CANADA
DEPARTMENT OF MINES
AND
TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 274

GROUND-WATER RESOURCES OF TOWNSHIPS 43 TO 46, RANGES 13 TO 16, WEST OF 4th. MERIDIAN, ALBERTA

Records collected by P. S. Warren and R. L. Rutherford;
compiled by G. S. Hume

OTTAWA
1947

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MINES AND GEOLOGY BRANCH
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INTRODUCTION

Information on the ground-water resources of east-central Alberta and western Saskatchewan was collected, mostly in 1935, during the progress of geological investigations for oil and gas. The region studied extends from Edmonton in the west to Battleford in the east, and from township 32 on the south to township 59 in central Alberta, township 63 in eastern Alberta, and in part as far north as township 56 in western Saskatchewan.

This region is crossed by North Saskatchewan and Battle Rivers, and includes other more or less permanent streams. Most of the lakes within the area, however, are alkaline, and water is obtained in wells from two sources, namely, from water-bearing sands in surface or glacial deposits, and from sands in the underlying bedrock.

A division has been made in the well records, in so far as possible, between glacial and bedrock water-bearing sands. In investigations for oil and gas, however, the bedrock wells were used to trace the lateral extent of geological formations, with the result that the records deal more particularly with this type of well. No detailed studies were made of the glacial materials in relation to the water supply, nor were the glacial deposits mapped adequately for this purpose. In almost all of the region investigated in Alberta, and in all but the northeast part of the region studied in Saskatchewan, water can be obtained from bedrock. In a few places, however, the water from the shallower bedrock sands is unsatisfactory, and deeper drilling may be necessary.

The water records were obtained mostly from the well owners, some of whom had acquired the land after the water supply had been found, and hence had no personal knowledge of the water-bearing beds that had been encountered in their wells. Also, the elevations of the wells were taken by aneroid barometer and are, consequently, only approximate. In spite of these defects, however, it is hoped that the publication of these water records may prove of value to farmers, town authorities, and drillers in their efforts to obtain water supplies adequate for their needs.

In collecting this information several parties were employed. These were under the direction of Professors R. L. Rutherford and P. S. Warren of the University of Alberta, C. H. Crickmay of Vancouver, and C. O. Hage, until recently a member of the Geological Survey. The oil and gas investigations of which these water records are a part were undertaken under the general supervision of G. S. Hume.

Publication of Results

The essential information pertaining to ground-water conditions is being issued in reports that in Saskatchewan cover each municipality, and in Alberta cover each square block of sixteen townships beginning at the 4th meridian and lying between the correction lines. The secretary treasurer of each municipality in Saskatchewan and Alberta will be supplied with the information covering that municipality. Copies of the reports will also be available for study at offices of the Provincial and Federal Government Departments. Further assistance in the interpretation of the reports may be obtained by applying to the Chief Geologist, Geological Survey, Ottawa. Technical terms used in the reports are defined in the glossary.

How to Use the Report

Anyone desiring information concerning ground water in any particular locality will find the available data listed in the well records. These should be consulted to see if a supply of water is likely to be found in shallow wells sunk in the glacial drift, or whether a better supply may be obtained at greater depth in the underlying bedrock formations. The wells in glacial drift commonly show no regional level, as the sands or gravels in which the water occurs are irregularly distributed and of limited extent. As the surface of the ground is uneven, the best means of comparing water wells is by the elevations of their water-bearing beds. For any particular well this elevation is obtained by subtracting the figure for the depth of the well to the water-bearing bed from that for the surface elevation at the well. For convenience, both the elevation of the wells and the elevation of the water-bearing bed or beds in each well are given in the well record tables. Where water is obtained from bedrock, the name of the formation in which the water-bearing sand occurs is also listed in these tables, and this information should be used in conjunction with that provided on bedrock formations, pages 4 to 11, which describes these formations and gives their thickness and sequence. Where the level of the water-bearing sand is known, its depth at any point can easily be calculated by subtracting its elevation, as given in the well record tables, from the elevation of the surface at that point.

With each report is a map consisting of two figures. Figure 1 shows the bedrock formations that will be encountered beneath the unconsolidated surface deposits. Figure 2 shows the position of all wells for which records are available, the class of well at each location, and the contour lines or lines of equal surface elevation. The elevation at any location can thus be roughly judged from the nearest contour line, and the records of the wells show at what levels water is likely to be encountered. The depth of the well can then be calculated, and some information on the character and quantity of water can be obtained from a study of the records of surrounding wells.

GLOSSARY OF TERMS USED

Alkaline. The term "alkaline" has been applied rather loosely to some ground waters that have a peculiar and disagreeable taste. In the Prairie Provinces, water that is commonly described as alkaline usually contains a large amount of sodium sulphate and magnesium sulphate, the principal constituents of Glauber's salts and Epsom salts respectively. Most of the so-called alkaline waters are more correctly termed sulphate waters, many of which may be used for stock without ill effect. Water that tastes strongly of common salt is described as salty.

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 porous bed, lens, or pocket in unconsolidated deposits or in bedrock that carries water.

Buried pre-Glacial Stream Channels. A channel carved into 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 first encountered.

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 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.

(2) Wells in which the water is under pressure but does not rise to the surface.

(3) Wells in which the water does not rise above the water-table.

BEDROCK FORMATIONS IN EAST-CENTRAL ALBERTA

The formations that outcrop in east-central Alberta are mainly of Upper Cretaceous age, but Tertiary beds occur to the southwest in the Red Deer area. These higher strata are sandstones and shales with thin coaly and carbonaceous beds. Commercial coal beds occur in the Upper Cretaceous Edmonton formation, but other thin coal seams are present, particularly in the Ribstone Creek formation and in the Pale and Variegated Beds. Carbonaceous beds also occur in the Bearpaw formation and are widely scattered through other formations. The Edmonton formation contains some harder sandstones, but almost the whole Upper Cretaceous succession consists of softer sands and sandstones alternating with shales in which ironstone nodules are commonly present. The succession, character, and estimated thickness of the formations are shown in the following table:

Age	Formation	Character	Thickness
			Feet
Tertiary	Paskapoo	Sandstones and shales with thin coal seams and carbonaceous beds; basal sandstones, massive and crossbedded; some siliceous limestone 150 to 200 feet above the base of the formation.	A few hundred feet thick in Red Deer area. The thickness increases to the south and west.

	Edmonton	Grey to white bentonitic sandstones with grey and greenish shales; coal seams prominent in some areas as at Castor, Alberta.	1,000 to 1,150
	Bearpaw	Dark shales, green sands with smooth black chert pebbles; partly non-marine, with white bentonitic sands, carbonaceous shales, or thin coal seams similar to Pale Beds; shales at certain horizons contain lobster claw nodules and marine fossils; at other horizons are abundant selenite crystals.	300 to 600; Thins rapidly to the northwest.
Upper Cretaceous	Pale and Variegated Beds	Light grey sands with bentonite; soft, dark grey and light grey shales with selenite and ironstone; carbonaceous shales and coal seams; abundant selenite crystals in certain layers.	950 to 1,000 in Czar-Tit Hills area; may be thinner elsewhere.
	Birch Lake	Grey sand and sandstone in upper part; middle part of shales and sandy shales, thinly laminated; lower part with grey and yellow weathering sands; oyster bed commonly at base.	100 in west, but less to east and south
	Grizzly Bear	Mostly dark grey shale with a few minor sand horizons; marine origin, with selenite crystals and nodules up to 6 or 8 inches in diameter	Maximum, 100
	Ribstone Creek	Grey sands and sandstones at the top and bottom, with intermediate sands and shales; thin coal seams in the vicinity of Wainwright; mostly non-marine, but intermediate shale in some areas is marine.	Maximum, 325 at Viking; thins eastward.
	Lea Park	Dark grey shales and sandy shales with nodules of ironstone; a sand 70 feet thick 110 feet below the top of the formation in the Ribstone area.	950 to 1,100

Paskapoo Formation

The Paskapoo formation was first named by Tyrrell from exposures of the lower part of the formation occurring along Blindman

River near its confluence with the Red Deer. It is composed essentially of sandstones and shales of freshwater deposition, and includes some thin coal seams and carbonaceous beds. The basal beds are massive, crossbedded sandstones that weather buff-yellow, and are in striking contrast to the underlying, light-coloured, bentonitic clays of the Edmonton formation. About 150 to 200 feet above the base of the formation are beds of siliceous limestones containing gastropods and pelecypods, but these beds are lenticular rather than continuous, although a zone of them appears widely distributed at about the same stratigraphic level.

Edmonton Formation

The name Edmonton formation was first applied to the beds containing coal in the Edmonton area, and later to the same beds in adjoining areas. The formation has a total thickness of 1,000 to 1,150 feet, but is bevelled off eastwards, and the east edge of the formation follows a northwest line from Coronation through Tofield to a point on North Saskatchewan River about midway between Edmonton and Fort Saskatchewan. No Edmonton beds occur northeast of this line, but the formation becomes progressively thicker to the southwest due to the fact that the beds dip in that direction and are bevelled across at the surface.

The Edmonton formation consists of poorly bedded grey and greenish clay shales, coal seams, and sands and sandstones that contain clay and a white material known as bentonite. This material when wet is very sticky and swells greatly in volume, and when dry tends to whiten the beds containing it. Such beds are relatively impervious to water, and at the surface produce the "burns" of barren ground, where vegetation is scanty or absent.

Water is relatively abundant in the Edmonton formation, which contains much sand, commonly in the form of isolated lenses distributed irregularly through the formation. Water occurs in these sands, and, hence, there is little uniformity in the depth of wells even within a small area. Water also occurs commonly with coal seams, and, unlike the sand lenses, these beds are much more regular and persistent. In contrast with the water from the bentonitic sands, which is generally "soft", water from the coal seams, as the water from the shallow surface deposits, may be "hard". The basal beds of the Edmonton formation usually contain fresh water, but this may become brackish locally, where the underlying Bearpaw beds contain highly alkaline or salty water.

Bearpaw Formation

In southern Alberta, where the Bearpaw formation is thickest, the beds composing it are mainly shales that have been deposited in sea water. In the area north of township 32 the formation thins to the northwest and becomes a shoreline deposit composed of shales containing bentonite, impure sands, and thin coal seams. In some areas, as at Ryley and near Monitor, Alberta, and in the Neutral Hills, the Bearpaw contains pebble beds. At Ryley these are consolidated into a conglomerate, but mostly the pebbles are loosely distributed in shale or sandy beds.

In the area immediately north of township 32 the Bearpaw occupies a widespread belt beneath the glacial drift, but farther northwest the belt narrows, and at Ryley and northwestward it is only a few miles wide. This belt crosses North Saskatchewan River about midway between Edmonton and Fort Saskatchewan. Bearpaw beds form the main bedrock deposits of the Neutral Hills. Farther south, where they have an exposed thickness of at least 400 feet, they contain green sands, and beds of marine shale interfinger with the bentonitic shales and sands of the underlying formation. To the north, on the banks of North Saskatchewan River, the division between the Bearpaw and the overlying and underlying formations is indefinite, and the thickness of beds of Bearpaw age is relatively small.

The water in the Ryley area is from the Bearpaw formation, and is salty. In other areas to the south the marine Bearpaw formation carries green sand beds that yield fresh water, but commonly a much better supply is found by drilling through the Bearpaw into the underlying Pale Beds.

In Saskatchewan, Bearpaw beds occur southeast of Macklin and south of Luseland and Kerrobert. Only the basal beds are present, and these contain green sands that are commonly water-bearing.

Pale and Variegated Beds

Underlying the Bearpaw formation is a succession of bentonitic sands, shales, and sandy shales containing a few coal seams. The upper part of this succession, due to the bentonitic content, is commonly light coloured and has been described as the Pale Beds, whereas the lower part is darker, and is known as Variegated Beds. In part, dark shales are present in both Pale and Variegated Beds; others are greenish, grey, brown, and dark chocolate carbonaceous types. The sands may also be yellow, but where bentonite is present it imparts a light colour to the beds. Both Pale and Variegated Beds are characterized by the presence of thin seams of ironstone, commonly dark reddish, but in part purplish. Selenite (gypsum) crystals are, in places, abundant in the shales.

The best sections of Pale Beds exposed in the region are in the Tit Hills, southwest of Czar. These hills carry a thin capping of Bearpaw shales, beneath which, and around Bruce Lake, more than 200 feet of Pale Beds are exposed. The total thickness of Pale and Variegated Beds in the Tit Hills area is about 970 feet. Variegated Beds outcrop near Hawkins on the Canadian National Railway west of Wainwright, but no area exposes the complete succession, which is considered to comprise about 200 feet of beds.

Records of wells drilled into the Pale and Variegated Beds do not, in general, indicate lateral persistence of sands for long distances, nor any uniform average depth to water-bearing sands in a local area. This points to the conclusion that the sands are mainly lenticular, but as such lenses are numerous few wells fail to obtain water. In the Cadogan area many flowing wells have been obtained from sands about midway in the succession. In western Saskatchewan, Pale and Variegated Beds occur over a wide area from Macklin and Kerrobert northeast through Wilkie to the Eagle Hills, south of Battleford. Numerous outcrops occur in the area south of Unity at Muddy Lake, but south and east around Biggar these beds are almost wholly concealed by glacial drift.

The water from the sands of the Pale and Variegated Beds is generally soft. The supply, apparently, is dependent in part on the size of the sand body that contains the water and in part on the ease with which water may be replenished in the sand. Small sand lenses surrounded by shales may be filled with water that has infiltrated into them, but when tapped by a well the supply may be very slowly replenished. In many instances such wells yield only a small supply, although this is commonly persistent and regular.

Birch Lake Formation

The Birch Lake formation underlies the Variegated Beds, but in many areas the division is not sharp. The type area of the formation is along the north shore of Birch Lake south of Innisfree, where a section 65 feet thick, composed mostly of sand, is exposed. The total thickness of the formation in this area is about 100 feet, and although this is dominantly sand a central part is composed of alternating thin sand and shale beds. At the base of the formation, in a number of places, is an oyster bed, and this is exposed in a road-cut in a section 73 feet thick on the east side of Buffalo Coulée, in sec. 3, tp. 47, rge. 7, W. 4th mer. In both upper and lower parts of the formation the sand is commonly massive and outcrops tend to consolidate into hard, nodular masses from a foot to a few feet in diameter. Apparently these are formed through the deposition of salts from the water that finds an outlet at the outcrops. In fact, in some areas the sand may be traced along the side of a hill by the presence of small springs or nodular masses of sandstone.

The Birch Lake formation occurs under the drift and in outcrops in a large area south of North Saskatchewan River and northeast of a line from Willingdon to Innisfree and Minburn. East of this area the southwest boundary is more irregular, but outcrops are persistent on the banks of Battle River from a few miles north of Hardisty to and beyond the mouth of Grizzly Bear Coulée in tp. 47, rge. 5. It is believed, too, that a large area near Edgerton and Chauvin is underlain by the Birch Lake formation and that it extends southeastward into Saskatchewan around Manitou Lake, and southeast to Vera.

It is thought that the Birch Lake formation thins eastwards from its type section at Birch Lake, and that it loses its identity in western Saskatchewan. Deep wells drilled at Czar, Castor, and elsewhere no longer show the Birch Lake as a clearly recognizable sand formation, so that its southern limit beneath younger formations is unknown. Wherever it occurs as a sand, however, it is water-bearing, although in some areas the sand is apparently too fine to yield any considerable volume of water. In other areas, however, it persistently yields good wells. There is no apparent uniformity in the character of the water, which is either hard or soft in different wells in the same general area. Direct contact with surface waters that contain calcium sulphate may in time change a "soft" water well to a "hard" water well, and many wells are not sufficiently cased to prevent the percolation of water from surface sands into the well, and hence into the deeper, soft water producing sands. In part this accounts for the change in character of the water in a well, a feature that has been noted by many well owners.

Grizzly Bear Formation

The type locality for the Grizzly Bear formation, which underlies the Birch Lake beds, is near the mouth of Grizzly Bear Coulée, a tributary of Battle River with outlet in tp. 47, rge. 5. The formation is mainly composed of dark shales that were deposited in sea water. At the mouth of Grizzly Bear Coulée two shale sections, each about 100 feet thick, are separated by a zone of thin sand beds. It is now recognized that the upper section is the Grizzly Bear shale, and that the lower one, very similar in character and also deposited in sea water, occurs in the next lower formation, the Ribstone Creek. The Grizzly Bear shale contains a thin nodular zone about 50 feet above the base, that is, at about the centre of the formation. This zone is sandy, and is believed to yield water in various wells. Other thin sands, in places water-bearing, are also present. The impervious nature of the Grizzly Bear shales makes the overlying Birch Lake sand a strong aquifer, as water collects in the sand above the shale. The contact of the Birch Lake and Grizzly Bear formations can be traced in some places by the occurrence of springs issuing from the base of the Birch Lake sand even where this is not exposed.

Grizzly Bear shales occur in a road-cut on the south side of Battle River near the Jasper highway bridge at Fabyan. The shales in this area are about 100 feet thick. It is thought they extend as far west as the Viking gas field, where they have been recognized in samples from deep wells. It is probable, however, that the shales thin westward and thicken eastwards so that their general form is a wedge between both higher and lower sand beds. The position of the thin edge of the wedge to the west is unknown, but evidently the Grizzly Bear marine shale underlies a large area in east-central Alberta, extending into Saskatchewan mainly in the area south of Battle River.

Ribstone Creek Formation

The type area of the Ribstone Creek formation is on Ribstone Creek near its junction with Battle River in tp. 45, rge. 1, W. 4th mer. At this place the lower sand beds of the formation are well exposed. On the north side of Battle River, in the northeast part of sec. 26, tp. 47, rge. 5, near the mouth of Grizzly Bear Coulée, the upper part of the lower sand member of this formation outcrops. Above it, higher on the bank and at a short distance from the river, there is a 12-foot zone of carbonaceous and coaly beds in two layers, each about 2 feet thick, separated by 8 feet of shale. Above this are 90 feet of dark shales that are thought to have been deposited in sea water, that is, they are marine shales.

These marine shales in turn are overlain by a sandy zone about 20 feet thick containing oysters in the basal part. This sandy zone is the upper sand member of the Ribstone Creek formation. It thickens to the east and west from the Grizzly Bear area, but is probably at no place much more than 50 feet thick.

The lower sand member of the Ribstone Creek formation also varies in thickness from a minimum of about 25 feet. On the banks of Vermilion Creek, north of Mannville, the basal sand is at least 60, and may be 75, feet thick. It is overlain by shaly sand and sandy shale beds, which replace the shale beds in the central part of the formation as exposed at the mouth of Grizzly Bear Coulée. In the Wainwright area, where the formation has been drilled in deep wells, the basal sand is 60 feet thick, with the central part composed of shale containing sand streaks. The upper sand member is about 20 feet thick in this area. The total thickness of the formation in the Wainwright area is 180 to 200 feet, but this increases to the west and in the Viking area exceeds 300 feet.

The Ribstone Creek formation is widely exposed in a northwest-trending belt in east-central Alberta. The southern boundary on the Alberta-Saskatchewan meridian is in the south part of township 44, south of Battle River, whereas the northern boundary is in township 51, a few miles north of Lloydminster. The southwest boundary of this northwest-trending belt passes through the mouth of Grizzly Bear Coulée in tp. 47, rge. 5, and beyond to the Tit Hills area in tp. 54, rge. 12, whereas the northeast boundary crosses North Saskatchewan River southwest of Elk Point and extends northwest to include an area only slightly north of St. Paul des Metis and Vilna to tp. 60, rge. 14. Within this belt water wells are common in the Ribstone Creek sands, which are almost without exception water-bearing in some part of the formation. The limits of the belt to the northeast determine the limits of water from this source, but to the southwest of the belt, as here outlined, water may be obtained in this formation by drilling through the younger beds that overlie it. The Ribstone Creek sands are a prolific source of water in many places, and hence the distribution of this formation is of considerable economic importance. Where the formation consists of upper and lower sands with a central shale zone only the sands are water-bearing, although thin sand members may occur in the shale. Where the formation is largely sand the distribution of water may be in any part of the formation, although the upper and lower sands are perhaps the better aquifers. To the east of Alberta along Battle River and Big Coulée in Saskatchewan the Ribstone Creek sands are marine. Marine conditions apparently become more prevalent to the southeast, and it is believed that in this direction the sands are gradually replaced by marine shales. Thus at some distance southeast of Battleford the Ribstone Creek formation loses its identity and its equivalents are shales in a marine succession.

Lea Park Formation

The Lea Park formation is largely a marine shale, and only in the upper 180 feet is there any water. In the Dina area south of Lloydminster the upper beds of the Lea Park consist of silty shales about 110 feet thick underlain by silty sands 70 feet thick. Below these sands are marine shales only, and these yield no fresh water either in east-central Alberta or west-central

Saskatchewan. The sand in the upper Lea Park formation is thus the lowest freshwater aquifer within a very large area. The extent of this sand in the Lea Park, particularly to the northeast, is not known, but as the strata in east-central Alberta have a southwest inclination, progressively lower beds occur at the surface to the northeast. Consequently, at a short distance beyond the northeast boundary of the Ribstone Creek formation, as previously outlined, the sand in the upper Lea Park reaches the surface, and represents the last bedrock aquifer in that direction. Farther northeast water must be obtained from glacial or surface deposits only. In Alberta this area without fresh water in the bedrock includes the country north of North Saskatchewan River in the vicinity of Frog Lake and a large area extending to and beyond Beaver River. In this area, however, more freshwater streams are present than farther south, and bush lands help to retain the surface waters. The area northeast of North Saskatchewan River in Saskatchewan is almost wholly within the Lea Park formation, where water can be found only in surface deposits.

TOWNSHIPS 43 TO 46, RANGES 13 TO 16, WEST 4TH MERIDIAN, ALBERTA

Physical Features

This area is flat prairie land with low relief. One branch of Iron Creek drains the northeastern part, and another branch drains the southern part. Both branches are intermittent streams, with water only in wet periods. Wavey Lake, north of Strome, is a shallow alkaline body of water without any outlet.

Geology

The southwest part of this area, southwest of Killam, is thought to be underlain by Bearpaw strata with Edmonton in the southwest and west parts. The northeast part is underlain by Pale Beds, and the only known outcrops are north of Killam, on sec. 19, tp. 45, rge. 13, and on sec. 24, tp. 45, rge. 14, at elevations of about 2,200 feet.

Water Supply

A few wells in this area obtain water in glacial materials, but most of the wells are in bedrock, and a considerable part of the Bearpaw is sand and sandy shale, which in lithology is similar to the underlying Pale Beds. The boundary line between the Bearpaw and Pale Beds is, thus, indefinite, and the precise age of many of the lower water-bearing sands is questionable. In the vicinity of Ryley, north of this area, many wells yield salty water. This salt is thought to have been derived from the Bearpaw, which in this area was deposited under shallow water conditions, but the underlying Pale Beds also carry salt water, presumably as a result of downward percolation from the higher Bearpaw sands. This may explain why a well in one place yields salt water from a Pale Beds sand and an adjoining well from the same sand yields fresh water. It is known that the strata in this area have a regional southwest dip of about 25 feet a mile, but little is known of the local structure. The records of the water wells seem to indicate a shallow syncline crossing tp. 45, rge. 13, in a northwest direction, but the information is not sufficiently precise to define this structure.

Township 43, Range 13. A few wells in this township obtain water from glacial gravel and sand, but the main supply comes from sands that are either in the base of the Bearpaw or the upper part of the Pale Beds at elevations between 2,150 and 2,210 feet. It is thought that the bedrock underlying the drift in this township is almost entirely Bearpaw. In the northeast part these beds are thin, as they are in proximity to the Pale Beds contact, but they thicken to the southwest due to the dip in that direction. It is probable that at no place do they exceed 200 feet in thickness, and as the deepest wells in the township are only 100 to 130 feet deep it seems likely that few, if any, penetrate them into the underlying Pale Beds.

Township 43, Range 14. Most of the wells in this township obtain water in glacial sand and gravel beds at comparatively shallow depths. These show no regularity of distribution and occur at various elevations. It is not known by what means their presence or absence can be predicted in any locality, and even closely spaced wells may find water at quite different depths in the drift depending on the occurrence and extent of individual gravel or sand beds. Many such sand beds, however, occur in the drift, and hence most wells sunk into it obtain water. Surface waters containing sulphates are commonly hard.

Two wells in this township reach sands probably in the Pale Beds. One of these, 325 feet deep on SW. section 1 reaches an elevation of 1,946 feet. Evidently it encountered the same bed that is productive at an elevation of 1,953 feet in a well, 308 feet deep, on NE. sec. 8, tp. 42, rge. 13. Another well, 170 feet deep on SW. section 23, reaches an elevation of 2,085 feet. This may be in the lower part of the Bearpaw. It appears to produce from a sand that has not been reached elsewhere in the immediate vicinity. It is probable that any well drilled into the bedrock in this township will obtain water.

Township 43, Range 15. Almost the whole of this township is underlain by Edmonton beds, but these are thin on the east side. A few wells apparently obtain water on basal Edmonton sands, but others reach water-bearing beds in the Bearpaw formation. From the records it is inferred that the best water supply occurs at the base of the drift, but sand and gravel beds are not always present at this level. Deeper water-bearing sands than any so far reached occur in the basal Bearpaw or the upper Pale Beds.

Township 43, Range 16. In this township a few wells obtain water in glacial beds, but wells from 120 to nearly 300 feet deep have been drilled in order to get an adequate supply. It is impossible from the records to determine to what extent the aquifers are continuous, but it is assumed that several different water-bearing beds are present. One well in section 8 flows from a depth of 286 feet. It is possible that this is not in the Edmonton formation, as indicated, but is in a deep channel that has been filled by glacial materials with possibly sand in the bottom through which water flows. Under these conditions a head for the water is provided nearer the source of the stream, and as the stream channel is probably quite narrow it is only rarely that a well has been drilled in it.

Township 44, Range 13. The northeast part of this township is thought to be underlain by Pale Beds, whereas in the southwest part these are covered by a small thickness of Bearpaw beds. A few relatively shallow wells obtain water in the glacial drift, but in this township these are an unreliable source of water and most wells have been sunk into bedrock. A sand at an elevation of 2,175 to 2,195 feet produces water from the base of the Bearpaw formation. Apparently this is the same sand that yields water in tp. 43, rge. 13, at elevations of 2,190 to 2,215 feet. It is probable that the well, 175 feet deep, on SW. section 34, which obtains water at an elevation of 2,000 feet, reached the same sand as the well 192 feet deep on SW. section 27, which obtains water at an elevation of 1,995 feet. These wells are both in that part of the township where Pale Beds underlie the drift, and the water zone is believed to be about 200 feet below the Bearpaw-Pale Beds contact. One well, 320 feet deep on NE.

section 28, obtains water at an elevation of 1,874 feet. The well is assumed to begin almost at the top of the Pale Beds.

Township 44, Range 14. In the southwest part of this township several wells less than 60 feet deep are thought to be in surface or glacial sands and not in bedrock. A few other wells only slightly deeper reach sands in the Bearpaw formation and other deeper wells reach the underlying Pale Beds. A Bearpaw water-bearing sand occurs between elevations of 2,170 and 2,205 feet. A lower sand, at an elevation of 2,060 to 2,070 feet in wells on SE. section 26, NW. section 32, SE. section 36, and NE. section 36, produces soft water from a Pale Beds sand. A still lower sand in the Pale Beds in a well 328 feet deep on NE. section 22 and in a well 326 feet deep on SW. section 34, occurs at elevations of 1,929 and 1,937 feet respectively. In the first well the water is salty. This water may be derived from the Bearpaw formation, as there is no obvious explanation for the distribution of salty and freshwater wells in the same sand except by downward percolation from an overlying, salty, water-bearing bed.

Township 44, Range 15. In this township several wells obtain water at elevations between 2,200 and 2,260 feet. In one of these, 100 feet deep on SW. section 9, a coal seam was reported at 80 feet or at an elevation of 2,230 feet. It is assumed that this coal is in the Edmonton formation, and if so the water in other wells slightly above or below this level may also be in this formation. It seems probable, however, that many wells obtain water from glacial sands resting on bedrock. A well, 325 feet deep on NE. section 23, a well 350 feet deep on NE. section 30, and a well 385 feet deep on SE. section 32, reach a sand in the Pale Beds at elevations of 1,945, 1,950, and 1,915 feet respectively. A well 412 feet deep on NE. section 36 reached an elevation of 1,888 feet. This well must have passed the level of the aquifer of the wells at elevations of 1,915 to 1,950 feet, but, apparently, only a poor supply of water was obtained.

Township 44, Range 16. Edmonton beds underlie the drift in this township, and with the exception of a few wells in drift water has been found at several horizons in the Edmonton and Bearpaw formations. The southwest dip is apparently indicated by an increase in depth to the southwest, resulting in a decrease in elevation of the water-bearing beds in this direction. It seems that the well on SE. section 25, at a depth of 166 feet or an elevation of 2,164 feet, has encountered the same water-bearing bed as the well on NE. section 23, 160 feet deep at an elevation of 2,140 feet, the well on NW. section 14, 180 feet deep at 2,130 feet, and possibly the well on SE. section 29, 206 feet deep at an elevation of 2,094 feet. Also, it is inferred that the water-bearing bed on section 36 at 2,195 feet is the same as that recorded on section 24 at 2,200 feet, and may be the same as the water sands on section 33 at 2,190 feet, on section 27 at 2,183 feet, on sectio n 20 at 2,168 feet, and on section 30 at 2,160 feet. Also, it may be that a third water-bearing sand occurs on section 34 at 2,260 feet, on section 16 at 2,250 feet, and on section 18 at 2,225 and 2,231 feet. Some other sands, apparently in the Edmonton formation, do not conform to these water-bearing beds, and it is unknown whether they represent other horizons or whether there are discrepancies in the records. It seems safe to infer, however, that the Edmonton beds are a reasonably reliable source of water in this township.

Township 45, Range 13. The southwest part of this township is underlain by a thin cover of Bearpaw strata, but the northeast part is occupied by Pale Beds. It is highly improbable that any water is obtained from the Bearpaw, and as the Pale Beds outcrop on section 19 it is assumed that elsewhere they occur at very shallow depth beneath the drift. For this reason no wells seem to obtain water in the drift immediately above the bedrock, as in other areas, and most of the wells penetrate rather deeply into the bedrock. A well on SW. section 24 flows from a depth of 125 feet or an elevation of 2,140 feet. This is difficult to explain, for other wells go to deeper sands for their water supply. This would seem to indicate that the water bed in the flowing well is of very limited extent, but if so it is impossible to explain the hydrostatic pressure that is necessary to bring the water to the surface. A few miles east of the flowing well the surface rises to an elevation above 2,400 feet. It is possible that this might provide the head for the flowing well if the water-bearing sand had a water intake at this higher level. Such an assumption would infer that the water-bearing sand had a very considerable lateral extent, and if so other flowing wells should have been supplied from this source. Not only is this not the case, but most of the wells were drilled to below the level of this water-bearing horizon without encountering water.

The well 300 feet deep on SW. section 9 is believed to have commenced only slightly below the Bearpaw-Pale Beds contact. It thus obtains water at least 300 feet below the top of the Pale Beds. A well 360 feet deep on NW section 22 reaches an elevation of 1,870 feet, 50 feet lower than that of the 300-foot well, and the deepest water-bearing sand encountered in the township.

Township 45, Range 14. This township is partly underlain by Pale Beds and partly by the Bearpaw formation. It is probable, however, that all of the water comes from the Pale Beds. A well, 320 feet deep on NW. section 23, obtains salty water at an elevation of 1,925 feet. This water is from the same sand that produces fresh water in a well 345 feet deep on SW. section 7, a well, also 345 feet deep, on SE. section 8, a well 354 feet deep on NW. section 16, and a well 375 feet deep on NE. section 20. It is presumably also the same sand that produces water in tp. 44, rge. 14, between elevations of 1,925 and 1,940 feet.

Township 45, Range 15. Glacial sands provide some water in this township, but many of the wells have been drilled into bedrock. The west part of this township is believed to be underlain by the Edmonton formation, in the base of which are water-bearing sands. Most of the wells, however, fail to find sufficient water in the higher beds and have been drilled into the Bearpaw or penetrate the underlying Pale Beds.

The Bearpaw-Edmonton contact is thought to occur at an elevation of about 2,300 feet. The strata are believed to dip southwest at about 25 feet to the mile, so that the thickness of Edmonton in the southwest part of this township is less than 100 feet. It may be that a well, 110 feet deep on NW. section 18, and another 125 feet deep on SW. section 18, obtain their water supply from the base of the drift rather than in bedrock. The water in these wells is hard, whereas the water from the basal sands of the Edmonton is commonly soft. A water-bearing sand at an elevation of 2,130 to 2,150 feet appears to be in the Bearpaw formation. This sand was encountered in a well 190 feet deep on SW. section 5, in a well 160 feet deep on NW. section 5, in a well 150 feet deep on NW. section 10, in a well 150 feet deep on NW. section 22, and in a well 150 feet deep on SE. section 33. On SE. section 26 a water sand occurs at an elevation of 1,964 feet in a well 296 feet deep. If this is assumed to be the same sand as that which yields salty water in a well 320 feet deep, or at an elevation of 1,925 feet, on sec. 23, tp. 45, rge. 14, and at elevations between 1,925 and 1,940 feet in wells in tp. 44, rge. 14, and in a well 320 feet deep, or an elevation of 1,874 feet, in tp. 44, rge. 13, it indicates a local east or northeast dip into a small syncline in this area, with an anticline to the west. Under these conditions the salty water may be related in part to the position of the salty water wells in or toward the deeper part of the syncline.

Township 46, Range 16. In this township a few wells are in glacial sands whereas others are in bedrock, presumably in both Edmonton and Bearpaw strata, although it is difficult to make a distinction in many instances. West of Wavey Lake the Edmonton-Bearpaw contact has been mapped at an elevation of 2,300 feet, and the dip is thought to be southwestward at about 25 feet to the mile. Thus a number of the wells are presumably in Bearpaw sands.

Township 46, Range 13. The wells in this township are deep. With the exception of a well, 464 feet deep, on NE. section 36, which may reach the Birch Lake formation, all other wells are in the Pale Beds. There is no apparent regularity in the distribution of the producing sands, but many water-bearing sands are present. Most of these appear to have a limited lateral extent, and in general supplies of water from them are not large. All the water, however, is soft.

Township 46, Range 14. In this township, as in the last, most of the wells are deep and several yield salty water. This salty water zone occurs between elevations of 1,950 and 2,085 feet. It may be that the salt water occurs only at the higher elevation, and that the lower sands are contaminated by downward percolation in the wells. The salt water is, however, reported in a well 340 feet deep on SW. section 18, or at an elevation of 1,970 feet; in a well 320 feet deep on NW. section 21 at an elevation of 1,955 feet, and in a well 360 feet deep on SW. section 30 at an elevation 1,950 feet. This may be the same horizon as that reached in a well 320 feet deep on NW. sec. 23, tp. 45, rge. 14, at an elevation of 1,925 feet, and in a well 328 feet deep on NE. sec. 22, tp. 44, rge. 14, at an elevation of 1,929 feet. The sand at an elevation of 2,085 feet occurs in a well 170 feet deep on NW. section 14. It may be that this is the same sand as in a well 200 feet deep on SE. sec. 16, tp. 48, rge. 14, at an elevation of 2,070 feet. A well, 340 feet deep on SE. sec. 32, tp. 46, rge. 14, appears to obtain its water in the same salty sand as that at an elevation of 1,950 feet in SW. section 30. The water from this well, however, was not reported as salty, but may be so. In this township, therefore, it would seem that the preferable water horizons are those at a high elevation and that the lower ones contain salty water.

Township 46, Range 15. This area is mostly underlain by Bearpaw beds, but a small part of the southwest corner may be underlain by Edmonton beds. A few wells may obtain water from the sands in the base of the Edmonton, but most of the water comes from sands in the Bearpaw or Pale Beds. A sand at an eleva tion of 1,925 to 1,938 feet produces salty water in a well 350 feet deep, on SE. section 9, a well 400 feet deep, on SW. section 30, and a well 350 feet deep, on SW. section 32. This same sand apparently produces fresh water in a well 348 feet deep on NW. section 33, and a well 418 feet deep, on SE. section 18, is reported to have passed through the horizon of this sand and obtained water from a lower aquifer at an elevation of 1,907 feet. It may be, however, that this is the same water-bearing sand, and that the well was drilled slightly below it.

Township 46, Range 16. In this township are many wells 100 feet or more deep, a couple more than 250 feet deep, and one 380 feet deep. The township is believed to be wholly underlain by Edmonton beds, but on the east edge these beds are not very thick. It is almost certain that the two wells more than 250 feet deep reach Bearpaw beds, and as this formation is not thought to be very thick the deepest well reaches the Pale Beds. Salty water seems to be prevalent at the base of the Bearpaw and in the upper Pale Beds, where contamination from Bearpaw beds may have occurred. Thus, these deeper water-bearing zones should be avoided if it is at all possible to obtain a sufficient supply at higher levels.

NOTE: Because of difficulties involved in reproduction, the tables of well records referred to are not included with this report. Information regarding individual wells may be obtained by writing to the Director, Geological Survey of Canada, Ottawa.