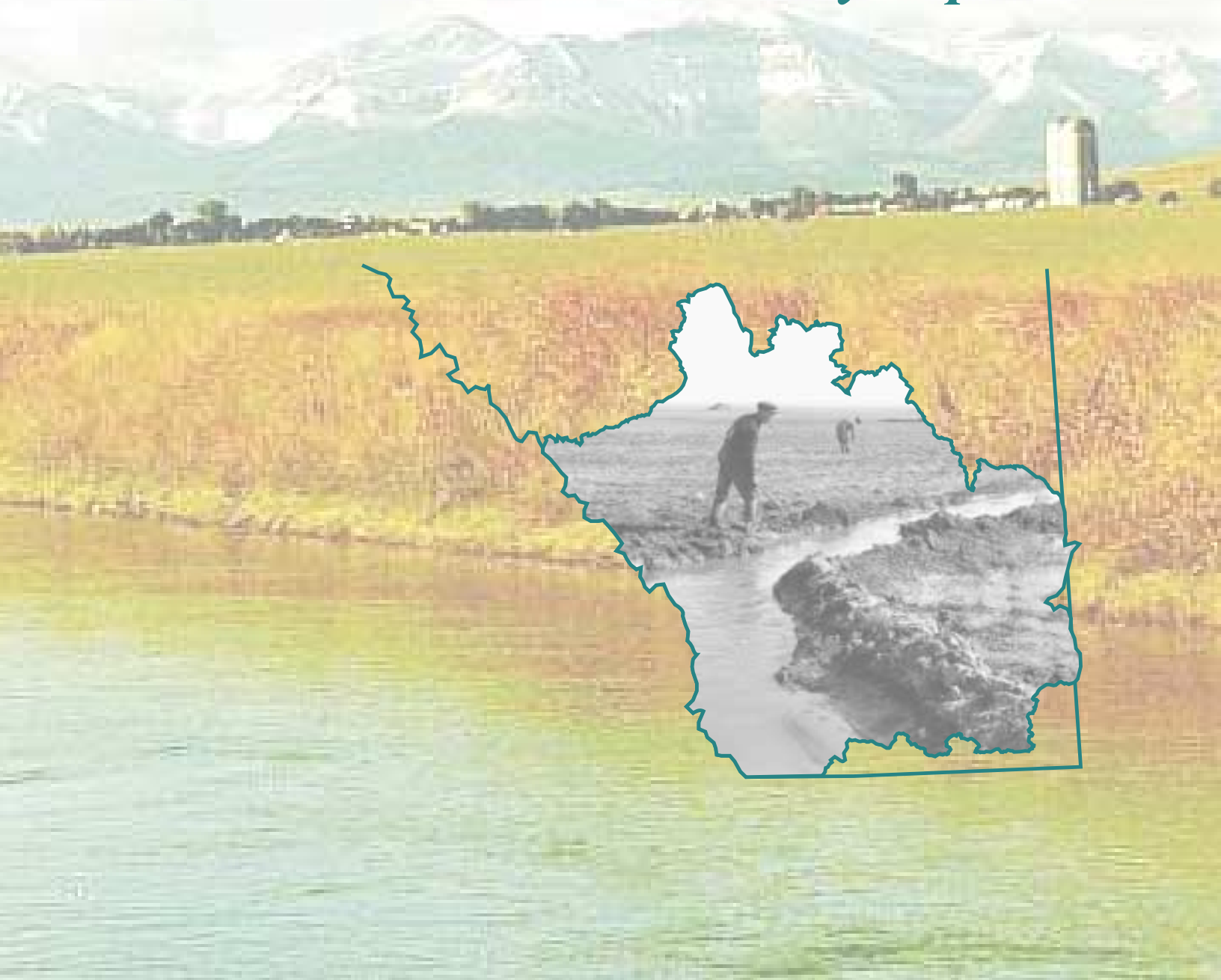


SOUTH SASKATCHEWAN RIVER BASIN

# IRRIGATION

*in the 21st Century*

*Volume 1:  
Summary Report*



# **SOUTH SASKATCHEWAN RIVER BASIN IRRIGATION IN THE 21ST CENTURY**

## **INDEX TO VOLUMES**

### **Volume 1: Summary Report**

### **Volume 2: On-Farm Irrigation Water Demand**

- I. Potential Evapotranspiration in Southern Alberta from Historical Weather Data
- II. Current Irrigation Management Practices, 1996 - 2000

### **Volume 3: Conveyance Water Management**

- I. Seepage Losses from Irrigation Canals in Southern Alberta
- II. Evaporation Losses from Irrigation Canals and Reservoirs in Southern Alberta
- III. Return Flow from Alberta's Irrigation Districts

### **Volume 4: Modelling Irrigation Water Management**

- I. Deriving Irrigation Water Demands Through the Irrigation District Model (IDM)
- II. Determining Water Supply Availability to Meet Irrigation Demands

### **Volume 5: Economic Opportunities and Impacts**

- I. Assessing the Farm Financial Risks and Impacts of Irrigation Water Supply Deficits
- II. The Economic Benefit of Growth in Alberta Irrigation Development

# **South Saskatchewan River Basin Irrigation in the 21st Century**

**Volume 1:  
Summary Report**

**Published on behalf of the Irrigation Water Management Study Steering Committee**  
by the Alberta Irrigation Projects Association, Lethbridge, Alberta.

**Copyright 2002**

Copies of this report are available from the

Alberta Irrigation Projects Association  
909, 400 - 4 Avenue South  
Lethbridge, Alberta T1J 4E1  
(403) 328-3068

and the

Irrigation Branch, Alberta Agriculture, Food and Rural Development  
Agriculture Centre  
100, 5401 - 1 Avenue South  
Lethbridge, Alberta T1J 4V6  
(403) 381-5140

**Citation:** Irrigation Water Management Study Committee. 2002. South Saskatchewan River Basin: Irrigation in the 21st Century. Volume 1: Summary Report. Alberta Irrigation Projects Association. Lethbridge, Alberta.

Reproduction of up to 100 copies by non-profit organizations, or photocopying of single copies, is permitted. Please acknowledge the Alberta Irrigation Projects Association. All other reproduction, including storage in electronic data retrieval systems, requires written permission from the Alberta Irrigation Projects Association.

Photographs on pages 10 and 11 are courtesy of The Galt Museum, Glenbow Archives, and Eastern Irrigation District. All other photographs are courtesy of Alberta Agriculture, Food and Rural Development.

## Acknowledgments

The databases and analytical tools contained in this report will be of value to the irrigation industry, water managers and the public. This summary report draws heavily on the technical reports contained in Volumes 2 to 5.

A large measure of the credit for this report goes to the staff of the Irrigation Districts and the Irrigation Branch of Alberta Agriculture, Food and Rural Development (AAFRD). Field staff persevered through bad weather, equipment failures and calibration challenges to gather the raw data that made this report possible. Other staff analyzed the mountain of collected data and ensured the results were accurate and understandable.

A share of the credit must also go to the many farm producers who willingly participated in the research and monitoring studies.

The report was written primarily by J. R. (Dick) Hart, Hart Water Management Consulting, Calgary, Alberta. Barbara Grinder, Viewpoints Communications, Hill Spring, Alberta, completed the final edit and formatted the report. The report was printed by Dial Printing Inc. in Edmonton, Alberta.

Irrigation demand modelling and data assimilation software were developed under contract by Phoenix Engineering Inc., Calgary, Alberta. Development of the economic risk and impact analysis software was carried out through the Economics Unit of AAFRD.

The report was reviewed by the Irrigation Water Management Study Steering Committee and board members and staff of the irrigation districts. Their collective input is much appreciated.



# Contents

Executive Summary .....	<i>xi</i>
Chapter I. Introduction	
A. Purpose and Rationale .....	3
B. Approach .....	4
C. About the Summary Report .....	5
Chapter II. Irrigation Development	
A. History of Irrigation in Southern Alberta .....	9
1. The Early Years: Pre-1920 .....	9
2. The Adjustment Years: 1920 to 1950 .....	13
3. Rehabilitation and Expansion of the Delivery Systems: 1950 to 1970 ..	16
4. Provincial and Irrigation District Control: 1970 to Present .....	17
B. South Saskatchewan River Basin Water Management Policy .....	20
C. Irrigation Expansion Guidelines .....	21
D. AENV's SSRB Water Management Planning Process .....	24
Chapter III. Scope and Methodology	
A. Objectives .....	27
B. Organizational Structure and Funding .....	28
C. Components of the Irrigation Water Management Study .....	30
1. On-farm Working Group .....	30
2. Distribution Working Group .....	34
3. Modelling Working Group .....	37
D. Simulation Modelling .....	40
E. Limitations of the Irrigation Water Management Study .....	42
1. Private Irrigation .....	42
2. Non-irrigation Uses in the South Saskatchewan River Basin .....	44
3. Non-irrigation Uses through the Works of the Irrigation Districts .....	44
4. Water Management Headworks Losses .....	45
5. Climate Variability .....	45
Chapter IV. Key Research Findings	
A. On-Farm Component .....	50
1. Agro-climatic Database .....	50
2. Crop Types and Water Requirements .....	51
3. On-farm Irrigation Systems and Application Efficiencies .....	61
4. Irrigation Management Practices .....	64
B. Irrigation District Distribution System .....	67
1. District Characteristics .....	68
2. Canal Seepage .....	72
3. Evaporation .....	74
4. Return Flow .....	77
C. Water Demand Summary Based on Key Findings .....	83
D. Conclusions .....	85
Chapter V. Simulation Modelling	
A. Introduction .....	89
B. Modelling Assumptions and Calibration .....	90
1. Irrigation District Model (IDM) .....	90
2. Water Resources Management Model (WRMM) .....	91
3. Farm Financial Impact and Risk Model (FFIRM) .....	92
C. The Scenarios .....	98
D. Conclusions .....	103





Chapter VI. Potential for Irrigation Expansion	
A. Analysis of IDM Irrigation Demand Data .....	107
1. Comparisons with 1991 <i>Regulation</i> Licence Volumes .....	108
2. Basin Specific Variations .....	109
3. District Specific Variations .....	110
4. Variation in Water Use Efficiencies .....	110
5. Impacts of Water Management on Gross Diversion Demand .....	111
B. Analysis of WRMM Water Deficit Data .....	112
C. Analysis of FFIRM Output on Impacts of Irrigation Deficits .....	114
D. Detailed Assessment of Selected Expansion Scenarios .....	116
E. Conclusions .....	134
Chapter VII. Benefits of Irrigation Development	
A. Introduction .....	139
B. 1999 Benefits of Irrigation Development .....	140
1. Primary Agricultural Production .....	140
2. Farm Supply Implications .....	141
3. Agri-processing Implications .....	141
4. Total Agricultural Impacts .....	142
5. Non-agricultural Benefits of Irrigation Infrastructure .....	142
C. Opportunities for the Future .....	143
1. Livestock .....	143
2. Agri-processing .....	144
3. Impacts of Intensification and Expansion of Irrigation .....	144
D. Conclusions .....	146
References .....	151
Appendix .....	155
List of Acronyms .....	175
Unit Conversion Chart	