CANADA
DEPARTMENT OF MINES

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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF WHISKA CREEK No. 106 SASKATCHEWAN

BY

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

Water Supply Paper No. 117

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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 fine the approximate depth to a water-bearing horizon, be must learn: (1) the elevation of the site, and (2) the probable elevation of the water-bearing bed. The elevation of the well site is obtained by marking its position on the map, Figure 2, and estimating its elevation with respect to the two contour lines between which it lies and whose elevations are given on the figure. Where contour lines are not shown on the figure, the elevations of adjacent wells as indicated in the Table of Well Records accompanying each repc o 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-boaring 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. Fr 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 côteau. 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 Whiska Creek covers an area of 324 square miles in southwestern Saskatchewan. It is comprised of nine townships, described as tps. 10, 11, and 12, ranges 10, 11, and 12, W. 3rd mer. The centre of the municipality lies about 30 miles southeast of the city of Swift Current and 63 miles north of the International Boundary. The Meyronne branch of the Canadian Pacific railway crosses the central part of the municipality in an east-west direction. On this line are located the villages of Vanguard, Pambrun, and Neville. Notukeu creek enters the municipality in sec. 4, tp. 10, range 11, flows in a northeasterly direction through township 10, range 10, and leaves the municipality in sec. 12, tp. 11, range 10. Russell creek, an intermittent stream, runs through townships 11, ranges 10, 11, and 12. Another small, seasonally flowing creek rises in township 12, range 11, and flows southeasterly to join Russell creek in township 11, range 10. The valley of Notukeu creek has an elevation of 2,350 feet above sea-level, where it crosses the eastern boundary of the municipality. The creek flows between fairly steep banks in places, but in township 11, range 10, the valley widens to a broad plain on which is located the village of Vanguard. Russell creek and the other, above-mentioned, small creek flow through deeply eroded valleys in the northern and western uplands, but farther downstream the valleys are only slightly deeper than the surrounding lowlands. The land surface rises gradually in all directions from the valley of Notukeu creek. South and east of the creek the land is gently rolling, and rises to elevations of approximately 2,550 feet above sea-level in the southeast corner of the municipality. Similar elevations prevail in the rolling area intervening between Notukeu and Russell creeks. North of Russell creek, and along the central part of the western boundary, the surface rises rapidly to form rugged, steep-sided uplands, carved by many deep ravines. Elevations reach 2,900 feet in township 11, range 12, and nearly 3,000 feet on the hill-tops along the northern boundary.

The greater part of the water supply of this municipality is derived from wells. In some places small dams are constructed across coulées to conserve surface water for stock. On some other farms residents have found the supplies from wells inadequate for stock, and have excavated dugouts to store surface water. The existing wells of the area derive their supplies from Recent deposits along the creeks, from the glacial drift that covers the greater part of the area, and from the underlying Cypress Hills, Eastend, and Bearpaw bedrock formations.

Water-bearing Horizons in the Unconsolidated Deposits

Recent deposits floor Notukeu Creek valley for a width of approximately a mile in the southern part of township 10, range 11, and for a narrower width along the remainder of its course through the municipality. Similar deposits also occur along Russell creek, and the other small creek that joins it on the north. The deposits are chiefly composed of sandy clay, and probably do not exceed 20 feet in thickness at any point. Thin beds of sand are interbedded with the clays, and are generally water bearing. The few wells dug into Recent alluvium in this municipality have tapped sand aquifers at depths of 4 to 18 feet. Supplies from individual wells are usually sufficient for 10 to 20 head of stock. The water is of good quality for household use. Shallow seepage wells are also dug close to the stream channel, and derive water by direct seepage from the creeks. Residents in the vicinity of the creeks could obtain further supplies of water by digging wells into the Recent deposits. Such sand aquifers may not form continuous horizons, but should be found in most places. Water contained in shallow wells is easily polluted by decaying organic matter, and care should be exercised to keep the catchment area free from sewage or other contaminating material.

The glacial deposits that cover this area owe their origin to the great ice-sheet that moved across the province of Saskatchewan many thousands of years ago, and to the water derived from the melting of the ice. As the ice-sheet moved it laid down a layer of bluish grey boulder clay, generally referred to as till, over this municipality. The upper few feet of the till is light yellowish buff due to weathering. In the southwest corner the till may reach a thickness of 80 feet, but on the upland it is less than 25 feet thick. On many of the steeper slopes, and in places in Russell Creek valley, the till has been entirely eroded away, and the bedrock is exposed. Where the ice-sheet paused for considerable periods of time during its retreat there was deposited a thicker accumulation of boulder clay, sand, and gravel, partly sorted by the action of water issuing from the ice front. Such deposits are termed moraine and are characterized by numerous small hills and undrained hollows. Owing to the damming up of some of the natural drainage channels by the ice-sheet, and to the volume of water from the melting ice, glacial lakes were formed in several depressions. Such a lake extended along the present valley of Notukeu creek, and occupied the low plains area in township 11, range 10. Another smaller lake covered an area in the south-central part of township 11, range 11. The areal extent of these extinct glacial lakes is indicated by the presence of layers of dark-coloured, compact clays, overlying the boulder clay. These lake clays represent the fine sediments washed from the uplands and settled at the bottoms of the lakes. In a few places, particularly in township 12, range 10, the clays are sandy, but in most places the clays themselves are too compact to be water bearing, and the water is derived from sand beds that occur near the contact of the lake clays and the underlying boulder clay, and which have been tapped by wells between 14 and 35 feet deep. In places where no porous bed has been encountered at the base of the lake clays, wells have been dug deeper into the underlying boulder clay, where they have encountered water-bearing sand or gravel pockets. The deepest of the producing wells recorded in the lake-covered area is at Vanguard, and is 72 feet deep. Individual wells yield enough water for 10 to 45 head of stock, and the water is of good quality. A few dry holes have been sunk, but the condition is generally local, as water is to be expected at depths not exceeding that of the Vanguard well. A few test holes may be necessary in some places due to the fact that the individual water-bearing beds are not generally continuous over large areas.

The till and the moraine are more or less similar in that they both consist largely of boulder clay, through which are irregularly interspersed pockets and occasionally more extensive beds of sand and gravels that are water bearing. Moraine within the municipality is confined to two small areas, one occurring on the hill-top immediately southeast of Pambrun, and the other covering a larger area in the northeast corner of township 11, range 10, and the southeast corner of township 12, range 10, and extending into the municipality to the east. Although water-bearing sand and gravel pockets are generally more numerous in the moraine than they are in the till deposits, in these areas only two wells have tapped such aquifers. Several other wells have been sunk, but they passed through the glacial drift into the underlying Bearpaw bedrock formation without encountering sand or gravel. The sands and gravels do not form continuous horizons, but occur as localized pockets. Untapped aquifers doubtless exist in the moraine, and could be located by sinking a series of test holes to depths not exceeding 50 feet. Where these aquifers are found, supplies obtained should be more satisfactory than those obtained from the Bearpaw formation at greater depths.

A few wells in the highlands area derive water from gravel and sand pockets scattered through the till, but as good water supplies are obtainable from the underlying bedrock, the scattered aquifers in the drift are of less value than in other parts of the municipality. In each township a number of wells are drawing water from sands and gravel pockets in the till, and others obtain small supplies from the sandy clays. The depth at which the aquifers are found ranges from less than 10 feet to 50 feet, but is most commonly from 15 to 40 feet. The few wells scattered over the district do not supply enough water for local requirements, but usually sufficient water for 10 to 45 head of stock is obtainable from individual wells. Shallow wells have the disadvantage that their yields are more readily affected by prolonged drought than are the yields from deeper aquifers. Most of the water from this source is hard, and of good quality for household use, but a few wells at isolated points produce water with too high a dissolved mineral salt content to be used for drinking. The water derived from the clays is usually more highly mineralized than the water from sand or gravel beds, and supplies are usually smaller. Due to the irregular occurrence of porous beds in the boulder clay, their presence cannot be determined from the surface, and can be located only by testing. If further supplies of water from the drift are desired, shallow holes should be sunk with a test auger until a suitable water-bearing horizon is located. Gravels and sands that have been washed down from the hills often occur buried beneath a few feet of clay in the coulées.

These sands and gravels should form good reservoirs for water at shallow depths, and the water obtained is generally of good quality. The location of shallow wells at or near the bottoms of slopes has proved to be good practice in many parts of the area.

Water-bearing Horizons in the Bedrock

Three distinct bedrock formations, the Cypress Hills, Eastend, and Bearpaw, occur immediately below the glacial drift in various parts of the municipality. The distribution of these formations is shown on the accompanying map, Figure 1.

The uppermost of these formations is the Cypress Hills. It is confined to the higher land in the north and northwestern parts of the municipality. It consists of beds of cobblestone conglomerate, interbedded with layers of coarse and fine-grained sandstone. In some places the beds are firmly consolidated and more or less impervious to the passage of water, whereas in other places the cobblestones are only loosely packed, and form excellent reservoirs for water. The upper beds appear to be less consolidated than the lower beds and the water percolates downwards to the lower part of the formation. It is probable that the surface of the Bearpaw formation upon which the Cypress Hills beds were deposited was somewhat irregular, and hence the base of the formation does not occur at the same elevation at all points. It occurs at approximately 2,880 feet above sea-level in the extreme northwest corner, but appears to slope away gradually to the southeast, conforming approximately with the general slope of the present land surface, and extends down to approximately 2,750 feet along the southern boundary of the area covered by these beds. In township 12, range 12, a spring flows from the base of the formation at its southern boundary, at an elevation of 2,750 feet. Several other springs mark the base of the formation, where it lies at or near the land surface on the slopes. The surface is irregular in this area, so that the depths of wells necessary to reach the lower productive beds of the formation vary from 32 to 120 feet. The water obtained in most wells is soft, and is almost invariably satisfactory for all household requirements. A few wells yield only small supplies, and an additional well or some other auxiliary source of water is required, but most of the wells produce enough water for 20 to 50 head of stock. The Cypress Hills formation is the best source of water in this municipality, and sufficient good water for local domestic and stock requirements should always be available, providing wells are sunk to the lower part of the formation. The recent drought period has had little effect on the water supplies from this source.

The Eastend formation underlies the Cypress Hills formation in the northern townships, and has a slightly greater areal extent. On the map, Figure 1, are shown narrow areas bordering the area of the Cypress Hills formation, in which the Eastend formation directly underlies the glacial drift. The Eastend formation is made up of beds of light coloured, fine sands and silts, grading downward into darker coloured, fine sands, silts, clays, and shales. As good water supplies are obtained from the overlying Cypress Hills beds, no wells have been sunk through this formation into the Eastend, although water in some places may have percolated to the base of the Cypress Hills formation, where it is stopped by the more impervious Eastend beds. Three wells are drawing water from sandy beds of the Eastend formation, in the areas where it is covered only by the glacial drift. These wells range in depth from 29 to 70 feet. The water is of good quality, and each well produces enough water for local needs. Twenty-five head of stock are watered regularly from one of the wells. These wells indicate that water supplic are to be expected from the

Eastend formation at other points, but only in the narrow belts in which the Eastend directly underlies the drift should it be found necessary to sink wells into this formation.

The Bearpaw formati is the lowest of the three bedrock formations. It underlies the beds of the Eastend formation wherever they occur, and elsewhere immediately underlies the Cypress Hills formation, or where this is absent the glacial drift. It is exposed at the surface at several points along the slopes of the valleys of Notukeu and Russell creeks. The formation consists of dark grey to brownish grey shales which weather light grey or buff where exposed at the surface. The dark shales resemble the dark clays in the lower part of the glacial drift in many respects, but they are distinguishable from them by their more soapy feel, by the roughly cubical fragments into which they crumble upon weathering, and by the almost entire absence of stones or pebbles. Beds of light-coloured sand occur at some localities, but are not common in this area. A few wells in township 10, range 10, have encountered water-bearing san beds in the Bearpaw formation. This formation is not a good source of water. A number of wells throughout the municipality have penetrated the Bearpaw, and of those obtaining supplies only four are reported to yield water that is drinkable. A few others produce water that is usable for stock, but th water from the greater number of the wells is too highly mineralized for any farm use. Those wells obtaining water range from 20 to 110 feet deep. Dry holes have been sunk into the bedrock 60 to 700 feet in various localities. As only in very few places is usable water obtained from the Bearpaw formation, it is advisable to confine the search for water to the overlying glacial drift. On sec. 36, tp. 12, range 10, a 700-foot well penetrated the lower part of the Bearpaw formation, where a water-producing sand bed was found.

The water was reported to be of good quality, and it ascended in the well under hydrostatic pressure to a point 200 feet below the ground surface. This well was never used due to the fact that it was drilled crooked, and could not be cased. A few other wells in nearby municipalities have tapped the same or a similar horizon, but it does not appear to be continuous over large areas. The 700-foot well on sec. 33, tp. 10, range 11, was dry, although it reached to a lower elevation than the deep well in township 12, range 10. Other dry holes drilled equally deep in adjoining municipalities also indicate that a continuous water-bearing horizon does not exist in the lower part of the Bearpaw formation, in this region. Owing to the great depth of well required, and the uncertainty of obtaining water of satisfactory quality for any farm use, drilling to these low levels is inadvisable.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 10, Range 10

Most of the ground water supplies in the township are either insufficient for local requirements or the water is of too poor quality to be used. Some stock water is obtained from Notukeu creek, and on many of the farms dugouts and dams conserve surface water for stock use.

The Recent deposits of sands and silts along the course of Notukeu creek should form sources of at least small quantities of ground water, but to date no wells have been reported to have been dug into them. The deposits are thin, and aquifers should be found at depths of less than 15 feet. Wells located in these deposits near points where the Bearpaw formation is exposed at the surface on the steeper banks may yield a more highly mineralized water than wells sunk nearer the stream channel.

The glacial lake clays covering the valley bottom are probably fairly sandy in this area. At the base of the clays water-bearing sand beds may be fairly continuous. A good supply of soft water is obtained from a sand bed at a depth of 16 feet in a well sunk on section 19. Similar supplies should be obtainable at depths not exceeding 20 to 30 feet, throughout the area of the lake clays shown on the map, Figure 1. Deeper wells would undoubtedly penetrate the Bearpaw shales.

Glacial till covers the remaining parts of the township to depths ranging from a foot or two along the slopes of the stream valley to 50 feet or more over the higher land. Most of the wells in the area have passed through the till into the underlying bedrock without encountering aquifers in the till. The boulder clay will yield little or no water except in places where it is sandy, and here only small amounts of water are found. Gravel and sand pockets are scattered through the boulder clay, but are not numerous. Four wells have tapped these pockets at depths of 16 to 55 feet, and have obtained supplies of good water sufficient for local needs. Untapped pockets doubtless occur in other places, but considerable testing might be required to find them. Since the glacial drift, although not highly productive, forms a source of ground water of better quality than that from the underlying bedrock, careful testing for productive pockets in it is preferable to deeper drilling. Small supplies of water suitable for household use and a few head of stock should be found by digging shallow wells in the coulée bottoms.

The Bearpaw formation which underlies the whole township is composed largely of compact shales, but a few thin sand beds have been penetrated on some farms. Water has been obtained from the sands or shales in several wells. A small supply of usable water is derived from the top of the bedrock in a 20-foot well on section 5. Other wells range in depth from 50 to 110 feet, and the water in each well has a very high dissolved mineral salt content, which makes it unfit for drinking. In seven of the wells reported the water is not usable even for stock. At some points no water will be found in the Bearpaw formation, and at other points, satisfactory supplies for stock cannot be assured. Efforts should be made to conserve surface water by dams or dugouts, and household water supplies may be obtained from shallow seepage wells close to these reservoirs.

Township 10, Range 11

Most of the farms in this township are satisfactorily supplied with well water. Notukeu creek, and surface water stored by dams and dugouts, provide additional supplies where the yields from wells are insufficient for farm requirements.

Recent deposits cover the valley bottom of Notukeu creek in the southern part of the township, and a narrow belt adjacent to the stream through sections 13 and 14. Wells have been dug into these deposits on sections 13 and 15, and have passed through sandy clay to tap sand beds at depths of 18 and 14 feet. The supply from thes wells is ample for 10 and 18 head of stock, and the water is of good quality for household use. Sand beds should be located fairly readily at shallow depths in the Recent deposits at other points. A narrow strip of Recent alluvium borders Russell creek in the north half of section 34, and should be similar in character to that along Notukeu creek.

Water-bearing sand beds similar to those in the Recent deposits should occur at or near the base of the glacial lake clays in sections 13 and 14, and should be found within 35 feet of the surface. Where aquifers are not encountered at the base of the lake clays, deeper digging into the underlying boulder clay may locate water-bearing gravel or sand pockets. The water should be of good quality, and the supplies sufficient for local needs.

Sand and gravel pockets buried in the boulder clay, which covers the remainder of the township, have been tapped by wells on several sections, and yield good supplies of water. These underground reservoirs have been found at depths ranging from 14 to 35 feet. Each well produces enough water for 15 to 30 head of stock, with the exception of one well on section 8, from which only enough water for household use is obtained. Most of the water is of quality suitable for drinking except that obtained from the 20-foot well on section 1, which is usable only for stock, owing to its high dissolved mineral content. In a few wells definite sand or gravel aquifers have not been encountered, and water is obtained from sandy phases of the boulder clay; however, in most places little water is to be expected from the clay itself. The water-bearing pockets of sand and gravel appear to be fairly numerous in this area, and further testing on those sections where satisfactory supplies have not been obtained is advisable.

Sinking wells to depths greater than 50 feet at any place in the township is expected to penetrate the shales of the Bearpaw formation that underlie the glacial drift throughout the entire township. In the southwest corner of the area the shales may lie within 30 feet of the surface. Wells on sections 24 and 27 obtained water from the bedrock, but the water was too highly charged with the sulphate salts in solution to be usable for any farm purpose. On sections 25 and 28 dry holes were sunk 150 and 85 feet, and on section 33 no water was obtained from a hole drilled 700 feet deep, which indicates the inadvisability of deep drilling in this section. Any water obtained from the upper part of the formation will be of very poor quality, and little is known of the water-bearing properties of the lower part. It seems advisable to confine the search for ground water to the overlying Recent and glacial deposits in this township.

Township 10, Range 12

Water supplies in this township are derived from a few dams and dugouts, but mainly from wells. Most of the ground water is obtained from the glacial drift, but a few wells have found water in the underlying Bearpaw formation.

Glacial till covers the whole township, and varies irregularly in thickness from about 20 to 50 feet, but in most places the shales of the bedrock are encountered at depths not exceeding 30 feet. The till consists mainly of boulder clay, and due to the fact that several wells are deriving water supplies from the clay, it is probably fairly sandy in this area. Water-bearing sand and gravel pockets are numerous in the boulder clay, and have been tapped by wells at depths ranging from 8 to 46 feet.

Individual wells yield enough water for 15 to 40 head of stock. The water is hard, and of good quality, except from the wells on sections 16, 21, and 28, from which it is too "alkaline" to be used for drinking. Gravel or sand aquifers should be found on every section, and on those farms where satisfactory ground water supplies have not been found it is advisable to continue tests in the glacial drift down to the contact of the drift with the underlying Bearpaw formation.

Several attempts have been made to obtain water from the Bearpaw formation in this township. Two wells sunk 60 feet deep on section 12 are drawing water from near the top of the bedrock. The water-bearing horizon here may be at the contact of the glacial drift and the Bearpaw formation. The dissolved mineral salt content of this water is high and the water is accordingly usable only for stock. On sections 34 and 36 water has been obtained from a similar horizon, but it is too highly mineralized to be used even for stock. Dry holes have penetrated the Bearpaw formation on sections 4 and 33. Water may be expected at or near the contact between the drift and the bedrock, at most points in the township. However, owing to the poor quality of the water usually found, this cannot be considered a reliable source of water even for stock. Deeper drilling into the Bearpaw formation is not advised, and all efforts to obtain ground water supplies in the township should be confined to the glacial drift. Where sufficient water cannot be found in the drift, surface water should be stored by constructing dams or dugouts in suitable places.

Township 11, Range 10

The ground water supplies on many farms in this township are inadequate, and surface water in Notukeu creek and in dams and dugouts is used as a supplementary supply. Some farmers are compelled to haul water from the few wells that have encountered porous beds in the glacial drift.

A 14-foot well on section 10 is drawing water from a sand bed in the Recent deposits close to Notukeu creek. This aquifer is buried beneath 10 feet of light sandy clay. The water is of good quality, and the supply is adequate for local requirements. The Recent deposits are confined to narrow belts bordering the creeks, and at least small supplies should be readily obtained by digging shallow wells into them.

The remainder of the lowland area is covered with glacial lake clays, as shown on Figure 1 of the accompanying map. Water-bearing sand beds near the base or lying immediately below the lake clays have been encountered in wells 18 to 35 feet deep. A well, which provides part of the supply for the village of Vanguard, is 72 feet deep, and has tapped a sand pocket in the boulder clay underlying the lake clay. The water from all the wells is of good quality. Satisfactory ground water supplies should be available throughout the area of the lake clays. At isolated points aquifers may be absent, but in most places water should be found in sand or gravel beds near the base of the lake clays, or in the underlying boulder clay. Further tests in this area to locate these aquifers is advisable.

Moraine covers the northeast corner of the township, and glacial till mantles the remaining areas. The gravel and sand pockets that are scattered through the boulder clay of which these deposits largely consist have been tapped in a few wells, and moderately large supplies of water of good quality are obtained. The wells range in depth from 25 to 50 feet. A number of holes sunk deeper passed into the bedrock without encountering aquifers in the drift. The sand and gravel pockets are very irregular in their occurrence, and careful prospecting directed to cover as large an area as possible will be necessary in order to locate them. They appear to be more numerous in the northern till- and moraine-covered areas than in the southern sections where many holes have been sunk through the drift, into the bedrock, without finding water. If shallow wells located in coulées or at the bases of slopes fail to give an adequate supply, residents of the southern sections construct dugouts for stock requirements, and sink shallow wells beside these reservoirs to provide household supplies. Apparently all ground water to be found in this township occurs in the drift, and nothing can be gained by extending wells into the underlying Bearpaw formation.

A number of dry holes, ranging in depth from 90 to 190 feet, have penetrated the Bearpaw formation. Water in the 23-foot well, on the SW.¼, section 4, is believed to be coming from the shale at the top of the formation, but this water is unfit for any farm use. Several wells drilled by the Canadian Pacific Railway Company, in the town of Vanguard, are believed to have penetrated the shales at depths not greater than 70 feet, but no water was reported either from the drift or from the shale. The possible occurrence of sand beds at the base of the lake clays offers the best prospects of obtaining water in the town. Deep drilling cannot be expected to yield water suitable for any use other than fire protection, and it is improbable that the supply obtainable will warrant the expense of sinking deep wells. It would be necessary to drill to a depth of at least 450 or 500 feet to determine if porous beds occur in the lower part of the Bearpaw formation, at the horizon tapped in the 700-foot well on sec. 36, tp. 12, range 10.

Township 11, Range 11

Water supplies in the township are derived from Russell creek, and a small, unnamed creek, which crosses section 35 and 36; from surface reservoirs formed by dams and dugouts, and from wells.

Russell creek and the other smaller creek cease to flow in dry weather. Good supplies of ground water have been obtained in the northern and southern sections, but in the central and east-central parts of the township little ground water has been found.

Recent deposits of silt and sand occur as narrow belts bordering the stream channels of Russell creek, and the smaller stream. Water-bearing sand beds usually occur in the silts, and should be tapped by wells 15 feet deep or less. A small supply of good water has been obtained from one such well on section 7. Shallow wells dug close to the creeks would obtain seepages from the creeks for a short time, at least, after the streams have ceased to flow.

The glacial lake clays occurring in the southwest part of the township, as indicated on Figure 1 of the accompanying map, are somewhat similar in composition to the Recent deposits, and consist largely of sandy clays. Towards the base of the clays are found beds of sand and occasionally gravel, which contain ground water. Several wells sunk to depths of 10 to 20 feet have tapped these aquifers, and supply good water, the yields from individual wells being adequate for 12 to 45 head of stock. A 40-foot well located on the SW.$\frac{1}{4}$, section 10, gave water that was too highly mineralized to be used. It is probable that water of similar poor quality will be found at many points in the area. Ground water supplies should be readily located throughout the area of the lake clays, at depths not greatly exceeding 25 feet.

The remainder of the township is covered by glacial till, with the exception of a small area in section 21 and 22, where morainic deposits occur. There appears to be little difference between these two types of deposits in this area, and their water possibilities will be considered together. The boulder clay of which the till and moraine are chiefly composed is generally only very sparingly productive of water. However, some wells in this township are reported to be drawing good supplies of water from the clays, and in these localities the clays are probably more sandy than in other places, or thin sand beds that escaped notice when the wells were being dug are serving as aquifers. More reliable aquifers, in the form of sand or gravel pockets in the boulder clay, are found at several scattered points along the northern, western, and southern borders of the township. These pockets usually produce enough water for local use, and it is suitable for drinking. Gravel and sand pockets in the drift evidently occur more sparingly in the central, east-central, and southeastern parts of the township than in the other sections, as in the former localities many wells have been sunk into the underlying bedrock without obtaining any water. However, aquifers in the drift are probably not entirely absent in this area, but will be found only by careful and extensive testing.

The contact between the glacial drift and the underlying Bearpaw formation is not readily determined because of the similarity between the lower dark clays of the glacial drift, and the upper, weathered shales of the Bearpaw. From the evidence available, it would appear that the compact shales of the bedrock will be encountered at depths not greatly exceeding 40 feet in the western half of the township, but may lie at depths as great as 90 or 100 feet in the east-central sections. Several wells located in the western half of the area, and ranging in depth from 40 to 60 feet, appear to be receiving water from the contact or from the upper part of the bedrock. A 56-foot well on section 16 yields enough water for 18 head of stock, and the water is also usable for the household. The water from the other wells contains large amounts of dissolved mineral salts, and in at least three of the wells is not even fit for stock. A 100-foot well, located on the NW.$\frac{1}{4}$, section 24, yields a fairly large supply of water, suitable for watering stock, from the Bearpaw shales. This aquifer is evidently confined to a very limited area, as wells sunk to similar or greater depths in the vicinity yielded no water. Dry holes ranging from 75 to 307 feet deep have also penetrated the bedrock. As the water-bearing horizons in the formation are not continuous, and the water is of such poor quality, it seems advisable to confine all well digging to the overlying Recent and glacial deposits. Good water supplies are not to be found everywhere in the drift, but the possibilities are better than in the lower lying Bearpaw formation.

Many of the coulées on the slopes of the central upland would form suitable sites for small dams. On other farms on the lower lands, where careful prospecting of the drift has failed to produce adequate water supplies, residents are obliged to excavate dugouts for the conservation of surface water.

Township 11, Range 12

The ground water supplies of this township are derived in part from the glacial drift, and in part from the underlying bedrock formations. As the same formations do not occur in all parts of the township, ground water conditions are not uniform throughout the area. In the northeastern part of the township the ground water supplies are unsatisfactory, but in most other parts, adequate supplies of water have been found. Russell creek, which crosses the township from section 3 to section 12, supplies water for stock, and small seepages are also derived from shallow wells dug close to it. Dams and dugouts also supply stock water, and may be found necessary to ensure adequate water supplies in the southeast and northeast parts of the township. Recent deposits occur along the channel of Russell creek. Where sand beds are found in the silts, water supplies may be expected. Most of this water would probably be seepage from the creek. The Recent deposits are probably sufficiently permeable for seepage water to be obtained anywhere along the banks of the creek. Much of this water is probably derived as seepage from the shales of the Bearpaw formation which are exposed at many places along the creek. Water from this source may be too highly mineralized for household use.

A blanket of glacial till ranging in thickness from 15 to over 35 feet covers the remainder of the township. The boulder clay appears to be sandy in many places, and pockets of well-sorted sands and gravels have been encountered on sections 3, 9, and 25. Sufficient water for local needs is being obtained from the sandy clay struck in several wells. This water has a high content of dissolved mineral salts, but from only one well is the water reported to be unfit for drinking. The water from sand or gravel pockets is of better quality, and the supplies obtained are usually adequate for local requirements, although a 7-foot well, striking gravel on section 7, produces only enough water for household use. In the west-central part of the township water supplies are obtained from the underlying Cypress Hills formation, but throughout the remaining parts the glacial drift is the best source of ground water. In the southern sections, and in the lowland area adjacent to Russell creek, water supplies have been obtained with little difficulty, but in the northeast aquifers appear to be less numerous. However, even in this latter area water-bearing sand and gravel pockets probably occur in the drift, and further systematically spaced test holes should be made to locate them. Wells should not exceed 30 feet in depth, and should be abandoned when the upper 5 to 10 feet of the underlying Bearpaw formations have been penetrated. The bases of slopes may prove to be good locations for wells. At some points the water may be of poor quality owing to the high dissolved mineral salt content, but should be satisfactory at least for stock.

The Cypress Hills formation underlies the drift in the west-central and central parts of the township, and in the northern part of sections 31 and 32, as shown on Figure 1 of the accompanying map. Five wells have tapped aquifers at elevations ranging from 2,801 to 2,776 fe t above sea-level, and springs located on sections 8 and 29 appear to mark the southern and northern boundaries of this water-bearing horizon. The wells range in depth from 32 to 120 feet, depending on the surface elevation at the well site. The water is of excellent quality, and each well produces enough water for 20 to 50 head of stock. Additional supplies of good water should be obtainable throughout the area in which this formation occurs.

In those parts of the township in which the Cypress Hills formation is absent, the Bearpaw formation lies directly beneath the glacial drift. In some places the shales at the top of the formation are impervious, and water percolating downwards is retained at the contact of the drift and the bedrock. In other places the upper few feet of shale has been weathered to such an extent that it is permeable to the passage of ground water. Several wells have pen trated the Bearpaw formation in this township, but the water in each well is too highly mineralized for drinking. In a few of the wells it is usable for stock. On section 26 no water was found in a hole dug 85 feet deep. Two wells 100 and 128 feet deep, on the SW.$\frac{1}{4}$, section 25, and SW.$\frac{1}{4}$, section 35, may be deriving at least part of their highly mineralized water from the shales, but it is more probable that the greater amount of the water comes from the contact of the drift and the bedrock, at depths not greatly exceeding 50 feet. No water of good quality can be expected from the Bearpaw formation at any point in this township, so that the further sinking of wells into it is not advisable. The overlying glacial drift should be thoroughly tested for sand or gravel aquifers, and only if these tests fail should water be sought at greater depths. In any event, wells should not be drilled deep into the Bearpaw formation, and the construction of dams and dugouts should be considered if a reasonable amount of prospecting in the drift proves unproductive.

Township 12, Range 10

Little difficulty has been experienced in obtaining a satisfactory ground water supply on the plateau in the northwestern part of the township, but throughout the remainder of the area only a few wells give satisfactory supplies. Several dams have been built in coulées to store the spring run-off for stock use.

The glacial drift that covers the area is about 30 feet thick on the northern highlands, and increases to over 85 feet towards the south. Glacial lake clays and moraine occur in small patches in the southeast corner of the township, and glacial till covers the remainder of the township, as shown on Figure 1 of the accompanying map. No wells have been reported in the areas of lake clays and moraine, but both areas seem worthy of prospecting. Water is being obtained from sand beds lying at or close to the base of the lake clays, at depths of 35 feet or less, in the township to the south. Similar sand beds should occur in the area of the lake clays in this township. Pockets of sand and gravel are scattered through the boulder clay in the morainic deposits, and are usually good sources of water. Water-bearing pockets should be found in the moraine on sections 1 and 2, within 50 feet of the surface. In each of these areas, test holes should be sunk to locate aquifers before wells are dug.

Several farmers have dug wells into the glacial till. The till is similar to the morainic deposits in composition, and consists of boulder clay in which water-bearing sand and gravel pockets are scattered with no apparent regularity. A few of these pockets have been encountered, at depths of 8 to 40 feet, on the lower slopes of the uplands. Wells located in coulée bottoms are generally more productive than wells located on the intervening uplands. Five of the wells sunk on the slopes yield sufficient water for local needs, but two wells have tapped small reservoirs and produce only small amounts of water. On section 16 the water obtained is too highly mineralized to be used in the household. The compact boulder clay will not yield water, but at some points it is more sandy, and small seepages may be obtained. Some wells have encountered only clays, and where sandy phases have been penetrated small amounts of water are found. Other wells situated close to dams obtain seepages of water from the surface reservoir. Water-bearing sand and gravel pockets that are as yet untapped doubtless occur at many points, and could be located b careful testing. It is expected, however, that much more careful prospecting will be required to find water at shallow depths in the southern and southeastern lowlands than in the coulées of the uplands. On those farms where water supplies are inadequate, a series of holes should be sunk with a test auger, t locate any aquifers that might be present. With the exception of the top of the plateau, wells should not exceed 50 feet in depth.

The Cypress Hills formation occurs in the northern uplands of the township. The formation is overlain by about 30 feet of glacial drift, except on the southern slopes where the drift is thinner. Three wells, 110 to 115 feet deep, have penetrated the formation, and have tapped water-bearing gravel beds, presumably near the base of the formation, at elevations of between 2,840 and 2,800 feet above sea-level. Each well yields a large supply of soft, drinkable water. Additional ground water supplies should be readily procured in this area by sinking wells similar to those now in use.

No wells have penetrated the Eastend formation, which underlies the Cypress Hills formation and underlies the glacial drift in a narrow belt extending from section 30 to section 26, and northward through section 35. Water-bearing sand beds probably occur in this formation, and could be tapped by wells passing through the Cypress Hills formation, or at lesser depths in the area in which the drift alone covers the Eastend. Good water supplies have been obtained from these beds, in the township to the west. However, throughout the area in which the Cypress Hills formation occurs water will undoubtedly be found in sand or gravel beds before the Eastend formation is reached. In the area in which the Eastend borders the Cypress Hills area, it would be advisable to test for water in the Eastend formation if supplies are not found in the drift at shallower depths.

The Bearpaw formation underlies the Eastend formation, and occurs immediately below the glacial drift throughout all other parts of the township. A 700-foot well on section 36 is the only one in the township known to have penetrated the formation. A sand bed near the base of the Bearpaw formation at an elevation about 1,900 feet above sea-level was tapped, and water rose 500 feet in the well. However, the well was not completed, and is not in use. Water could probably be obtained from sand beds at about this elevation in other parts of the township, but they may not occur at all points. At higher levels in the Bearpaw, little or no water is to be expected. Some water may be found at the contact between the drift and the Bearpaw formation, but this water is likely to be too highly mineralized for use. Drilling to great depths to the base of the Bearpaw formation seems to be an undertaking of questionable value, and since there can be no assurance that any large supply will be found or that the water will be suitable for any farm use, search for water in the lowlands areas should be confined to the glacial drift.

Township 12, Range 11

The greater part of the water supply of the township is derived from wells. One spring has also been reported, and a few dams in the southern sections contribute to the available supply of stock water. An intermittent creek runs from section 20 in a southeasterly direction through section 2, and provides water for stock in seasons of ample precipitation.

The glacial till, or boulder clay, which covers the whole township is comparatively thin. Over most of the southern plains it is about 25 feet thick, but decreases on the slopes to the north and west, and on the highlands of the north it is less than 10 feet thick. The till consists of dark-coloured boulder clay, sandy in places, and contains a few scattered sand or gravel pockets. Where wells have encountered the sandy clays or sand and gravel pockets water supplies have been obtained. These wells range in depth from 10 to 24 feet. Supplies from some wells are small, but others yield sufficient water for 10 to 70 head of stock. The water is hard, and in some places "alkaline". The water from a well on section 5 is too highly mineralized to be used. Sand and gravel aquifers in the drift occur more sparingly in areas where the drift is thin than where it is thick, and in this township they have been found at only a few localities. However, in the southern two-thirds of this township it will be necessary to thoroughly prospect in the drift if additional ground water supplies are required. By sinking a series of test holes, an aquifer of sand, gravel, or sandy clay should be found somewhere in the vicinity desired. Coarse gravels and sands have been washed down from the Cypress Hills formation on the higher land and deposited on the slopes. These are found chiefly in the coulées, and are buried beneath more recent deposits of clays. On the SE.$\frac{1}{4}$, section 27, coarse gravel of this nature was found in a coulée at a depth of 12 feet, and a good supply of water was obtained. Locations such as this throughout the southern part of the area should be prospected for ground water.

As shown on the accompanying map of the municipality (Figure 1), the Cypress Hills formation immediately underlies the glacial drift in the plateau area in the northern and western parts of this township. In the western areas no wells have as yet been sunk into this formation. One spring has been reported, on section 18, that indicated the presence of a water-bearing horizon in this formation. This spring is considered to mark the eastern boundary of the formation in this part of the township. Wells sunk in the western area to depths not exceeding 60 feet are expected to encounter this water-bearing horizon near the base of the formation, and will yield water supplies. Several wells have tapped an aquifer in the Cypress Hills formation in the northeastern part of the township, at depths ranging from 42 to 114 feet. Supplies from these wells are not large, but usually provide enough water for local needs. The water is of good quality. On the SE.$\frac{1}{4}$, section 33, a 70-foot well appears to have passed through the glacial drift and directly into the Eastend formation. The Cypress Hills formation occurs throughout most of this locality, as indicated on the map (Figure 1), but at the site of this well it is evidently absent or very thin. This condition is probably only local and the Cypress Hills formation may be expected in all other parts of the area shown, and water supplies may be expected from wells sunk into it.

The Eastend formation underlies the Cypress Hills formation and occurs directly below the drift in a narrow belt bordering the area covered by the overlying formation. The Eastend formation is difficult to distinguish from the underlying Bearpaw formation, but wells on sections 7, 18, and 33, appear to be obtaining water from the Eastend beds at an elevation of 2,790 to 2,810 feet above sea-level. The wells on sections 18 and 33 yield satisfactory supplies for local use. The well on section 7 had not been completed when the district was visited, but the water appears to be coming from an horizon at the contact between the Eastend and the underlying Bearpaw formation. Only in the small areas in which the Eastend formation occurs directly beneath the drift will it be desirable to seek water from this source, and in these areas moderately large supplies should be obtainable at depths probably not greatly exceeding 50 feet.

The Bearpaw formation underlies the glacial drift throughout the remainder of the area. Wells on sections 15, 16, 28, and 32 appear to be drawing water from this formation, and the water is suitable for household use. The fact that the water is of better quality than that obtained from this formation in other districts is probably explainable by the fact that the beds tapped here are close to the top of the formation, are more sandy than the lower beds, and do not contain as large concentrations of readily dissolvable mineral salts. The thinness of the covering of boulder clay also tends towards a lower dissolved mineral salt content than in places where the water must percolate through thick beds of clay. However, water in the Bearpaw formation at other points in this township may be of inferior quality. Continuous water-bearing horizons are not traceable from the few wells recorded. In some places water will accumulate at the contact between the drift and the Bearpaw formation, and little or no water will percolate into the impervious shales. On section 1 no water was found in a hole 70 feet deep. Prospecting in the overlying drift is advisable before sinking wells into the bedrock in this area, but if satisfactory supplies are not f und in the unconsolidated deposits, water at least usable for stock should be found in the upper few feet of the Bearpaw formation. Deep drilling into the shales is not advisable.

Township 12, Range 12

Water supplies in this township are derived mainly from wells tapping the Cypress Hills formation. Small supplies are obtained from wells in the glacial drift, and a few dams and dugouts store surface water for stock use. Most of the farms in the township have satisfactory water supplies.

The glacial till which covers the whole township ranges in thickness from about 15 to 35 feet. In the southeast and northeast corners it is slightly thicker, and on the slopes it may be thinner. As reliable water-producing horizons exist in the underlying bedrock, little search has been made for aquifers in the glacial drift. A few shallow wells are drawing water from the sandy phases of the boulder clay, but the yield from these wells is small and sufficient only for household u and a few head of stock. This water usually has a high dissolved mineral content, and in one well is not drinkable. In another well the water is not usable even for stock. Only in the southeastern part of the township, in sections 1, 2, and 3, should the drift be carefully prospected for water. As shown on the map (Figure 1), the Cypress Hills formation does not occur in this part of the township. Water-bearing sand and gravel pockets occur sparingly in the boulder clay, but it is presumable that considerable amounts of coarse sediments have been washed down from the uplands, and now fill or partly fill depressions on the hill-slopes or in the coulées. Prospecting at shallow depths in these depressions, in the southeast corner, is expected to yield better and large supplies of water than will be obtained from deep wells in this part of the township. Farmers residing there may find it necessary to sink a number of test holes before these aquifers are located. The depth at which the water-bearing sands or gravels may be expected ranges from about 15 to 40 feet. Throughout the remainder of the township, if water supplies are not found in the drift, supplies are assured by sinking deeper wells into the bedrock.

The Cypress Hills formation underlies the boulder clay in all parts of the township except the southeastern sections. Ground water accumulates in the lower horizons of the formation, and has been obtained by sinking wells 72 to 110 feet deep. The depth of well depends chiefly on the elevation of the land surface. The elevation of the water-bearing horizon falls from 2,883 feet above sea-level, in section 31, to 2,740 feet in section 5, conforming to the southward slope of the land surface. The water obtained is of good quality, and in most places is soft. Individual wells do not yield large supplies, but each produces enough water for household use, and at least 10 or 15 head of stock. The yield from some of the wells is ample for 25 to 40 head of stock. Flowing springs occur on the slopes in sections 5, 9, 11, and 26, where the water-bearing beds lie close to the surface. No difficulty should be experienced in obtaining additional water supplies from beds of sand, gravel, or conglomerate near the base of the Cypress Hills formation.

The Eastend formation underlies the Cypress Hills formation in part of the area, but its exact areal extent is unknown. As shown on the map (Figure 1), it occurs immediately below the glacial drift in a small area in the north of section 1, and the south of section 12, and in the northeast it underlies the drift in most of section 36. A 29-foot well on the SE.$\frac{1}{4}$, section 12, appears to be drawing water from this formation. The water-bearing horizon there may occur at the contact between the overlying glacial drift and more impervious clays or shales of the Eastend formation. The supply from this well is adequate for 25 head of stock, and the water is of good quality. The water in the 38-foot well on the NE.$\frac{1}{4}$, section 36, may also be derived from this formation, but the thickness of the drift there is not known and the water may be obtained from the boulder clay. Water-bearing horizons are to be expected in the sandy members of the Eastend formation, and further water supplies should be obtainable in these two small areas. Where the Cypress Hills formation occurs, undoubtedly water will be found before the Eastend formation is reached.

In sections 1, 2, 3, and part of 4, the Bearpaw formation directly underlies the glacial drift. No wells have penetrated the formation, but the 45-foot well on section 2 has probably reached the top of the shales. The water obtained in this well is typical of water from the Bearpaw formation, and is unfit for any use owing to the high content of dissolved mineral salts. It is advisable to cease digging when the compact shales of the Bearpaw formation are encountered as any water that might be available would probably be found on top of the shales. At some points this water might be satisfactory for stock use.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF WHISKA CREEK, NO.106, SASKATCHEWAN

Township	10	10	10	11	11	11	12	12	12	Total No. in municipality
West of 3rd meridian Range	10	11	12	10	11	12	10	11	12	
Total No. of Wells in Township	28	26	48	36	40	39	19	35	55	326
No. of wells in bedrock	12	5	8	9	14	15	4	21	43	131
No. of wells in glacial drift	16	19	40	26	25	24	15	14	12	191
No. of wells in alluvium	0	2	0	1	1	0	0	0	0	4
Permanency of Water Supply										
No. with permanent supply	21	23	45	23	33	36	17	32	51	281
No. with intermittent supply	2	0	1	1	2	1	0	0	3	10
No. dry holes	5	3	2	12	5	2	2	3	1	35
Types of Wells										
No. of flowing artesian wells	0	0	0	1	0	0	0	0	0	1
No. of non-flowing artesian wells	3	2	1	6	4	4	3	8	9	40
No. of non-artesian wells	20	21	45	17	31	33	14	24	45	250
Quality of Water										
No. with hard water	21	21	42	22	31	30	12	25	37	241
No. with soft water	2	2	4	2	4	7	5	7	17	50
No. with salty water	3	0	0	0	0	0	0	0	0	3
No. with "alkaline" water	15	8	17	9	14	9	3	4	9	88
Depths of Wells										
No. from 0 to 50 feet deep	14	21	43	23	26	30	10	26	42	235
No. from 51 to 100 feet deep	8	3	4	10	12	7	5	8	9	66
No. from 101 to 150 feet deep	5	1	0	2	1	2	3	1	3	18
No. from 151 to 200 feet deep	0	0	0	1	0	0	0	0	0	1
No. from 201 to 500 feet deep	1	0	1	0	1	0	0	0	1	4
No. from 501 to 1,000 feet deep	0	1	0	0	0	0	1	0	0	2
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	11	19	38	21	20	30	14	29	51	233
No. not usable for domestic purposes	12	4	8	3	15	7	3	3	3	58
No. usable for stock	15	21	45	23	29	34	17	32	54	270
No. not usable for stock	8	2	1	1	6	3	0	0	0	21
Sufficiency of Water Supply										
No. sufficient for domestic needs	20	23	46	23	32	36	17	31	54	282
No. insufficient for domestic needs	3	0	0	1	3	1	0	1	0	9
No. sufficient for stock needs	13	21	34	22	27	29	10	23	43	222
No. insufficient for stock needs	10	2	12	2	8	8	7	9	11	69

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. Resident 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 Whiska Creek, No. 106, Saskatchewan

LOCATION						Depth of Well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS										Source of Water
No	Qtr	Sec	Tp	Rge	Mer			Total	Perm.	Temp	Cl.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	NW	27	10	10	3	110	5,100	2,200	1,800	400	115	630	500	270	2,714	1,270	4,670	630	357		805		2,688	190		x3
2	SW	28	11	11	-	40	1,950											(4)	(1)		(2)		(3)		(5)	
3	SE	33	12	10	3	114	140	100	100		4	115	50	18	21	5	145	90		21	24		3	7		x2
4	NW	33	12	10	3	115	340	300	300		12	230	50	68	90	50	353	90		117	30		90	20		x2
5	SW	5	12	11	3	25	3,320											(4)	(1)		(2)		(3)		(5)	x1

Water samples indicated thus, x1, are from glacial drift.
Water samples indicated thus, x2, are from bedrock, Cypress Hills formation.
Water samples indicated thus, x3, 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. 2 and 5, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The ground water derived from the sand beds in the Recent deposits bordering the creeks is generally only moderately hard, and suitable for drinking. Variations will be found in the dissolved mineral salt content of the water from place to place, but with the possible exception of localities where the Bearpaw shales occur at or very near the surface in the stream channel the water should be suitable for domestic use.

Considerable variations in the character of the glacial deposits are noted, often within very small areas, and corresponding variations are to be expected in the quality of the ground water. As water percolates from the surface downward through the glacial drift it dissolves mineral salts present in the boulder clay. If the water is retained in sand or gravel beds at shallow depths it has had little opportunity to dissolve any large amounts of salts owing to the short period of contact with the boulder clay, and is usually fairly soft. If the water percolates to lower levels, the concentration of the dissolved salts is correspondingly greater, and may be sufficiently high to render the water unfit for use. Despite the general increase of mineralization with depth, exceptions are by no means uncommon. Shallow wells dug entirely in boulder clay may yield a water that is unfit for any use, whereas deeper wells encountering thick beds of porous deposits yield a hard but drinkable water. Of the total dissolved solids present in waters from the drift, Glauber's salt (Na_2SO_4) and Epsom salts ($MgSO_4$) are generally present in the largest amounts. These salts have a laxative effect, and are the most harmful of the salts found in the waters. Analysis No. 5 in the accompanying table is of a water from a 25-foot well located on the SW.$\frac{1}{4}$, sec. 5, tp. 12, range 11, in which the dissolved sulphate salt content is sufficiently high to make the water unfit for use. This water is reported to be very hard; the hardness being due to the presence of the calcium sulphate ($CaSO_4$). Although no other analyses are available of waters from the glacial deposits in this area, it is probable that the total dissolved solid content of the waters from many of the shallow wells does not greatly exceed 2,000 parts per million, and may be as low as 1,000 parts. The first analysis given on the accompanying table is considered to have been derived from the Bearpaw formation, but is probably only slightly higher in dissolved salts than water from the contact between the drift and the Bearpaw shales.

Water from the Bedrock

Water from the Cypress Hills formation is of excellent quality. The total content of dissolved solids is small and the water is fairly soft. This water is suitable for drinking, laundry purposes, watering stock, or any other farm use. Analyses Nos. 3 and 4 in the accompanying table are of samples of waters from two deep wells deriving their supplies from the base of the Cypress Hills formation. The water is quite soft, the total hardness not exceeding 300 parts per million, and is much softer than waters from the drift or from the other bedrock formations in the municipality. None of the dissolved mineral salts are present in sufficient quantity to have any harmful effects, or even give any appreciable taste to the water.

No samples of water were collected from the few wells tapping the Eastend formation in this municipality. The water from these wells is reported to be hard, and of good quality for household use. These wells are scattered over the area in which the Eastend formation occurs, and are fairly representative of the water from this formation. Usable water is to be expected from any other wells sunk into this formation. The water is harder and of poorer quality than that obtained from the Cypress Hills beds, but it is superior to water from the underlying Bearpaw formation.

Ground water in the Bearpaw formation is highly mineralized, and usually unfit for use. The large dissolved mineral content is due both to the water percolating through the boulder clay of the glacial drift, and to the salt content inherent in the shales themselves. In a few places usable water has been obtained in the upper few feet of the shales, but even at best this water may contain 2,000 or more parts per million of dissolved salts, largely sul hates, and should be used only by persons accustomed to highly mineralized water. In other places water from the shale is unfit even for stock. Good water cannot be expected from the upper part of the formation, but wells that have been sunk to great depths to the base of the formation report water of fairly good quality. However, the depth of well necessary to reach these lower water-bearing beds is too great for them to be considered as a source of supply. Analysis No. 1 in the table is typical of water from the Bearpaw. As will be seen, the total dissolved solid content is high, the water is very hard, and the sulphates of sodium and magnesium are present in quantities sufficient to make the water unfit for any farm use. Analysis No. 2 is of the better type of water from this formation. The total solids content is lower, and the sulphates content is smaller than in sample No. 1. This water has a laxative effect on humans, but can be used for ock without apparent ill effects.

WELL RECORDS—Rural Municipality of WHISKA CREEK, NO. 106, 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
1	N.½	1	10	10	3	Bored	70	2,550									Dry hole in Bearpaw shale; dam for stock dry at times. Hauls drinking water.
2	SW.	5	"	"	"	Dug	20	2,500	- 16	2,484	16	2,484	Bearpaw shale	Hard, clear, "alkaline"		D, S	Insufficient supply; 60-foot well in gravel, not used. Several shallow wells not good.
3	NE.	6	"	"	"	Dug	12	2,510	- 10	2,500	10	2,500	Glacial sandy clay	Hard, clear, "alkaline"		D, S	Intermittent, insufficient supply; dam supplies stock.
4	SE.	9	"	"	"	Dug	14	2,440	- 11	2,429	11	2,429	Glacial sandy clay	Hard, clear, "alkaline"		D	Insufficient supply; dam supplies stock most of the time.
5	NW.	10	"	"	"	Bored	65	2,450	- 50	2,400	50	2,400	Bearpaw shale	Hard, cloudy, "alkaline"		N	Good supply. Water is too "alkaline" for humans or stock, so filled in.
6	SW.	12	"	"	"	Dug	20	2,490	- 16	2,474	16	2,474	Glacial quick-sand	Hard, clear		D, S	Sufficient supply.
7	SW.	14	"	"	"	Dug	16	2,465	- 12	2,453	12	2,453	Glacial gravel	Soft, clear		D, S	Sufficient supply; neighbours haul drinking water from this well.
8	NE.	14	"	"	"	Bored	120	2,490			120	2,370	Bearpaw sand	Hard, iron, "alkaline", black sediment, sulphur		N	Good supply; water too mineralized for use.
9	NE.	16	"	"	"	Bored	40	2,430	- 30	2,400	40	2,390	Glacial sand	Hard, clear		D, S	Sufficient supply.
10	NE.	17	"	"	"	Drilled	240	2,425	- 50	2,375	50	2,375	Glacial sand	Hard, clear, "alkaline"		D, S	Small, insufficient supply; well has been rebored 55 feet deep with 5 feet of water; a 14-foot well in sand for stock.
11	NE.	18	"	"	"		50	2,410					Glacial drift				Wells have all caved in; used to yield fair supply; haul water now.
12	NE.	19	"	"	"	Dug	20	2,420	- 16	2,404	16	2,404	Glacial sand	Soft, clear		D, S	Sufficient supply; neighbours haul drinking water from here.
13	NE.	22	"	"	"	Bored	140	2,465	-110	2,355	140	2,325	Bearpaw sand	Hard, iron, "alkaline", brown colour		S	Strong supply; three dry holes 30 feet deep; haul drinking water; a dam used.
14	NE.	23	"	"	"	Bored	110	2,465					Bearpaw sand	Hard, "alkaline"			Water too "alkaline" for use.
15	SE.	27	"	"	"	Bored	110	2,460			110	2,350	Bearpaw sand	Hard, sulphur, "alkaline", dark colour		N	Well filled in; a 60-foot dry hole; haul drinking water.
16	NW.	27	"	"	"	Bored	110	2,455	- 95	2,360	95	2,360	Bearpaw shale	Hard, iron, "alkaline", clear		S	Sufficient supply; scours stock; haul water; #.
17	SW.	35	"	"	"	Bored	55	2,420	- 47	2,373	47	2,373	Bearpaw shale	Hard, "alkaline", clear, salty		S	Was sufficient; well caved in; dam holds water in summer.
18	NE.	35	"	"	"	Bored	50	2,400					Bearpaw	Hard, salty, cloudy, "alkaline"		S	Sufficient supply; 8-foot well in coulee used for drinking.
19	SW.	36	"	"	"	Bored	60	2,410	- 55	2,355	55	2,355	Bearpaw sand or shale	Hard, iron, salty, clear, "alkaline"		S	Water scours stock; intermittent, insufficient supply; small supply in dam.
20	NW.	36	"	"	"	Bored	100	2,400	- 80	2,320	80	2,320	Bearpaw shale	Hard, iron, red colour, "alkaline"		N	Sufficient supply; scours stock badly; well not used now; dugout gives small supply.
1	NE.	1	10	11	3	Dug	18	2,490	- 14	2,476	14	2,476	Glacial sand	Hard, clear, "alkaline"		S	Insufficient for 15 head stock; two 12-foot wells for house use; all three yield sufficient supply.

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

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

WELL RECORDS—Rural Municipality of WHISKA CREEK, NO. 106, 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
2	NW.	4	10	11	3	Dug	22	2,460	− 19	2,441	19	2,441	Glacial sand	Soft, clear		D, S	Sufficient supply.
3	NE.	7	"	"	"	Bored	45	2,480	− 39	2,441	39	2,441	Glacial yellow clay	Hard, clear, "alkaline"		D, S	Sufficient supply; laxative on humans.
4	NW.	8	"	"	"	Dug	18	2,450	− 15	2,435	15	2,435	Glacial sand	Hard		D, S	Sufficient for house; a 60-foot well on section 17, township 11, range 10, west 3rd meridian, used; good supply.
5	NW.	9	"	"	"	Dug	15	2,450	− 10	2,440	10	2,440	Glacial sand	Soft, clear		D, S	Waters 20 head stock.
6	NE.	13	"	"	"	Dug	18	2,400	− 10	2,390	18	2,382	Recent sand	Medium hard, clear		D, S	Waters 10 head stock; also use creek for stock.
7	SW.	15	"	"	"	Dug	17	2,425	− 14	2,411	14	2,411	Recent sand	Hard, clear, "alkaline"		D, S	Sufficient for 18 head stock.
8	SW.	17	"	"	"	Bored	50	2,460	− 32	2,428	32	2,428	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply for 25 head stock; a 60-foot well used by neighbours on NW.¼, section 8, township 10, range 11.
9	NW.	17	"	"	"	Dug	16	2,460	− 10	2,450	10	2,450	Glacial sand and clay	Hard, clear		D, S	Waters 30 head stock; neighbours use well also.
10	NE.	18	"	"	"	Dug	17	2,460	− 10	2,450	10	2,450	Glacial sandy clay	Hard, clear		D, S	Sufficient for about 30 head stock.
11	NE.	20	"	"	"	Dug	15	2,470	− 10	2,460	10	2,460	Glacial sand	Medium hard, clear		D, S	Sufficient supply for 25 head stock.
12	NW.	22	"	"	"	Dug	28	2,450	− 26	2,424	26	2,424	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient supply; laxative.
13	SE.	22	"	"	"	Dug	16	2,420	− 12	2,408	12	2,408	Glacial sand	Hard, clear		D, S	Large supply.
14	NW.	24	"	"	"	Bored	80	2,440	− 75	2,365	75	2,365	Bearpaw clay	Hard, oily grey colour, "alkaline"		N	Small supply; very poor quality.
15	SE.	24	"	"	"	Bored	36	2,400	− 16	2,384	25	2,375	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply for 20 head stock; laxative on humans.
16	SE.	25	"	"	"	Bored	150	2,450									Dry hole in Bearpaw shale; haul water for house and stock.
17	NW.	27	"	"	"	Dug	20	2,455	− 19	2,436	19	2,436	Bearpaw	Hard, "alkaline"		N	Not suitable for man or stock.
18	SE.	28	"	"	"	Bored	85	2,450									Dry hole in Bearpaw shale; haul water for house.
19	SE.	30	"	"	"	Dug	45	2,480	− 35	2,445	35	2,445	Glacial sand	Hard, clear		D, S	Sufficient supply for 7 head stock.
20	SW.	31	"	"	"	Dug	18	2,500					Glacial clay	Hard, clear		D	Sufficient for house.
21	SE.	33	"	"	"	Drilled	700	2,450									Dry hole in Bearpaw; some water at 500 feet; a seepage well for house use.
22	NE.	34	"	"	"	Dug	14	2,440	− 10	2,430	10	2,430	Glacial gravel	Hard, clear		D, S	Sufficient for 12 head stock.
1	SE.	2	10	12	3	Dug	16	2,520	− 8	2,512	8	2,512	Glacial lay	Hard, clear, "alkaline"		D, S	Sufficient for 12 head stock; laxative on humans.
2	NE.	3	"	"	"	Dug	14	2,520	− 11	2,509	11	2,509	Glacial sand	Hard, clear		D, S	Sufficient supply.
3	NW.	3	"	"	"	Dug	10	2,540	− 6	2,534	6	2,534	Glacial sand	Hard, clear		D, S	Sufficient for 15 head stock.
4	NE.	4	"	"	"	Drilled	400	2,545									Dry hole in Bearpaw.

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 WHISKA CREEK, NO. 106, 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
5	NE.	5	10	12	3	Dug	27	2,555	- 14	2,541	14	2,541	Glacial clay	Medium hard, clear		D, S	Sufficient for 25 head stock.
6	SW.	5	"	"	"	Dug	13	2,520	- 9	2,511	9	2,511	Glacial sand	Hard, clear		D, S	Sufficient supply.
7	SE.	6	"	"	"	Dug	30	2,520	- 29	2,491	29	2,491	Glacial clay	Hard, clear, "alkaline"		D, S	Sufficient for 8 head stock; laxative.
8	SW.	6	"	"	"	Dug	35	2,540	- 31	2,509	31	2,509	Glacial fine gravel	Soft, clear		S	Sufficient supply.
9	NW.	7	"	"	"	Dug	22	2,590	- 7	2,583	22	2,568	Glacial gravel	Soft, clear		N	Sufficient supply.
10	SE.	9	"	"	"	Dug	35	2,540	- 30	2,510	30	2,510	Glacial sand	Hard, clear		D, S	Sufficient supply.
11	NE.	10	"	"	"	Dug	12	2,500	- 8	2,492	8	2,492	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply; also a 7-foot well in sand used for stock.
12	SE.	10	"	"	"	Dug	45	2,525	- 43	2,482	43	2,482	Glacial quick-sand	Medium hard, clear		D, S	Sufficient for 25 head stock.
13	NW.	11	"	"	"	Spring							Glacial drift	Hard, clear		S	Sufficient supply all season.
14	NE.	12	"	"	"	Bored	60	2,500	- 50	2,450	50	2,450	Bearpaw clay	Hard, clear, "alkaline", some iron		S	Sufficient supply; a 35-foot well yields insufficient supply.
15	SE.	12	"	"	"	Bored	60	2,505	- 54	2,451	54	2,451	Bearpaw clay	Hard, clear, "alkaline"		S	Insufficient for 21 head stock; laxative on humans; haul drinking water.
16	SE.	14	"	"	"	Dug	50	2,505	- 46	2,459	46	2,459	Glacial grey sand	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock; use dugout.
17	SW.	15	"	"	"		20	2,505	- 16	2,489	16	2,489	Glacial green sand	Medium hard, clear		D, S	Sufficient for 15 head stock.
18	SW.	16	"	"	"	Dug	20	2,530	- 16	2,514	16	2,514	Glacial dark, clay	Hard, clear, some iron		D, S	Insufficient supply.
19	SW.	16	"	"	"	Dug	20	2,520	?				Glacial sand	Hard, "alk-aline"		N	Probably good supply. Stock are affected by the water.
20	NE.	18	"	"	"	Dug	12	2,530	- 10	2,520	10	2,520	Glacial quick-sand	Soft, clear		D, S	Waters 40 head stock; an 8-foot well with similar aquifer.
21	NE.	19	"	"	"		20	2,560	- 18	2,542	18	2,542	Glacial sand	Hard, clear, slightly "alkaline"		D, S	Waters 15 head stock.
22	NE.	20	"	"	"	Dug	11	2,540	- 6	2,534	6	2,534	Glacial sand	Medium hard, clear		D, S	Sufficient supply; neighbours use well; 20-foot well yields small supply.
23	SE.	20	"	"	"	Dug	27	2,540	- 19	2,521	19	2,521	Glacial yellow clay	Hard, "alk-aline"		D, S	Sufficient supply for 30 head stock; 7-foot well has good supply of hard water.
24	NE.	21	"	"	"	Dug	30	2,540	- 27	2,513	27	2,513	Glacial sand	Hard, clear, white sedi-ment, "alkal-ine"		S	Sufficient supply; used for cooking and 7 head stock.
25	SW.	24	"	"	"	Dug	20	2,520	- 16	2,504	16	2,504	Glacial sand	Hard, clear, "alkaline"		D, S	Insufficient supply; two other similar wells yield fair supply.
26	SE.	24	"	"	"	Dug	38	2,490	- 36	2,454	36	2,454	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 13 head stock.
27	SE.	25	"	"	"	Dug	28	2,515	- 16	2,499	16	2,499	Glacial quick-sand	Soft, iron, clear		D, S	Sufficient for 20 head stock; another shallow well used also.
28	NW.	25	"	"	"	Bored	60	2,540	- 30	2,510	30	2,510	Glacial sandy clay	Hard, clear, "alkaline", iron		S	Sufficient for 20 head stock; a 28-foot well used for house.
29	SW.	28	"	"	"	Dug	30	2,545	- 24	2,521	24	2,521	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply for 40 head stock; laxative on humans; used for cooking.

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 WHISKA CREEK, NO. 106, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
30	SE.	30	10	12	3		20	2,580	- 17	2,563	17	2,563	Glacial gravel	Medium hard, clear		D, S	Sufficient supply.
31	SW.	32	"	"	"		15	2,600					Glacial drift			D, S	Water obtainable at 15 feet in coulée; supply suitable for man and stock; also use a dam.
32	SE.	33	"	"	"	Bored	60	2,580									Dry hole in Bearpaw.
33	SW.	34	"	"	"	Dug	24	2,590	- 10	2,580	10	2,580	Glacial drift	Hard, clear, iron, red sediment		D, S	Intermittent supply; sufficient for 13 head stock at times.
34	SE.	34	"	"	"		40	2,570	- 28	2,542	28	2,542	Bearpaw clay	Hard, "alkaline"		S	Sufficient supply; scours stock; 20-foot well yields small supply for house.
35	NW.	36	"	"	"	Dug	20	2,520	- 10	2,510	10	2,510	Glacial dark clay	Hard, clear, "alkaline"		D, S	Insufficient supply for 4 horses; 13-foot well only sufficient for house.
36	SE.	36	"	"	"	Bored	40	2,480	- 34	2,446	34	2,446	Bearpaw clay	Hard, "alkaline"		N	Water is unfit for man or stock; seven wells--poor quality of water.
1	SW.	1	11	10	3	Bored	60	2,390	- 40	2,350	60	2,340	Glacial gravel	Hard, yellow "alkaline", cloudy		S	Sufficient supply; hauls drinking water.
2	NW.	2	"	"	"	Dug	16	2,380	- 13	2,367	13	2,367	Glacial gravel	Hard, clear		D, S	Sufficient supply.
3	NE.	2	"	"	"	Dug	18	2,380	- 10	2,370	18	2,362	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply.
4	NW.	3	"	"	"	Bored	95	2,450									Dry hole in Bearpaw shale.
5	SE.	4	"	"	"	Bored	110	2,460									Dry hole in Bearpaw shale.
6	SW.	4	"	"	"	Bored	23	2,450	- 20	2,430	20	2,430	Bearpaw shale	"Alkaline"		N	Too "alkaline" for use; intermittent supply.
7	SW.	5	"	"	"	Bored	100	2,450									Dry hole in Bearpaw shale; haul water.
8	SW.	6	"	"	"		90	2,450									Dry hole, probably in Bearpaw shale; haul water 1 mile.
9	SE.	7	"	"	"	Bored	100	2,420									Dry hole in Bearpaw shale; another dry hole 20 feet away.
10	SE.	7	"	"	"	Bored	80	2,420	- 50	2,370	50	2,370	Glacial sand	Hard, clear		D, S	Sufficient supply.
11	E.½	9	"	"	"	Dug	22	2,390	- 17	2,373	17	2,373	Glacial dark sand	Hard, clear, iron		D, S	Sufficient supply; a similar well.
12	NW.	9	"	"	"	Dug	35	2,400	- 19	2,381	35	2,365	Glacial sand and gravel	Hard, clear		D, S	Sufficient supply.
13	NW.	10	"	"	"	Dug	14	2,390	- 10	2,380	10	2,380	Recent alluvium	Hard, clear		D, S	Sufficient supply; used to be a similar well.
14	SW.	12	"	"	"	Spring	0	2,370	+ 4	2,374	0	2,370	Glacial gravel	Hard, clear, iron		D, S	Sufficient supply; spring flows steadily.
15	SE.	15	"	"	"	Bored	35	2,380	- 12	2,368	35	2,345	Glacial sand	Hard, clear, slightly "alkaline"		D	Sufficient supply for house; dam supplies stock.
16		15	"	"	"		60	2,400									Dry hole in glacial drift.
17		15	"	"	"		70	2,400									Dry hole in glacial drift.
18	SE.	16	"	"	"	Bored	72	2,395	- 35	2,360	72	2,323	Glacial sand	Soft, clear		D, S	Residents of Vanguard use this well; sufficient for local needs.

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 WHISKA CREEK, NO. 106, SASKATCHEWAN.

B 4-4
R. 7526

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
19	SE.	21	11	10	3	Bored	90	2,400									Dry hole in Bearpaw shale; a 26-foot well in sand yields sufficient supply of "alkaline" water.
20	NE.	22	"	"	"	Dug	14	2,400	- 10	2,390	10	2,390	Glacial sand	Hard, clear, "alkaline"		S	Strong supply; seepage well used for house.
21	NE.	24	"	"	"	Dug	30	2,400	- 26	2,374	26	2,374	Glacial sand	Hard, slightly"alkaline"		S	Sufficient supply; use pond that seldom goes dry.
22	NW.	25	"	"	"	Bored	120	2,430									Dry hole in Bearpaw blue clay.
23	NW.	28	"	"	"	Dug	30	2,440	- 24	2,416	24	2,416	Glacial clay	Hard, clear, "alkaline"		D, S	Sufficient supply for 20 head stock; 15-foot well, 6 feet of water; good supply; 50 -foot dry holes.
24	NE.	31	"	"	"	Dug	38	2,520	- 10	2,510	10	2,510	Glacial clay	Hard		D, S	Good well before dam was built; very strong supply.
25	SW.	33	"	"	"	Dug	23	2,460	- 16	2,444	16	2,444	Glacial clay and sand	Hard, clear, slightly "alkaline"		D, S	Sufficient supply; neighbours haul from here in dry seasons.
26	NW.	35	"	"	"	Bored	36	2,440	- 26	2,414	26	2,414	Glacial sand and gravel	Soft, clear		D, S	Sufficient supply.
27	SW.	36	"	"	"	Bored	25	2,450	- 10	2,440	25	2,425	Glacial sand	Medium hard clear		D, S	Sufficient supply.
28	NW.	36	"	"	"	Bored	190	2,450									Dry hole in Bearpaw shale; 34-foot seepage well yields sufficient supply.
1	NW.	1	11	11	3		60	2,430	- 30	2,400	60	2,370	Bearpaw	Hard, clear, "alkaline"		N	Sufficient supply; has bad effect on humans and stock; used very little.
2	NE.	2	"	"	"	Dug	20	2,430	- 8	2,422	20	2,410	Glacial red sand	Medium hard, clear		D	Sufficient for house only.
3	SE.	3	"	"	"	Dug	14	2,440	- 8	2,432	8	2,432	Glacial sand	Hard, clear,		D, S	Sufficient supply for 12 head stock.
4	SW.	3	"	"	"	Dug	13	2,445	- 9	2,436	9	2,436	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for 40 head stock.
5	NW.	3	"	"	"	Dug	16	2,440	- 10	2,430	10	2,430	Glacial gravel	Soft, clear		D, S	Sufficient supply.
6	NE.	4	"	"	"	Dug	9	2,440	- 4	2,436	4	2,436	Glacial dark clay	Hard, clear, slightly "alkaline"		D, S	Sufficient supply.
7	NW.	4	"	"	"	Dug	20	2,440					Glacial sand and gravel	Hard, clear, iron, slightly"alkaline"		D, S	Waters 45 head stock; five tanks a day are taken from well.
8	NW.	5	"	"	"	Dug	14	2,450	- 8	2,442	8	2,442	Glacial gravel	Hard, clear		D, S	Sufficient supply.
9	SW.	6	"	"	"	Dug	16	2,515	- 12	2,503	12	2,503	Glacial clay	Soft, clear		D, S	Sufficient supply.
10	NW.	6	"	"	"	Dug	30	2,550	- 28	2,522	28	2,522	Glacial clay	Soft, clear		D, S	Sufficient for 10 head stock.
11	NE.	7	"	"	"	Dug	12	2,480	- 4	2,476	4	2,476	Recent sand	Hard, clear		D	Intermittent supply; sufficient for house most of the time.
12	SW.	10	"	"	"	Dug	16	2,435	- 10	2,425	10	2,425	Glacial drift	Hard, clear		D, S	Sufficient for 13 head stock; a 40-foot well with supply unfit for man or stock.
13	NE.	10	"	"	"	Dug	65	2,430	- 50	2,380	50	2,380	Bearpaw clay	Hard, "alkaline"		S	Intermittent; insufficient in winter; laxative to humans and stock.
14	SW.	12	"	"	"	Dug	54	2,415	- 51	2,364	51	2,364	Bearpaw	Hard, "alkaline"		N	Insufficient for 5 head stock; use creek for stock now; well not good.

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

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

B 4-4
R. 7526

WELL RECORDS—Rural Municipality of WHISKA CREEK, NO. 106, 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.	14	11	11	3	Bored	75	2,420									Dry hole in Bearpaw shale; creek used for watering stock.
16	NW.	16	"	"	"	Bored	56	2,540	- 48	2,492	48	2,492	Bearpaw	Hard, clear, iron		D, S	Sufficient for 18 head stock.
17	NW.	17	"	"	"		40	2,500	- 20	2,480	20	2,480	Glacial clay	Hard, clear, "alkaline"		S	Waters 30 head stock; a 20-foot well in coulée for stock; haul drinking water.
18	NW.	17	"	"	"	Bored	100	2,480					Bearpaw	Hard		N	Water not usable.
19	NW.	18	"	"	"	Dug	15	2,525	- 12	2,513	12	2,513	Glacial clay	Hard, clear, "alkaline"		S	Sufficient supply; laxative on humans; no harmful effect on stock.
20	SW.	19	"	"	"	Dug	20	2,550	- 14	2,536	14	2,536	Glacial quicksand	Hard, clear		D, S	Sufficient for 6 head stock.
21	SE.	19	"	"	"	Dug	20	2,550	- 13	2,537	13	2,537	Glacial clay	Hard, clear		D, S	Sufficient supply; use dam for stock also.
22	SE.	21	"	"	"	Bored	60	2,570	- 45	2,525	60	2,510	Bearpaw clay	Hard, clear, iron		S	Insufficient supply; laxative on humans.
23	NE.	21	"	"	"	Bored	60	2,560	- 35	2,525			Bearpaw	Hard, "alkaline"		D, S	Sufficient for 10 head stock; laxative on those not accustomed to its use.
24	NW.	21	"	"	"	Bored	80	2,600									Dry hole in Bearpaw.
25	SW.	23	"	"	"	Drilled	307	2,510									Dry hole in Bearpaw.
26	SW.	23	"	"	"	Dug	30	2,470	- 23	2,447	23	2,447	Bearpaw clay	Hard, "alkaline"		S	Only water for stock in winter; haul drinking water.
27	NW.	24	"	"	"	Bored	100	2,450	- 75	2,375	90	2,360	Bearpaw	Hard, clear, "alkaline"		S	Sufficient supply; unfit for humans; 104-foot dry hole in Bearpaw.
28	NW.	24	"	"	"	Dug	25	2,450									Several dry holes in glacial drift.
29	NW.	27	"	"	"	Dug	26	2,490	- 23	2,467	23	2,467	Glacial sand	Soft, clear		D, S	Large supply.
30	SW.	28	"	"	"	Bored	40	2,570	- 36	2,534	36	2,534	Bearpaw clay	Hard, slightly "alkaline", cloudy		D, S	Probably fair supply; not recommended for human use. #1
31	SW.	31	"	"	"	Dug	14	2,600	- 6	2,594	6	2,594	Glacial sandy yellow clay	Hard, clear		S	Sufficient supply.
32	SE.	31	"	"	"	Dug	30	2,600	- 21	2,579	21	2,579	Glacial red sand and gravel	Hard, clear, iron		D, S	A 20-foot well, about 3 feet of water; sufficient supply with the two wells.
33	SE.	32	"	"	"	Dug	35	2,560	- 31	2,529	31	2,529	Glacial quicksand	Hard, clear		D, S	Sufficient supply for 6 head stock.
34	NE.	35	"	"	"	Bored	42	2,425	- 17	2,408	17	2,408	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 6 horses and house; a 25-foot well caved in; dam for stock.
35	NE.	36	"	"	"	Dug	57	2,485	- 25	2,460	25	2,460	Glacial clay	Medium hard, clear		D, S	Sufficient supply; can be pumped for 9 hours, good for drinking.
1	SE.	3	11	12	3	Bored	32	2,610	- 17	2,593	32	2,578	Glacial sand	Medium hard, clear		D, S	Sufficient for 27 head stock.
2	SW.	3	"	"	"	Dug	22	2,620	- 16	2,604	16	2,604	Glacial sandy gravel	Hard, clear, "alkaline"		D, S	Sufficient for 14 head stock; laxative on humans
3	NE.	4	"	"	"	Dug	23	2,690	- 18	2,672	18	2,672	Glacial drift	Hard, clear		D, S	Sufficient supply.
4	NW.	6	"	"	"	Dug	28	2,700	- 22	2,678	22	2,678	Glacial brown clay	Hard, clear		D, S	Sufficient for 100 head stock; also dam used.
5	NW.	7	"	"	"	Dug	14	2,800	- 11	2,789	11	2,789	Glacial gravel	Hard, clear		D	Only sufficient for house use; a 7-foot dugout for stock with soft water.

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 WHISKA CREEK, NO. 106, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
6	NE.	8	11	12	3	Spring	0	2,790	0	2,790			Cypress Hills	Hard			Spring flows all year.
7	SW.	9	"	"	"	Dug	30	2,700	- 25	2,675	25	2,675	Glacial clay	Hard, clear		D	Sufficient supply; used for tractor.
8	NW.	9	"	"	"	Dug	24	2,795	- 20	2,775	20	2,775	Glacial yellow clay	Soft, clear		D, S	Sufficient supply.
9	NW.	10	"	"	"	Dug	20	2,710	- 18	2,692	18	2,692	Bearpaw	Hard, "alkaline"		S	Intermittent supply; insufficient; laxative; 85-foot well in Bearpaw almost dry.
10	NW.	15	"	"	"	Dug	24	2,810	- 21	2,789	21	2,789	Glacial drift	Hard, clear		D, S	Sufficient supply.
11	SE.	16	"	"	"	Dug	18	2,775	- 14	2,761	14	2,761	Glacial drift	Hard, clear, slightly "alkaline"		D	Sufficient supply for house.
12	SE.	16	"	"	"	Dug	24	2,770	- 18	2,752	18	2,752	Glacial clay	Hard, clear, "alkaline"		S	Sufficient supply; not good for drinking.
13	SW.	16	"	"	"	Bored	32	2,800	- 16	2,784	16	2,784	Cypress Hills	Soft, clear		D, S	Sufficient for 50 head stock.
14	SW.	18	"	"	"	Dug	90	2,885	- 84	2,801	84	2,801	Cypress Hills	Hard, clear		D, S	Sufficient for 20 head stock; also a dug-out fed by a spring.
15	NW.	20	"	"	"	Drilled	120	2,870	- 80	2,790	90	2,780	Cypress Hills	Hard, clear		D, S	Sufficient supply.
16	NE.	20	"	"	"	Dug	82	2,850	- 74	2,776	74	2,776	Cypress Hills	Soft, clear		D, S	Sufficient supply; waters 8 head stock.
17	NW.	21	"	"	"	Dug	65	2,850	- 63	2,787	63	2,787	Cypress Hills	Hard, clear, iron		D, S	Sufficient supply; a 4-foot well in coulee; small supply of hard, "alkaline" water.
18	NE.	25	"	"	"	Dug	23	2,610	- 17	2,593	22	2,688	Glacial sand	Hard, clear		D, S	Sufficient supply for 22 head stock.
19	SW.	25	"	"	"	Bored	100	2,620	- 20	2,600	90	2,530	Bearpaw clay	Hard, clear, iron, red sediment		S	Sufficient supply; scours stock; a 14-foot well sufficient for house use; 7 feet of water.
20	NW.	26	"	"	"	Dug	35	2,650									Dry hole in Bearpaw; 35-foot well--large supply of poor water.
21	NW.	28	"	"	"	Dug	24	2,710	- 18	2,692	18	2,692	Glacial quicksand	Soft, clear		D, S	Sufficient supply.
22	SE.	29	"	"	"	Spring	0	2,800	0	2,800			Cypress Hills	Soft, clear		S	Waters all stock.
23	SW.	32	"	"	"	Dug	7	2,750	- 7	2,743	7	2,743	Glacial quicksand	Medium hard, clear, slightly "alkaline"		D, S	Sufficient supply.
24	SW.	33	"	"	"	Dug	28	2,730	- 23	2,607	23	2,607	Glacial gravel	Hard, iron, red colour		S	Sufficient for 25 head stock.
25	SW.	33	"	"	"	Dug	12	2,715					Glacial gravel	Soft, clear		D	Sufficient supply for house only.
26	NE.	34	"	"	"	Bored	75	2,750	- 35	2,715	35	2,715	Bearpaw	Hard, clear, "alkaline"		N	Water is too mineralized for use; a seepage well used.
27	SW.	35	"	"	"	Drilled	128	2,690	- 53	2,637	53	2,637	Bearpaw	Hard, clear, "alkaline"		D, S	Sufficient supply; laxative on humans if not accustomed to this water.
28	NE.	35	"	"	"	Dug	35	2,700	- 28	2,672	28	2,672	Bearpaw	Hard, oily grey colour, "alkaline"		N	Water unfit for use; a 26-foot well with 15 feet of hard, "alkaline" water used for stock.
29	NW.	36	"	"	"	Dug	20	2,700	- 14	2,686	14	2,686	Glacial clay	Hard, clear		D, S	Waters 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 WHISKA CREEK, NO. 106, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
30	SE.	36	11	12	3	Dug	16	2,640	− 11	2,629	11	2,629	Glacial yellow clay and pebbles	Hard, clear		D	Sufficient for house only; two other wells 16 feet are similar.
1	NE.	2	12	10	3	Dug	14	2,450	− 10	2,440	10	2,440	Glacial gravel	Hard, clear, iron		D	Sufficient supply; also use a dam.
2	SW.	6	"	"	"	Bored	60	2,520	− 56	2,464	56	2,464	Glacial clay	Hard, clear, "alkaline"		S	Scours stock; insufficient supply.
3	W.½	7	"	"	"	Bored	60	2,575	− 16	2,559	60	2,515	Glacial blue clay	Hard, clear, iron, red sediment		S	Not usually sufficient; 13-foot well for house; several dry holes.
4	SE.	13	"	"	"	Dug	16	2,475	− 8	2,467	8	2,467	Glacial gravel	Soft, clear		D, S	Sufficient supply.
5	S½.	14	"	"	"	Dug	18	2,565	− 13	2,552	13	2,552	Glacial sand	Soft, clear, good		D, S	Sufficient supply; also a dugout.
6	NE.	14	"	"	"	Dug	14	2,540	− 10	2,530	10	2,530	Glacial gravel	Hard, clear		D, S.	Sufficient supply; also a dam used.
7	NE.	16	"	"	"	Bored	47	2,650	− 17	2,633	40	2,610	Glacial sand	Hard, iron, red sediment, "alkaline", sulphur		S	Sufficient supply; water scours stock; dam in coulée.
8	NW.	17	"	"	"	Dug	30	2,660	− 26	2,634	26	2,634	Glacial clay	Hard, clear		D, S	Insufficient supply.
9	NW.	17	"	"	"	Bored	85	2,680									Dry hole in glacial drift.
10	SE.	18	"	"	"	Dug	12	2,590	− 8	2,582	8	2,582	Glacial sand and gravel	Hard, clear, slightly "alkaline"		D, S	Insufficient supply.
11	SW.	19	"	"	"	Dug	18	2,710	− 8	2,702	8	2,702	Glacial yellow clay	Hard, clear, good		D, S	Insufficient supply; two fairly large dams usually have good supply.
12	SE.	23	"	"	"	Dug	20	2,580	− 15	2,565	15	2,565	Glacial sand	Hard, clear		D	Insufficient supply; shallow well in coulée for stock; fair supply.
13	SE.	31	"	"	"	Dug	110	2,950	−105	2,845	105	2,845	Cypress Hills gravel	Soft, clear	40	D, S	Large supply.
14	SE.	33	"	"	"	Bored	114	2,915	−110	2,805	110	2,805	Cypress Hills gravel	Soft, clear		D, S	Sufficient supply; #.
15	NW.	33	"	"	"	Dug	115	2,945	−112	2,833	112	2,833	Cypress Hills gravel	Soft, clear	40	D, S	Sufficient supply; #.
16	SW.	36	"	"	"	Drilled	715	2,600	−200	2,400	700	1,900	Bearpaw sand	Good water			Cannot sink casing owing to crooked drilling.
1	SW.	1	12	11	3	Bored	70	2,475									Dry hole in Bearpaw; dug 65 feet; very small supply of water at 58 feet; haul water for drinking; use dam for stock.
2	SE.	2	"	"	"	Dug	14	2,460	− 10	2,450	10	2,450	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock.
3	SW.	2	"	"	"	Dug	13	2,440	− 10	2,430	10	2,430	Glacial sand	Hard, clear		D, S	Sufficient supply.
4	NW.	2	"	"	"	Bored	24	2,445	− 14	2,431	14	2,431	Glacial drift	Hard, clear		D	Insufficient supply; only two pails a day.
5	NE.	3	"	"	"	Dug	24	2,450	− 18	2,432			Glacial drift	Hard		D, S	Sufficient for 6 head stock.
6	SW.	5	"	"	"	Dug	25	2,600	− 10	2,590	10	2,590	Glacial blue clay	Hard, odour, "alkaline", brown sediment, cloudy		S	Insufficient supply; too "alkaline" for human use or for stock; use dam for stock; haul water for house; #.

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 WHISKA CREEK, NO. 106, 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	NW.	7	12	11	3	Dug	50	2,840	- 47	2,793	47	2,793	Eastend and Bearpaw	Hard, clear		N	Very little water; at present this well is being dug.
8	SE.	11	"	"	"	Dug	10	2,460	- 8	2,452	8	2,452	Glacial sandy clay	Hard, clear		D, S	Sufficient for 70 head stock.
9	SW.	14	"	"	"	Dug	22	2,520	- 16	2,504	22	2,498	Glacial gravel	Medium hard, clear		D, S	Sufficient supply.
10	SW.	15	"	"	"	Bored	80	2,550	- 45	2,505	70	2,480	Bearpaw	Hard, clear, "alkaline"		D, S	Sufficient for 12 head stock.
11	SW.	13	"	"	"	Dug	45	2,550	- 38	2,512	38	2,512	Bearpaw	Hard, clear, bitter taste		S	Reserve supply for stock; can be used for drinking.
12	SW.	18	"	"	"	Dug	47	2,840	- 27	2,813	47	2,793	Eastend	Hard, clear		D, S	Sufficient for 6 head stock.
13	SW.	18	"	"	"	Dug	10	2,840			10	2,830	Cypress Hills	Hard			No information--probably a fair supply.
14	NW.	18	"	"	"	Spring	0	2,800					Cypress Hills	Soft, clear		S	Spring flows all year
15	SW.	21	"	"	"	Dug	20	2,520	- 10	2,510			Glacial blue clay	Hard, clear, "alkaline"		S	Unfit for humans; does not hurt horses.
16	SE.	21	"	"	"	Dug	25	2,600	- 15	2,585	12	2,588	Glacial blue clay	Hard, clear		D, S	Waters 25 head stock.
17	SE.	25	"	"	"	Dug	8	2,750	- 4	2,746	4	2,746	Glacial drift	Soft, clear		D, S	Sufficient supply.
18	SE.	27	"	"	"	Dug	12	2,700	- 9	2,691	12	2,688	Glacial gravel	Hard, clear		D, S	Sufficient supply.
19	SW.	28	"	"	"	Dug	16	2,775	- 13	2,762	13	2,762	Bearpaw	Medium hard, clear		D, S	Sufficient for house only; an 8-foot well in coulée; plenty of water used for stock.
20	NW.	32	"	"	"	Bored	48	2,790	- 36	2,754	36	2,754	Bearpaw?	Hard, clear		D, S	Supply is steady, probably sufficient.
21	NW.	33	"	"	"	Dug	60	2,900									Dry hole in Cypress Hills and Eastend.
22	SE.	33	"	"	"	Bored	70	2,860	- 50	2,810			Eastend?	Hard, clear		D, S	Sufficient supply; a 45-foot well in coulée in Bearpaw; sufficient supply.
23	SE.	34	"	"	"	Dug	42	2,910	- 35	2,875	42	2,868	Cypress Hills	Hard, iron, clear		D	Only sufficient for house use; dry hole 35 feet deep in coulée.
24	NE.	34	"	"	"	Bored	60	2,930	- 58	2,872	58	2,872	Cypress Hills	Soft, clear		D, S	Sufficient supply; a 32-foot well in coulée with similar water supply.
25	NW.	35	"	"	"	Bored	68	2,930	- 33	2,897	44	2,886	Cypress Hills	Soft, clear		D, S	Sufficient supply; this was a drilled well 150 feet deep; it plugged and was bored.
26	SE.	35	"	"	"	Dug	62	2,900	- 60	2,840	60	2,840	Cypress Hills	Soft, clear		D, S	Sufficient supply for house only; a 30-foot well in coulée in Cypress Hills formation; a 12-foot well also similar; large supply of water.
27	SW.	36	"	"	"	Dug	16	2,890	- 2	2,888	16	2,874	Cypress Hills	Soft, clear		D, S	Sufficient for 15 head stock.
28	SE.	36	"	"	"	Dug	114	2,950	-110	2,840	110	2,840	Cypress Hills	Soft, clear		D, S	Sufficient supply.
1	NE.	2	12	12	3	Bored	45	2,770	- 35	2,735	35	2,735	Glacial clay	Hard, clear, "alkaline"		S	Used for pigs; scours stock; a 31-foot well in stones and blue clay used for house.
2	SW.	3	"	"	"	Dug	16	2,760	- 8	2,752	8	2,752	Glacial clay	Hard, clear, "alkaline",		S	Insufficient supply; scours stock; has a bitter taste.
3	NE.	4	"	"	"	Dug	28	2,755	- 21	2,734	21	2,734	Glacial clay	Hard, clear, "alkaline"		D, S	Intermittent, insufficient supply; well went dry in 1934.

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 WHISKA CREEK, NO. 106, 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
4	SW.	4	12	12	3	Dug	19	2,750	− 17	2,733	17	2,733	Glacial gravelly clay	Hard, clear		D, S	Sufficient for 4 head stock.
5	NE.	5	"	"	"	Spring	0	2,750					Cypress Hills?			S	Flows all year.
6	NE.	5	"	"	"	Dug	15	2,755	− 10	2,745	15	2,740	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient supply; a 65-foot well with hard water not used.
7	NW.	5	"	"	"	Spring	0	2,820					Cypress Hills?	Soft, clear		S	This is a permanent spring supply.
8	SE.	6	"	"	"	Bored	52	2,820	− 45	2,775	52	2,768	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient supply.
9	SE.	6	"	"	"	Bored	36	2,806	− 32	2,774	32	2,774	Cypress Hills sand	Soft, clear		D	Sufficient supply.
10	SE.	6	"	"	"	Dug	25	2,820	− 21	2,799	21	2,799	Cypress Hills? sand	Soft, clear		D, S	Sufficient supply; used for drinking by several families.
11	SE.	6	"	"	"		130	2,806			35	2,771	Cypress Hills ?				No information; base in blue clay.
12	NE.	6	"	"	"	Dug	70	2,840	− 68	2,772	68	2,772	Cypress Hills sand	Hard, clear		D, S	Sufficient supply.
13	SW.	8	"	"	"	Dug	27	2,800	− 23	2,777	23	2,777	Cypress Hills sand	Soft, clear		D, S	Large supply of water; sufficint for 20 head stock.
14	NW.	8	"	"	"	Dug	35	2,830	− 30	2,800	30	2,800	Cypress Hills quicksand	Soft, iron, clear		D, S	Sufficient for 40 head stock.
15	SW.	9	"	"	"	Dug	18	2,825	− 16	2,809	18	2,807	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 10 head stock; a spring yields a permanent supply.
16	SW.	10	"	"	"	Dug	30	2,820	− 27	2,793	27	2,793	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 9 head stock.
17	SW.	11	"	"	"	Dug	20	2,770	− 14	2,756	14	2,756	Glacial clay	Hard, clear		D	Intermittent, insufficient supply.
18	SE.	11	"	"	"	Spring	0	2,790					Cypress Hills	Soft, clear		S	Intermittent supply; usually sufficient to water stock;stops running in dry summers.
19	NW.	12	"	"	"	Dug	22	2,830	− 19	2,811	19	2,811	Cypress Hills conglomerate	Hard, clear, "alkaline"		D, S	Sufficient supply for 12 head stock.
20	SE.	12	"	"	"	Dug	29	2,790	− 8	2,782			Eastend ?	Medium hard, clear		D, S	Sufficient for 25 head stock except in 1933 and 1934.
21	SW.	15	"	"	"	Dug	44	2,855	− 41	2,814	43	2,812	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient supply; 50 gallons an hour.
22	NE.	16	"	"	"	Drilled	68	2,860	− 60	2,800	68	2,792	Cypress Hills conglomerate	Soft, clear, iron, red sediment		D, S	Sufficient for 15 head stock; another well very similar is used for house.
23	SW.	16	"	"	"	Dug	50	2,848	− 48	2,800	48	2,800	Cypress Hills sand	Soft, clear		D, S	Insufficient for 20 head stock; a 50-foot well also; the two wells are sufficient.
24	SW.	17	"	"	"	Bored	110	2,850	− 50	2,800	100	2,750	Cypress Hills sand	Medium hard, clear		D, S	Sufficient supply.
25	NE.	18	"	"	"	Bored	127	2,870									Dry hole in Cypress Hills formation.
26	NW.	18	"	"	"	Bored	55	2,850	− 52	2,798	20	2,830	Cypress Hills sand	Soft, clear		D, S	Sufficient supply.
27	NE.	13	"	"	"	Dug	20	2,850	− 17	2,833	17	2,833	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 15 head stock.
28	SE.	19	"	"	"	Dug	54	2,870	− 50	2,820	50	2,820	Cypress Hills conglomerate	Hard, clear		D, S	Insufficient 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 WHISKA CREEK, NO. 106, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
29	NW.	21	12	12	3	Dug	20	2,870	− 17	2,853	17	2,853	Cypress Hills conglomerate	Hard, clear, slightly "alkaline"		D, S	Sufficient for 20 head stock; the water is quite soft if used often.
30	NE.	21	"	"	"	Dug	12	2,870	− 2	2,868			Glacial clay	Hard, "alkaline"		D, S	Sufficient supply.
31	NW.	22	"	"	"	Dug	12	2,850					Glacial drift				Yield an abundant supply.
32	SW.	23	"	"	"	Dug	65	2,860	− 60	2,800	60	2,800	Cypress Hills sand	Hard, clear		D, S	Sufficient for 15 head stock.
33	E.½	24	"	"	"	Dug	58	2,855	− 56	2,799	56	2,799	Cypress Hills sand	Medium hard, clear		D	Sufficient for house; used for washing; drilled to 85 feet, filled in with quicksand to 58 feet.
34	SE.	24	"	"	"	Dug	17	2,845	− 14	2,8[illegible]	14	2,831	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 15 head stock.
35	SE.	25	"	"	"	Drilled	250	2,870	−150	2,720			Cypress Hills?	Hard, clear		D, S	Sufficient supply.
36	NW.	25	"	"	"	Dug	[illegible]	2,805	− 19	2,786	19	2,786	Glacial yellow and blue clay	Hard, clear		D	Sufficient for house; use dam for stock.
37	NE.	26	"	"	"	Spring	0	2,790					Cypress Hills?	Hard, clear		S	Waters stock in summer; freezes in winter.
38	NW.	27	"	"	"	Dug	21	2,860	− 10	2,850	10	2,850	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient supply.
39	SE.	28	"	"	"	Dug	12	2,870	− 8	2,862	8	2,862	Glacial sandy clay	Hard, clear, slightly "alkaline"		D, S	Sufficient for 10 head stock.
40	NW.	29	"	"	"	Dug	25	2,888	− 22	2,866	22	2,866	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 23 head stock.
41	NE.	30	"	"	"	Dug	35	2,898	− 30	2,868	35	2,863	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 25 head stock.
42	NW.	30	"	"	"	Dug	49	2,905	− 44	2,861	44	2,861	Cypress Hills conglomerate	Medium hard, clear		D, S	Small supply; sufficient for 20 head stock.
43	NE.	31	"	"	"	Dug	20	2,900	− 17	2,883	17	2,883	Cypress Hills gravel	Soft, clear		D, S	Sufficient supply; a similar well dug in cellar.
44	NW.	31	"	"	"	Dug	14	2,915	− 8	2,807	8	2,807	Glacial sandy clay	Hard		D, S	Six to seven feet of good water.
45	NW.	33	"	"	"	Dug	20	2,875	− 17	2,858	17	2,858	Cypress Hills conglomerate	Slightly hard, clear		D, S	Sufficient supply.
46	SW.	33	"	"	"	Dug	12	2,875	− 10	2,865	10	2,865	Cypress Hills gravel	Soft		D, S	Sufficient supply for 5 head stock; two dugouts.
47	SE.	36	"	"	"	Drilled	48	2,825	− 23	2,802	48	2,777	Cypress Hills gravel	Hard, clear, slightly "alkaline"		D, S	Sufficient supply; waters stock in natural spring lake during summer.
48	NE.	36	"	"	"	Drilled	38	2,785	− 16	2,769	16	2,769	Glacial sandy yellow clay	Hard, clear, "alkaline"		D, S	Sufficient supply for house; laxative on those not accustomed to its use; also use lake.

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

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(#) Sample taken for analysis.