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BUREAU OF ECONOMIC GEOLOGY
GEOLOGICAL SURVEY

PRELIMINARY REPORT
GROUND-WATER RESOURCES
OF THE
RURAL MUNICIPALITY OF LAC PELLETIER
No. 107
SASKATCHEWAN

BY

B. R. MacKay, H. H. Beach & D. P. Goodall

Water Supply Paper No. 118



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CONTENTS

	<u>Page</u>
Introduction	1
Glossary of terms used	5
Names and descriptions of geological formations referred to..	8
Water-bearing horizons of the municipality	10
Water-bearing horizons in the unconsolidated deposits	11
Water-bearing horizons in the bedrock	13
Ground water conditions by townships:	
Township 10, Range 13, west of 3rd meridian	18
Township 10, Range 14, " " " "	19
Township 10, Range 15, " " " "	21
Township 11, Range 13, " " " "	22
Township 11, Range 14, " " " "	24
Township 11, Range 15, " " " "	25
Township 12, Range 13, " " " "	27
Township 12, Range 14, " " " "	28
Township 12, Range 15, " " " "	29
Statistical summary of well information	32
Analyses and quality of water	33
General statement	35
Table of analyses of water samples	37
Water from the unconsolidated deposits	38
Water from the bedrock	39
Well records	41

Illustrations

Map of the municipality.

Figure 1. Map showing surface and bedrock geology that affect the ground water supply.

Figure 2. Map showing relief and the location and types of wells.

GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY

OF LAC PELLETIER, NO. 107

SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

If one intends to sink a well and wishes to find the approximate depth to a water-bearing horizon, he must learn: (1) the elevation of the site, and (2) the probable elevation of the water-bearing bed. The elevation of the well site is obtained by marking its position on the map, Figure 2, and estimating its elevation with respect to the two contour lines between which it lies and whose elevations are 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 overlie the bedrock.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Lac Pelletier, No. 107, comprises an area of 324 square miles situated in the southwestern part of Saskatchewan. The municipality is a square block of nine townships described as tps. 10, 11, and 12, ranges 13, 14, and 15, W. 3rd mer. The centre of the area lies approximately 25 miles due south of the city of Swift Current. The Meyronne branch of the Canadian Pacific railway passes through the northeastern township of the area and on it in sec. 22, tp. 12, range 13, is situated the village of Blumenhof. Another branch of the same railway extending from Dunelm to Simmie crosses the northwest corner of the municipality. The siding of Vesper is located on this line in sec. 20, tp. 12, range 15. In this municipality is situated the height of land between the northwesterly flowing Swiftcurrent creek and the southeasterly flowing Notukeu creek. Lac Pelletier, from which the municipality derives its name, is situated on the eastern side of township 12, range 15. It occupies a depression about 3 miles in length in a deep, steep-sided, flat-bottomed trench, which extends southeasterly across the highlands, between the two main stream channels. The bottom of this coulée is about half a mile wide, and lies at an elevation of 2,717 feet above sea-level, or from 150 to 200 feet below the average level of the bordering upland plains. Overflow from the lake drains northward into Pelletier creek, a tributary of Swiftcurrent creek. South of the lake, however, the valley has no well-developed drainage. Just north of the area in which the valley crosses the northern boundary of township 10, range 14, the valley slopes gradually to the south, forming the headwaters of a small stream that flows southeastward to join Notukeu creek just beyond the southeast corner of the municipality. Much larger streams than now exist undoubtedly flowed through this valley in past times.

The land surface of the highlands east of Pelletier valley, including most of townships 11 and 12, ranges 13 and 14, is

a level to gently undulating plain with prevailing surface elevations ranging from 2,900 to 2,950 feet above sea-level. South of this area from the northern border of township 10, ranges 13 and 14, the land surface slopes rapidly southward to elevations of 2,500 to 2,600 feet along the creek bottom in the southeastern part. On the southwestern and western sides of the valley the land surface is more irregularly rolling. Elevations exceed 3,100 feet on the tops of some of the hills extending along the western border of the municipality.

The water of lac Pelletier is reported to be of good quality and not highly mineralized. This water is not contaminated by surface pollution, and is quite suitable for domestic and stock-watering requirements. Little difficulty has been experienced in obtaining an adequate supply of ground water from wells sunk to depths not generally exceeding 200 feet throughout the greater part of the municipality. Only in the southeastern lowlands where the bedrock underlying the surface deposits is of a more compact character has careful prospecting at shallow depths been necessary.

Ground water supplies of the municipality are obtained from two sources: (1) the glacial drift that covers the bedrock throughout the municipality except in Pelletier valley where the Recent stream deposits immediately overlies the bedrock; and (2) the Cypress Hills and Bearpaw, bedrock formations.

Water-bearing Horizons in the Unconsolidated Deposits

The thin beds of sands, silts, and gravels that cover the floor of Pelletier Lake valley and extend along the channels of the streams are derived from the erosion of the glacial drift and bedrock of the uplands. This material is porous and expected to be water bearing. Although no wells are known to have been sunk into the Recent deposits in this municipality, it is believed that shallow dug wells located in the vicinity of the lake would yield satisfactory drinking water supplies. In many places the sides of the valley are

steep and this source of water is not conveniently located for farms on the uplands.

Farther down the creek in the southeastern lowlands the stream deposits are thinner, not exceeding 5 to 10 feet in many places. Very shallow wells dug close to the stream channel would yield water derived by direct seepage from the stream. It is expected that water from wells located in the valley more remote from the stream channel will yield a more highly mineralized water but it should be drinkable. The mantle of glacial drift that covers the uplands was deposited many thousands of years ago by one or more great continental ice sheets that advanced and retreated across the province of Saskatchewan.

Over the greater part of the area the drift consists of till composed of light yellowish brown boulder clay grading a few feet below the surface into compact, bluish grey, unweathered boulder clay. Over the uplands extending along the western boundary of the municipality the retreating ice front paused for a considerable length of time, allowing a much greater thickness of drift to be deposited. This material is characterized by a much more irregularly rolling land surface and referred to as moraine. In many places along the valley sides and along the gently sloping escarpment extending along the northern boundaries of township 10, ranges 13 and 14, erosion that has taken place since the disappearance of the ice has removed much or all of the drift and in some of the valleys the bedrock is exposed at the surface. The areal distribution of the moraine and till, and the places where the bedrock is exposed at the surface, are indicated by means of symbols on Figure 1 of the map accompanying this report.

Over the uplands east of the lake valley the drift is thin and does not generally form a source of ground water, although in some places pockets are found, and in several localities more extensive water-bearing beds of fine silts, sands, and gravels, sparsely interspersed through the more impervious boulder clay. These porous beds

are more commonly encountered by wells sunk in the moraine in the west-central parts and on the lowland in the south-central part and the southeastern corner of the municipality. Wells sunk to those beds in the lowlands encounter water at depths less than 30 feet. The yield from individual wells varies, but it is usually sufficient for 10 to 20 head of stock. The water is hard and may contain appreciable amounts of sulphate salts in solution, but the concentration is rarely sufficiently great to render the water unfit for drinking. In the moraine on the western highlands pockets of water-bearing sands and gravels are encountered in wells sunk to depths ranging from 10 to 60 feet. The aquifers are not extensive, and in many of them it is necessary to sink several holes before a suitable water supply is obtained. These waters are of better quality than those encountered in the lowland areas. They are usually hard and are reported to be quite suitable for drinking.

Throughout the remainder of the highlands and in many sections in the lowlands to the south the settlers find it necessary to sink their wells into the underlying bedrock formations before a suitable water supply is obtained.

Water-bearing Horizons in the Bedrock

Ground water supplies are obtained from three formations that immediately underlie the drift in different parts of the municipality.

The two upper formations are very similar in character and mode of occurrence and can rarely be distinguished one from the other by the well data available. The lower of these, called the Swift Current beds, has been noted in rock exposures along Pelletier coulée southwest of Lac Pelletier village in the NE. $\frac{1}{4}$, sec. 8, tp. 11, range 14, W. 3rd mer. These beds consist of conglomerate and concretionary sandstone and were observed to have a thickness of about 50 feet. They are overlain in this vicinity by the Cypress Hills

formation, also composed of conglomerate and coarse sandstone which is generally between 100 and 125 feet thick. The areal extent of each formation is not known, and where they occur together they have been distinguished more by the difference in age of their fossil content than by any striking differences in the character of the component sediments. As their ground water possibilities appear to be similar these two formations are mapped and discussed as a unit, under the name of the Cypress Hills formation.

The Cypress Hills formation consists of thick beds of unconsolidated sands interbedded with layers of cemented gravels (conglomerate), sandstones, and grey shales. It extends throughout the highlands in the northern two-thirds of the municipality and southward in range 15, on the western side, to within a mile of the southern border. The approximate geological boundary of this formation is outlined on Figure 1 of the geological map accompanying this report. The Cypress Hills formation was deposited on an eroded and hence irregularly rolling land surface of the underlying Bearpaw formation. Its base apparently does not extend to elevations lower than about 2,850 feet at the southern boundary of this area, on the western side of the municipality, but has been found at depths down to an elevation of about 2,800 feet on the eastern sides of the area. These deposits, however, occur at greater depths toward the north as several wells drilled in the northwestern part of the municipality encountered Cypress Hills sediments at elevations as low as 2,650 feet.

Ground water supplies are obtained from several different horizons in this formation. The lowest water-bearing horizon occurs near the base at depths ranging from 50 feet to 200 feet, depending upon the thickness of the formation at the well location. This horizon apparently extends throughout the entire area covered by these sediments, as no wells are definitely known to have been drilled through this formation without encountering water in the lower beds.

It seems probable that water percolating through the porous beds of sands and conglomerate is eventually collected on the top of the more impervious dark shales of the Bearpaw formation. Other water-bearing beds occur irregularly interspersed through porous zones at shallower depths. These aquifers are rarely traceable over great distances and are thought to occur only where they are underlain by less pervious beds such as shale or cemented conglomerate. Many of the shallower aquifers yield large supplies of water where wells have been sunk to them. Other wells yield only sufficient water for 5 to 10 head of stock or for domestic use and in many places it is found necessary to deepen the well to a lower horizon or to the extensive water-bearing beds at the base of the formation.

The quality of the waters from the different horizons are essentially the same. Many of them are reported to be soft or slightly hard. The mineral salt content is low and the waters are reported to be of excellent quality for domestic use.

Many of the wells situated in the southern part of the municipality yield water from the Bearpaw formation. This formation consists essentially of soft, dark-grey, clay shales interbedded with thin beds of fine sand. The Bearpaw shales are readily recognized in wells and on outcrops by their dark colour, their soapy feel, the absence in them of large stones or pebbles, and by the small, roughly cubical, buff-coloured fragments into which they crumble upon weathering. This formation has a wide areal extent and underlies the entire municipality. It is found immediately beneath the glacial drift throughout the southern lowland parts and extends northward beneath the Cypress Hills formation, to beyond the northern border of the map-area. Pelletier valley has been cut throughout its length in the uplands through the overlying beds down to the Bearpaw shales. Along the stream channel to the southeast corner of the municipality these shales are concealed by only the few feet of Recent valley silts.

Wells sunk to these shales in the southern part of the municipality encounter water within a few feet below the base of the glacial drift. Few of these wells are over 50 feet in depth, and the water-bearing horizon apparently follows the general contour of the land surface. Most of the waters from this source contain appreciable amounts of sulphate salts in solution, rendering about one-third of the wells useless as a source of domestic drinking supply. None of the waters from the upper part of the shales, however, is reported to be too highly mineralized to be used for watering stock. The yield from these wells varies in different localities. Individual wells situated in the eastern part of this area produce only sufficient water for 5 to 10 head of stock. The yield increases toward the west. Most of the wells penetrating the shales on the western side of Pelletier valley yield sufficient water for farm requirements of 15 to 30 head of stock. The water is apparently under hydrostatic pressure in some of these wells, as a constant water-level is maintained at 30 to 40 feet above the base of the wells.

A 90-foot well, situated in the NW. $\frac{1}{4}$, sec. 9, tp. 10, range 14, probably yields water from a deeper aquifer in the Bearpaw shales. A sample of this water was not taken for analysis, but it is reported to be soft and suitable for drinking. The exact depth to the water-bearing beds in the well was not determined, but the water stands at a constant level 22 feet below the surface, or at an elevation of about 2,600 feet. The areal extent of this horizon is not known, but it probably extends westward, as soft water horizons have been encountered at approximately the same elevation in the northwestern corner of the municipality to the south and on the eastern side of the municipality to the west of this area. This horizon cannot be expected to occur in the southeastern part of the municipality, however, where surface elevations are below 2,600 feet.

No wells are known to have been sunk to any great depths into the shale in the southeastern part. Studies made of the formation over wide areas suggest that at depths of 50 feet or more into the shales the supply available becomes less and that the quality of the water is very poor. The laxative-acting salts in the water may be in such concentration as to render it unsuitable for watering stock.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 10, Range 13

Recent stream deposits are thinly distributed over the bottom of Pelletier valley and its tributary coulées, but are not known to be water-bearing except in a few isolated localities. In these localities water seeping from the glacial drift, and possibly from the Bearpaw formation that is exposed along the valley sides, gradually collects in the Recent deposits and may attain sufficient head to come to the surface as springs along the lower edges of the slopes. Some of these springs if dug out could be used for watering a few head of stock, but the water, particularly if derived from the shale, may be too highly mineralized to be used for domestic purposes.

The glacial drift covering the area remote from the valleys varies in thickness from 10 to 20 feet over the northern uplands of the township, to 30 feet or more over the southern lowlands. Extensive beds of water-bearing sands and gravels are known to occur at or near the base of the till over slightly more than the southern half of the township. The northern border of this area apparently extends in a northeasterly direction from section 18 to section 25. Wells sunk in this area usually encounter the water-bearing horizon at depths of 20 to 30 feet from the surface, or at elevations of 2,550 to 2,500 feet above sea-level.

Several springs located in the bottoms of small coulées that extend through sections 9, 15, 16, and 17 also yield good flows of water from this horizon. The yields of the wells sunk to this horizon are usually sufficient for the average farm requirements of 15 to 20 head of stock. The water is hard and appreciable amounts of the soluble salts are generally present, although the concentrations are rarely excessive and the water can be used for household purposes.

Water-bearing beds are apparently scarce in the thin layer of glacial drift covering the northern half of the township and most

of the farmers in this area have sunk their wells to the underlying Bearpaw formation before encountering water. In this area only small supplies of highly mineralized water occur in the soft shales a few feet below the base of the drift at depths of 20 to 30 feet from the surface. These waters are hard and in nearly all cases the mineral salt content is too high for human consumption, although the water is used for stock. The possibilities of better water conditions occurring at greater depths in this formation are not favourable. A hole sunk to a depth of 400 feet or to an elevation of about 2,145 feet above sea-level in section 4 in the township to the east failed to encounter water and it seems probable that similar conditions occur at depth throughout this township. Dugouts may be necessary to ensure adequate supplies of water on farms in this part of the area, although careful prospecting of the drift and upper part of the shales may find drinkable water in some places.

In the extreme northwestern corner of the township water-bearing beds of sand may be expected to occur in the Cypress Hills formation, which extends through the highlands in the northern half of section 31 and northwestern part of section 32 at elevations greater than approximately 2,775 feet. This formation does not occur elsewhere in the township.

Township 10, Range 14

No wells are known to have been sunk into the Recent stream deposits and it is probable that in most places these deposits are too thin to form reservoirs for more than small quantities of water.

The thickness of the glacial drift varies in different parts of the township, but is not known to exceed 50 feet at any point where wells have been sunk through it into bedrock. Only two wells in the township are reported to have encountered water-bearing beds of sand or gravel in the glacial till, although their occurrence may be more numerous than indicated by these two wells, especially in the sparsely settled district of the southeastern parts, as well as

in the moraine-covered area along the western border of the township. Waters suitable for drinking may be obtained from these aquifers in a few localities, but the highly mineralized types are likely to be of common occurrence.

The Cypress Hills bedrock formation underlies the drift along the northern border of the township in two areas of about 2 square miles each lying to the east and west of Pelletier valley. The approximate southern boundary of these areas is shown on the geological map accompanying this report, Figure 1. This formation apparently does not extend to elevations lower than about 2,775 feet above sea-level. Wells situated in sections 31 and 32 on the western side of the valley yield fairly large supplies of hard, drinkable water from sand aquifers at depths of 30 and 80 feet, respectively. On the eastern side of the valley, in section 35, a 50-foot well is reported to yield soft water, but the supply is only sufficient for household use. These water-bearing sands no doubt also occur in the unprospected parts of these areas and would be reached by wells not exceeding 100 feet in depth.

Throughout the remainder of the township where the Cypress Hills formation has been removed by erosion the unconsolidated stream and glacial drift deposits are underlain by the Bearpaw formation. Wells sunk in this formation encounter water at depths ranging from 20 to 90 feet. These aquifers are reported to consist of blue clay, but it is possible that some of them are sands or sandy shales, as large yields of water are obtained from some of the wells. Appreciable amounts of soluble salts are present in most of these waters, but from only one well was the concentration of salts sufficiently high to render the water unfit for household use. No attempt is made to outline the boundaries of these aquifers as they are of limited individual areal extent and occur at various elevations from about 2,690 feet down to 2,590 feet above sea-level.

Township 10, Range 15

Glacial drift covers the bedrock of the area to depths of 50 to 80 feet in the northern part of the township, with an irregularly rolling land surface characteristic of the moraine. It thins out perceptibly toward the south and has a maximum thickness of about 30 feet at the southern border of the township. Only a few isolated pockets of water-bearing sands have been encountered in wells sunk in the drift in the various parts of the township. The yield of water from individual wells is rarely sufficient for more than 10 head of stock, but the water is of good quality and is used for the household drinking supply. Deeper wells sunk into the bedrock have been found necessary to obtain a satisfactory water supply on most farms. Flowing springs occur in several places in the southern third of the township. They are situated on the southern slopes of highlands that cover the northern part. Although these springs issue from the drift the waters no doubt have their source in underlying bedrock aquifers.

Ground water supplies are obtained from the two bedrock formations that underlie the drift in different parts of the township. The upper or Cypress Hills formation underlies most of the northern two-thirds of the township. Its southern boundary extends in an easterly direction from the north part of section 7 to the SE. $\frac{1}{4}$, section 10, thence in a northeasterly direction to the NE. $\frac{1}{4}$, section 24. Wells sunk in the area north and west of this boundary encounter bedrock at depths ranging from 40 feet in the southern part to 70 to 80 feet in some sections in the northern part of the township. Water is encountered in sand or sandstone at depths of 60 to 115 feet, or at an average elevation of about 2,900 feet above sea-level throughout most of this area. Alternating layers of dry sand, sandstone, shale, and conglomerate are usually penetrated before water is obtained. The water supply from wells sunk to this aquifer is amply sufficient for the average farm requirements, and some large yields are reported.

These waters are of excellent quality as they contain only small amounts of mineral salts in solution. The hardness is not excessive and some are reported to be moderately soft.

In the southern and southeastern part of the township, where the Cypress Hills formation does not occur, ground water is obtained from the Bearpaw clays and sandy shales. This water-bearing horizon or zone is encountered at depths of 30 to 50 feet from the surface.

The largest yields from this formation are obtained from three wells situated along the southern border of the township in sections 2, 4, and 5. These wells each supply sufficient water for 25 to 40 head of stock. Throughout the rest of the area the yields are inadequate for the farm requirements. These waters are excessively hard and the soluble salt content is probably in excess of 1,500 parts per million. Only two wells, however, are reported to yield water that is too highly mineralized for drinking and these are used for watering stock.

A second water-bearing horizon may occur in this area at depths of 200 to 300 feet from the surface, or at an elevation of about 2,550 feet above sea-level. Wells sunk to this aquifer in the northwestern part of the township adjacent on the south encounter soft water of excellent quality in this horizon. Similar soft waters are also encountered at approximately the same elevation several miles farther west of this area. Considering the known extent of this horizon the possibility of it occurring in the southern part of the township is very favourable.

Township 11, Range 13

A thin mantle of glacial till overlies partly cemented sands and gravels of the Cypress Hills formation on the highlands that extend over most of this township. As the drift and the upper part of the underlying bedrock are quite porous little water is retained near the surface. In a small area of lower elevation in the southeastern corner of the township the grey boulder clay is underlain by beds

of sand and gravel which in turn are underlain by compact clay shales of the Bearpaw formation. Wells sunk into these glacial deposits in section 1 and the NE $\frac{1}{4}$, section 2, encounter abundant supplies at depths of 15 to 20 feet from the surface. The water is hard and is used for the household drinking supply and for watering stock.

On the uplands, water is obtained from two horizons in the Cypress Hills formation. The upper horizon occurs at shallow depths, generally not over 30 feet below the surface. The water occurs in unconsolidated sands or gravels which probably represent the pre-glacial weathered zone of this formation. Where underlain by impervious conglomerate or firmly cemented sands the aquifers are capable of retaining large supplies of water. Wells sunk into these deposits generally yield sufficient water for the average farm requirements, although inadequate supplies are reported from a few of the wells. The water ranges in hardness from moderately soft to hard and is apparently quite satisfactory for household use.

The second water-bearing horizon occurs at an average elevation of about 2,820 feet, or at depths ranging from 30 feet to 110 feet depending upon the surface elevation at the well site. Wells sunk to this horizon usually penetrate alternating layers of dry sands, conglomerate, sandstone, and thin beds of shale before encountering water. The water is not under hydrostatic pressure, but the supply in most places is amply sufficient for the farm requirements. The quality of the water is similar to that of the upper horizon. Only small yields of water are reported from wells located in sections 14 and 15. In this locality the water-bearing horizon is encountered at depths of 70 to 80 feet. In a 220-foot drilled well located in the NE $\frac{1}{4}$, section 15, the Bearpaw shales were encountered at a depth of about 80 feet below the surface at an elevation of about 2,836 feet above sea-level. This is the highest elevation at which these shales are known to occur within the township, and as the elevation is slightly higher than the average water-level of other wells in the vicinity this no doubt accounts for the paucity of water in the locality.

Deeper drilling in the Boarpaw formation is not recommended in this township as few beds sufficiently porous to allow for any large accumulation of water are expected to occur at greater depths.

Township 11, Range 14

Ground water supplies are obtained from several horizons in this township. Recent deposits of sand and gravel that occur in the bottom of Pelletier valley are believed to be sufficiently thick and porous to retain water in some localities, although at present these supplies are little utilized.

On the highlands, remote from the valley, the land surface is mantled by glacial drift to variable depths ranging from only a few feet on the steeper slopes to over 40 feet in isolated localities in the northeast corner. The drift is composed mostly of boulder clay in which only small seepages of mineralized water were encountered in several wells. These waters, where encountered, have been cased off and the wells sunk to the underlying bedrock where waters of better quality are found.

The Cypress Hills formation, which underlies the drift throughout the township, extends to depths of 150 to 200 feet and possibly more in some sections. Its base lies at an elevation of approximately 2,750 feet above sea-level. Wells sunk into this formation encounter water at various depths. The lowest water-bearing horizon apparently occurs near the base of the formation at an elevation of about 2,800 feet, or slightly lower in some locations. It is of wide areal extent and has been tapped by wells sunk in various parts of the township to depths ranging from 50 to 165 feet depending upon the surface elevation at the well site. The water occurs in unconsolidated beds of sand or gravel and the supply is amply sufficient for the local farm requirements. It is reported to be soft or only moderately hard and of excellent quality for household use.

Other water-bearing horizons occur irregularly interspersed through the formation at higher elevations. These aquifers are

apparently not extensive over great distances and many of them have been encountered in close proximity to wells that failed to reach production before penetrating the lower horizon. The waters, however, are similar in character to those of the lower horizon and where these aquifers have been encountered the supply is usually large.

As the aquifers in the Cypress Hills formation supply sufficient water for the requirements of this township there has been no necessity to prospect for water in the underlying Bearpaw formation. The Bearpaw, however, forms the bedrock underlying the stream deposits in Pelletier valley, and with the exception of the Recent deposits is the only potential source of ground water in the valley bottoms. Springs issuing from the Cypress Hills formation on the banks of the valley supply water for stock, but if it becomes necessary to sink wells in the Bearpaw formation, "alkali" water will probably be obtained.

Township 11, Range 15

The Recent stream deposits can be expected to yield water only in the bottom of Pelletier valley where it skirts the eastern border of the township from sections 13 to 36. No wells are reported to have been dug in this area, but it is quite possible that water of good quality may be obtained at shallow depths in a few localities, especially where the aquifers are replenished by water from springs that occur along the lower valley sides.

Throughout the remainder of the township the bedrock is overlain by an irregular mantle of glacial drift composed of boulder clay interspersed with occasional pockets of sand or gravels. The drift varies in thickness from a few feet on the eastern side of the township to 60 feet or more in the moraine that covers the southwestern half.

Wells sunk in the boulder clay seldom yield more than small seepages of water adequate only for household use. Only one well, situated in the SE. $\frac{1}{4}$, section 17, is known to yield sufficient water

for the farm requirements. At this location water in sufficient quantities for 30 or more head of stock was encountered in an aquifer of undetermined character at a depth of about 28 feet from the surface. The water is hard and is used as a household drinking supply.

The Cypress Hills formation, which underlies the drift throughout the township, except in the bottom of Pelletier valley, yields water to wells sunk to various elevations ranging from 2,960 feet to 2,810 feet above sea-level. Water conditions are apparently similar to those described in an earlier section dealing with township 7, range 14, on the eastern side of the valley. An extensive water-bearing horizon occurs at the base of the formation, the water being trapped by more impervious beds of the underlying Bearpaw formation. Less extensive horizons have been found in isolated localities at shallower depths in the Cypress Hills formation. Wells encountering water in the upper horizons range in depth from 30 to 190 feet. The first aquifer encountered generally supplies sufficient water for farm use, although one well situated in the SW. $\frac{1}{4}$, section 5, passed through two horizons that yielded small seepages at depths of 106 and 130 feet before a large flow of water was struck at a depth of about 162 feet.

The deepest wells in the township are situated in section 20. Two wells in this section were drilled to depths of 290 feet. Water was encountered in sand in the lower part of the Cypress Hills formation, and a few feet of blue clay, probably Bearpaw shale, was penetrated at the base of the well. The depth to this horizon was not determined, but the water stands in these wells at a constant level about 265 feet from the surface.

Apparently no difficulty is found in obtaining ground water supplies suitable for all farm requirements from the Cypress Hills formation in this township, if wells are sunk to a sufficient depth.

Most of these waters are reported to be soft. They are all of excellent quality, and the large yield to be expected justifies the expense of drilling to the lower horizon.

No wells have penetrated sufficiently far into the Bearpaw formation to determine its water-bearing possibilities. Due to the more compact nature of the shales forming much of the formation it is probable that supplies obtainable will not be as large as from the overlying Cypress Hills formation. There should be little necessity for sinking wells below the base of the Cypress Hills formation in this township.

Township 12, Range 13

Glacial drift, composed largely of compact, buff-weathering, greyish boulder clay, forms a thin mantle over the bedrock of this township. Where wells have been sunk through the drift the underlying bedrock has been encountered at depths of 10 to 20 feet from the surface.

Suitable ground water supplies are not known to occur in the boulder clay, although several wells situated in the eastern half of the township encounter water-bearing sands and gravels that lie at the contact of the drift and the underlying bedrock. These porous beds were probably deposited before the advance of the ice-sheet. The waters contained in these deposits vary considerably in character in different localities. Several shallow wells situated in the village of Blumenhof are reported to yield "alkaline" water, but in other parts of this township small supplies of less highly mineralized drinkable water are obtained from these aquifers.

The Cypress Hills formation underlies the drift throughout the township. Its base lies at an elevation of approximately 2,750 feet, or at depths of 100 to 200 feet from the surface depending upon the surface elevation. Wells sunk in this formation penetrate sands, usually unconsolidated, interbedded with layers of grey shales and occasionally beds of conglomerate. Ground water is encountered in

the sands at various elevations from about 2,900 to 2,800 feet above sea-level, or at depths of 20 to 160 feet from the surface. Most of these wells supply sufficient water for the farm requirements, although quicksand flowing into the wells naturally has reduced the yield or even plugged a few of the wells. Several wells sunk to a depth of 108 feet in the village of Blumenhof, in section 27, have been rendered unproductive on account of these sands. Fortunately the sands are more consolidated in other parts of the township and this difficulty is not experienced. Most of the waters obtained from the Cypress Hills formation are reported to be soft and all are apparently quite suitable for drinking. No dry holes are known to have been sunk through this formation and it seems probable that suitable water supplies may be obtained in any part of the township at depths probably nowhere greatly exceeding 150 feet. There should be little necessity to sink wells through the Cypress Hills formation into the less productive Bearpaw formation.

Township 12, Range 14

Ground water supplies suitable for farm requirements are not known to occur in the thin mantle of glacial till that covers the bedrock in this township.

Wells sunk through the boulder clay usually encounter the underlying Cypress Hills formation at depths of less than 20 feet. Two water-bearing horizons are known to occur in this formation in the township. The upper horizon is encountered at depths ranging from 15 to 75 feet, or at elevations greater than 2,915 feet above sea-level. Wells located in the eastern half of the township where surface elevations exceed 2,940 feet yield water from these aquifers. The aquifers consist of sand and gravel beds irregularly interspersed through the clays and shales. Most of these wells yield only sufficient water for household use and for a few head of stock, although several have encountered larger supplies.

The second and lower water-bearing horizon occurs at elevations ranging from 2,780 to 2,680. It is tapped by wells sunk in the western half of the township to depths of 180 to 225 feet. The water occurs in sand and is under sufficient hydrostatic pressure to cause it to rise in the wells 15 to 40 feet above the water-bearing bed. The supply is amply sufficient for all farm requirements. This is the principal water-bearing horizon of the Cypress Hills formation and it no doubt extends to the eastward through the rest of the township. Should deeper wells be sunk in the eastern parts larger supplies of water of good quality will probably be found.

All ground waters obtained in this township are of good quality and most of them are reported to be soft. There is no scarcity of water if wells are sunk to sufficient depths to reach the lower productive bed of the Cypress Hills formation. There should be no necessity to sink wells through the Cypress Hills formation into the underlying shales of the Bearpaw formation.

Township 12, Range 15

No records were obtained of wells having been sunk into the Recent deposits covering the floor of Pelletier valley in the vicinity of the lake. These sediments are sufficiently porous to form reservoirs for ground water seeping from the uplands. Although shallow wells in these deposits would undoubtedly yield drinkable water, this source is not conveniently located to farms located on the uplands. Till covers almost all of this township. It is only a few feet thick, or is even absent along the sides of the valley, but is thicker on the uplands. Wells sunk to depths of 30 feet or less in the southern and southwestern part of the township have encountered a few pockets of water-bearing sands and gravels interspersed throughout the boulder clay. Owing to the small individual areal extent of these aquifers it has been found necessary in many places to sink several holes before a suitable water supply is located. These waters,

where located, are reported to be of good quality, with the exception of the supply from one well situated on section 18. This well yields "alkali" water that is not used.

Most of the residents in this township have failed to locate water supplies in the glacial drift and have sunk wells into the Cypress Hills formation that underlies the drift throughout the upland parts of the township. The deepest horizon from which water is obtained from this formation occurs near its base at an elevation of about 2,690 to 2,650 feet. This horizon is of wide areal extent and probably extends throughout the entire township remote from the valley. Three wells, situated in sections 19 and 30, on the western side of the township, yield small supplies of hard water from a sand aquifer at depths of 50 to 60 feet, or at elevations of 2,670 to 2,690 feet. These waters contain small amounts of iron in solution, but they are being used for the household drinking supply.

Owing to the higher elevation of the land surface it is generally necessary to drill to greater depths before tapping this horizon in the central and eastern parts of the township. Wells situated in sections 16, 21, 22, and 27 encounter water at depths of 175 to 185 feet. The deepest well in the township, situated on section 13, on the eastern side of Lac Pelletier valley, encountered this horizon at a depth of 201 feet. Flowing springs that occur at an elevation of about 2,675 feet in the bottom of Pelletier Creek valley in sections 24 and 25 are also producing from this horizon. The yield from the deep wells, with the exception of those situated on the western side of the township, is amply sufficient for the average farm requirements of 30 to 40 head of stock. The water is reported to be hard and quite suitable for drinking.

Several wells, situated in the southern part of the township and along the northern border, are yielding water from aquifers that occur at higher elevations in this formation. These water-bearing beds are apparently of small individual extent as they have not been

encountered elsewhere in the township. The yields from most of these wells are sufficient for 40 to 50 head of stock.

There is apparently no scarcity of ground water supplies in this township provided wells are sunk to the base of the Cypress Hills formation. The wells in sections 19 and 30 do not appear to have reached the base of this formation, and larger yields are to be expected in these sections by deepening wells to this horizon. Should the base of the Cypress Hills formation prove to be unproductive, water of good quality may occur in the upper 50 feet of the underlying Bearpaw formation.

The Bearpaw immediately underlies the Cypress Hills formation throughout the township. Thin beds of fine, bluish grey sand interbedded with the dark grey shales comprise an extensive water-bearing horizon in the adjoining township to the west and northwest. For a description of these water supplies the reader is referred to the report on the "Ground Water Resources of the Rural Municipality of Webb, No. 138".

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL
MUNICIPALITY OF LAC PELLETIER, NO. 107, SASKATCHEWAN

	Township	10	10	10	11	11	11	12	12	12	Total No. in muni- cipality
		13	14	15	13	14	15	13	14	15	
West of 3rd meridian	Range										
<u>Total No. of Wells in Township</u>		30	14	33	42	29	20	26	27	31	252
No. of wells in bedrock		14	9	25	37	28	17	23	26	25	204
No. of wells in glacial drift		15	5	8	5	1	3	3	1	6	47
No. of wells in alluvium		1	0	0	0	0	0	0	0	0	1
<u>Permanency of Water Supply</u>											
No. with permanent supply		29	14	33	38	28	19	26	26	28	241
No. with intermittent supply		0	0	0	1	0	1	0	0	1	3
No. dry holes		1	0	0	3	1	0	0	1	2	8
<u>Types of Wells</u>											
No. of flowing artesian wells		0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells		0	2	3	2	1	3	2	8	7	28
No. of non-artesian wells		29	12	30	37	27	17	24	18	22	216
<u>Quality of Water</u>											
No. with hard water		27	12	29	29	20	12	12	9	21	171
No. with soft water		2	2	4	10	8	8	14	17	8	73
No. with salty water		1	0	0	0	0	0	0	0	0	1
No. with "alkaline" water		21	8	6	0	0	0	1	0	2	38
<u>Depths of Wells</u>											
No. from 0 to 50 feet deep		30	9	18	26	13	10	14	18	18	156
No. from 51 to 100 feet deep		0	5	8	11	9	3	4	2	6	48
No. from 101 to 150 feet deep		0	0	5	4	3	3	7	0	1	23
No. from 151 to 200 feet deep		0	0	2	0	3	2	1	4	5	17
No. from 201 to 500 feet deep		0	0	0	1	1	2	0	3	1	8
No. from 501 to 1,000 feet deep		0	0	0	0	0	0	0	0	0	0
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		19	11	30	38	26	20	25	26	29	224
No. not usable for domestic purposes		10	3	3	1	2	0	1	0	0	20
No. usable for stock		29	13	32	39	27	20	26	26	29	241
No. not usable for stock		0	1	1	0	1	0	0	0	0	3
<u>Sufficiency of Water Supply</u>											
No. sufficient for domestic needs		28	14	33	37	28	19	25	26	27	237
No. insufficient for domestic needs		1	0	0	2	0	1	1	0	2	7
No. sufficient for stock needs		20	13	30	33	28	16	24	22	25	211
No. insufficient for stock needs		9	1	3	6	0	4	2	4	4	33

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 Lac Pelletier, No. 107, Saskatchewan

No.	LOCATION			Depth of well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED							CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS					Source of water			
	Qtr.	Sec.	Tp.			Rge.	Mer.	Total	Perm.	Temp.	Cl.	Alka-linity	CaO	MgO	SO ₄	Na ₂ O	Solids	CaCO ₃	CaSO ₄	MgCO ₃		MgSO ₄	Na ₂ CO ₃	Na ₂ SO ₄
1	SW.	27	10	13	3	6,100	3,000+	-	97	260	510	634	3,805	1,165	5,659	260			1,889			2,466	160	# 3
2	SE.	1	10	15	3	1,480											(2)	(3)	(4)	(5)				# 3
3	SW.	30	10	15	3	220	150	50	7	135	70	14	16	-										# 2
4	NW.	13	11	13	3	460	320	60	11	225	60	65	144	76	428	107			51		152	18		# 2
5	SW.	31	11	13	3	220	240	40	5	140	40	32	25	8	170	72			15		19	8		# 2
6	SW.	17	12	13	3	260	280	20	13	225	30	61	57	60	307	54			127		84	21	21	# 2
7	NE.	18	11	15	3	360	360	20	6	275	20	83	78	75	369	36			173		115	10	35	# 2
8	NE.	13	12	15	3	320	280	100	8	245	30	25	70	132	360	54			52		104	13	137	# 2

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).
 Analysis No. 2, 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 unconsolidated deposits were taken for analysis. The following generalizations are based upon observations at well sites, opinions of residents, and upon analyses of waters from beds of similar character in adjoining areas.

The water contained in lac Pelletier is only moderately hard and not highly mineralized. From the standpoint of its mineral salt content alone this water would be quite suitable for domestic purposes, but such bodies of water filling deep valleys are particularly liable to pollution by sewage or other organic matter. Hence should residents consider using the lake water or supplies from seepage wells in close proximity to the lake on examination of the water for bacteria should first be made by the Provincial Analyst. Water found in the porous sand beds flooring the ravines and valley bottoms is also moderately soft and not highly charged with sulphate salts. The danger of pollution is also great in the case of shallow wells sunk into these deposits. Marked variations occur in the character of the glacial drift, many within small areas, and corresponding variations occur in the concentration of dissolved mineral salts present in the waters derived from these deposits. In general, porous beds or pockets of sands and gravels occurring at shallow depths in both the moraine and the till yield water that may be hard, but the dissolved sulphate or other mineral content is not excessive. Wells that have tapped those pockets within 25 to 35 feet from the surface form a satisfactory source of water for domestic needs. The boulder clay, which composes the greater part of the glacial drift, is considered to be the source of the greater part of the mineral salts found in waters from the glacial drift. Hence, wells sunk entirely in boulder clay in general yield a water much more highly charged with sodium sulphate, magnesium sulphate, and possibly calcium sulphate, than waters from the more porous beds. The laxative effect of sodium sulphate and magnesium sulphate in

solution, if the total sulphate content exceeds 1,000 parts per million, may render the water unfit for domestic use and may create scour in stock. Water derived from the drift, where it is underlain by the Cypress Hills formation, is in most places less highly mineralized than that from the drift overlying the shales of the Bearpaw. In this municipality no waters were reported to be too highly mineralized for stock use, although several are considered unsuitable for the household drinking supply.

Water from the Bedrock

Water obtained from the Cypress Hills formation is usually of excellent quality for all farm requirements. Analyses Nos. 3 to 8, inclusive, in the table of water analyses, are of water samples taken from these deposits. Although these samples were taken from widely scattered wells having considerable variations in depth, a close similarity is noted not only in the hardness but in the type and relative quantities of the mineral salts present in the waters. Probably the most notable feature of this group of analyses is the low concentration of total dissolved solids, the highest being 460 parts per million. The total hardness ranges from 150 to 360 parts per million. These waters are much softer than waters from the glacial drift. The hardness is largely permanent and hence is not greatly reduced by boiling the water. Of the mineral salts present in solution sodium sulphate Na_2SO_4 and magnesium carbonate (MgCO_3) are present in the greatest amounts. But as in none of the analyses made did either of these salts exceed 200 parts per million they cause no ill effects or disagreeable taste. Water from the Bearpaw formation is generally more highly mineralized than that from the Cypress Hills formation. Large amounts of soluble salts are present inherently in the dark-coloured marine shales and additional quantities are undoubtedly leached out of the overlying drift by the downward percolating waters. These waters more closely resemble those from the boulder clay of the drift in that the sulphate

salts are predominant and the total solid content may be very large. Seepages derived from the compact shales may be excessively hard and so highly mineralized as to be unfit for any farm use. The first analysis listed on the accompanying table is of water from a 20-foot well deriving its supply by seepage from the shale. This water is extremely hard (over 3,000 parts per million) and the sodium sulphate and magnesium sulphates are present respectively in 2,466 and 1,889 parts per million, rendering the water strongly laxative in action and unsuitable even for watering stock, although it is being used as a better supply is not available. Sand beds encountered in the shales yield water less highly mineralized. The second analysis on the table is of water from a 43-foot well that penetrated sand. The sulphate salts of sodium, calcium, and magnesium are present as the dominant constituents of the total solids. This water would have an appreciably bitter taste due to the sulphate salts, but is not too highly mineralized to be used for drinking.

Although no wells have penetrated the potential soft water horizon in the Bearpaw formation in the southwest corner of this municipality, an analysis is available indicating the character of water found at this horizon in the municipality to the south. The water is from a 258-foot well sunk on the NE. $\frac{1}{4}$, sec. 33, tp. 9, range 15. It is very soft, the total hardness being only 30 parts per million. The total solids, however, amount to 1,048 parts per million, made up of 621 parts of Na_2CO_3 , (black alkali), 219 parts of Na_2SO_4 , 170 parts of NaCl (common salt), and minor amounts of MgCO_3 and CaCO_3 . This water may have a flat, salty taste due to the presence of Na_2CO_3 and NaCl , but is being used for domestic purposes as well as for stock. The high content of "black alkali" would, however, make this water quite unsuitable for irrigating gardens.

WELL RECORDS—Rural Municipality of

LAC FELLETTIER, NO. 107, 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				
1	NE.	5	10	13	3	Dug	44	2,550	- 32	2,518	32	2,518	Bearpaw	Hard, clear, "alkaline"		D, S	Sufficient for 50 head stock.
2	SW.	5	"	"	"	Dug	16	2,556	- 13	2,543	13	2,543	Glacial sandy clay	Hard, "alkaline"		S	Sufficient for 10 head stock; also a spring on farm.
3	SE.	6	"	"	"	Bored	30	2,540	- 25	2,515	25	2,515	Glacial grey clay	Hard, clear, "alkaline"		S	Sufficient for 45 head stock.
4	NE.	7	"	"	"	Dug	20	2,580	- 17	2,563	17	2,563	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock; another similar well.
5	NW.	9	"	"	"	Spring		2,500	0	2,500	0	2,500	Glacial gravel	Soft, clear		D, S	Sufficient for 100 head stock.
6	NE.	14	"	"	"	Dug	13	2,595	- 9	2,586	9	2,586	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
7	SE.	15	"	"	"	Dug	3	2,520	0	2,520	0	2,520	Recent gravel	Hard, clear, "alkaline"		D, S	Oversufficient for local needs.
8	SE.	17	"	"	"	Spring		2,530	0	2,530	0	2,530	Glacial gravel	Hard, clear		D, S	Sufficient for 15 head stock; also other similar springs.
9	NW.	20	"	"	"	Dug	23	2,550	- 21	2,529	21	2,529	Bearpaw	Hard, clear, "alkaline"		D, S	Insufficient; enough for 4 head stock; stock watered at creek.
10	NE.	21	"	"	"	Dug	30	2,665	- 27	2,638	27	2,638	Bearpaw shale	Hard, clear, "alkaline"		D	Insufficient; a small dam for 15 head stock.
11	SW.	23	"	"	"	Dug	10	2,592	- 5	2,587			Glacial sand and clay	Hard, clear, "alkaline"		S	Insufficient for local needs; a 16-foot well in house for domestic use.
12	NW.	23	"	"	"	Dug	25	2,560	- 22	2,538	22	2,538	Glacial drift	Hard, "alkaline"		D, S	Sufficient for local needs.
13	SE.	26	"	"	"	Dug	15	2,600					Bearpaw at base				Dry hole; Bearpaw clay at base; also a 25-foot seepage well.
14	SW.	27	"	"	"	Dug	20	2,603	- 18	2,585	18	2,585	Bearpaw shale	Hard, cloudy, "alkaline"		S	Insufficient for 25 head stock; #.
15	SE.	28	"	"	"	Dug	22	2,640	- 16	2,624	16	2,624	Bearpaw shale(?)	Hard, clear, "alkaline"		S	Sufficient for 12 head stock; 3 other similar wells.
16	NW.	28	"	"	"	Dug		2,680					Glacial gravel				Small supply.
17	SW.	30	"	"	"	Dug	40	2,655	- 20	2,635			Bearpaw	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock.
18	NE.	35	"	"	"	Dug	30	2,680	- 28	2,652	28	2,652	Bearpaw blue shale	Hard, clear, "alkaline", bitter		S	Insufficient for local needs.
19	NW.	36	"	"	"	Dug	32	2,674	- 28	2,646	28	2,646	Bearpaw	Hard, clear, "alkaline", salty		S	Insufficient for 4 to 8 head stock.
1	SW.	1	10	14	3	Bored	31	2,640	- 26	2,614			Bearpaw	Hard, clear, iron		D, S	Sufficient for 45 head stock.
2	SE.	4	"	"	"	Dug	16	2,690	- 11	2,679	11	2,679	Glacial sand	Hard, clear		D, S	Sufficient for 30 head stock; another well 65 foot deep.
3	NW.	5	"	"	"	Dug	20	2,630	- 10	2,620			Bearpaw	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock.
4		8	"	"	"	Spring		2,650	0	2,650	0	2,650	Glacial drift				
5	SW.	9	"	"	"	Dug	50	2,665					Bearpaw	Hard, clear, "alkaline", iron		S	Sufficient for 16 head stock.
6	NW.	9	"	"	"	Bored	90	2,620	- 22	2,598			Bearpaw	Soft, clear, "alkaline"		D, S	Sufficient for local needs.

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

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

WELL RECORDS—Rural Municipality of LAC PELLETIER, NO. 107, 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.	18	10	14	3	Bored	53	2,655	- 23	2,632			Bearpaw	Hard, clear, "alkaline"		D, S	Sufficient for 100 head stock.
8	NE.	25	"	"	"	Bored	72	2,740	- 52	2,688	52	2,686	Bearpaw	Hard, clear, "alkaline"		D, S	
9	SE.	27	"	"	"	Dug	25	2,580					Glacial gravel	Hard, clear, "alkaline"		S	Insufficient for local needs.
10	NW.	31	"	"	"	Dug	30	2,820					Cypress Hills sand and clay	Hard, clear, "alkaline"		D, S	Sufficient for 10 head stock.
11	SW.	32	"	"	"	Bored	80	2,850	- 71	2,779			Cypress Hills conglomerate	Hard, clear		D, S	Sufficient for 18 head stock.
12	SE.	35	"	"	"	Dug	50	2,840	- 41	2,799			Cypress Hills sand	Soft, clear		D	A spring is used for stock.
1	SE.	1	10	15	3	Bored	43	2,820	- 37	2,783			Bearpaw clay and sand	Hard, clear, "alkaline"		D, S	Insufficient for 25 head stock.
2	SE.	2	"	"	"	Bored	54	2,802	- 20	2,782			Bearpaw shale	Hard, clear, "alkaline", iron		D, S	Sufficient for 25 head stock.
3		3	"	"	"	Spring		2,850	0	2,850	0	2,850	Glacial drift				
4	SW.	4	"	"	"	Bored	52	2,750	- 22	2,728			Bearpaw	Hard, clear, "alkaline"		S	Sufficient for 17 head stock.
5	NE.	4	"	"	"	Dug	29	2,840	- 25	2,815			Bearpaw	Hard, clear, "alkaline"		S	Insufficient for 10 head stock.
6	SE.	5	"	"	"	Dug	45	2,750	- 6	2,744			Bearpaw	Hard		D, S	Sufficient for local needs.
7	NE.	7	"	"	"	Bored	40	2,850	- 30	2,820			Bearpaw shale	Hard, clear, "alkaline"	45	D, S	Sufficient for 8 head stock; also a spring in pasture.
8	SW.	10	"	"	"	Dug	16	2,875	- 10	2,865			Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for 12 head stock.
9		10	"	"	"	Spring		2,900	0	2,900	0	2,900	Glacial drift				
10		11	"	"	"	Spring		2,850	0	2,850	0	2,850	Glacial drift				
11		15	"	"	"	Spring		2,950	0	2,950	0	2,950	Glacial drift				
12	SE.	16	"	"	"	Dug	97	2,987	- 95	2,892			Cypress Hills sand	Hard, clear, iron		D, S	Sufficient for 17 head stock.
13	SW.	16	"	"	"	Dug	73	2,950	- 70	2,880			Cypress Hills sand	Hard, clear		D, S	Sufficient for 50 head stock; also a spring in a coulée.
14	NE.	17	"	"	"	Dug	123	3,000	-107	2,893			Cypress Hills gravel	Hard, clear	45	D, S	Sufficient for 50 head stock.
15	SE.	19	"	"	"	Dug	110	3,002	-100	2,902			Cypress Hills sand	Soft, clear		D, S	Sufficient for local needs.
16	SW.	21	"	"	"	Dug	70	3,000	- 60	2,940			Cypress Hills sand	Hard, clear	45	D, S	Sufficient for local needs.
17	NE.	21	"	"	"	Bored	112	3,000	-110	2,890			Cypress Hills sand	Hard, clear, iron		D, S	Sufficient for 15 head stock.
18	NW.	22	"	"	"	Dug	112	3,000	-110	2,890			Cypress Hills sand	Hard, clear, iron	45	D, S	Sufficient for 40 head stock.
19	NE.	22	"	"	"	Bored	124	3,000	-122	2,878			Cypress Hills sand	Hard, clear, iron		N	Sufficient for local needs.
20	SW.	28	"	"	"	Drilled	180	3,008	-100	2,908			Cypress Hills sand	Soft, clear		D, S	Oversufficient for 20 head stock.
21	NE.	28	"	"	"	Drilled	156	3,000	-116	2,884			Cypress Hills sand	Soft, clear	45	D, S	Sufficient for 80 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 LAC PELLETIER, NO. 107, 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				
22	SW.	30	10	15	3	Dug	80	2,980	- 75	2,905			Cypress Hills sand	Soft, clear	45	D, S	Oversufficient for 20 head stock; #.
23	SE.	31	"	"	"	Dug	70	3,000	- 65	2,935			Cypress Hills sand	Hard, clear	45	D, S	Sufficient for local needs.
24	NE.	33	"	"	"	Dug	17	2,980	- 15	2,965			Glacial sand	Hard, clear		D, S	Sufficient for 10 head stock.
25	NW.	35	"	"	"	Spring		2,880	0	2,880			Cypress Hills sand	Hard, clear	45	D, S	Sufficient for 12 head stock.
26	SE.	36	"	"	"	Dug	56	2,850	- 54	2,796			Cypress Hills sand	Hard, clear		D, S	Insufficient; also a number of springs on farm.
1	NW.	1	11	13	3	Dug	16	2,700					Glacial drift	Hard, clear		D, S	Sufficient for local needs.
2	NE.	2	"	"	"	Dug	25	2,713	- 18	2,695	18	2,695	Glacial gravel and clay	Hard, clear		S	Sufficient for 30 head stock; another well 16 feet deep.
3	NW.	2	"	"	"	Dug	21	2,842	- 19	2,823			Cypress Hills sand	Hard, clear		D, S	Insufficient; also has a dam and reservoir.
4	SW.	5	"	"	"	Dug	55	2,880	- 46	2,834			Cypress Hills sand	Soft, clear		D, S	Sufficient for 30 head stock.
5	NW.	6	"	"	"	Drilled	110	2,920	-102	2,818			Cypress Hills sand	Hard, clear		D, S	Sufficient for 30 head stock.
6	NW.	7	"	"	"	Dug	35	2,860	- 32	2,828			Cypress Hills sand	Hard, clear		D, S	Sufficient for 20 head stock.
7	NW.	12	"	"	"	Spring		2,800					Cypress Hills	Hard, clear		D, S	Abundant supply.
8	NW.	13	"	"	"	Dug	82	2,896					Cypress Hills sand	Soft		D, S	Sufficient for local needs; #.
9	SW.	14	"	"	"	Bored	74	2,890	- 71	2,819	71	2,819	Cypress Hills sand	Soft, clear		D	Insufficient; also another 22-foot well.
10	NE.	14	"	"	"	Spring		2,850					Glacial drift				
11	NE.	15	"	"	"	Drilled	220	2,916	- 70	2,846	70	2,846	Cypress Hills sand	Hard, clear		D, S	Insufficient ; enough for only 6 head stock; also an 80-foot dry hole.
12	NW.	15	"	"	"	Dug	80	2,892	- 78	2,814	78	2,814	Cypress Hills sand	Hard, clear		D, S	Sufficient for 6 horses.
13	SW.	17	"	"	"	Dug	42	2,875	- 38	2,837			Cypress Hills gravel	Soft, clear		D, S	Sufficient for 15 head stock.
14	NE.	17	"	"	"	Spring		2,800					Cypress Hills(?)				
15	SE.	18	"	"	"	Dug	35	2,875	- 33	2,842			Cypress Hills sand	Hard, clear		D, S	Sufficient for 11 head stock.
16	SE.	19	"	"	"	Dug	60	2,897	- 57	2,840			Cypress Hills sand	Soft, clear		D, S	Sufficient for 25 head stock.
17	SW.	20	"	"	"	Dug	28	2,890	- 20	2,870			Cypress Hills sand	Hard, clear		D, S	Sufficient for 30 head stock; also a spring on farm.
18	SE.	20	"	"	"	Dug	14	2,800					Cypress Hills gravel	Hard		D, S	Good supply.
19	SW.	21	"	"	"	Dug	10	2,850	- 6	2,844			Cypress Hills sand	Hard		D, S	Good supply.
20	NW.	21	"	"	"	Dug	22	2,900	- 17	2,883			Cypress Hills sand	Hard, clear		D, S	Insufficient for local needs.
21	SE.	21	"	"	"	Dug	80	2,895	- 77	2,818			Cypress Hills sand	Hard, clear		D, S	Sufficient for local needs; also another well 10 feet deep.

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 LAC PELLERIN, NO. 107, 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				
22	SW.	24	11	13	3	Dug	30	2,845	- 28	2,817			Cypress Hills sand	Hard, clear	D, S	Intermittent supply,	
23	SE.	25	"	"	"	Drilled	75	2,840	- 60	2,780	75	2,765	Cypress Hills sand	Soft, clear	D, S	Sufficient for local needs.	
24	SE.	23	"	"	"	Dug	13	2,906	- 15	2,891	15	2,891	Cypress Hills sand	Hard, clear	D, S	Sufficient for 30 head stock.	
25	SE.	30	"	"	"	Dug	40	2,895					Cypress Hills sand	Hard, clear	D, S	Sufficient for 16 head stock; also another similar well.	
26	SW.	31	"	"	"	Drilled	122	2,920	-100	2,820			Cypress Hills sand	Soft, clear	D, S	Sufficient for 50 head stock; #.	
27	SE.	32	"	"	"	Dug	14	2,930	- 12	2,918			Cypress Hills sand	Hard, clear	D, S	Sufficient for 25 head stock; also 2 dry holes 120 and 30 feet deep.	
28	NW.	33	"	"	"	Drilled	93	2,878			93	2,785	Cypress Hills sand	Hard, clear	D, S	Oversufficient for local needs.	
29	SE.	33	"	"	"	Dug	98	2,887	- 96	2,791	96	2,791	Cypress Hills sand	Soft, clear	D, S	Sufficient for 30 head stock.	
30	SE.	34	"	"	"	Bored	100	2,868	- 96	2,772			Cypress Hills sand	Hard, clear	D, S	Oversufficient for 20 head stock; also another well 110 feet deep in the house.	
31	NE.	36	"	"	"	Dug	14	2,792	- 12	2,780	12	2,780	Cypress Hills sand	Hard, clear	D, S	Sufficient for local needs; also another similar well.	
1	SE.	1	11	14	3	Drilled	185	2,950	-100	2,850	100	2,850	Cypress Hills sand and gravel	Soft, clear	D, S	Sufficient for 35 head stock.	
2	SE.	2	"	"	"	Drilled	220	2,950	-155	2,795			Cypress Hills gravel	Soft, clear	D, S	Sufficient for 100 head stock; also springs on farm.	
3	SE.	6	"	"	"	Dug	53	2,870	- 50	2,820			Cypress Hills clay	Soft, clear	D, S	Sufficient for 20 head stock.	
4	SE.	12	"	"	"	Dug	55	2,900	- 53	2,847			Cypress Hills gravel and sand	Hard, clear	D, S	Sufficient for 40 head stock.	
5	NE.	13	"	"	"	Dug	35	2,890	- 29	2,861			Cypress Hills gravel	Hard, clear	D, S	Sufficient for 10 head stock.	
6	NW.	15	"	"	"	Dug	12	2,900								Dry hole; glacial clay to base.	
7	NW.	16	"	"	"	Dug	45	2,930	- 41	2,889	41	2,889	Cypress Hills gravel	Hard, clear	D, S	Oversufficient for 50 head stock.	
8	SE.	17	"	"	"	Dug	125	2,950	-122	2,828			Cypress Hills sand	Soft, clear	D, S	Sufficient for 15 head stock.	
9	NE.	17	"	"	"	Dug	25	2,965	- 13	2,952			Cypress Hills sand	Hard, clear	D, S	Sufficient for 15 head stock.	
10	NW.	20	"	"	"	Dug	52	2,980	- 49	2,931			Cypress Hills sand	Hard, clear	D, S	Sufficient for local needs.	
11	SE.	23	"	"	"	Dug	75	2,920	- 72	2,848			Cypress Hills sand	Soft, clear	S	Sufficient for 10 head stock; also another well 75 feet deep.	
12	NE.	25	"	"	"	Drilled	135	2,920	-109	2,811	109	2,811	Cypress Hills sand	Soft, clear	D, S	Sufficient for 9 head stock; also a 100-foot well which is not used.	
13	SW.	25	"	"	"	Dug	34	2,950	- 31	2,919			Cypress Hills sand	Hard, clear	D, S	Sufficient for 8 head stock.	
14	SE.	28	"	"	"	Drilled	35	2,950	- 73	2,877			Cypress Hills sand	Hard, clear	D, S	Sufficient for local needs.	
15		30	"	"	"	Spring							Cypress Hills				
16	SE.	32	"	"	"	Drilled	50	2,960	- 35	2,925			Cypress Hills white clay	Soft, clear	D, S	Sufficient for 20 head stock; another similar well.	

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.

5

WELL RECORDS—Rural Municipality of LAC PELLETIER, NO. 107, 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				
17	SW.	34	11	14	3	Drilled	175	2,936	-165	2,771			Cypress Hills sand	Hard, clear		D, S	Sufficient for 30 head stock; also a similar well and a spring.
18	NW.	36	"	"	"	Drilled	130	2,930					Cypress Hills	Hard, clear		D, S	Sufficient for 15 head stock.
19	NE.	36	"	"	"	Dug	30	2,930	- 21	2,909			Cypress Hills sand	Hard, clear		D, S	Sufficient for 13 head stock.
1	NE.	1	11	15	3	Dug	33	2,910					Cypress Hills clay	Soft, clear		D, S	Sufficient for 12 head stock.
2	NW.	3	"	"	"	Dug	110	3,000	-106	2,894	106	2,894	Cypress Hills sand	Hard, clear		D, S	Sufficient for 30 head stock.
3	SW.	5	"	"	"	Drilled	162	3,040	-106	2,934	162	2,878	Cypress Hills sand	Hard			Four gallons a minute.
4	NE.	6	"	"	"	Dug	67	2,980	- 64	2,916	64	2,916	Cypress Hills sand	Hard, clear		D, S	Sufficient for 18 head stock.
5	SW.	9	"	"	"	Dug	116	3,025	-106	2,919	106	2,919	Cypress Hills sand	Soft, clear		D, S	Sufficient for 20 head stock.
6	ST.	11	"	"	"	Dug	40	3,000	- 36	2,964	36	2,964	Cypress Hills sand	Soft, clear	45	D, S	Oversufficient for 20 head stock.
7		12	"	"	"	Spring							Cypress Hills				
8	SW.	13	"	"	"	Dug	70	3,000	- 68	2,932	68	2,932	Cypress Hills sand	Soft, clear		D, S	Sufficient for 15 head stock; also a spring on farm.
9	NW.	13	"	"	"	Spring							Cypress Hills sand				There are 4 springs; large supply.
10	NE.	14	"	"	"	Drilled	190	3,045					Cypress Hills sand	Soft, clear	45	D, S	Insufficient for 25 head stock.
11	SE.	17	"	"	"	Dug	33	3,034	- 28	3,006	28	3,006	Glacial drift	Hard, clear		D, S	Sufficient for 30 head stock.
12	NE.	18	"	"	"	Dug	114	3,025	-112	2,913	112	2,913	Cypress Hills sand	Hard, clear		D, S	Oversufficient for local needs; #.
13	SW.	19	"	"	"	Dug	100	2,995	- 98	2,897			Cypress Hills sand	Hard, clear		D, S	Insufficient for local needs.
14	NW.	20	"	"	"	Drilled	290	3,080	-270	2,810			Cypress Hills sand	Soft, clear		D, S	Sufficient; never pumped dry.
15	SE.	20	"	"	"	Drilled	293	3,100	-265	2,835			Cypress Hills sand	Soft, clear		D, S	Sufficient; never pumped dry.
16	NE.	31	"	"	"	Dug	22	2,925	- 8	2,917			Glacial sand	Soft, clear		D, S	Intermittent supply.
17	NE.	35	"	"	"	Dug	34	2,890	- 22	2,868			Glacial clay	Hard, clear		D, S	Insufficient for 2 head stock.
1	NW.	1	12	13	3	Bored	75	2,844					Cypress Hills sand	Hard, clear, "alkaline"		D, S	Sufficient for 75 head stock.
2	NW.	6	"	"	"	Drilled	140	2,944					Cypress Hills sand	Soft, clear		D, S	Sufficient for 10 head stock.
3	SE.	10	"	"	"	Drilled	96	2,890	- 78	2,812			Cypress Hills sand	Hard, clear		D, S	Sufficient for 10 head stock.
4	NE.	12	"	"	"	Dug	49	2,840					Cypress Hills sand	Soft, clear		D, S	Sufficient for 15 head stock.
5	SW.	13	"	"	"	Dug	25	2,855	- 21	2,834	21	2,834	Cypress Hills sand	Soft, clear		D, S	Sufficient for 10 head stock.
6	SE.	14	"	"	"	Dug	28	2,856	- 26	2,830	26	2,830	Cypress Hills	Hard, clear		D	Insufficient; another well 20 feet deep.
7	SW.	17	"	"	"	Drilled	126	2,970	-106	2,864			Cypress Hills sand	Soft, clear		D, S	Sufficient for 30 head stock; several similar wells; #.

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 LAC PELLETIER, NO. 107, 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				
8	NE.	22	12	13	3	Dug	35	2,944	- 32	2,912	32	2,912	Cypress Hills sand	Soft, clear	D, S	Sufficient for 10 head stock.	
9	SW.	24	"	"	"	Dug	58	2,930	- 56	2,874	56	2,874	Cypress Hills sand	Soft, clear	D, S	Sufficient for 20 head stock.	
10	NW.	27	"	"	"	Bored	54	2,965	- 49	2,916	50	2,915	Cypress Hills sand and gravel	Hard, clear	D, S	Sufficient for 10 head stock; several similar wells.	
11	NE.	27	"	"	"	Spring		2,950	0	2,950	0	2,950	Glacial drift		S		
12	NE.	30	"	"	"	Spring		2,950	0	2,950	0	2,950	Cypress Hills				
13	SW.	31	"	"	"	Dug	15	2,935	- 7	2,928	15	2,920	Cypress Hills sand and gravel	Soft, clear	D, S	Sufficient for 50 head stock.	
14	SW.	32	"	"	"	Drilled	150	2,936	-108	2,828	150	2,776	Cypress Hills sand	Soft, clear	D, S, I	Sufficient for 25 head stock.	
15	NW.	36	"	"	"	Dug	12	2,944	- 9	2,935	9	2,935	Glacial gravel	Soft, clear	D, S	Sufficient for 20 head stock; another well 15 feet deep.	
1	NE.	2	12	14	3	Dug	18	2,952	- 15	2,937	15	2,937	Glacial clay	Hard, clear	D, S	Sufficient for 12 head stock.	
2	SW.	2	"	"	"	Dug	18	2,978	- 10	2,968	16	2,962	Cypress Hills sand	Soft, clear	D, S	Sufficient for local needs; also an 84-foot dry hole.	
3	SE.	3	"	"	"	Dug	35	2,990					Cypress Hills sand	Soft, clear	D, S	Sufficient for 10 head stock.	
4	SE.	4	"	"	"	Dug	28	2,970	- 23	2,947	23	2,947	Cypress Hills sand	Hard, clear	D, S	Sufficient for 12 head stock; also a small spring for stock.	
5	NE.	4	"	"	"	Drilled	180	2,960	-150	2,810	180	2,780	Cypress Hills sand	Soft, clear	D, S	Oversufficient for 20 head stock.	
6	SW.	5	"	"	"	Drilled	180	2,905	-140	2,765			Cypress Hills sand	Soft, clear	D, S	Sufficient for 30 head stock.	
7	NE.	9	"	"	"	Drilled	185	2,950	-173	2,777			Cypress Hills sand	Soft, clear	D, S	Sufficient for 20 head stock.	
8	NE.	17	"	"	"	Drilled	200	2,942					Cypress Hills sand	Hard, clear	D, S	Sufficient; never has been pumped dry.	
9	SE.	18	"	"	"	Drilled	225	2,938	-217	2,721	225	2,713	Cypress Hills sand	Hard, clear	D, S	Oversufficient for 30 head stock.	
10	NW.	21	"	"	"	Drilled	206	2,945	-184	2,761			Cypress Hills sand	Soft, clear	D, S	Sufficient for 30 head stock.	
11	NW.	22	"	"	"	Dug	80	2,990	- 75	2,915			Cypress Hills sand	Soft, clear	D, S	Sufficient for 10 head stock; also another well 50 feet deep.	
12	SE.	22	"	"	"	Dug	20	2,970	- 18	2,952	18	2,952	Cypress Hills sand	Soft, clear	D, S	Insufficient; enough for 7 head stock; a similar well caved in.	
13	NE.	25	"	"	"	Dug	30	2,966	- 24	2,942	30	2,936	Cypress Hills sand and gravel	Soft, clear	D, S	Sufficient for 30 head stock; also another similar well.	
14	NW.	26	"	"	"	Dug	29	2,990	- 25	2,965	25	2,965	Cypress Hills sand	Hard, clear	D, S	Sufficient for 30 head stock; another similar well.	
15	NE.	30	"	"	"	Drilled	246	2,900	-176	2,724	216	2,684	Cypress Hills sand	Soft, clear	D, S	Oversufficient for 100 head stock.	
16	SE.	33	"	"	"	Dug	20	2,930	- 16	2,904	16	2,914	Cypress Hills gravel	Soft, clear	D, S	Insufficient; enough for 10 head stock; also another seepage well.	
17	SW.	34	"	"	"	Dug	32	2,950					Cypress Hills sand	Soft, clear	D, S	Insufficient; 2 wells supply 10 head stock.	
18	SE.	35	"	"	"	Dug	31	2,974	- 23	2,951	23	2,951	Cypress Hills sand and gravel	Hard, clear	D, S	Sufficient for 6 head stock; another similar well.	

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of LAC PELLETIER, NO. 107, 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	SE.	36	12	14	3	Dug	15	2,954	- 14	2,940	14	2,940	Cypress Hills sand	Soft, clear	D, S	Sufficient for 7 head stock.	
1	NE.	1	12	15	3	Spring		2,720	0	2,720	0	2,720	Cypress Hills sand	Soft, clear	D	Numerous springs in this vicinity.	
2	NW.	2	"	"	"	Dug	38	2,844	- 32	2,812	32	2,812	Glacial sand	Soft, clear	D, S	Sufficient for 20 head stock.	
3	SW.	4	"	"	"	Dug	65	2,840	- 60	2,780	65	2,775	Cypress Hills sand	Hard, clear	D, S	Sufficient for 45 head stock.	
4	NE.	6	"	"	"	Dug	15	2,835	- 11	2,824			Glacial gravel	Hard, clear	D, S	Sufficient for 11 head stock.	
5	SW.	6	"	"	"	Dug	8	2,905	- 7	2,898			Glacial sand	Soft, clear	D	Insufficient; also a dry hole 35 feet deep.	
6	NE.	10	"	"	"	Drilled	140	2,854	-128	2,726	128	2,726	Cypress Hills sand	Hard, clear	D, S	Sufficient for 50 head stock.	
7	NE.	13	"	"	"	Drilled	201	2,878	-183	2,695	201	2,677	Cypress Hills sand	Hard, clear	D, S	Oversufficient for 30 head stock; #.	
8	SW.	16	"	"	"	Drilled	180	2,854	-162	2,692	180	2,674	Cypress Hills sand	Hard, clear, iron	D, S	Oversufficient for 40 head stock.	
9	SW.	18	"	"	"	Dug	20	2,755	- 10	2,745	10	2,745	Glacial sand and gravel	Hard, "alkaline"	D	Sufficient; also a spring and a 70-foot dry hole.	
10	NW.	19	"	"	"	Dug	50	2,720	- 48	2,672	48	2,672	Cypress Hills sand	Hard, clear, iron	D, S	Sufficient only for 8 head stock.	
11	SE.	19	"	"	"	Dug	65	2,755	- 63	2,692	63	2,692	Cypress Hills sand	Hard, clear	D, S	Insufficient for local needs.	
12	NW.	21	"	"	"	Drilled	180	2,850	-169	2,681	180	2,670	Cypress Hills gravel	Hard, clear	D, S	Sufficient for 20 head stock; has never been pumped dry.	
13	NE.	21	"	"	"	Drilled	183	2,835	-147	2,688	183	2,652	Cypress Hills	Hard, clear	D, S	Sufficient for 50 head stock; has never been pumped dry.	
14	SW.	22	"	"	"	Drilled	175	2,840			175	2,665	Cypress Hills sand	Hard, clear	D, S	Oversufficient for local needs.	
15	NW.	24	"	"	"	Spring	4	2,678	0	2,678	3	2,675	Cypress Hills sand	Hard	D, S	Sufficient for local needs; numerous springs in neighbourhood.	
16	SE.	25	"	"	"	Spring							Cypress Hills			Abundant supply.	
17	NW.	27	"	"	"	Drilled	190	2,835			190	2,645	Cypress Hills sand	Hard, clear	D, S	Oversufficient for local needs.	
18	SW.	30	"	"	"	Dug	55	2,725	- 51	2,674	51	2,674	Cypress Hills sand	Hard, clear, iron	D, S	Sufficient for 10 head stock.	
19	NW.	33	"	"	"	Dug	65	2,810	- 60	2,750	60	2,750	Cypress Hills sand	Hard, clear	D, S	Sufficient for 40 head stock.	
20	SW.	34	"	"	"	Dug	74	2,840	- 62	2,778	62	2,778	Cypress Hills sand	Hard, clear, "alkaline"	D, S	Intermittent supply.	

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(#) Sample taken for analysis.