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DEPARTMENT OF MINES
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GEOLOGICAL SURVEY OF CANADA
WATER SUPPLY PAPER No. 129

PRELIMINARY REPORT

GROUND-WATER RESOURCES
OF THE
RURAL MUNICIPALITY OF COULEE
NO. 136
SASKATCHEWAN

By

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



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DEPARTMENT OF MINES
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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY

OF COULÉE, NO. 136,

SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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 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. These are called Flowing Artesian Wells.

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

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

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

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

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

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

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

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

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

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

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Coulée covers an area of 324 square miles in southwestern Saskatchewan. It consists of nine townships described as tps. 13, 14, and 15, ranges 10, 11, and 12, W. 3rd mer. The centre of the municipality is about 15 miles east and 7 miles south of the city of Swift Current. The Gravelbourg Branch of the Canadian National railways crosses the three northern townships, and on it are located the sidings of Friend, Toppingham, Burnham, and Roderickville. McMahon, Braddock, and Hallonquist are situated on the Coderre branch of the Canadian Pacific railway which runs through the southern part of the municipality.

The northwest-southeast diagonal of the municipality roughly divides the area into two areas of different topographic relief. The northeastern half of the area is for the most part a gently rolling plain. The lowest surface elevations of the municipality, of approximately 2,350 feet above sea-level, occur in the broad, flat-bottomed valley that extends in a northwesterly direction across township 15, range 10. North of this valley the land surface rises to elevations of approximately 2,550 feet. From a similar elevation at the southern edge of the valley the land rises to the southwest to elevations approximating 2,600 feet, at the base of a steep escarpment that extends along the northwest-southeast diagonal of the municipality. At isolated areas in the east-central parts the land rises to heights exceeding 2,750 feet. In places, along the escarpment in the central part, the slopes rise fairly abruptly for heights of 150 to 250 feet. The southwestern half of the municipality is mostly an upland having an average elevation of 2,800 feet, and exceeding 2,900 feet in the west-central part. The upland is deeply dissected. Rushlake creek flows east through one of these valleys

in the northwestern part, and Wiwa creek, a smaller, intermittent stream extends from the upland to cross the eastern boundary of the municipality in sec. 25, tp. 13, range 10.

Springs occurring on the slopes of the upland and along the creeks form sources of water for stock in the area. Many of the coulées form ideal sites for the construction of dams or for the excavation of dugouts to conserve the surface run-off. On the majority of farms, however, wells are used. On the upland little difficulty has been experienced in obtaining adequate supplies from wells sunk into the unconsolidated deposits and the bedrock, but in the lowland the bedrock is very sparingly productive and prospecting must be confined largely to the stream deposits or glacial drift.

Water-bearing Horizons in the Unconsolidated Deposits

Few attempts have been made to obtain water from the Recent alluvium that occurs as narrow belts of flood-plain deposits bordering Wiwa and Rushlake creeks. Layers of sand and more occasionally gravel occur interbedded with the fine silt that makes up the greater part of the stream deposits. These more porous beds form good aquifers. The few wells that have tapped these beds yield ample supplies for about 15 head of stock. In some places in the lowland where the stream gradient is lower and the underground circulation of the water less rapid, conditions are favourable for the gradual accumulation of mineral salts, particularly sulphates. Some of the waters derived from the silt are so highly charged with dissolved sulphate salts as to be unfit for drinking, but are, nevertheless, being used for watering stock. Aquifers are to be expected in the Recent deposits at most places along the creeks and should be water bearing at depths not exceeding 15 feet. As the more porous sand and gravel are not present at all points in

the silt, prospecting with a test auger may be necessary to locate an adequate supply.

As shown on the accompanying geological map, Figure 1, the glacial drift in the municipality is made up of four types of deposits, namely, glacial lake sand, glacial lake clay, moraine, and glacial till or boulder clay. Such variations as are noted in the character of these deposits may be attributed largely to differences in their mode of deposition. The great continental ice-sheet that advanced and retreated over the province of Saskatchewan many thousands of years ago carried with it masses of boulders, gravel, and more finely ground rock debris. Much of the load carried by the ice was dropped as the ice front retreated and formed a covering of boulder clay of irregular thickness over the land surface throughout extensive areas. Where the ice front paused for considerable periods of time in its retreat, as over some of the upland areas, greater accumulations of boulder clay and water-sorted sands and gravels were deposited. Such areas are irregularly rolling and the surface is characterized by many low hills and ridges with intervening undrained depressions. They are known as moraines to differentiate them from the less irregularly rolling areas of drift designated as till plains. Water resulting from the melting ice gradually accumulated to form lakes in the lowlands and particularly in the previously existing northerly trending drainage channels that were blocked by the ice-sheet. Such lakes covered large areas in the municipality to the north and extended along the wide valley in the northeast corner of this municipality, as is evidenced by the thin layer of compact lake clay that covers the valley bottom. A layer of lake sand also occupied a small area in the extreme northeastern corner of the municipality. The lake clay is too

compact to yield water, but the glacial lake sands, and sands underlying the lake clay, form good reservoirs for ground water accumulation. In the area covered by the lake sands water is to be expected by digging wells to depths not exceeding 45 feet. The water-bearing sand beds in the area of lake clay lie 20 to 40 feet below the ground surface. Large supplies of water are not usually obtained from these deposits, but individual wells should produce ample water for 10 to 20 head of stock.

As the moraine and till consist of essentially the same materials and little difference is noted in their water-bearing properties the two types of deposits will be considered together as glacial drift. The drift varies considerably in thickness within the municipality. On the highlands in the south and west the covering is less than 5 feet thick in places and does not appear to greatly exceed 20 feet at any point. On the slopes and in the lowland areas the thickness increases to over 35 feet. In the northern townships the glacial covering becomes still thicker and is believed to exceed 90 feet in the northern part of township 15, range 11. The boulder clay, of which the till and moraine are largely composed, is too impervious in most places to yield more than very small seepages of water. In some places the clay is more sandy and sufficient water for local requirements is obtained from wells dug into it. Scattered sparingly through the boulder clay are pockets of sand and gravel that serve as underground reservoirs for water accumulation. These pockets are not to be found on the highlands, where the drift is very thin, but are interspersed through the boulder clay of the lowlands, with great variation as to their individual areal extent, porosity, and depth of occurrence. The greatest depth at which aquifers in the drift have been recorded is 60 feet in township 15, range 10.

Many of the water-bearing pockets yield sufficient water for 20 to 40 head of stock, but where smaller pockets or only sandy phases in the clay were encountered the yield is appreciably less. The water is hard and contains considerable amounts of sulphate salts in solution, but only in very few places are these salts sufficiently concentrated to make the water unfit for drinking. The glacial drift is not an important source of water in those parts of the municipality that lie at the higher elevations, owing to their thinness and also to the porosity of the underlying bedrock in which water seeping from the surface eventually accumulates. However, the thicker deposits on the lower land are more productive and are worthy of further prospecting. Lack of water-bearing horizons in the bedrock that underlies the lowland areas increases the importance of the scattered aquifers in the drift in these localities. Since there is little evidence at the surface of the occurrence of these porous beds in the drift, careful testing may be necessary to ensure adequate water supplies. Wells located at or near the bases of slopes or in depressions are usually more satisfactory than those dug or bored at random locations on the plains.

Water-bearing Horizons in the Bedrock

Four bedrock formations known as the Cypress Hills, Ravenscrag, Eastend, and Bearpaw formations immediately underlie the glacial drift throughout this municipality, as indicated on Figure 1 of the map accompanying this report. All of these formations presumably, at one time, extended over the whole area. Extensive erosion before the deposition of the drift greatly reduced the areal distribution of most of these formations. The uppermost or Cypress Hills beds are confined to the areas of highest relief and the lower formations have

successively greater areal extent at lower elevations. Only the Bearpaw formation, however, extends over the entire municipality.

Much of the Ravenscrag was eroded away before the Cypress Hills beds were laid down and in some places even the Eastend was removed. Hence, the base of the Cypress Hills formation, lying as it does on a very uneven surface, occurs at different elevations in different parts. In some places in the central part of the area it lies upon the Ravenscrag, but farther north and south it may rest directly upon the Eastend or even upon the Bearpaw formation. This latter condition exists in the northwest and northeast townships and in the isolated highland area in township 14, range 10.

The Cypress Hills formation consists of beds of sand, loosely consolidated sandstone, quartzite, conglomerate, and occasional beds of clay. The unconsolidated coarse beds form good aquifers. Lateral variations exist in the beds of the formation and few of the water-bearing horizons extend over large areas, but aquifers are sufficiently numerous so that wells sunk in any area underlain by the formation should penetrate them. The depth of wells required varies considerably within short distances and ranges from 10 to 110 feet. Only a small number of wells exceed 80 feet in depth. Springs along the slopes mark the occurrence at the surface of water-bearing horizons. Many of these springs are used for watering stock and on some farms provide water for domestic use. The yields from a few wells scattered over the area are small and are inadequate for local requirements. Larger supplies might be obtained by deepening these wells, or the supply may be increased by sinking additional holes. The greater number of the wells, however, provide ample water for local domestic needs and will also water 10 to 20 or more head of stock. Although the

water from the greater number of the wells is reported to be soft, or only slightly hard, and of good quality, water of inferior quality is obtained in isolated wells. The water from several wells in the southern part of township 14, range 12, and in the central part of township 15, range 12, contains large concentrations of dissolved mineral salts and is unfit for drinking, but is usable for stock. The Cypress Hills formation is the most reliable source of water in the municipality and satisfactory supplies should be obtainable on every farm in the area in which it occurs.

Little information is available regarding the Ravenscrag formation in this municipality. Its existence is known from outcrops in township 14, range 11, and its areal extent is believed to be approximately as shown on the map, Figure 1. The Ravenscrag beds to the west probably extend beneath the Cypress Hills formation, but their extent in this direction has not been determined. The Ravenscrag formation consists of greenish grey to dark grey sands and sandstones interbedded with layers of light- and dark-coloured clay and shales. A number of wells in township 14, range 11, range in depth from 18 to 78 feet and tap the water-bearing sands and sandstones of the formation. The water is of good quality and each well provides enough water for local needs. It is probable that similar satisfactory supplies could be obtained throughout the area in which this formation occurs. The glacial drift covering the formation will yield little water, so that the testing of this bedrock formation in the area where it is present should be included in all future prospecting.

The Eastend formation normally occurs beneath the Ravenscrag formation, but in the southern and western parts of the municipality it lies directly beneath the Cypress Hills formation. In the northern townships it was apparently removed

before the deposition of the Cypress Hills beds. Owing to the lower elevation at which it occurs its areal extent is slightly greater on the slopes than that of either the Cypress Hills or Ravenscrag formations, and in narrow belts on the slopes the Eastend beds are overlain only by the glacial drift. These belts are shown on the geological map, Figure 1. The upper part of the formation consists of yellowish, and yellowish green sands and silts and the lower part of fine sands and silts, and grey shales. Water-bearing horizons in the formation are evidenced by a few springs on the slopes and by several wells. The wells range in depth from 20 to 92 feet. Two of the wells yield only very small supplies, but the others produce sufficient water for local requirements. The water is variable in quality, but from only one well is it unsuitable for drinking. Water supplies may be expected in wells sunk into the Eastend formation at most points where it is covered only by the drift. Where the Cypress Hills or Ravenscrag formations overlie the Eastend, water-bearing horizons should be encountered before the lowest of these formations is reached.

The Bearpaw formation underlies the whole of the municipality, and in those areas where the other three formations are absent it occurs immediately beneath the drift. This formation consists of not less than 500 feet of compact, dark grey to black shales. These shales are exposed at the surface at several points in township 13, range 10, township 14, range 11, and along the valley slopes in township 15, ranges 10, 11, and 12. The shales may be distinguished from the boulder clay in drilling by their darker colour and soapy feel, the absence in the shales of stones or pebbles, and by the small, roughly cubical, buff to orange-coloured fragments into which the shales crumble upon drying. More sandy beds may occur in

the shales near the top of the formation in some localities, and sand beds are also believed to occur near the base of the formation. In areas where only the compact shales are present water percolating downward from the surface cannot seep beyond the top of the bedrock. Water accumulates at this horizon and hence the zone of contact of the glacial drift and the Bearpaw shales is found to be a good source of water supply in some places. A few wells in the southeastern townships have encountered sandy beds or shales that are rendered more porous by weathering and obtain supplies of water. The depth of these wells ranges from 35 to 100 feet. Sufficient water for local requirements is not obtained in all places, but many of the wells yield ample supplies for 20 to 40 head of stock. The water from this source is hard and contains considerable amounts of mineral salts in solution. The concentration of these salts is sufficient to render the water from many wells undrinkable and in a few places even unfit for stock. Although there can be no assurance of obtaining water from the upper part of the Bearpaw formation, only very few dry holes have been sunk, and supplies of water usable at least for stock are to be expected in most places.

Several wells, 216 to 390 feet in depth, have been drilled into the Bearpaw formation in township 15, range 10. The records of these wells are not complete, so that it is impossible to determine the position of the aquifer or to trace any continuous aquifer through the formation. The widely scattered locations of these wells, however, would indicate that water supplies might be expected from similar wells at other points in the northeastern part of the municipality. The water is believed to be under hydrostatic pressure, so that it rises part of the way up the wells. Each well produces ample

water for 30 to 40 head of stock and the water is of good quality, being soft or only moderately hard. A 590-foot well on sec. 28, tp. 14, range 10, and a 550-foot well on sec. 12, tp. 15, range 10, have encountered water-bearing horizons near the base of the Bearpaw formation. The water from the wells is of good quality and the supply is sufficient for 25 and 22 head of stock, respectively. A sufficient number of deep wells have not been drilled in the area to indicate a continuous aquifer at this depth, but it is probable that water-bearing sand beds are present near the base of the formation over most of the area. A 700-foot dry hole on sec. 33, tp. 15, range 10, indicates, however, that such an aquifer is not present at this point. Notwithstanding that this horizon can be considered a potential source of water drilling to this depth should be unnecessary in most parts of the municipality. It is advisable to prospect carefully in the glacial drift or in the upper part of the Bearpaw formation before undertaking deep drilling.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 13, Range 10

Recent alluvial deposits occur in a narrow belt adjacent to Wiwa creek. Shallow wells dug in the vicinity of the creek, on section 27, show the silts and sands to be water bearing. One of these wells tapping a sand aquifer produces enough water for 15 head of stock. The water has a high content of dissolved mineral salts and is not suitable for drinking. Some of the water in these wells comes as direct seepage from the creek, but the sands serve as buried reservoirs for water. At other points along the creek, water supplies should also be obtained by digging shallow wells, and if the porous beds encountered are extensive the water obtained should be of better quality.

A mantle of glacial till varying in thickness from 20 to about 60 feet extends over all the township. The till on the highlands of the south has not been prospected for water, but many wells have been dug throughout the remainder of the area. Small supplies of highly mineralized water are obtained from the boulder clay in a few places and as a rule the clay cannot be considered as a good source of water. Several dry holes and a few wells, which passed through the drift into the bedrock before locating water are further proof of the non-water-bearing character of the boulder clay. Scattered through the boulder clay at irregular intervals are pockets of water-bearing sands and gravels. A few wells have tapped gravel pockets at depths ranging from 3 to 58 feet. The pockets vary in their lateral extent and hence in their capacity as reservoirs for water and although in a few places only very small supplies are obtained from the gravels in other places pockets yield ample water for 10 to 40 head of stock. The water is hard and except from the 60-foot

well on section 13 is usable in the households. Untapped sand and gravel pockets no doubt occur in many parts of the township and are worthy of further prospecting in view of the unsatisfactory water supplies at present available on a number of the farms. The gravel in the 60-foot well on section 13 appears to lie immediately above the bedrock. As the Bearpaw shales are impervious in most places this zone of contact between the drift and the Bearpaw shales in many cases proves to be a good source of water. At most points the water will be found to have a high dissolved mineral salt content and, therefore, is usable only for stock.

As shown on the geological map, Figure 1, the Cypress Hills formation immediately underlies the glacial drift in the highlands area in the southern sections of the township. No wells have been dug in the area in which this formation occurs. These beds continue into the townships immediately to the south and west where they have been penetrated by a number of wells. The covering of drift is about 30 feet thick and the wells have penetrated the bedrock for depths of 10 to 85 feet. The water obtained is fairly soft and of good quality and individual wells yield ample water for local domestic and stock requirements. Similar supplies should be obtained in this township by sinking wells to the lower beds of the Cypress Hills formation. There is less certainty of obtaining water from this formation where it occurs to the east of the valley in sections 1 and 12 than in the sections towards the western border, but water-bearing horizons probably also exist in this locality. A number of springs on the slopes have been reported and are believed to originate in the Cypress Hills formation. The gravel and sand beds of this formation are probably the best potential source of ground water in this township.

The Eastend formation underlies the Cypress Hills formation and owing to its lower elevation extends over a slightly greater area than the Cypress Hills beds, as is indicated on the map (Figure 1). Water-bearing horizons probably occur in the sandy beds of this formation, but they are as yet untested. Since water is to be expected at shallower depths in the overlying beds of the Cypress Hills formation it will not probably be necessary to seek water in the Eastend. In the narrow belt in which the Eastend formation directly underlies the glacial drift, however, it would be advisable to test for water in the bedrock if supplies are not found in the drift. The water will probably be of inferior quality to that found in the Cypress Hills formation.

The dark, compact shales of the Bearpaw formation underlie the Eastend formation and extend throughout the remainder of the township where they are covered only by the glacial drift. In some localities the upper part of the Bearpaw formation is very compact and impervious, whereas in other places it is more porous owing to weathering of the shales before the deposition of the drift, and to the presence of sandy beds. On sections 12 and 16 dry holes were sunk into the shales, but on sections 19, 32, and 34, water is obtained from the bedrock in wells 36 to 100 feet deep. The supplies obtained from these wells, however, are small and are inadequate for local requirements. Sulphate salts are concentrated in the water and make it unfit for drinking. From some of the wells the water cannot be used even for stock. When digging wells in this township it is advisable to cease drilling when the compact shales are reached. Usable supplies may be found at the contact between the drift and the bedrock, but are not to be expected from the shales.

Deep drilling is not advised as the depth to reach any possible existing aquifers in the lower part of the Bearpaw formation would be at least 500 feet. Except where the Cypress Hills formation occurs it is advisable to confine all prospecting for ground water to the Recent and glacial deposits. Additional dams and dugouts might be constructed on many of the farms to provide stock water, and domestic supplies could be obtained by digging shallow seepage wells close to these surface reservoirs.

Township 13, Range 11

Wiwa creek has carved a broad, and in some places a deep, valley through the uplands of this township. From an elevation of 2,550 feet above sea-level in the valley of the creek near Braddock the land rises to both the south and the northwest, reaching elevations of 2,950 feet along the southern border and over 2,900 feet in the northwest corner. Ground water of the area is derived almost entirely from the bedrock, the glacial drift in many parts being too thin and too impervious to retain any large accumulations of water.

Thin layers of Recent stream sands and silts probably occur in the vicinity of Wiwa creek, but no wells are reported to have been dug into them. In the upper reaches of the creek coarser sediments are to be expected than in the township to the east. Such sediments are sufficiently porous to retain water, and shallow dug wells are expected to yield water that is not too highly mineralized for domestic use. The Recent deposits probably do not exceed 10 to 12 feet in thickness.

A mantle of glacial till covers the entire township remote from the lower stream valley. Over the higher land this covering ranges from less than 5 feet to 20 feet in thickness.

On the lower land in the central and northeastern parts of the township the drift is at least 30 feet thick. The boulder clay, in most places, is too compact to yield more than very small seepages of water. Where more sandy phases occur larger supplies are obtainable, as evidenced by the 28-foot well on section 21. Sand and gravel pockets scattered through the boulder clay are usually good reservoirs. Few of these pockets will be found on the highlands, where the drift is thin, but in the valley area they should be more numerous. Such pockets have been tapped by wells on sections 13 and 24 at depths from 7 to 23 feet. The well on section 13 produces only enough water for household use, but the 14-foot well on section 24 yields sufficient quantities for 30 head of stock. All the water derived from the glacial drift is of satisfactory quality for household use. Sufficient water for local requirements should be obtainable from the drift throughout the central and northeastern parts of the township if sand and gravel pockets are located. The location of these porous beds is not usually indicated on the surface and it is advisable to sink a series of test holes with an auger before sinking a well.

Before the deposition of the glacial drift considerable amounts of sand were washed down from the uplands and deposited on the slopes and in the valley. These sands may form fairly continuous beds and should be an excellent source of water. Sand beds such as these are difficult to distinguish from those of glacial origin, or from those in the upper part of the Eastend and Bearpaw formation, which underlie the drift in various parts of the township. Water percolating from the highlands down through these sands would be under some hydrostatic pressure and will rise in wells a few feet above the aquifer. Several wells in the northeastern part of the township whose aquifers have been recorded to be in the bedrock may be

tapping these sand beds at the contact of the glacial drift and the bedrock, particularly in those parts of the township in which either the Eastend formation or Bearpaw formation directly underlies the drift. These sands probably are not distributed over the whole area, but their extent cannot be determined from the well records available.

The Cypress Hills, Eastend, and Bearpaw formations occur immediately beneath the glacial drift in different parts of the township and are indicated approximately on the accompanying geological map, Figure 1. The Ravenscrag formation is also believed to occur in a small portion of section 33. The Cypress Hills, being the uppermost of the four formations, is found only on the high land in the southern, western, and northwestern parts of the township. A number of springs on the slopes indicate the presence of water-bearing horizons in the formation. Sand or coarse gravel beds are tapped by most of the wells sunk into this formation, but in a few places sandy clay beds serve as aquifers. In some places the upper part of the formation is very porous and the water percolates to lower levels, necessitating deeper wells. The existing wells range in depth from 13 to 84 feet. A few of the wells visited were found to produce only enough water for household requirements, but in general individual wells yield sufficient water for domestic use and 10 to 30 or more head of stock. One well on section 30 supplies ample water for 60 head of stock. The water from the Cypress Hills formation in this township is variable in quality. The soft water, characteristic of this formation, is found in a few wells on sections 3, 4, 6, 28, and 33. In other places the water is hard, and contains considerable amounts of dissolved mineral salts. However, only from the 73-foot well on section 19 has the water been found to cause any ill effects when used for drinking. It is possible

that these deeper wells have penetrated through the Cypress Hills formation into the underlying Eastend formation.

This latter formation probably underlies the Cypress Hills formation throughout its extent in this township and extends over the lower slopes, where it is covered only by the glacial drift. Several springs occur on the slopes where the water-bearing beds of the Eastend come near the surface. Several wells located on sections 5, 9, and 10, and ranging in depth between 40 and 92 feet, have encountered beds of fine grey sand at elevations of 2,715 to 2,727 feet above sea-level. From two of the wells the water is of good quality but the supply is very small, whereas from the well on section 9, large quantities of water are available, but it is usable only for stock. Wells and springs on sections 6, 7, 18, and 20 derive water from an aquifer in the Eastend at an elevation about 2,760 feet above sea-level. The wells range in depth from 23 to 60 feet, depending upon surface elevations at the well site. Supplies are sufficient for local requirements and the water is of suitable quality for domestic use. Four wells on sections 34 and 35, ranging in depth from 35 to 72 feet, encountered beds of water-bearing sand at elevations from 2,728 to 2,675 feet above sea-level. There is some doubt as to whether these sands are a part of the Eastend formation or whether they were washed down by water from the higher land and deposited on top of the bedrock in pre-glacial time. The supplies from two of the wells are sufficient for only 12 and 20 head of stock, but from the other two wells, 60 and 120 head are watered. The water is not of the same quality in the different wells, but all is used for household purposes. From the evidence of existing wells water supplies are to be expected from other wells that may be sunk into the

Eastend formation.

The Bearpaw formation underlies the glacial drift in the remainder of the township and extends beneath overlying formations capping the uplands. Few wells have penetrated this formation, as the Cypress Hills and Eastend formations that overlie it throughout much of the township are productive of water, and the covering of drift in the central and eastern parts of the township is also fairly productive. The upper part of the Bearpaw formation includes thin sandy beds within the shales in some places, and these phases form good aquifers. Wells 35 to 83 feet deep on sections 15, 21, and 25 are believed to have tapped these sand beds in the Bearpaw formation. The water is of good quality and each well produces a supply ample for 10 to 40 head of stock. Those sands may be a part of those washed down from the hills before the deposition of the glacial drift. An 80-foot well on section 5 and a 210-foot well on section 4 are definitely known to have penetrated the Bearpaw, and the water from each of these wells is too highly charged with dissolved sulphate salts to be used for any purposes. It is probable that any water suitable for farm use in the Bearpaw formation will be confined to the upper few feet of the formation. Deep drilling into this formation is not recommended. Water-bearing sand beds probably exist in the lower part of the Bearpaw at depths of 400 to 500 feet, but their presence has not been proved in this township.

Township 13, Range 12

The glacial till, which covers the whole of this township, is thin, being less than 15 feet in most places. No wells are known to be obtaining water from the drift and it is improbable that more than very small supplies could be found, even by careful prospecting.

The Cypress Hills formation immediately underlies the drift throughout the entire area except in the southern portion of section 1 where it has been removed by erosion, leaving the Eastend formation uppermost beneath the mantle of drift.

No water-bearing horizon has been found to be continuous through the whole township, but several aquifers have been found, each of which extends over one or more sections. These horizons conform approximately to the surface elevation, so that the depths of wells are fairly uniform over the township. On the lower land in the southeastern part aquifers occur at lower elevations than on the higher land. Most of the wells range in depth from 10 to 35 feet, but others have been sunk as deep as 90 feet. Large supplies of water are not obtained from the sands and gravels of this formation, but on nearly every farm sufficient water for local requirements has been procured. A few wells yield only sufficient water for household use, but generally individual wells produce ample supplies for 10 to 20 or more head of stock. On those farms where wells are not sufficiently productive to satisfy the local demand additional wells have been dug to augment the original supply. The water from many of the wells is soft, and from the others is only moderately hard. All the water is usable for domestic purposes. Numerous springs scattered over the area derive water from the bedrock and if reservoirs were constructed to conserve their flow they would serve to water a considerable number of stock.

The Eastend formation is believed to underlie the Cypress Hills formation throughout the whole township, except in a small part of section 1, where the Eastend occurs directly beneath the glacial drift. Many of the beds of this formation

are believed to be sufficiently porous to be water bearing. The 90-foot well located on section 3 is believed to have penetrated this formation, but most of the water in the well is derived from the overlying Cypress Hills beds. In section 1 it may be desirable to prospect for water in the Eastend formation, but in all other sections supplies should be obtained from the Cypress Hills formation at depths much less than those required to tap the Eastend beds.

Township 14, Range 10

A mantle of glacial drift covers the township to depths ranging from about 35 to 65 feet. In the valley in the extreme northeastern part of the township a thin layer of glacial lake clay overlies the till. Over all other parts the till is exposed at the surface. Although many of the wells in the township yield sufficient water for local requirements, it is necessary to store the spring run-off in dams and dugouts to ensure adequate supplies for stock.

Water is readily obtained from shallow wells in the Recent deposits in the valley in sections 35 and 36. Sand beds are buried beneath 10 to 15 feet of glacial lake clay in the valley and serve as aquifers. On the NE. $\frac{1}{4}$, section 36, a 15-foot well derives a supply of water ample for 40 head of stock from the sands at a depth of 11 feet. Similar supplies should be easily located at shallow depths in this valley.

The till covering the remainder of the township is less productive of water than are the Recent valley deposits. The boulder clay has been found to be fairly permeable in several sections and wells sunk into it yield enough water for 15 or more head of stock. Other wells, however, are much less productive. The pockets of sand and gravel that are scattered irregularly through the boulder clay have been tapped by a few

wells at depths ranging from 7 to 56 feet. Each well yields enough water for 15 to 40 head of stock. The water is hard and of good quality from all the wells except the 60-foot well on section 33. This water is too highly charged with sulphate salts to be used for drinking, but it is usable for stock. As this well has penetrated the underlying Bearpaw shales it is probable that the greater part of the objectionable mineral salts contained in the water come from this source. Due to the unsatisfactory water conditions existing in the bedrock, careful prospecting of the glacial drift for sand and gravel pockets is necessary to ensure drinkable water. It has been found advantageous on some farms to sink a series of test holes before digging wells.

Water percolating to the lower part of the glacial drift is prevented from penetrating deeper by the impermeable shales composing the Bearpaw formation, and hence the water collects at this contact zone. Several of the deeper wells appear to be drawing at least part of their water from this horizon. Supplies from individual wells are usually sufficient for at least 15 to 25 head of stock. The water contains considerable amounts of dissolved mineral salts, which are in sufficient concentration to make the water from some wells undrinkable. The water is satisfactory for stock, however. When searching for supplies of ground water it is advisable to first test carefully for water-bearing sands or gravels in the drift, but if these cannot be located then the search should be continued deeper to the contact between the drift and the bedrock.

As shown on the accompanying geological map, Figure 1, the Cypress Hills formation occurs in a small part of the township embracing parts of sections 13, 14, 23, and 24. No

wells have been dug in this small area. The sands and coarse gravels that make up this formation are usually found to be good sources of water. In this area the greater part of the formation has been eroded away and the remaining beds may be too thin to retain large accumulations of water.

The Bearpaw formation directly underlies the glacial drift throughout the remainder of the township. As previously indicated, this formation consists largely of impervious shales, but in some places it is rendered slightly more permeable by the presence of sandy beds or of shales that were weathered before glaciation. Several wells, 35 to 100 feet deep, scattered throughout the township, are believed to be obtaining water from the upper part of the Bearpaw formation. Each of these wells produces enough water for 25 to 40 head of stock. The water is hard and "alkaline", and that obtained from the 100-foot well on section 5 is not drinkable. Several wells were sunk into the bedrock on section 33, but the water was of such poor quality that it is not used even for stock. Water supplies should be sought from the upper part of the Bearpaw formation only after efforts to find it in the drift or at the contact of the drift and the bedrock have failed. On section 28 a hole was drilled 590 feet deep and water was obtained from the lower part of the Bearpaw formation, probably from a sand bed. The water from this well is of good quality and the supply is ample for at least 25 head of stock. Drinkable water has also been obtained from deep wells in the township to the north, but the quantities available are no greater than is obtained from shallower wells. Such deep drilling is expensive. One or more shallower wells can be utilized, and additional supplies of stock water can be obtained from dams and dugouts with less expenditure.

Township 14, Range 11

Due to its rugged, rolling topography this township is not well settled and consequently little information pertaining to the water possibilities is available from wells. Several wells are reported from the southern half of the township, but no wells are recorded in the northern sections which are given over almost entirely to grazing. A plateau occupies the southwestern part of the township, at elevations exceeding 2,800 feet above sea-level. In the valley in the extreme northwest and southeast corners elevations as low as 2,550 feet occur.

The glacial till that covers the entire township is quite thin on the plateau, but thickens towards the north. On section 6 it is less than 5 feet thick and probably does not greatly exceed 10 feet anywhere on the highlands. On section 25 the drift is at least 40 feet thick and is believed to reach even greater thicknesses in the northern sections. The thin mantle of boulder clay on the plateau will yield little or no water and as water-bearing horizons are known to exist in the underlying bedrock any small quantities of water present in the drift are of little importance. In the valley and on the slopes in the north the drift is thicker and may prove to be an important source of water. Water-bearing pockets of sand and gravel that would yield satisfactory supplies in many places no doubt occur scattered through the boulder clay. The location of these aquifers can be determined only by digging wells or by sinking small holes with a test auger. The bases of slopes and the bottoms of depressions are probably the best locations for prospecting. More continuous aquifers in the form of sands washed down from the uplands may be found in the lowlands. As much of this material may have been

carried into the lowlands before the deposition of the glacial drift it may be covered by several feet of boulder clay.

Four bedrock formations, the Cypress Hills, Ravenscrag, Eastend, and Bearpaw formations occur beneath the glacial drift in different parts of this township, as indicated on the geological map, Figure 1. The Cypress Hills formation is confined to the highest area in the southwest corner of the township. Five wells, ranging in depth from 18 to 78 feet, have tapped water-bearing horizons in the formation. The yield of water from each well is sufficient only for household use and for about 10 head of stock and on some of the farms the supply does not meet the requirements. The water is usable, although from one well it has a laxative effect on humans. Large supplies of water are not to be expected in this formation due to its isolated occurrence on the uplands where no large catchment area is presented. On those farms where inadequate supplies have been obtained a second well dug not far distant should sufficiently augment the supply. Deeper drilling in the Eastend formation in this locality might locate larger water supplies, but in the absence of any deep wells to date this assumption remains unsubstantiated.

The Ravenscrag formation extends over most of the remainder of the uplands area. It probably also continues beneath the Cypress Hills formation, but its extent in this direction cannot at present be determined. A spring on the NE. $\frac{1}{4}$, section 17, is believed to mark the northern boundary of a water-bearing horizon at or near the base of the formation at an elevation of 2,748 feet above sea-level. Five wells appear to have penetrated water-bearing sand beds in this formation at depths from 18 to 78 feet. Three distinct horizons at elevations about 2,850, 2,785, and 2,750 feet above sea-level have been encountered in the various wells. At any

point in the area in which this formation occurs water should be obtainable by sinking a well to one of these horizons. Each of the existing wells provides enough water for 6 to 35 or more head of stock and the water is of satisfactory quality for drinking. The 12-foot flowing well on section 20 is believed to derive its water from the Ravenscrag formation. This well is located near the northern boundary of the formation and the water-bearing beds lie close to the surface.

The Eastend formation underlies the Ravenscrag and also the Cypress Hills formation where the Ravenscrag is absent. Owing to the lower elevation at which the Eastend occurs it extends farther down the slopes than either of the other two formations. Although water-bearing horizons no doubt exist throughout the extent of the formation only one well in this township appears to have penetrated the formation. This 20-foot well, located on section 21, tapped a sand aquifer at an elevation of 2,734 feet above sea-level. This well produces hard, "alkaline" water in quantities sufficient for local requirements. Water supplies should be obtainable from the Eastend formation by digging wells to depths not in excess of 50 feet.

No wells have penetrated the Bearpaw formation, which occurs below the Eastend formation and immediately underlies the drift throughout the remainder of the township. Sandy beds probably occur in the shales near the top of the formation and will be water-bearing, but the shales themselves are poor sources of water. The location and extent of the sandy members are not known, and in many places little or no water will be found. The water may be of very poor quality. In the area in which the drift is underlain by the Bearpaw formation it is advisable to test carefully for water in the drift rather than to sink wells into the bedrock. The zone of contact of the glacial drift and

the Bearpaw formation may be found to be a good source of water owing to the impermeability of the underlying shales.

Township 14, Range 12

The greater part of this township lies on the uplands at elevations exceeding 2,800 feet above sea-level. It slopes downward toward the north to 2,550 feet in the valley of the headwaters of Rushlake creek in the extreme northeast corner. Wells and numerous springs provide the water supplies for the residents of the township.

Thin layers of Recent deposits occur along the creek valley. The silts and sands of which these deposits are composed are probably water-bearing, but no reports have been received of wells having been dug into them. Residents close to the creek could no doubt obtain water supplies from sand beds in the Recent deposits by digging wells less than 15 feet deep.

The thickness of the glacial till, or boulder clay, that blankets the remainder of the township, is less than 15 feet in most localities, but in the central sections it appears to be greater, and in places may exceed 20 feet. These deposits are too thin to retain any large supplies of water and the greater number of the wells in the township have passed through the drift without locating water, and have penetrated the underlying bedrock. A sand bed encountered in the 14-foot well on section 15 appears to be in the drift, but it may represent the top of the Cypress Hills formation. Three other wells in nearby sections are obtaining small supplies from the boulder clay. Extensive prospecting in the drift appears to be scarcely worthwhile, as adequate supplies are to be expected at no great depth in the underlying bedrock.

The glacial drift is directly underlain by the Cypress Hills formation in all but a narrow strip, in sections 13 and 24, and a small area in the northeastern corner of the township. Wells in nearly all parts of the township have penetrated the formation and have found water-bearing beds of sand or coarse gravel in all but a few localities. The formation varies in composition laterally and in isolated areas consists of clay and fine sand which are less permeable than the sands and gravels that make up the greater part of the formation. The depths of wells are fairly uniform over the township except in the central area where deeper wells are necessary owing to the greater thickness of the drift. Water-bearing horizons are found at elevations corresponding to the surface elevations. On the highest part of the township, in section 2, an aquifer lies at an elevation of about 2,910 feet above sea-level. Aquifers are found at lower elevations towards the north, until on sections 34 and 35 two wells tap a water-bearing horizon at an elevation of about 2,555 feet above sea-level. Most of the wells range in depth from 10 to 40 feet, but the wells in the central sections and a few other isolated points reach depths of 60 to 100 feet. Large supplies are not common, but on most of the farms sufficient water is available for local domestic and stock requirements. A few wells do not yield enough water for 10 head of stock. Where such small supplies of water are obtained additional wells should be sunk. Water from the Cypress Hills formation is usually of excellent quality and is fairly soft. In the southern sections of this township, however, the dissolved mineral salt content is higher, the water is hard, and from a few wells is usable only for stock. The location of shallow wells at the bases of steep slopes would probably provide sufficient drinkable water for

domestic requirements.

The Eastend formation is known to occur in the eastern part of the township and probably underlies the Cypress Hills formation throughout the rest of the area, but this has not been definitely determined. As water is found in the Cypress Hills formation, deeper drilling into the lower lying Eastend has been found as a rule to be unnecessary. A 107-foot well on the NE. $\frac{1}{4}$, section 24, however, appears to have penetrated the Eastend formation in the area in which it immediately underlies the glacial drift. A good supply of soft water is derived from this well. This formation should be productive at even shallower depths in the eastern part of sections 13 and 24.

The Cypress Hills and Eastend formations have been removed by erosion from the northern lowland part of sections 35 and 36 and the Bearpaw formation lies directly beneath the glacial drift in this locality. Throughout the remainder of the township the Bearpaw formation underlies the Eastend formation. No wells have penetrated the Bearpaw in this township. A water horizon may occur at the contact between the glacial drift and the compact shales and would be encountered at no great depth. Water is not to be expected from the upper part of the formation at depths much less than 200 feet, and it might be necessary to drill to a depth of 500 feet or more to reach the sand beds that are expected to occur near the base of the formation. As drilling to such depths is expensive and since there is no certainty of finding water, it is advisable to confine the search for water to the glacial drift. The bottoms of coulées in this region should prove to be good well sites. Dams might also be constructed to store surface water if it is required to supplement existing stock water supplies.

Township 15, Range 10

The water supplies of this township are derived from wells and from a few springs. Sufficient water is being obtained on nearly every farm, but in a few places the water is of poor quality. Aquifers tapped by a number of deep wells in the township appear to be better sources of water than those found close to the surface.

No wells are reported to have been dug into the Recent deposits bordering Rushlake creek, in sections 30 and 31, but supplies of usable water should be obtainable from sand beds buried in the silts at depths probably not exceeding 15 feet.

Three types of glacial deposits are shown on the accompanying map, Figure 1, to occur in various parts of the township. These are glacial lake sands, glacial lake clay, and glacial till or boulder clay. No wells have been dug into the lake sands where they occur in sections 35 and 36 of this township, but several wells have found water in these deposits in township 16, range 10. These wells penetrated about 40 feet of sand to encounter a bed of water-bearing gravel at the base. Water supplies should be obtained from these deposits in this township by digging wells to depths not exceeding 45 feet.

Little water is obtained from the deposit of grey, fine-textured lake clay that covers the bottom of the broad valley extending along the eastern and northern parts of the township to depths of about 20 feet. Sand beds occurring at the base of the clay, however, are found to be more productive. Wells on sections 1, 14, 24, and the SW. $\frac{1}{4}$, section 31, have tapped these sand beds. The supplies from three of the wells are ample for about 20 head of stock, but from the well on section 24 the yield is smaller. The water contains considerable

amounts of dissolved mineral salts and in the water from the well on section 14 these salts are sufficiently concentrated to have a harmful effect on humans. Water supplies should be readily obtainable in most parts of the valley. On section 1, in and around Neidpath, several deeper holes were sunk, but the water obtained was too "alkaline" to be used. A thin bed of gravel was reported in one well at a depth of 36 feet. This gravel is probably in the form of a small pocket in the layer of boulder clay that underlies the lake clay and covers the bedrock. Such pockets no doubt occur at other points, but owing to their very scattered occurrence they are a less reliable source of water than the sands at the base of the lake clay. Outcrops of Bearpaw shale are known to occur on the western side of the valley just west of Neidpath. It is possible that some of the deeper wells have penetrated the shale, from which a more highly mineralized water is to be expected. The blanket of glacial till that covers the remaining parts of the township ranges in thickness from only a few feet along the valley slopes to nearly 70 feet in the southwestern sections of the township. Wells dug into sandy phases of the boulder clay or tapping pockets of sand or gravel yield supplies of water. Three wells that are reported to be drawing water from the sandy boulder clay each produce enough water for 11 to 20 head of stock. The water from one of the wells is too highly mineralized to be used for drinking, but from the other wells is of good quality. The sand and gravel pockets occur at irregular intervals, and have been encountered in the wells at depths ranging from 12 to 60 feet. Individual wells produce ample water for 10 to 30 head of stock. In most places the water is satisfactory for domestic use, but from two wells on section 10 the water is usable only for stock, owing to the high concentration of dissolved mineral salts. Although deep wells appear

to be the most reliable source of water in the township it should be possible to obtain satisfactory supplies by careful prospecting of the drift at depths not greater than 50 or 60 feet. When additional supplies are desired a number of holes should be sunk with a test auger along coulée bottoms or at the bases of slopes, which are the most favourable locations for finding porous water-bearing beds. If the drift is found to be unproductive, it will then be necessary to sink deep wells into the bedrock or to construct dams and dugouts for the storing of surface water.

Several outcrops in the northern sections indicate that the Cypress Hills formation is present immediately beneath the glacial drift in the uplands part of the township, north of the broad valley. The approximate areal extent of the formation is indicated on Figure 1 of the accompanying map. Few wells have been dug in this area and some of these are not sufficiently deep to reach the bedrock. A 70-foot well, on section 25, appears to have penetrated sand beds in the Cypress Hills formation. Only a small quantity of water was obtainable from this well, and the supply decreased due to fine sand plugging the well. A spring on the NE. $\frac{1}{4}$, section 34, probably has its source in the Cypress Hills formation. Other wells dug 60 to 100 feet deep in this area should find supplies of water in the bedrock.

The Bearpaw formation is found directly below the glacial drift throughout the remainder of the township. The compact shale near the top of the formation is too impervious to contain any large supply of water. An 80-foot well on section 8 yields a small supply of highly mineralized water that is undrinkable by humans, and is sufficient for only 9 head of stock. Unless residents are prepared to drill wells to depths between

300 and 400 feet drilling should be discontinued when the top of the Bearpaw formation is reached. A number of wells have been drilled to the sand horizon occurring near the base of the formation at depths ranging from 216 to 550 feet. In each of these wells fairly soft water was obtained, and the supplies are adequate for 20 to 40 head of stock. Most of the water has a slightly brownish colour. Little information is at hand regarding the exact depths at which the water-bearing beds were encountered. Since the exact elevation of the aquifer is not known the existence of an extensive horizon can only be postulated. Sand beds are known to occur over extensive areas in adjoining municipalities, and it is probable that the sand beds will be found to be fairly continuous under this township, particularly since the producing deep wells are widely scattered. A 238-foot well drilled on section 1 produced water that was unfit for use. Possibly it was not sufficiently deep to reach the soft-water horizon. It is noted, however, that in a 700-foot well drilled on section 33 no aquifer was encountered. Should the village of Neidpath desire to increase its water supply, drilling to this lower horizon might prove to be a worthwhile venture. Residents requiring only small water supplies are advised to prospect carefully in the drift, but otherwise deep drilling must be considered.

Township 15, Range 11

Recent alluvial deposits occur along the valley of Rushlake creek, which crosses the township from section 7 to section 25. A 14-foot well, dug into the silts on section 7, is the only well recorded in the township that is known to be drawing water from these deposits. The yield from this well is ample for local needs and the water is reported to be of good quality. Water-bearing sand beds are generally to be found

interbedded with the silts in the Recent alluvium and should be found along the valley in this township at depths less than 20 feet.

On the map, Figure 1, is shown a small area in the northeastern corner of the township that extends westerly in a narrow belt along the northern boundary, and in which glacial lake clay overlies the glacial till. The lake clay is fine-grained and compact, and prevents the downward percolation of waters. However, in many places sand beds occur near the base of the lake clay and these form aquifers. A 12-foot well dug on section 35 appears to be tapping such a sand bed, but yields only a small amount of water. Further testing in this area to depths not exceeding 25 feet should locate sand aquifers at or near the contact between the lake clay and the boulder clay. In some places sand beds will not be found at this horizon and prospecting should be continued deeper in an effort to locate the water-bearing sand or gravel pockets that occur scattered through the boulder clay. The location of aquifers at the base of the lake clay and deeper in the boulder clay can only be determined by sinking test holes. A 92-foot well on section 36 was reported to have passed through clay only in its entire depth, indicating that the porous beds are by no means present at all points.

Few wells are obtaining water from the glacial till that mantles other parts of the township. The thickness of the glacial till covering is not definitely known, but it appears to increase from only a few feet along the slopes of Rushlake Creek valley to over 40 feet in the southern and western uplands. Two shallow wells on section 28 are drawing small supplies from gravel pockets in the till. Such pockets evidently occur only very sparingly in this township as they have been penetrated in no other wells. Water-bearing sand or

gravel pockets might be found in other places, but extensive testing would probably be required to locate them. Some doubt exists as to the source of the water in many of the deeper wells. Some of these wells were sunk twenty or more years ago and reliable logs of the drilling are not obtainable. The zone of contact of the boulder clay and the underlying shales of the Bearpaw formation may be a productive horizon and form the source of water in the deep wells on sections 16, 22, 23, 26, and 28. However, these wells are believed to have penetrated the Bearpaw formation, and the water may occur in sandy phases of the bedrock. The till cannot be considered a good source of water in this township and, unless water-bearing pockets are encountered at shallow depths, wells should be dug to the contact of the till and the bedrock or into the bedrock formations themselves.

The Cypress Hills formation immediately underlies the drift in the northwestern part of the township and in a small area in the southwestern corner. Water-bearing horizons occur in the sands and coarse gravels of the formation in the township to the west and probably continue into this township. Wells, 45 feet deep on sections 20 and 30, appear to be deriving their small supplies of water from the bedrock. The formation may be quite thin in this area and thus less productive of water than in the higher land to the west. Two wells, 130 feet deep on section 20, are reported to be drawing good supplies of water from a gravel aquifer at an elevation of 2,380 feet above sea-level. The gravels occurring at this depth are typical of the Cypress Hills formation, yet the Bearpaw formation is believed to lie at this elevation from the evidence of outcrops examined along the valley of Rushlake creek. Regardless of the formation in which it occurs a productive horizon has been tapped by these two wells. Water is

being obtained from an aquifer at a similar elevation in the sections to the east and indicates a possible aquifer throughout the central part of the township at elevations ranging from 2,380 to 2,400 feet above sea-level.

The Bearpaw formation underlies the Cypress Hills formation, and extends throughout the remainder of the township, immediately beneath the glacial drift. The upper part of the Bearpaw is believed to include sandy beds interbedded with shales. Several wells, 85 to 120 feet deep, in the central part of the township, have penetrated the formation and may be deriving their supplies of water from the sandy beds. Each well provides sufficient water for local requirements, but the water is highly mineralized and from four of the wells is usable only for stock. On section 15 a well, 572 feet deep, is drawing a large supply of water from the lower part of the Bearpaw formation. A sand bed probably forms the aquifer in this well. Water supplies could undoubtedly be obtained in other parts of the township by drilling wells to depths ranging from 400 to 600 feet. However, this great depth should not be necessary at most points, as water should be found near the top of the formation or at the contact between the glacial drift and the shales.

Township 15, Range 12

The surface of the township is a fairly level plateau cut by the deep valley of Rushlake creek along its northwest-southeast diagonal. Water supplies in the township are derived from wells and from numerous springs along the valley sides. Stock water is also obtained from Rushlake creek and from a few sloughs in the valley and in the northern part of the township.

Recent alluvial deposits of sand and fine silt cover the valley bottom in the vicinity of the creek. These deposits probably do not greatly exceed 10 feet in thickness. Sand beds

interbedded with the silts are usually water bearing. A 10-foot well in section 12 obtains from these deposits sufficient water for domestic requirements and for 16 head of stock. Similar supplies should be obtainable by digging wells at other points along the valley. The sand beds may not form continuous horizons, but one or more such beds should be located with a small amount of testing in any locality. Drinkable water may also be obtained by digging wells close enough to the creek to derive water by direct seepage.

Glacial drift covers the entire township remote from the valley bottom. It is in the form of till on the slopes and over the southern uplands, forms an irregularly rolling area of moraine on the plateau north of the valley. The variations in the thickness of the drift have not been accurately determined. The log of the well on section 19 indicates a covering of glacial drift of only $2\frac{1}{2}$ feet, but over most of the area the drift is 10 to 35 feet thick. In the central and northern moraine-covered sections it may extend to depths as great as 80 or 90 feet. These moraine and till deposits consist almost entirely of clay, and no sand or gravel pockets that usually occur irregularly scattered through the clay have been encountered in the existing wells. All the wells have passed through the drift into the bedrock before finding water with the exception of those on section 36. A 20-foot well on this section yields hard, "alkaline" water that is usable for household purposes, and a 30-foot well nearby formerly gave a similar supply. Doubtlessly water may be found in the drift in other places, particularly in the moraine-covered area, but as the Cypress Hills formation, which underlies the greater part of the township, is a more reliable source of water, little prospecting has been done in the drift. Along the valley bottom

water probably occurs at the contact of the till and the Bearpaw formation which underlies the drift in this part of the township. The depth to the top of the bedrock in the valley has not been determined.

As shown on the accompanying geological map, the Cypress Hills formation underlies the glacial drift in the whole of the township except in the valley of Rushlake creek. Springs occurring on both sides of the valley have their source in this formation, and indicate the presence of water-bearing horizons. The water-bearing horizon slopes from south to north. On the south side of the valley in section 6 the most productive horizon lies at an approximate elevation of 2,700 feet above sea-level. Throughout the central sections it ranges in elevation from about 2,610 to 2,550 feet, and in section 34 it lies at about 2,500 feet. The depth of wells necessary to tap this horizon depends on the thickness of the overlying drift and on the elevation of the land surface at the selected well site. The existing wells range from 12 to 110 feet deep. A few wells yield only very small quantities of water, but the greater number produce ample supplies for 10 to 40 head of stock. Two hundred head are watered from the 12-foot well on section 19. Water from the Cypress Hills formation in most places is fairly soft and of good quality for domestic use, but from a few wells in this township the water is highly mineralized and is not satisfactory for drinking. The Cypress Hills formation constitutes the best potential source of water in the township and further requirements for water supplies should be met by sinking additional wells into it.

The Bearpaw formation occurs beneath the glacial drift in the valley and probably immediately underlies the Cypress Hills formation throughout most of the remainder of the township. Only one well in the township appears to have penetrated this

formation. This well is 96 feet deep and is located on section 13 where the Cypress Hills formation is either very thin or is absent. The aquifer in this well is not definitely known. A large supply of water is derived from this well, but the water is highly charged with sulphate salts and is suitable only for stock. The drinking water on this farm is obtained from shallow seepage wells. Little is known of the water possibilities of the Bearpaw formation in this area, but the formation is believed to be only sparingly productive of water except at considerable depths. Water-bearing sand beds probably could be located in the bedrock at depths ranging from 200 to 500 feet, but in the absence of deep wells the extent of such aquifers has not been determined. The sinking of wells should be discontinued when the top of the compact, dark shales is reached.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL
MUNICIPALITY OF COULÉE, NO. 136, SASKATCHEWAN

	Township	13	13	13	14	14	14	15	15	15	Total No. in muni- cipality
		10	11	12	10	11	12	10	11	12	
West of 3rd meridian	Range										
<u>Total No. of Wells in Township</u>		45	56	91	36	15	73	35	27	29	407
No. of wells in bedrock		11	40	91	11	14	62	12	13	22	276
No. of wells in glacial drift		28	16	0	25	1	11	23	13	6	123
No. of wells in alluvium		6	0	0	0	0	0	0	1	1	8
<u>Permanency of Water Supply</u>											
No. with permanent supply		37	55	87	30	15	70	34	22	28	378
No. with intermittent supply		0	1	4	2	0	1	0	3	0	11
No. dry holes		8	0	0	4	0	2	1	2	1	18
<u>Types of Wells</u>											
No. of flowing artesian wells		0	1	0	0	1	0	0	0	0	2
No. of non-flowing artesian wells		2	2	8	6	5	19	13	7	5	67
No. of non-artesian wells		35	53	83	26	9	52	21	18	23	320
<u>Quality of Water</u>											
No. with hard water		34	44	69	32	12	50	28	23	23	315
No. with soft water		3	12	22	0	3	21	6	2	5	74
No. with salty water		0	0	0	1	0	0	0	0	0	1
No. with "alkaline" water		26	12	16	12	3	12	7	11	4	103
<u>Depths of Wells</u>											
No. from 0 to 50 feet deep		37	46	77	23	11	58	21	15	21	309
No. from 51 to 100 feet deep		8	9	14	12	4	13	5	4	7	76
No. from 101 to 150 feet deep		0	0	0	0	0	2	0	7	1	10
No. from 151 to 200 feet deep		0	0	0	0	0	0	0	0	0	0
No. from 201 to 500 feet deep		0	1	0	0	0	0	7	0	0	8
No. from 501 to 1,000 feet deep		0	0	0	1	0	0	2	1	0	4
No. over 1,000 feet deep		0	0	0	0	0	0	0	0	0	0
<u>How the Water is Used</u>											
No. usable for domestic purposes		24	53	91	27	14	66	26	15	22	338
No. not usable for domestic purposes		13	3	0	5	1	5	8	10	6	51
No. usable for stock		31	54	91	30	15	69	31	25	28	374
No. not usable for stock		6	2	0	2	0	2	3	0	0	15
<u>Sufficiency of Water Supply</u>											
No. sufficient for domestic needs		35	55	85	30	15	68	32	25	28	373
No. insufficient for domestic needs		2	1	6	2	0	3	2	0	0	16
No. sufficient for stock needs		20	44	66	20	13	59	28	15	25	290
No. insufficient for stock needs		17	12	25	12	2	12	6	10	3	99

ANALYSES AND QUALITY OF WATER

General Statement

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

Total Dissolved Mineral Solids

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

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

Mineral Substances Present

Calcium and Magnesium

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

Sodium

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

Sulphates

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

Chlorides

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

Iron

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

Hardness

Calcium and magnesium salts impart hardness to water. Hardness of water is commonly recognized by its ~~soap-destroying~~ powers as shown by the difficulty of obtaining lather with soap. The total hardness of a water is the hardness of the water in its original state. Total hardness is divided into "permanent hardness" and "temporary hardness". Permanent hardness is the hardness of the water remaining after the sample has been boiled and it represents the amount of mineral salts that cannot be removed by boiling. Temporary hardness is the difference between the total hardness and the permanent hardness and represents the amount of mineral salts that can be removed by boiling. Temporary hardness is due mainly to the bicarbonates of calcium and magnesium and iron, and permanent 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 excess of 300 parts per million; when the total hardness exceeded 3,000 parts per million no exact hardness determination was made. Also no determination for temporary hardness was made on waters having a total hardness less than 50 parts per million. As the determinations of the soap hardness in some cases were made after the samples had been stored for some time, the temporary hardness of some of the waters as they come from the wells probably is higher than that given in the table of analyses.

Analyses of Water Samples from the Municipality of Coulee, No. 136, Saskatchewan

LOCATION				HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS										Source of water
No.	Qtr.	Sec.	Tr. Rge. Mer.	Depth of well, Ft.	Total	Perm.	Temp.	Cl.	Alkalinity	CaO	MgO	SO ₄	Na ₂ O	Solids	CaCO ₃	CaSO ₄	MgCO ₃	MgSO ₄	Na ₂ CO ₃	Na ₂ SO ₄	NaCl	MgCl ₂	
1	NE.	27	13 12 3rd	16	1,080	1,200	1,000	200	124	565	110	234	131	62	858	197		309	164		117	71	2
2	SE.	28	13 12 3	60	800	520	280	240	50	360	100	90	238	170	757	179		153	51	292	82		2
3	SW.	28	14 10 3	590	920										(3)	(3)		(4)		(1)	(5)	(2)	3
4	SW.	14	14 12 3	15	370										(3)	(3)	(1)		(2)			CaCl ₂ (4)	1
5	NE.	22	14 12 3	85	120										(1)	(1)	(4)	(2)				(3)	2
6	NE.	22	14 12 3	80	205										(1)	(1)	(4)	(2)				(3)	2
7	SE.	1	15 10 3	27	1,630										(4)	(4)	(1)		(2)	(3)		(5)	1
8	NE.	12	15 10 3	550	900	15			85	665	20	7	16	462	863	36		15		648	24	140	3
9	NE.	32	15 10 3	216	870																		3
10		5	15 11 3	40	17,300												(3)		(2)	(4)	(1)	(5)	1
11	SW.	19	15 12 3	12	900	600	450	150	18	275	100	83	394	202	849	179		81	131		30		2
12	SE.	22	15 12 3	50	1,000	800	700	100	13	340	170	86	480	211	1,027	304		31	212	459	21		2
13	NE.	34	15 12 3	95	2,420	1,300	1,050	250	17	445	150	209	1,283	631	2,270	269		149	408	1,416	28		2

Water samples indicated thus, # 1, are from glacial drift or other unconsolidated deposits.

Water samples indicated thus, # 2, are from bedrock, Cypress Hills formation.

Water samples indicated thus, # 3, are from bedrock, Bearpaw formation.

Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.

Hardness is the soap hardness expressed as calcium carbonate (CaCO₃).

Analyses Nos. 3, 4, 5, 6, 7, 9, and 10, by Provincial Analyst, Regina.

For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

No samples of water from the Recent deposits occurring along the creeks were taken for analysis by the Geological Survey. Residents along Rushlake creek report the water from these deposits to be soft or moderately hard and of good quality for drinking. Much of the water found in these deposits, in township 15, range 12, and the western part of township 15, range 11, has seeped down from water-bearing horizons in the Cypress Hills formation. Towards the east the water will probably be found to contain larger amounts of dissolved mineral salts, as in the lowlands the water contained in the sediments is derived from the glacial drift and from the outcrops of the Bearpaw formation along the creek. Both the boulder clay and the shales are sources of mineral salts. Water in the Recent deposits along Wiwa creek also contains appreciable amounts of dissolved minerals of which the sulphates of sodium and magnesium are probably the chief constituents. These salts make the water from the wells on sec. 27, tp. 13, range 10, unfit for household use. They are derived partly from the drift and partly from the Bearpaw formation.

Considerable variations are noted in the quality of the waters from the glacial drift owing to the variations in the character of the materials with which the water comes in contact. The compact boulder clay contains inherently large amounts of readily dissolvable mineral salts, particularly sodium sulphate (Na_2SO_4), or Glauber's salt; magnesium sulphate (MgSO_4), or Epsom salts; and calcium sulphate (CaSO_4). Shallow wells sunk entirely in boulder clay may yield a water that is extremely hard and so highly mineralized as to be undrinkable. Even surface waters washed over boulder clay and collecting in undrained

depressions may be charged with mineral salts, the concentration of which greatly increases with continued surface evaporation. Porous beds occurring near the surface contain water that has not been in contact with any considerable thickness of boulder clay and hence, although hard, is satisfactory for domestic use. Porous sand and gravel beds underlying greater thicknesses of boulder clay are correspondingly more highly mineralized. Analyses Nos. 4, 7, and 10, indicated on the accompanying table of analyses, are of waters from the drift and illustrate these variations. The fourth analysis is of water from a shallow drift well on the uplands. The water contains only 370 parts per million of dissolved solids and is very soft. Calcium and magnesium sulphate are present in solution, but not in sufficient quantities to give any appreciable taste to the water. Such water if uncontaminated by surface pollution should be of excellent quality for household use.

Analysis No. 7 is more typical of waters from the drift on the lowlands. This water is derived from sands beneath the lake clay at Neidpath. Of the 1,630 parts per million of dissolved salts present calcium sulphate, which is harmless but produces hardness, is present in the greatest concentration. Magnesium sulphate is also present and may give the water an "alkaline" taste, but its concentration is not such as to render the water strongly laxative. The other salts present are in only minor concentrations. Analysis No. 10 is typical of the water of poor quality derived from the compact boulder clay. This water contains 17,300 parts per million of dissolved solids, of which the laxative acting sodium and magnesium sulphate are present in the greatest amounts, with lesser quantities of calcium sulphate, sodium carbonate, and common salt. Such water is unfit for drinking

and would tend to have severe scouring action on stock. Water with lesser concentrations of these salts has been known to kill cattle.

Water from the Bedrock

Samples of water from the Cypress Hills and Bearpaw formation were collected for analysis, but no samples were obtained of water from either the Ravenscrag or Eastend formations in this municipality. The water from most of the wells tapping the Cypress Hills formation is of excellent quality and is suitable for all farm purposes. Analyses Nos. 5 and 6 in the accompanying table, having total solid contents of only 120 and 250 parts per million of dissolved solids, are typical of these soft waters. It will be noted that sulphate salts, with the exception of small amounts of calcium sulphate, are absent. These calcium and magnesium carbonate salts are to be expected due to the calcium carbonate cement that forms the consolidating matrix in most of the Cypress Hills beds.

Analysis No. 1 is also of water from the Cypress Hills formation, but its dissolved mineral solid content is higher than is usual. It is possible that in this area the boulder clay is sufficiently thick to be a source of sufficient quantities of mineral salts to affect the quality of the water in the underlying bedrock. This water is exceedingly hard, and due to the presence of 164 parts per million of magnesium sulphate it may have a slight laxative effect upon persons not accustomed to mineralized waters. Nevertheless this water is satisfactory for domestic use. Analyses Nos. 11 and 12 are also of water from the Cypress Hills formation and resemble the water referred to above except that a slightly greater concentration of sodium sulphate is present.

Analysis No. 13 is of water of much poorer quality than is generally found in the Cypress Hills formation. It is probable that this well has penetrated into the underlying Bearpaw formation and from it derives water containing large amounts of sodium and magnesium sulphate salts. This water has a decided laxative effect on humans, but is being used for watering stock.

Residents report that the water being derived from the Ravenscrag formation in wells in township 14, range 11, is of good quality. The water is soft to moderately hard and is usable in the households. The quality of the water to be found in the Ravenscrag formation throughout its extent in the municipality should be quite uniform.

Reports of the water derived from the Eastend formation indicate little uniformity in quality. The water from four wells is reported to be soft, whereas that from the other wells is hard. The water from one well in township 13, range 11, is too highly mineralized to be used for drinking. Water such as this, however, is not to be expected in most places.

Two more or less distinct types of water are found in the Bearpaw formation. Water occurring in the upper few feet of the formation is invariably highly mineralized, in many places to such a degree that the water is unfit for drinking, and in a few places it cannot be used even for stock. The poor quality of the water is due to the presence of large quantities of sulphates of sodium and magnesium that are leached out of the boulder clay by downward percolating waters and concentrated in the upper part of the less pervious Bearpaw shales. Considerable amounts of these salts may be also inherent in the shales. Water found in sand beds at greater

depths in the formation is soft or only slightly hard. Analyses Nos. 3, 8, and 9 in the table are of waters from deep wells tapping porous beds in the lower part of the Bearpaw formation. The total dissolved solids content of these waters ranges from 800 to 900 parts per million and the main constituents are sodium salts that do not cause hardness of the water. Only small amounts of the sulphates and carbonates of calcium and magnesium that cause hardness are present. Sodium chloride (common salt) is found in relatively large amounts but is not in sufficient concentration to give the water an unpleasant taste. These waters are of good quality for both domestic and stock requirements.

WELL RECORDS—Rural Municipality of

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (-) Surface	Elev.	Depth	Elev.	Geological Horizon				
1	NW.	2	13	10	3	Bored	20	2,650	- 8	2,642	20	2,630	Glacial drift	Hard, clear		D	Sufficient supply; several springs in vicinity; many people get water from this well; dam with spring for stock. Several dry holes in Bearpaw shale.
2	SE.	12	"	"	"		80	2,750									
3	SW.	13	"	"	"	Bored	60	2,650	- 53	2,597	53	2,597	Glacial gravel	Hard, clear, "alkaline"		S	Sufficient for 8 head stock.
4	SE.	13	"	"	"	Dug	38	2,650	- 20	2,630	20	2,630	Glacial drift	Hard, iron, "alkaline"	50	D, S	Good supply.
5	NW.	14	"	"	"	Dug	14	2,520	- 3	2,517	3	2,517	Glacial sand and gravel	Soft, clear		D	Supply insufficient; a 40-foot well for stock in blue clay.
6	SW.	15	"	"	"	Bored	16	2,600	- 8	2,592	8	2,592	Glacial drift	Hard, clear, "alkaline"		S	Insufficient; only waters 8 head stock.
7	NW.	16	"	"	"	Bored	32	2,610	- 16	2,594	28	2,582	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for 13 head stock; 2 dry holes 90 and 70 feet deep in Bearpaw shale.
8	SW.	18	"	"	"	Bored	45	2,690	- 21	2,669	21	2,669	Glacial drift	Soft		D, S	Waters 10 head stock; a spring on slope yields large supply.
9	SW.	19	"	"	"	Dug	53	2,560	- 49	2,511	49	2,511	Bearpaw shale	Hard, cloudy, "alkaline", blue		N	Insufficient supply; very poor quality; several similar wells.
10	NE.	19	"	"	"	Dug	30	2,555	- 12	2,543			Bearpaw shale	Hard, clear, "alkaline"			Sufficient supply; an 18-foot well with 5 feet of soft water in glacial drift.
11	NW.	21	"	"	"		23	2,550	- 15	2,535	15	2,535	Glacial drift	Hard, clear, "alkaline"		S	Insufficient supply; only waters 6 head stock.
12	SE.	21	"	"	"	Bored	38	2,560	- 10	2,550	10	2,550	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 18 head stock; a dry hole 26 feet deep in glacial drift.
13	NW.	22	"	"	"	Dug	24	2,520	- 20	2,500	20	2,500	Glacial drift	Hard, clear, "alkaline", iron		N	Insufficient supply; unfit for humans or stock; a dam for stock use.
14	SE.	22	"	"	"	Bored	35	2,500					Glacial drift	Hard, clear, "alkaline"		S	Insufficient supply; 30 head stock watered at creek; several dry holes.
15	SW.	27	"	"	"	Dug	15	2,500	- 10	2,490	10	2,490	Recent alluvium	Hard, clear, "alkaline"		S	Sufficient for 15 head stock; bad effect; 5 similar seepage wells.
16	SE.	28	"	"	"	Dug	18	2,520									Dry hole in glacial drift; shallow seepage wells in depression; unfit for human use; dam for stock.
17	SE.	29	"	"	"	Bored	35	2,516	- 15	2,501	15	2,501	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for 40 head stock.
18	SW.	29	"	"	"	Bored	35	2,550	- 15	2,535	15	2,535	Glacial gravel	Hard, clear, "alkaline"		D, S	Good supply.
19	NE.	31	"	"	"	Dug	7	2,630	- 3	2,627	3	2,627	Glacial gravel	Hard, clear		D, S	Waters 9 head stock.
20	NE.	32	"	"	"	Bored	50	2,670	- 35	2,635	35	2,635	Bearpaw shale	Hard, iron, red sediment, "alkaline", clear		N	Small supply; poor quality of water; a similar 60-foot well with 15 feet of poor water unfit for stock use.
21	SW.	34	"	"	"	Dug	35	2,500	- 28	2,532	28	2,532	Glacial clay	Hard, clear		D, S	Sufficient, constant supply.
22	NW.	34	"	"	"	Dug	42	2,600	- 32	2,568	32	2,568	Bearpaw shale	Hard, clear, "alkaline", bitter		S	Insufficient supply; bad effect on humans; a 14-foot well in sand and gravel with 7 feet of water.
23	SE.	35	"	"	"	Bored	58	2,520	- 34	2,486	58	2,462	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for 30 head stock.
1	NW.	1	13	11	3	Spring	0	2,850					Cypress Hills				Spring flowing.

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 COULEE, NO. 136, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (-) Surface	Elev.	Depth	Elev.	Geological Horizon				
2	SE.	3	13	11	3	Dug	40	2,920	- 38	2,882	38	2,882	Cypress Hills gravel	Soft, clear		M, S	Sufficient for 6 head stock.
3	SW.	3	"	"	"	Dug	84	2,930	- 82	2,848	82	2,848	Cypress Hills sand	Soft, clear, sand sediment		D, S	Sufficient for 20 head stock.
4	NE.	4	"	"	"	Bored	40	2,866	- 34	2,832	34	2,832	Cypress Hills	Soft, clear		D, S	Sufficient for 11 head stock; a 210-foot well in Bearpaw; very good supply of poor water.
5	SE.	4	"	"	"	Dug	48	2,926	- 46	2,880	46	2,880	Cypress Hills gravel	Medium hard, clear, red sediment		D, S	Sufficient for about 25 head stock.
6	SE.	5	"	"	"	Dug	80	2,783	- 70	2,713	70	2,713	Bearpaw	Hard, "alkaline"		N	Well closed now; water had a strong odour.
7	SE.	5	"	"	"	Drilled	75	2,800	- 73	2,727	73	2,727	Eastend fine sand	Soft, clear, some grey sediment		D, S	Insufficient supply for 30 head stock; use dugout also.
8	SE.	6	"	"	"	Dug	24	2,776	- 20	2,756	20	2,756	Eastend yellow clay	Soft, clear, "alkaline"		D, S	Sufficient for 40 head stock; also an intermittent spring.
9	NW.	6	"	"	"	Dug	16	2,836	- 14	2,822	14	2,822	Cypress Hills fine sand	Soft, clear		D, S	Sufficient supply; another 16-foot well filled in; a spring in use now also.
10	NE.	7	"	"	"	Dug	23	2,785	- 18	2,767	18	2,767	Eastend	Hard, clear, "alkaline"		D, S	Insufficient for 10 head stock; a spring used also.
11	NE.	9	"	"	"	Bored	92	2,785	- 66	2,717	66	2,717	Eastend sand	Hard, clear, "alkaline", red sediment, iron		S	Excellent supply; laxative on humans; use well on SE.¼, Section 16, for house.
12	NE.	10	"	"	"	Dug	40	2,760	- 30	2,730	30	2,730	Eastend sand	Hard, clear, iron, red sediment		D, S	Insufficient supply for 12 head stock; also use a spring.
13	NE.	13	"	"	"	Dug	11	2,600	- 7	2,593	7	2,593	Glacial sand	Soft, iron, clear		D	Only sufficient for house use.
14	NW.	14	"	"	"	Bored	42	2,662	- 32	2,630	32	2,630	Glacial blue clay	Soft, clear, "alkaline"		D, S	Insufficient supply.
15	NE.	15	"	"	"	Dug	36	2,631	- 33	2,598	33	2,598	Bearpaw sand	Hard, clear		D, S	Sufficient for 40 head stock; a 30-foot well was used until 1930.
16	SE.	15	"	"	"	Dug	30	2,708	- 15	2,693	15	2,693	Glacial drift	Hard, clear		D, S	Sufficient for 20 head stock; a 14-foot well is used for house.
17	SW.	17	"	"	"	Dug	15	2,723	- 7	2,716	7	2,716	Glacial drift	Hard, clear		D, S	Insufficient supply; a spring used also.
18	NW.	18	"	"	"	Bored	55	2,825	- 35	2,790	35	2,790	Cypress Hills sand	Hard, clear, "alkaline"		D, S	Sufficient for 3 head stock.
19	NW.	19	"	"	"	Bored	73	2,888	- 69	2,819	69	2,819	Cypress Hills	Hard, clear, "alkaline"		D, S	Insufficient for stock; laxative on humans; a spring also used.
20	NE.	20	"	"	"	Bored	60	2,820	- 27	2,793	27	2,793	Cypress Hills and Eastend sands	Hard, clear		D, S	Good supply; another aquifer at 60 feet; also use a dugout.
21	SW.	21	"	"	"	Dug	28	2,755	- 22	2,733	22	2,733	Glacial yellow clay	Soft, clear		D, S	Sufficient supply for 12 head stock; another 35-foot well, small supply.
22	SE.	21	"	"	"	Bored	83	2,750	- 56	2,694	56	2,694	Bearpaw clay	Hard, clear		D	Sufficient for house use; another well 30 feet deep is also used.
23	SE.	24	"	"	"	Dug	25	2,560	- 23	2,537	23	2,537	Glacial sand	Hard, clear		D, S	Sufficient supply for 3 head stock; a 40-foot well, good supply not used.
24	SE.	24	"	"	"	Dug	14	2,550	- 10	2,540	10	2,540	Glacial gravel	Medium hard, clear		D, S	Sufficient for 30 head stock; an 18-foot well and a spring also used.

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

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
25	SE.	25	13	11	3	Dug	35	2,640	- 29	2,611	29	2,611	Bearpaw sand	Medium hard, clear		D, S	Spring used also; sufficient supply for 15 head stock.
26	SW.	25	"	"	"	Dug	37	2,636	- 33	2,603	33	2,603	Bearpaw sand	Hard, clear		D, S	Sufficient for 8 head stock.
27	NE.	28	"	"	"	Dug	13	2,764	- 10	2,754	10	2,754	Cypress Hills fine sand	Soft, clear		D, S	Sufficient for 10 head stock.
28	NE.	30	"	"	"	Dug	36	2,910	- 22	2,888	22	2,888	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient supply; will water 60 head stock.
29	SW.	30	"	"	"	Dug	36	2,910	- 11	2,899	11	2,899	Cypress Hills coarse sand	Hard, clear		D, S	Waters 30 head stock.
30	NW.	30	"	"	"	Dug	22	2,910	- 18	2,892	18	2,892	Cypress Hills sand	Hard, clear		D	Only sufficient for house use.
31	NW.	31	"	"	"	Dug	35	2,940	- 20	2,920	20	2,920	Cypress Hills sandstone	Hard, "alkaline"		D, S	Sufficient for 12 headstock; a 40-foot well, hard, "alkaline" water for stock.
32	NW.	32	"	"	"	Dug	50	2,925	- 38	2,887	38	2,887	Cypress Hills	Hard, clear, "alkaline"		D, S	Sufficient supply; can be pumped dry.
33	SE.	33	"	"	"	Dug	16	2,737	- 11	2,726	11	2,726	Cypress Hills	Soft, clear		D, S	Sufficient for 12 head stock; neighbours use well also.
34	NW.	34	"	"	"	Bored	50	2,776	- 48	2,728	48	2,728	Eastend	Hard, clear, "alkaline"		D, S	Sufficient for 12 head stock.
35	SE.	34	"	"	"	Dug	40	2,735	- 20	2,715	40	2,695	Eastend fine sand	Soft, clear		D, S	Abundant supply; waters 120 head stock regularly.
36	SW.	34	"	"	"	Spring	0	2,726					Cypress Hills	Hard, clear			Probably sufficient.
37	NE.	35	"	"	"	Dug	35	2,710	- 21	2,689	21	2,689	Eastend	Hard, clear		D, S	Sufficient for 60 head stock.
38	SE.	35	"	"	"	Bored	72	2,740	- 60	2,680	60	2,680	Eastend sand	Hard, clear, "alkaline"		D, S	Only sufficient for 20 head stock; needs water for 40 to 50 head stock.
39	NW.	36	"	"	"	Spring	0	2,650					Glacial drift	Hard			A spring located in coulée.
1	SE.	1	13	12	3	Dug	67	2,832	- 50	2,772	60	2,772	Cypress Hills?	Hard, clear		D, S	Sufficient for 10 head stock; use dugout.
2	NW.	2	"	"	"	Dug	31	2,854	- 27	2,827	27	2,827	Cypress Hills	Hard, clear		D, S	Sufficient for 9 head stock; also a spring with intermittent supply.
3	SE.	3	"	"	"	Dug	90	2,863	- 80	2,783	80	2,783	Cypress Hills	Hard, clear		N	Very small supply; well filled in.
4	SE.	3	"	"	"	Dug	30	2,863	- 6	2,857	6	2,857	Cypress Hills	Medium hard, clear		D, S	Intermittent supply; two wells 30 feet and 20 feet deep; both yield a small supply.
5	SW.	4	"	"	"	Dug	10	2,870	- 6	2,864	6	2,864	Cypress Hills	Hard, clear		D, S	Sufficient supply; rarely use well.
6	NW.	4	"	"	"	Dug	16	2,884	- 13	2,871	13	2,871	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient supply for 25 head stock; 1 14-foot well caved in.
7	NW.	6	"	"	"	Bored	72	2,920	- 15	2,905	15	2,905	Cypress Hills	Hard, clear, "alkaline"		D, S	Insufficient supply; needs water for 21 head stock.
8	SW.	8	"	"	"	Bored	80	2,933	- 40	2,893	80	2,853	Cypress Hills	Hard, clear, "alkaline", white sediment		D, S	Waters 25 head stock usually; sufficient supply for 50 head stock.
9	NW.	8	"	"	"	Bored	63	2,935	- 23	2,912	63	2,872	Cypress Hills gravel	Hard, clear		D, S	Insufficient supply; a 63-foot well in Cypress Hills formation waters 8 head stock.
10	SE.	9	"	"	"	Dug	10	2,890					Cypress Hills	Hard			Sufficient for local needs.
11	NE.	9	"	"	"	Dug	27	2,888	- 23	2,865	23	2,865	Cypress Hills	Hard, clear		D, S	Sufficient for at least 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

COULEE, NO. 136, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
12	SW.	10	13	12	3	Dug	20	2,898	- 16	2,882	16	2,882	Cypress Hills sand	Soft, clear		D, S	Insufficient supply for 20 head stock; only waters 10 head stock; a 10-foot well used also.
13	NW.	10	"	"	"	Dug	12	2,863	- 9	2,854	9	2,854	Cypress Hills sand and gravel	Hard, clear, "alkaline"		D, S	Sufficient for town use.
14	SE.	10	"	"	"	Dug	54	2,850	- 44	2,806	44	2,806	Cypress Hills	Hard, clear		D, S	Insufficient supply; waters 5 head stock; 3 other wells 25 feet deep are not sufficient; needs water for 15 head stock. Only sufficient for house use.
15	NE.	10	"	"	"	Dug	16	2,855	- 12	2,844	12	2,844	Cypress Hills	Hard, clear, sulphur		D	
16	NE.	10	"	"	"	Dug	14	2,844	- 10	2,834	10	2,834	Cypress Hills sand	Soft, clear		D, S	Sufficient for 20 head stock.
17	NW.	11	"	"	"	Spring		2,834					Cypress Hills				Permanent supply.
18	SE.	11	"	"	"	Dug	29	2,852	- 26	2,826	26	2,826	Cypress Hills	Soft, clear		D, S	Insufficient for 9 head stock; a 14-foot well has 9 feet of water; also an intermittent spring.
19	SW.	12	"	"	"	Drilled	74	2,860	- 54	2,806	74	2,786	Cypress Hills	Soft, clear		D, S	Sufficient for 25 head stock.
20	NW.	12	"	"	"	Drilled	80	2,865	- 65	2,800	80	2,785	Cypress Hills	Soft, clear		D, S	Sufficient for over 25 head stock.
21	SE.	12	"	"	"	Dug	52	2,860	- 48	2,812	48	2,812	Cypress Hills sand	Soft, clear, iron		D, S	Sufficient for 35 head stock.
22	NE.	13	"	"	"	Dug	55	2,870	- 51	2,825	51	2,825	Cypress Hills	Soft, clear		D, S	Sufficient for 20 head stock.
23	NE.	13	"	"	"	Bored	72	2,874					Cypress Hills	Hard, clear, "alkaline"		D, S	Sufficient for 25 head stock.
24	NE.	13	"	"	"	Dug	60	2,864	- 55	2,829	55	2,829	Cypress Hills	Hard, clear, "alkaline", grey sediment		D, S	Sufficient supply.
25	SE.	14	"	"	"	Dug & Bored	60	2,886	- 20	2,866	60	2,820	Cypress Hills gravel	Soft, clear		D, S	Insufficient for 15 head stock; waters 8 head stock.
26	NE.	14	"	"	"	Dug	30	2,883	- 28	2,855	28	2,855	Cypress Hills sand	Hard, clear, "alkaline"		D, S	Sufficient supply; well is used by neighbours also.
27	SW.	15	"	"	"	Dug	15	2,850	- 14	2,836	14	2,836	Cypress Hills sand	Hard, clear		D, I	Sufficient supply; used for garden.
28	SW.	15	"	"	"	Dug	12	2,840	- 10	2,830	10	2,830	Cypress Hills sand	Soft, clear		D, S	Sufficient for 2 head stock.
29	SW.	15	"	"	"	Dug	35	2,888	- 20	2,868	35	2,853	Cypress Hills	Hard, clear, "alkaline"		D, S	Sufficient supply.
30	NW.	16	"	"	"	Dug	25	2,904	- 21	2,883	21	2,883	Cypress Hills sand	Soft, clear		D, S	Sufficient for 20 head stock; also use a spring.
31	SE.	16	"	"	"	Dug	30	2,918					Cypress Hills sand				Good supply; sufficient for local needs.
32	SE.	17	"	"	"	Dug	33	2,918	- 30	2,888	30	2,888	Cypress Hills fine sand	Soft, clear		D, S	Sufficient for local needs.
33	NE.	18	"	"	"	Dug	29	2,920	- 27	2,893	27	2,893	Cypress Hills sand and gravel	Hard, clear		D, S	Waters 15 head stock.
34	SW.	18	"	"	"	Dug	24	2,925	- 22	2,903	22	2,903	Cypress Hills sand	Medium hard, clear		D, S	Sufficient for 10 head stock at once; water comes back in one hour.
35	SW.	18	"	"	"	Drilled	38	2,920	- 28	2,892	38	2,882	Cypress Hills sand	Hard, clear, sand sediment		D, S	Excellent supply; a 24-foot well also yields a good 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

COULEE, NO. 130, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (-) Surface	Elev.	Depth	Elev.	Geological Horizon				
36	SE.	18	13	12	3			2,960						Hard, "alkaline"			Insufficient for local needs.
37	NW.	18	"	"	"	Dug	24	2,925	- 21	2,904	21	2,904	Cypress Hills sand	Soft, clear		D, S, I	Sufficient for 20 head stock and garden.
38	SW.	19	"	"	"	Dug	24	2,916	- 22	2,894	22	2,894	Cypress Hills sand	Soft, clear		D, S	Sufficient for 20 head stock; a 23-foot well similar in Cypress Hills sand.
39	NW.	19	"	"	"	Dug	26	2,915	- 24	2,891	24	2,891	Cypress Hills sand	Soft, clear, "alkaline",		D, S, I	Sufficient for 12 head stock and used for garden at times.
40	NW.	19	"	"	"	Dug	20	2,916	- 18	2,898	18	2,898	Cypress Hills sand	red sediment Soft, clear		D, S, I	Sufficient for 16 head stock; used for garden also.
41	NW.	19	"	"	"	Dug	20	2,916	- 17	2,899	17	2,899	Cypress Hills sand	Soft, clear		D, S, I	Sufficient for 30 head stock; used for garden also.
42	NW.	19	"	"	"	Dug	20	2,916	- 17	2,899	17	2,899	Cypress Hills sand?	Hard, clear, "alkaline"		D, S, I	Sufficient for 7 head stock and garden.
43	NW.	19	"	"	"	Dug	23	2,916	- 20	2,896	20	2,896	Cypress Hills sand	Soft, clear		D, S, I	Sufficient for 10 head stock and garden.
44	NW.	19	"	"	"	Dug	23	2,916	- 20	2,896	20	2,896	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 10 head stock; a 28-foot well also.
45	NW.	19	"	"	"	Dug	23	2,916	- 20	2,896	20	2,896	Cypress Hills conglomerate	Medium hard, clear		D, S, I	Sufficient for 25 head stock and garden; also a well 13 feet deep; sufficient supply.
46	NW.	19	"	"	"	Dug	22	2,915	- 10	2,899	10	2,899	Cypress Hills sand	Soft, clear		D, S	Sufficient for 12 head stock.
47	NW.	19	"	"	"	Dug	25	2,916	- 19	2,897	19	2,897	Cypress Hills sand	Medium hard, clear		D, S	Sufficient for 12 head stock.
48	SE.	20	"	"	"	Dug	15	2,898	- 13	2,885	13	2,885	Cypress Hills sand	Soft, clear		D, S	Sufficient supply for 18 head stock; a 12-foot well yields good supply of soft water.
49	NW.	20	"	"	"	Bored	20	2,920	- 12	2,914	12	2,914	Cypress Hills sand	Hard, clear		D, S	Insufficient for 25 head stock; only waters 5 head stock; 3 other wells 29, 21, 18 feet deep yield additional supply.
50	SW.	27	"	"	"	Dug	17	2,910	- 14	2,896	14	2,896	Cypress Hills conglomerate	Hard, clear		D, S	Insufficient for 8 head stock.
51	SW.	27	"	"	"	Dug	15	2,910	- 12	2,898	12	2,898	Cypress Hills unconsolidated conglomerate	Hard, clear		D, S	Sufficient for 25 head stock.
52	SE.	27	"	"	"	Dug	16	2,910	- 13	2,897	13	2,897	Cypress Hills conglomerate	Hard, clear, "alkaline", white sediment		D, S	Sufficient for 12 head stock.
53	SE.	27	"	"	"	Dug	16	2,910	- 13	2,897	13	2,897	Cypress Hills sand	Hard, clear		D, S	Sufficient for 10 head stock; a 15-foot similar well was filled in.
54	NE.	27	"	"	"	Dug	16	2,910	- 7	2,903	7	2,903	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 25 head stock; #.
55	NE.	27	"	"	"	Dug	15	2,910	- 7	2,903	15	2,895	Cypress Hills fine sand	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock; another well 15 feet deep yields similar supply.
56	NW.	28	"	"	"	Dug	38	2,905	- 17	2,888	17	2,888	Cypress Hills sand	Hard, clear		D, S	Insufficient for 10 head stock; a 20-foot well also; small supply.
57	NW.	28	"	"	"	Dug	20	2,905	- 18	2,887	18	2,887	Cypress Hills sand	Hard, clear		D, S	Sufficient for 18 head stock; another 20-foot similar well.
58	SE.	28	"	"	"	Bored	30	2,910	- 20	2,890	20	2,890	Cypress Hills fine sand	Hard, clear, "alkaline", iron		D, S	Insufficient supply; hauled water in 1930; laxative on humans and stock; #.
59	NE.	28	"	"	"	Dug	19	2,905	- 16	2,889	16	2,889	Cypress Hills sand	Hard, clear		D, S	Sufficient supply for 13 head stock; Another 19-foot similar well.

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

WELL RECORDS—Rural Municipality of

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (-) Surface	Elev.	Depth	Elev.	Geological Horizon				
00	SW.	30	13	12	3	Dug	27	2,916	- 17	2,899	17	2,899	Cypress Hills sand	Hard, clear		D, S	Insufficient supply; only enough to water 20 head stock.
01	NE.	33	"	"	"	Dug	24	2,872	- 19	2,853	19	2,853	Cypress Hills sand	Hard, clear		D, S, I	Sufficient for 20 head stock and garden; a 24-foot well, good supply.
02	SW.	33	"	"	"	Spring							Cypress Hills				No information.
03	NW.	33	"	"	"	Dug	42	2,864	- 40	2,844	40	2,844	Cypress Hills	Soft, clear		D	Only sufficient for house use; also a 39-foot well; a spring is also used.
04	NW.	34	"	"	"	Dug	24	2,863	- 16	2,867	16	2,867	Cypress Hills	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock; laxative on man; a spring also used.
1	SE.	1	14	10	3	Dug	30	2,518	- 15	2,503	15	2,503	Glacial blue clay	Hard, clear, slightly "alkaline"		D, S	Insufficient supply; only water 5 head stock.
2	SE.	3	"	"	"	Bored	50	2,615									Dry hole in Bearpaw shale; 3 other dry holes; a shallow "alkaline"; well abandoned.
3	SW.	5	"	"	"	Bored	100	2,700	- 50	2,650			Bearpaw shale	Hard		S	Sufficient for 40 head stock.
4	NE.	5	"	"	"	Spring	0						Glacial drift	Hard			Small supply of good water.
5	SW.	9	"	"	"	Bored	30	2,742	- 40	2,702	40	2,702	Bearpaw shale	Hard, clear		D, S	Insufficient supply; waters 25 head stock; a 71-foot well in Bearpaw supply for stock use.
6	NE.	11	"	"	"	Bored	60	2,730	- 40	2,690			Glacial sand	Hard, clear, iron, red sediment		D, S	Sufficient for 15 head stock.
7	SW.	12	"	"	"	Dug	52	2,676	- 27	2,649	27	2,649	Glacial drift	Hard, clear, "alkaline"		S	Sufficient supply; a 15-foot well is seepage from slough.
8	N.	16	"	"	"	Dug	33	2,665	- 15	2,650	15	2,650	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 40 head stock; good water for domestic use.
9	SE.	17	"	"	"	Bored	50	2,675	- 25	2,650	25	2,650	Glacial drift	Hard, clear, "alkaline", iron		D, S	Insufficient supply; only water 15 head stock.
10	SW.	21	"	"	"	Dug	32	2,665	- 28	2,637	28	2,637	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock.
11	NW.	23	"	"	"	Bored	57	2,650	- 24	2,626	50	2,594	Glacial gravel	Hard, iron, "alkaline", bad odour, clear		S	Sufficient for 30 head stock; a 14-foot seepage well with good water.
12	NW.	24	"	"	"	Bored	90	2,700	- 80	2,620	80	2,620	Bearpaw shale	Hard, clear, "alkaline"		D, S	Sufficient supply; a 70-foot well in coulee; poor water, iron; filled in.
13	SE.	24	"	"	"	Bored	55	2,674	- 20	2,654	55	2,619	Bearpaw shale	Hard, clear, "alkaline", iron		S, D	Sufficient for 30 head stock.
14	NE.	28	"	"	"	Dug	8	2,520	- 4	2,516	4	2,516	Glacial drift	Hard, clear		D	Intermittent supply; waters 17 head stock at times; also use dam.
15	SW.	28	"	"	"	Drilled	590	2,640	-300	2,340			Bearpaw shale	Medium hard, clear, salty		D, S	Sufficient for 25 head stock; #. Several wells from 30 to 50 feet deep; poor water.
16	NW.	30	"	"	"	Dug	43	2,680	- 40	2,640	40	2,640	Glacial sandy clay	Hard, clear, iron		D, S	Insufficient for 15 head stock; a 16-foot intermittent seepage well; dam for stock.
17	NW.	31	"	"	"	Bored	82	2,690	- 32	2,658	32	2,658	Bearpaw shale	Hard, clear	45	D, S	Insufficient supply for 25 head stock; also a 40-foot seepage well.
18	NE.	32	"	"	"	Bored	50	2,620	- 31	2,589			Glacial drift	Hard, clear, "alkaline", red sediment, iron	43	S	Sufficient for 25 head stock; laxative on humans.

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

COULEE, NO. 136, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (-) Surface	Elev.	Depth	Elev.	Geological Horizon				
19	NW.	33	14	10	3	Bored	00	2,590	- 40	2,550	50	2,540	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply for 20 head stock; two wells 90 and 75 feet in Bearpaw; small supply, too "alkaline".
20	NW.	34	"	"	"	Dug	10	2,500	- 4	2,556	4	2,556	Glacial gravel	Hard, clear		D, S	Sufficient supply; large dam used for stock.
21	NE.	36	"	"	"	Bored	15	2,370	- 11	2,359	11	2,359	Glacial sandy clay	Hard, clear		D, S	Sufficient for 40 head stock; water obtained along valley at same level.
1	SW.	5	14	10	3	Dug	35	2,944	- 25	2,919	35	2,909	Cypress Hills sandstone	Hard, clear		D, S	Sufficient for 10 head stock.
2	SE.	6	"	"	"	Dug	28	2,942	- 23	2,919	23	2,919	Cypress Hills unconsolidated yellow clay	Hard, clear, "alkaline", sediment		D, S	Sufficient for 11 head stock; laxative on humans.
3	NW.	6	"	"	"	Bored	60	2,928	- 40	2,888	60	2,868	Cypress Hills sand	Soft, clear		D, S	Sufficient for 10 head stock; a 14-foot well; waters 10 head stock; good water.
4	SW.	7	"	"	"	Bored	60	2,929	- 55	2,874	55	2,874	Cypress Hills sand	Soft, clear		D, S	Insufficient supply; only a few barrels; well closed in 1934.
5	SE.	7	"	"	"	Bored	81	2,930					Cypress Hills sandstone	Hard, clear		D, S	Insufficient for 10 head stock.
6	NE.	10	"	"	"	Dug	22	2,800	- 12	2,848	12	2,848	Ravenscrag sand	Soft, clear		D, S	Sufficient for 35 head stock.
7	SE.	15	"	"	"	Dug	18	2,805	- 6	2,859	6	2,859	Ravenscrag sand	Medium hard, clear, sediment		D, S	Sufficient for 0 head stock; a 40-foot well in blue clay; sufficient for 5 head stock; well not used now.
8	SW.	15	"	"	"	Bored	78	2,800			78	2,782	Ravenscrag sand	Hard, clear		D, S	Sufficient supply; 1 barrel an hour.
9	NE.	17	"	"	"	Dug	30	2,820	- 32	2,788	32	2,788	Cypress Hills sandstone	Slightly hard, clear		D, S	Sufficient supply for 8 head stock; have a spring in pasture.
10	SE.	20	"	"	"	Dug	12	2,750	- 1	2,751			Ravenscrag (?)	Hard		S	Spring flows.
11	SW.	21	"	"	"	Dug	20	2,754	- 4	2,750	20	2,730	Eastend sandstone	Hard, clear, "alkaline"		D, S	Sufficient supply; haul drinking water.
12	SE.	25	"	"	"	Bored	40	2,720	- 15	2,705	40	2,680	Glacial pebble clay	Hard, clear, "alkaline"		D, S	Sufficient supply; laxative; also use slough for stock.
1	NE.	1	14	12	3	Dug	12	2,892	- 6	2,886	6	2,886	Cypress Hills sand	Hard, clear		D, S	Sufficient for 20 head stock; also have a spring.
2	SW.	1	"	"	"	Dug	28	2,930	- 24	2,906	24	2,906	Cypress Hills sand	Medium hard, clear, sediment		D, S, I	Sufficient for 27 head stock; also used for garden.
3	SE.	2	"	"	"	Dug	32	2,942	- 20	2,922	32	2,910	Cypress Hills conglomerate	Hard, clear		D, S, I	Waters 10 head stock; a 26-foot well waters 10 head stock.
4	SW.	2	"	"	"		25	2,930					Cypress Hills	Hard		S	Sufficient for a few head stock only.
5	NW.	2	"	"	"	Dug	26	2,936	- 18	2,918	18	2,918	Cypress Hills sand	Hard, clear, sediment		D, S	Only waters 2 head stock.
6	NW.	2	"	"	"	Dug	25	2,924	- 19	2,905	19	2,905	Cypress Hills sand	Hard, clear, "alkaline"		D, S	Sufficient for 12 head stock; two wells 23 feet and 21 feet yield a fair supply each.
7	NE.	3	"	"	"	Dug	45	2,888	- 30	2,858	45	2,843	Cypress Hills	Soft, clear		D, S	Sufficient for 20 head stock.
8	SW.	3	"	"	"	Dug	24	2,882	- 20	2,862	20	2,862	Cypress Hills	Hard, clear, "alkaline"		D, S	Sufficient for 4 head stock; a spring also used; a 24-foot well yields a slightly larger supply of similar water.
9	NE.	4	"	"	"	Dug	37	2,880	- 22	2,858	22	2,858	Cypress Hills sand	Hard, clear, "alkaline"		S	Sufficient for 9 head stock; laxative on humans.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of

COULEE, NO. 136, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
10	NE.	4	14	12	3	Bored	40	2,882	- 30	2,840	30	2,846	Cypress Hills sand	Hard, clear, "alkaline"		D, S, I	Sufficient for 25 head stock and garden.
11	SE.	4	"	"	"	Dug	18	2,872	- 15	2,857	15	2,857	Cypress Hills gravel	Hard, clear, "alkaline"		D, S, I	Sufficient for 20 head stock; a 50-foot well good supply of hard, "alkaline" water.
12	SE.	4	"	"	"	Dug	18	2,872	- 15	2,857	15	2,857	Cypress Hills sand	Hard, clear, "alkaline"		N	Insufficient supply; only 8 pails a day.
13	SE.	9	"	"	"	Dug	65	2,900	- 40	2,860	65	2,835	Cypress Hills	Hard, clear, "alkaline"		D, S	Insufficient in summer; a 15-foot well; sufficient supply for house and neighbours.
14	SW.	10	"	"	"	Bored	60	2,902	- 55	2,847	55	2,847	Cypress Hills	Hard, clear, "alkaline", bitter, blue		S	Sufficient for more than 7 head stock; laxative on human and stock.
15	NE.	12	"	"	"	Dug	17	2,900	- 13	2,887	17	2,883	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 9 head stock.
16	SE.	13	"	"	"	Spring	0	2,800					Cypress Hills	Hard		D, S	Probably a sufficient supply.
17	NE.	14	"	"	"	Dug	40	2,850	- 33	2,817	33	2,817	Cypress Hills	Soft, clear		D, S	Insufficient supply; only waters 8 head stock.
18	SW.	14	"	"	"	Dug	215	2,858	- 10	2,848	10	2,848	Glacial drift	Hard, clear		D	Sufficient for house; #. Stock water at spring on NW.¼, section 14, tp. 14, range 12, W. 3rd mer.
19	NW.	14	"	"	"	Spring	0	2,800					Cypress Hills	Hard		S	Sufficient for stock.
20	NE.	15	"	"	"	Dug	14	2,840	- 13	2,827	13	2,827	Glacial sand	Soft, clear, "alkaline"		D	Sufficient for house.
21	SE.	15	"	"	"	Dug	13	2,860	- 8	2,858	8	2,858	Glacial drift	Soft, clear		S	Waters 10 head stock.
22	NE.	16	"	"	"	Drilled	90	2,898	- 40	2,858	90	2,802	Cypress Hills gravel	Medium hard, clear		D, S	Good supply; cannot be pumped dry.
23	SW.	16	"	"	"	Drilled	100	2,894	- 60	2,834	100	2,794	Cypress Hills?	Hard, clear, "alkaline"		D, S	Sufficient for 36 head stock.
24	SW.	16	"	"	"	Drilled	60	2,895	- 20	2,875	60	2,835	Cypress Hills	Soft, clear		D, S	Oversufficient for 30 head stock; a 60-foot well yields good supply.
25	NW.	17	"	"	"	Bored	30	2,750	- 35	2,721	35	2,721	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 28 head stock.
26	SE.	19	"	"	"	Dug	20	2,729	- 17	2,712	17	2,712	Cypress Hills conglomerate	Medium hard, clear		D, S	Sufficient for 23 head stock; a spring also used.
27	NE.	19	"	"	"	Dug	25	2,700	- 21	2,679	21	2,679	Cypress Hills sand	Soft, clear		D, S	Sufficient for 20 head stock.
28	NE.	19	"	"	"	Dug	24	2,684	- 19	2,665	19	2,665	Cypress Hills sand and gravel	Medium hard, clear, sand		D, S	Sufficient for 10 head stock; also a spring.
29	NE.	20	"	"	"	Dug	52	2,708	- 50	2,658	50	2,658	Cypress Hills sand	sediment Hard, clear		D, S	Sufficient for 40 head stock.
30	SE.	21	"	"	"	Dug	15	2,825	- 12	2,813	12	2,813	Cypress Hills conglomerate	Soft, clear		D, S	Insufficient; only waters 10 head stock.
31	NE.	22	"	"	"	Drilled	65	2,724			65	2,659	Cypress Hills sand	Soft, clear		D, S	Abundant supply; #.
32	NE.	22	"	"	"	Drilled	60	2,710			60	2,630	Cypress Hills gravel	Soft, clear		N	Good supply.
33	SE.	22	"	"	"	Dug	20	2,820	0	2,820	0	2,820	Glacial blue clay	Hard, clear		S	Insufficient supply; a 20-foot well for house; a 40-foot well for stock; a 104-foot well dry; probably in Cypress Hills.
34	NW.	24	"	"	"	Dug	30	2,750	- 28	2,722	28	2,722	Glacial blue clay	Soft, clear		D, S	Insufficient supply; only waters 3 head stock; haul water.
35	NE.	24	"	"	"	Drilled	107	2,718	- 47	2,671	107	2,611	Eastend (?)	Soft, clear		D, S	Good supply for 21 head stock; spring also used.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of

COULÉE, NO. 136, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
36	SE.	24	14	12	3	Dug	30	2,700	− 6	2,754	30	2,730	Cypress Hills blue sand	Soft, clear		D, S	Sufficient for 25 head stock.
37	SE.	24	"	"	"	Dug	38	2,740	− 30	2,710	50	2,690	Cypress Hills sand	Soft, clear		D, S	Sufficient for 15 head stock.
38	NW.	27	"	"	"	Drilled	77	2,670	− 25	2,645	35	2,635	Cypress Hills sand	Soft, clear		D, S, I	Sufficient for 20 head stock and garden.
39	NE.	28	"	"	"	Drilled	80	2,678			80	2,598	Cypress Hills sand	Soft, clear		D, S	Sufficient for 15 head stock or more.
40	SW.	28	"	"	"	Dug	33	2,750	− 31	2,719	31	2,719	Cypress Hills conglomerate	Hard, clear		D, S	Insufficient for 5 head stock.
41	SW.	28	"	"	"	Drilled	80	2,750	− 65	2,685	80	2,670	Cypress Hills sand	Soft, clear		D, S	Sufficient for 15 head stock.
42	NW.	29	"	"	"	Dug	20	2,668	− 17	2,651	17	2,651	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 12 head stock; a spring used also.
43	SE.	30	"	"	"	Dug	15	2,679	− 11	2,668	11	2,668	Cypress Hills sand	Soft, clear		D, S	Sufficient for 25 head stock.
44	SE.	32	"	"	"	Dug	30	2,667	− 26	2,641	26	2,641	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 20 head stock.
45	NE.	33	"	"	"	Dug	26	2,643	− 10	2,633	26	2,617	Cypress Hills	Medium hard, clear		D, S	Sufficient for 75 head stock.
46	SE.	33	"	"	"	Dug	28	2,667	− 20	2,647	20	2,647	Cypress Hills conglomerate	Soft, clear		D, S	Abundant supply; another 40-foot well.
47	NW.	34	"	"	"	Bored	30	2,645	− 15	2,630	30	2,615	Cypress Hills	Soft, clear		D, S	Sufficient for 9 head stock.
48	SW.	34	"	"	"	Bored	25	2,600	− 18	2,642	18	2,642	Cypress Hills fine sand	Hard, clear, sand sediment		D, S	Sufficient for 8 head stock.
49	SW.	34	"	"	"	Dug	39	2,600	− 5	2,655	5	2,655	Glacial yellow clay	Hard, clear		D, S	Insufficient supply; only waters 4 head stock.
50	NE.	34	"	"	"	Drilled	85	2,638	− 30	2,608	85	2,553	Cypress Hills sand	Soft, clear, yellow sediment		D, S	Abundant supply for 30 head stock.
51	NE.	34	"	"	"	Dug	32	2,638	− 29	2,609	29	2,609	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 30 head stock; poor cribbing.
52	SE.	34	"	"	"	Dug	43	2,646	− 6	2,640	43	2,603	Cypress Hills sandstone	Soft, clear		D, S	Sufficient for 13 head stock.
53	SE.	35	"	"	"	Dug	34	2,645	− 4	2,641	34	2,611	Cypress Hills	Hard, clear			Good supply.
54	SW.	35	"	"	"	Dug	30	2,580	− 24	2,556	24	2,556	Cypress Hills conglomerate	Hard, clear, "alkaline"		D, S	Sufficient for 6 head stock.
55	SE.	36	"	"	"	Dug	45	2,650	− 42	2,608	42	2,608	Cypress Hills gravel	Hard, clear		D, S	Insufficient supply; intermittent; also use a spring.
1	SE.	1	15	10	3		68	2,400	− 3	2,397	36	2,364	Glacial gravel	Hard		N	Unfit for human consumption.
2	SE.	1	"	"	"	Drilled	238	2,400	− 14	2,386			Bearpaw shale			N	Water not usable; well filled in.
3	SE.	1	"	"	"	Dug	27	2,370	− 24	2,346	24	2,346	Glacial sandy clay	Hard, clear, "alkaline"		D, S	Sufficient supply; #. Several other similar wells.
4	SE.	2	"	"	"	Dug	32	2,385	− 18	2,367	32	2,353	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 11 head stock; laxative on humans.
5	SW.	3	"	"	"	Drilled	350	2,585	− 40	2,545			Bearpaw shale	Soft, clear		D, S	Sufficient for 30 head stock.
6	NW.	4	"	"	"	Drilled	320	2,625	− 210	2,415			Bearpaw shale	Soft, brown		D, S	Sufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of

COULÉE, NO.136, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (-) Surface	Elev.	Depth	Elev.	Geological Horizon				
7	SW.	5	15	10	3	Drilled	390	2,655	-200	2,455			Bearpaw shale	Hard, brown		D, S	Sufficient for 30 head stock.
8	SE.	6	"	"	"	Drilled	290	2,650					Bearpaw shale	Soft, brown		D, S	Sufficient for 40 head stock.
9	SE.	8	"	"	"	Bored	80	2,630	- 50	2,580			Bearpaw shale	Hard, clear, "alkaline"		S	Sufficient for 9 head stock; laxative on humans.
10	NW.	10	"	"	"	Bored	31	2,505	- 25	2,540	25	2,540	Glacial sand	Hard, clear, "alkaline"		S	Sufficient for 18 head stock; laxative; a 28-foot well with small supply for house use.
11	NE.	10	"	"	"	Bored	30	2,555	- 20	2,535	20	2,535	Glacial sand	Hard, clear, "alkaline"		S	Sufficient for 12 head stock; laxative.
12	NE.	12	"	"	"	Drilled	550	2,500	-200	2,300			Bearpaw sand	Soft, clear		D, S	Sufficient for 22 head stock; #.
13	SE.	14	"	"	"	Bored	30	2,370	- 5	2,365	30	2,340	Glacial sand	Hard, clear		S	Sufficient for 18 head stock; laxative on humans; affect stock.
14	SW.	16	"	"	"	Bored	32	2,600	- 18	2,582	32	2,568	Glacial drift	Hard, clear		S	Sufficient for 30 head stock; a 28-foot well for house with a similar supply.
15	SW.	17	"	"	"	Drilled	205	2,600	-100	2,500			Bearpaw shale	Soft, black		D, S	Sufficient for local needs.
16	NW.	17	"	"	"	Spring		2,600					Glacial drift				Several springs in locality.
17	SE.	18	"	"	"	Bored	60	2,600	- 55	2,545	55	2,545	Glacial gravel	Hard, clear		D, S	Sufficient for 30 head stock.
18	ST.	24	"	"	"	Dug	20	2,400	- 19	2,381	19	2,381	Glacial quicksand	Hard			Several similar wells; insufficient supply; plugged by sand.
19	NE.	25	"	"	"	Bored	70	2,500	- 00	2,434	00	2,434	Cypress Hills sand	Hard, clear		D, S	Was a small supply; well filled in with quicksand; haul water.
20	SW.	31	"	"	"	Dug	25	2,375	- 21	2,354	21	2,354	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock; also a similar well.
21	NE.	31	"	"	"	Bored	70	2,440	- 60	2,380	00	2,380	Glacial clay and sand	Hard, clear		D, S	Waters 20 head stock.
22	SE.	32	"	"	"	Dug	25	2,500	- 21	2,479	21	2,479	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for 10 head stock.
23	NE.	32	"	"	"	Drilled	216	2,480					Bearpaw gravel	Hard, brown		N	Abundant supply; #.
24	NE.	33	"	"	"	Drilled	700	2,550									Dry hole in Bearpaw sand.
25	NE.	34	"	"	"	Spring	0						Cypress Hills	Hard, clear		S	Abundant supply.
26	SE.	36	"	"	"	Dug	25	2,440	- 17	2,423	17	2,423	Glacial sandy clay	Soft, clear		D, S	Sufficient for 20 head stock; a 30-foot well filled with quicksand.
27	NE.	36	"	"	"	Dug	15	2,420	- 12	2,408	12	2,408	Glacial quicksand	Hard, clear		D, S	Sufficient for 20 head stock.
1		5	15	11	3		40	2,600	- 24	2,576	24	2,576	Glacial sand	Hard, cloudy, "alkaline"			#
2	SE.	6	"	"	"	Bored	55	2,508	- 53	2,535	53	2,535	Glacial drift	Hard, black sediment, "alkaline"		D, S	Intermittent, insufficient supply.
3	NW.	7	"	"	"	Dug	14	2,500	- 8	2,492	8	2,492	Recent alluvium	Hard, clear		D, S	Sufficient supply.
4	NE.	10	"	"	"	Bored	50	2,560	- 20	2,540	20	2,540	Glacial drift	Hard, clear, "alkaline"		D, S	Intermittent, sufficient supply; laxative; well can be pumped dry.
5	SW.	15	"	"	"	Drilled	572	2,560	-230	2,330	572	1,988	Bearpaw sand	Soft, cloudy		D	Abundant supply.
6	SE.	16	"	"	"	Drilled	120	2,520	- 60	2,460			Bearpaw	Hard, clear, "alkaline"		S	Sufficient for stock; laxative.

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

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (-) Surface	Elev.	Depth	Elev.	Geological Horizon				
7	SE.	20	15	11	3	Drilled	130	2,525	- 30	2,495	100	2,425	Cypress Hills gravel	Hard, clear, "alkaline"	44	S	Sufficient for stock; a 10-foot well for house use.
8	NE.	20	"	"	"	Drilled	130	2,520	- 30	2,490	130	2,390	Cypress Hills gravel	Hard, clear, "alkaline"	44	S	Sufficient for stock; haul drinking water from spring on NW.¼, section 21.
9	SW.	20	"	"	"	Bored	45	2,540	- 18	2,522	45	2,495	Cypress Hills?	Hard, clear, "alkaline"		D, S	Sufficient supply for 12 head stock; laxative on humans; very unsatisfactory for house use.
10	NW.	21	"	"	"	Spring	0	2,535					Glacial drift	Hard		D	Sufficient for house use.
11	NW.	22	"	"	"	Bored	112	2,510	-100	2,410	100	2,410	Bearpaw (?)	Hard, "alkaline"		S	Insufficient supply; laxative on humans; a 16-foot well used for hard drinking water.
12	NE.	22	"	"	"	Bored	120	2,510	-105	2,405	105	2,405	Bearpaw (?)	Hard, clear, corrosive		D, S	Abundant supply.
13	NW.	23	"	"	"	Drilled	110	2,490	- 60	2,430	110	2,380	Bearpaw (?)	Hard, clear, "alkaline"		S	Large supply; laxative on humans; 14-foot well went dry; haul drinking water.
14	SW.	26	"	"	"	Drilled	85	2,506	- 55	2,451	85	2,421	Bearpaw (?)	Hard, clear, "alkaline"		S	Sufficient for stock; laxative on humans.
15	NE.	28	"	"	"	Dug	20	2,556	- 18	2,538	18	2,538	Glacial drift	Medium hard		D	Insufficient supply; a 35-foot well yields a small supply; also a 90-foot dry hole.
16	NW.	28	"	"	"	Dug	12	2,550	- 8	2,542	8	2,542	Glacial gravel	Hard, "alkaline", white sediment		D, S	Insufficient for 5 head stock in dry seasons.
17	SE.	28	"	"	"	Drilled	120	2,536					Bearpaw (?)	Hard, clear, "alkaline", white sediment		S	Sufficient for 20 head stock; laxative.
18	NW.	30	"	"	"	Dug	45	2,500	- 43	2,517	43	2,517	Cypress Hills sand	Hard, clear		D, S	Insufficient supply; intermittent.
19	SE.	35	"	"	"	Dug	12	2,450	- 11	2,439	11	2,439	Glacial sand	Soft, clear		D, S	Insufficient supply; need water for 14 head stock; sufficient for house use.
20	SW.	30	"	"	"	Bored	92	2,400	- 32	2,368			Glacial drift	Hard		N	Well caved in; a 10-foot well is sufficient for house use.
21	NW.	36	"	"	"	Spring	0	2,350					Glacial drift				Spring in coulée; probably sufficient supply.
1	SW.	2	15	12	3	Spring	0	2,594					Cypress Hills	Hard, clear		D, S	Probably sufficient supply.
2	NE.	3	"	"	"	Spring	0	2,600					Cypress Hills	Hard, clear		D, S	Probably sufficient supply.
3	SE.	4	"	"	"	Dug	12	2,635					Glacial drift	Hard, clear		D, S	Sufficient for 15 head stock.
4	SW.	6	"	"	"	Dug	17	2,705	- 12	2,693	12	2,693	Cypress Hills sand	Soft, clear		D, S	Sufficient for 25 head stock.
5	NE.	10	"	"	"	Spring	0	2,500					Cypress Hills	Hard		D, S	Probably sufficient supply.
6	SE.	12	"	"	"	Dug	10	2,473	- 6	2,467	6	2,467	Recent alluvium	Soft, clear		D, S	Abundant supply for 16 head stock; a 16-foot well used for stock.
7	NE.	13	"	"	"	Bored	96	2,570	- 24	2,546	96	2,474	Bearpaw shale	Hard, clear, white sediment		S	Abundant supply; several 15-foot seepage wells for drinking water.
8	NE.	14	"	"	"	Dug	50	2,620	- 48	2,572	48	2,572	Cypress Hills conglomerate	Hard		S	Sufficient for 40 head stock.
9	SW.	16	"	"	"	Spring	0	2,588					Cypress Hills	Hard			Probably sufficient.
10	NE.	17	"	"	"	Dug	35	2,628	- 32	2,596	32	2,596	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 11 head stock.

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WELL RECORDS—Rural Municipality of

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
11	SW.	19	15	12	3	Dug	12	2,673	- 6	2,667	6	2,667	Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 200 head stock; #.
12	SE.	20	"	"	"	Drilled	35	2,636	- 30	2,606	30	2,606	Cypress Hills conglomerate	Soft, clear		D	Only sufficient for house use.
13	SE.	20	"	"	"	Dug	35	2,632	- 30	2,602	30	2,602	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 30 head stock; neighbours use well also.
14	NE.	20	"	"	"	Dug	50	2,598									Dry hole in Cypress Hills sand.
15	NE.	20	"	"	"	Dug	57	2,678	- 63	2,615	63	2,615	Cypress Hills conglomerate	Medium hard, clear		D, S	Insufficient supply at time; waters 17 head stock usually.
16	SE.	21	"	"	"	Dug	60	2,630	- 50	2,580	50	2,580	Cypress Hills quicksand	Hard, "alkaline"		S	Sufficient supply; laxative.
17	SE.	22	"	"	"	Dug	53	2,627	- 45	2,582	45	2,582	Cypress Hills conglomerate	Hard, clear		D	Insufficient supply; laxative.
18	SE.	22	"	"	"	Dug	50	2,627	- 45	2,582	45	2,582	Cypress Hills conglomerate	Hard, clear		D, S	Insufficient supply; laxative; #.
19	NW.	23	"	"	"	Drilled	110	2,618	- 50	2,568			Cypress Hills	Hard, clear, iron		D, S	Sufficient for 10 head stock.
20	NW.	24	"	"	"	Dug	50	2,602	- 49	2,553	49	2,553	Cypress Hills conglomerate	Soft, clear		D, S	Sufficient for 20 head stock.
21	NE.	27	"	"	"	Dug	40	2,592	- 34	2,558	34	2,558	Cypress Hills sand	Hard, clear		D, S	Sufficient for 10 head stock.
22	NW.	34	"	"	"	Bored	97	2,590	- 30	2,560	90	2,500	Cypress Hills sand	Hard, clear, "alkaline", rusty sediment	42	D, S	Sufficient supply.
23	NE.	34	"	"	"	Bored	95	2,588	- 30	2,558	95	2,493	Cypress Hills sand	Hard, cloudy, slightly "alkaline"	42	D, S	Abundant supply; slightly laxative on humans; #.
24	NE.	35	"	"	"	Drilled	96	2,550	- 46	2,504	96	2,454	Cypress Hills sand	Hard, clear	42	D, S	Sufficient supply; laxative.
25	NW.	36	"	"	"	Dug	20	2,550	- 16	2,534	16	2,534	Glacial drift	Hard, clear, "alkaline"	40	D, S	Sufficient supply; a 30-foot well with 6 feet of water was closed up in 1925.

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(#) Sample taken for analysis.