Leduc County

Part of the North Saskatchewan River Basin
Parts of Tp 047 to 051, R 21 to 28, W4M and R 01 to 04, W5M
Regional Groundwater Assessment

Prepared for

LEDUC COUNTY

In conjunction with

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada
Prairie Farm Rehabilitation Administration
Administration du rétablisseme agricole des Prairies

Canada

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The Association of Professional Engineers,
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1 PROJECT OVERVIEW

"Water is the lifeblood of the earth." - Anonymous

How a County takes care of one of its most precious resources - groundwater - reflects the future wealth and health of its people. Good environmental practices are not an accident. They must include genuine foresight with knowledgeable planning. Implementation of strong practices not only commits to a better quality of life for future generations, but also creates a solid base for increased economic activity. **This report, even though it is regional in nature, is the first step in fulfilling a commitment by Leduc County toward the management of the groundwater resource, which is a key component toward the well-being of the County, and is a guide for future groundwater-related projects.**

1.1 About This Report

This report provides an overview of (a) the groundwater resources of Leduc County, (b) the processes used for the present project and (c) the groundwater characteristics in the County.

Additional technical details are available from files on the CD-ROM to be provided with the final version of this report. The files include the geo-referenced electronic groundwater database, maps showing distribution of various hydrogeological parameters, the groundwater query, and ArcView files. Likewise, all of the illustrations and maps from the present report, plus additional maps, figures and cross-sections, are available on the CD-ROM. For convenience, poster-size maps and cross-sections have been prepared as a visual summary of the results presented in this report. Copies of these poster-size drawings have been forwarded with this report, and are included as page-size drawings in Appendix D.

Appendix A features page-size copies of the figures within the report plus additional maps and cross-sections. An index of the page-size maps and figures is given at the beginning of Appendix A.

Appendix B provides a complete list of maps and figures included on the CD-ROM.

Appendix C includes the following:

1) a procedure for conducting aquifer tests with water wells;
2) a table of contents for the Water Well Regulation under the Environmental Protection and Enhancement Act;
3) a flow chart showing the licensing of a groundwater diversion under the new Water Act; and
4) additional information.

The Water Well Regulation deals with the wellhead completion requirement (no more water-well pits), the proper procedure for abandoning unused water wells and the correct procedure for installing a pump in a water well. The new Water Act was proclaimed 10 Jan 1999.

Appendix E provides a list of water wells recommended for field verification.

1.2 The Project

It must be noted that the present project is a regional study and as such the results are to be used only as a guide. Detailed local studies are required to verify hydrogeological conditions at given locations.

The present project is made up of five parts as follows:

Module 1 - Data Collection and Synthesis
Module 2 - Hydrogeological Maps
Module 3 - Covering Report
Module 4 - Groundwater Query
Module 5 - Training Session

This report and the accompanying maps represent Modules 2 and 3.

1.3 Purpose

This project is a regional groundwater assessment of Leduc County. The regional groundwater assessment provides the information to assist in the management of the groundwater resource within the County. Groundwater resource management involves determining the suitability of various areas in the County for particular activities. These activities can vary from the development of groundwater for agricultural or industrial purposes, to the siting of waste storage. **Proper management ensures protection and utilization of the groundwater resource for the maximum benefit of the people of the County.**

The regional groundwater assessment includes:

- identification of the aquifers[1] within the surficial deposits[2] and the upper bedrock;
- spatial definition of the main aquifers;
- quantity and quality of the groundwater associated with each aquifer;
- hydraulic relationship between aquifers; and
- identification of the first sand and gravel deposits below ground level.

Under the present program, the groundwater-related data for the County have been assembled. Where practical, the data have been digitized. These data are then being used in the regional groundwater assessment for the County.

[1] See glossary
[2] See glossary

2 INTRODUCTION

2.1 Setting

Leduc County is situated in central Alberta. This area is part of the Alberta Plains region. The County is within the North Saskatchewan River basin; a part of the County's northern boundary is the North Saskatchewan River. The other County boundaries follow township or section lines. The area includes parts of the area bounded by township 051, range 04, W5M in the northwest and township 047, range 21, W4M in the southeast.

Regionally, the topographic surface varies between 640 and 940 metres above mean sea level (AMSL). The lowest elevations occur in the North Saskatchewan River Valley in the northern part of the County and the highest are in the southwestern part of the County as shown in Figure 1.

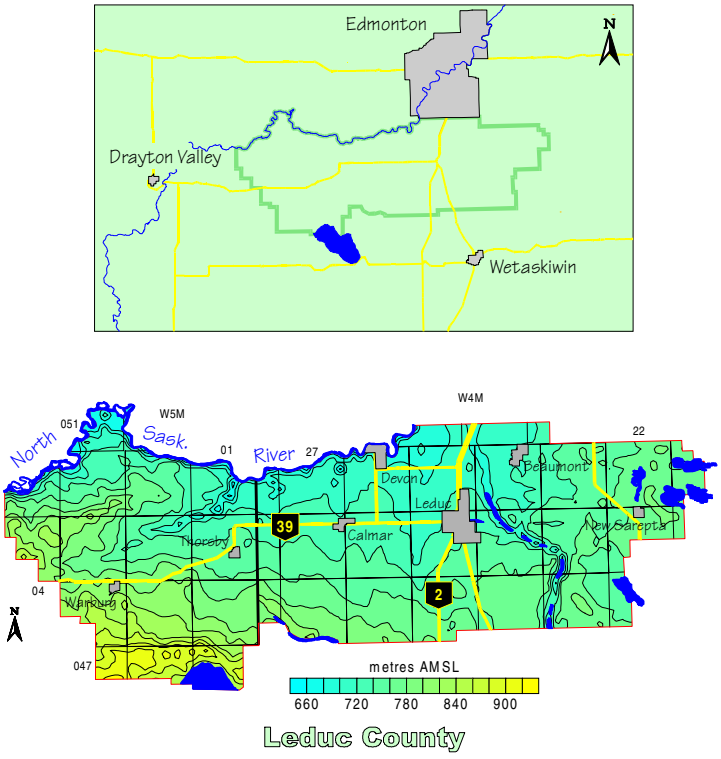

Figure 1. Index Map

2.2 Climate

Leduc County lies within the Dfb climate boundary. This classification is based on potential evapotranspiration values determined using the Thornthwaite method (Thornthwaite and Mather, 1957), combined with the distribution of natural ecoregions in the area. The ecoregions map (Strong and Legatt, 1981) shows that the County is located in both the Low Boreal Mixedwood region and the Aspen Parkland region. Increased precipitation and cooler temperatures, resulting in additional moisture availability influence this vegetation change.

A Dfb climate consists of long, cool summers and severe winters. The mean monthly temperature drops below –3 °C in the coolest month, and exceeds 10 °C in the warmest month.

The mean annual precipitation averaged from three meteorological stations within the County measured 473 millimetres (mm), based on data from 1938 to 1993. The mean annual temperature averaged 2.5 °C, with the mean monthly temperature reaching a high of 16.2 °C in July, and dropping to a low of -13.6 °C in January. The calculated annual potential evapotranspiration is 508 millimetres.

2.3 Background Information

There are currently records for 5,922 water wells in the groundwater database for the County. Of the 5,922 water wells, 5,362 are for domestic/stock purposes. The remaining 560 water wells were completed for a variety of uses, including industrial, investigation, observation and municipal. Based on a rural population of 12,361, there are two domestic/stock water wells per family of four. The domestic or stock water wells vary in depth from 0.91 metres to 209.1 metres below ground level. Lithologic details are available for 3,093 water wells.

Data for casing diameters are available for 2,322 water wells, with 2,193 indicated as having a diameter of less than 275 mm and 129 having a diameter of more than 450 mm. The casing diameters of greater than 450 mm are mainly bored or dug water wells and those with a surface casing diameter of less than 275 mm are drilled water wells. The majority of large-diameter water wells occur along a northwest-southeast-trending area from the northern to the southern border through the Village of Thorsby. These water wells are in an area where the upper bedrock is either the Battle or Whitemud formations or the Lower Scollard.

Steel, galvanized steel and plastic represent 99% of the materials that have been used for surface casing in drilled water wells over the last 40 years in the County. Steel and galvanized steel were the main casing types until the start of the 1990s, when plastic casing became the dominant type.

Galvanized steel surface casing was used in 3% of the new water wells in the early 1960s. By the early 1970s, galvanized steel casing was being used in 55% of the water wells. From 1975 onward, there was a general decrease in the percentage of water wells using galvanized steel, with the last reported use in October 1993.

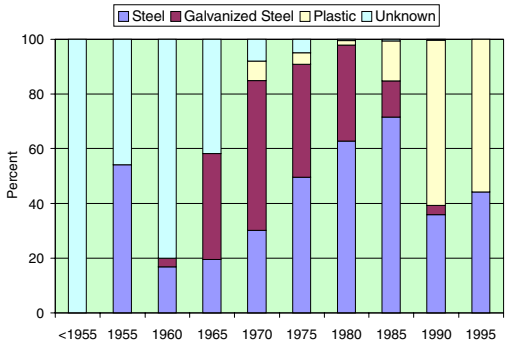

Figure 2. Surface Casing Types used in Drilled Water Wells

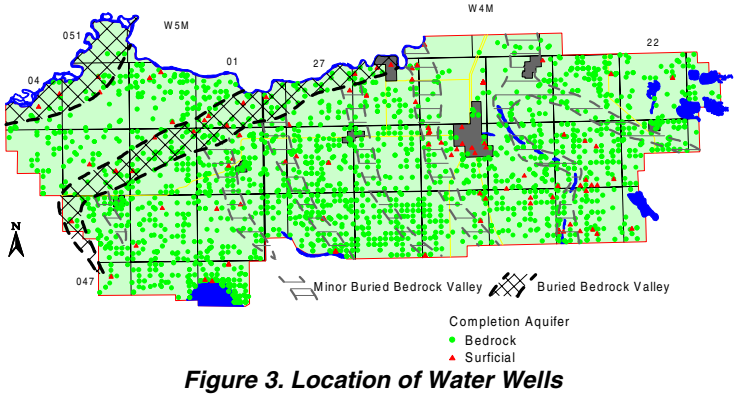

Figure 3. Location of Water Wells

There are 2,590 water well records with sufficient information to identify the aquifer in which the water wells are completed. The water wells that were not drilled deep enough to encounter the bedrock plus water wells that have the bottom of their completion interval above the bedrock surface are water wells completed in surficial aquifers. The number of water wells completed in aquifers in the surficial deposits is 126. The adjacent map shows that these water wells occur in most areas throughout the County. Approximately 80% of the water wells completed in surficial aquifers have a completion depth of less than 30 metres.