

Groundwater Mapping and Management Tools

**WaterTech 2009
Banff, Alberta**

**Presented by Bob Chandler
Water Policy Branch**

Today's Presentation

- **Groundwater Program Drivers**
- **Alberta Environment Response**
- **Enhancing Groundwater Knowledge**
 - Groundwater Mapping Program
- **Groundwater Management - Policies and Tools**
- **Challenges and Opportunities Ahead**

Groundwater Program Drivers

- *Water for Life*
 - CBM/MAC Recommendations
- Rosenberg Forum on Water Policy – GW Review
 - Groundwater Risk Assessment for Alberta
- Alberta Water Council: 5-year review of W4L
 - *Water for Life* renewal

Messages

- **Water for Life (2003)**

- Understand the state of the quality and quantity of Alberta's groundwater supply

- **CBM/MAC (2006)**

- Improve scientific information on the province's water resources
 - AENV should complete its inventory of groundwater in the province
 - AENV should expand its current monitoring network and data management system

Messages

- **Rosenberg International Forum on Water Policy (2007)**
 - Increase GoA financial support to undertake a phased and appropriately sized Groundwater Action Plan
 - The GW management scheme developed and adopted by the GoA should be of realistic size and scope
 - If effective GW governance mechanisms are developed, information about the GW resource will need to be readily accessible to all interested parties

Messages

- **Groundwater Risk Assessment (2008)**

- 32 risks identified
- Highest Ranked Risk: Quality of groundwater data and data management

“The Province does not have a clear understanding of its groundwater resources and therefore the Government of Alberta cannot effectively manage groundwater in a sustainable manner.”

Groundwater Strategy and Action Plan

- **AENV Program Review (2007/08)**
 - Groundwater program team developed a 10-yr plan
- **Groundwater Strategy and Action Plan 2008-2018**
 - 4 pillars
 - Building capacity
 - Improving knowledge of groundwater resources
 - Groundwater management policies and tools
 - Improving Stewardship

Messages

- **Alberta Water Council (2008)**

“There is no question that knowledge is the most critical element in our ability to manage water effectively. However, the availability, quality and accessibility of data continue to be a concern, despite improvements in our knowledge and research.”

- **Water for Life Renewal (2008)**

“Finding the best way to allocate water resources and increasing our understanding of surface and groundwater are priorities for preparing for the future.”

Partnerships in Groundwater Management

- Groundwater Management is not solely an AENV role
- Government of Alberta Partnerships
 - Water for Life
 - Policy streamlining (examples: ERCB; AARD & NRCB)
 - Mapping (AGS; AENV Regional Specialists)
 - GW information management
- Stakeholder Engagement

Improving Knowledge of Groundwater Resources

Overview of the Provincial Groundwater Mapping Program

Groundwater Mapping Program

- **Who is involved?**

- AENV / Alberta Geological Survey Partnership
 - Memorandum of Understanding between ERCB and AENV
 - AGS restructuring to undertake this program
 - Groundwater Policy Section / Water Policy Branch

- **Funding (through 2008/09 fiscal)**

- Energy Innovation Fund for major contracts
 - AGS and AENV operations – agency budgets

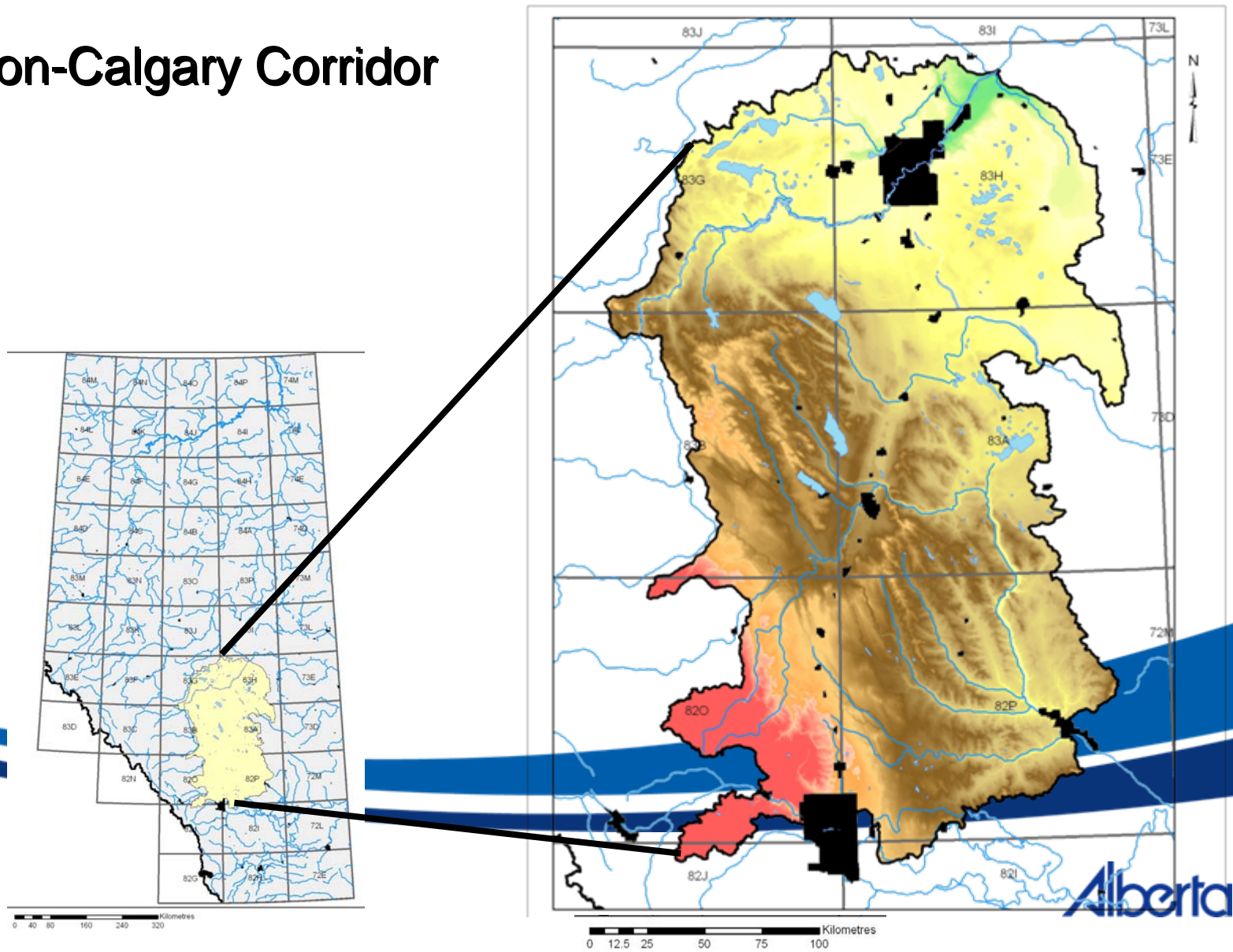
Groundwater Mapping Program

- **Where are we starting? / What do we know?**
 - Alberta Research Council hydrogeology map sheets
 - Groundwater yield; groundwater quality
 - Prairie Farm Rehabilitation Administration
 - White Area
 - Municipality/County basis
 - Groundwater budget; sensitivity to contamination

Groundwater Mapping Program

Pilot Project: Edmonton-Calgary Corridor

Edmonton-Calgary Corridor



Edmonton-Calgary Corridor

- Pilot groundwater mapping area:
 - ECC Region selected on the basis of highest priority
 - Well density
 - Competing water users (residential, agricultural, industrial)
 - CBM Development
 - 3 year project that began in late 2007/08; completion in 2010/2011

Edmonton-Calgary Corridor

- **Objectives:**

- Identify major aquifers in ECC
- Delineate and map groundwater flow systems
- Classify the major aquifers
- Estimate steady-state flow balance for each system
- Create predictive tools for managing groundwater in the major aquifers

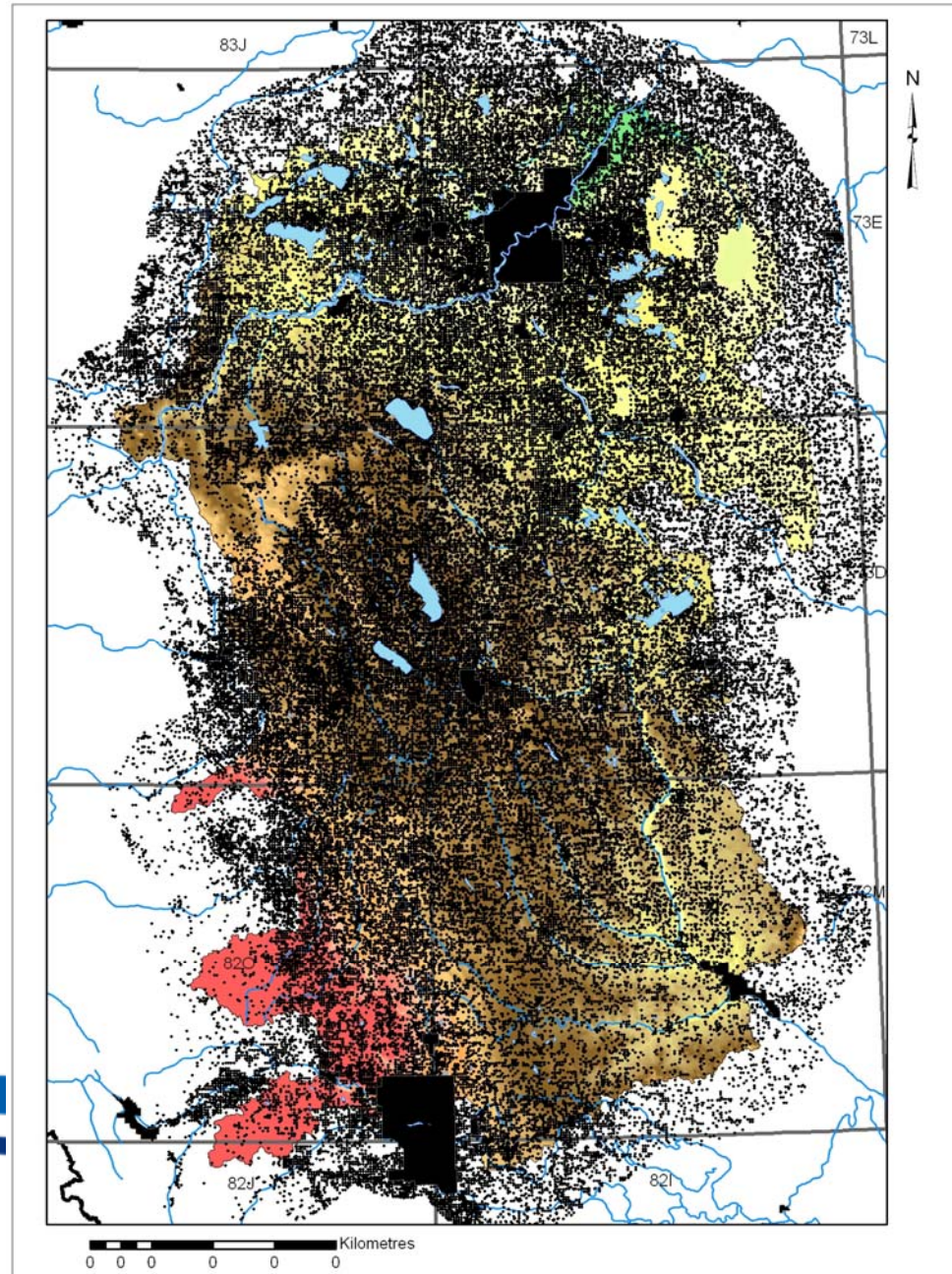
Edmonton-Calgary Corridor

- **Process**

- Build on geologic knowledge
 - Start with existing databases (e.g., water well records; oil and gas logs)
 - Add new geological information (e.g., airborne geophysics)
- Add water levels and build hydrogeology
- Develop predictive tools

Innovation

~188,00 Water Wells
in the ECC



Innovation: Incorporating Airborne Geophysics

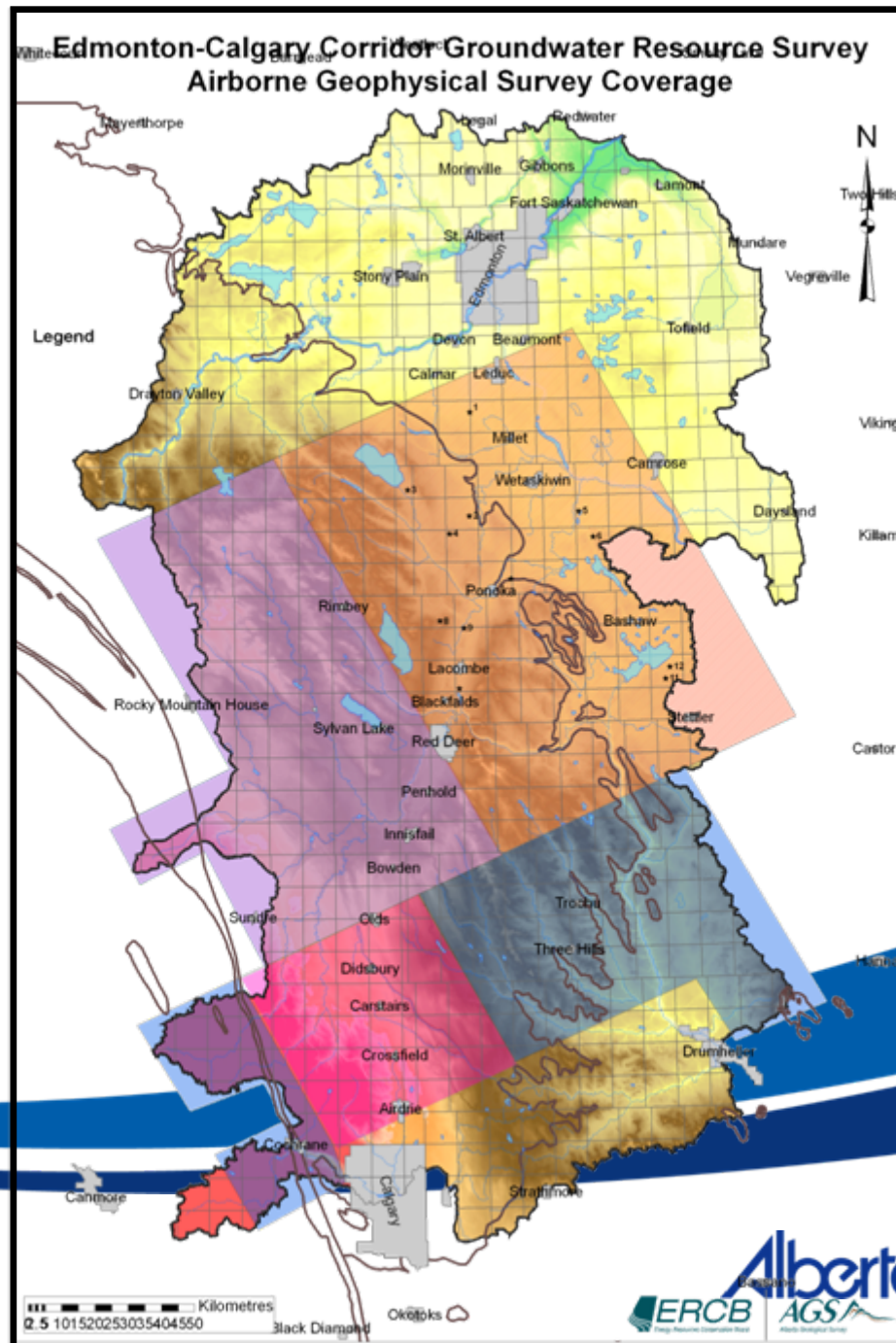


2007/08 & 2008/09 Airborne Surveys

Total area covered to date
~ 37,000 km²

Cost to Date: \$4 million
Energy Innovation Fund
& ERBC/AGS

Estimated Cost to Complete:
\$2 million



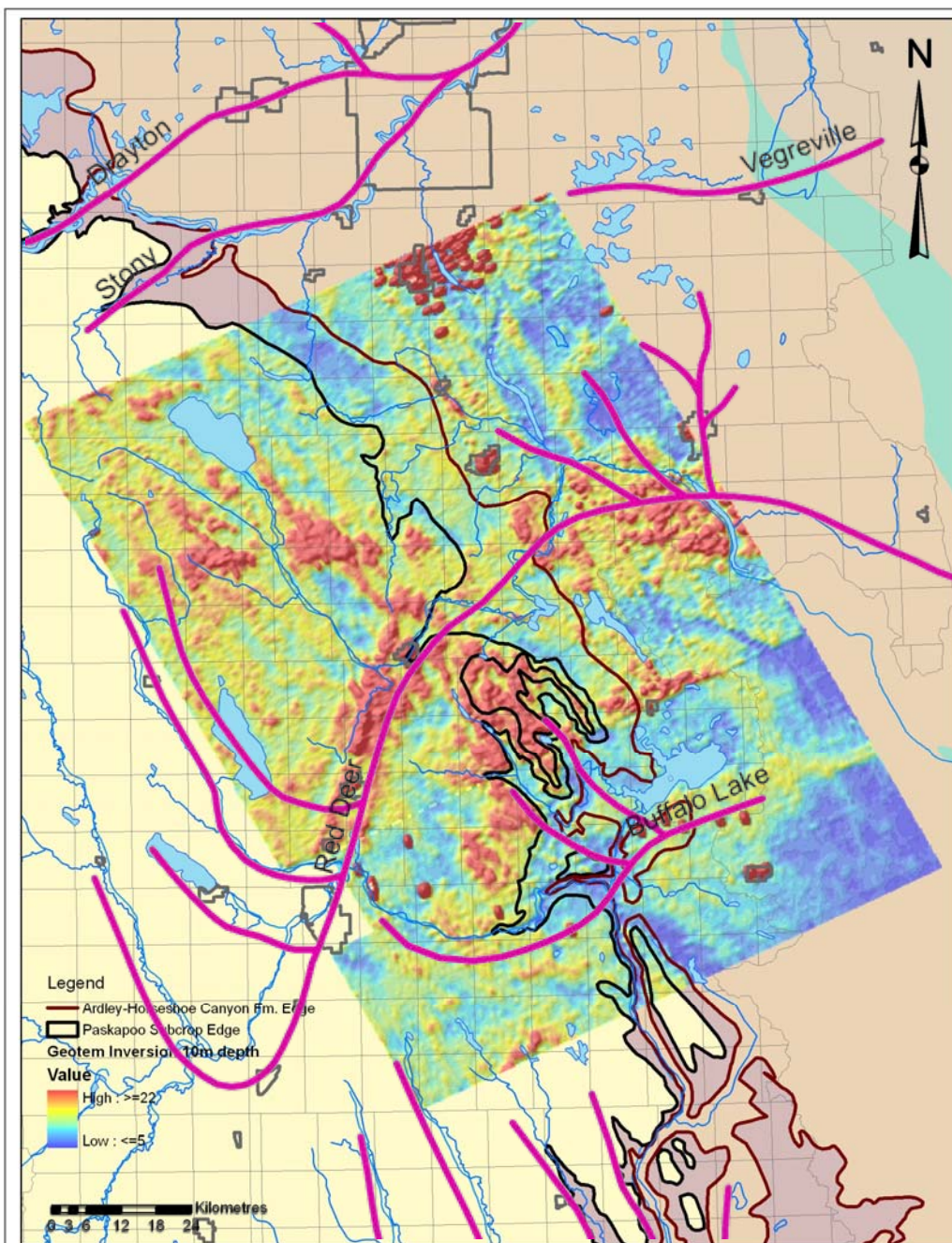
Results of fixed-wing survey

10m depth slice

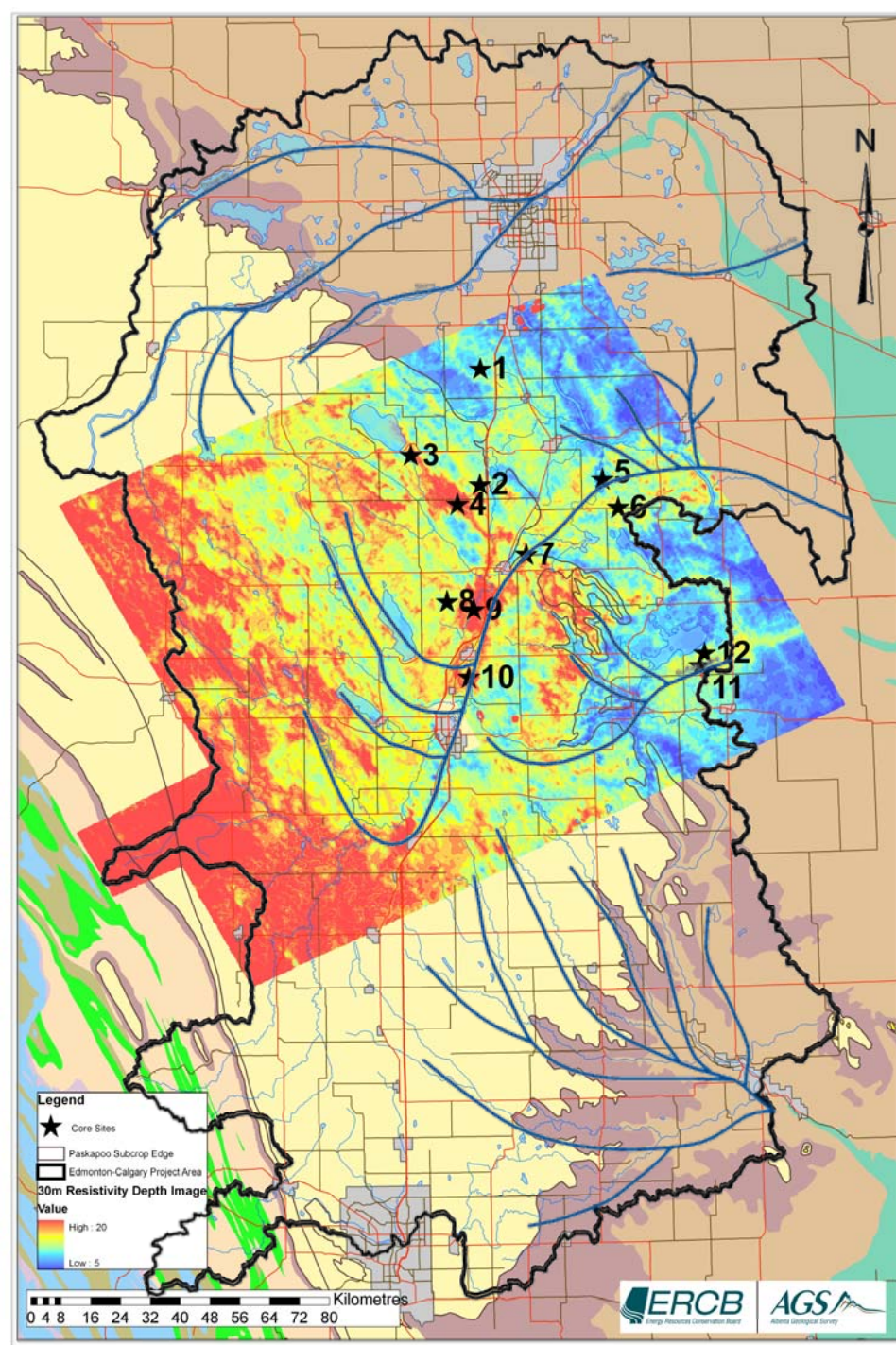
- Highly resistive elements of the landscape correspond well to currently known sandy geological units
- Other similarly highly resistive areas may better define the eastern edge of the Paskapoo Fm

 **High resistivity - sandy**

 **Low resistivity - clayey**



2008/09 Core Hole Program



Edmonton-Calgary Corridor

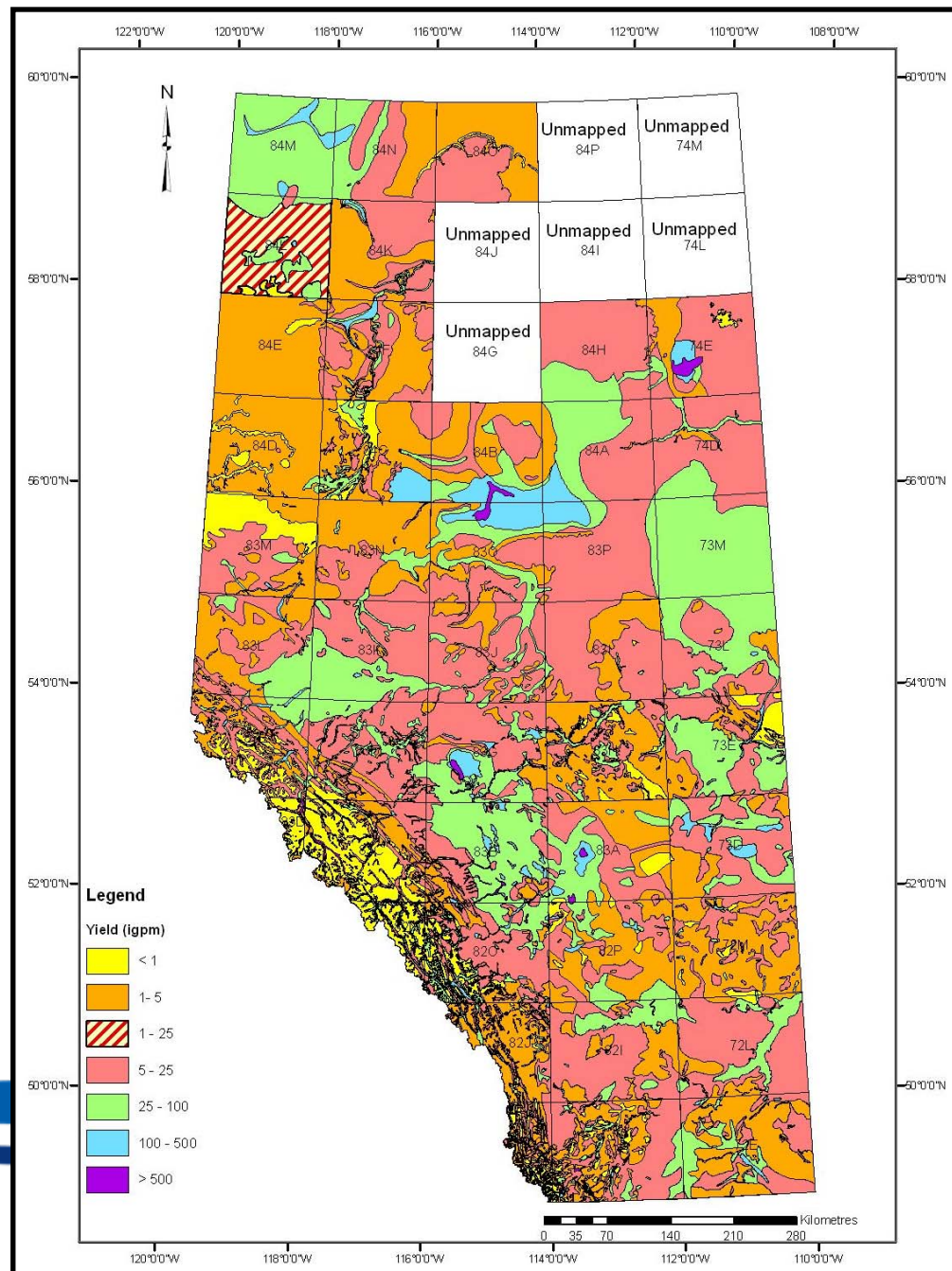
- **Numerical Models – A Tool for GW Management**
 - To describe the present state of Alberta's groundwater resources.
 - To prepare outlooks and forecasts; identify potential threats and impacts on quantity and quality:
 - water-balances
 - cumulative pumping and water-level responses
 - vulnerability of the major aquifers to drought

Edmonton-Calgary Corridor

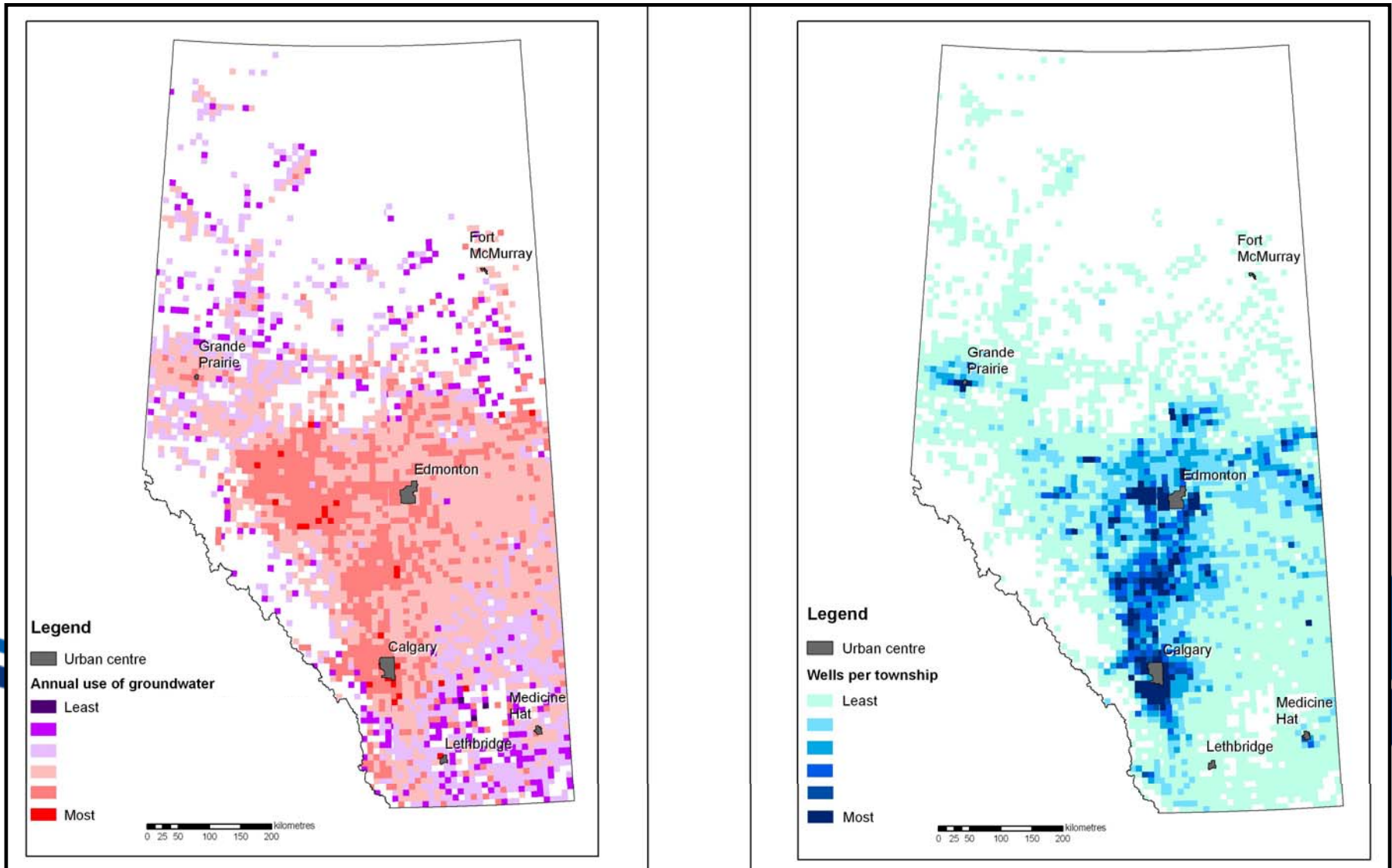
- **Progress to date:**

- Bedrock topography completed
- Drift thickness – almost complete
- Building hydrogeology – drift and near-surface bedrock aquifers
- Conceptual modeling/defensible approach:
 - selection and development of numerical models
- Incorporating airborne geophysics

Provincial-scale Yield Map



Estimate of groundwater use by township



Groundwater Mapping Program

- Challenges -

- **Funding**

- Energy Innovation Fund support ended in 2008-2009
 - Without a source of additional funding, field operations will be significantly reduced:
 - Airborne surveys
 - Boreholes / water wells / aquifer tests
 - Geochemistry - sampling

- **Timing**

- Long-term project; everyone wants the information now

Groundwater Management

- Policies and Tools -**
- Challenges and Opportunities -**

Groundwater Management

- Policies and Tools -

- **Water Allocation Policy**

- Priority GoA and AENV corporate initiative
 - Water Policy Branch providing leadership
 - Cross-Ministry development for the initial phase
 - Stakeholder involvement will be critical
- What will the future look like?
 - FITFIR?
 - Water Market?

Groundwater Management

- Policies and Tools -

- **Cumulative Effects Management System**
 - Provincial initiative
 - Groundwater management component
 - First step: Industrial Heartland project
 - CEMS can be:
 - place-based – site specific; regional
 - based on performance objectives
 - It is linked to the Land-Use Framework

Groundwater Management

- Policies and Tools -

- **Land Use Framework**

- Enhanced knowledge of groundwater systems is required to improve GW resource management.
- Land use management is an essential component of groundwater source protection.
- Groundwater source protection can only be achieved by working together.

Groundwater Management

- Policies and Tools -

- **Aquifer Classification**

- A groundwater management “tool” to enhance planning
 - An aquifer’s classification needs to be understood by experts, planners and public with little explanation
 - Needs to mesh with the land use framework concepts
- Is there something that could include:
 - Sustainability - use/yield; major aquifer; single source
 - Usability – based on water quality parameters
 - Vulnerability – quantity and/or quality

Groundwater Management

- Policies and Tools -

- **Groundwater Management Units (GMUs)**
 - How do we identify and manage groundwater use within watersheds defined by surface water contours?
 - Suggesting GMUs
 - AENV has completed a project to:
 - Learn how GMUs are defined in other jurisdictions
 - Identify advantages and disadvantages
 - Suggest an Alberta application of the concept
 - Phase 2: Stakeholder input and discussion

Groundwater Management

- Challenges and Opportunities -

- **Water Allocation Policy**

- Effectively fitting groundwater into the policy structure

- **Cumulative Effects Monitoring**

- Development of an over-arching groundwater framework

- **Land-Use Planning**

- Building in the groundwater protection components

- **Groundwater Mapping**

- Keeping the initiative alive

**Thanks for this opportunity to talk about
the groundwater programs in
Alberta Environment.**

Questions?

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