	"	"	"	50	1,845	− 15	1,830			" clay	Hard, red, alkaline		N	Too alkaline for use.
7	NE.	4	"	"	"	"	3	1,850	0	1,850	0	1,850	" sand	Soft, clear	58	D, I	Abundant supply.
8	SW.	4	"	"	"	"	14	1,880	− 3	1,877	10	1,870	" "	Hard, "	48	D, S	House use and 10 head stock.
9	SE.	6	"	"	"	"	30	1,870	− 23	1,847	29	1,841	Ravenscrag coal	Soft, "	45	D, S, I	Waters 30 head stock.
10	NE.	10	"	"	"	"	23	1,790	− 18	1,772	18	1,772	River sand	Hard, "	41	D, S	" 5 " " .
11	SE.	11	"	"	"	"	8	1,790	− 3	1,787	4	1,786	" "	" "	44	D, S, I	" 2 " " .
12	NW.	12	"	"	"	"	22	1,780	− 19	1,761	20	1,760	" "	alkaline Hard, clear	41	D, S	Abundant supply.
13	SW.	12	"	"	"	"	23	1,780	− 20	1,760	22	1,758	" "	" "	50	D, S	House supply; waters 5 head stock.
14	NE.	12	"	"	"	"	22	1,795	− 15	1,780	21	1,774	" "	" "	43	D, S, I	" " ; " 4 " " .
15	SE.	12	"	"	"	"	22	1,780	− 14	1,766	20	1,760	" "	" "	43	D, I	Sufficient supply.
16	SE.	13	"	"	"	Drilled	297	1,800	+ 1	1,801	290	1,510	Ravenscrag	Soft, soda, clear	50	D	Drinking supply for Dominion Electric Company.
17	NE.	15	"	"	"	Dug	20	1,790	− 16	1,774	18	1,772	River silt	Hard, iron		N	Dry since 1933.
18	SE.	16	"	"	"	"	12	1,790	− 9	1,781	10	1,780	" sand	Soft, clear	45	D, S	Waters 20 head stock.
19	SW.	16	"	"	"	"	32	1,820			32	1,788 1,798	Ravenscrag	" , soda		S	" 18 " " only.
20	NE.	18	"	"	"	"	20	1,785	− 12	1,773	17	1,768	River sand	" , clear	47	D, S	" 10 " " .
21	NW.	19	"	"	"	"	11	1,815	− 7	1,808	7	1,808	" gravel	" , "	44	D, S	" 30 " " .

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

WELL RECORDS—RURAL MUNICIPALITY OF ESTEVAN, NO. 5, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
22	NE.	20	2	8	2	Drilled	220	1,810	− 2	1,808	220	1,590	Ravenscrag sandy beds	Soft, clear	46	D, S	Waters 75 head stock.
23	NW.	22	"	"	"	Dug	25	1,825	− 15	1,810	6	1,819	Glacial gravel	Hard, "	52	D	Sufficient supply.
24	NE.	22	"	"	"	"	20	1,885	− 13	1,872	19	1,866	Ravenscrag coal	Soft, "	42	D, S, I	Abundant household supply.
25		22	"	"	"	Drilled	2000	1,869					Marine shale	Salty			Abandoned.
26	SE.	22	"	"	"	Dug	30	1,870	− 15	1,855	29	1,841	Ravenscrag gravel	Soft, "	46	D	Use for aerated water.
27	NW.	23	"	"	"	"	16	1,870	− 2	1,868	2	1,868	Glacial sand	Hard, "	47	D, I	Abundant supply; #.
28	SW.	24	"	"	"	"	18	1,875	− 16	1,859	16	1,859	" gravel	" "	46	D, S, I	Waters 30 head stock.
29	SW.	25	"	"	"	Drilled	300	1,885	− 50	1,835	300	1,585	Ravenscrag	Soft, soda, alkaline		D, S	Abundant supply.
30	NE.	26	"	"	"	Dug	24	1,900	− 17	1,883	23	1,877	" coal	Hard, clear	41	S, I	Sufficient " .
31	NE.	28	"	"	"	"	20	1,900	− 11	1,889	16	1,884	Glacial sand	" "	43	D, S, I	" " .
32	NE.	29	"	"	"	"	15	1,880	− 10	1,870	10	1,870	" "	" "	43	D, S	Abundant " .
33	NW.	30	"	"	"	"	10	1,840	− 6	1,834	10	1,830	River gravel	" " alkaline	45	D, S, I	Sufficient supply.
34	NE.	32	"	"	"	Drilled	120	1,900	−35	1,865	100	1,800	Ravenscrag sand	Soft, soda, salty	44	D, S	Abundant " .
35	SE.	34	"	"	"	Bored	40	1,890	− 32	1,858	39	1,851	" coal	Hard, clear, alkaline	46	S	Poor supply; laxative for humans.
36	NE.	34	"	"	"	Dug	9	1,885	− 6	1,879	9	1,876	Glacial sand	Hard, clear	45	D, S	Abundant supply.
37	SW.	35	"	"	"	"	60	1,890	− 45	1,845	39	1,851	Ravenscrag coal	" , soda, clear	42	D, S	Sufficient " .
38	SE.	35	"	"	"	"	40	1,890	− 34	1,856	37	1,853	" "	Hard, clear, alkaline	44	D, S	Insufficient supply.
39	NE.	35	"	"	"	Bored	50	1,900	− 40	1,860	50	1,850	" "	Soft, clear, alkaline	46	D, S	Waters 10 head stock.
40	NE.	36	"	"	"	Dug	15	1,895	− 3	1,892	15	1,880	Glacial gravel	Hard, clear	45	D, S	Goes dry in autumn.
1	NE.	2	2	9	2	Dug	14	1,865	− 2	1,863	8	1,857	" sand	" , "	44	D, S, I	Moderate supply.
2	SW.	2	"	"	"	Bored	82	1,870	− 32	1,838	76	1,794	Ravenscrag sand	" , " , alkaline	43	S	Unfit for house use; sufficient for stock.
3	NW.	3	"	"	"	Drilled	105	1,870	− 20	1,850	105	1,765	"	Hard, clear	43	D, S	Sufficient supply.
4	SW.	4	"	"	"	"	146	1,860	− 50	1,810	120	1,640 1,740	"	" , " , soda	43	D, S, I	Abundant " .
5	NW.	4	"	"	"	Dug	30	1,880	− 21	1,859	29	1,851	Glacial sand	Soft, "		D, S	Insufficient in autumn and winter.
6	SW.	7	"	"	"	Drilled	172	1,885	−110	1,775	163	1,722	Ravenscrag sand, coal	" , soda	44	D, S	Sufficient supply.
7	SW.	9	"	"	"	"	126	1,860	− 66	1,794	123	1,737	Ravenscrag "	Hard, " , clear	43	D, S, I	" " .
8	SW.	10	"	"	"	Dug	20	1,860	− 5	1,855	19	1,841	" coal	Soft, clear	42	D, S, I	" " .

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 ESTEVAN, NO. 5, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
9	SW.	14	2	9	2	Dug	16	1,860	− 12	1,848	16	1,844	Ravenscrag coal	Soft, soda, brown	42	D, S	Similar well gives unlimited supply.
10	SE.	17	"	"	"	"	20	1,865	− 11	1,854	9	1,856	Glacial yellow clay	Hard, brown, alkaline	44	S	Insufficient supply.
11	NW.	24	"	"	"	"	6	1,790	− 2	1,788	2	1,788	River gravel	Soft, clear	44	D	House supply.
12	NE.	36	"	"	"	"	25	1,855	− 19	1,836	21	1,834	Glacial sand	Hard, " , alkaline	46	D, S	Sufficient supply; high mineral content.
1	SE.	2	3	7	2	Dug	38	1,905	− 33	1,872	36	1,869	" clay	Hard, clear	45	D, S, I	Waters 11 head stock.
2	SW.	4	"	"	"	"	25	1,900	− 17	1,883	24	1,876	" gravel	" "	42	D, S, I	" 28 " " .
3	SE.	6	"	"	"	Bored	60	1,900	− 10	1,890	60	1,840	" sand	" " alkaline	44	S	Goes dry in autumn.
4	SW.	6	"	"	"	"	25	1,895	− 15	1,880	24	1,871	" "	Hard, clear	41	D, S	Insufficient supply.
5	SW.	9	"	"	"	Dug	34	1,910	− 18	1,892	33	1,877	Ravenscrag sand	" "	43	D, S, I	Waters 12 head stock.
6	NW.	10	"	"	"	"	45	1,910	− 37	1,873	39	1,871	Glacial sand	" "	44	D, S, I	Abundant supply.
7	SW.	12	"	"	"	Bored	72	1,905	− 37	1,868	63	1,842	Ravenscrag sand	" "	43	D, S, I	Cloudy when windy; waters 80 head stock.
8	SE.	12	"	"	"	Drilled	123	1,905	− 30	1,875	113	1,792	Glacial sand at base blue clay	" ", red sediment	40	D, S	Waters 50 head stock.
9	NE.	13	"	"	"	"	147	~~1,915~~ 1915	− 35	1,880	115	1,800	Glacial sand at base blue clay	Hard, clear, alkaline	42	D, S	" 60 " " .
10	SW.	14	"	"	"	Dug	28	~~1,195~~	− 26	1,889	22	1,893	Glacial sand	Hard, clear, alkaline	44	D, S, I	" 33 " " .
11	SE.	16	"	"	"	"	35	1,915	− 25	1,890	33	1,882	Ravenscrag sand	Hard, clear	44	D, S, I	" 17 " " .
12	SW.	16	"	"	"	"	30	1,915	− 14	1,901	26	1,889	" "	" "	45	D, S	" 12 " " .
13	NW.	16	"	"	"	"	24	1,915	− 20	1,895	11	1,904	Glacial sandy clay	" "	44	D, S	" 10 " " only.
14	NE.	17	"	"	"	"	27	1,910	− 10	1,900	10	1,900	Glacial sand	" "		D, S, I	Abundant supply.
15	SW.	17	"	"	"	"	37	1,910	− 21	1,889	36	1,874	" "	" "	44	D, S	Waters 18 head stock; #.
16	SW.	18	"	"	"	"	17	1,905	− 5	1,900	13	1,892	" "	" " alkaline	46	D, S, I	Abundant supply.
17	SW.	21	"	"	"	"	28	1,910	− 24	1,886	27	1,883	" "	Hard, clear	46	D, S	" " .
18	NE.	22	"	"	"	"	28	1,910	− 17	1,893	17	1,893	" "	" "	43	D, S	Waters 20 head stock.
19	E½	23	"	"	"	Drilled	144	1,900	− 13	1,887	144	1,756	?	Soft, soda			No information.
20	NW.	23	"	"	"	Bored	40	1,910	− 33	1,877	36	1,874	Glacial sand	Hard, cloudy, alkaline	46	D	House supply only.
21	SE.	25	"	"	"	Drilled	227	1,910	−100	1,810	207	1,703	Ravenscrag sand	Soft, clear		D, S, I	Abundant supply.
22	SE.	26	"	"	"	Dug	8	1,900	− 4	1,896	2	1,898	Glacial "	Hard, "	58	D, S	Insufficient for 11 head stock.
23	NW.	26	"	"	"	"	14	1,905	− 11	1,894	11	1,894	" "	" "	47	D, S	" " 30 " " .

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 ESTEVAN, NO. 5. SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
24	NW.	27	3	7	2	Dug	12	1,910	− 5	1,905	7	1,903	Glacial gravel	Hard, clear	48	D	House supply only.
25	NE.	28	"	"	"	"	27	1,915	− 21	1,894	4	1,911	" sand	alkaline Soft, clear	48	D, S, I	Insufficient for 20 head stock.
26	NW.	28	"	"	"	Drilled	415	1,915	−100	1,815	342	1,573	Ravenscrag sand	" "		D	Abundant supply.
27	SE.	30	"	"	"	Dug	12	1,905	− 11	1,894	11	1,894	Glacial "	soda Hard, "	42	D	House supply only.
28	NE.	30	"	"	"	"	15	1,910	− 4	1,906	11	1,899	" "	" "	42	D	" " " .
29	SE.	32	"	"	"	"	14	1,915	− 10	1,905	4	1,911	" yellow clay	alkaline Hard, clear	48	D	" " " .
30	NE.	32	"	"	"	"	32	1,925	− 29	1,896	2	1,923	" sand	" "		D, S	Usually a poor supply.
31	NW.	34	"	"	"	"	18	1,910	− 10	1,900	10	1,900	" sandy clay	alkaline Hard, clear	46	D, S	Insufficient for 21 head stock.
32	NW.	35	"	"	"	"	18	1,910	− 4	1,906	12	1,898	" sand	Soft, "	45	D, S	" " 40 " " .
33	SE.	35	"	"	"	"	8	1,920	− 1	1,919	1	1,919	" "	" "	41	D, S, I	Waters 30 head stock.
1	NW.	2	3	8	2	Dug	15	1,900	− 12	1,888	12	1,888	" clay	Hard, "	43	D	House supply only.
2	NE.	2	"	"	"	"	52	1,890	− 20	1,870	49	1,841	Ravenscrag sand-stone	" "	42	D, S, I	Waters 60 head stock.
3	SW.	4	"	"	"	Bored	80	1,901	− 30	1,871	77	1,824	Ravenscrag	iron Hard, "	41	D, S	Fair supply.
4	SE.	4	"	"	"	Dug	45	1,900	− 25	1,875	45	1,830	?	alkaline Hard, soda, clear	44	S	Waters 35 head stock.
5	NW.	6	"	"	"	"	55	1,890	− 35	1,855	55	1,835	Ravenscrag coal	Soft, brown,	44	D, S, I	Abundant supply.
6	SE.	6	"	"	"	Drilled	129	1,890	− 30	1,860	128	1,762	" "	alkaline Soft, brown	44	D, S	" " .
7	NE.	9	"	"	"	Bored	82	1,903	− 42	1,861	82	1,821	Glacial sand	Hard, clear		D, S	Used to water 40 horses, but caven in now.
8	NW.	10	"	"	"	Dug	20	1,900	− 18	1,882	20	1,880	" "	" "	42	D, S	Sufficient for only 14 head stock.
9	SE.	10	"	"	"	Bored	35	1,900	− 12	1,888	32	1,868	Ravenscrag sand	" yellow,	42	S, I	Waters 30 head stock.
10	SW.	11	"	"	"	Dug	24	1,897	− 19	1,878	20	1,877	" sandstone	alkaline Hard, clear,	43	D, S	" 20 " " .
11	SW.	12	"	"	"	Bored	75	1,910	− 65	1,845	70	1,840	" "	soda Soft, " ,	42	S	Insufficient for 30 head stock.
12	NW.	12	"	"	"	Dug	17	1,895	− 11	1,884	11	1,884	Glacial sand	soda Soft, "	45	D, S	" in winter.
13	NE.	13	"	"	"	"	28	1,900	− 18	1,882	20	1,880	" gravel	Hard, " ,	42	D, S	Waters 25 head stock.
14	SE.	14	"	"	"	"	54	1,900	− 16	1,884	51	1,849	Ravenscrag sand	alkaline Hard, yellow,	44	D, S	4 bbls. a day; kills vegetation.
15	SW.	15	"	"	"	"	23	1,898	− 8	1,890	19	1,879	Glacial "	alkaline Hard, clear	41	D, S, I	Waters 25 head stock.
16	SE.	15	"	"	"	"	61	1,905	− 18	1,887	55	1,850	Ravenscrag " - stone	" "	44	D, S, I	" 50 " " .
17	NE.	15	"	"	"	"	20	1,890	− 12	1,878 ~~1,888~~	18	1,872	Glacial gravel	alkaline " , hard, clear	41	D, S	" 30 " " .

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 ESTEVAN, NO. 5. SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
18	SE.	16	3	8	2	Dug	23	1,896	− 33	1,863	48	1,848	Ravenscrag sand	Soft, clear		D, S	Waters 21 head stock.
19	NW.	16	"	"	"	"	45	1,896	− 30	1,866	43	1,853	Glacial sand	Hard, " , alkaline	42	D, S	Unlimited supply.
20	SW.	16	"	"	"	"	42	1,900	− 28	1,872	41	1,859	" "	Soft, clear	44	D, S	Sufficient for 5 head stock only.
21	NE.	17	"	"	"	"	54	1,900	− 53	1,847	53	1,847	" gravel	Hard, " , alkaline	45	S	Kills plants; sufficient for 4 head stock only.
22	NW.	18	"	"	"	"	40	1,890	− 30	1,860	37	1,853	" sand	Hard, clear, alkaline	44	S	Insufficient for 20 head stock.
23	SW.	18	"	"	"	Drilled	60	1,900	− 59	1,841	59	1,841	" "	Hard, clear	43	D, S, I	" supply.
24	SE.	19	"	"	"	Dug	32	1,903					" "			N	Dry hole.
25	NE.	19	"	"	"	"	20	1,895	− 9	1,886	10	1,885	" gravel	Hard, clear, alkaline	43	D, S, I	Waters 18 head stock.
26	NW.	20	"	"	"	"	20	1,895	− 16	1,879	19	1,876	" sand	Hard, dark, alkaline		D, S	Insufficient supply.
27	NE.	20	"	"	"	"	33	1,892	− 12	1,880	31	1,861	" "	Hard, clear	44	D, S, I	Waters 25 head stock.
28	SW.	20	"	"	"	"	48	1,900	− 44	1,856	44	1,856	" "	" " alkaline	44	D.	" 20 " " .
29	SW.	21	"	"	"	"	30	1,890	− 26	1,864	26	1,864	" clay	Hard, clear, alkaline		S	Very small supply.
30	SW.	23	"	"	"	Drilled	360	1,905	− 3	1,902	360	1,545	Ravenscrag sand	Soft, soda, salty	43	D, S	Abundant supply.
31	NE.	28	"	"	"	Dug	32	1,900	− 17	1,883	17	1,883	Glacial clay	Hard, clear	44	D, S	Waters 5 head stock.
32	SE.	29	"	"	"	"	56	1,896	− 25	1,871	52	1,844	" sand	" " alkaline	48	D, S	" 40 " " .
33	SW.	30	"	"	"	"	14	1,900	− 11	1,889	12	1,888	" "	Hard, clear	40	D, S	" 15 " " .
34	NW.	31	"	"	"	Drilled	360	1,910	− 60	1,850	360	1,550	Ravenscrag	Soft, " soda	45	D, S, I	" 40 " "; poor for irrigation.
35	SW.	32	"	"	"	Dug	25	1,910	− 23	1,887	24	1,886	Glacial sand	Hard, " alkaline		S	" 25 " ".
36	SE.	34	"	"	"	Drilled	550	1,905	−120	~~1,875~~ 1,785	550	1,355	Ravenscrag sand	Hard, clear, salty	49	S	" 50 " ".
37	NW.	34	"	"	"	Dug	20	1,904	− 6	1,898	12	1,892	Glacial gravel	Hard, clear	44	D	Used for domestic use; similar well for stock.
38	NE.	34	"	"	"	Drilled	350	1,903	− 80	1,823	350	1,553	Ravenscrag	Soft, " , soda	43	D, S, I	Waters 50 head stock.
39	SW.	35	"	"	"	"	175	1,915	−150	1,765	173	1,742	" sandstone	Hard, red, alkaline	48	D, S, I	" 20 " " .
40	SW.	36	"	"	"	Dug	40	1,904	− 28	1,876	38	1,866	Glacial sand	Hard, clear	42	S	" 35 " " .
1	NW.	1	"	9	"	"	18	1,895	− 12	1,883	17	1,878	" "	" " alkaline	42	D, S	Insufficient for 40 head stock.
2	NE.	2	"	"	"	"	23	1,860	− 11	1,849	11	1,849	" gravel	Hard, clear		D, S	Waters 10 head stock.
3	NW.	2	"	"	"	"	30	1,860	− 20	1,840	28	1,832	" sand	" " alkaline	44	D, S	" 15 " " .
4	NE.	3	"	"	"	"	8	1,835	− 3	1,832	6	1,829	" "	Hard, clear	52	D, S	" 6 " " .
5	NW.	7	"	"	"	"	13	1,790	− 8	1,782	4	1,786	River "	" "		D, S	" 30 " " .

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

WELL RECORDS—RURAL MUNICIPALITY OF ESTEVAN, NO. 5. SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
6	SE.	9	3	9	2	Dug	12	1,850	− 2	1,848	2	1,848	Glacial gravel	Soft, clear		D, S	Waters 10 head stock.
7	NW.	10	"	"	"	"	21	1,890	− 7	1,883	17	1,873	" "	Hard, "	43	D, S	Dry in 1935.
8	SW.	11	"	"	"	"	48	1,870	− 26	1,844	29	1,841	" sand	" " alkaline		D, S	Sufficient supply.
9	NE.	12	"	"	"	Drilled	330	1,895	− 60	1,835	280	1,615	Ravenscrag sand	Soft, soda, clear		D, S, I	Abundant " .
10	SE.	14	"	"	"	"	333	1,885	− 70	1,815	233	1,652	" "	Soft, soda, clear	46	D, S	Waters 50 head stock; kills plants.
11	SW.	14	"	"	"	"	225	1,890	− 80	1,810	225	1,665	" "	Soft, soda, clear	46	D, S, I	" 50 " " .
12	SW.	16	"	"	"	Dug	23	1,870	− 13	1,857	19	1,851	Glacial "	Hard, clear, alkaline	47	S	" 5 " " only.
13	SE.	18	"	"	"	"	12	1,845	0	1,845	8	1,837	" gravel	Hard, soda, clear	42	D, S	" 8 " " and house. Dry in July.
14	SE.	20	"	"	"	"	24	1,880	− 2	1,878	22	1,858	" sand	Hard, cloudy	42	D, S, I	Insufficient for 4 head stock.
15	NE.	21	"	"	"	Drilled	180	1,910	− 60	1,850	171	1,739	" " at base blue clay	" clear, alkaline	44	D, S	Cannot be pumped dry.
16	NW.	22	"	"	"	Dug	60	1,910	− 40	1,870	58	1,852	Glacial gravel	Hard, clear, alkaline	40	S	Insufficient for 25 head stock.
17	SE.	22	"	"	"	"	38	1,910	− 13	1,897	36	1,874	" sand	Hard, clear	45	D, S	Waters 13 head stock.
18	SW.	23	"	"	"	Drilled	385	1,910	−185	1,725	369	1,541	Ravenscrag sand	Soft, " , soda	45	D, S, M	Town of Hitchcock.
19	NE.	25	"	"	"	Dug	42	1,905	− 34	1,871	42	1,863	Glacial gravel	Hard, " , alkaline	44	S	Waters 50 head stock.
20	NE.	26	"	"	"	"	20	1,910	− 17	1,893	19	1,891	" sand	Hard, clear	41	D, S, I	" 6 " " only.
21	SW.	26	"	"	"	"	22	1,900	−10	1,890	22	1,878	" "	Soft, "	46	D, S	" 10 " " .
22	SE.	28	"	"	"	"	50	1,905	− 30	1,875	30	1,875	" "	Hard, " , alkaline	45	S	" 10 " " .
23	NW.	28	"	"	"	Drilled	307	1,910	−217	1,693	305	1,605	Ravenscrag sandstone	Hard, clear, soda	44	D, S	" 60 " " .
24	SE.	30	"	"	"	Dug	38	1,885	− 34	1,851	36	1,849	Glacial sand	Hard, clear, alkaline	44	S	Poor supply.
25	SW.	30	"	"	"	"	26	1,880	− 4	1,876	25	1,855	" gravel	Hard, clear	42	D, S	Insufficient for 10 head stock.
26	NW.	32	"	"	"	"	30	1,890	− 12	1,878	27	1,863	" sand	" "	44	D, S	" supply.
27	NE.	32	"	"	"	Drilled	215	1,905			205	1,700	Ravenscrag sand	Soft, "	43	D, S, I	Waters 50 head stock.
28	SE.	33	"	"	"	Dug	42	1,905	− 39	1,866	39	1,866	Glacial gravel	Hard, "	42	S	" 30 " " .
29	SE.	36	"	"	"	"	24	1,895			24	1,871	" sand	" "	41	D, S	" 20 " " .

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(#) Sample taken for analysis.