CANADA
DEPARTMENT OF MINES
AND
TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 294

GROUND-WATER RESOURCES OF TOWNSHIP 39 TO 42, RANGES 13 TO 16, WEST OF 4th. MERIDIAN, ALBERTA

by

R. L. Rutherford, A.M. Stalker, and H. W. Tipper

OTTAWA
1948

CANADA
DEPARTMENT OF MINES AND RESOURCES

MINES, FORESTS AND SCIENTIFIC SERVICES BRANCH

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER NO.294

GROUND-WATER RESOURCES OF TOWNSHIPS 39 to 42, RANGES 13 to 16, WEST 4th MERIDIAN, ALBERTA

By
R.L.Rutherford, A.M.Stalker,
and H.W.Tipper

OTTAWA
1948

CONTENTS

Illustrations

INTRODUCTION

The survey of the ground-water resources of the Red Deer region, Alberta, was resumed during the field season of 1946, and much information on these resources was obtained by a compilation of records of water wells.

A division has been made in the well records, in so far as possible, between the glacial and bedrock water-bearing sands. The water records themselves 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 the farmers, town authorities, and drillers in their efforts to obtain adequate water supplies.

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 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 report 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 on bedrock formations, provided in the report, 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-records tables, from the elevation of the surface at that point.

With each report is a map consisting of two figures. Figure 1 shows the distribution and type of surface deposits and bedrock formation that occur in the area. Figure 2 shows the locations of all wells for which records are available, the class of well at each location, and the contour lines or lines of equal 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 apt 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 salt 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. A porous bed, lens, or pocket in unconsolidated deposits or in bedrock that carries water.

Buried pre-Glacial Stream Channel. 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 pauses in 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 overlies 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 OF EAST-CENTRAL ALBERTA

The formations that outcrop in east-central Alberta are of Tertiary and Upper Cretaceous age, and consist entirely of relatively soft shales and sandstones, with some bands of hard sandstone and layers of ironstone nodules. The succession, character, and estimated thickness of the formations are shown in the following table:

Age	Formation	Character	Thickness Feet
Tertiary	Paskapoo	Light grey sandstone, in part carbonaceous; shale; small amounts of siliceous limestone and volcanic dust; coal seams.	800 ±
Upper Cretaceous	Edmonton	Grey to white, bentonitic sands and sandstones, with grey and greenish shales; coal seams prominent in some areas, as at Drumheller.	1,000 to 1,150
	Bearpaw	Dark shales, green sands with smooth, black chert pebbles; partly non-marine, with white bentonic sands, carbonaceous shales, or thin coal seams similar to those in Pale Beds; shales at certain horizons contain lobster-claw nodules and marine fossils; at other horizons selenite crystals are abundant.	300 to 600
	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.	600 ±
	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 ±
	Grizzly Bear	Mostly dark grey shale of marine origin, with a few minor sand horizons; selenite crystals and nodules up to 6 or 8 inches in diameter.	100 -
	Ribstone Creek	Grey sands and sandstones at the top and bottom with intermediate sands and shales; mostly non-marine, but middle shale in some areas is marine.	325 -

WATER ANALYSES

Introduction

The following discussion of water analyses is included to assist those who wish to know the effect of various mineral constituents in well water, which give the water in some wells certain peculiar qualities.

Discussion of Chemical Determinations

The dissolved mineral constituents vary with the material encountered by the water in its migration to the reservoir bed. The mineral salts present are referred to as the total dissolved solids, and they represent the residue when the water is completely evaporated. This is expressed quantitatively as "parts per million", which refers to the proportion by weight in 1,000,000 parts of water. A salt when dissolved in water separates into two chemical units called "radicals", and these are expressed as such in the chemical analyses. In the one group is included the metallic elements of calcium (Ca), magnesium (Mg), and sodium (Na), and in the other group are the sulphate (SO_4), chloride (Cl), and carbonate (CO_3) radicals.

Mineral Constituents Present

Calcium (Ca) in the water comes from mineral particles present in the surface deposits, the chief source being limestone, gypsum, and dolomite. Fossil shells provide a source of calcium, as does also the decomposition of igneous rocks. The common compounds of calcium are calcium carbonate ($CaCO_3$) and calcium sulphate ($CaSO_4$).

Magnesium (Mg) is a common constituent of many igneous rocks and, therefore, very prevalent in ground water. Dolomite, a carbonate of calcium and magnesium, is also a source of the mineral. The sulphate of magnesium ($MgSO_4$) combines with water to form "Epsom salts", and if present in large amounts imparts a bad taste and is detrimental to the health.

Sodium (Na) is derived from a number of important rock-forming minerals, so that sodium sulphate and carbonate are very common in ground waters. Sodium sulphate (Na_2SO_4) combines with water to form "Glauber's salts", which if present in amounts over 1,200 parts per million makes the water unfit for domestic use or for irrigation. Sodium carbonate (Na_2CO_3) or "black alkali" waters are mostly soft, the degree of softness depending upon the ratio of sodium carbonate to the calcium and magnesium salts. Waters containing sodium carbonate in excess of 200 parts per million are unsuitable for irrigation.

Chlorine (Cl) is, with a few exceptions, expressed as sodium chloride (NaCl), which is common table salt. When found in water in excess of 400 parts per million it renders the water unfit for domestic use.

Iron, when present in more than 0.1 parts per million, will settle out of the water as a red precipitate on exposure to the air. Water that contains not more than 0.5 parts per million is considered the usual upper limit for potable water, but this amount is often exceeded. A water that contains considerable iron will stain porcelain, enamel ware, and clothing that is washed in it, but the iron can be almost completely removed by aeration and filtration of the water.

Hardness. Hardness is of two kinds, temporary and permanent. Temporary hardness is caused by calcium and magnesium bicarbonates, which are soluble in water but are precipitated as insoluble normal carbonates by boiling, as shown by the scale that forms in teakettles. Permanent hardness is caused by the presence of calcium and magnesium sulphates, and is not removed by boiling. Waters grade from very soft to very hard, and can be classified according to the following system[1].

---

[1] The "Examination of Waters and Water Supplies"; Thresh and Beale, Fourth Ed. 1933, p. 21.

A water under 50 degrees (that is, parts per million) of hardness may be said to be very soft.

A water with 50 to 100 degrees of hardness may be said to be moderately soft.

A water with 100 to 150 degrees of hardness may be said to be moderately hard.

A water with more than 200 and less than 300 degrees of hardness may be said to be hard.

A water with more than 300 degrees of hardness may be said to be very hard.

Hard waters are usually high in calcium carbonate. Almost all of the waters from the glacial drift are of this type, particularly those not associated with sand and gravel deposits that come close to the surface.

In soft water the calcium carbonate has been replaced by sodium carbonate, due to natural reagents present in the sands and clays. Bentonite and glauconite are two such reagents known to be present. Montmorillonite, one of the clay-forming minerals, has the same property of softening water, owing to the absorbed sodium that is available for chemical reaction.[2]

---

[2] Piper, A.M.: "Ground Water in Southern Pennsylvania", Penn. Geol. Surv., 4th series.

If surface water reaches the lower sands by percolating through the higher beds it may be highly charged with calcium salts before reaching the bedrock formations containing bentonite or glauconite. The completeness of the exchange of calcium carbonate for sodium carbonate will, therefore, depend upon the length of time that the water is in contact with the softening reagent, and also upon the amount of this material present. The rate of movement of underground water will, consequently, be a factor in determining the extent of the reaction.

TOWNSHIPS 39 to 42, RANGES 13 to 16,

WEST FOURTH MERIDIAN, ALBERTA

Introduction

Information on the ground-water resources of this area was obtained from the records of water wells and by a study of both the surface deposits and the underlying bedrock in their relation to the ground-water supply. The well record information was collected by R.L.Rutherford in 1935, and A.M.Stalker in 1947; the surface deposits were mapped by A.M.Stalker in 1947; and the report was compiled by H.W.Tipper in 1948.

Physical Features

The surface of this township is essentially a gently rolling plain, with little hummocky terrain and no hills of importance. Battle River and Paintearth Creek have cut easterly trending valleys 200 feet deep through the glacial drift into the underlying bedrock. The area includes a few small, scattered lakes and creeks, several of which are dry in summer.

Geology

Bedrock Formations

The glacial drift in this area is underlain by the Edmonton formation except in the northeast and southeast corners and along the eastern parts of the valleys of Battle River and Paintearth Creek, where it is underlain by the Bearpaw formation. Bedrock is exposed along Battle River and Paintearth Creek and in road cuts. In the southern townships the deposit of glacial material is not thick.

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 eastern 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.

The Edmonton formation consists of poorly bedded, grey and greenish clay shales, coal seams, and sand 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.

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 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.

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 its 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 crystals are, in places, abundant in the shales.

The best sections of Pale beds exposed in east-central Alberta 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.

Unconsolidated Deposits

During the Pleistocene or Glacial epoch, great accumulations of ice formed at various centres in northern Canada. This ice moved out in all directions from these centres and covered large regions with what has been called the continental ice-sheet. As the ice advanced, it picked up great quantities of loose rock debris, which was deposited when the ice finally melted. This material is unconsolidated, and is commonly called glacial drift.

This area was entirely covered by one or more continental ice-sheets during Pleistocene time, and the final retreat of the ice left the bedrock surface covered to a variable depth with a mantle of glacial drift, which constitutes the unconsolidated deposits in the area. Most of the glacial drift consists of boulders and pebbles of various compositions and sizes embedded in a matrix of clay or sandy clay to form a more or less impervious mass known as boulder clay or till. Irregularly intermingled with this impervious mass, and also lying above it, are beds, pockets, and lenses of sand and gravel that form the water-bearing members or aquifers of the drift.

Ground Moraine. This type of glacial drift is chiefly boulder clay and till laid down beneath the ice-sheet, and consists of a heterogeneous mixture of clay, boulders, and pebbles enclosing irregularly distributed lenses and pockets of water-laid sand and gravel. The matrix of such deposits varies in composition from a yellowish sandy clay to a grey or white clay. Boulders and pebbles contained in the ground moraine are generally less than 6 to 8 inches in diameter but may reach dimensions of 2 to 3 feet.

Terminal Moraine. Part of the load carried by the continental ice-sheet was dropped at its front or margin during pauses in the general retreat of the melting glacier. This load consisted of material gathered during the advance of the ice-sheet, and was deposited as a mixture of boulder clay, silt, sand, and gravel. Much of the clay, silt, and fine sand has been carried away by melt water from the glacier, the deposits now consisting mainly of coarse till, gravel, and sand arranged in characteristic hummocks and poorly drained hollows. No unmodified terminal moraine has been recognized within this area.

Reworked Moraine. During the final recession of the ice-sheet, great volumes of melt-water accumulated along the margin of the ice. The glacial lakes so formed were of irregular size, and in many places were very shallow and contained small islands. The duration of the glacial lakes depended on the persistence of barriers that had to be removed by stream erosion or by the melting of ice dams. In the drainage process many areas of terminal and ground moraine were greatly modified, depressions were filled with sand and silt, knolls and hills were eroded and much of the till was reworked, sorted or carried away. Areas so affected are now rolling plains consisting of irregular patches of silt and sand intermingled with patches of till and gravel. Such an area occurs in the western half of tp. 40, rge. 16.

Glacial-lake Deposits. One small area of glacial-lake sand occurs in tp. 39, rge. 13. The sand is dark buff and fine grained, and is poorly stratified. Several other such areas of local extent, probably occur in this region in depressions in the ground moraine.

Water Supply

Within this area, most wells yield an adequate supply of water for present needs, although in several wells the supply is barely adequate and in many the quality is not satisfactory because the water is alkaline or salty or contains iron.

Wells in the glacial drift usually yield hard water, and the supply of many varies with the seasonal rainfall, so that they are not as dependable as the bedrock wells. In the southern townships the deposit of glacial drift is very shallow, and the better wells are in bedrock.

The porous lenses of sand and gravel in the till serve as the best aquifers, but it is not possible to predict where these lenses will occur; and their discovery is a matter of chance.

Most of the wells obtain water from bedrock at depths of less than 200 feet, the greatest recorded depth being 438 feet. In general these wells yield adequate supplies of soft water under sub-artesian conditions, although in most wells hydrostatic pressure is not great. Many shallow wells yield hard water, possibly as a result of surface contamination. No flowing wells have been recorded, but, on the other hand, only two dry holes are known.

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 depths of the wells even within a limited area. Water also occurs commonly with coal seams, which, unlike the sand lenses, 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 from the glacial deposits, may be 'hard'. The basal beds of the Edmonton formation usually contain fresh water, but this may become brackish where the underlying Bearpaw beds contain highly alkaline or salty water.

The aquifers in the Bearpaw formation have not yielded satisfactory supplies of water in many wells. The water has been salty or alkaline, and the supply in many wells is insufficient or soon exhausted. In other areas to the southeast 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.

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 most of the sand deposits are lenticular, but as such lenses are numerous few wells fail to obtain water. The water from the Pale and Variegated beds is usually 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 little water, although the supply is commonly persistent and regular.

Township 39, Range 13. This township has a surface deposit of ground moraine with a small area of glacial-lake sand overlying the till in the southeast corner. The surface is comparatively flat, with Battle River crossing the northeast corner.

Little information has been obtained on the wells of this township. However, shallow wells in the Edmonton formation have yielded limited supplies of hard or soft water, and deeper wells in the Bearpaw formation have obtained a good supply of soft water. The deepest bedrock well recorded is 380 feet.

Township 39, Range 14. A shallow mantle of till overlies bedrock in this township except along Painteearth Creek where bedrock is exposed. The surface is gently rolling, with the valley of Painteearth Creek cutting across the township from west to east.

Several wells obtain a sufficient supply of soft water from the Edmonton formation. These wells are less than 130 feet deep and the water is under hydrostatic pressure. Two wells more than 300 feet deep have been drilled through the Edmonton and Bearpaw formations into the upper part of the Pale beds. In one well the supply of water is limited and in the other the water is salty. If a sufficient supply of water can be obtained in the Edmonton, it is not advisable to drill deeper.

Township 39, Range 15. A shallow deposit of till overlies bedrock within most of this township, but bedrock is exposed in the valley of Painteearth Creek. The surface is gently rolling, broken only by the valleys and gullies of Painteearth Creek and its tributaries.

All wells in bedrock obtain their supply of water from the Edmonton formation. A water-bearing zone occurs between elevations of 2,500 and 2,535 feet, but other wells have obtained water above and below these elevations. The wells are usually less than 50 feet deep and have been dug rather than drilled. The water is commonly soft but surface seepage makes the water in several wells hard, and in some alkaline. The supply is usually sufficient but is not abundant.

Township 39, Range 16. A surface deposit of till, 15 to 20 feet deep, overlies the bedrock in most of this township, but in the northeast corner the till deposit is very shallow and bedrock is exposed in many places. The surface is undulating and slopes northeast toward Painteearth Creek.

A water-bearing zone occurs in the Edmonton formation between elevations of 2,500 and 2,535 feet. The supply of water from this zone is barely sufficient or insufficient for local requirements, and the water is under little pressure. The wells are usually less than 70 feet deep, and the water in many wells is contaminated by surface seepage. Most of the wells pass through coal seams, and the water varies greatly in hardness from well to well.

Township 40, Range 13. Ground moraine covers this township. The surface is comparatively flat, with the valley of Battle River crossing the southwest corner of the township.

A water-bearing zone occurs in bedrock between elevations of 2,200 and 2,250 feet. This zone is near the base of the Edmonton formation and includes some Bearpaw beds. The water supplied by this zone is soft; is under strong hydrostatic pressure; and is sufficient for local requirements. Some deeper wells in the Bearpaw formation provide a good supply of soft water. Most bedrock wells are less than 175 feet deep.

Township 40, Range 14. This township has a shallow surface deposit of glacial till overlying bedrock. The surface is undulating and slopes gently toward the valley of Battle River, which crosses the township from west to east. Bedrock is exposed along Battle River.

A water-bearing zone occurs near the base of the Edmonton formation between elevations of 2,210 and 2,245 feet. The water from this zone is usually soft; is under strong hydrostatic pressure; and is sufficient for most requirements. Most wells in bedrock are 90 to 130 feet deep, and the deepest is 200 feet.

Township 40, Range 15. Bedrock is exposed along the valley of Battle River which crosses the northern sections of the township from west to east. Elsewhere bedrock is overlain by a shallow deposit of ground moraine. North of Battle River the surface is flat, and south of the river it is rolling, becoming hummocky in the southwest corner of the township.

Several wells less than 35 feet deep have been dug in the glacial till, and these have obtained hard, clear water from lenses of sand and gravel in the till. The water is not under pressure, but the supply is sufficient although dependent on rainfall.

Most bedrock wells in this township obtain water from the Edmonton formation between elevations of 2,375 and 2,425 feet. The water in this zone is hard or medium hard, and is not under strong pressure. Most of the wells pass through coal seams, and in some wells the water is alkaline or contains sulphur and is unfit for domestic use. Several wells have been drilled through the Edmonton into the Bearpaw formation, and the water from these wells is salty or the supply is insufficient. Most bedrock wells are less than 75 feet deep and have been dug; the deepest well was drilled 407 feet.

Township 40, Range 16. The surface deposit of this township consists of ground moraine in the eastern sections and reworked moraine in the western sections, with small areas of silt and sand. The surface is comparatively flat, but includes a few small hills and knolls. The drift is less than 45 feet deep for most of the township and commonly much less.

A supply of water has been obtained from the glacial deposits and has been adequate for present requirements. Most of these wells are less than 40 feet deep and secure water from lenses of sand and gravel in the till or from the small areas of sand in the western sections. The water is hard, and commonly contains iron. The supply is dependent on rainfall and may not be adequate in a dry season.

Soft or medium hard water under pressure is obtained in the Edmonton formation between elevations of 2,370 and 2,430 feet. Many of the wells that reach this zone pass through coal seams and the water obtained may contain iron or sulphur. The supply of water is not great, and in many wells is not sufficient for all requirements. Most wells in bedrock are less than 75 feet deep, and the deepest is 280 feet.

Township 41, Range 13. This township has a surface deposit of light brown till overlying bedrock to a depth of 40 feet or less. The surface is generally flat, with a shallow stream valley trending easterly across the township. Several northwest-trending knolls rise 30 to 70 feet above the plain in the southeast sections.

A few shallow wells obtain hard water from lenses of sand and gravel in the glacial till. The supply is not dependable, and bedrock wells are preferred.

Information on the bedrock wells of this township is not sufficient to indicate any water-bearing zone. Wells in the Edmonton formation provide a sufficient supply of hard or soft water for local requirements. One well, 280 feet deep, obtains a good supply of soft water from the Bearpaw formation, and another well, 438 feet deep, drilled through the Edmonton and Bearpaw formations and into the Pale beds, provides a limited supply of soft water.

Township 41, Range 14. This township has a surface deposit of glacial till overlying bedrock. The surface is flat in the south but becomes more uneven in the north where there are several small knolls.

Several wells obtain hard water from lenses of sand and gravel in the glacial till. The supply is dependent on the rainfall, but is usually sufficient to satisfy requirements.

Wells in bedrock usually provide a sufficient supply of soft water throughout the township. A water-bearing zone occurs in the Edmonton formation between elevations of 2,215 and 2,250 feet. Other wells have been drilled through the Edmonton formation into the Bearpaw formation, from which a good supply of soft water has been obtained.

Township 41, Range 15. Glacial till forms the surface deposit of the township. The surface is comparatively flat, and the township has no outstanding topographic features.

Water has been obtained from sand lenses in the till. The wells are shallow and the supply is dependent on rainfall, so that this type of well is not reliable in dry seasons.

A sufficient supply of water is secured by two wells in the northwest corner of the township from the Edmonton formation. The wells are 128 feet deep and the water is soft. One well in section 4 was drilled to a depth of 360 feet but is a dry hole.

Township 41, Range 16. Battle River crosses the southern sections of the township in a valley 200 feet deep, and bedrock is exposed along the river. Elsewhere in the township bedrock is overlain by a deposit of glacial till. North of Battle River the surface is comparatively flat or gently rolling.

A few wells supply hard water, which is obtained from lenses of sand and gravel in the glacial drift. The supply is sufficient for local requirements but is dependent on rainfall.

Bedrock wells, 120 to 200 feet deep, in the Edmonton formation, provide a sufficient supply of soft water. Other wells have obtained water at greater depths, and the deepest well is 400 feet.

Township 42, Range 13. Bedrock is overlain by a deposit of light brown, coarse till, 50 to 75 feet thick, and is not exposed in the township. The surface is uneven with several low hills and undrained depressions, and a shallow stream valley trends northwest through the centre of the township.

Several wells less than 50 feet deep have been dug in the glacial drift but these do not provide a satisfactory supply of water. In many, the supply is insufficient or limited, and in others the water is alkaline or contains iron.

A water-bearing, sand zone lies in the Bearpaw formation between elevations of 2,210 and 2,235 feet. The water from this zone is generally hard and is not under strong pressure. The supply is good or sufficient. Other wells have been drilled through the Bearpaw formation into the Pale beds to elevations of about 2,000 feet. These wells are all more than 200 feet deep and provide a good supply of soft water under strong hydrostatic pressure. The deepest well recorded in the township is 308 feet.

Township 42, Range 14. The surface deposit of this township consists of light brown till overlying bedrock to a depth of 75 feet or less. The surface is flat in the northeast corner but becomes more uneven in the south where there are low knolls and swampy hollows.

Many wells in the glacial drift provide a sufficient supply of hard water, but in others the supply is limited. The water is usually alkaline or contains much iron, so that it is not entirely satisfactory for domestic purposes. Most of the wells are 25 to 50 feet deep, and obtain water from porous sand lenses in the glacial till. The supply is dependent on rainfall.

Bedrock wells in this township have not provided a completely satisfactory supply of water. Between elevations of 2,225 and 2,265 feet in the Edmonton formation, limited amounts of soft water have been obtained.

Wells 150 to 200 feet deep in the Bearpaw formation have yielded varying amounts of soft water, and two wells drilled through the Bearpaw formation into the Pale beds yielded salty water that was unfit for use.

Township 42, Range 15. All of this township is overlain by a deposit of glacial till, which in most places is 55 feet deep or less. The surface is comparatively flat, with a few gently undulating areas.

Bedrock wells provide a sufficient supply of water for most requirements. Two water-bearing zones occur in the Edmonton formation between elevations of 2,210 and 2,225 feet and 2,250 and 2,300 feet. The water is soft and under pressure, and is satisfactory for most uses. Most wells are 100 feet or less deep, and none is deeper than 140 feet.

Township 42, Range 16. In this township the surface deposit is glacial till. The surface is gently rolling and rises slightly to the west.

A sufficient supply of soft water is obtained from a water-bearing zone in the Edmonton formation between elevations of 2,185 and 2,225 feet. Most of these wells pass through coal seams, but apparently the quality of the water has not been affected. The wells are 100 to 200 feet deep, and the deepest well recorded is 217 feet.

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.