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PROVEN | EFFECTIVE | STRATEGY

OIL SANDS DEVELOPMENT INTO THE FUTURE

October 23, 2013

A Brief History

- 1788 Alexander MacKenzie
- 1889 Laird Expedition
- 1913 Sydney Ells experimented with processing
- 1920's R.C. Fitzsimmons commercial operation
- 1929 Dr. Karl Clark patented hot water process
- 1936 Max Ball produced diesel from bitumen
- 1948 Province commercial processing
- 1962 Province oil sands policy
- 1967 Suncor operational
- 1978 Syncrude operational
- 1985 Cyclic Steam Stimulation in situ
- 1990's Steam Assisted Gravity Drainage in situ

Post mid 1990's

- Shift in oil sands development
- Major companies had sold leases to pursue other opportunities
- Technology improvements made development feasible
- World demand for oil and oil prices were positive
- Oil development in other regions changing to nationalized companies

Forecasts

- 5 million bbl/d approved
- 2008 1.3 million bbl/d
- 2012 1.5 million bbl/d
- Since 2007 oldest mining operations have seen little production growth
- Mining growth from new operations and expansions
- In situ projects show the greatest growth
- 20% mining
- 80% in situ

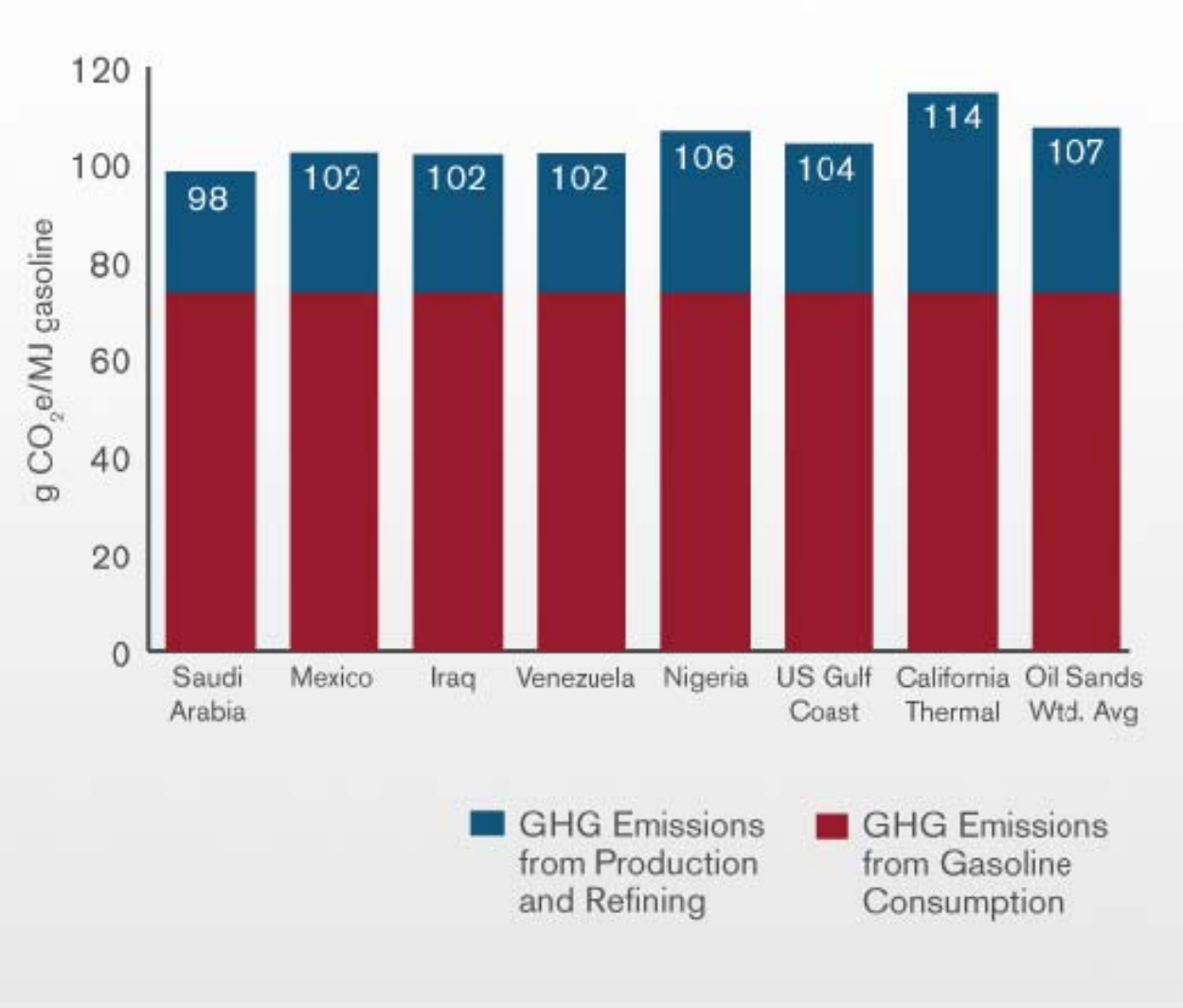
Media View

- Dirty Tar Sands
- Fastest growing GHGs in Canada
- Poor air quality
- Water pollution
- Land destruction
- Lack of regulation
- Link to cancer
- Oil spills
- Social values
- Have and have not regions
- PAH equivalent to a major oil spill every year

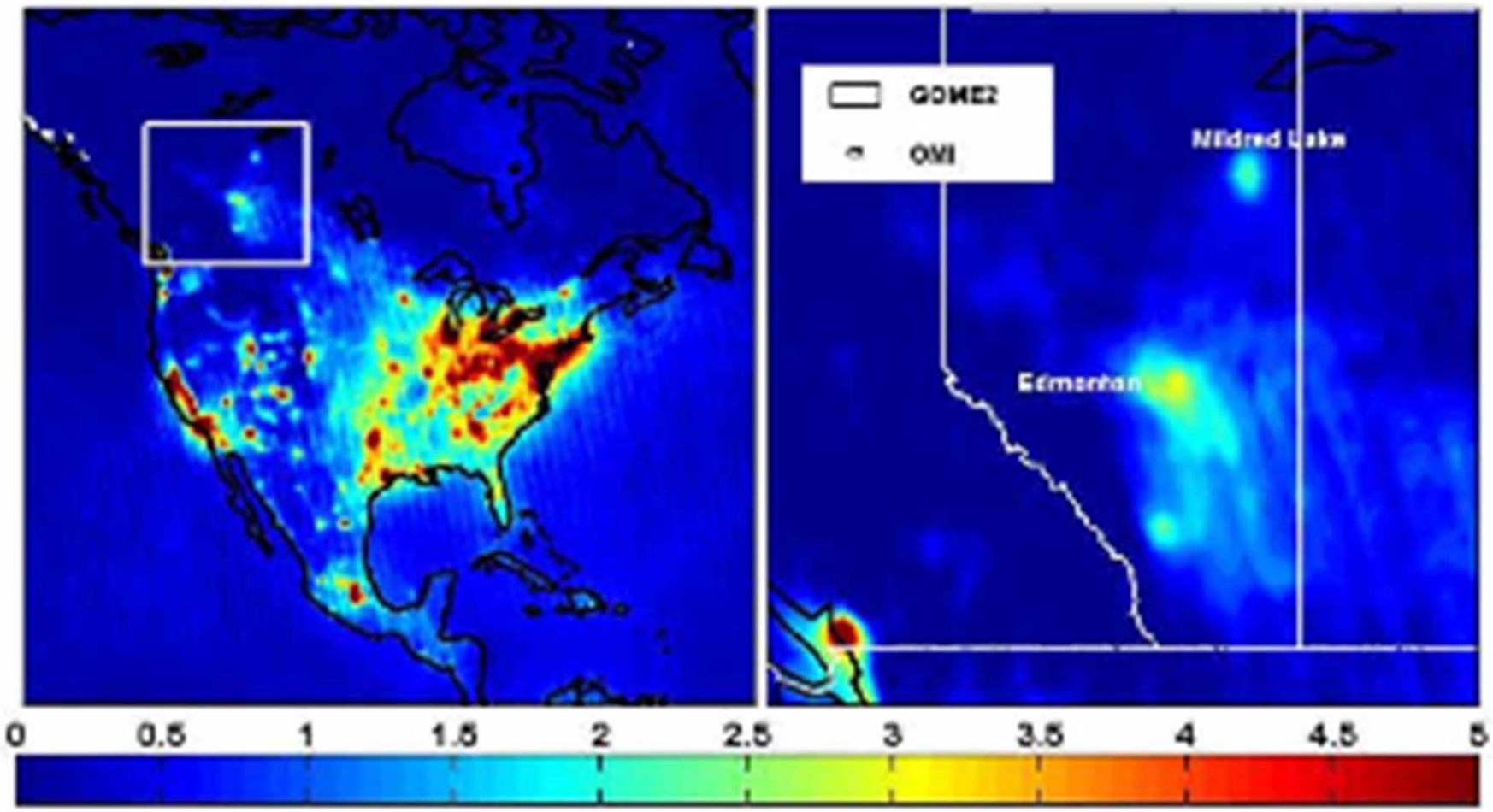
Issue Management Post 2000

- Tar Sands vs. Oil Sands
- Fear Factor Emerges
  - Specter of rapid oil sands development
- Shift of Environmental Groups from working together for change to opposing change
- Aboriginal issues in dialogue blossom
- Environmental Impacts are front and centre
- Governments and industry ill prepared for focus
- Switch to issue resolution and communication
  - Attempt to resolve concerns through accommodation
  - "If only the public understood oil sands"
- Companies establishing distance from "bad oil sands"

Greenhouse Gases

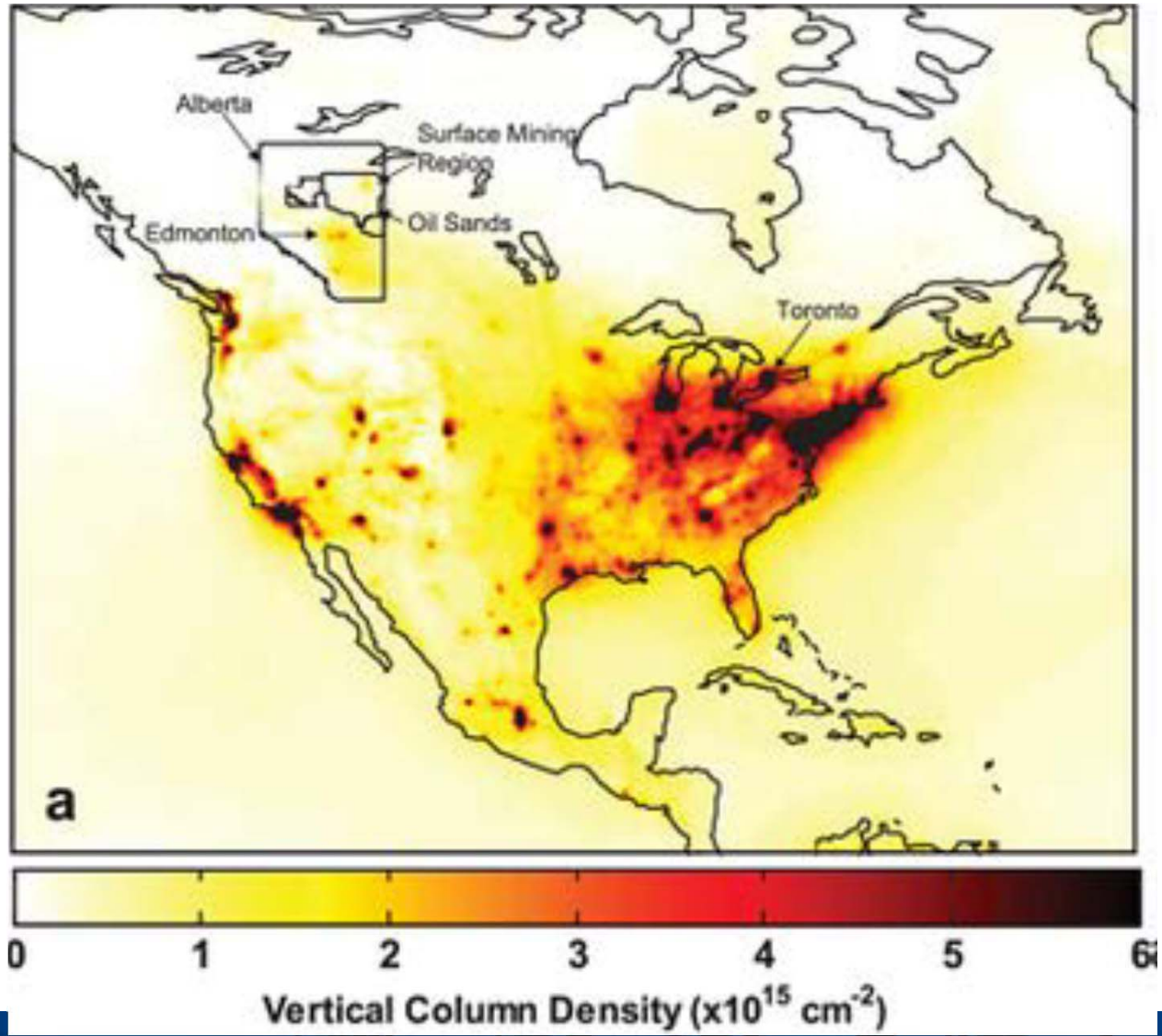


Air issues - Ozone



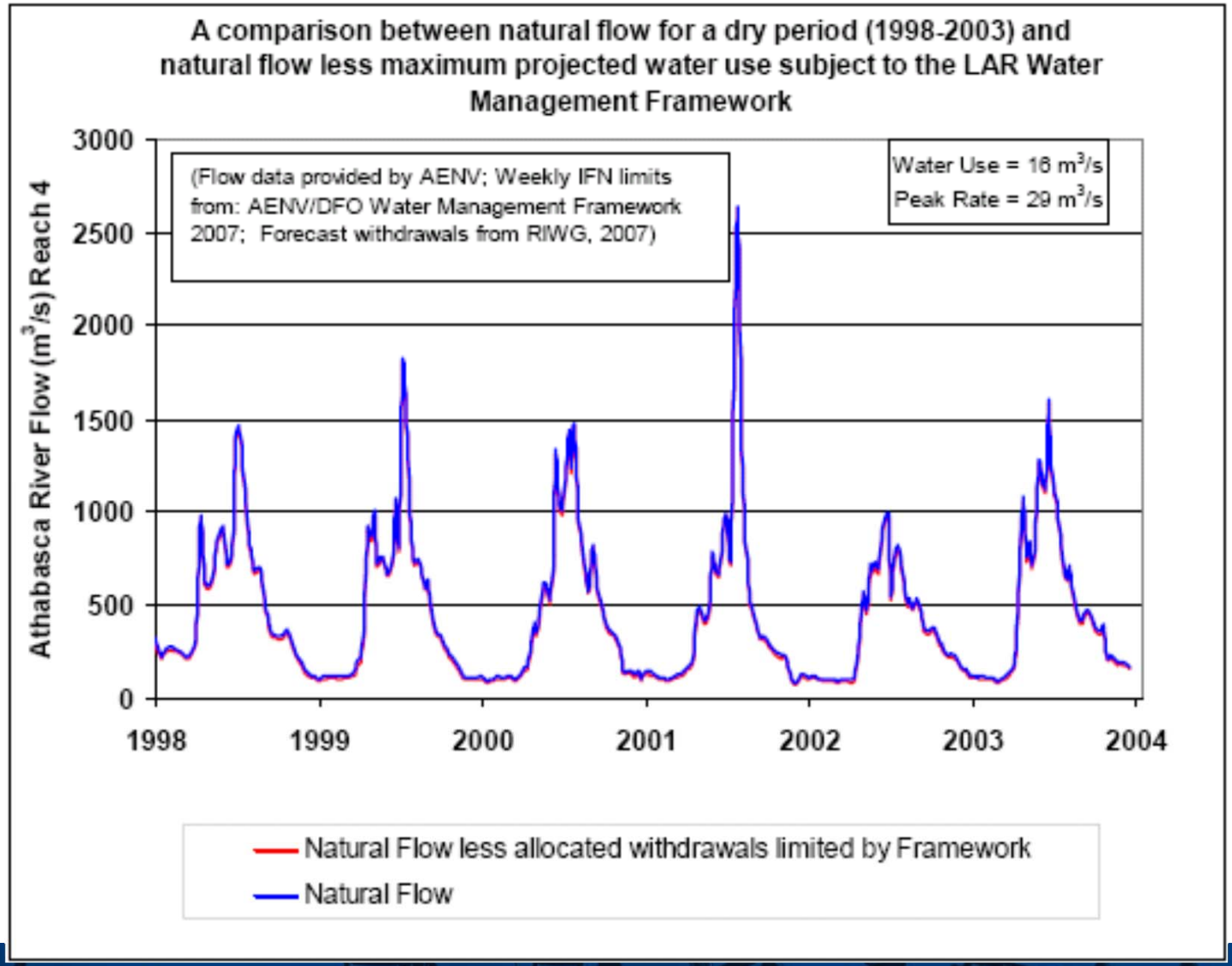
Environment Canada, 2011

NO_2 and SO_2 emissions

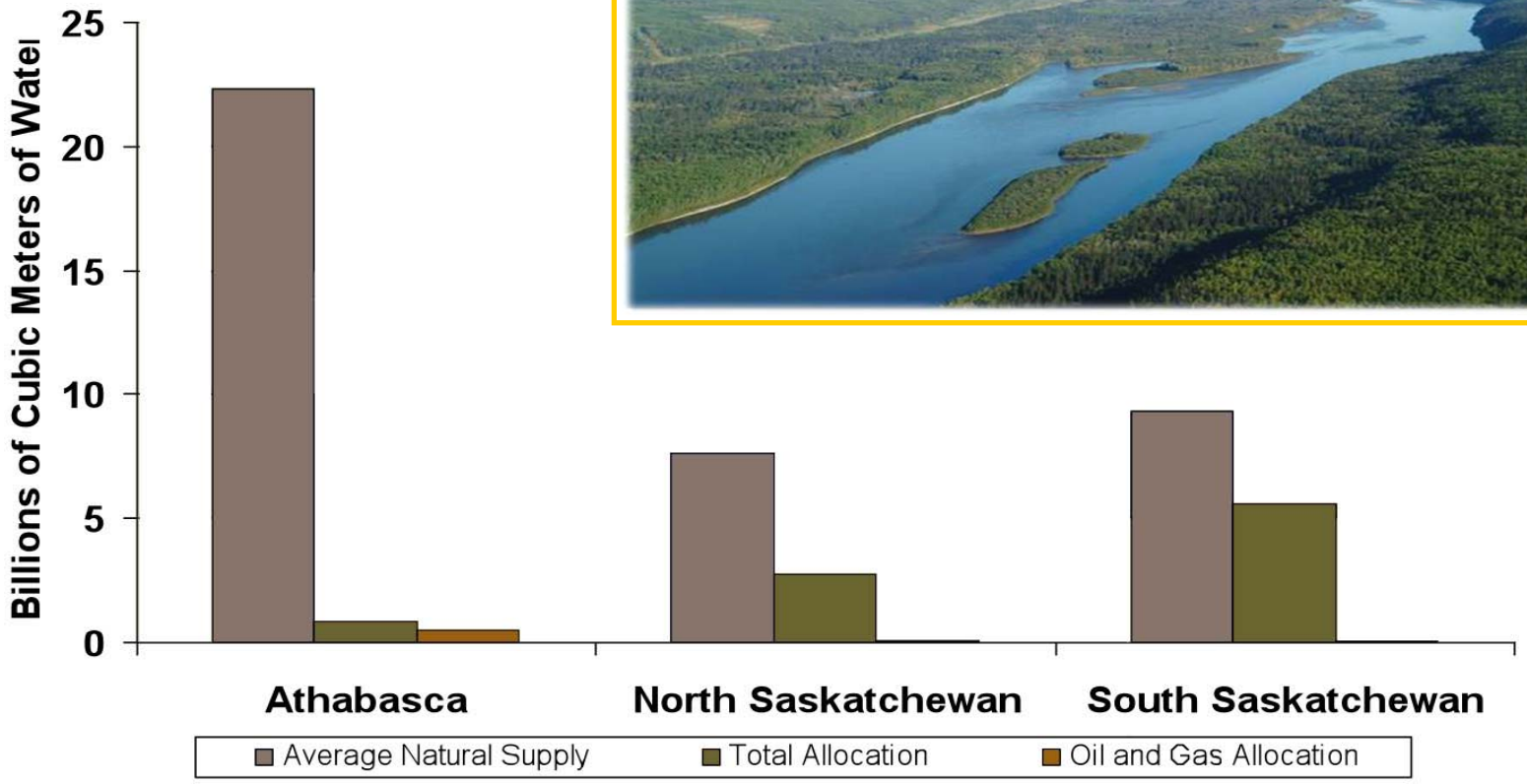


McLinden, C. A. et al, 2012

Athabasca river water use



Water use from Alberta river basins



Biodiversity

- Alberta Biodiversity Monitoring Institute
  - Report on Upland Birds – September 2012
  - Boreal Forest in Alberta – 80% intact
  - Boreal Forest in Oil Sands area – 85% intact
  - Primary Reason – Bird species associated with agricultural habitat

Land Disturbance

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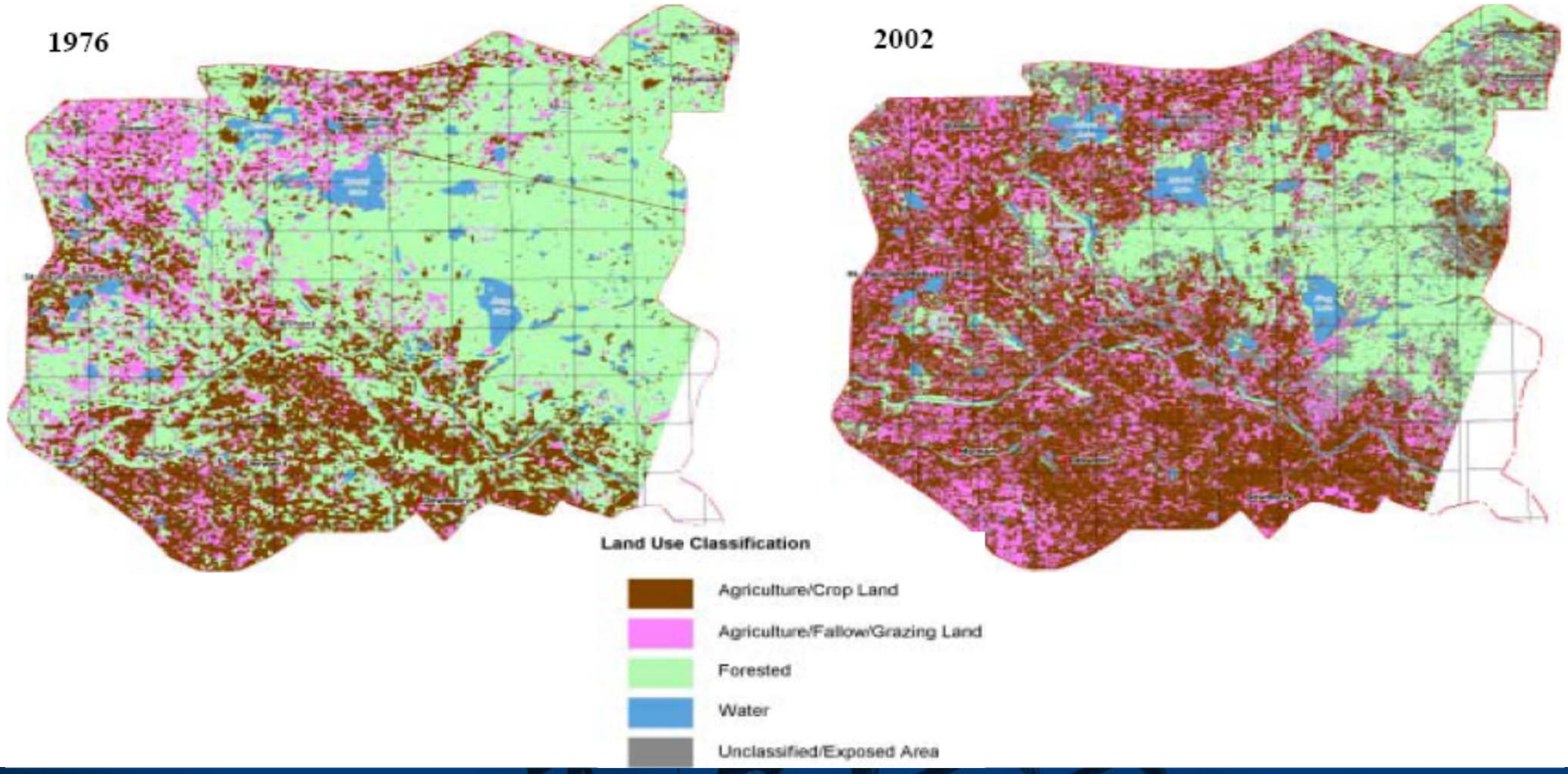
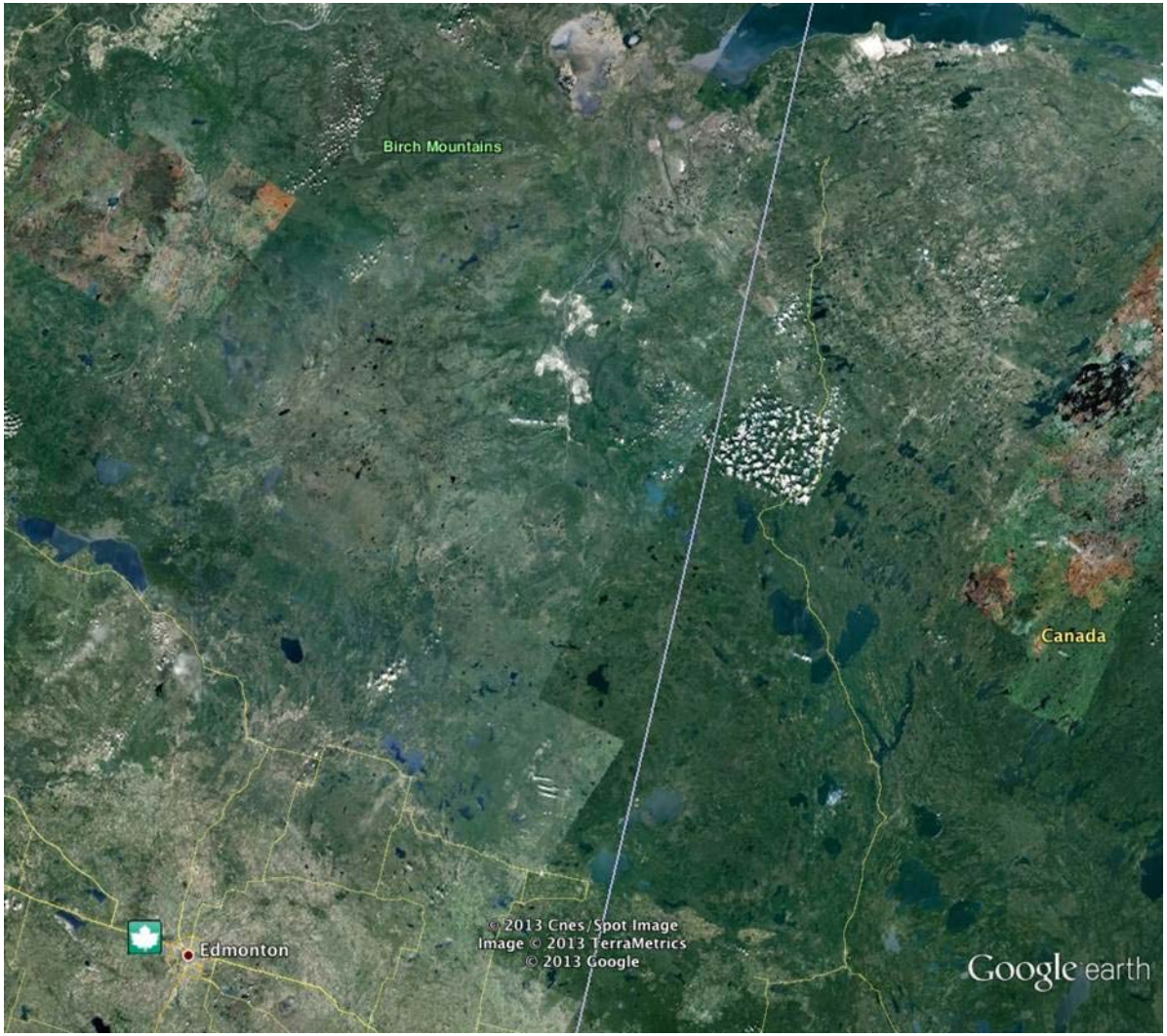
Loss of Boreal Forest in the Cold Lake Area



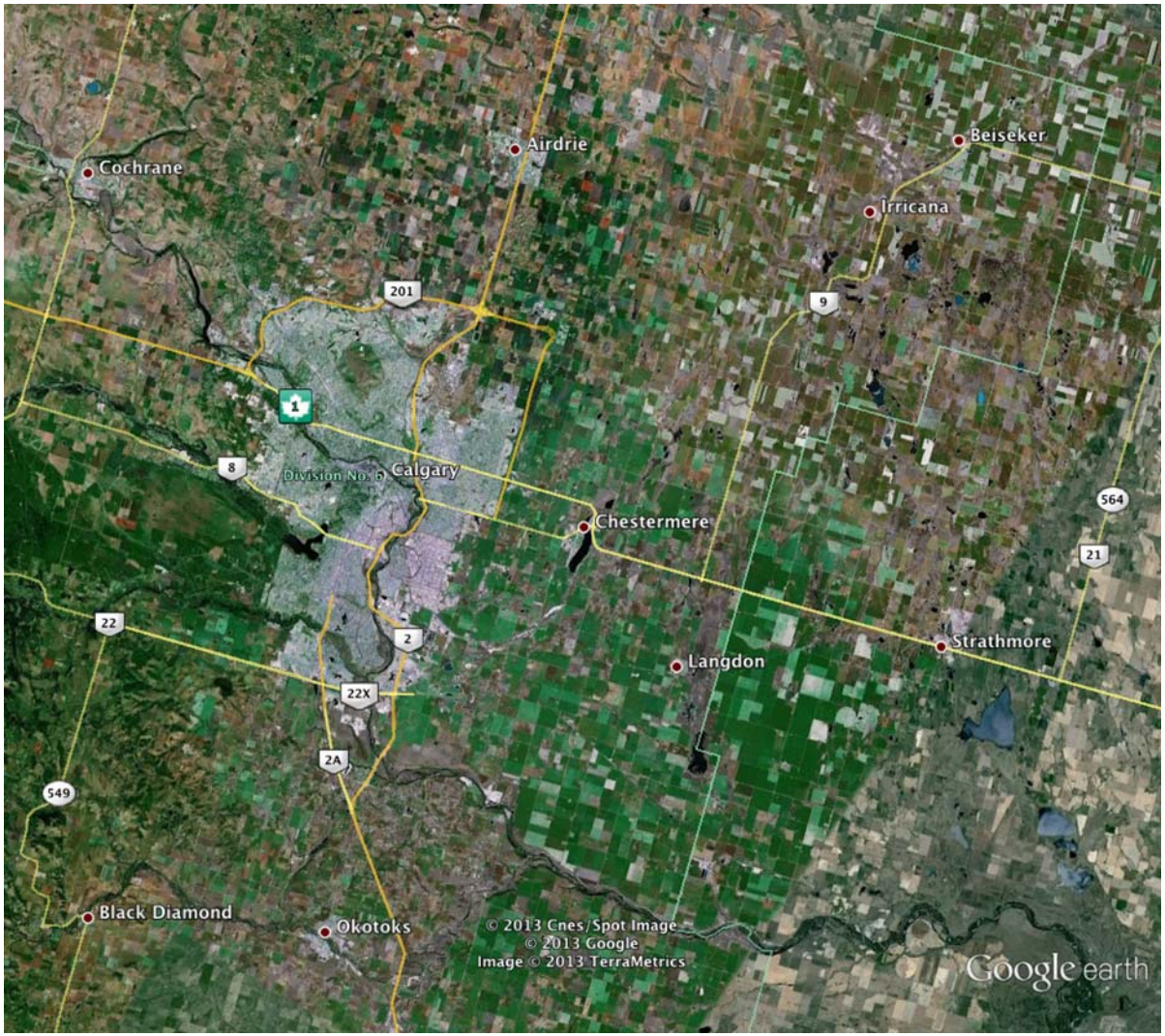
Lower Athabasca



In situ Development

Oil Sands Mining

Calgary


Airdrie
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Black Diamond
Okotoks
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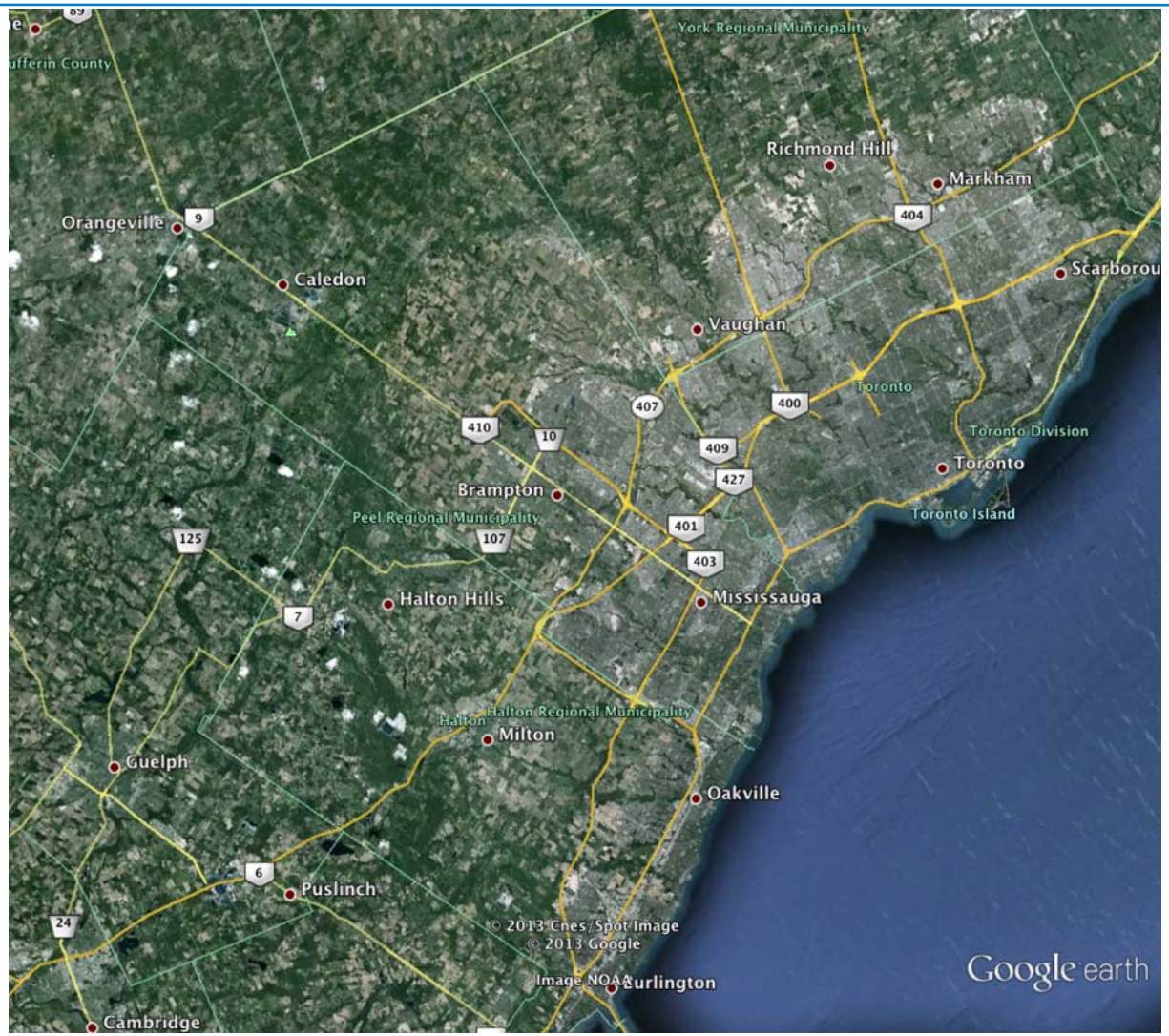
Toronto


York Regional Municipality
Richmond Hill
Markham
Orangeville
Caledon
Vaughan
Toronto
Toronto Division
Toronto
Toronto Island
Brampton
Peel Regional Municipality
Halton Hills
Mississauga
Halton Regional Municipality
Milton
Guelph
Oakville
Puslinch
Cambridge
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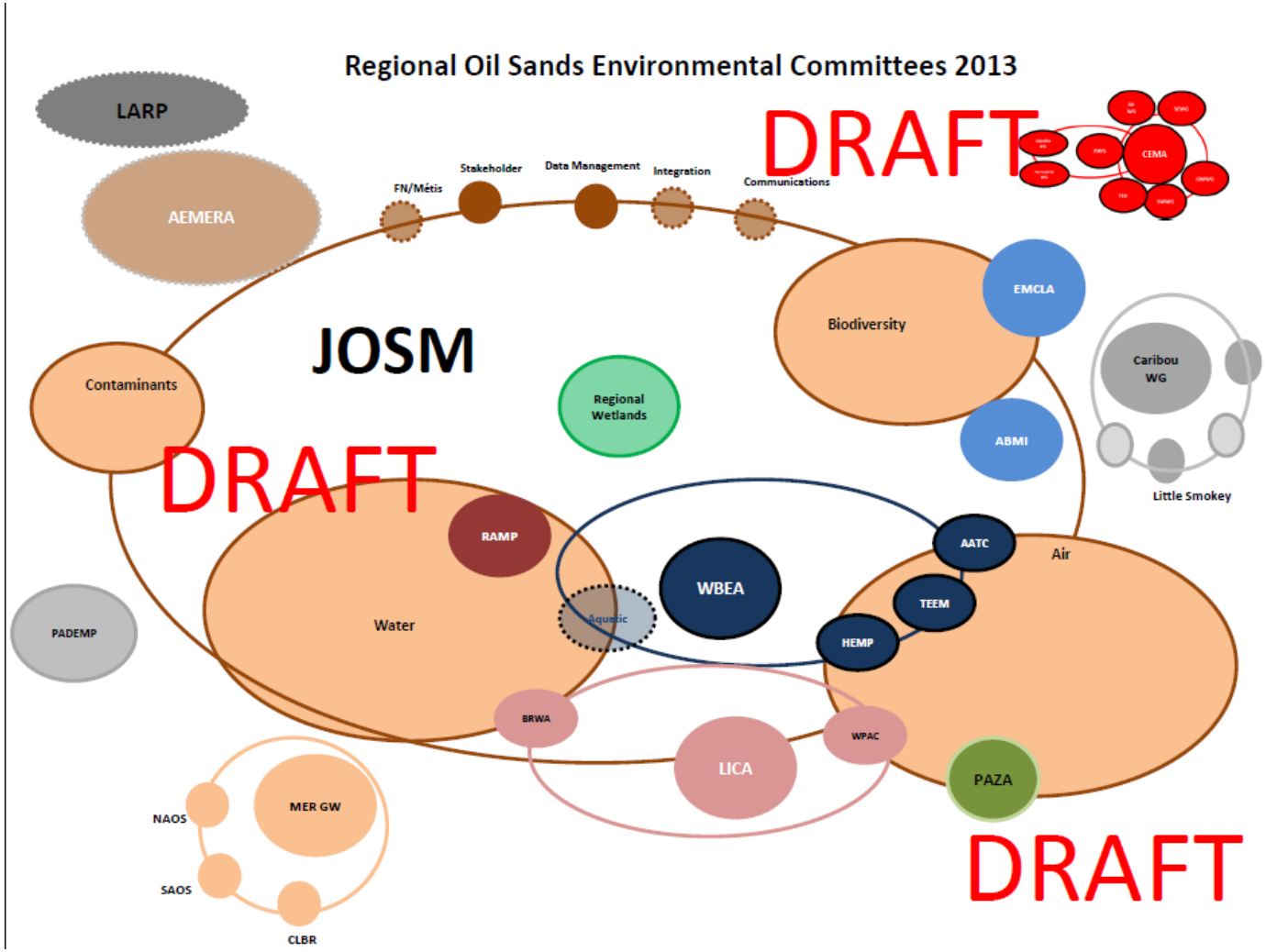
Evolving Regulations

- Aboriginal consultation requirements
- Caribou recovery plans
  - Provincial and Federal, SARA
- Environmental performance improvements
  - Tailings Directive
  - Land Stewardship Act and Land Use Plans
- Water use
  - Fresh, brackish and produced water
- Manage growing issues
  - Cumulative air emissions, NOx policy, GHG
- Address changes in technical operations
  - Cap rock integrity, polymer addition
- Enhancement to regulatory performance
  - Single regulatory agency
  - Enhanced Approval Process

Environmental Monitoring

- Compliance
  - Strict requirements for maximum emissions
  - Limits on use of water
  - Reclamation standards
- Regional Framework triggers and limits
  - Air, water and groundwater quality
  - Biodiversity and tailings management in preparation
- Public assurance
  - Transparent reporting
  - Scientifically credible
  - Regional cumulative effects
- Joint Oil Sands Monitoring

Oil Sands Monitoring



What was the Problem?

- Monitoring evolved from direct compliance to regional assurance
- Compliance standards expanded through ad hoc process
- Data was viewed as a financial resource
- Expectations to deliver beyond scope
- New analytic techniques
- Opposition to oil sands

Need for Monitoring

- Determine if project impact effects are within predictions
- Assurance of environment performance of mitigation program
- Meet regulatory requirements of approvals
- Indicate where improvements required to operational performance
- Measure magnitude, duration and residual nature of impacts

Regulatory Requirements for Monitoring

- Approvals contain specific conditions for monitoring
  - Water
  - Air
  - Land
  - Wildlife
  - Biodiversity
- The monitoring program must deliver these
  - Existing monitoring groups perform mandatory monitoring
  - Multi-stakeholder involvement

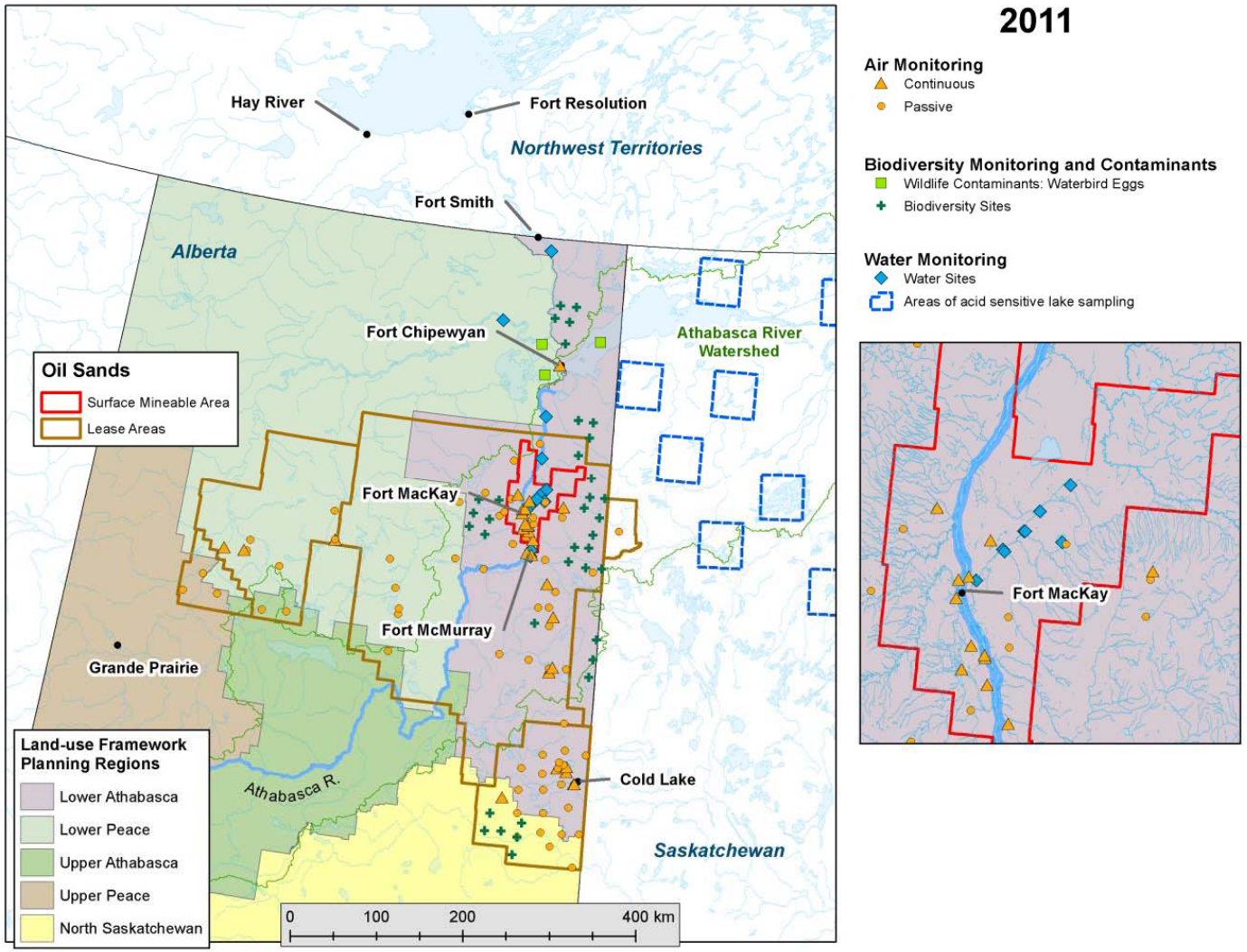
Existing Regional Oil Sands Monitoring Plan

- Wood Buffalo Environmental Association, Lakeland Industry Community Association, Peace Air Shed Zone Association
  - Air emissions
  - Terrestrial Effects (soil and vegetation)
- Regional Aquatic Monitoring Program
  - River quality
  - Sediment
  - Benthics
  - Lake acidification
  - Fisheries
- Alberta Biodiversity Monitoring Institute
  - Measure of intactness across a suite of indicators
- Ecological Monitoring Program
  - Rare plants
  - Bird species of concern
  - Caribou

Existing Regional Oil Sands Monitoring Plan cont'd

- Reclamation Working Group
  - Reclamation Performance
  - Wetlands
- Wildlife
  - Mammals
  - Owls
  - Bats
  - Migratory birds
  - Amphibians
  - Rare species

Existing Monitoring

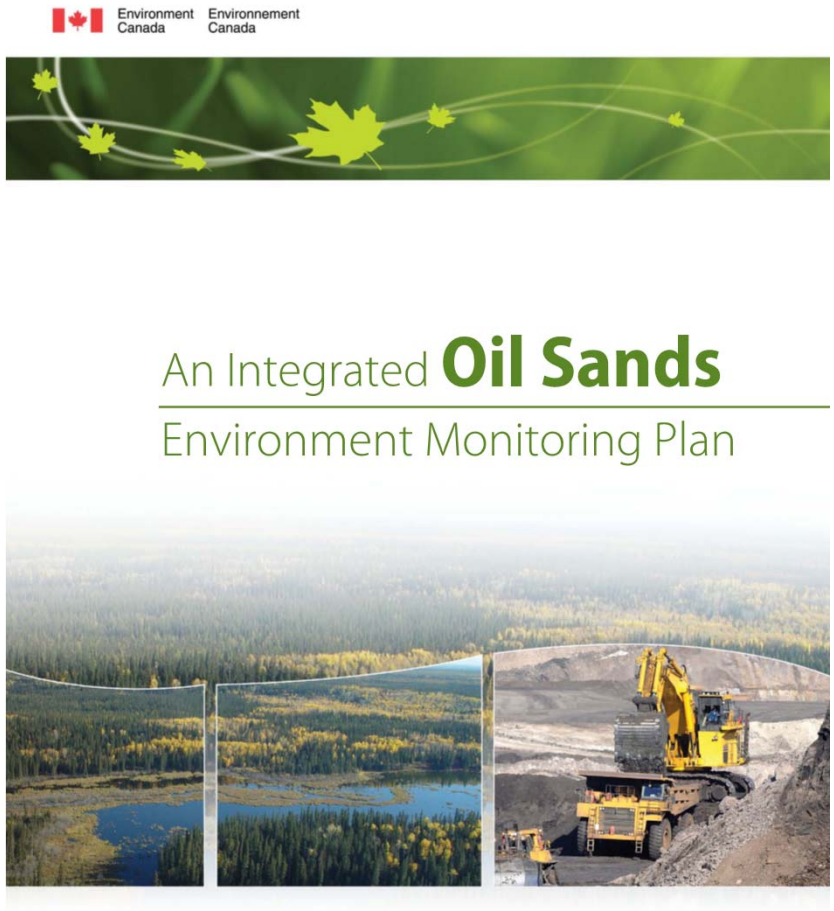


Project Level Monitoring

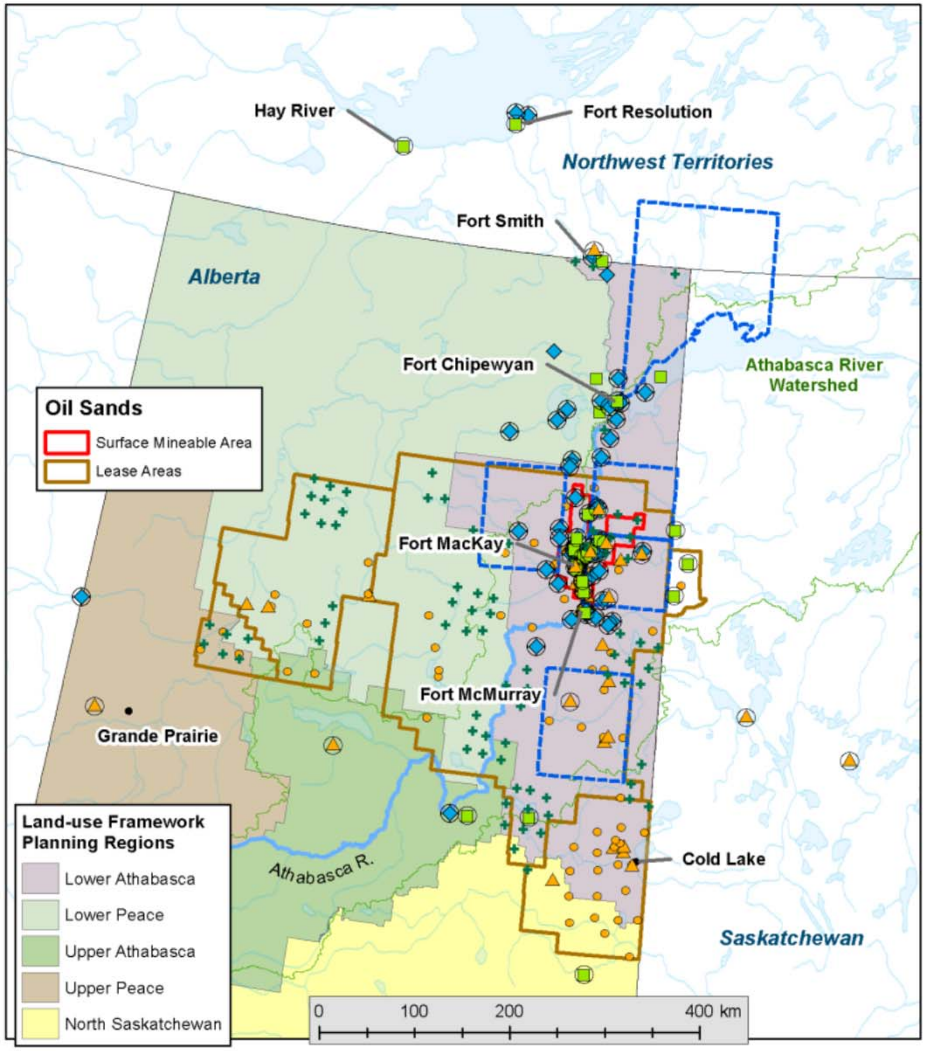
- Land disturbance
- Wildlife activities
- Bird activities
- Fisheries
- Noise
- Water quantity and quality
- Air emissions
- Reclamation

The Future Monitoring

- Integrated, holistic monitoring
  - Scientifically based to assess impacts from oil sands, other sources and to distinguish from background
  - Air
  - Water
  - Biodiversity



Proposed Monitoring

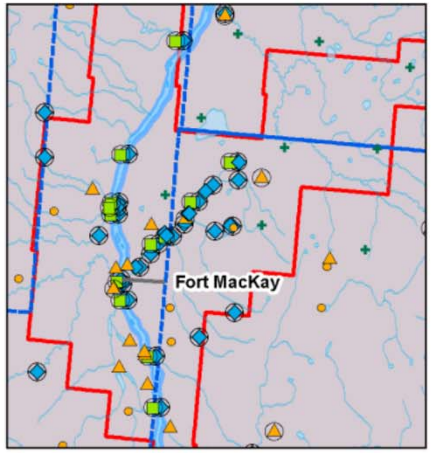


2015

Air Monitoring
- Continuous
- Passive
- New air sites

Biodiversity Monitoring and Contaminants
- Wildlife Contaminants: Waterbird Eggs
- New Wildlife Contaminant Sites
- Biodiversity Sites (see below)

Water Monitoring
- Water Sites
- New Water Sites
- Areas of acid sensitive lake sampling



Not Shown

Air Monitoring :
- 1 new site in Man., 1 new site in Sask.

Biodiversity Monitoring :
- Balance of 414 sites (20x20 km grid) in the Oilsands Areas and Lower Athabasca Planning Region sampled on a 5 year cycle.
- Sites added for rare species, reference sites, and cause effects monitoring.

Background on Oil Sands Monitoring Review

- Royal Society Review - 2010
- Federal Expert Panel Review - 2010
- Provincial Expert Panel Review – 2011
- Provincial Panel Recommendation on Monitoring - 2011
- Federal Integrated Monitoring Program – 2011
- Joint Oil Sands Monitoring Implementation – 2012
- Provincial Oil Sands Environmental Monitoring - 2012

Joint Oil Sands Monitoring

- Background effects
- Regional cumulative effects (air, land & water)
- Long-range transport effects
- Fulfills regulatory requirement for regional effects monitoring
- Does not conduct project, site-specific monitoring, e.g:
  - Air emissions
  - Groundwater
- Conducts research on new monitoring techniques, technology, protocols and laboratory analysis
- Addresses pathways of potential impacts
  - Air → water & land → animals & human health
- Scientific peer review

Objectives of JOSM Program

- Support sound decision-making by governments as well as stakeholders.; Ensure transparency through accessible, comparable and quality-assured data;
- Enhance science-based monitoring for improved characterization of the state of the environment and collect the information necessary to understand cumulative effects;
- Improve analysis of existing monitoring data to develop a better understanding of historical baselines and changes, and;
- Reflect the trans-boundary nature of the issue and promote collaboration with the Governments of Saskatchewan and the Northwest Territories.

Monitoring Program Deliverables

- Air quality
- Acid sensitive lakes and accumulated aerial deposition
- Water quantity/quality
- Aquatic ecosystem health – Fish status and health, benthic invertebrates and other aquatic biota
- Wildlife toxicology
- Terrestrial biodiversity and habitat disturbance
- Data management

Land Use Framework and Cumulative Effects Plan

- Lower Athabasca Regional Plan effective September 1, 2012
  - Regulation on regional environmental limits
  - Defined limits in frameworks
    - Air quality
    - Water quality
    - Groundwater quality
  - Commitment to establish frameworks for:
    - Tailings
    - Surface water quantity
    - Biodiversity

Delivery of the Monitoring Plan

- Agreement with Provincial and Federal Governments
- Implementation using researchers and consultants
- Stakeholder engagement – Aboriginal people, public, local government, industry
- Industry funded
- Inclusion of all monitoring media in one to assess cumulative effects

Meeting Requirements

- Monitoring based on extensive reviews conducted in 2010/2011
- Encompasses all existing programs and regulatory requirements
- Increases spatial and temporal sampling
- Improved detection limits
- Improved methodology and protocols
- Assessment to Framework Limits
  - Surface Water Quality
  - Groundwater Quality
  - Air Emissions (NOx and SO_2)
  - Frameworks in Development
    - Surface Water Quantity
    - Tailings Management
    - Biodiversity and Land Disturbance

What is Missing?

- Regional scale environmental baseline
- Landscape Management Objectives
- True cumulative effects assessment
- Establishment of publicly accepted thresholds
- Integration of all issues
- Process for science to inform decision making
- Clear and measurable linkages to Lower Athabasca Regional Plan and JOSM output
- Transparency

Will the Program Deliver?

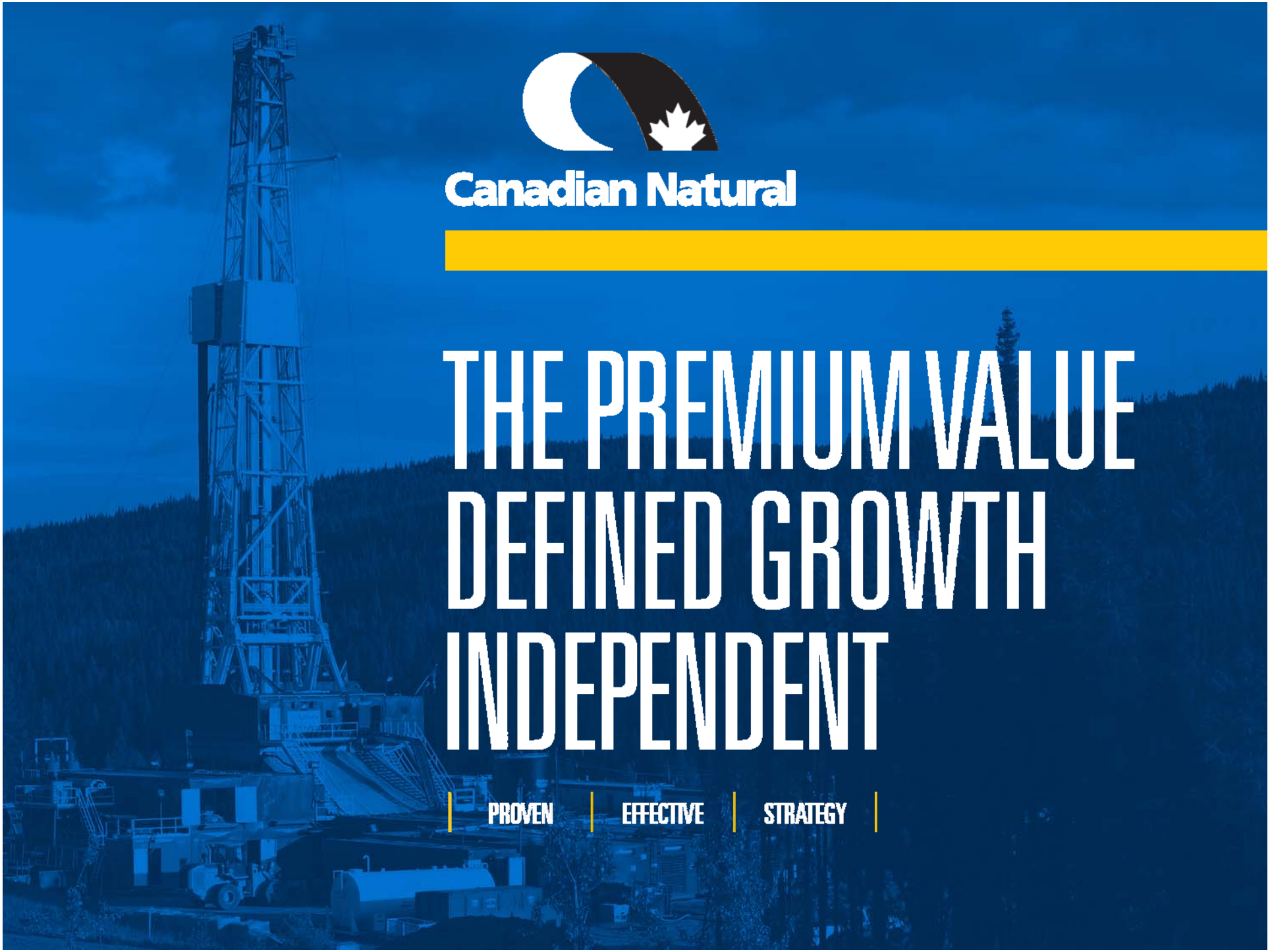
- Monitoring has been conducted for over 30 years
- The program elevates world class to a new level
- What if no impacts beyond approved levels exists?
- Is the issue oil sands or environmental effect?
- Are we willing to make decisions based on balance of benefits against impacts?

Purpose of Stakeholder Engagement

- Defined in regulatory requirements and case law definitions
  - Requirement to consult and to participate in process
- Meaningful engagement on issues pertinent to the project
- Factual discussion of impacts and their effects
- Not a debate of laws and regulations or policies of government

Industry challenges

- Accelerating performance
  - Technology and innovation
  - Regulatory enhancement
- Access to market
  - Oil price
  - Bitumen price differential
  - Regional differences of regulatory requirements, environmental performance and monitoring
  - Public support for pipeline access
- Public interest
  - Environmental focus
  - Increased regulations
  - Energy literacy – Economic and social value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