

Responsible Development in Alberta: *Hydraulic Fracturing*

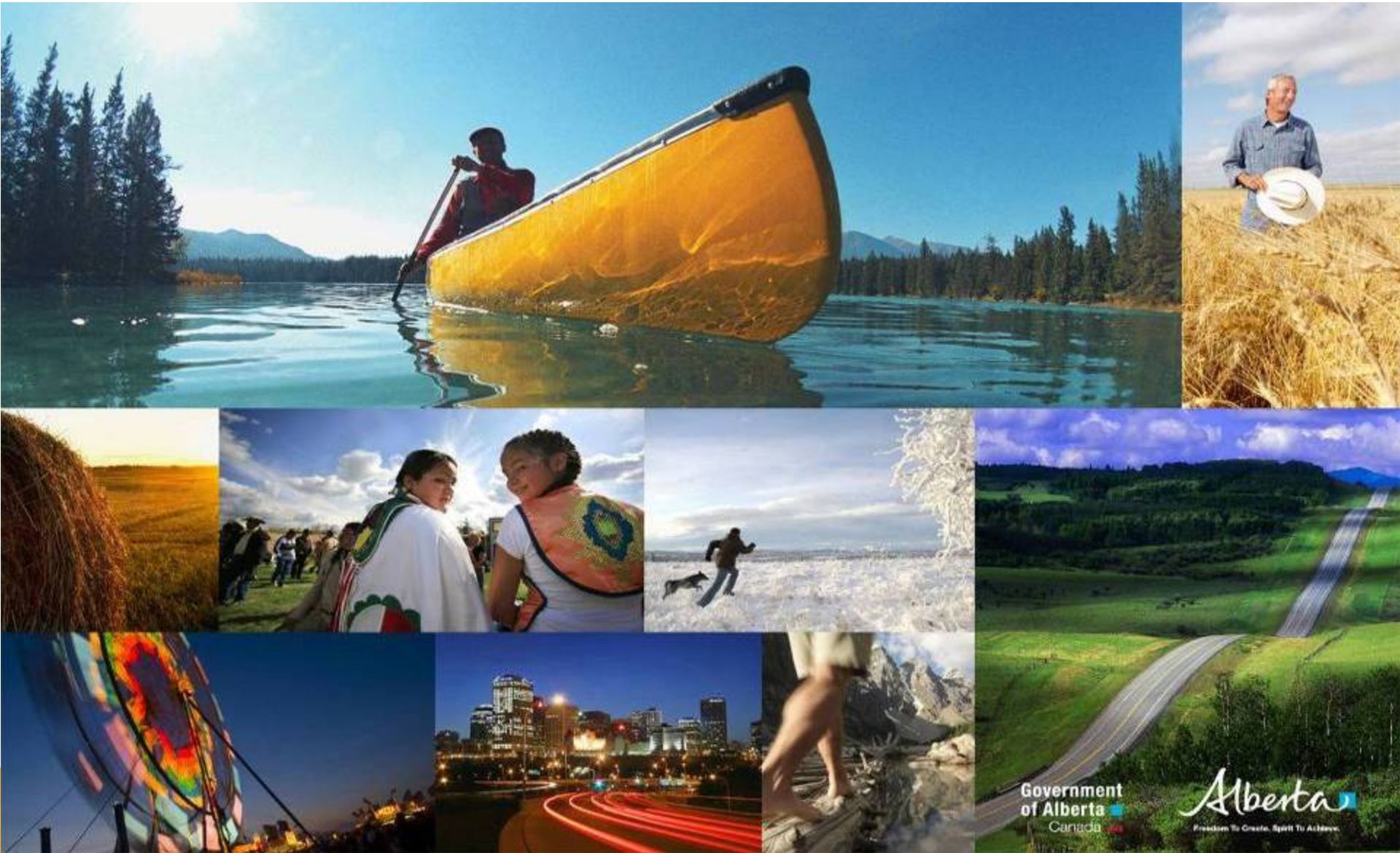
January 2014

Alberta Environment and Sustainable Resource Development

Outline

- Context
- Evolving Management Approach
- Engaging Albertans
- Policy Direction

Albertans demand a healthy environment



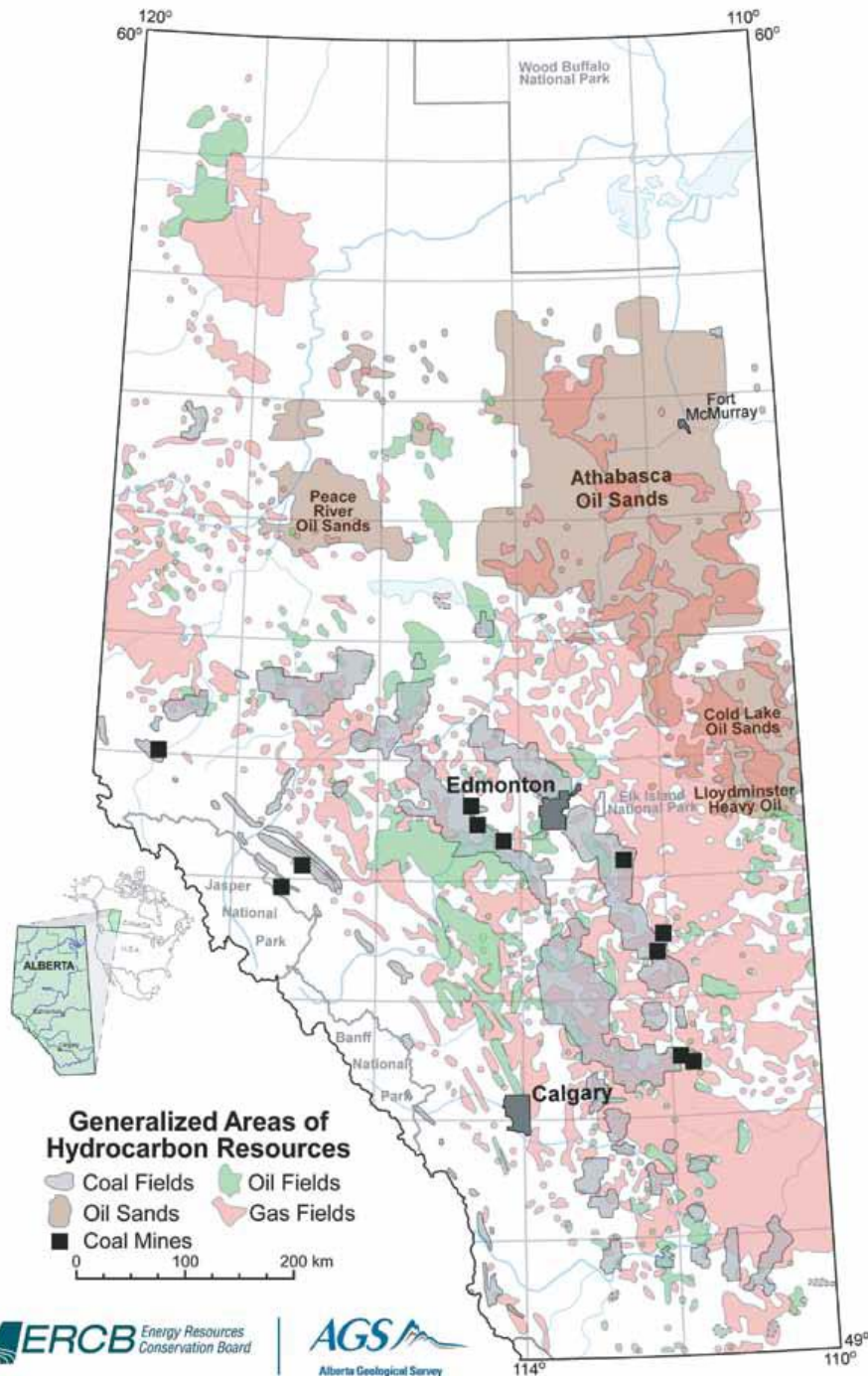
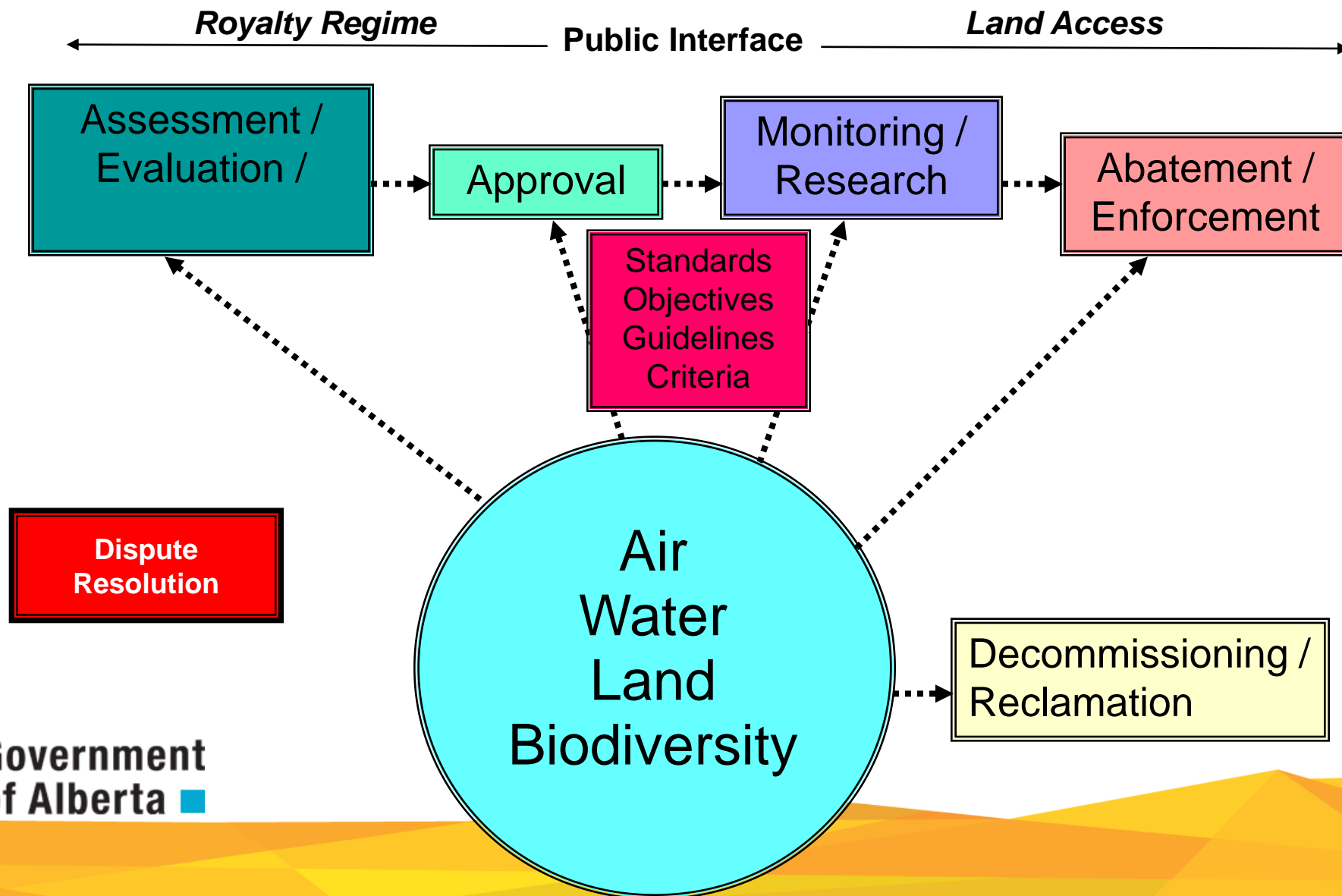


Table 1. Summary of estimates of Alberta shale- and siltstone-hosted hydrocarbon resource endowment.

Unit	Adsorbed Gas Content %*	Natural Gas (Tcf)	Natural-Gas Liquids (billion bbl)	Oil (billion bbl)
Duvernay P50	6.8	443	11.3	61.7
Duvernay P90–P10	5.6–8.5	353–540	7.5–16.3	44.1–82.9
Muskwa P50	6.9	419	14.8	115.1
Muskwa P90–P10	4.1–10.5	289–527	6.0–26.3	74.8–159.9
Montney P50	17.7	2133	28.9	136.3
Montney P90–P10	10.8–26.0	1630–2828	11.7–54.4	78.6–220.5
Basal Banff/Exshaw P50 (preliminary data; see Section 5.1)	5.7	35	0.092	24.8
Basal Banff/Exshaw P90–P10	3.2–10.0	16–70	0.034–0.217	9.0–44.9
North Nordegg P50 (preliminary data; see Section 5.1)	18.2	148	1.4	37.8
North Nordegg P90–P10	4.6–34.8	70–281	0.487–3.5	19.9–66.4
Wilrich P50 (preliminary data; see Section 5.1)	33.7	246	2.1	47.9
Wilrich P90–P10	6.2–59.2	115–568	0.689–4.449	20.2–172.3
Total P50 (medium estimate) resource endowment	n/a	3424	58.6	423.6

* The percentage of adsorbed gas represents the portion of natural gas that is stored as adsorbed gas.

Oil and Gas Regulatory Framework



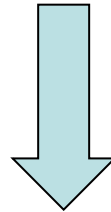
Regulatory Experience

- +70 years of regulatory experience
- Staff of +900
- Regulates
 - 176,000 oil and gas wells
 - 400,000 km of pipelines
 - 955 gas processing plants
 - 8 oil sands mines
 - 53 in situ oil sands projects
 - 5 upgraders
 - 12 coal mines
- Ongoing surveillance
 - About 100 inspections of oil sands mines in 2011, typically lasting several days
 - Conducted more than 3,000 inspections of in situ facility components in 2011
- **Compliance with major AER regulations was 98.6% in 2009**
- Penalties for non-compliance
 - Immediate shut down of facilities until operator shows problem can not occur again

Confluence of Priorities

Social

- *Quality of life*
- *Population growth / interface with development*



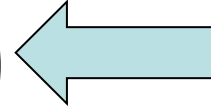
Environment

- *Lower footprint*
- *Increased transparency*
- *Water*

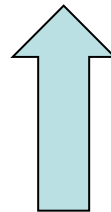


Economy

- *Resource economy*
- *Value add*
- *Economic recovery*



License
To
Operate



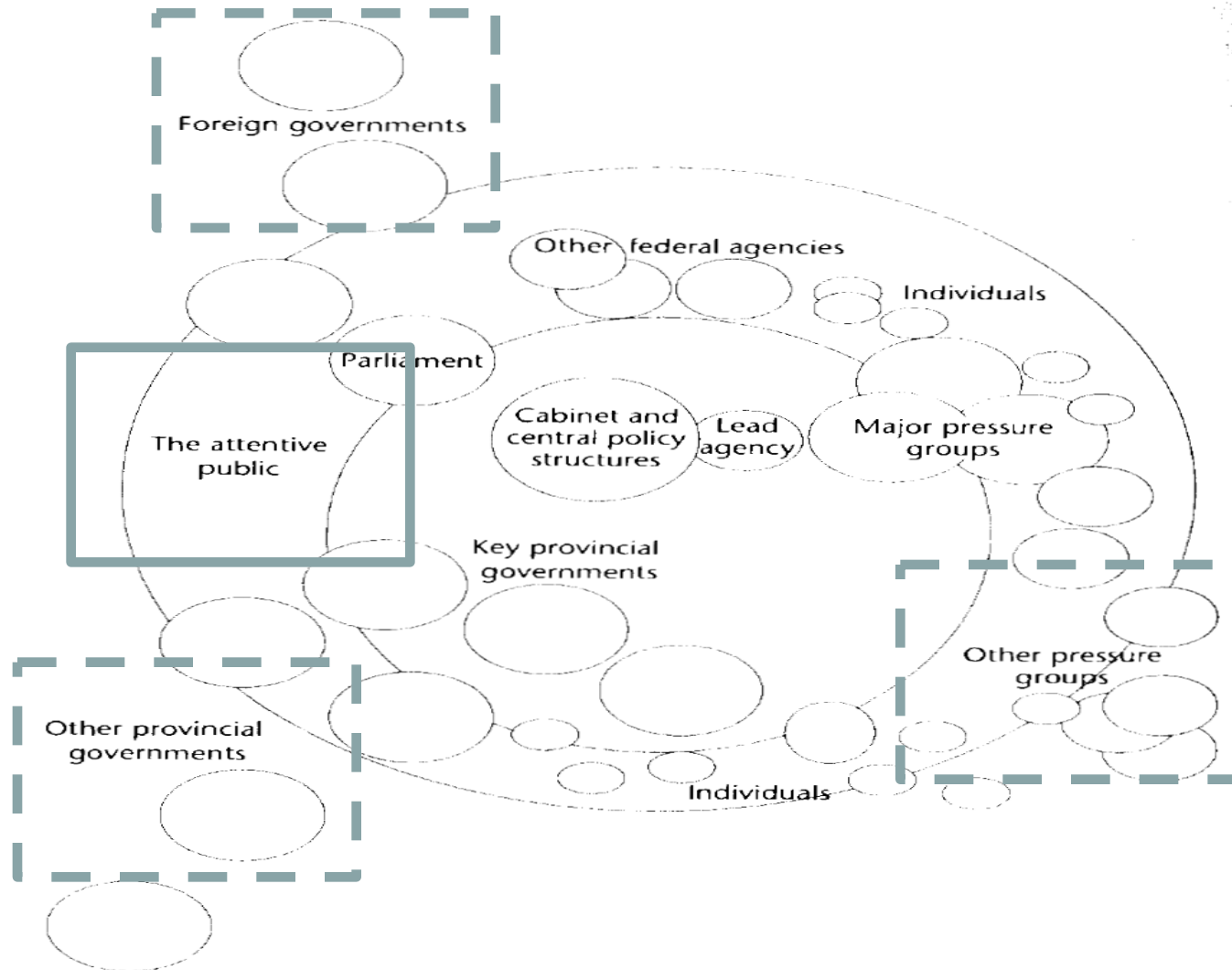
Energy

- *Growing demand for oil and gas*
- *Desire for alternatives (clean gas)*

The [Water] Policy Challenge

Figure 4.3

Paul Pross's diagram of the policy community



Source: Paul A. Pross, *Group Politics and Public Policy* (Toronto: Oxford University Press, 1992), 123.

Integrated Resource Management

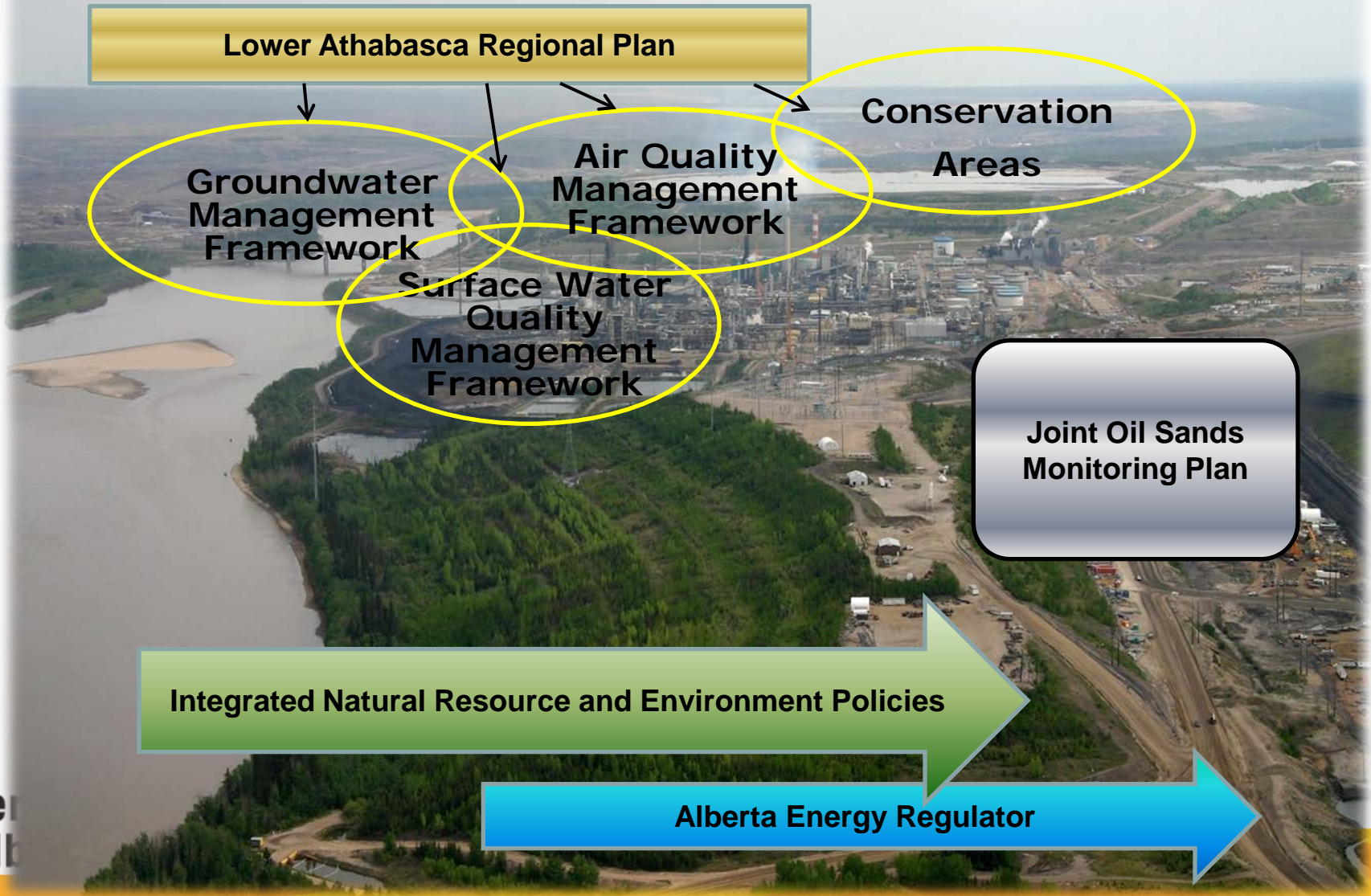
- The IRM System is the means by which Alberta will achieve **responsible resource stewardship**.
- The System is broadly defined, incorporating the management, conservation and wise use of all resources.
- It is founded upon principles of cumulative effects management:
 - Knowledge based
 - Outcomes driven
 - Future focused
 - Comprehensive implementation
 - Place based flexibility
 - Collaboration
 - Adaptation and Continuous Improvement

Integrated Resource Management

IRMS Functions



IRMS Overlay



Land-use Framework

- Blueprint for land-use, natural resource management, and decision-making to manage growth
- Seven regions based major provincial watersheds
- Sustains growing economy while balancing social and environmental goals
 - Considers the cumulative effects of all activities
 - Legally enforceable
 - Subject to regular reviews
 - Incorporates significant public feedback gathered through extensive consultation

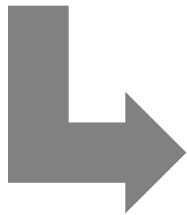


Management Frameworks

- Key approach to manage the long term cumulative effects of development on the environment at a regional level
- Limits are clear boundaries in the system not to be exceeded, triggers are proactive warning signals
- Progressive action based on conditions found in the environment

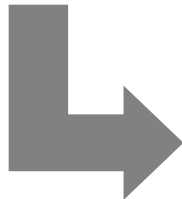
Indicators,
Triggers and
Limits

- Indicators are chosen
- Triggers & limits are set



Monitoring
and
Modelling

- Ongoing monitoring and assessment of conditions relative to triggers & limits



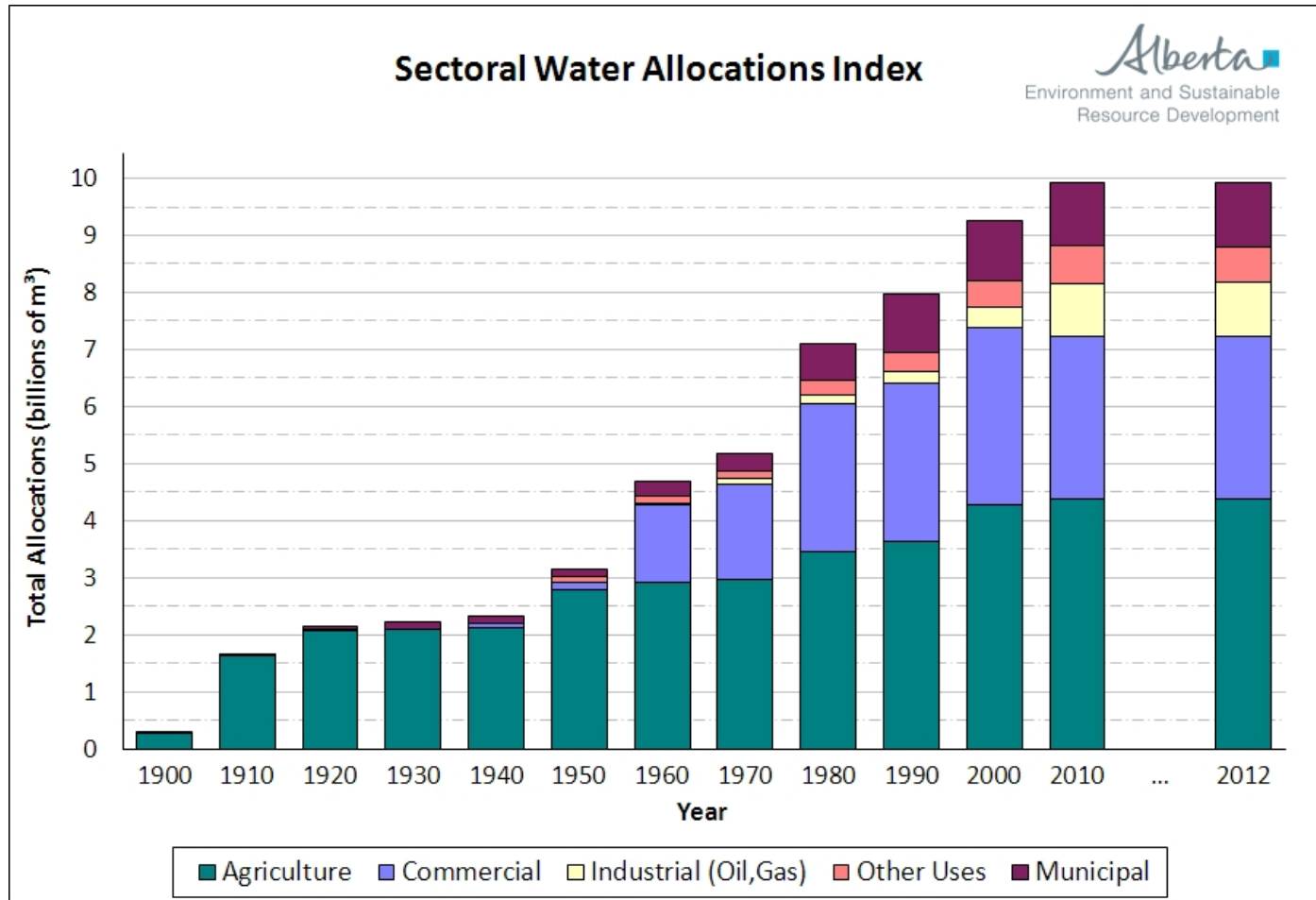
Management
Response and
Reporting

- Management actions taken as needed at triggers & limits
- Results reported

General Indicator	Water Quality Triggers		Water Quality Limits
	Mean	Peak	
Calcium (Ca ²⁺)	34.7	48.8	1,000 ^c
Chloride (Cl ⁻)	20.2	45.0	100 ^c
Magnesium (Mg ⁺)	9.5	13.6	-
Potassium (K ⁺)	1.4	2.1	-

Sodium (Na ⁺)	21.4	Level	Description	Management Intent
Sulphate (SO ₄ ⁻)	26.7	3	Exceedance of water quality limits	Improve ambient water quality to below limits..
Total Dissolved Phosphorus (TDP)	0.016	Limit		
Total Phosphorus (TP)	0.073	2	Exceedance of water quality triggers	Proactively maintain water quality below limits. Improve knowledge and understanding of trends.
Nitrate (NO ₃ -N)	0.092	Trigger		
		1	Mean and peak water quality at or better than historical conditions	Apply standard regulatory and non-regulatory approaches to manage water quality.

Provincial Water Demand





Water Legislation and Strategy

Water Act and EPEA

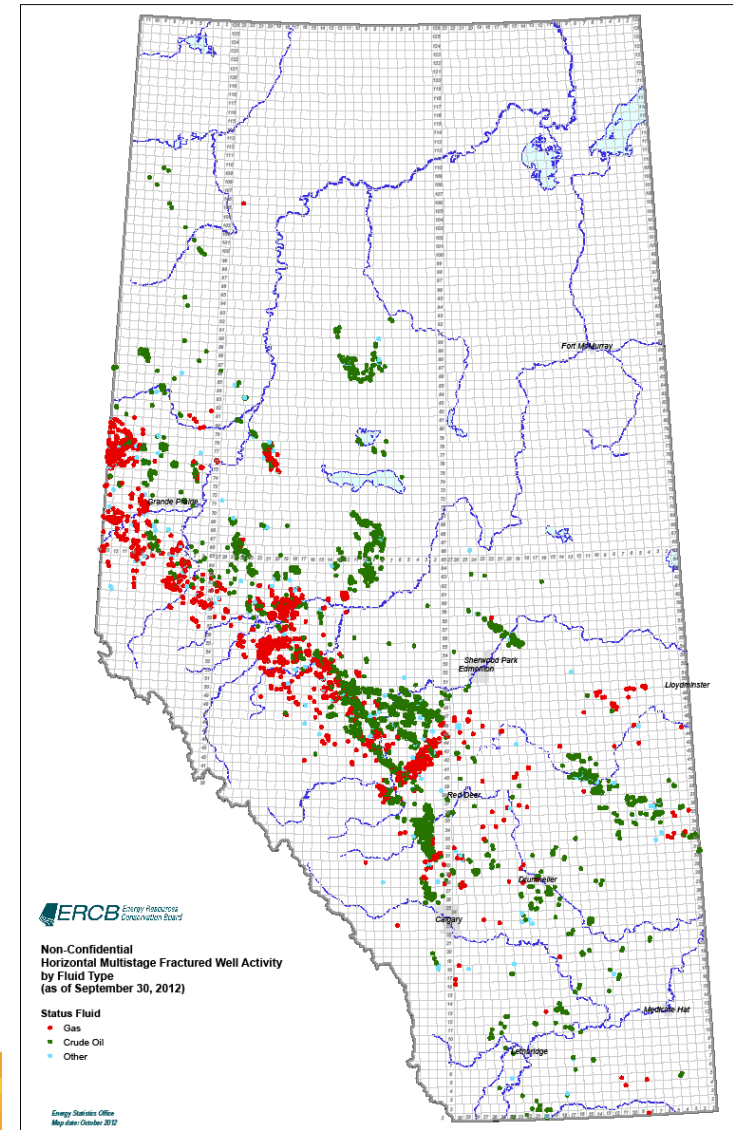
- Regulates the use of water, and activities within and near waterbodies
- Provision for Water Management Planning--limits on the amount of water withdrawn from surface and groundwater sources
- EPEA dictates water quality limits for designated activities (point sources)

Water for Life Strategy

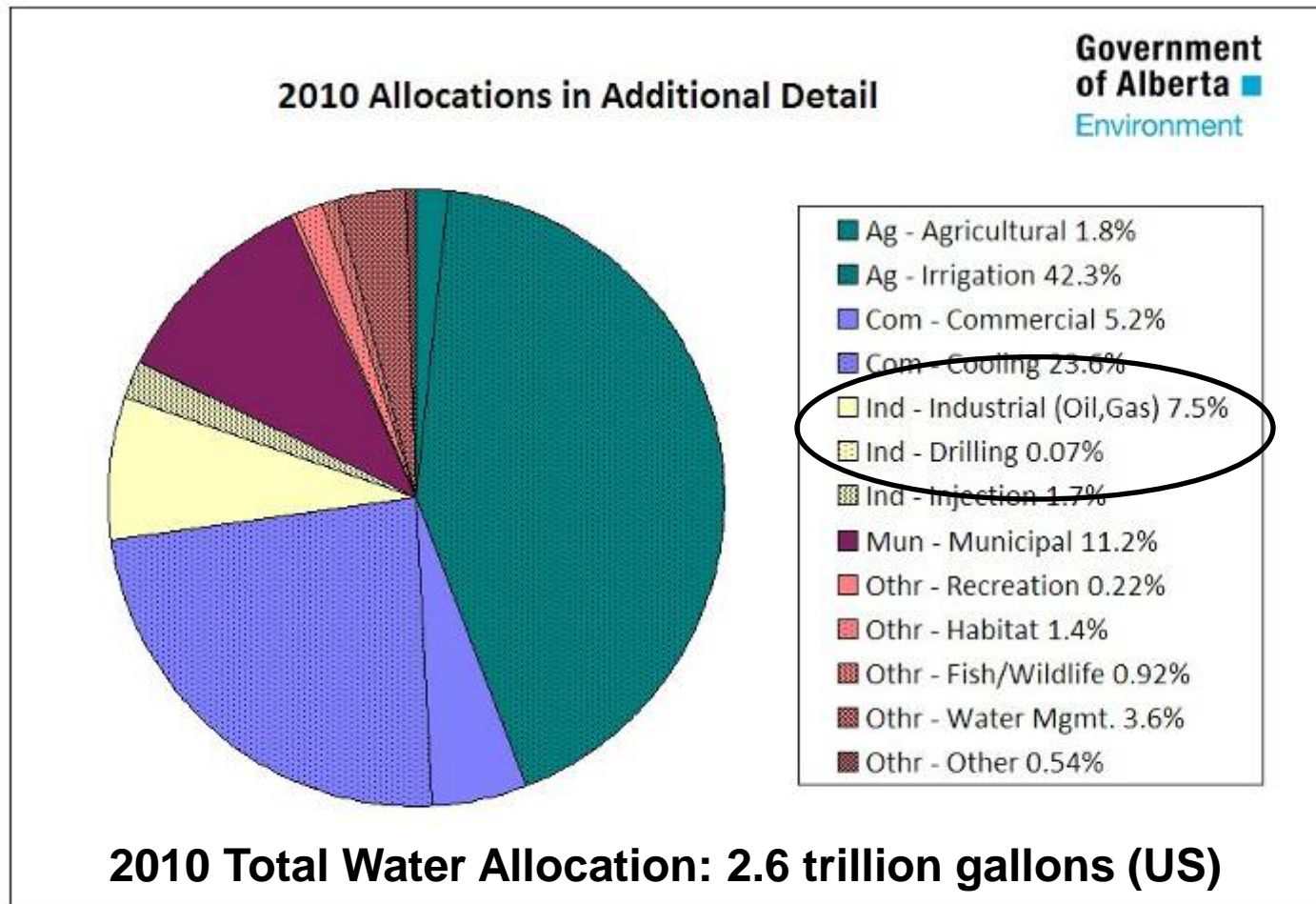
- Three goals: Safe, secure drinking water supply, Healthy aquatic ecosystems, Reliable, quality water supplies for a sustainable economy
- Three key directions: Knowledge and research, Partnerships, Water conservation

Hydraulic Fracturing in Alberta

- Decades of experience with development
 - 171,000+ wells drilled with hydraulic fracturing since 1950s
 - 6000+ horizontal wells to date (tight oil, shale gas and liquids)
- Measures in place to protect groundwater
 - Base of Groundwater Protection
- Deep well injection of waste
 - Not into surface water



Water Allocation in Alberta



Water Use

- Access to water is typically temporary diversion licenses
- Must meet key criteria
 - availability, no significant impact to other users, or the environment
- Additional requirements depending on geographic location
- No return (disposal)

LICENCE TO TEMPORARILY DIVERT WATER PROVINCE OF ALBERTA WATER ACT, R.S.A. 2000, c.W-3, as amended

LICENCE NO.:	00310508
FILE NO.:	SE 17-043-02-W5
EFFECTIVE DATE:	2012/05/23
EXPIRY DATE:	2012/07/23
SOURCE OF WATER:	Unnamed Water Body
POINT OF DIVERSION:	SE 17-043-02-W5
POINT OF USE:	02 19-043-02-W5
LICENSEE:	CONOCOPHILLIPS CANADA RESOURCES CORP.
RESTRICTION:	n/a

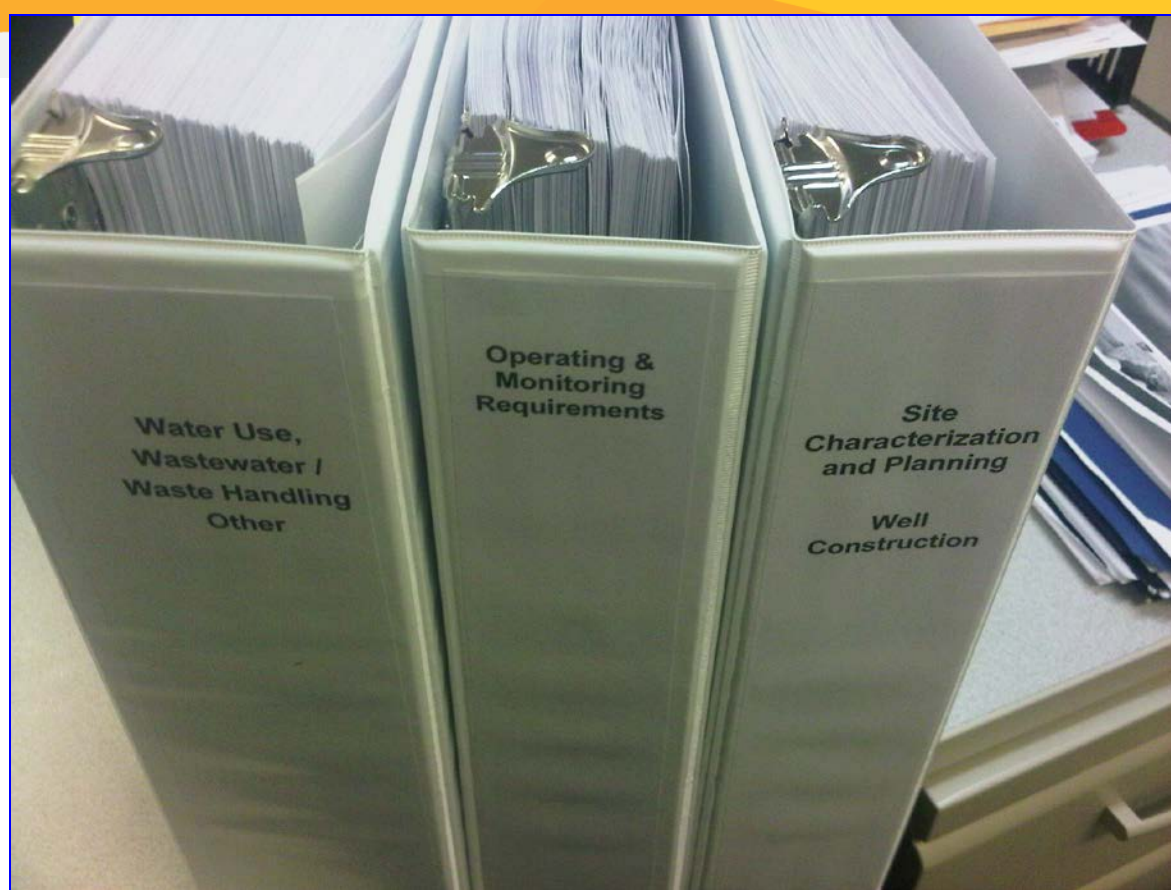
Pursuant to the Water Act, R.S.A. 2000, c.W-3, as amended, a licence for the temporary diversion of water is issued to the Licensee to:

divert and use up to 2,000 cubic metres of water from the source of water for the purpose of oil & gas well drilling,

subject to the attached term and condition nos. 1 to 17, inclusive.

Current Operating Requirements

Management Areas	Current Legislation, Directive or Guideline relating to Fracturing	Regulatory Body
Site Characterization and Planning	Oil and Gas Conservation Act and Regulations	Alberta Energy
	Directive 056: Energy Development Applications	AER
	Directive 029: Energy and Utility Development Applications and the Hearing Process	AER
	Directive 031: Guidelines for the Energy Proceeding Cost Claims	AER
	Provincial Groundwater Inventory Program	ESRD
Well Construction	Directive 008: Surface Casing Depth Requirements	AER
	Directive 009: Casing Cementing Minimum Requirements	AER
Operating & Monitoring Requirements	Directive 036: Drilling Blowout Prevention Requirements and Procedures	AER
	Directive 038: Noise Control	AER
	Directive 044: Requirements for the Surveillance of Water Production in Oil and Gas Wells	AER
	Directive 050: Drilling Waste Management	AER
	Directive 027: Shallow Fracturing Operations-Restricted Operations	AER
	Directive 035: Baseline Water Testing Requirements for Coalbed Methane Wells	AER
	Directive 051: Injection and Disposal Wells - Well Classifications, Completions, Logging, and Testing	AER
	Directive 059: Well Drilling & Completion Data Filing Requirements	AER
	Collection and Reporting of Fracture Fluids	AER
Water Use, Wastewater / Waste Handling	Environmental Protection and Enhancement Act – water use, re-use and discharge (none)	ESRD
	Water Act – water use (and water impacts)	ESRD
	Directive 055: Storage Requirements for the Upstream Petroleum Industry	AER
	Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry	AER
Other	Directive 020: Well Abandonment	AER
	Remediation Certificate Regulation	ESRD
	Alberta Tier I and Tier II Soil and Groundwater Remediation Guidelines	ESRD



Groundwater Monitoring

Shallow Groundwater Observation Well Network (<30m)

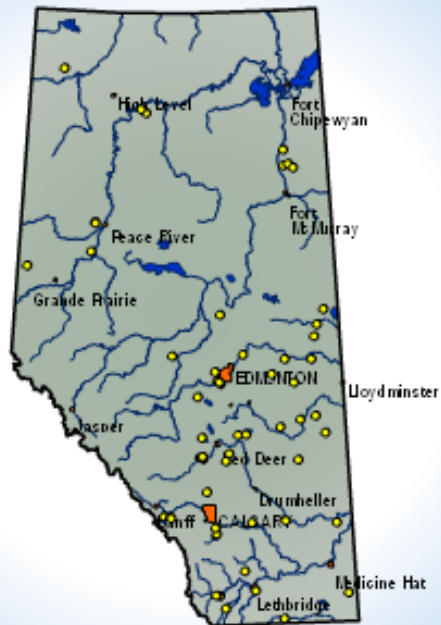
Alberta
Environment

- RESET
- CURSOR
- ZOOM
- PAN
- HELP

SHALLOW
WELLS

INTERMEDIATE
WELLS

DEEP
WELLS



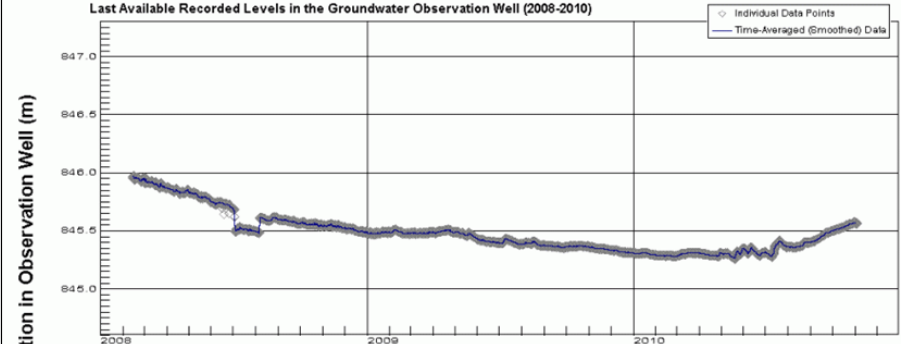
Groundwater Observation Well Network...

Warburg 2181E (Obs.Well #313)

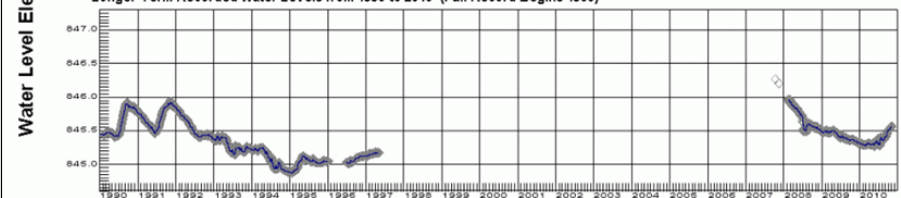
Lat: 53° 7' 36.6" N Long: 114° 21' 40.8" W Formation: Surficial Aquifer: Surficial Depth Class: Shallow

Government
of Alberta
Environment

Last Available Recorded Levels in the Groundwater Observation Well (2008-2010)



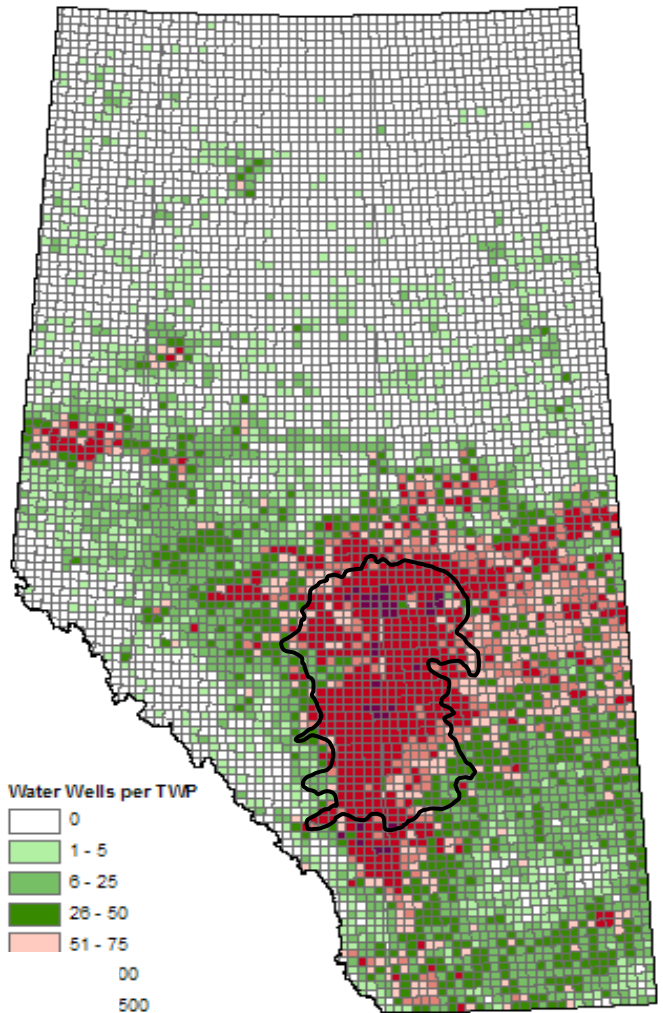
Longer-Term Recorded Water Levels from 1990 to 2010 (Full Record Begins 1983)



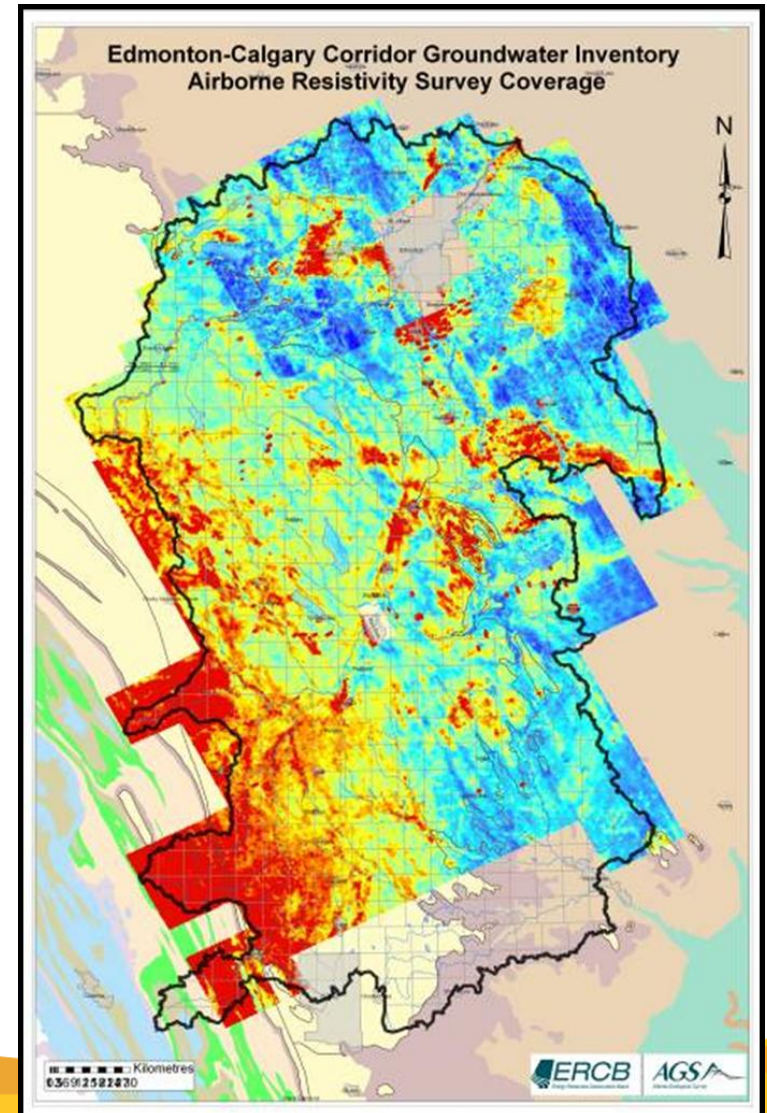
Data Source: Alberta Environment

Government
of Alberta

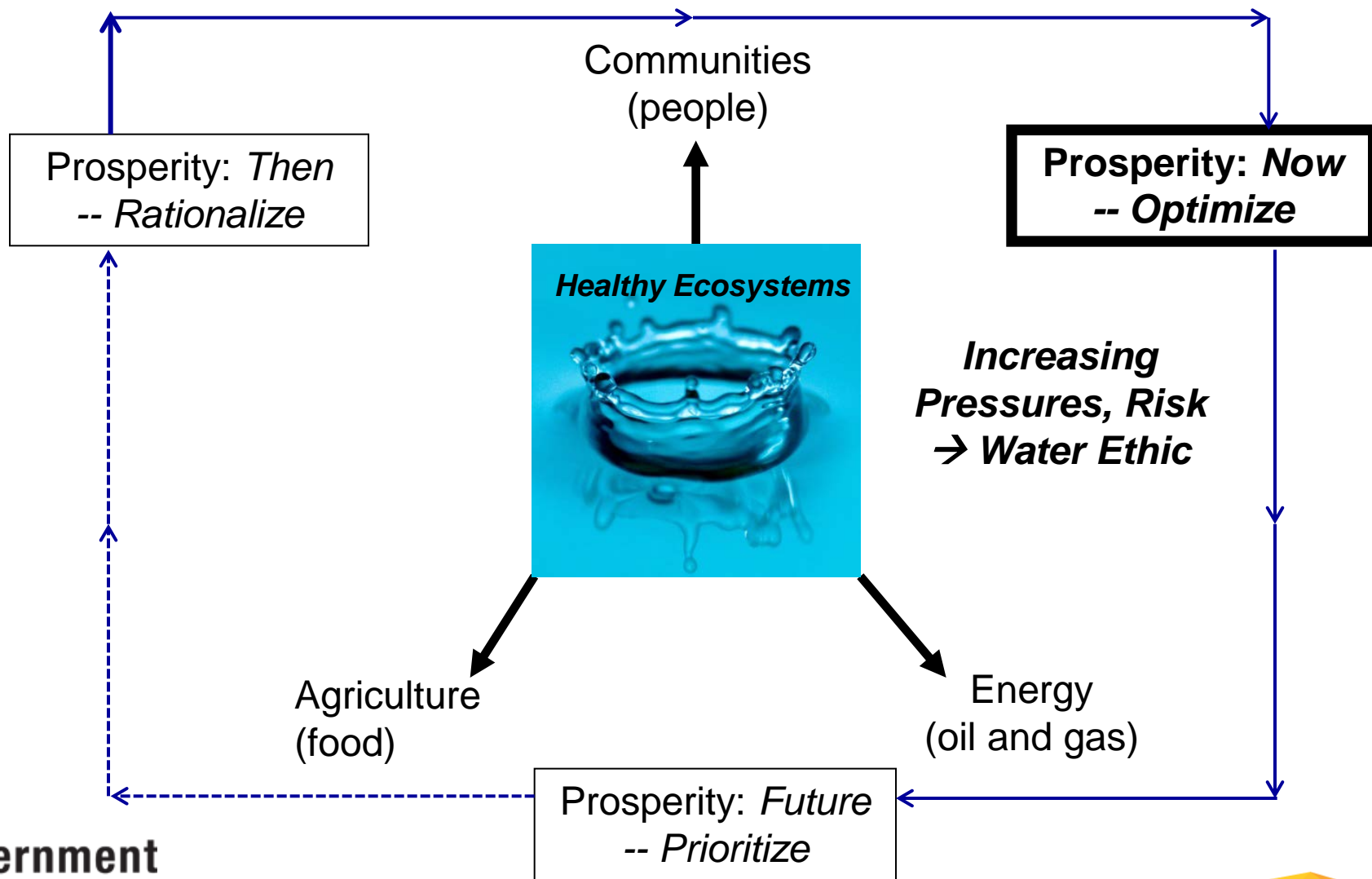
Groundwater Mapping



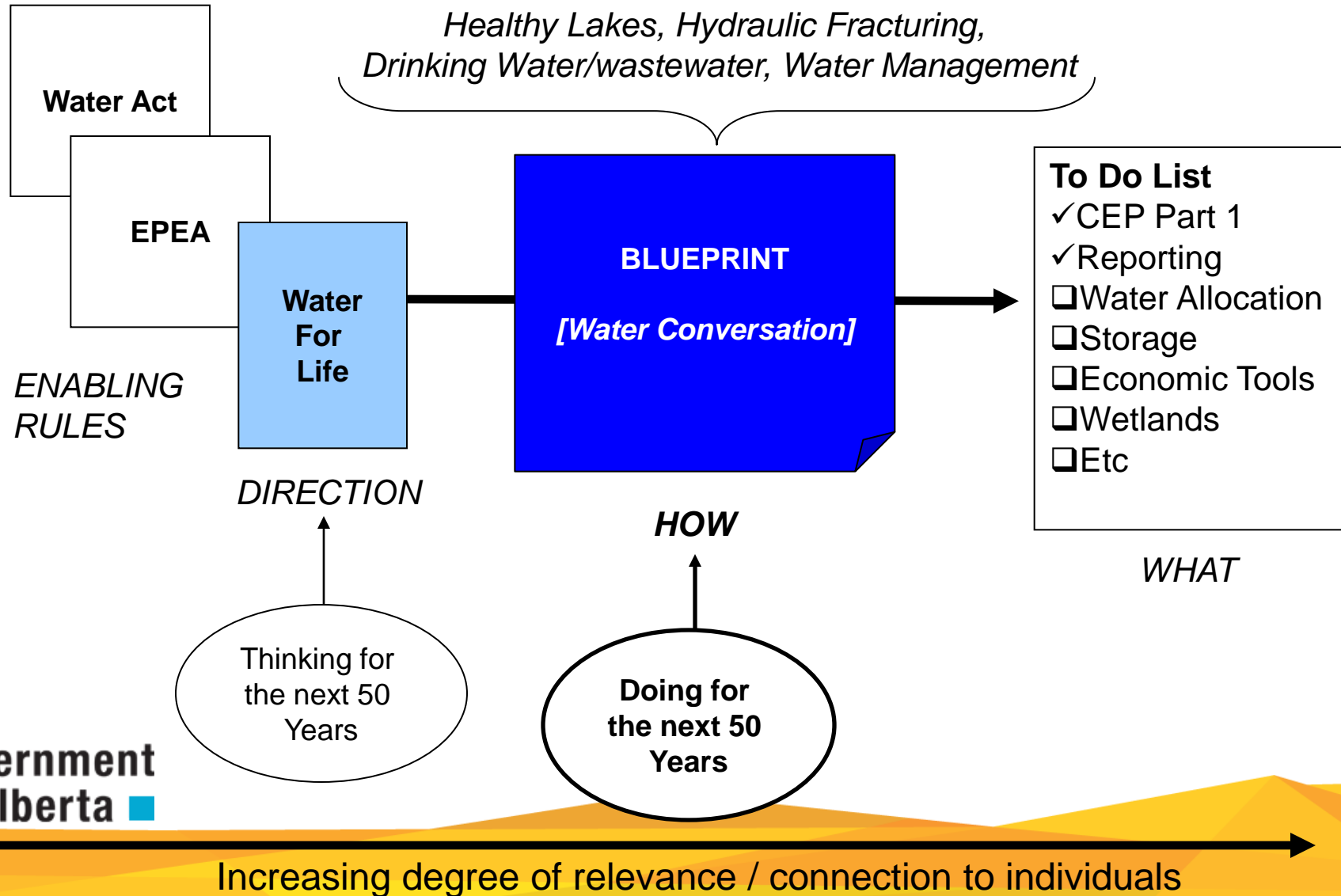
Total Wells: 215,816



Alberta Water Nexus



The Water Conversation

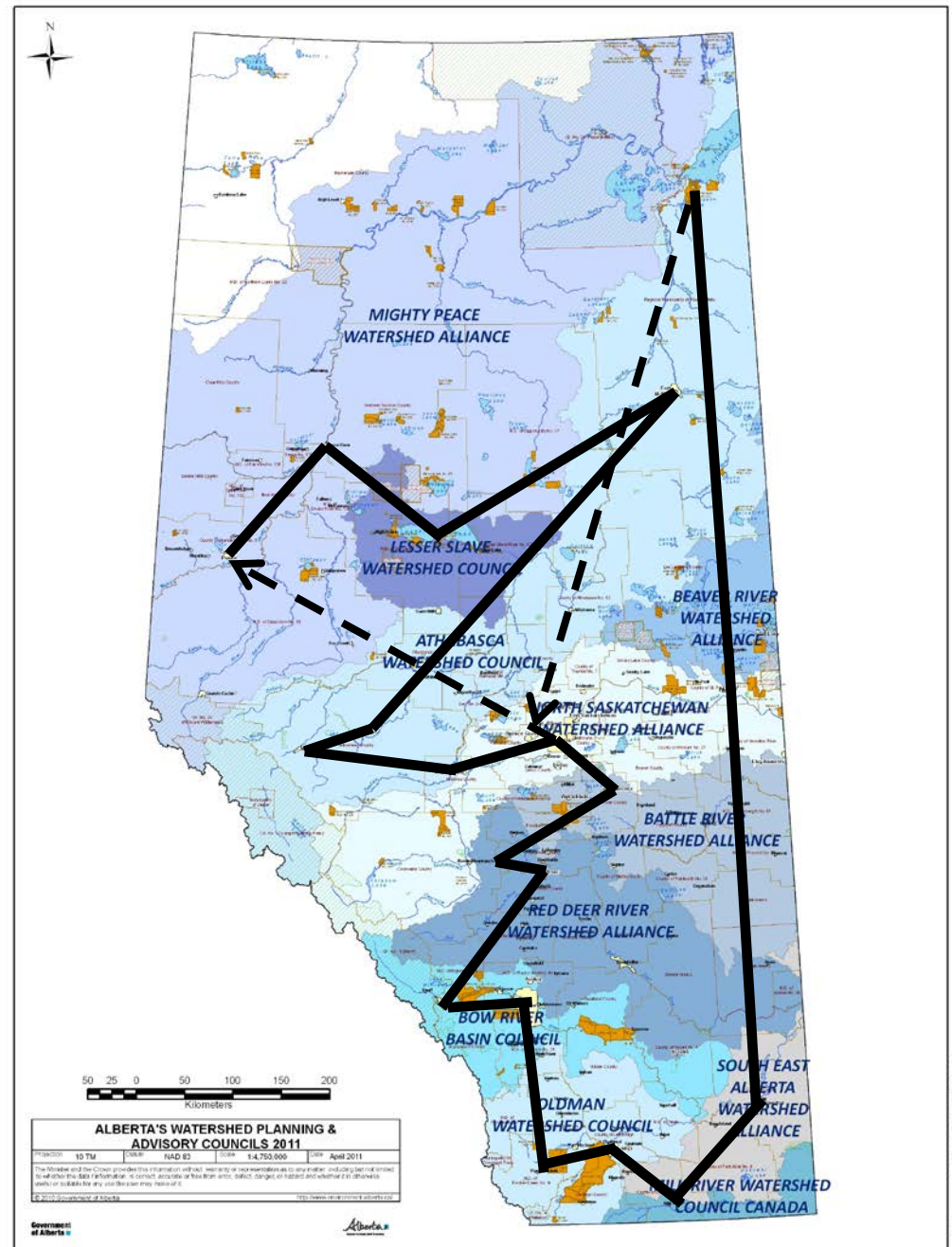


Longer Term Vision (5 years+)

- Healthy Lakes
 - Fully implement a provincial lakes framework including clarified roles, responsibilities, and a decision-making system
- **Hydraulic Fracturing and Water**
 - **Adopt play-based and regional approaches to hydraulic fracturing providing assurance that water supply and quality is safe and secure**
- Drinking Water and Wastewater
 - Develop options for provincial level governance and funding schemes that will continue to respect regional differences and allow for flexibility
- Water Management
 - Optimize the water management system by taking actions on the water demand and supply sides, clarifying governance, and providing overall system clarity

By the Numbers:

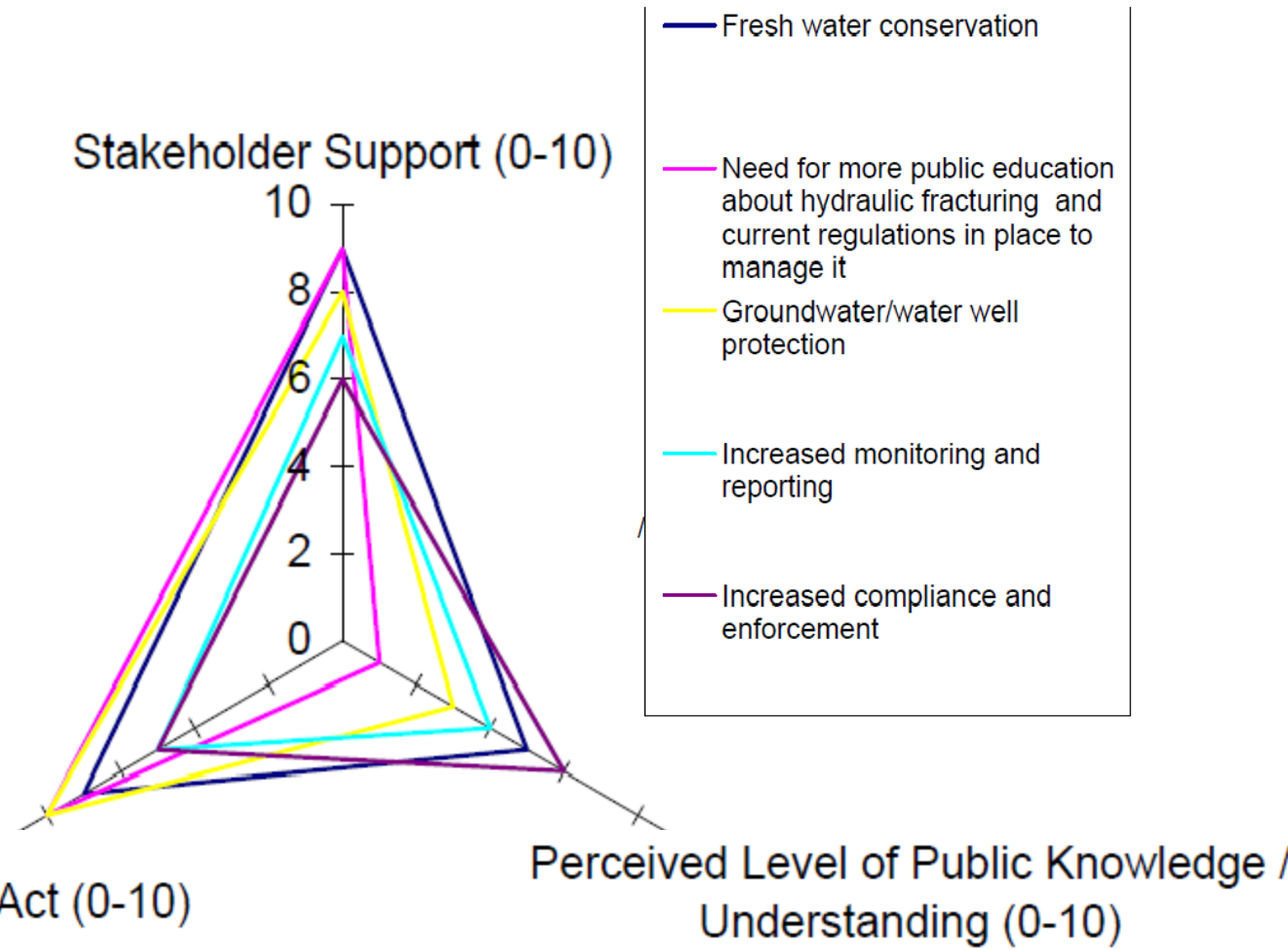
- 44 sessions
- 20 locations
- 11 Watersheds
- Attended by over 1,300 Albertans
- 650 Surveys submitted
- Over 200 alternative submissions
- Hundreds of pages of discussion summaries
- Thousands of stories



Hydraulic Fracturing and Water

- Need to **raise public awareness** and understanding about hydraulic fracturing and relationship to water
- Groundwater protection critical - **more mapping** needed
- Establish policies to **limit/prohibit use of fresh water**
- Enhance rules around **well bore integrity**
- Strict **controls for chemical storage**, use and disposal
- **Baseline water testing** before operations commence
- **Document data** and results of drilling using fracturing
- Consider **surface effects** of heavy equipment used in fracturing - impacts on soil, etc.
- **Play-based** and regional approaches should be used
- **Consistently enforce regulations**, capacity enhancements here might be needed
- **Resolve conflicts in policies** regarding natural resource development and water management

Hydraulic Fracturing – Initial Theme Analysis



***ST* – Hydraulic Fracturing and Water**

- Develop a policy guideline setting out **water conservation** practices expected from upstream oil and gas industry
- Develop and implement science-based standards for **baseline water well testing** near fracturing operations
- Provide **balanced and credible information** on how Alberta manages hydraulic fracturing

Unconventional Oil and Gas

- Dispersed on the landscape
 - No set 'region'
- Multiple players
 - Includes service elements
- Range of impacts on the land
 - Some focused and accumulated (air, noise, footprint)
 - Others dispersed (source of water, waste management, truck traffic)
- Social dynamic

Responsible Development Challenges

- Water protection and management
 - Reporting, recycling, water well / aquifer distances
- Containment
 - Fluids, waste handling, casing
- Communication
 - Offset well management
- Surface infrastructure planning and cumulative effects

→ ***AER Hydraulic Fracturing Directive***

Additional Response Areas

Water Use and Source

- Expanded Water Conservation for all Oil and Gas

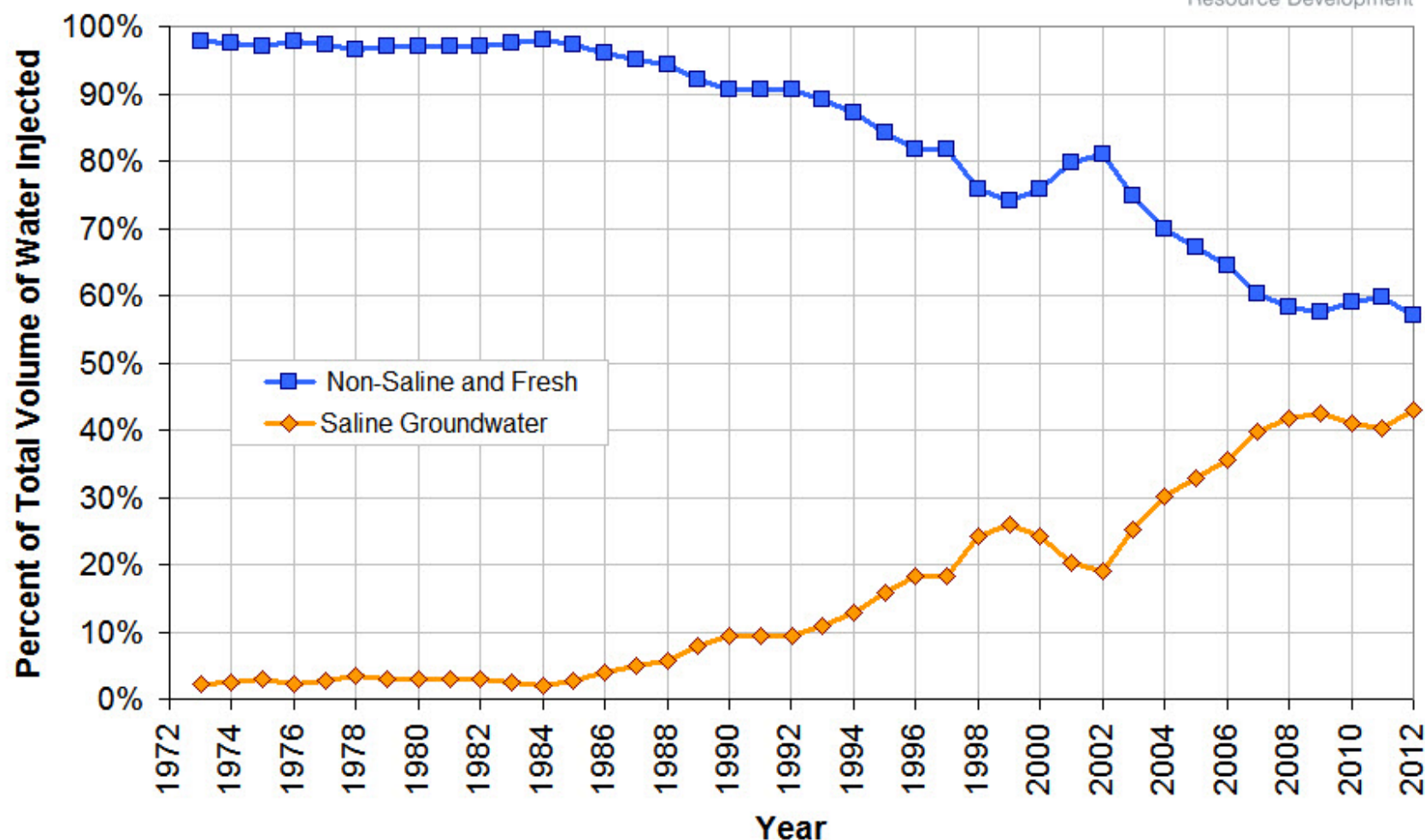
Transparency and Assurance

- Expanded Baseline Water Well Testing
- Disclosure of fluids
- Information portals (volume and source)

Cumulative Effects Management

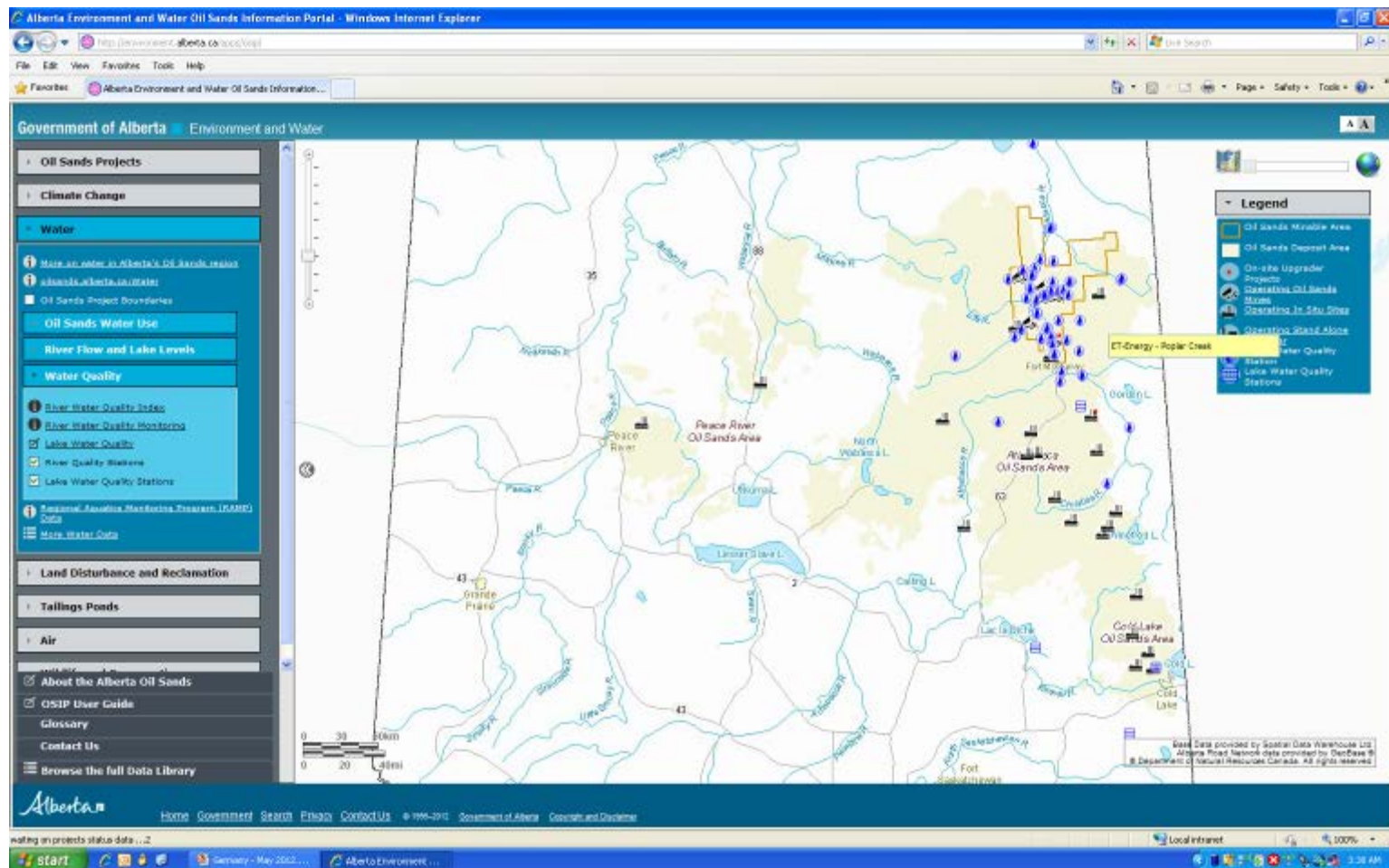
- Unconventional Regulatory Framework, play-based management approach)

Relative Proportion of Source Water Types Over Time 1973-2012*



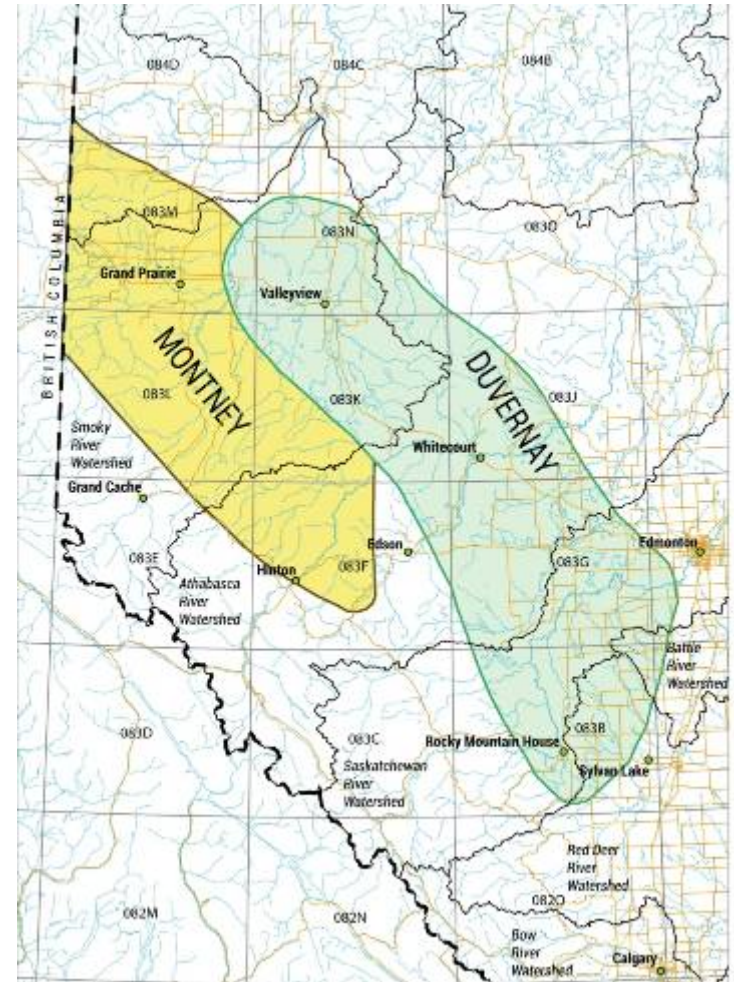
*Data Source: Alberta Energy Resources Conservation Board (ERCB). Chart produced by Water Policy Branch, Alberta ESRD.

Oil Sands Information Portal



Sub-Regional Authorization

- Plays defined by geology, resource and technology
- Cumulative effects management within a play
- Collaboration amongst operators is key
- Initial focus on hot spots



Sub-Regional Authorization

Caribou Recovery
Requirements

Biodiversity Zone
Requirements

TENURE

PLANNING

Unconventional Play
MULTIPLE PLAYERS
STAGGERED STARTS

MONITORING

ENFORCEMENT

Exploratory

Commercial

TDLS

Storage
Reservoirs

Term Water
Licence

PLA

Water Act

EPEA

APPROVAL
(AER)

Fish
Habitat
Air
Water / Treatment
Other?

Closing Comments

- Growing demand for energy must be reconciled with...
 - Move to unconventional resource base
 - Desire for cleaner alternatives
 - Social awareness and expectations
- Alberta experience demonstrates that...
 - Unconventional resources can be developed responsibly
 - Requires a robust regulatory regime including strong backstops
- Further development will require...
 - Transparency of experience (positive and negative)
 - Meaningful engagement with citizens
 - New management approaches to address intensity and scope of impacts
 - Collaboration across developers
 - Shared, independent, state of science, risks, etc.