CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 27

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF POPLAR VALLEY NO. 12 SASKATCHEWAN

By

B. R. MacKay and H. H. Beach

OTTAWA

1936

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BUREAU OF ECONOMIC GEOLOGY

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INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Bearpaw Formation. The Bearpaw consists mostly of incoherent dark grey to dark brownish grey, partly bentonitic shales, weathering light grey, or, in places where much iron is present, buff. Beds of sand occur in places in the lower part of the formation. It forms the uppermost bedrock formation over much of western and southwestern Saskatchewan and has a maximum thickness of 700 feet or somewhat more.

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Poplar Valley is an area of about 310 square miles lying along the International Boundary immediately to the east of the third meridian, in the south-central part of the province. The municipality consists of six full and three fractional townships, described as tps. 1, 2, and 3, ranges 28, 29, and 30 W. 2nd mer. The Rockglen-Big Beaver branch of the Canadian Pacific railway crosses the northern part of the municipality. The villages of Rockglen and Fife Lake, located on this line, are practically the only centres of population within the area.

The northwest-southeast diagonal divides the municipality into two areas in which not only the topography but the character of the surface deposits and the ground water conditions show marked differences. From an approximate elevation of 2,500 feet above sea-level in the bottoms of the creeks in the extreme southeast corner the ground surface rises irregularly to elevations ranging between 2,700 and 2,800 feet throughout the greater part of the area, and reaching heights exceeding 3,000 feet in isolated points west of the town of Rockglen. A southeasterly trending drainage system consisting of Poplar river and numerous intermittent tributaries extends in dendritic pattern over the southwestern half of the municipality. These streams have eroded deep valleys and tend to give a "badlands" appearance to this part of the Wood Mountain uplands. The topography of the northeastern half of the municipality is much more gently rolling. Streams are less numerous and the sides of the valleys have more gentle slopes. A broad, flat plain extends over the greater part of township 3, ranges 29 and 30, which is covered in part by Fife lake. The topography shown on Figure 2 must be considered as only approximate, many minor discrepancies having been found to exist between elevations of points as indicated by the contours on the map and those as determined by barometric observations made in the course of this investigation. Accordingly, in several instances it will be found that the elevations given for well sites do not agree with the contour elevations.

Water-bearing Horizons in the Unconsolidated Deposits

The water-bearing horizons of this municipality occur in Recent stream deposits, Glacial drift, and Ravenscrag bedrock formation.

Many thousands of years ago a great continental ice-sheet passed in a southwesterly direction over the province of Saskatchewan and deposited a layer of till or boulder clay. The drift is 100 feet or less thick. The southwestern half of this municipality forms part of a "driftless" area lying well within the extensive glaciated territory. It is entirely barren of glacial deposits or other evidences of glacial action such as are apparent throughout the northeastern half of the municipality. This "driftless" area has been described by Wickenden[1]. Throughout this area the Ravenscrag

[1] Trans. Roy. Soc., Canada, 3rd ser., vol. 25, sec. 4, pp. 45-47 (1931).

formation is either exposed at the surface or is covered by a thin veneer of soil or Recent sands and gravels. A few scattered boulders lying on the bedrock surface constitute the only evidence of glaciation along the northwest-southeast diagonal of the area. In a northeasterly direction from the diagonal, however, an increasing thickness of boulder clay is encountered. It is known to have a thickness of 40 to 50 feet in the extreme northeast corner of the municipality.

With the gradual melting and retreat of the ice-sheet a more irregularly surfaced and generally more porous layer of drift was deposited. Such areas of rolls, hillocks, and undrained depressions, generally termed "moraine", were formed in places where the ice front paused in its retreat for any considerable period of time. A moraine forms a belt 1 to 2 miles in width which extends from the northwest corner in a southeasterly direction northeast of the diagonal of the municipality. With the continued melting of the ice, lakes were formed in the lowlands. Fife lake is a remnant of a previously existing lake which covered most of township 3, range 29, and extended east and west into the adjoining townships. A layer of some 30 to 45 feet of compact, bluish grey, lake clay interspersed with sand beds covers the boulder clay throughout this lake basin. At other places swiftly moving streams carried considerable amounts of sands and gravels away from the ice front and spread them out in thin layers as outwash gravels. An area of outwash deposits occurs northeast of the village of Fife Lake. Along the smaller creeks the deposits of alluvium are generally too thin to form a source of ground water supply. Several wells located on the flats beside the larger streams have encountered gravels at shallow depths, from which are obtained sufficient quantities of water of good quality for household needs and for a few head of stock, from which are obtained sufficient quantities of water of good quality for household needs and for a few head of stock. In areas where only silts are found the supply is generally less and in some instances contains large amounts of mineral salts in solution.

Due to their porous nature outwash sands and gravels form very good reservoirs of water at shallow depths. Dug wells not exceeding 30 feet in depth in the area mentioned above yield sufficient quantities of water for 10 to 20 head of stock. The water is soft or moderately hard and quite suitable for household use. The proximity of these beds to the surface has caused the supply to decrease markedly during periods of scanty rainfall.

The beds of sands, and more occasionally gravels, interspersed through the lake clay area form the sources of supply at depths not exceeding 40 feet. Individual wells yield sufficient water for household use and for 20 to 30 head of stock. The water is generally suitable for drinking although iron and dissolved mineral salts form objectionable impurities in some areas.

The boulder clay or till does not in general yield a large supply of ground water. Shallow wells sunk near knolls and gravel ridges form sources of household supply on many farms, but where larger quantities of water for stock are required it is usuallly necessary to sink wells into the underlying bedrock. The small seepages derived from the compact boulder clay itself are often highly charged with mineral salts in solution which in some places render the water unfit for drinking. The sand and gravel pockets scattered through the upper part of the drift, however, yield small supplies of water of much better quality.

The belt of moraine is considerably more porous in character than the till; due to the presence in it of more extensive sand and gravel beds, and, consequently, yields much larger supplies. Wells sunk to depths of 15 to 25 feet at many places along the morainic belt yield sufficient supplies of hard, slightly mineralized water for household use and for a few head of stock. Here again, drilling or boring into the bedrock seems advisable where larger supplies for stock watering are required.

Water-bearing Horizons in the Bedrock

The uppermost bedrock formation known to exist in the municipality consists of light brownish coloured quartzite gravel interbedded with layers of sand occurring in a few scattered areas over the upland parts of the Wood Mountain plateau. These gravels, termed the Wood Mountain beds, generally occur above an approximate elevation of 2,900 feet above sea-level. They have been observed on the uplands to the north and to the south of the village of Rockglen, and in sec. 29, tp. 2, range 29. The thickness of these beds is variable, being only a few feet in some places and 40 or 50 in others.

No information has been obtained of wells having been sunk into these beds in this municipality. The porosity of the gravels and the character of cementing material suggest, however, that these beds will probably yield fair supplies of hard, slightly mineralized water at shallow depths.

The Ravenscrag formation immediately underlies the Wood Mountain beds and forms the uppermost bedrock formation throughout the remainder of the municipality. As has been described above it either outcrops at the surface or is covered only by a very thin veneer of soil throughout the southwestern half of the municipality, and occurs at increasing depths in a north-easterly direction. The Ravenscrag formation consists of beds of buff-grey sands, shales, and clays and thin seams of lignite coal. The total thickness of the formation in this municipality has not been determined, but is probably not less than 300 or 400 feet over much of the area. The coarse grey sand beds and the coal seams form aquifers in this formation. Individual beds may not extend over any large area, but they are sufficiently numerous in the formation to constitute fairly extensive water-bearing horizons throughout the entire municipality. Three such general horizons have been traced in the Ravenscrag in this municipality. This uppermost horizon is west of the "A" line on Figure 1. It occurs at elevations between 2,875 and 2,790 feet above sea-level throughout the highland area of the west-central part of the municipality. The second or "B" horizon is known to be present below the area of the "A" horizon and also to extend throughout the lower land of the central part of the municipality. It occurs at an elevation ranging from 2,740 to 2,680 feet above sea-level. It is present west of the "B" line in the central and western part of the municipality and also east of the "B" line in the northeastern corner. A third horizon, designated as the "C" horizon, occurs beneath the lowland areas of the municipality between the two "B" lines and at an elevation ranging from 2,630 to 2,580 feet above sea-level. As deep drilling has not been necessary in this municipality the areal extent of the "C" horizon beneath the "A" and "B" horizons has not been proved. In only a few localities has it been found necessary to sink wells below the uppermost horizon existing in any one part of the municipality. Water is generally obtained at depths of 45 to 75 feet from the surface and at no place have wells been sunk to depths exceeding 150 feet from the surface. The yield to be expected from individual wells sunk into the bedrock varies in different localities, but is usually sufficient for at least 20 head of stock and several wells supply 100 head. Much of the water from the Ravenscrag in the "driftless" area is soft or moderately hard and although often containing small amounts of "soda" is not highly mineralized. In the drift covered areas, however, a hard "alkaline" water is more common. The mineral salts producing this quality are probably reached from the overlying boulder clay during the downward percolation of surface waters. Several residents in the northern townships use two wells to advantage; one a shallow well sunk into a sand or gravel pocket in the drift for household supply and a deeper well into the bedrock for watering stock.

Many springs occur along the outcrops of sandy beds and coal seams in the bottoms and along the sides of the valleys and deeper coulées of the "driftless" area. These springs form a small but constant supply of good water on many of the small farms in the district.

WATER CONDITIONS BY TOWNSHIPS

Township 1, Range 28

The Glacial drift in this township, which forms part of an extensive moraine, is confined to the northeastern corner. Although no wells are drawing their supply from the drift it is probable that small supplies of hard water, suitable for household use, will be found at shallow depths in wells located at bases of slopes or on gravel knolls and ridges. A shallow well sunk into the sand and gravel deposits in the bottom of a coulée in NE. $\frac{1}{4}$, section 1, yields a soft, clear water in sufficient quantities for 17 head of stock. Most of the ground water supply of the township is, however, derived from productive horizons of the Ravenscrag bedrock formation. Coal seams form the aquifers in most of the wells. These aquifers occur at elevations ranging from 2,700 to 2,660 feet above sea-level in the northwest corner of the area. Throughout the remainder of the township a fairly continuous coal seam occurs at elevations of 2,640 to 2,580 feet. This latter horizon is encountered at depths of 12 to 50 feet in the valleys. It was found necessary, however, on the higher land in section 10 to drill to a depth of 110 feet, and in section 14 to 85 feet, before production was obtained. The yield in all places is reported to be sufficient for at least 10 head of stock, and many wells particularly those located in valleys, yield supplies sufficient for 50 head of stock or more. Springs also form important sources of water in the valleys. One spring issuing from a coal seam in SE. $\frac{1}{4}$, section 19, waters 300 head of sheep and 30 head of cattle. Much of the water from the bedrock is soft or moderately hard. Iron occurs in the water from several of the wells along the western boundary of the township. In no instance, however, does the iron or other mineral salts in solution cause the water to be unfit for drinking.

Township 1, Range 29

The ground water supply of this township is derived entirely from the Ravenscrag bedrock formation. Coal seams form the aquifers in most of the wells, but sandy beds are productive in some places. Throughout the broad valleys occupied by Poplar river and its tributaries in the southeastern and central parts of the township little difficulty has been experienced in obtaining an adequate water supply for all household and stock requirements at depths not exceeding 40 feet. A coal seam aquifer is believed to extend continuously at elevations between 2,610 to 2,580 throughout the central parts of the township. It has been encountered in wells located in sections 4, 9, 12, 13, 15, 16, 18, 21, 22, and 28, and will probably be found to be productive in the intervening areas in sections 8, 10, 11, 14, 19, and 20. In many of the wells the coal seam was penetrated at depths of 10 to 20 feet, but in sections 12, 13, and 15, depths of 40 to 65 feet were necessary before water was obtained. The yields from all wells in this large area are amply sufficient for 20 or more head of stock. The water is soft to moderately hard and, although often containing small amounts of iron, is reported in all instances to be quite suitable for household use and for watering plants. In the north-eastern corner of the township wells sunk to depths of 35 to 65 feet yield sufficient supplies of water for 20 to 30 head of stock. The water is hard and reported to be slightly "alkaline", but not unsuitable for household use.

Information was obtained on only one well in the north-western sections of the township. A well located in SW. $\frac{1}{4}$, section 32, derives its water from the bedrock at a depth of 83 feet. Other wells located in immediately adjoining townships to the north and west have struck small to fairly large supplies at depths not exceeding 35 feet. It is probable that throughout this part of the township the "B" horizon (See Figure 1) will be found to be productive at depths not exceeding that of the well in section 32.

Township 1, Range 30

This township is entirely devoid of glacial deposits. A thin layer of Recent sands, silts, and gravels varying from 5 to 35 feet in thickness covers the floors of Poplar River valley and many of its tributaries. Very shallow wells sunk into these deposits supply drinking water for many farms throughout the lowland areas of the township. The character of the water is variable. In places where the well is largely in clay or silt the water is hard and may contain considerable amounts of iron or other mineral salts in solution. Wells in sand and gravel yield a soft or medium hard water.

Most of the ground water used for both domestic and stock purposes in this township is derived from the Ravenscrag bedrock formation that underlies the top soil or Recent stream deposits throughout the entire township. Coal seams form the water-bearing horizons in most of the wells.

Throughout the lowland area of the east-central part of the township coal seams occurring at the "B" horizon (See Figure 1) form what are believed to be fairly continuous aquifers. Wells sunk to depths not exceeding 35 feet in the lowlands encounter soft to medium hard, drinkable water sufficient for 20 or more head of stock. In SE. ¼, section 23, and NE. ¼, section 24, it was found necessary to sink wells to depths of 80 feet before a coal aquifer was tapped and any large supply was obtained. Throughout the remainder of the township the "A" horizon has been encountered in many wells. Coal seams again form the producing aquifers, and with few exceptions occur at elevations between 2,760 and 2,700 feet above sea-level. This horizon is tapped at very shallow depths in the valleys. On the uplands in sections 4 and 5 it is generally necessary to bore to depths of 70 to 80 feet before water is found. Similarly in the northern highland sections, remote from the valleys, wells sunk to depths of 50 to 75 feet are common. In SE. $\frac{1}{4}$, section 34, it was necessary to bore to a depth of 118 feet before the water-bearing coal seam was tapped. This aquifer is believed to extend continuously over the northeastern quarter of the township at an approximate elevation of 2,790 feet above sea-level. The water from the "A" horizon is generally hard and many residents call it slightly "alkaline". In all places in the township, however, the water derived from the Ravenscrag formation is used for drinking.

Township 2, Range 28

An irregular mantle of glacial till or boulder clay covers the northeastern half of this township. Southwest of the till is a belt 2 miles wide of moraine. The southwest corner has no glacial cover. The glacial drift thickens in a northeasterly direction and is 30 feet thick in the northeast corner.

The boulder clay itself does not generally yield more than small seepages of highly mineralized, often undrinkable water and the more productive sand and gravel pockets interspersed through the clay are of limited areal extent. The few shallow wells that have been sunk to tap water-bearing pockets in the drift yield only small supplies sufficient for household needs. The water is generally inferior in quality to supplies obtainable at shallow depths in the Recent sands, silts, and gravels lying along the bottoms of some of the larger coulées. Two wells located in SW. $\frac{1}{4}$, section 26, and NE. $\frac{1}{4}$, section 36, are producing drinkable water sufficient for 20 head of stock from sand and gravel beds in the drift at depths of 28 and 25 feet. The moraine is composed of boulder clay in which are interspersed irregular pockets of sands and gravels. In the eastern half of the belt these gravels can be expected to yield fair supplies of drinkable water during periods of ample precipitation. Low gravel knolls and ridges having greater relative porosity than the boulder clay covering intervening areas form better sites for shallow wells. In the western half of the belt of moraine the glacial drift is too thin to be a potential source of more than very small seepages of water. Apart from the north-eastern corner the glacial deposits of this township cannot be looked upon as a source of any adequate supply of ground water. Residents are much better advised to sink wells through the drift to aquifers in the underlying bedrock.

The Ravenscrag bedrock formation either outcrops at the surface or is covered by only a thin veneer of soil in the southwest corner of the township and is found immediately beneath the mantle of glacial drift throughout the remainder of the area.

What is believed to be a continuous water-bearing horizon in the Ravenscrag, at elevations ranging from 2,535 to 2,490 feet above sea-level throughout the northeastern half of the township is formed in some places by a coal seam and in others by a bed of sandy shale or sand. The depth to this horizon depends essentially upon the elevation of the surface at the particular well site, but in most places throughout the area the aquifer is tapped at depths of 60 to 85 feet below the surface. The yield is generally large, several individual wells giving sufficient water for 30 to 50 head of stock. The water is hard and although in many places it contains iron it is nowhere regarded as being unsuitable for domestic use.

A coal seam forming another extensive aquifer has been tapped at elevations between 2,630 and 2,580 feet above sea-level in NE. $\frac{1}{4}$, section 9, SE. $\frac{1}{4}$, sections 16 and 20, SW. and NE. $\frac{1}{4}$'s, section 30, and SE. $\frac{1}{4}$, section 31. In creek bottoms this horizon has been encountered at depth as shallow as 12 feet, but most of the wells were sunk to depths of 60 to 75 feet before the horizon was tapped, and one well on the higher land in SW. $\frac{1}{4}$, section 30, was drilled 136 feet before production was obtained. The quality of the water is similar to supplies derived from the lower aquifer extending under the lowlands. The yield from the wells located at the southern part of the area underlain by this aquifer is large but in the northwest corner of the township several of the wells do not yield more than enough water for household needs and 10 head of stock.

A single well located in SE. $\frac{1}{4}$, section 7, taps a water-bearing coal seam at a depth of 56 feet. The aquifer lies at an elevation of 2,684 feet above sea-level and is believed to mark the eastern extent of the "B" horizon, which is known to be productive in the townships adjoining on the west and south. The aquifer will probably be found to be productive at similar depths throughout the southwestern quarter of this township. The well in section 7 yields sufficient quantities of hard, drinkable water for household requirements and for 35 head of stock.

Township 2, Range 29

The many streams flowing through this township have cut deep valleys and have created a rugged topography which does not lend itself to extensive cultivation. Glacial drift in the form of moraine covers the northeastern part of the township, producing a more gently rolling type of country on which are situated several farms. The drift is composed of boulder clay interspersed with beds of sand and gravel. Water is obtained largely from the sandy beds in wells sunk to depths of 15 to 30 feet from the surface. The water is of good quality, and the yield is sufficient in most instances for at least 50 head of stock. One well, situated in NW. $\frac{1}{4}$, section 25 derives a large supply of hard, drinkable water from the Ravenscrag bedrock formation at a depth of 148 feet from the surface. Several wells in the township adjoining on the east sunk to this horizon indicate that this aquifer may be fairly extensive over the northeast corner of this township. Throughout the remaining part of the township water is undoubtedly to be found at shallow depths in the recent deposits of sand and gravels lying along the stream valleys and from the water-bearing horizons of the Ravenscrag bedrock formation. Coal seams are believed to form the most extensive aquifers in the bedrock, but as no wells have been sunk in the southwestern half of the township the areal extent or the depths to this aquifer are unknown. The data obtained in areas adjoining the southwestern half of this township suggest that wells sunk to depths not exceeding 80 feet in this area can be expected to yield sufficient supplies for at least 20 head of stock.

A few small areas of brown gravels of the Wood Mountain formation occur as remnants on the tops of some of the hills. No wells have been sunk into these gravels in this area. The porous character of the beds suggest, however, that they might yield small supplies of water at shallow depths.

Township 2, Range 30

This township lies entirely within the area of "no drift", and hence the water supply of the area is derived wholly from the Recent stream deposits and from the Ravenscrag bedrock formation which either outcrops at the surface or is covered by a thin veneer of soil. Thin beds of reddish brown Wood Mountain gravels overlie the Ravenscrag in some places on the uplands in the northern part of the township. No wells are known to have been sunk into these gravels in this area. The beds are loosely consolidated and would act as reservoirs in periods of ample rainfall. Shallow wells penetrating these beds should yield at least small supplies of drinkable water.

Beds of sand, gravel, and silt extend along the bottoms and over the lower slopes of many of the valleys. The total thickness of these recent deposits varies considerably over small areas, being practically absent in some localities and having a thickness of more than 30 feet in others. Where gravel is present shallow wells sunk to depths of 15 to 30 feet yield soft or medium hard water in sufficient quantities for domestic requirements and for 20 to 50 head of stock. In areas where sands and silts form the stream deposits in the valleys little water can be expected and it seems advisable to sink wells through the recent deposits into the underlying Ravenscrag formation. A fairly continuous water-bearing horizon occurs in a coal seam at elevations between 2,780 and 2,750 in the township to the south. This horizon was struck in a well in SE. $\frac{1}{4}$, section 5, at a depth of 72 feet.

As few wells have been sunk throughout the remainder of the township the water conditions existing in the bedrock can only be inferred from data gathered in the adjacent areas where the geological conditions are similar. Little difficulty should be experienced in obtaining fairly large supplies of drinkable water at depths not exceeding 100 feet in any part of the township.

Springs are common along the valley slopes in many parts of the area. They are situated immediately below outcrops of coal seams and coarse sand beds in nearly all places, and are believed to derive their supply from these beds. The presence of these springs further suggests the possibility of an ample ground water supply in the aquifers in the bedrock.

Township 3, Range 28

The mantle of glacial drift that overlies the entire township shows considerable variation over small areas both in the character and thickness. Moraine made up of yellow boulder clay interspersed with pockets and occasionally fairly extensive beds of sands and gravels covers the northeastern quarter of the township. Due to the irregular distribution of the porous beds in the moraine it is practically impossible to trace a water-bearing horizon over more than a small area. Several holes may be sunk in the drift before a productive sand bed is encountered. Low gravel and sand ridges and knolls have proved to be the most suitable well sites on several farms, and shallow wells located near the bottoms of slopes can be expected to yield fair supplies of hard water. Mineral salts sometimes occur in solution in the waters from the drift in sufficient concentration to render them slightly "alkaline", although still fit for household use. Iron forms a more objectionable form of impurity in many of these waters.

An area of 2 square miles of glacial outwash sands and gravels occurs northeast of the town of Fife Lake. Shallow wells, not exceeding 30 feet deep, yield a moderately hard water, containing small amounts of iron, in sufficient quantities for household requirements and for a few head of stock. The proximity of these beds to the surface, however, has caused the supply to decrease considerably during the periods of drought. These gravels form the present source of water for the town of Fife Lake.

Recent lake sands covering parts of sections 7, 18, and 19, to depths up to 40 feet, can be expected to yield water similar in quality to supplies from the glacial outwash gravels at shallow depths. In this area, however, residents desiring large supplies have found it advisable to sink wells into the underlying bedrock.

The most extensive water-bearing horizon known to exist in the bedrock in this township occurs at elevations ranging from 2,630 and 2,590 feet above sea-level throughout the southern third of the township. It is also believed to form the aquifer in NW. $\frac{1}{4}$, section 17. A bed of coarse sand forms the aquifer in most wells sunk to this horizon, but coal has been found to be the water-bearing horizon in a few of the southern wells. The depth of well necessary to reach this aquifer varies with the elevation of the ground surface. Along the southern border the aquifer is struck at depths of 60 to 85 feet, in section 12 at 100 feet, and in the central part of the township at depths of 40 to 65 feet. It seems probable that should the town of Fife Lake be obliged to increase its water supply this aquifer could be tapped by wells sunk to depths not exceeding 75 feet. The yields from most of the wells to this horizon is amply sufficient for 20 head of stock and several wells have watered 40 to 75 head of stock for considerable periods of time. The water is hard and occasionally contains small amounts of iron, but is quite satisfactory for household use.

In section 13, 14, 24 and 25, wells sunk to depths ranging from 40 to 80 feet encounter a higher or "B" horizon (See Figure 1) at elevations between 2,730 and 2,700 feet above sea-level. The yield is quite large and the water is of good quality. This horizon may prove to be productive in the extreme northeast corner of the area at somewhat greater depths. Along the western border and the northwest corner of the township several horizons believed to be of local occurrence have been penetrated. No continuous horizons have been traced, but it is probable that fairly large supplies of water will be obtained generally throughout this part of the township at depths varying from 40 to 75 feet.

Township 3, Range 29

The greater part of this township lies within the basin previously the site of a glacial lake and now occupied in part by Fife lake. The area surrounding the lake for several miles is covered to depths of 20 to 30 feet by recent lake deposits, which are underlain by sands and silts interbedded with beds of bluish grey clay. Individual wells sunk to depths not exceeding 50 feet throughout the lake sands area in general supply sufficient water for 20 or more head of stock. In several areas the dissolved mineral salt content of the water is high. Residents located in sections 10, 11, 15, and 18, and particularly in and near the village of Constance, report the water from wells sunk into the lake sands to be too highly "alkaline" for household use. This condition appears to be more prevalent in wells sunk to depths of 40 and 50 feet than from the recent sand beds encountered nearer the surface. In general, however, the shallow wells deriving their supply from the lake sands are better sources of drinking water than wells sunk into the underlying bedrock.

The southern sections of the township are in part covered by moraine. The presence of small, irregular pockets of sands and gravels make the moraine quite porous, but the thinness of the drift cover restricts it to being a source for only small supplies of water for household use. Most of the water throughout this part of the township is derived from aquifers in the underlying bedrock.

The Ravenscrag formation underlies the drift throughout the entire township. It is believed that a fairly continuous water-bearing horizon underlies the greater part of the township at elevations ranging between 2,665 and 2,600 feet above sea-level. Throughout the eastern half of the township this horizon is encountered at depths of between 35 and 60 feet. In the northern parts of sections 23, and 24, where the surface elevation is greater, it was found necessary to sink wells to depths of 100 to 120 feet in order to tap the aquifer.

Along the southern boundary beds of sand and thin coal seams forming aquifers are encountered at this same horizon at depths ranging from 50 to 110 feet below the surface. The yield from the bedrock wells is in general much larger than from wells deriving their supply from the overlying lake sands. Many wells yield sufficient water for 25 or more head of stock. The water is generally hard and contains iron and is not usually as suitable for household use as water from shallower sources.

Township 3, Range 30

The glacial drift is confined to the northeastern half of this township. An area of lake sands extends for a maximum distance of 1 mile to the west from Fife lake. Water is being obtained at shallow depths in these sands, but the quality is poor and the supply small. Moraine blankets the remaining part of the drift-covered, northeast half of the township. Ground water occurs in the pockets and beds of sands and gravels occurring in the boulder clay. Only one well, located in NE. $\frac{1}{4}$, section 14, is known definitely to be deriving its supply from such sand beds in the moraine. This well yields sufficient quantities of hard, clear water for household use and for 40 head of stock. Further prospecting along low ridges and at the bases of slopes should produce similar supplies. The drift thins in a southwesterly direction and terminates along the northwest-southeast diagonal of the township.

The Ravenscrag bedrock formation either outcrops at the surface or is covered by only a few feet of soil throughout the rugged southwestern half of the township, and it underlies the glacial drift over the remaining area. Residents in drift-covered areas who have been unable to obtain a sufficient water supply for stock requirements in the glacial drift have continued their wells into the underlying Ravenscrag bedrock. Small supplies of water, sufficient for 5 to 25 head of stock, are to be expected from wells tapping the coal seams and thin sand beds interbedded in the clays and shales of this formation, at depths not generally exceeding 50 feet from the surface. The rugged character of the southwestern half of the township makes the tracing of continuous water-bearing horizons in the bedrock difficult. The presence of many continuously flowing springs in the valleys suggests that the coal seams and sand beds of the formation are water-bearing. Residents sinking wells to depths of 30 to 50 feet on the lower slopes of the hills and encountering these aquifers can be assurred of fairly large supplies of water. The quality is variable in different parts of the area, but is generally suitable for household requirements. Wells sunk in the valley plains often yield water that is highly charged with dissolved mineral salts. In many places the water is unfit for human consumption. Such conditions have been found in a few wells in the vicinity of the village of Roseglen.

Beds of light brown gravels are known to occur at shallow depths over small areas in the uplands to the northeast of Roseglen village. No wells are known to have been sunk into these deposits but it is probable that due to their porous nature they will yield at least small supplies of water of fairly good quality.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF POPLAR VALLEY, NO. 12, SASKATCHEWAN

West of 2 mer. — Township	1	1	1	2	2	2	3	3	3	Total No. in Municipality
Range	28	29	30	28	29	30	28	29	30	
Total No. of Wells in Township	19	41	47	37	20	21	77	39	47	348
No. of wells in bedrock	18	41	43	32	3	19	25	25	43	249
No. of wells in glacial drift	0	0	0	4	17	0	52	14	4	91
No. of wells in alluvium	1	0	4	1	0	2	0	0	0	8
Permanency of Water Supply										
No. with permanent supply	16	37	40	26	12	12	63	38	47	291
No. with intermittent supply	2	1	0	6	1	0	6	0	0	16
No. dry holes	1	3	7	5	7	9	8	1	0	41
Types of Wells										
No. of flowing artesian wells	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells	5	6	9	16	3	6	27	24	16	112
No. of non-artesian wells	13	32	31	16	10	6	42	14	31	195
Quality of Water										
No. with hard water	15	25	32	29	10	9	52	35	45	252
No. with soft water	3	13	8	3	3	3	17	3	2	55
No. with salty water	0	0	0	0	0	0	1	0	0	1
No. with "alkaline" water	0	18	6	4	1	1	3	8	12	53
Depths of Wells										
No. from 0 to 50 feet deep	12	37	37	18	15	13	56	25	40	253
No. from 51 to 100 feet deep	6	4	9	17	3	7	18	9	6	79
No. from 101 to 150 feet deep	1	0	1	2	2	1	2	5	1	15
No. from 151 to 200 feet deep	0	0	0	0	0	0	1	0	0	1
No. from 201 to 500 feet deep	0	0	0	0	0	0	0	0	0	0
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is Used										
No. usable for domestic purposes	18	30	37	30	11	11	63	27	38	265
No. not usable for domestic purposes	0	8	3	2	2	1	6	11	9	42
No. usable for stock	18	35	40	32	12	12	68	37	45	299
No. not usable for stock	0	3	0	0	1	0	1	1	2	8
Sufficiency of Water Supply										
No. sufficient for domestic needs	18	38	39	31	12	12	65	38	47	300
No. insufficient for domestic needs	0	0	1	1	1	0	4	0	0	7
No. sufficient for stock needs	16	34	35	30	10	8	55	26	43	257
No. insufficient for stock needs	2	4	5	2	6	4	14	12	4	50

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 differance between the total hardness and the permanent hardness and represents the amount of mineral salts that ban 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 excesss 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 **Poplar Valley**, No. 12, Saskatchewan.

LOCATION						Depth of Well, Ft.	Total dis'vd solida	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of Water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alka-linity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	NW.	30	3	28	2	26	237											(3)	(1)		(2)				4	x 2
2	SW.	11	3	29	2	22	586											(3)	(1)		(2)				(4)	x 1
3	SW.	11	3	29	2	40	5,140											(4)	(1)		(2)		(3)		(5)	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; 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. 1, 2, and 3, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

No samples of ground water were collected for analysis by the Geological Survey in this municipality, the three submitted being made by the Provincial Analyst, Regina. Eight analyses were made of waters taken at widely separated localities in municipality No. 13, which adjoins this municipality on the west. Since a close similarity exists in the mode of occurrence and character of the source beds, the quality of the waters from the two areas should also be similar. The following generalizations are based to a large extent upon the analyses of the waters of municipality No. 13.

Throughout the area overlain by glacial lake sands in the north-central part of the municipality drinkable water is generally obtainable at shallow depths. Wells less than 30 feet in depth yield a water that is hard and contains small amounts of mineral salts, generally sulphates, in solution.

The second analysis given on the accompanying table is of water from a well sunk to a depth of 22 feet in the lake sands in SW. $\frac{1}{4}$, sec. 11, tp. 3, range 29. Calcium and magnesium sulphates are the principal salts in solution, but are not in sufficient quantities to make the water unfit for drinking. At greater depths in the lake sand area a more highly "alkaline" water is encountered. The third analysis of water from a 40-foot well located in the village of Constance, is believed to be representative of the waters of poorer quality to be found in these sands. The dissolved mineral salts are essentially the same, but in a much greater concentration than in the upper parts of the lake sands. The great concentration, 5,140 parts per million, of dissolved solids renders this water unfit for drinking and it cannot be considered to be beneficial to stock.

Water from very shallow wells sunk into gravel pockets in the glacial till and moraine is moderately hard and low in dissolved mineral salts. Such water, if uncontaminated by sewage or decaying organic matter, is of excellent quality for household use. Wells sunk entirely in boulder clay or encountering only small, isolated sand pockets generally yield water that is highly mineralized. Sodium sulphate and magesium sulphate are the salts usually present in solution in the largest amounts, and due to their laxative effects the water is unfit for drinking.

Gravel beds occurring in the bottoms of coulées and valleys form good sources of drinking water. Fine sands and silts, however, tend to retard the circulation of ground water and lend to the concentration of mineral salts, and thus render the water of much poorer quality. Wells situated near the bottoms of slopes and on or near low gravel ridges yield water of better quality than wells sunk on the flat areas in the drift-covered districts.

The water of Fife lake is of much better quality than is generally found in the lakes over the southern part of the province. This condition may be largely due to the absence in the surrounding area of thick deposits of glacial drift that in many places appear to contribute much of the salts found in "alkali" lakes; the lake may be fed by springs that come from the bedrock and are only slightly mineralized.

Water from the Bedrock

The Ravenscrag bedrock formation, which either outcrops or underlies a veneer of soil or glacial deposits throughout the entire municipality, is the source of most of the ground water used in the district. Two general types of water are obtained from the bedrock; a hard water containing varying amounts of sulphate salts in solution, and a much softer water in which sodium carbonate, "soda", magnesium carbonate, and calcium carbonate are the dominant salts in solution. In areas where the Ravenscrag is covered by any considerable thickness of glacial deposits, composed largely of boulder clay, the waters from the upper 100 feet of the bedrock are generally of the first type. Throughout the "driftless" area and from greater depths in areas where the Ravenscrag is overlain by boulder clay the softer, sodium carbonate waters are found. These waters are of excellent quality compared with supplies found throughout the greater part of the province. The total dissolved solid content is generally less than 300 parts per million, and the total hardness has been found to be less than 200 parts per million in many places. Iron is often found in waters derived from the coal seams and forms the most objectionable constituent in the waters of the district. Much of the iron may be removed by allowing the water to stand for a period of time in a trough or other container that allows a large water surface to be exposed to the air. Agitation of the water is also helpful in removing iron. One method that has proved successful in several places is to allow the water to pass over a sheet of corrugated, galvanized iron suspended between the pump and the trough. The iron upon being oxidized by contact with the air settles as a brown precipitate in the bottom of the trough.

The first analysis given on the accompanying table is of water derived from sand in the Ravenscrag at a depth of 26 feet, in a well located in NW. $\frac{1}{4}$, sec. 30, tp. 3, range 28. Although this water is moderately soft the influence of the overlying drift is noted in the presence of sulphate salts rather than the carbonates which are indicative of waters from the bedrock in the "driftless" area.

WELL RECORDS—Rural Municipality of POPLAR VALLEY NO. 12, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	NE.	1	1	28	2	Dug	5	2,710	- 1	2,709	5	2,705	Stream gravel	Soft, clear	43	D, S	Sufficient for 17 head stock.
2	NE.	2	"	"	"	Bored	42	2,650	- 39	2,611	40	2,610	Ravenscrag coal	Hard, iron	43	D, S	" " 30 " ".
3	NW.	4	"	"	"	Dug	27	2,565	- 20	2,545	27	2,538	" sand	" clear	42	D, S	" " 20 " ". Well goes dry in winter.
4	NW.	6	"	"	"	Bored	70	2,632	- 60	2,572	70	2,562	" coal	" " iron	44	N	Sufficient " 20 " ".
5	NW.	10	"	"	"	"	116	2,720	- 10	2,710	116	2,604	" "	Hard, clear	43	D, S	" " 50 " ". 60 and 62 foot wells form auxiliary supply.
6	NW.	14	"	"	"	"	85	2,750	- 75	2,675	85	2,665	" clay	Med. hard, clear	42	D, S	Insufficient for 15 head stock.
7	SE.	16	"	"	"	"	54	2,720	- 25	2,695	54	2,666	Glacial sand	Hard, clear	42	D, S	Sufficient for 20 head stock.
8	SE.	17	"	"	"	Dug	12	2,630	- 10	2,620	12	2,618	" "	Soft, clear	42	D, S	" " 10 " ". Spring on same quarter.
9	SW.	18	"	"	"	Spring	4	2,625	+ 1	2,626	4	2,621	Ravenscrag coal	" "	44	D, S	Sufficient " 50 " ".
10	SE.	19	"	"	"	"	4	2,590	0	2,590	4	2,586	" "	Med. hard, clear		D, S	" " 300 " ". 3 other springs nearby.
11	SE.	25	"	"	"	Bored	50	2,800					" clay				Dry hole.
12	SW.	25	"	"	"	"	88	2,725	- 78	2,647	88	2,737	" coal	Hard, clear	43	D, S	Sufficient for 16 head stock.
13	NE.	32	"	"	"	Spring		2,680			20	2,660	" "	" "	47	D, S	" " 38 " ". Water flows from a coal mine.
1	SW.	1	1	29	2	Bored	46	2,480	- 28	2,452	48	2,432	" "	Soft, clear, iron	41	D, S	Large supply. 30 foot dry hole in clay.
2	SW.	4	"	"	"	Spring	8	2,625	+ 1	2,626	8	2,617	" "	Hard, "alkaline"	41	D, S	Sufficient for 12 head stock.
3	NE.	5	"	"	"	Dug	12	2,700	- 6	2,694	12	2,688	" sand	Soft, clear	48	D, S	" " household only. 60 foot dry hole struck coal.
4	SW.	6	"	"	"	"	13	2,770	- 10	2,760	13	2,757	Ravenscrag sand	" "	42	D, S	Sufficient for 30 head stock.
5	NW.	6	"	"	"	Spring	4	2,750	+ 1	2,751	4	2,746	" coal	" "	56	D, S	Large supply.
6	SW.	9	"	"	"	Spring	5	2,565	+ 1	2,566	5	2,560	" "	Hard, iron, "alkaline"	41	D, S	" ". Several similar springs.
7	NW.	9	"	"	"	Dug	18	2,600	- 10	2,590	18	2,582	" "	Hard, iron, "alkaline"	42	D, S	" ". 2 similar wells.
8	NE.	12	"	"	"	Bored	65	2,645	- 60	2,585	65	2,580	" sand	Soft, cloudy	42	D, S	Sufficient for 14 head stock.
9	SE.	13	"	"	"	"	46	2,655	- 40	2,615	46	2,609	" "	Med. hard, clear	40	D, S	Insufficient for 12 head stock.
10	SW.	13	"	"	"	"	64	2,635	- 61	2,574	64	2,571	" "	Hard, iron, clear	40	D, S	Sufficient for 15 head stock.
11	NW.	15	"	"	"	"	27	2,575	- 14	2,561	27	2,548	" coal	Hard, iron, "alkaline"	43	D, S	" " 40 " ".
12	SE.	16	"	"	"	"	43	2,580	- 30	2,550	43	2,537	" "	Soft, iron, sulphur	43	D, S	" " 20 " ". 53 foot well also struck coal.
13	SW.	18	"	"	"	Dug	14	2,610	- 11	2,599	14	2,596	" shale	Hard, clear	45	D, S	Insufficient for 20 head stock.
14	NW.	21	"	"	"	"	14	2,630	- 7	2,623	14	2,616	" sand	Soft, clear	42	D, S	Sufficient for 21 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 POPLAR VALLEY NO. 12, 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
15	SE.	21	1	29	2	Dug	16	2,615	- 9	2,606	16	2,599	Ravenscrag coal	Hard, slightly "alkaline"	44	, I	Good supply but organic taste.
16	NE.	21	"	"	"	"	15	2,615	- 6	2,609	15	2,600	" sand	Med. hard, clear	43	D, S	Large supply. Another good well 24 feet deep.
17	SW.	22	"	"	"	Bored	33	2,555	- 25	2,540	33	2,532	" "	Soft, clear	42	D, S	Sufficient for 20 head stock.
18	NE.	26	"	"	"	"	65	2,575	- 45	2,530	65	2,510	" coal	Hard, clear, "alkaline"	40	D, S	" " 20 " " .
19	SE.	28	"	"	"	Dug	22	2,665	- 16	2,649	22	2,643	" clay	Hard, clear	43	D, S	" " 8 " " .
20	SW.	28	"	"	"	"	22	2,630	- 19	2,611	22	2,608	" coal	Soft, clear	43	D, S	" " 25 " " .
21	SW.	32	"	"	"	Drilled	83	2,725			80	2,645	" ?			N	No information.
22	SE.	35	"	"	"	Bored	33	2,575	- 25	2,550	33	2,542	" sand	Hard, clear, "alkaline"	42	D, S	Sufficient for 13 head stock.
1	SE.	1	1	30	2	Bored	30	2,731	- 24	2,707	30	2,701	Ravenscrag coal	Soft, clear	41	D, S	Sufficient for 20 head stock.
2	SW.	2	"	"	"	Dug	32	2,770	- 28	2,742	32	2,738	" "	Hard, clear	41	D, S	" " 10 " " . Also 12 foot well in clay yielding hard water.
3	NW.	4	"	"	"	Bored	83	2,805	- 67	2,738	72	2,733	" "	" iron	40	D, S	Sufficient for 20 head stock ; 14 foot well for house use.
4	NW.	5	"	"	"	"	88	2,850	- 74	2,775	88	2,762	" clay	" " "alkaline"	40	D, S	Sufficient for 24 head stock, 28 foot well for house use.
5	NE.	6	"	"	"	Dug	16	2,870	- 10	2,860	16	2,854	" coal	Soft, clear	42	D, S	Sufficient for 20 head stock. Continuously flowing spring nearby.
6	SE.	10	"	"	"	Bored	35	2,742	- 25	2,717	35	2,707	" sand	Hard, clear	42	D, S	Sufficient for 30 head stock.
7	SE.	12	"	"	"	Dug	12	2,730	- 8	2,722	12	2,718	Recent stream gravel	Soft, clear	39	D, S	" " household needs
8	SE.	13	"	"	"	"	25	2,700			25	2,675	Ravenscrag sand	Hard, clear	39	D, S	" " local needs.
9	SE.	15	"	"	"	Bored	52	2,750	- 35	2,715	52	2,698	" "	Soft, clear	42	D, S	Large supply.
10	SE.	17	"	"	"	"	18	2,755	- 8	2,747	18	2,737	Recent sand	Hard, "alkaline"	44	S	Sufficient for 26 head stock. 12 foot well for house.
11	SW.	17	"	"	"	"	28	2,755	- 24	2,731	28	2,727	" clay	Hard, "alkaline"	43	D, S	Sufficient for 6 " " ; continuously flowing spring on same quarter.
12	SW.	21	"	"	"	Dug	28	2,787	- 8	2,779	28	2,759	Ravenscrag coal	Hard, "alkaline"	43	D, S	Sufficient for local needs.
13	SW.	23	"	"	"	"	36	2,850	- 24	2,826	36	2,814	" "	Hard, iron	42	D, S	" " 100 head stock. 16 foot well in red gravel--now dry.
14	NW.	23	"	"	"	"	38	2,895	- 26	2,869	38	2,857	" "	Hard, iron, cloudy	42	D, S	Sufficient for local needs.
15	SE.	23	"	"	"	Bored	98	2,750	- 80	2,670	80	2,670	" "	Soft, iron, clear	39	D, S	Large supply. 78 foot dry hole.
16	NE.	24	"	"	"	"	78	2,700	- 68	2,632	78	2,622	" coarse sand	Hard, iron, cloudy	40	D, S	Sufficient for 20 head stock.
17	NW.	25	"	"	"	Spring	5	2,795	+ 1	2,796	5	2,790	Ravenscrag coal	Hard, clear		D, S	Sufficient for local needs; 14 foot well for house use.
18	SW.	31	"	"	"	Bored	36	2,735	- 7	2,728	36	2,699	" "	" " "alkaline"	40	, S	Large supply; 14 foot well for house use.
19	NW.	33	"	"	"	Dug	8	2,680	- 4	2,676	8	2,672	Recent sand	Med. hard	45	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 POPLAR VALLEY NO. 12, 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	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
20	NW.	34	1	30	2	Bored	46	2,040	- 36	2,804	46	2,794	Ravenscrag coal	Hard, iron	40	D, S	Sufficient for 15 head stock.
21	SE.	34	"	"	"	"	118	2,870	-100	2,770	118	2,752	" sand	" " clear	42	D, S	" " 12 " ".
22	SW.	35	"	"	"	"	16	2,805	- 4	2,801	16	2,789	" coal	Hard, iron, cloudy	44	D, S	" " 50 " ". 10 foot well in coal and spring on same quarter.
23	SW.	36	"	"	"	"	42	2,815	- 20	2,795	42	2,773	" "	Hard, iron, clear		D, S	Large supply.
24	NW.	36	"	"	"	"	73	2,800	- 68	2,732	73	2,727	" "	Hard, clear, "alkaline"	43	D, S	Small supply. 40 foot well nearby also, dry.
1	NE.	1	2	28	2	Bored	39	2,590	- 17	2,573	39	2,551	" clay	Hard, iron, reddish	42	D, S	Sufficient for 15 head stock. Excellent household supply.
2	SE.	7	"	"	"	Dug	56	2,740	- 45	2,695	56	2,684	" coal	Hard, clear	44	D, S	Sufficient for 30 head stock.
3	NE.	9	"	"	"	Bored	60	2,695	- 48	2,647	60	2,635	" "	Hard, iron, clear	40	D, S	Large supply.
4	SE.	13	"	"	"	"	50	2,550	- 20	2,530	50	2,500	" red sand	Hard, clear, "alkaline"	40	D, S	" " .
5	SW.	15	"	"	"	"	90	2,610	- 80	2,530	90	2,520	" sand	Hard, clear	44	D, S	" " . 2 dry holes in clay 30 and 70 foot deep.
6	NW.	15	"	"	"	"	70	2,605	- 50	2,555	70	2,535	" coal	" " iron	44	D, S	Sufficient for 40 head stock.
7	S½.	16	"	"	"	"	120	2,610	- 90	2,520	120	2,490	" "	Hard, clear		D, S	Sufficient for local needs.
8	NE.	16	"	"	"	Dug	10	2,613	- 8	2,605	10	2,603	Stream sand	" "	42	D, S	Sufficient for local needs.
9	NW.	18	"	"	"	"	36	2,790	- 30	2,760	30	2,760	Ravenscrag sand	" "alkaline"	42	D, S	Small supply. 30 foot bored well for stock.
10	SE.	20	"	"	"	Drilled	60	2,640	- 45	2,595	60	2,580	" coal	" clear		D, S, I	Sufficient for local needs.
11	SW.	20	"	"	"	"	61	2,620	- 49	2,571	61	2,559	Ravenscrag gravel (?)	Clear		D,	Small supply.
12	NE.	20	"	"	"	Bored	85	2,630	- 75	2,555	85	2,545	Ravenscrag coal	Hard, clear, iron	40	D, S	Sufficient for 15 head stock.
13	SW.	22	"	"	"	"	65	2,550	- 30	2,520	65	2,485	" "	Hard, clear, iron	39	D, S	" " 20 " " . Several shallow wells yield small seepages.
14	SE.	23	"	"	"	"	60	2,570	- 30	2,540	60	2,510	" "	Hard, clear, iron	40	D, S	Large supply. 14 foot dug well also used
15	SE.	24	"	"	"	"	55	2,595	- 5	2,590	55	2,540	" sand	Hard, clear, iron	40	D, S	Sufficient for 10 head stock.
16	SW.	26	"	"	"	Dug	28	2,510	- 26	2,484	28	2,482	Glacial gravel	Hard, clear	44	D, S	" " 20 " ".
17	NE.	27	"	"	"	Bored	82	2,630			82	2,548	Ravenscrag sand	Hard, iron, "alkaline"	40	D, S	" " 50 " ".
18	NE.	30	"	"	"	"	75	2,675	- 65	2,610	75	2,600	" coal	Hard, clear, iron	42	D, S	" " household needs only.
19	SW.	30	"	"	"	"	136	2,750	-126	2,624	136	2,614	" "	Hard, clear, iron	44	D, S	Large supply. 36 foot well in sand is now dry
20	SE.	31	"	"	"	Dug	12	2,650	- 5	2,645	10	2,640	" sand	Soft, clear	42	D, S	Sufficient for 10 head stock.
21	NW.	36	"	"	"	Bored	50	2,680	- 40	2,640	50	2,630	Ravenscrag sand	Hard, iron, "alkaline"	40	D, S	Sufficient for 30 head stock; laxative.
22	NE.	36	"	"	"	"	25	2,700	- 20	2,680	25	2,675	Glacial "	Soft, clear	42	D, S	Large 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 POPLAR VALLEY NO. 12, 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	SW.	6	2	29	2	Dug	29	2,710	- 23	2,687	29	2,681	**Ravenscrag sand**	Hard, cloudy	42	D, S	Sufficient for 20 head stock. 30 foot well in sand went dry.
2	NE.	23	"	"	"	Bored	15	2,885	- 10	2,875	15	2,870	**Glacial "**	Soft, clear	49	D, S	Large supply.
3	SE.	24	"	"	"	"	15	2,800					" "				Dry hole.
4	NW.	25	"	"	"	"	148	2,800	-136	2,664	143	2,652	Ravenscrag clay	~~Hard, clear,~~ "alkaline"	~~44~~	~~D, S~~	~~Sufficient for local needs.~~
5	SE.	26	"	"	"	"	24	2,890	- 22	2,868	24	2,866	Glacial sand	Soft, clear	42	D, S	" " 20 head stock. 79 foot dry hole in clay.
6	SW.	27	"	"	"	Spring	10	2,820	+ 1	2,821	10	2,810	Ravenscrag coal	Hard, clear	48	D, S	Sufficient for 100 head stock.
7	NW.	34	"	"	"	Bored	60	2,775	- 50	2,725	60	2,715	Glacial? clay	Hard, clear, iron	41	D, S	Very small supply; dry in summer.
8	SW.	36	"	"	"	Dug	28	2,740	- 2	2,738	28	2,712	" "	Soft, clear	42	D, S	Sufficient for 50 head stock.
1	NW.	3	2	30	2	Dug	71	2,895	- 50	2,845	70	2,825	**Ravenscrag sand**	Hard, clear	42	D, S	Sufficient for 15 head stock. Several test holes 85 to 135 feet deep.
2	SE.	4	"	"	"	"	13	2,865	- 10	2,855	13	2,852	" "	" "	44	D, S	Sufficient for 6 " " .
3	NW.	4	"	"	"	" ?	40	2,925					Ravenscrag clay				Dry hole.
4	SE.	5	"	"	"	Bored	72	2,815	- 32	2,783	72	2,743	" coal	Hard, iron, "alkaline"	40	D, S	Sufficient for 12 head stock. 37 foot well on SW.¼ gives large supply.
5	NE.	5	"	"	"	Dug	18	2,815					" "				Dry hole; spring on this quarter.
6	NW.	9	"	"	"	"	30	2,900	- 26	2,874	30	2,870	" clay	Hard, clear		D,	Sufficient for household needs only.
7	NE.	10	"	"	"	Bored	96	2,865	- 66	2,799	96	2,769	Ravenscrag sand	Soft, clear	44	D, S	" " 21 head stock. 68 foot well gives seasonal supply.
8	NE.	20	"	"	"	Dug	28	2,990	- 23	2,967	28	2,962	Stream? gravel	" "		D, S	Sufficient for local needs.
9	NW.	25	"	"	"	"	18	2,700	- 12	2,688	18	2,682	" sand	" "	42	S	" " 40 head stock; spring nearby.
1	NE.	3	3	28	2	Bored	86	2,710	- 74	2,636	86	2,624	Ravenscrag sand	Hard, clear	44	S	" " 16 " " ; poor drinking water.
2	SE.	4	"	"	"	"	75	2,650					" clay				Dry hole. Three 14 foot wells yield small supply.
3	SE.	4	"	"	"	"	80	2,675			80	2,595	" ?	Hard, cloudy		D, S	Sufficient for local needs.
4	NW.	5	"	"	"	"	76	2,670	- 60	2,610	76	2,594	" gravel	" clear	43	D, S	Sufficient for 75 head stock.
5	NE.	6	"	"	"	"	60	2,660	- 30	2,630	60	2,600	" sand	" " "alkaline"	43	D, S	Large supply.
6	NW.	8	"	"	"	"	56	2,650	- 46	2,604	56	2,594	" "	Hard, clear	43	D, S	Sufficient for 20 head stock.
7	SE.	8	"	"	"	Dug	12	2,650	- 9	2,641	12	2,638	" " and gravel	" " iron	43	D, S	" " local needs. About 15 such wells in village of Fife Lake
8	NW.	9	"	"	"	Bored	32	2,660	- 9	2,651	29	2,631	Glacial sand and gravel	Soft, "	42	D, S	Sufficient for 22 head stock.
9	SW.	10	"	"	"	"	62	2,720	- 42	2,678	62	2,658	Ravenscrag coal	Med. hard, clear	43	D, S	" " local needs.
10	NW.	10	"	"	"	"	45	2,680	- 27	2,653	45	2,635	" sand	Soft, clear	43	D, S	" " 6 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 POPLAR VALLEY NO.12, 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
11	NE.	10	3	28	2	Bored	45	2,645	- 33	2,612	45	2,600	Ravenscrag sand	Hard, iron, clear	43	D, S	Sufficient for local needs. 30 foot well in sand yields salty water.
12	NE.	12	"	"	"	Drilled	100	2,690	- 85	2,605	100	2,590	" "	Hard, clear	42	D, S	Large supply.
13	SE.	13	"	"	"	Dug	15	2,680	- 12	2,668	15	2,665	Glacial gravel	" "	44	D, S	Sufficient for 15 head stock.
14	NW.	13	"	"	"	Bored	36	2,770	- 27	2,743	36	2,734	Ravenscrag sand	" "	44	D, S	" " 30 " " .
15	SE.	14	"	"	"	"	40	2,765	- 37	[illegible]	40	2,725	Ravenscrag sand	iron Hard, iron	44	D, S	Small supply. Similar well nearby.
16	SW.	14	"	"	"	"	67	2,760	- 62	2,698	67	2,693	" "	" "	43	D, S	Sufficient for 20 head stock. 20 foot well forms auxiliary supply
17	SE.	16	"	"	"	"	45	2,660	- 20	2,640	15	2,645	Glacial sand	clear Hard, iron,	43	D, S	Sufficient for 60 " " .
18	SE.	17	"	"	"	Dug	40	2,660	- 34	2,626	40	2,620	" gravel	rusty Hard, clear	43	D, S	" " local needs. 30 foot well gives soft water.
19	SW.	17	"	"	"	Bored	60	2,740			60	2,680	" sand	" "	42	D, S	Sufficient for 5 head stock.
20	NW.	17	"	"	"	"	60	2,685	- 52	2,633	60	2,625	Ravenscrag sand	iron Hard, clear	43	D, S	" " 3 " " . Also 12 foot dry hole.
21	NE.	18	"	"	"	"	85	2,750	- 80	2,670	85	2,665	" "	" "	42	D, S	Sufficient " 6 " " .
22	NW	18	"	"	"	"	42	2,735	- 36	2,699	42	2,693	Glacial gravel	" "	40	D, S	Small supply.
23	SW.	19	"	"	"	"	52	2,740	- 40	2,700	52	2,688	Ravenscrag coal	" "	42	D, S	Sufficient for 12 head stock.
24	NW.	19	"	"	"	"	70	2,700	- 63	2,637	70	2,630	Glacial gravel	" "	43	D,	" " household needs only.
25	SE.	20	"	"	"	Dug	12	2,640	- 7	2,633	12	2,628	" "	Soft, "	42	D, S	" " 10 head stock. 14 dry holes 10 to 50 feet deep on this quarter.
26	NE.	20	"	"	"	Bored	45	2,765	- 40	2,725	45	2,720	Ravenscrag sand	Hard, iron, "alkaline"	42	N	Spring supplies local needs.
27	SE.	21	"	"	"	Dug	5	2,675	- 4	2,671	5	2,670	Glacial sand	Soft, clear, iron	44	D, S	Sufficient for 11 head stock.
28	NE.	22	"	"	"	Bored	90	2,920	- 60	2,860	90	2,830	Ravenscrag sand	Soft, clear	44	D, S	Sufficient for 30 head stock. Dry hole 24 feet deep.
29	SE.	24	"	"	"	"	80	2,790	- 68	2,722	80	2,710	" clay	Hard, clear	42	D, S	Sufficient for 12 head stock.
30	NE.	25	"	"	"	"	60	2,760	- 45	2,715	60	2,700	" sand			N	Water turned dark colour.
31	SE.	26	"	"	"	Spring		2,790	+ 1	2,791			Glacial gravel	Hard, clear	45	D, S	Large supply.
32	SE.	27	"	"	"	Bored	110	2,950	- 98	2,852	110	2,840	Ravenscrag sand	" "	42	D, S	Small supply.
33	SW.	28	"	"	"	Dug	21	2,820	- 17	2,803	21	2,799	Glacial sand	" "	43	D, S	Sufficient for 21 head stock.
34	SE.	30	"	"	"	Bored	40	2,860	- 30	2,830	40	2,820	" "	Soft, "	43	D, S	Small supply.
35	NE.	30	"	"	"	"	60	2,915	- 40	2,875	60	2,855	Ravenscrag coal	Hard, clear, iron	41	D, S	Sufficient for at least 20 head stock. 12 foot well also used for stock.
36	NW.	30	"	"	"	"	26	2,900	- 18	2,882	26	2,874	" sand	Soft, clear		S	Large supply, contaminated by organic material
37	NW.	34	"	"	"	"	102	2,880	- 99	2,781	102	2,778	" "	" "	41	D, S	# Sufficient for 10 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 POPLAR VALLEY NO. 12, 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
38	SE.	35	3	28	2	Dug	15	2,910	- 9	2,901	15	2,895	Glacial ~~sand~~	Soft, clear	42	D, S	Sufficient for 31 head stock. 200 foot well into bedrock not being used.
1	SW.	1	3	29	2	Bored	110	2,710	-107	2,603	110	2,600	Ravenscrag?	Hard, iron, clear	42	S	Small supply; poor drinking water.
2	SW.	4	"	"	"	"	76	2,715	- 66	2,649	76	2,639	" sand	Hard, clear, iron	42	S	" " " " " . Shallow well for house use.
3	NE.	5	"	"	"	"	52	2,710	- 22	2,688	52	2,658	" "	Hard, iron, "alkaline"	43	S	~~Sufficient for 15 head stock, unfit for house-~~hold use. 20 foot well for house use.
4	NW.	5	"	"	"	Dug	38	2,770	- 30	2,740	38	2,732	" gravel	Hard, clear	43	D, S	Sufficient for 10 head stock.
5	SE.	7	"	"	"	Bored	130	2,785	-100	2,685	130	2,655	" sand	Hard, iron	43	D, S	" " 10 " " . 122 foot well encountered similar conditions.
6	SW.	8	"	"	"	Dug	22	2,760	- 19	2,741	22	2,738	Glacial gravel	Soft, clear	43	D	Sufficient for household only.
7	NW.	9	"	"	"	Bored	52	2,675	- 46	2,629	52	2,623	Ravenscrag coal	Hard, iron, clear	42	S,	" " 16 head stock, poor drinking water.
8	SE.	10	"	"	"	"	40	2,670	- 32	2,638	40	2,630	Glacial clay	Hard, iron, "alkaline"	43	D, S	Sufficient for 20 head stock.
9	NE.	10	"	"	"	"	40	2,665	- 28	2,637	40	2,625	" sand	Hard, clear, "alkaline"	43	D, S	Sufficient for at least 5 head stock. Also 35 foot dry hole.
10	SW.	11	"	"	"	"	22	2,645	- 19	2,626	22	2,623	" "	Hard, iron	47	D	Sufficient for household only. #
11	SW.	11	"	"	"	"	25	2,640	- 18	2,622	25	2,615	" clay	" soda	47	D	" " " " .
13	SE.	13	"	"	"	"	45	2,665	- 25	2,640	45	2,620	" ?	Hard, iron, clear	42	D, S	" " at least 25 head stock.
14	NW.	14	"	"	"	"	38	2,655	- 35	2,620	38	2,617	Ravenscrag coal	Hard, clear,	41	D, S	" " " " 30 " " .
15	NE.	15	"	"	"	Dug	12	2,670	- 7	2,663	12	2,658	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for 25 head stock. Haul water.
16	SW.	18	"	"	"	"	20	2,655	- 16	2,639	20	2,635	" sand	Hard, clear, "alkaline"	42	S	" " 3 " " .
17	SE.	23	"	"	"	Bored	52	2,660	- 39	2,621	52	2,608	" gravel	Soft, soda	43	D, S	Sufficient for 15 head stock, unfitfor household.
18	NE.	23	"	"	"	"	100	2,705	- 72	2,633	100	2,605	Ravenscrag sand	Hard, clear		D, S	Sufficient for local needs.
19	SW.	24	"	"	"	"	55	2,720	- 48	2,672	55	2,665	Ravenscrag coal	" "	42	D, S	Sufficient for 27 head stock. 47 foot well gives similar supply.
20	NW.	24	"	"	"	"	120	2,700	-100	2,600	116	2,584	" "	" iron	40	D, S	Sufficient for 20 head stock.
21	SW.	25	"	"	"	"	48	2,680	- 42	2,638	48	2,632	Glacial sand	" clear	43	D, S	Sufficient for 7 head stock.
22	SW.	27	"	"	"	"	50	2,645	- 40	2,605	50	2,595	" ? gravel	" "	42	D, S	Sufficient for 20 head stock.
23	NW.	29	"	"	"	"	86	2,645	- 66	2,579	86	2,559	Ravenscrag sand	" " iron	43	D, S	Sufficient for 20 head stock.
24	NE.	33	"	"	"	"	35	2,650	- 26	2,624	35	2,615	Glacial sand	Hard, clear	43	D, S	Sufficient for household use.
25	SW.	35	"	"	"	Dug	13	2,645	- 11	2,634	13	2,632	" sand	Soft, clear	47	D, S	Small supply.
26	SE.	35	"	"	"	Bored	60	2,665	- 45	2,620	60	2,605	Ravenscrag"	Hard, clear,	43	D, S	Sufficient for 15 head stock.
27	SE.	36	"	"	"	"	52	2,860	- 42	2,818	52	2,808	Ravenscrag sand	" "	43	D, S	Sufficient for 30 head stock.
12	SW.	11	"	"	"	"	40	2,654	- 30	2,624	40	2,614	Glacial sand	" , " , "alkaline"	44	S	Sufficient for local needs. Also another 25 foot well. #.

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 POPLAR VALLEY NO. 12, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
1	SW.	1	3	30	2	Dug	15	2,750	- 9	2,741			Ravenscrag coal	Hard, clear, "alkaline"		S	Sufficient for 45 head stock; unfit for household use.
2	NE.	2	"	"	"	Bored	56	2,702	- 53	2,649	56	2,646	" fine sand	Hard, clear	44	D, M	11 wells in town of Rock Glen 22 to 56 feet deep; all similar.
3	SE.	3	"	"	"	Spring	0	2,720	+ 1	2,721	0	2,720	" sand	Hard, iron, clear	44	D, S	Sufficient for local needs. 14 foot well gives water too "alkaline" for farm use.
4	NE.	4	"	"	"	Bored	35	2,725	- 28	2,697	35	2,690	" "	Hard, iron, clear	45	D, S	Sufficient for 38 head stock; several bedrock springs on this section.
5	SE.	8	"	"	"	"	38	2,790	- 28	2,762	38	2,752	" coal	Hard, clear, iron	45	D, S	Sufficient for 10 head stock. 2 springs on NE.¼ sec. 8, also used.
6	NW.	9	"	"	"	Spring	0	2,770	+ 1	2,771			" sand below coal	Hard, iron,	44	D, S	Sufficient for at least 20 head stock.
7	NW.	10	"	"	"	Dug	18	2,700	- 12	2,688	18	2,682	Ravenscrag fine sand	Hard, clear		D, S	Sufficient for local needs.
8	SW.	12	"	"	"	Bored	30	2,750	- 15	2,735	30	2,720	Ravenscrag sand	" "	42	D, S	" " 5 head stock.
9	SE.	12	"	"	"	Dug	15	2,790	- 10	2,780	15	2,775	" coal	Soft, clear	43	D, S	" " 17 " " .
10	NE.	14	"	"	"	Bored	25	2,680	- 20	2,660	25	2,655	Glacial sand	Hard, clear	43	D, S	" " 40 " " . Slough and spring also used.
11	SE.	15	"	"	"	Dug	16	2,690	- 8	2,682	16	2,674	Ravenscrag coal		43	D, S	Sufficient for 13 head stock,
12	NE.	15	"	"	"	Bored	24	2,700			24	2,676	" "	Hard, iron, "alkaline"	41	D	" " household needs only. 15 foot well used for stock.
13	SE.	21	"	"	"	Spring	0	2,720	+ 1	2,721			" sand	Hard, clear, iron	44	D, S	Large supply.
14	NE.	22	"	"	"	Bored	54	2,720	- 32	2,688	54	2,666	" "	Hard, iron, clear	42	D, S	Sufficient for 26 head stock. 28 foot well yields "alkaline" water. 105' soft water well; not used.
15	NW.	24	"	"	"	Dug	30	2,665	- 20	2,645	30	2,635	Glacial "	Hard, iron, "alkaline"	42	D, S	Sufficient for 13 head stock.
16	NE.	26	"	"	"	Bored	100	2,720	- 80	2,640	100	2,620	Ravenscrag?	Hard, iron, "alkaline"	43	N	Well contaminated. Spring supplies domestic and stock needs.
17	SE.	28	"	"	"	"	66	2,710	- 48	2,662	66	2,644	" coal	Hard, iron, "alkaline"	43	D, S	Sufficient for 12 head stock. Similar well also used.
18	NE.	29	"	"	"	Spring	0	2,720	+ 1	2,721	0	2,720	" sand	Hard, clear	43	D, S	Sufficient for 25 head stock. A 40 foot well yields highly mineralized.water that is unfit for stock.

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

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