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DEPARTMENT OF MINES

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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF VERMILLION HILLS No. 195 SASKATCHEWAN

BY

B. R. MacKay & D. C. Maddox

Water Supply Papper No. 106

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF VERMILION HILLS, NO. 195 SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Bearpaw Formation. The Bearpaw consists mostly of incoherent dark grey to dark brownish grey, partly bentonitic shales, weathering light grey, or, in places where much iron

is present, buff. Beds of sand occur in places in the lower part of the formation. It forms the uppermost bedrock formation over much of western and southwestern Saskatchewan and has a maximum thickness of 700 feet or somewhat more.

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Vermilion Hills, No. 195, is in southwestern Saskatchewan. The municipality is irregular in shape and its approximate centre is about 68 miles northwest of Moose Jaw, about 103 miles south of Saskatoon, and about 42 miles northeast of Swift Current. South Saskatchewan river forms part of the northern and western boundaries of the municipality. The municipality comprises the whole of tp. 19, ranges 7, 8, and 9, tp. 20, range 7, parts of tp. 20, ranges 8, and 9, and tp. 21, ranges 7, 8, and 9, all W. 3rd mer. Only about 2½ square miles in the southeast corner of township 21, range 8, and only about 2½ square miles in the south of township 21, range 9, are included in the municipality and the parts of both these townships included are on the valley slopes of South Saskatchewan river and no well records were obtained from them. The Canadian National railway passes through the southern part of the municipality and most of the centres of population are located on or near the railway, but there are no large settlements.

Missouri coteau occupies most of the municipality. In the east Vermilion hills rise to elevations of 2,500 feet above sea-level. In the southwest one hill is over 2,650 feet above sea-level, and a large proportion of that part of the municipality that is in the Missouri coteau is over 2,400 feet above sea-level; the country is generally rough and hilly. In the northern three-fourths of township 21, range 7, the country is flat or gently rolling, elevations are less than 2,100 feet above sea-level, and the land slopes gently northwards and westwards to South Saskatchewan river. Elevation of water-level in South Saskatchewan river ranges from about 1,725 feet above sea-level at the western boundary of range 9 to about 1,695 feet above sea-level at the northern boundary of township 21, range 7. Within Missouri coteau the river valley is 400 feet to 600 feet deep and the slopes are steep. In the northeast the valley is about 250 feet deep and the valley slopes are gentle. Many steep-sided coulées extend back for several miles from South

Saskatchewan River valley. Most of these coulées are occupied by intermittent streams, but there are no permanent streams in the municipality. A group of seven small lakes in the northern third of township 19, range 8, the water-level of one of which is 2,308 feet above sea-level, receive surface run-off in the vicinity but do not overflow. There are four small lakes in the southern third of township 19, range 8. Low, marshy areas and dry lake bottoms occur in several parts of the municipality and receive local run-off and a small area in the northeast drains to Thunder creek; with these exceptions drainage is to South Saskatchewan river.

Water-bearing Horizons in the Unconsolidated Deposits

Most of the northern two-thirds of township 21, range 7, is underlain by clays that were deposited in a glacial lake formed during the retreat of the ice-sheet northwards. The clay is too fine grained to permit considerable quantities of water to seep into wells, but there are usually beds of sand in the clay that contain ground water and act as aquifers.

About 3 square miles in the vicinity of the small lakes in the northern part of township 19, range 8, and about 6 square miles on and near the southern boundary of this township are underlain by glacial outwash sands and gravels formed during the retreat of the ice-sheet. Ground water is usually found at slight depths in these deposits, but in some areas the deposits of sand and gravel may be too thin to hold supplies of water. Most of that part of the municipality occupied by Missouri coteau is underlain by the moraine type of glacial drift which is thought to have been deposited when halts of long duration occurred during the retreat of the ice front. A belt of glacial till or boulder clay borders the moraine on the north, and extends to South Saskatchewan River valley except in the northeast where it extends to the area of glacial lake clays. The moraine and glacial till plain types of drift are largely composed of clay and boulders,

with irregularly distributed lenses, pockets, or layers of sand and gravel, many of which contain ground water. The conditions for ground water occurrence in these deposits are very unfavourable in parts of this municipality and no aquifers that extend over a considerable area can be outlined.

Water-bearing Horizons in the Bedrock

In this municipality the Bearpaw formation underlies glacial drift over the lower parts of the municipality; in the higher parts the Eastend formation underlies the drift and overlies the Bearpaw. Very few wells in this municipality have reached bedrock and information as to formation contacts and the thickness of the drift is very scanty. The water in the Bearpaw sands is usually soft and can be used for all purposes except irrigation. The Darmody-Riverhurst artesian area to the northeast is thought to extend into at least the northeast part of the municipality as two wells in township 21, range 7, seem to be in this artesian area. The increase in the salt content of the water of the southern two wells over that of the normal waters of the Darmody-Riverhurst area and the absence of sodium sulphate in the water appear to show that these wells lie near the margin of the artesian area and hence that the aquifer probably does not extend very far into the municipality. A small area of possible artesian flow occurs in the north of township 21, range 7, but no wells have been drilled in this area.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 19, Range 7

The surface of this township is hilly and has high elevations. On and near the northern boundary elevations of over 2,500 feet above sea-level occur and with the exception of a few low-lying areas on and near the eastern and southern boundaries the township is over 2,300 feet above sea-level. There are no streams in the township and the surface run-off accumulates in low areas that during wet seasons become marshes or lakes. The entire township with the exception of about a quarter of a square mile in the southwest corner, which is occupied by glacial outwash sands and gravels, is underlain by glacial drift of the moraine type. No producing wells have reached bedrock, but the Eastend formation is thought to underlie the drift over the entire township.

The well records do not show the presence of any widespread aquifers in the glacial drift. A well on the NW.$\frac{1}{4}$, section 17, 122 feet deep, and a well on the SW.$\frac{1}{4}$, section 24, 100 feet deep, may obtain their water from the same aquifer, although there is a difference of about 42 feet in the elevation of the aquifer in the two wells and although a well on the SE.$\frac{1}{4}$, section 22, 110 feet deep, was a dry hole. In both the producing wells the water is "alkaline" and the supply is not large. In this township most of the deep wells occur within 2 miles of a line that crosses the township from the northwest corner of section 30 to the southeast corner of section 1. Many of the shallow wells are supplied by seepage from sloughs. There are several springs in section 5, and there is a spring near Calderbank, the aquifer of which apparently supplies water to some wells in the vicinity that yield comparatively soft water. The water in most of the wells is hard, but not too "alkaline" for human use.

No producing wells have been put down to bedrock, but a dry hole on the SE.$\frac{1}{4}$, section 22, is reported to have reached "soapstone" at a depth of 110 feet. The thickness of the glacial drift in the township elsewhere is not known. There are several dry holes in the central and southern parts of the township.

Township 19, Range 8

The land surface in this township is typical of the higher parts of Missouri coteau. Irregularly shaped hills with comparatively gentle slopes, and undrained hollows, many of which are occupied by lakes or marshes, cover most of the area. Elevations range from a little less than 2,300 feet above sea-level in some of the undrained hollows to over 2,500 feet above sea-level in the northwest and the southwest. The valley of an intermittent stream that flows north to South Saskatchewan river crosses the south half of section 31, and drains a small area in the northwestern part of the township. Surface run-off elsewhere in the township is to the lakes and undrained hollows. The land-surface in the vicinity of the group of lakes in the north, and an area on and near the southern boundary, are underlain by glacial outwash sands which will probably contain ground water within a few feet of the surface. Ground water in the remainder of the township will only be found irregularly distributed in sand layers through the clayey deposits of the terminal moraine type of glacial drift.

No well records were obtained from the northwest part of this township. This area is rough and hilly and is apparently not well adapted to farming. In the south half of the township most of the wells are comparatively shallow and appear to be supplied by seepage from dams or sloughs. The water in most of these wells is hard but drinkable, but in a few the water is too "alkaline" for human use. In the northeast part there are two dry holes, 70 feet and 80 feet deep. The Eastend formation probably underlies the glacial drift throughout this township, but no producing wells

have been put down to bedrock. In the southern and the north-central parts the lakes provide water for cattle and springs are reported at two farms.

Township 19, Range 9

The eastern half of the township is rough and one hill in section 10 is over 2,650 feet above sea-level. The western half is rolling country except in the northeast and the northwest where the upper parts of coulées that lead to South Saskatchewan river enter the township. Almost all the township is over 2,400 feet above sea-level. A few low areas, occupied during wet seasons by lakes or marshes, occur chiefly in the southeast. The slope of the land surface and the direction of run-off water in the northern part is towards South Saskatchewan river. There are no permanent streams in the township, but an intermittent stream crosses the northeast corner. With the exception of about one square mile in the northwest which is underlain by glacial till the whole township is underlain by moraine. Ground water is distributed in lenses or pockets in the boulder clay, which forms a large part of the drift, and no well-defined aquifers extend over any considerable distances.

The Eastend formation underlies the glacial drift over the entire township. Only one well record was obtained from the eastern third of the township. In the western two-thirds the depth of the wells in the glacial drift ranges from 10 feet to 140 feet. Several of the wells are over 100 feet deep. Six wells south and east of Gouldtown appear to obtain water from an aquifer that is about 2,375 feet above sea-level. The elevation of water-level in these wells ranges from about 2,381 feet to 2,424 feet above sea-level. It is possible that this aquifer is at the base of the drift. Wells on the NE.$\frac{1}{4}$, section 17, the SW.$\frac{1}{4}$, section 27, and the SE.$\frac{1}{4}$, section 33, obtained water from an aquifer about 2,310 to 2,320 feet above sea-level. The water in a large proportion of

the wells is described as "alkaline", but in only a few wells is the water too "alkaline" for human use. There are springs near the low-lying area in section 3, and in some of the coulées near the northern boundary of the township.

Three wells in the township obtain soft water from sands thought to be in the Eastend formation. Two wells on the NE.$\frac{1}{4}$, section 28, and a well on the NE.$\frac{1}{4}$, section 33, obtain water from an aquifer that is about 2,338 feet to 2,375 feet above sea-level, the water-level in the wells being about 2,366 feet to 2,396 feet above sea-level. The well on the NW.$\frac{1}{4}$, section 4, passed through a thin coal seam at a depth of 200 feet, and the water is usually light brown but is occasionally colourless. The bottom of the well is about 2,135 feet above sea-level and is probably in the upper part of the Bearpaw formation. Water-level in this well is about 2,195 feet above sea-level. No information is available as to the nature of the aquifer, but it is assumed to be sand.

Township 20, Range 7

Vermilion hills occupy the northern part of the township and rise to elevations of over 2,500 feet above sea-level. South of Vermilion hills most of the country is over 2,400 feet above sea-level, but the relief is generally not very great and much of the central part of the township is rolling country. On and near the northern boundary the surface is dissected by the coulées that form part of the northward slope of Vermilion hills. There are no permanent streams in the township and surface run-off is into low, marshy areas. The entire township is overlain by moraine which in turn is underlain by the Eastend formation.

Very few well records were obtained from the central and eastern parts of this township, which are very sparsely settled. In the southern half of the township most of the wells are less than 35 feet deep and many of them are seepage wells,

but an aquifer at an elevation of about 2,370 feet above sea-level supplies water to several wells. A well 85 feet deep in the SE.$\frac{1}{4}$, section 2, obtained water too laxative for use and several dry holes were put down on this quarter section. Springs, the water from which is soft, are reported in the NW.$\frac{1}{4}$, section 9, and the SE.$\frac{1}{4}$, section 5, and a spring, the water from which is fairly hard, is reported on the SW.$\frac{1}{4}$, section 4. These springs probably issue from water-bearing beds of sand or gravel in the clays of the glacial drift.

In the northern part of the township ground water conditions are very unfavourable and many dry holes have been put down. An unusual feature of a well in the SE.$\frac{1}{4}$, section 26, is the presence of dry sands below a depth of about 70 feet. Dry sand pockets in clay were passed through by a well on the SW.$\frac{1}{4}$, section 33. Numerous springs in this part of the township form an important source of water supply, but in many places water must be hauled to the farms. No producing wells in this township obtain water from the bedrock. A well on the SE.$\frac{1}{4}$, section 26, passed through "white soapstone" at a depth of 40 feet to 65 feet, but obtained no water. The well on the NW.$\frac{1}{4}$, section 25, 458 feet deep, also passed through "white soapstone". No appreciable amount of water was found below a depth of 16 feet in this well, although sand was encountered at a depth of 202 feet to 208 feet. The Thickness of the drift in the well on the SE.$\frac{1}{4}$, section 26, is 65 feet and in the well on the NW.$\frac{1}{4}$, section 25, is about 100 feet. The thickness elsewhere is not known, but it appears to be at least 80 feet in the south and the northwest.

Township 20, Range 8

The southwestern part is high and hilly and rises to over 2,550 feet above sea-level. The northern part is formed by the valley slopes of South Saskatchewan river. Water-level in the river is about 600 feet below prairie-level and the slopes to the river are steep. Near the western boundary of the township the

valley of an intermittent stream extends back for over 6 miles from the river.

Between the valley slopes and the hilly area in the southwest the country is rolling. Drainage and surface run-off is to South Saskatchewan river. Elevations within the township range from about 1,710 feet above sea-level in the river valley to over 2,550 feet above sea-level in the southwest corner of the township. In the valley slopes of South Saskatchewan river boulder clay or till overlies the Bearpaw formation which is exposed in the lower parts of the river banks. The remainder of the township is underlain by moraine. The Eastend formation lies upon the Bearpaw formation in the higher parts of the township. Ground water conditions are not good in this township. Most of the producing wells are shallow seepage wells. Many dry holes from 50 feet to 375 feet deep were put down. The well on the NW.$\frac{1}{4}$, section 23, 110 feet deep, is the only well over 50 feet deep that obtained good water, but the supply in this well is only about 2 barrels a day. A well on the NW.$\frac{1}{4}$, section 12, obtained very bitter and "alkaline" water at a depth of 32 feet. A spring is reported on the NW.$\frac{1}{4}$, section 28, and other springs probably occur in some of the coulées that lead north to South Saskatchewan river.

The deepest well in the township is the dry hole on the NW.$\frac{1}{4}$, section 28. No log of this well is available, but it is probable that it passed into the Bearpaw shale as the bottom of the well is about 1,725 feet above sea-level.

Township 20, Range 9

The land surface is very much dissected by deep coulées or the valleys of intermittent streams which extend back several miles from South Saskatchewan river. The surface of the entire township slopes towards the river valley or to the valley of the tributary creeks. In the southwest elevations of over 2,500 feet

above sea-level occur. The areas near South Saskatchewan river between the creek valleys are comparatively flat and a narrow bench adjacent to the river a little below 1,800 feet above sea-level is also comparatively flat.

Moraine underlies about 2 square miles in the southeastern corner of the township, and the remainder of the township, except the part in the river valley where bedrock is at the surface, is underlain by boulder clay or glacial till.

In sections 3 to 6 the ground water supply is not very good, but it is supplemented by several springs. In the remainder of the township the producing wells in the drift are less than 25 feet deep. In three wells 52 feet to 115 feet deep, water was either absent or not of good quality.

In sections 3 to 6 three wells and a spring apparently obtain water, which is reported as soft and slightly "alkaline", from the Eastend formation. The aquifer supplying the well on the SE.$\frac{1}{4}$, section 5, is about 2,355 feet above sea-level. The aquifer that supplies the spring and the other two wells is about 2,257 feet to 2,290 feet above sea-level.

Two wells are thought to obtain water from sands in the Bearpaw formation. The well on the NW.$\frac{1}{4}$, section 20, is filled in and the nature of the water is unknown. The aquifer is about 1,610 feet above sea-level. In the well on the SW.$\frac{1}{4}$, section 20, the water is soft and the elevation of the aquifer is about 1,753 feet above sea-level. Although the wells are on adjoining quarter sections they appear to draw their water from different aquifers. Water-level in the wells differs by about 57 feet.

Township 21, Range 7

Ground surface over most of the township is flat to gently rolling with elevations ranging from 1,950 feet above sea-level to 2,100 feet above sea-level. In the northern half of the township the slopes to South Saskatchewan river are very

gentle, but south of the creek that enters the river near the northern boundary of section 18, the slopes are steep. The slope upwards to Vermilion hills occupies a strip from 1 to 2 miles wide, near the southern boundary of the township. The land surface within this strip rises from about 2,100 feet to nearly 2,500 feet above sea-level. An intermittent stream about 3 miles long drains a small area in the western part. A part of the eastern area drains to Thunder creek and a narrow, low-lying area in the north receives surface run-off in the vicinity. With these exceptions drainage is to South Saskatchewan river.

In the southern part of the township the ground water in the glacial drift is generally "alkaline". On the northward slope of Vermilion hills there are several springs, and in the southwest the water of these springs is hard and "alkaline". In the northern two-thirds of the township the wells in the glacial drift are less than 35 feet deep. Several springs occur in and near the valley of the intermittent stream in the west. In several of the shallow wells the water is comparatively soft.

Three wells are known to produce water from bedrock. The well on the NE.$\frac{1}{4}$, section 9, 390 feet deep, and the well on the NW.$\frac{1}{4}$, section 36, 382 feet deep, are thought to obtain soft water from sands in the Bearpaw formation at 1,668 feet and 1,644 feet above sea-level, respectively, the elevation of the water-level in the wells being 2,000 feet and 1,986 feet above sea-level, respectively. The well on the SE.$\frac{1}{4}$, section 27, obtained brown water from an aquifer that is probably a coal seam at an elevation of about 1,920 feet above sea-level, water-level being about 1,990 feet above sea-level. The water of a well on the SE.$\frac{1}{4}$, section 28, is also reported to be brown. Both these wells probably obtain water from the Eastend formation. The water in the well on the NE.$\frac{1}{4}$, section 9, contains a much large proportion of common salt than the normal deep well water in the Darmody-Riverhurst artesian

area and it is probable that the Bearpaw sands do not extend much farther south than township 21.

Township 21, Range 8

Only about 2½ square miles in the southeast corner of this township lies in this municipality. The entire area is within the valley of South Saskatchewan river and the river slopes are steep. Elevations range from about 2,350 feet at the southeast corner to about 1,710 feet at water-level in the river. In sections 1 and 12 the comparatively flat land that borders the river extends back to about half a mile from the water edge, elsewhere the slopes are steep. There are no houses or wells in the area.

Township 21, Range 9

Parts of sections 1 to 5, comprising an area of about 2½ square miles, are included in the municipality. The entire area is within the valley of South Saskatchewan river. Elevations range from a little over 2,100 feet above sea-level at the southern boundary to about 1,720 feet above sea-level at the river bank. The valley slopes are steep, especially in the eastern part of the area, but there is a gently sloping strip of land, with an average width of a little less than half a mile, that borders the river. There are no houses in the area, which is suitable only for ranching, and no well records were obtained.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF VERMILION HILLS, NO. 195, SASKATCHEWAN

West of 3rd meridian — Township / Range	19 / 7	19 / 8	19 / 9	20 / 7	20 / 8	20 / 9	21 / 7	21 / 8	21 / 9	Total No. in Municipality
Total No. of Wells in Township	48	49	55	59	30	30	36	0	0	307
No. of wells in bedrock	0	0	4	1	0	6	3	0	0	14
No. of wells in glacial drift	48	49	47	58	30	28	32	0	0	292
No. of wells in alluvium	0	0	0	0	0	0	0	0	0	0
Permanency of Water Supply										
No. with permanent supply	40	38	49	36	18	24	33	0	0	238
No. with intermittent supply	5	5	6	11	5	5	2	0	0	39
No. dry holes	3	6	0	12	7	1	1	0	0	30
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	3	18	6	9	6	5	0	0	52
No. of non-artesian wells	40	40	37	41	14	23	30	0	0	225
Quality of Water										
No. with hard water	37	32	47	40	23	20	29	0	0	228
No. with soft water	8	11	8	7	0	9	6	0	0	49
No. with salty water	0	0	0	0	1	0	0	0	0	1
No. with "alkaline" water	3	4	21	6	3	13	12	0	0	62
Depths of Wells										
No. from 0 to 50 feet deep	39	43	34	50	25	22	30	0	0	243
No. from 51 to 100 feet deep	7	6	9	6	2	5	3	0	0	38
No. from 101 to 150 feet deep	2	0	11	2	1	1	1	0	0	18
No. from 151 to 200 feet deep	0	0	0	0	0	1	0	0	0	1
No. from 201 to 500 feet deep	0	0	1	1	1	1	2	0	0	6
No. from 501 to 1,000 feet deep	0	0	0	0	0	1	0	0	0	1
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the water is used										
No. usable for domestic purposes	34	38	36	33	21	21	16	0	0	199
No. not usable for domestic purposes	11	5	19	14	2	8	19	0	0	78
No. usable for stock	44	43	55	44	22	26	35	0	0	269
No. not usable for stock	1	0	0	3	1	3	0	0	0	8
Sufficiency of Water Supply										
No. sufficient for domestic needs	33	35	34	28	15	18	15	0	0	178
No. insufficient for domestic needs	12	8	21	19	8	11	20	0	0	99
No. sufficient for stock needs	37	29	37	20	11	15	29	0	0	178
No. insufficient for stock needs	8	14	18	27	12	14	6	0	0	99

ANALYSES AND QUALITY OF WATER

General Statement

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

Total Dissolved Mineral Solids

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

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

Mineral Substances Present

Calcium and Magnesium

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

Sodium

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

Sulphates

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

Chlorides

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

Iron

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

Hardness

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

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

Analyses of Water Samples from the Municipality of Vermilion Hills, No. 195, Saskatchewan.

	LOCATION					Depth of Well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of Water.
No.	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alka-linity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	SE.	23	19	7	3	Spring	290										256	151	10	73			19	10		x-1
2	SE.	23	19	7	3	Spring	115										101	44	10	30			9	3		x-1
3	SE.	23	19	7	3	Slough	710										613		279	194	64		65	11		x-1
4	SW.	9	19	8	3	Lake	22,130										19,055		30	395	9,796		8,271	563		x-1
5	NW.	8	19	8	3	Spring	1,080										1,013		414		99		189	13		x-1
6	NW.	4	19	9	3	340	1,880	130	130	nil	10	445	60	29	980	805	1,914		146		86	472	1,193	17		x-2
7		16	19	9	3	Lake	340										237	87	2	94		42		14		x-1
8	NE.	28	19	9	3	147	760												(4)		(5)	(2)	(1)	(3)		x-2
9	NE.	3	20	7	3	18	3,771											(5)	(1)		(2)		(3)		(4)	x-1
10	NW.	25	20	7	3	16	17,174				70	30	524	1562	10696	3993	15,059	30	1,231		4,663		9,025	115		x-1
11	NE.	9	21	7	3	390	1,580	330				940					1,540					996		554		x-3
12	NE.	34	21	7	3	18	394				2															x-1

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

Analyses Nos. 8 and 9, by Provincial Analyst, Regina; Analyses Nos. 1 -5, and 7, by Canadian National railways; Analysis No. 10, by Supervisory Engineer, Calgary; Analysis No. 12, by Central Experimental Farm, Ottawa.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The composition of ground water in the unconsolidated deposits varies widely. The glacial drift consists of a heterogeneous mass of material the chemical composition of which differs from place to place. Part of the material is thought to have been transported for considerable distances by the ice-sheet, part to have been of local origin. The size of grain and porosity of the sediment, and the consequent rate of movement of the water through the sediments generally influence the composition of ground water. Topographical position also appears to influence to some extent the velocity of flow and the composition of ground water.

Most of the ground water in the glacial drift is hard. Sodium sulphate is usually present in ground water from the glacial drift, but is usually less abundant than the sulphates of calcium and magnesium. The laxative properties of some waters from the drift is due to sodium sulphate and magnesium sulphate. Magnesium sulphate in considerable amounts makes water bitter; sodium chloride in considerable amounts gives a salty taste to the water, but ground water from the drift generally contains little sodium chloride; sodium carbonate gives water a flat "soda" taste. Small amounts of sodium sulphate do not affect the taste of water noticeably. Calcium sulphate and the carbonates of calcium and magnesium are practically tasteless.

Analyses Nos. 1, 2, and 5 in the table are of spring water. Sodium chloride is very low in all three, being from 3 to 13 parts a million. The analyses indicate two types of water. Analyses Nos. 1 and 2, type 1, show waters that contain chiefly the carbonates of calcium and magnesium; they contain an unusually small proportion of dissolved solids and little or none of the sulphates of sodium, calcium, and magnesium. If these waters were boiled they would be very soft. Analysis No. 5, type 2, shows a spring water that contains much more dissolved solids than that of

type 1. In this water calcium and magnesium sulphates are present in solution and the water will not be softened by boiling. The unusual chemical purity of the water in analyses 1 and 2 may be due to rapid underground circulation of water towards the low area north and east of the springs. The water for analysis No. 5 came from a spring in a low-lying area in which there is a small lake and ground water circulation is probably slower than in the area from which the samples were taken for analyses 1 and 2.

Analysis No. 3 is of water from a slough on the same quarter section as the first two springs mentioned. This slough water is much less pure chemically than the spring water, but is unusually pure for water of this type. The water is a combination of the sulphate and carbonate types. Boiling would remove a considerable proportion of the hardness.

Analysis No. 4 shows the presence of a very large proportion of dissolved solids, the greater part of which is the sulphates of sodium and magnesium. The water is excessively hard, laxative, and bitter, and is quite unfit for use even for stock. The lake lies in a basin in which there is no through drainage. Analysis No. 7, is in general similar to analysis No. 1; this water would be very soft after boiling. The rapid run-off from the hill to the southeast may influence the composition of the water in this lake. The sample was taken on April 10, and surface run-off may also have affected the composition of the water.

The water from wells in the drift shows great variation in composition. Analysis No. 12 shows water that contains an unusually small amount of dissolved solids. The well is on the slope to a depressed area where circulation of ground water may be comparatively rapid. Analysis No. 9 is typical of many of the waters found in the glacial drift. The water is excessively hard and contains chiefly the sulphates of sodium, calcium and magnesium, with carbonates and chlorides subordinate. The water is probably

slightly laxative and is not good for human use. Analysis No. 10 is that of a sulphate water that is exceedingly hard, is decidedly laxative, and is quite unfit for any ordinary use. The sample was taken at a depth of only 16 feet from a well put down on the flank of one of the high locations in Vermilion hills, and the unusually high content of dissolved solids can best be explained by poor circulation conditions in the drift at that point and by the presence of soluble matter in unusually large proportions in the glacial drift.

For irrigation purposes sodium carbonate or black alkali is the most undesirable constituent of water. In the analyses referred to above sodium carbonate is either absent or present only in very small amounts. Sodium sulphate, "white alkali", is harmful to vegetation, but is much less harmful than sodium carbonate. Of the waters in the table of analysis those represented by analyses Nos. 1, 2, 3, 7, and 12 would be excellent for irrigation. Analysis No. 5 represents a water that is good for irrigation, but is not quite so good as Nos. 1, 2, 3, 7, and 12. Analysis No. 9 represents a water that could not be long used for irrigation unless drainage conditions were unusually good. Analyses Nos. 4 and 10 represent waters that are not suited for irrigation purposes.

Water from the Bedrock

Analyses Nos. 6 and 8 are of water from the Eastend formation. Sodium sulphate and sodium carbonate are the chief constituents. Both waters are comparatively soft. Analyses No. 8 is of a water that is excellent for washing and drinking, but which is unsuitable for irrigation. Analysis No. 6 is of a water that is slightly hard, is suitable for drinking, but is laxative if consumed in large amounts, and is not suitable for irrigation.

Analysis No. 11 is of water from the Bearpaw sands. The well from which the water came is thought to be in the Darmody-

Riverhurst artesian area. The water of most of the wells in that artesian area contains sodium sulphate, sodium carbonate, and sodium chloride, the relative abundance being in the order given. Analysis No. 11 shows that sodium sulphate is absent and that sodium chloride is present in much larger proportion than in most of the well waters in the artesian area. The nature of the water seems to show that the well is not far from the limit of the artesian area. The water is very soft, can be drunk by man or animals, but is poor for irrigation purposes as it contains so much sodium carbonate.

WELL RECORDS—Rural Municipality of VERMILION HILLS, NO. 195, 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	NW.	1	19	7	3	Dug	10	2,330	- 3	2,327	10	2,320	Glacial drift	Fairly soft		D, S	Supply insufficient.
2	NE.	2	"	"	"	Bored	52	2,340	- 38	2,302	52	2,288	Glacial drift	Hard, iron	44	D, S	Sufficient supply.
3	NW.	2	"	"	"	Bored	60	2,350	- 30	2,320	60	2,290	Glacial gravel	Hard, iron	42	D, S	Supply sufficient. Several dry holes.
4	SW.	5	"	"	"	Dug	9	2,290	- 6	2,284	9	2,281	Glacial sand	Very hard	50	D, S	Sufficient for 30 head stock. 5 springs also.
5	NE.	12	"	"	"	Dug	13	2,335	- 10	2,325	13	2,322	Glacial sand	Hard		D	Supply sufficient. Another seepage well in slough also used.
6	SW.	14	"	"	"	Dug	16	2,420	- 10	2,410	16	2,404	Glacial sand	Fairly soft	44	S	Seepage well; supply insufficient.
7	NW.	15	"	"	"	Dug	8	2,400	- 4	2,396	8	2,392	Glacial sand	Hard	47	S	Supply insufficient.
8	NE.	15	"	"	"	Dug	6	2,400	- 4	2,396	6	2,394	Glacial sand	Fairly soft	48	D, S	Dugout used. Supply sufficient.
9	SE.	16	"	"	"	Dug	22	2,390	- 9	2,381	22	2,368	Glacial drift	Hard	40	D, S	Another well 27 feet deep also used. Supply sufficient.
10	NW.	17	"	"	"	Bored	122	2,340	- 52	2,288	122	2,218	Glacial drift	"Alkaline"			
11	NW.	18	"	"	"	Dug	8	2,345	- 5	2,340	8	2,337	Glacial sand	Fairly hard	50	D, S	Sufficient supply.
12	NE.	19	"	"	"	Dug	20	2,320			20	2,300	Glacial sand	Hard	42	S	Sufficient for stock only.
13	SE.	20	"	"	"	Dug	18	2,320	- 14	2,306	10	2,310	Glacial sand	Fairly hard		D, S	Supply insufficient. Dry hole 80 feet deep.
14	SW.	21	"	"	"	Dug	12	2,340	- 11	2,329	12	2,328	Glacial sand	Hard	42	D	Sufficient for house only. Another seepage well, 10 feet deep for stock.
15	SE.	21	"	"	"	Dug	20	2,390	- 12	2,378	20	2,370	Glacial sand	Fairly hard		D, S	Supply sufficient.
16	SE.	22	"	"	"	Dug	9	2,350	- 5	2,345	9	2,341	Glacial sand	Fairly hard		D, S	Supply sufficient.
17	SE.	22	"	"	"	Bored	30	2,362	- 25	2,337	30	2,332	Glacial sand	Fairly hard		D	Sufficient for house only. Two other wells for stock. Dry hole 110 feet deep.
18	SW.	23	"	"	"	Dug	14	2,345	- 11	2,334	14	2,331	Glacial sand	Fairly hard		D, S	Supply sufficient.
19	SE.	23	"	"	"	Dug	6	2,360	- 4	2,356	6	2,354	Glacial sand	Soft		D, S	Supply sufficient. Spring near well.
20	SW.	24	"	"	"	Dug	12	2,350	- 8	2,342	12	2,338	Glacial drift	Soft		D, S	Supply sufficient.
21	SW.	24	"	"	"	Bored	53	2,370	- 3	2,367	28	2,342	Glacial sand	Soft			C. N. R. well. Large supply.
22	SW.	24	"	"	"	Bored	100	2,360	- 60	2,300	100	2,260	Glacial drift	Hard, "alkaline"		S	Supply sufficient for stock. Another well 28 feet for house.
23	SW.	27	"	"	"	Dug	15	2,370	- 8	2,362	15	2,355	Glacial drift	Hard, cloudy	40	D, S	Two other seepage wells for stock. Supply usually sufficient.
24	SE.	30	"	"	"	Dug	20	2,315	- 10	2,305	20	2,295	Glacial sand	Fairly hard	42	D, S	Supply sufficient.
25	NW.	30	"	"	"	Bored	20	2,340	- 10	2,330	20	2,320	Glacial sand	Hard	40	D, S	Supply sufficient. Sticky clay at depth which cannot be dug out.
26	SW.	36	"	"	"	Dug	15	2,328	- 3	2,325	12	2,316	Glacial sand	Hard	46	D, S	Two other wells 70 feet and 15 feet deep; also dugout. Supply sufficient.

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 VERMILION HILLS, NO. 195, 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
27	NE.	36	19	7	3	Dug	18	2,350	- 6	2,344	18	2,332	Glacial sand	Hard, "alkaline"	37	D, S	Another seepage well 30 feet deep. Supply barely sufficient.
1	SW.	2	19	8	3	Dug	10	2,340	- 7	2,333	10	2,330	Glacial sand	Soft, iron	46	D, S	Supply sufficient.
2	NW.	3	"	"	"	Dug	24	2,400	- 23	2,377	24	2,376	Glacial sand	Fairly soft	41	D, S	Supply sufficient.
3	SE.	4	"	"	"	Dug	9	2,410	- 7	2,403	9	2,401	Glacial sand	Soft		D, S	Sufficient for 20 head stock.
4	SW.	5	"	"	"	Bored	10	2,390	- 8	2,382	10	2,380	Glacial sand, gravel	Hard	41	D, S	Supply sufficient.
5	SW.	5	"	"	"	Dug	6	2,423	- 4	2,419	6	2,417	Glacial sand	Hard, "alkaline"	47	D, S	Supply sufficient with spring.
6	SW.	10	"	"	"	Dug	13	2,375	- 8	2,367	13	2,362	Glacial sand	Hard	42	D, S	Supply sufficient.
7	NW.	11	"	"	"	Dug	12	2,380	- 8	2,372	12	2,368	Glacial sand	Fairly hard	41	D, S	Sufficient for 4 head stock.
8	SE.	13	"	"	"	Bored	76	2,340	- 70	2,270	76	2,264	Glacial sand	Hard	42	D, S	Sufficient for house. Another seepage well 10 feet deep for stock.
9	NW.	13	"	"	"	Dug	55	2,340	- 43	2,297	55	2,285	Glacial sand	Hard, "alkaline"	42	S	Another well 13 feet deep; water soft, for house. Supply sufficient.
10	SW.	14	"	"	"	Dug	11	2,385	- 7	2,378	11	2,374	Glacial sand	Fairly hard	42	D, S	Supply sufficient.
11	NE.	14	"	"	"	Dug	10	2,350	- 8	2,342	10	2,340	Glacial sand	Soft	41	S	Sufficient for 20 head stock. Another well for house.
12	SE.	15	"	"	"	Bored		2,400						Fairly hard	45	D	Small supply.
13	SW.	15	"	"	"	Bored	32	2,500	- 10	2,490	32	2,468	Glacial sand	Soft	43	D, S	Supply not sufficient in dry seasons.
14	NW.	15	"	"	"		30	2,500									One of several dry holes. Water from spring on NE. ¼, of section 16.
15	NW.	16	"	"	"	Dug	15	2,500	- 13	2,487	15	2,485	Glacial sand	Hard	41	D, S	Supply sufficient.
16	SW.	16	"	"	"	Dug	15	2,520	- 11	2,509	15	2,505	Glacial drift	Hard	42	D	Small supply. Another well 10 feet deep has a large supply of hard "alkaline" water.
17	SW.	17	"	"	"	Dug	12	2,450	- 6	2,444	12	2,438	Glacial drift	Hard		D, S	Supply insufficient.
18	NW.	17	"	"	"	Dug	15	2,515	- 4	2,511	15	2,500	Glacial drift	Fairly hard	44	D, S	Another seepage well for stock.
19	NW.	18	"	"	"	Dug	10	2,485	- 6	2,479	10	2,475	Glacial sand	Fairly hard	44	D, S	Another seepage well for stock. Supply not always sufficient.
20	SW.	18	"	"	"	Bored	65	2,440	- 20	2,420	65	2,375	Glacial sand	Hard	41	D, S	Supply large, sufficient.
21	SW.	23	"	"	"	Dug	23	2,385	- 21	2,364	23	2,362	Glacial drift	Hard, "alkaline"	40	D	Sufficient for house. Spring for stock.
22	SE.	23	"	"	"	Bored	42	2,340	- 7	2,333	42	2,298	Glacial drift	Hard	39	D, S	Two other wells for stock supply. Supply sufficient.
23	SW.	24	"	"	"	Dug	17	2,340	- 12	2,328	17	2,323	Glacial sand	Fairly soft	44	D, S	Supply sufficient.
24	SE.	25	"	"	"	Dug	20	2,340	- 13	2,327	20	2,320	Glacial drift	Fairly hard	42	D, S	Another well for house. Supply insufficient.
25	NE.	25	"	"	"	Dug	10	2,350	- 5	2,345	10	2,340	Glacial sand	Hard	44	D, S	Another seepage well 15 feet deep. Supply sufficient. Dry hole, 70 feet deep.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of VERMILION HILLS, NO. 195, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
26	NE.	26	19	8	3	Dug	16	2,310	- 7	2,303	16	2,294	Glacial sand	Hard, slightly "alkaline"	39	D, S	Another well 29 feet deep used for house. Supply sufficient.
27	SW.	26	"	"	"	Dug	12	2,335	- 7	2,328	12	2,323	Glacial sand	Fairly hard slightly "alkaline"	42	D, S	Another seepage well on NW.¼ of section 26, for house. Supply sufficient.
28	SE.	36	"	"	"	Bored	16	2,345	- 7	2,338	16	2,329	Glacial sand	Fairly soft	40	D, S	Supply sufficient. Dry holes to 80 feet deep.
1	SE.	3	19	9	3	Bored	90	2,395	- 86	2,309	90	2,305	Glacial drift	Hard, "alkaline", iron	42	D, S	Sufficient for 4 head stock. Spring also used for stock.
2	SE.	4	"	"	"	Sandpoint	16	2,395					Glacial sand	Slightly hard	42	D, S	Supply sufficient. Spring for stock use.
3	NE.	4	"	"	"	Dug	28	2,500	- 5	2,495	28	2,472	Glacial sand	Hard, "alkaline"	50	D, S	Supply sufficient.
4	NW.	4	"	"	"	Drilled	340	2,475	-280	2,195	340	2,135	Bearpaw	Fairly soft, brown	43	D, S	Very large supply. Thin coal seam at 200 feet. #.
5	NE.	6	"	"	"	Bored	60	2,500	- 50	2,450	60	2,440	Glacial drift	Hard, "alkaline"	42	S	Another seepage well 15 feet deep. Supply insufficient.
6	SE.	7	"	"	"	Dug	16	2,475	- 10	2,465	16	2,459	Glacial drift	Hard, "alkaline"	42	S	Supply insufficient.
7	NE.	7	"	"	"	Bored	40	2,490	- 24	2,466	40	2,450	Glacial sand	Hard		D, S	Supply insufficient.
8	NW.	8	"	"	"	Bored	28	2,480	- 14	2,466	28	2,452	Glacial drift	Hard, "alkaline"	42	S	Another well 15 feet deep for stock. Supply insufficient.
9	NE.	9	"	"	"	Dug	12	2,480	- 6	2,474	12	2,468	Glacial sand	Hard	48	D, S	Another well 20 feet deep for stock. Supply sufficient.
10	NW.	10	"	"	"	Dug	30	2,500	0	2,500	30	2,470	Glacial sand	Hard	44	D, S	Another well 25 feet deep for stock. Supply sufficient.
11	NE.	10	"	"	"	Dug	8	2,450	- 5	2,445	8	2,442	Glacial sand	Hard, iron, "alkaline"	44	D, S	Supply sufficient.
12	SE.	14	"	"	"	Bored	26	2,410	- 22	2,388	26	2,384	Glacial sand	Hard, "alkaline"	41	S	Farm deserted.
13	NE.	15	"	"	"	Bored	20	2,405	- 6	2,399	20	2,385	Glacial sand	Hard	48	D	Another well 30 feet deep for stock. Several wells about 70 feet deep; water unusable. Supply insufficient.
14	NW.	15	"	"	"	Dug	33	2,470	- 25	2,445	33	2,437	Glacial sand	Hard	44	D, S	Another well 12 feet deep. Supply not always sufficient.
15	SE.	17	"	"	"	Bored	130	2,440			130	2,310	Glacial drift	Hard, "alkaline"		S	Two seepage wells for house. Supply insufficient.
16	NE.	17	"	"	"	Dug	20	2,490	0	2,490	20	2,470	Glacial drift	Fairly soft			Seepage well. Supply insufficient.
17	NE.	18	"	"	"	Bored	140	2,510	-110	2,400	140	2,370	Glacial sand	Hard		D, S	Supply sufficient.
18	SE.	19	"	"	"	Bored	119	2,500	- 76	2,424	119	2,381	Glacial sand	Hard, iron, "alkaline"	41	D, S	Dugout for stock. Supply insufficient.
19	NW.	19	"	"	"	Bored	123	2,490	-103	2,387	123	2,367	Glacial sand	Hard, "alkaline"	43	D, S	Supply sufficient.
20	NW.	20	"	"	"	Bored	75	2,500	- 45	2,455	75	2,425	Glacial drift	Hard, "alkaline"	42	D, S	Supply sufficient.
21	SW.	20	"	"	"	Bored	52	2,500	- 46	2,454	52	2,448	Glacial sand	Fairly soft	42	D, S	Supply sufficient.
22	NE.	20	"	"	"	Bored	80	2,500	- 34	2,466	80	2,420	Glacial drift	Hard, "alkaline"	42	D, S	Supply sufficient.
23	SE.	20	"	"	"	Bored	117	2,500	-113	2,387	117	2,383	Glacial sand	Fairly soft	43	D, S	Supply insufficient.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of VERMILION HILLS, NO. 195, 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.	22	19	9	3	Dug	16	2,435	- 11	2,424	16	2,419	Glacial sand	Hard, "alkaline"	38	D, S	Supply sufficient.
25	NE.	22	"	"	"	Dug	16	2,430	- 8	2,422	16	2,414	Glacial sand	Hard, "alkaline"	41	D, S	Supply sufficient.
26	SW.	27	"	"	"	Bored	110	2,430	- 83	2,347	110	2,320	Glacial drift	Hard, "alkaline"	42	D, S	Supply sufficient.
27	NE.	27	"	"	"	Bored	63	2,550	- 57	2,493	60	2,490	Glacial sand	Hard	42	D, S	Another well 22 feet deep, also used. Supply insufficient.
28	NW.	27	"	"	"	Dug	15	2,420	- 14	2,406	15	2,405	Glacial till	Hard, "alkaline"	45	D	Another well on SE.¼, section 27, for stock. Supply insufficient.
29	NE.	28	"	"	"	Bored	147	2,522	-126	2,396	147	2,375	Eastend sand	Soft	43	D, S	Supply insufficient. #.
30	NE.	28	"	"	"	Bored	102	2,440	- 74	2,366	102	2,338	Eastend sand	Soft	43	S	
31	SW.	28	"	"	"	Bored	122	2,490	- 92	2,398	122	2,368	Glacial drift	Hard, iron, "alkaline"	43	D, S	Supply insufficient. Another well in slough and one on NW.¼, section 28, for stock.
32	SE.	29	"	"	"	Bored	80	2,500	- 40	2,460	80	2,420	Glacial drift	Hard	43	D, S	Supply sufficient.
33	SE.	30	"	"	"	Bored	110	2,430			110	2,320	Glacial drift	Hard, "alkaline"	42	D, S	Supply sufficient.
34	SE.	31	"	"	"	Bored	63	2,445	- 58	2,387	63	2,382	Glacial drift	Hard, "alkaline"	42	D, S	Supply sufficient. Spring used for stock.
35	SW.	32	"	"	"	Bored	106	2,455	- 98	2,357	106	2,349	Glacial drift	Fairly soft, iron, "alkaline"	42	D, S	Supply sufficient. Spring for stock use.
36	NE.	33	"	"	"	Bored	77	2,431	- 70	2,361	77	2,354	Eastend sand	Soft	42	D, S	Sufficient for 10 head stock.
37	SE.	33	"	"	"	Bored	92	2,450	- 69	2,381	90	2,360	Glacial drift	Hard, "alkaline"	42	D, S	Sufficient for 20 head stock. Two shallow wells also used for stock.
38	NE.	34	"	"	"	Dug	15	2,395	- 10	2,385	15	2,380	Glacial sand	Hard, "alkaline"	40	D, S	Supply sufficient.
1	SE.	2	20	7	3	Dug	16	2,425			16	2,409	Glacial sand	Hard	43	D	Two other seepage wells for stock. Another well 85 feet deep; water laxative. Supply sufficient. Several dry holes.
2	NE.	3	"	"	"	Dug	14	2,400	- 6	2,394	14	2,386	Glacial drift				Farm deserted. Two other wells.
3	NE.	3	"	"	"	Dug	18	2,400	- 13	2,387	18	2,382	Glacial drift	Very hard			Niobe school well; #.
4	NE.	3	"	"	"	Dug	21	2,400	- 17	2,383	21	2,379	Glacial sand	Fairly hard	43	D	Another well 15 feet deep for stock. Supply sufficient.
5	SE.	3	"	"	"	Dug	18	2,440	- 6	2,434	18	2,422	Glacial drift	Very hard	45	D	A seepage well for stock 13 feet deep. Supply sufficient.
6	NE.	5	"	"	"	Dug	9	2,400	- 8	2,392	9	2,391	Glacial drift	"Alkaline"	48	D, S	Supply insufficient.
7	SE.	6	"	"	"	Bored	20	2,425	- 16	2,409	20	2,405	Glacial drift			D	Supply insufficient.
8	NW.	6	"	"	"	Bored	80	2,350			80	2,270	Glacial drift	Hard, slightly "alkaline"	42	D, S	Another seepage well 10 feet deep. Supply insufficient.
9	SW.	7	"	"	"	Dug	15	2,350	- 14	2,336	15	2,335	Glacial drift	Fairly soft		D, S	Another well 80 feet deep has large supply of good water.
10	SE.	9	"	"	"	Dug	24	2,400	- 12	2,388	24	2,376	Glacial drift	Hard	41	D, S	Another well in slough 35 feet deep. Sufficient for 40 head stock.

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WELL RECORDS—Rural Municipality of VERMILION HILLS, NO. 195, 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	NW.	9	20	7	3	Bored	24	2,390	- 10	2,380	26	2,364	Glacial drift	Hard		D, S	Sufficient supply. Spring on SE.¼ of section 5 and SW.¼ of section 4.
12	SE.	12	"	"	"	Dug	14	2,410	- 12	2,398	14	2,396	Glacial drift	Soft		D	Another seepage well 10 feet deep. Supply is barely sufficient. Dry hole.
13	NW.	12	"	"	"	Dug	30	2,400	- 26	2,374	30	2,370	Glacial sand	Hard	41	S	Another well 19 feet deep for house. Supply insufficient.
14	SW.	13	"	"	"	Bored	22	2,400	- 10	2,390	22	2,378	Glacial gravel	Fairly hard	41	D	Another well 130 feet deep caved in. Supply insufficient.
15	NE.	23	"	"	"	Dug	32	2,450	- 11	2,439	32	2,418	Glacial gravel	Hard	38	D	Seepage well 12 feet deep and spring for stock. Supply sufficient.
16	NW.	23	"	"	"	Dug	19	2,450	- 13	2,437	19	2,431	Glacial drift	Very hard	40	D, S	Stock use; seepage well and dams. Supply sufficient.
17	NE.	24	"	"	"	Dug	10	2,350	- 8	2,342	10	2,340	Glacial sand	Fairly hard	46	D, S	Supply sufficient.
18	SE.	24	"	"	"	Dug	14	2,350	- 12	2,338	14	2,336	Glacial sand	Slightly hard	42	D	Springs for stock. Supply sufficient.
19	NE.	25	"	"	"	Drilled	110	2,375			110	2,265	Glacial drift	Hard, iron	42	D	Spring for stock. Supply sufficient.
20	NW.	25	"	"	"	Drilled	458	2,445			20	2,425	Eastend and Bearpaw	"Alkaline"			Well drilled for oil and gas. #.
21	NE.	26	"	"	"	Dug	20	2,400	- 18	2,382	20	2,380	Glacial sandy clay	Fairly hard		D	Dugout for stock. Supply insufficient.
22	SE.	26	"	"	"	Dug	17	2,450	- 12	2,438	17	2,433	Glacial drift	Fairly hard	39	D	Many dry holes up to 85 feet deep. Supply insufficient.
23	SE.	31	"	"	"	Bored	80	2,400									One of many dry holes. Several other wells went dry after a few years.
24	NW.	32	"	"	"	Dug	12	2,300	- 10	2,290	12	2,288	Glacial drift	Hard			Large supply.
25	SW.	33	"	"	"	Dug	40										One of several dry holes.
26	NE.	33	"	"	"	Bored	33	2,500									Dry hole. Water hauled.
27	NE.	34	"	"	"	Dug	13	2,425	- 12	2,413	13	2,412	Glacial drift	Hard	40	D, S	Supply insufficient. Water hauled from spring.
28	SW.	34	"	"	"	Dug	22	2,500	- 21	2,479	22	2,478	Glacial drift	Hard		D	One of several seepage wells which failed in drought period. Water hauled.
29	SE.	35	"	"	"	Dug	14	2,400	- 8	2,392	14	2,386	Glacial drift	Hard	44	D	Another well 13 feet deep for stock. Dry hole 90 feet deep. Water hauled for stock.
30	NW.	36	"	"	"	Dug	15	2,350	- 10	2,340	15	2,335	Glacial drift	Hard	42	D, S	Spring in coulée for stock. Supply sufficient.
1	SE.	1	20	8	3	Dug	21	2,340	- 20	2,320	21	2,319	Glacial drift	Hard, slightly "alkaline"	40	D	Another seepage well for stock. Supply insufficient.
2	NW.	2	"	"	"	Dug	20	2,340	- 19	2,321	20	2,320	Glacial drift	Hard	54	D, S	Sufficient for house and 10 head stock. Water hauled.
3	NE.	10	"	"	"	Dug	20	2,350	- 19	2,331	20	2,330	Glacial drift	Hard		D, S	Another seepage well for stock. Supply insufficient.
4	NW.	12	"	"	"	Bored	30	2,340	- 16	2,324	30	2,310	Glacial drift	Hard		D, S	Another seepage well 12 feet deep. Dry hole 110 feet deep. Well 32 feet deep; water very bitter. Supply just sufficient.
5	NW.	13	"	"	"	Dug	27	2,340	- 16	2,324	27	2,313	Glacial drift	Very hard		D, S	Another seepage well for stock. Supply insufficient.
6	SW.	13	"	"	"	Bored	23	2,340	- 13	2,327	23	2,317	Glacial drift	Hard	38	D, S	Another seepage well 17 feet deep. Supply insufficient.

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WELL RECORDS—Rural Municipality of VERMILION HILLS, NO. 195, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
7	SE.	20	20	8	3	Bored	45	2,325	- 28	2,297	45	2,280	Glacial drift	Hard	40	D, S	Another well 17 feet deep. Supply sufficient. Dry holes to 80 feet.
8	SW.	20	"	"	"	Bored	20	2,325	- 5	2,320	20	2,305	Glacial drift	Hard, iron	42	D, S	Supply sufficient.
9	NW.	22	"	"	"	Dug	28	2,350	- 6	2,344	28	2,322	Glacial gravel, sand	Hard	40	D, S	Supply sufficient. Dry hole 100 feet deep.
10	NE.	23	"	"	"	Dug	22	2,340	- 9	2,331	22	2,318	Glacial drift	Hard	41	D, S	Supply sufficient.
11	NW.	23	"	"	"	Bored	110	2,350	- 70	2,280	110	2,240	Glacial drift	Hard, iron		D, S	Dry hole 50 feet deep. Supply insufficient.
12	SW.	23	"	"	"	Dug	30	2,350	- 28	2,322	30	2,320	Glacial sand	Very hard	42	D, S	Supply insufficient.
13	NW.	28	"	"	"	Bored	50	2,100	- 35	2,065	50	2,050	Glacial drift	Hard, slightly "alkaline"	41	D, S	Another well 35 feet deep. A spring and a dam also used. Dry hole 375 feet deep.
1	NW.	3	20	9	3	Bored	60	2,380			60	2,320	Glacial drift	Hard, "alkaline"	42	D, S	Spring on NE.¼, sec. 3, used for stock. Supply insufficient.
2	NE.	4	"	"	"	Dug	5	2,345	0	2,345	5	2,340	Glacial deposits	Hard, iron, "alkaline"		D, S	Three springs for stock. Supply sufficient.
3	SE.	5	"	"	"	Bored	40	2,395	- 30	2,365	40	2,355	Eastend	Soft, slightly "alkaline"	42	D, S	Supply sufficient.
4	NW.	5	"	"	"	Bored	63	2,320	- 33	2,287	63	2,257	Eastend sand	Slightly hard "alkaline"	42	S	Water in green sand. Supply sufficient.
5	SE.	6	"	"	"	Spring		2,280					Eastend (?)	Fairly soft, slightly "alkaline"	44	D, S	Supply sufficient.
6	SW.	6	"	"	"	Bored	60	2,350	- 56	2,294	60	2,290	Eastend	Soft, slightly "alkaline"	42	D, S	Spring also used. Supply sufficient.
7	NE.	7	"	"	"	Dug	10	2,330	- 4	2,326	10	2,320	Glacial drift	Hard, "alkaline"	42	S	Supply insufficient.
8	SE.	9	"	"	"	Bored	80	2,300									Dry hole. Dam for stock.
9	NE.	10	"	"	"	Dug	15	2,260	- 10	2,250	15	2,245	Glacial drift	Hard, "alkaline"		N	Another well 52 feet deep had bitter water.
10	NW.	14	"	"	"	Dug	12	2,180	- 9	2,171	12	2,168	Glacial drift	Hard		D	Dam used for stock. Supply insufficient.
11	NW.	16	"	"	"	Dug	14	2,230	- 2	2,228	14	2,216	Glacial drift	Soft		D, S	Well on NE.¼ of section 17 and dam also used Supply sufficient for 20 head stock.
12	SW.	17	"	"	"	Bored	115	2,240	- 95	2,145	115	2,125	Glacial drift	Hard, "alkaline"		N	Dam for stock. Supply insufficient.
13	NW.	20	"	"	"	Drilled	600	2,210	- 30	2,180	600	1,610	Bearpaw sand			N	Farm deserted. Well filled in.
14	SW.	20	"	"	"	Drilled	400	2,153	- 60	2,093	400	1,753	Bearpaw sand	Soft		D, S	Farm deserted. Large supply.
15	SE.	20	"	"	"	Dug	12	2,220	- 5	2,215	12	2,208	Glacial drift	Fairly soft	43	D, S	Well on NW.¼, section 21, and slough also used. Supply sufficient.
16	NW.	22	"	"	"	Dug	19	2,180	- 18	2,162	19	2,161	Glacial sand	Hard, "slightly "alkaline"	40	D	Supply insufficient.
17	NE.	23	"	"	"	Dug	15	2,200	- 9	2,191	15	2,185	Glacial drift	Hard		D	Supply insufficient.
18	SE.	23	"	"	"	Dug	15	2,220	- 13	2,207	15	2,205	Glacial drift	Hard, "alkaline"		D	Supply insufficient. Water hauled.
19	NE.	24	"	"	"	Dug	10	2,220	- 7	2,213	10	2,210	Glacial drift	Slightly hard		D, S	Sufficient for 12 head stock.

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WELL RECORDS—Rural Municipality of VERMILION HILLS, NO. 195, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
20	SE.	28	20	9	3	Dug	20	2,140	- 18	2,122	20	2,120	Glacial drift	Hard, "alkaline"		D, S	Sufficient for 3 head stock.
21	NE.	28	"	"	"	Dug	12	2,140	- 7	2,133	12	2,128	Glacial sand	Hard	42	D, S	Supply insufficient. Dry hole 20 feet deep.
22	SE.	33	"	"	"	Dug	20	2,125	- 14	2,111	20	2,105	Glacial sand	Fairly soft	40	D, S	Sufficient for 17 head stock.
23	NW.	34	"	"	"	Dug	12	2,120	- 10	2,110	12	2,108	Glacial sand	Fairly soft	42	D, S	Supply insufficient.
1	SE.	3	21	7	3	Dug	20	2,400	- 17	2,383	20	2,380	Glacial gravel	Hard, iron	41	D, S	Spring also used. Supply sufficient
2	NE.	5	"	"	"	Bored	60	2,145	- 55	2,090	60	2,085	Glacial drift	Hard, "alkaline"	43	S	Another well 22 feet deep for stock. Supply insufficient.
3	NW.	5	"	"	"	Bored	40	2,085	- 15	2,070	40	2,045	Glacial gravel	Hard		D, S	"Alkaline" springs on SW.¼, section 7; and SW.¼, section 5 and S½. of section 6 also used.
4	NE.	6	"	"	"	Bored	130	2,050									Dry hole.
5	NE.	7	"	"	"	Dug	15	2,065	- 13	2,052	15	2,050	Glacial drift	Hard	42	D, S	Another similar well. Supply sufficient.
6	SW.	9	"	"	"	Bored							Glacial drift	Hard, "alkaline"	44	S	No further information.
7	NE.	9	"	"	"	Drilled	390	2,058	- 58	2,000	380	1,668	Bearpaw sand	Very soft	43	S, D	Supply sufficient. #.
8	SW.	15	"	"	"	Dug	16	2,050	- 14	2,036	16	2,034	Glacial sand	Soft	42	D, S	Supply sufficient.
9	SW.	16	"	"	"	Dug	9	2,040	- 8	2,032	9	2,031	Glacial sand	Hard, "alkaline"	42	S	Another well 14 feet deep on SE.¼, section 17. Supply insufficient.
10	NE.	18	"	"	"	Dug	8	1,960	0	1,960	8	1,952	Glacial gravel	Fairly hard		D, S	Spring also used. Supply sufficient.
11	SE.	20	"	"	"	Bored	30	2,000	- 21	1,979	30	1,970	Glacial sand	Hard	42	D, S	Supply sufficient.
12	NE.	21	"	"	"	Dug	8	2,010	- 5	2,005	8	2,002	Glacial gravel	Hard, slightly "alkaline"	42	D, S	Spring also used for stock; supply insufficient.
13	NW.	21	"	"	"	Spring		2,060								D, S	Two springs on NE.¼ of section 20 also used. Supply sufficient.
14	SW.	22	"	"	"	Dug	15	2,045	- 14	2,031	15	2,030	Glacial sand	Hard, "alkaline"	42	S	Another well 10 feet deep for house. Supply sufficient.
15	SE.	27	"	"	"	Bored	100	2,020	- 30	1,990	100	1,920	Eastend	Soft, brown	43	D, S	Supply sufficient. Similar well on SE.¼, sec. 28.
16	NW.	27	"	"	"	Dug	16	1,985	- 3	1,982	16	1,969	Glacial sand	Hard	50	D, S	Supply sufficient.
17	SE.	28	"	"	"	Dug	16	2,050	- 14	2,036	16	2,034	Glacial drift	Hard	41	S	Another well on SE.¼, sec. also used. Supply sufficient.
18	NE.	33	"	"	"	Dug	16	2,000	- 12	1,988	16	1,984	Glacial drift	Hard	45	D, S	Supply sufficient.
19	NE.	34	"	"	"	Dug	18	1,950	- 15	1,935	18	1,932	Glacial drift				#.
20	NW.	36	"	"	"	Drilled	382	2,026	- 40	1,986	382	1,644	Bearpaw sand	Soft	44	D, S	Supply sufficient.
21	NE.	36	"	"	"	Bored	30	2,050	- 24	2,026	30	2,020	Glacial sand	Hard, "alkaline"	44	D, S	Supply sufficient.

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.