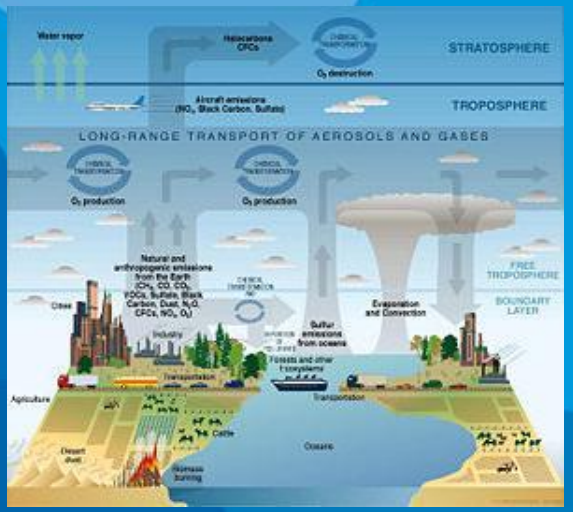
Cumulative Effects Modelling in the South Athabasca Oil Sands

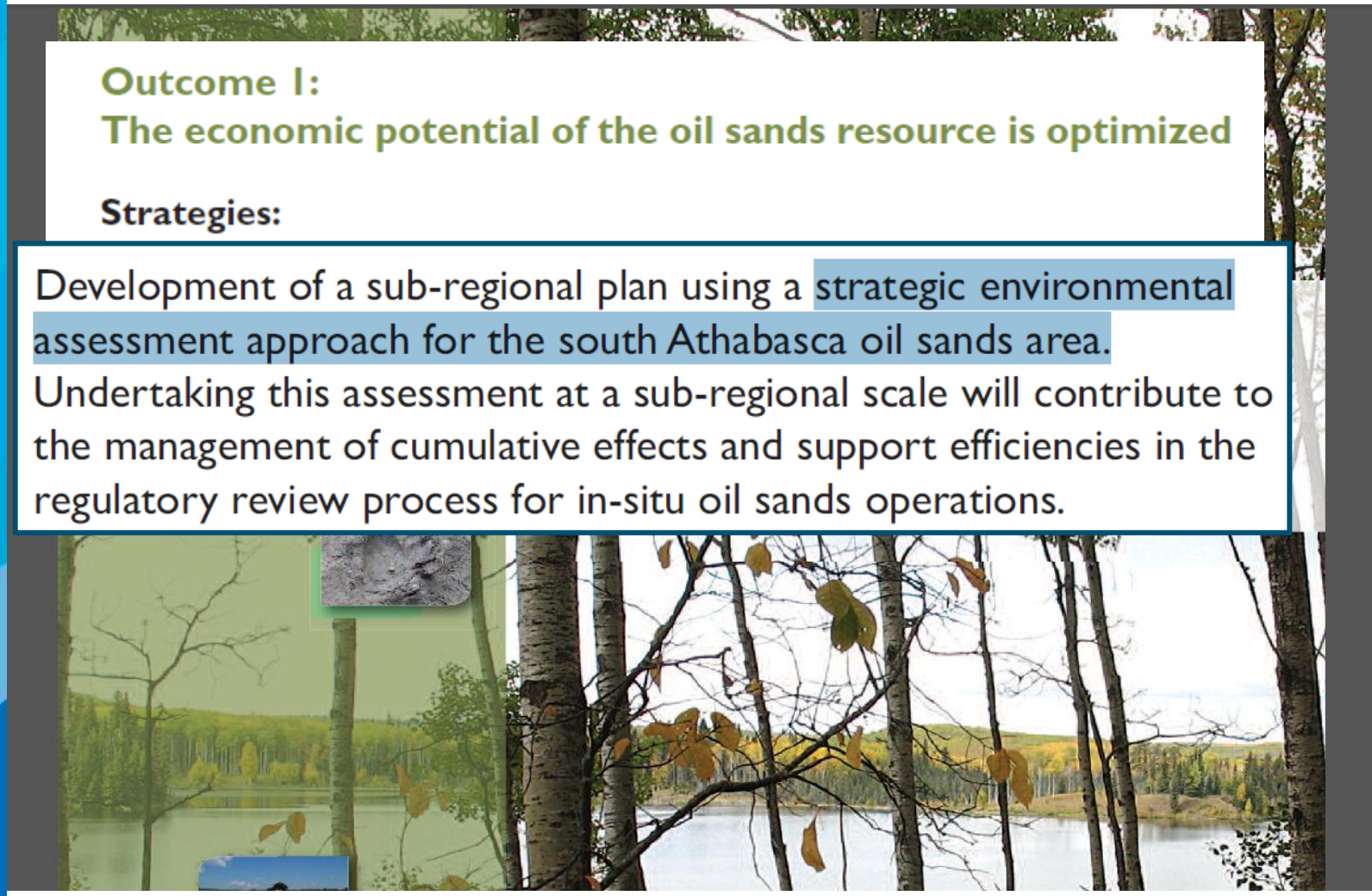
Environmental Modelling Workshop
March 14, 2013
Sarah Depoe – ESRD



Presentation Outline

- Policy direction for the South Athabasca Oil Sands (SAOS) Regional Strategic Assessment (RSA)
- What is Regional Strategic Assessment (RSA)?
- Cumulative Effects Approach in the SAOS RSA
- Environmental Models and Integration
  - Air Quality
  - Surface and Ground Water
  - Land and Biodiversity
  - Environmental Health Risk Assessment
- Lessons Learned

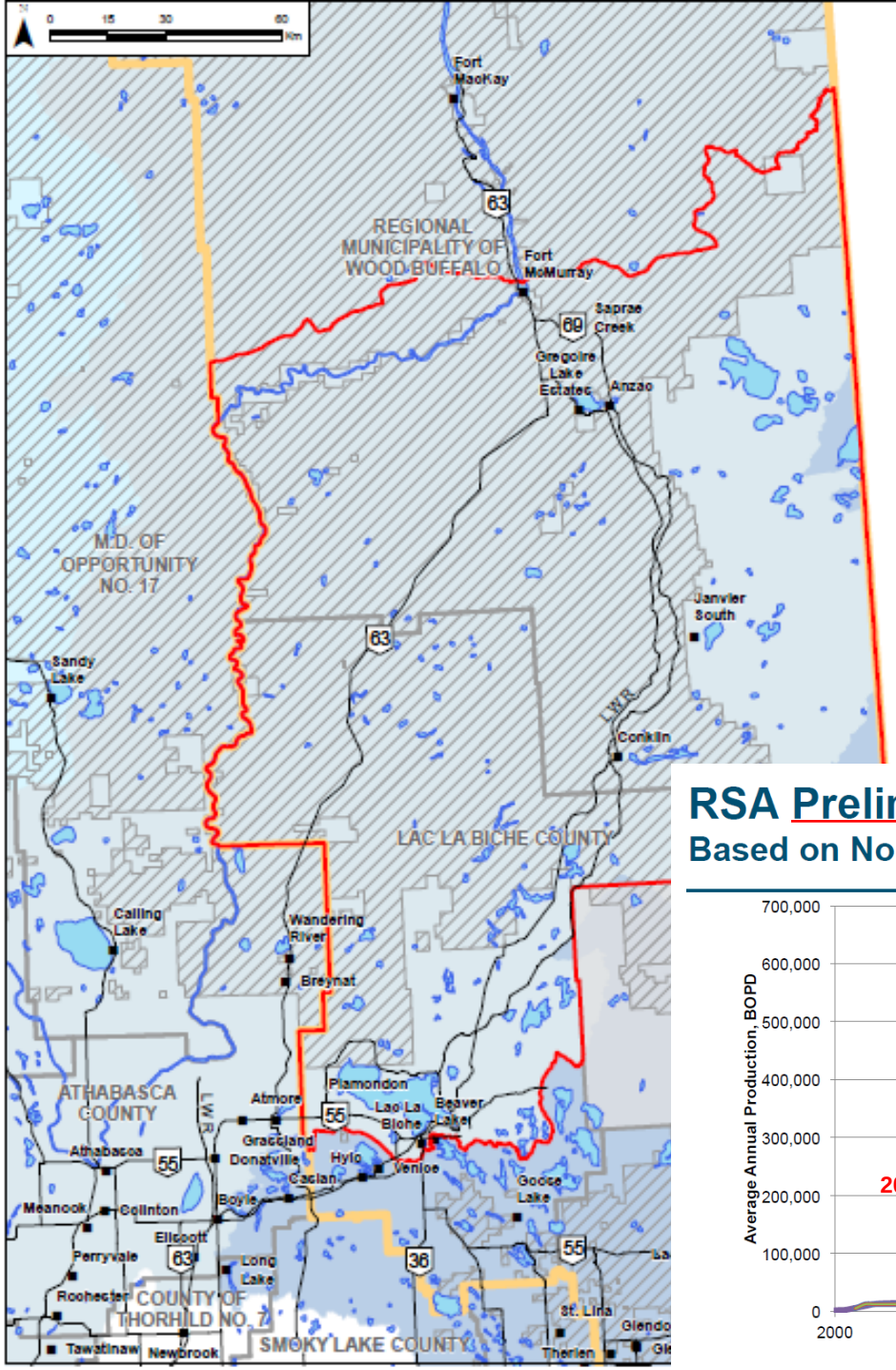
Policy direction



Outcome 1:
The economic potential of the oil sands resource is optimized

Strategies:

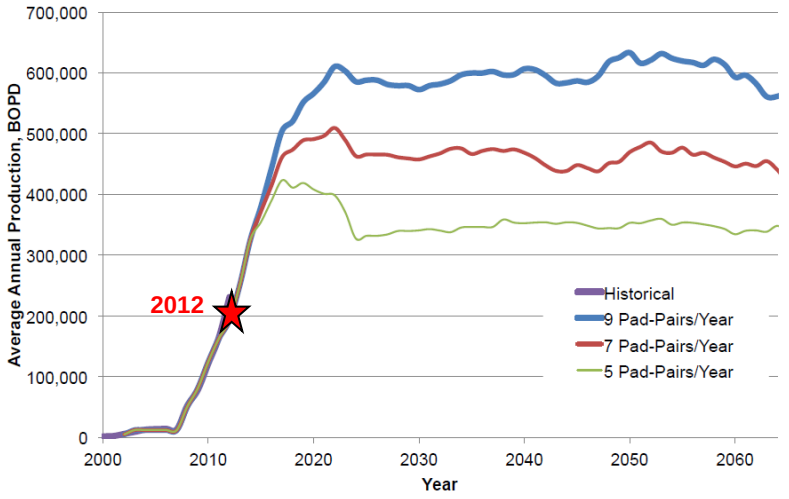
Development of a sub-regional plan using a strategic environmental assessment approach for the south Athabasca oil sands area. Undertaking this assessment at a sub-regional scale will contribute to the management of cumulative effects and support efficiencies in the regulatory review process for in-situ oil sands operations.



South Athabasca Oil Sands Regional Strategic Assessment Study Area

RSA Preliminary Production Scenarios

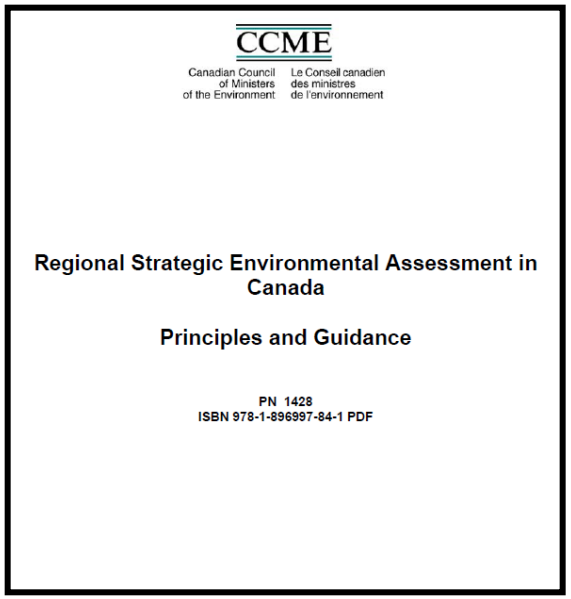
Based on No. of SAGD Pad-Pairs Added Annually



Regional Strategic Assessment (RSA): Definition

‘ A process designed to systematically assess the potential environmental effects, including cumulative effects, of alternative strategic initiatives, policies, plans or programs for a particular area’.

Canadian Council of Ministers of the Environment (CCME), 2009


CCME

Canadian Council of Ministers of the Environment | Le Conseil canadien des ministres de l'environnement

Regional Strategic Environmental Assessment in Canada

Principles and Guidance

PN 1428
ISBN 978-1-896997-84-1 PDF

Regional Strategic Assessment (RSA)

RSA merges the concepts of regional cumulative effects assessment and strategic environmental assessment.

It is valuable when:

- Rapid development of the regional area is anticipated
- Government wants to provide greater public confidence that decisions are being made with full consideration of the environmental impact.

RSA is intended to:

- Inform decision-making to ensure the sustainability of the region at a desired level of environmental quality (both biophysical and socio-economic)


Human footprint on landscape
Air emissions
Groundwater extraction
Habitat for species at risk (e.g. caribou)
Wetland loss
Environmental health effects
Traditional land use
© 2013 Cnes/Spot Image
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In Situ Oil Sands Development
Seismic Exploration
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Image Regional Municipality of Wood Buffalo
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RSA for the South Athabasca Oil Sands Area

Purpose:

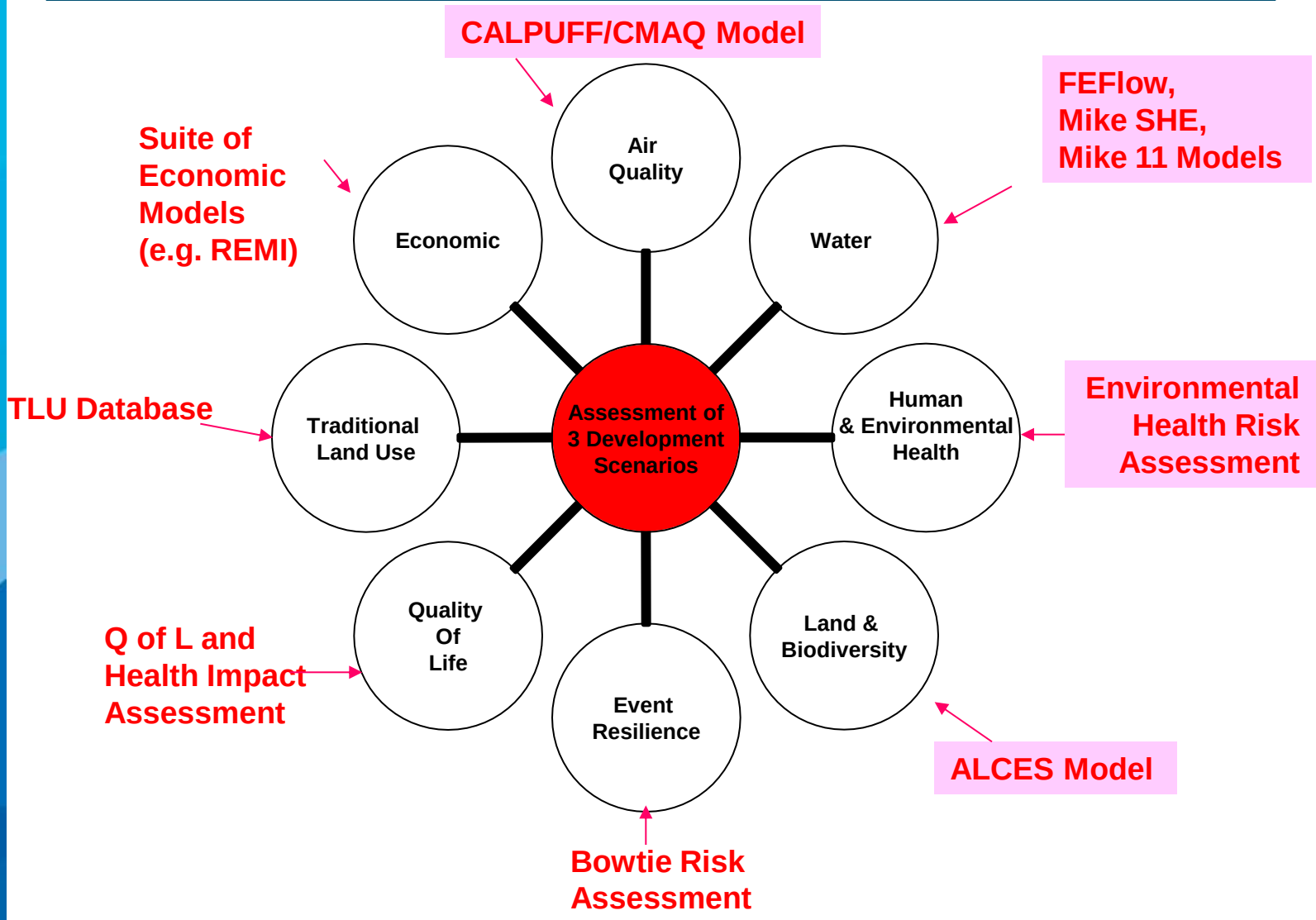
To inform decision-makers, planners, and stakeholders about:

(i) Cumulative effects of potential future development activities and other events and processes (e.g. demographic changes, natural events such as forest fires and floods)

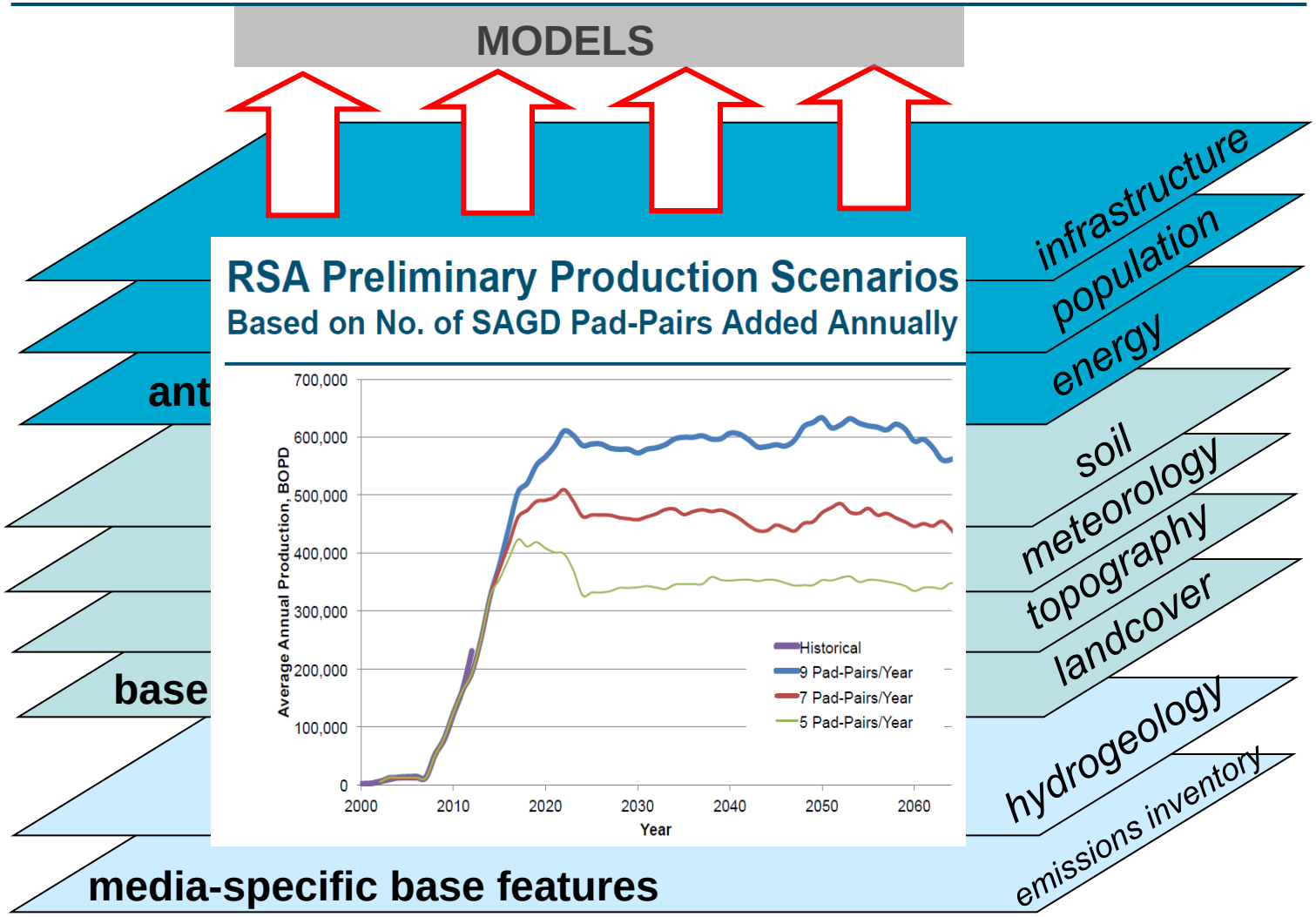
(i) Options for managing these effects such that desired outcomes are optimally achieved

(ii) Opportunities for regulatory enhancement

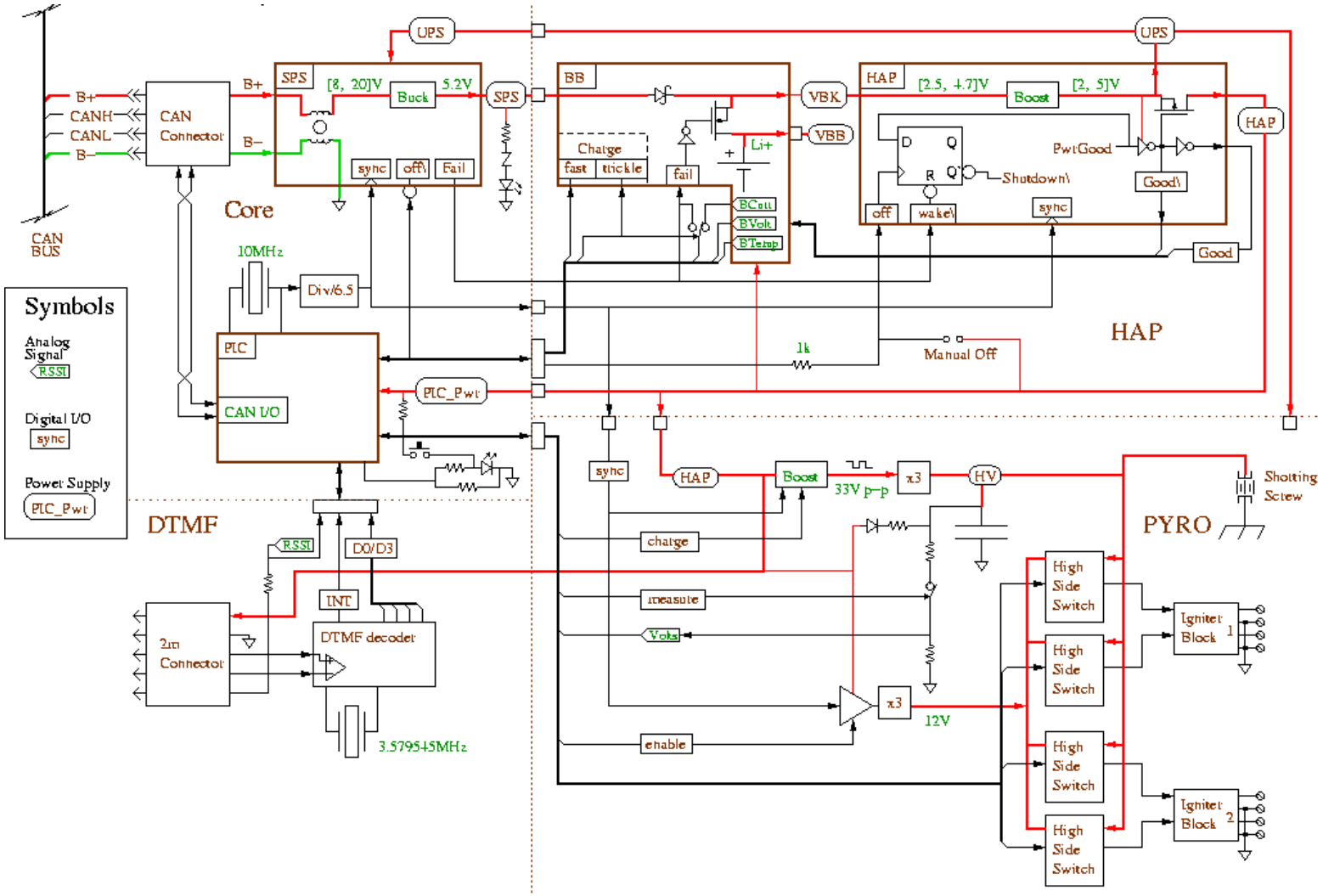
Regional Cumulative Effects Assessment



Integration: Same data inputs and scenario analysis



Air Quality: CALPUFF



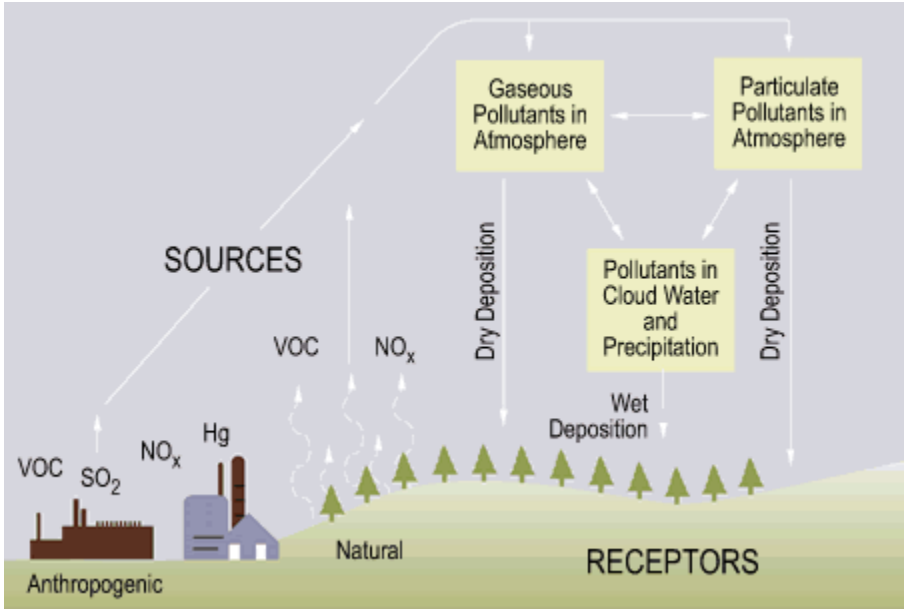
Air Quality Modelling

Currently using two models:

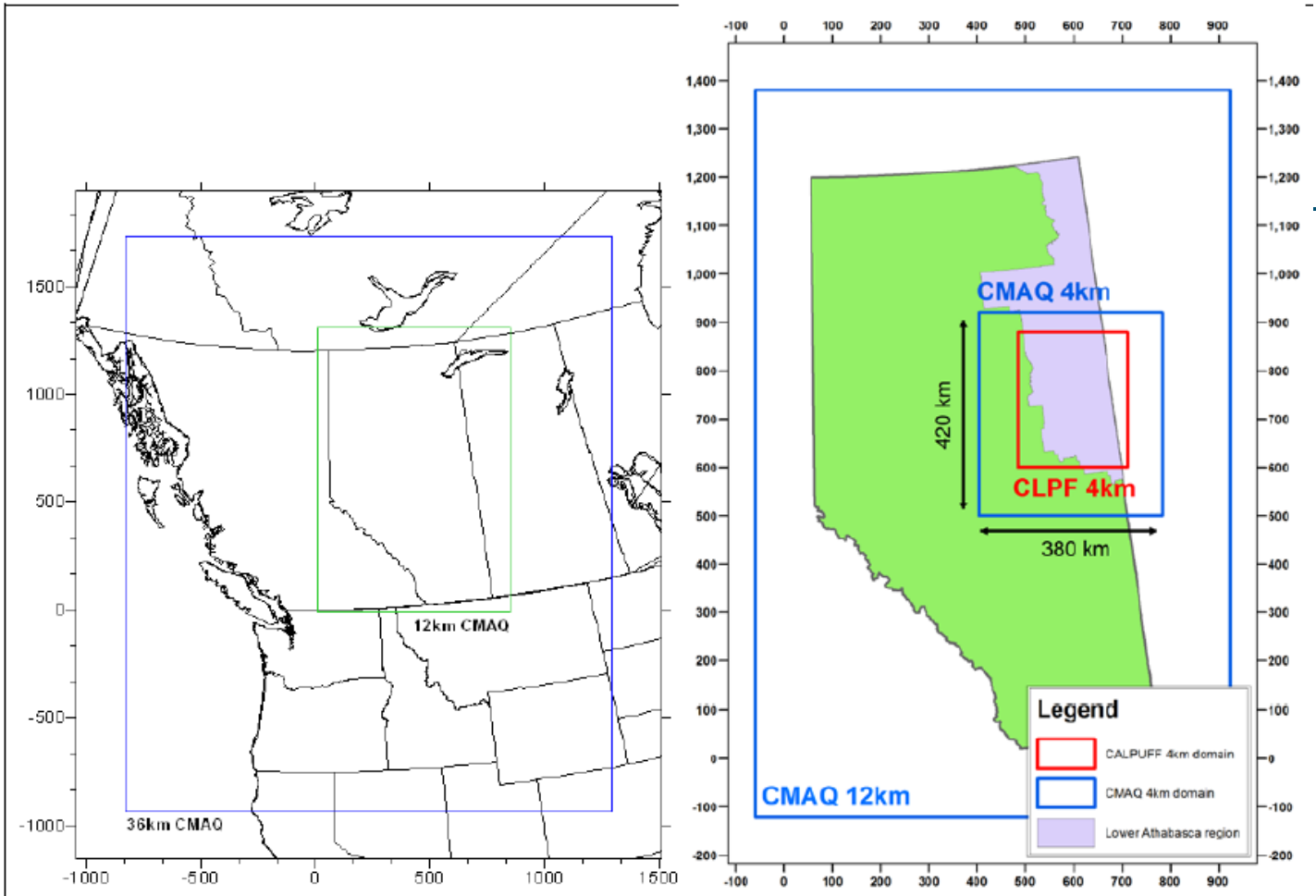
- CALPUFF modelling approach - transport and dispersion model
- CMAQ modelling approach - simulates multiple tropospheric air quality issues

We are using updated emissions inventories:

- TPM, $PM_{2.5}$, PM_{10}, SO_2, NO_2, CO, NH_3, TRS (e.g. carbon disulphide), acidic deposition, metals, PAHs, VOCs



Source: USEPA



SW Corner: (-828, -936) 59 x 74 cells 36 km
SW Corner: (-60, -12) 82 x 125 cells 12 km
SW Corner: (404, 500) 95 x 105 cells 4 km (CMAQ)
SW Corner: (484, 600) 57 x 70 cells 4 km (CALPUFF)

Figure 4-1. 36/12/4 km CMAQ modelling domains for the SAOS Region.

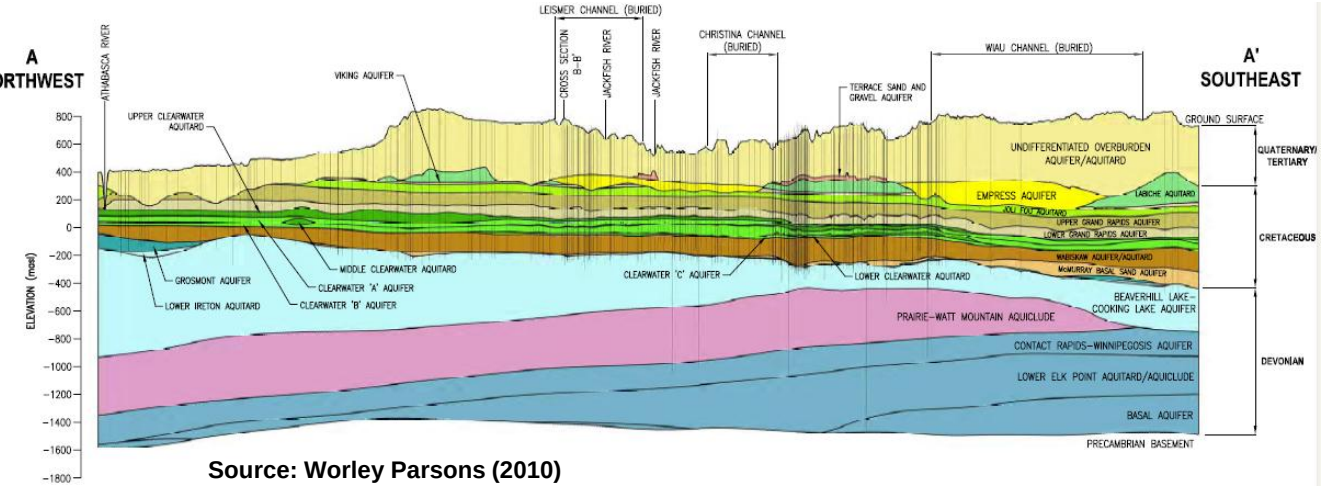
Water Modelling

Currently using three models:

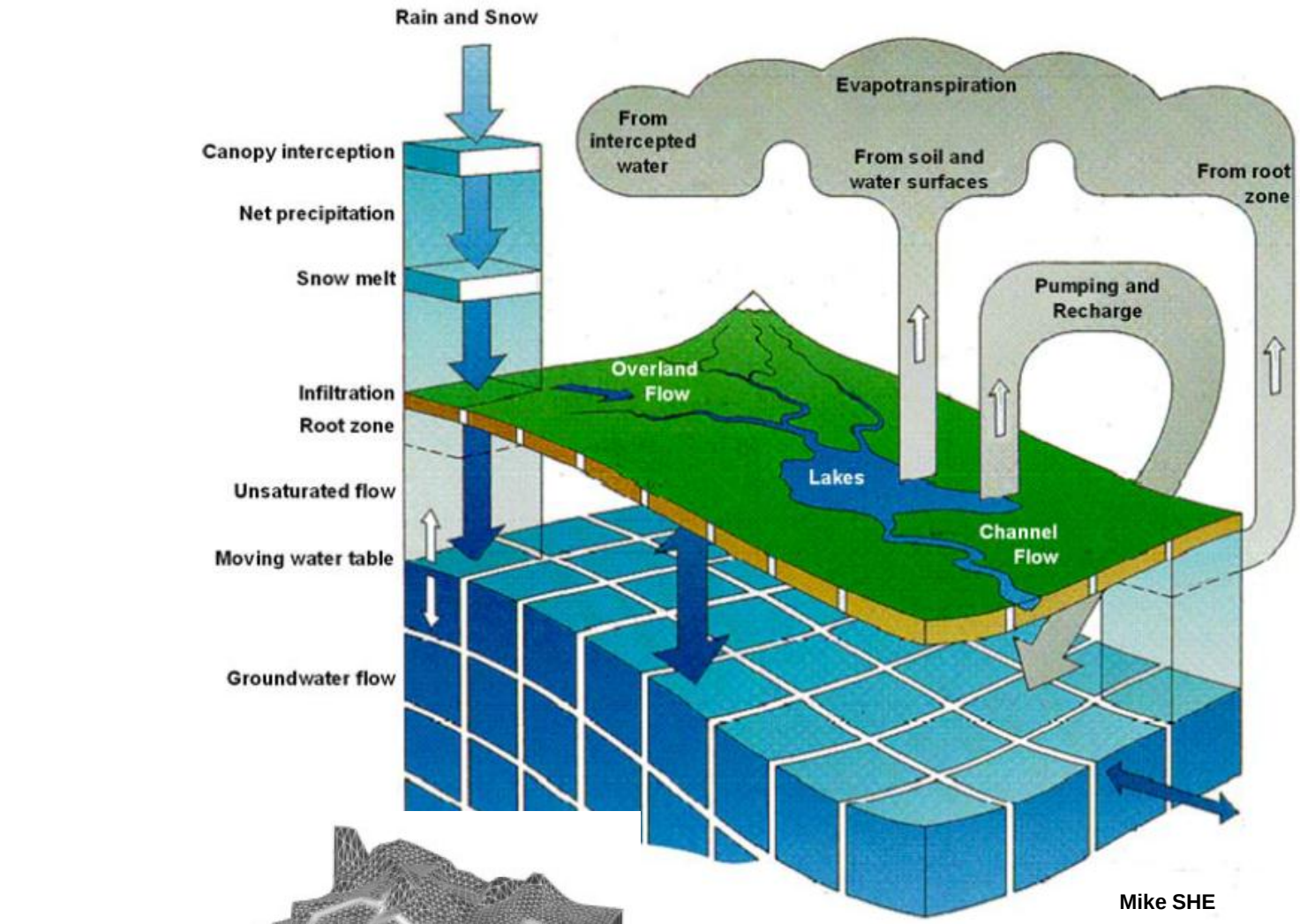
- FEFLOW – Advanced Groundwater Modelling
- Mike SHE – Integrated Catchment Modelling
- Mike 11 – River Modelling

Building on:

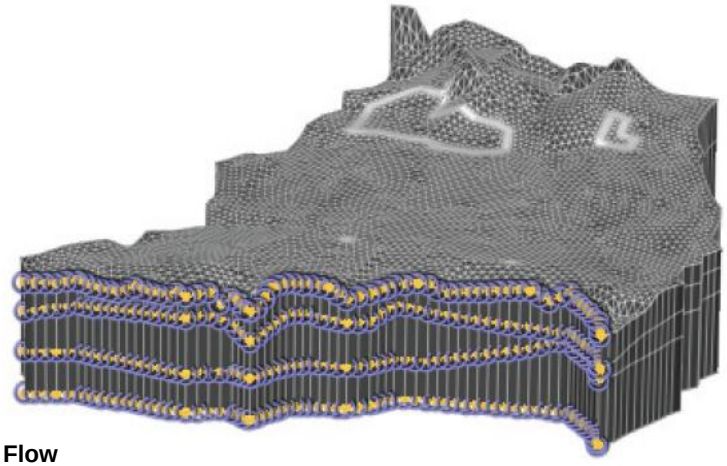
- Groundwater Flow Model for the Athabasca Oil Sands (In Situ) Area South of Fort McMurray (Worley Parsons, 2010)



Source: Worley Parsons (2010)



Mike SHE



FE Flow

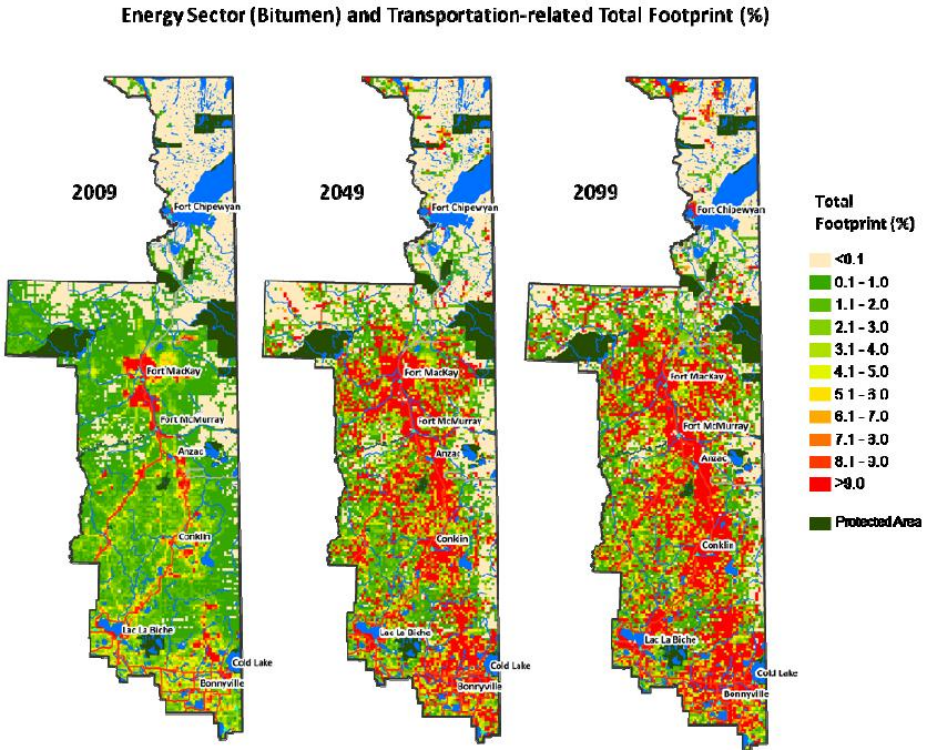
Land and Biodiversity

Modelling Approach

- ALCES/ ALCES Mapper
- Other spatially explicit modelling tools

Building on:

- Models developed to support the LARP



Source: LARP Report (ALCES Group, 2009)

Environmental Health Risk Assessment

EPA United States Environmental Protection Agency

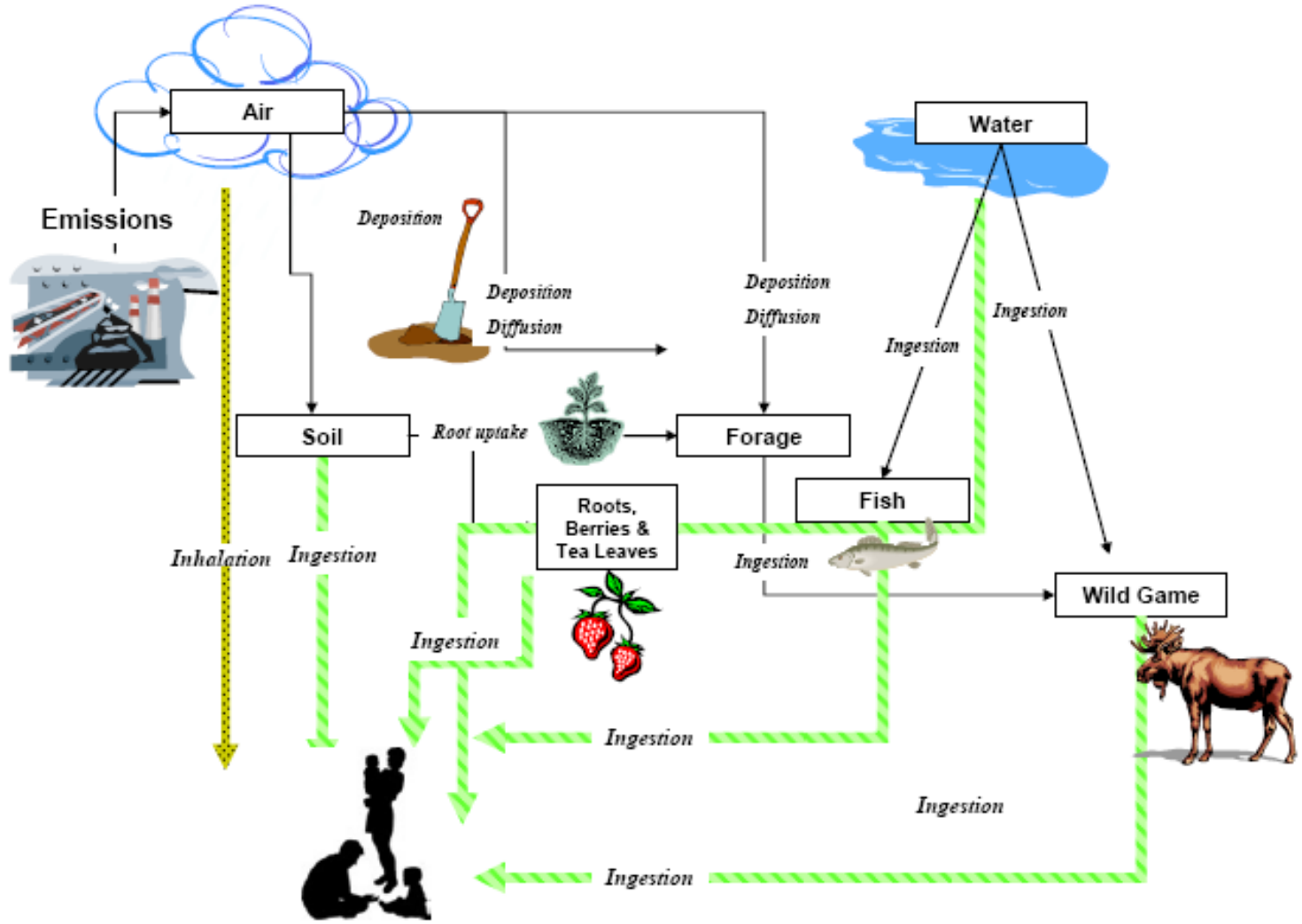
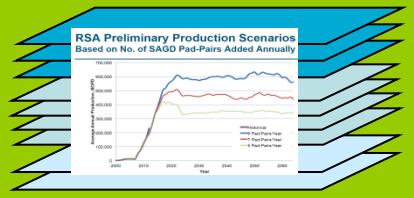


Image source: EIA Report

Model Integration

Air Quality
CALPUFF/CMAQ

Ground water
FEFLOW

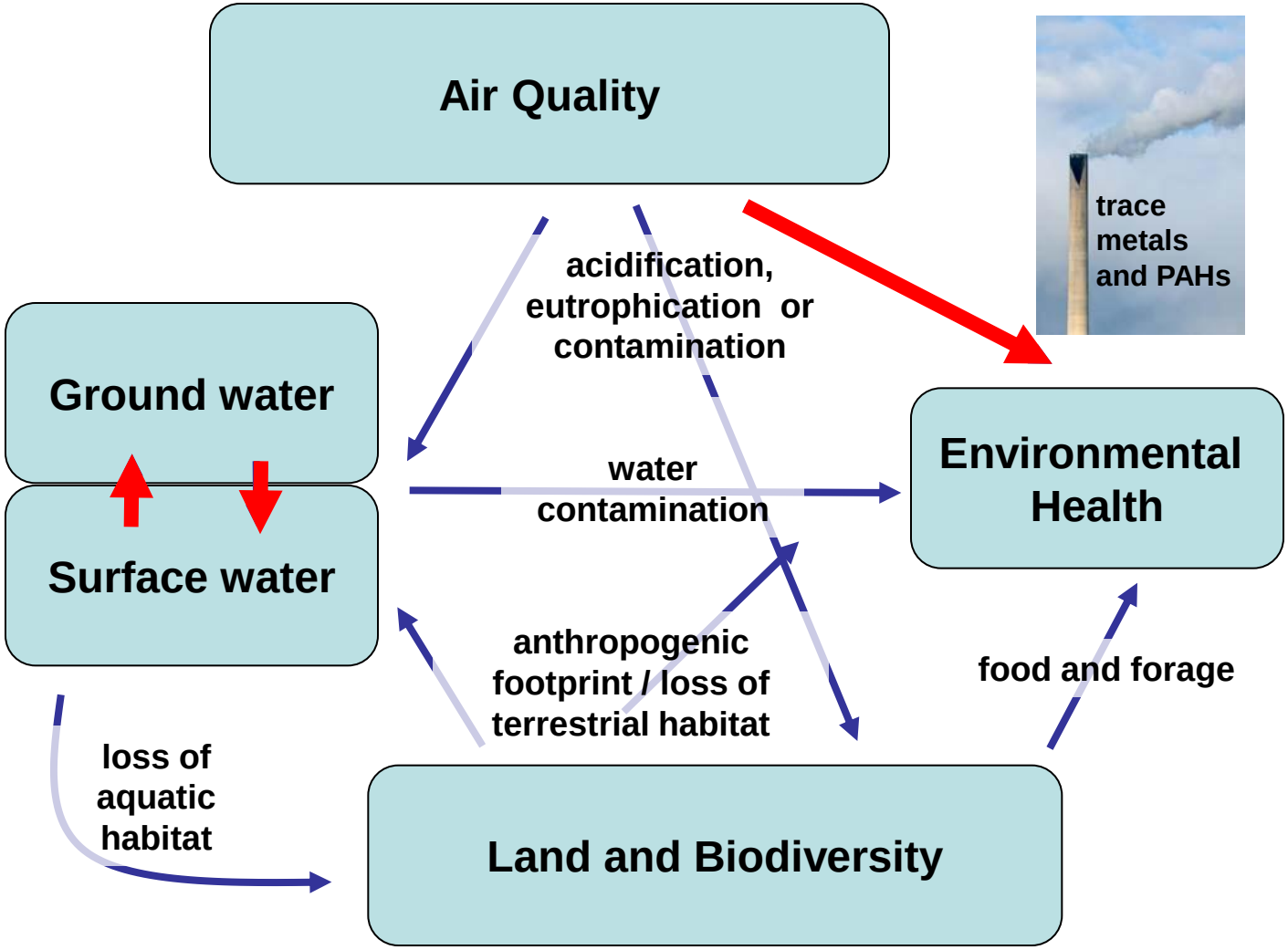


Environmental Health
EHRA

Surface water
Mike SHE / Mike 11

Land and Biodiversity
ALCES

Linking various model outputs in the assessment



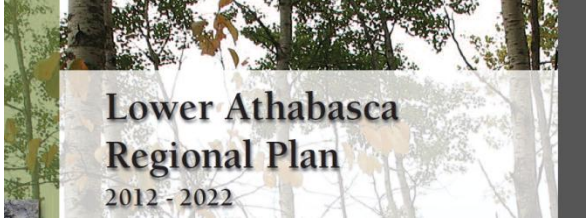
Lessons Learned

- Large data requirements to run models at this scale and complexity
- Time constraints
  - Computational time requirements
  - Integration among models hampered in part by the need to work in parallel versus in series
- Assumptions
  - The need to make assumptions around factors that may have significant impact on model outputs (e.g. reclamation rates of linear disturbance features)
- Data input quantity/quality
  - A lack of field data in certain cases, no data, or data with poor spatial and temporal representation.
- Inherent uncertainties about changes in climate, technology and demand for resources

Summary

- Models will provide valuable information to support decision making
- Environmental models are one aspect of the cumulative effects assessment
  - The SAOS RSA will include expert review, stakeholder engagement and other qualitative or quantitative assessment methods
- Use of information from each tool will be based on a foundation of knowledge of their limitations
- Cumulative effects assessments are complex
  - Continued efforts are needed to integrate and enhance our abilities to do it well
  - Reliant on good thinking

Major Outputs of the SAOS RSA



Profile of the SAOS Area Report

Spring 2013

- Present **general baseline** information regarding the condition of indicators related to **valued social, environmental and economic (SEE) components** within the area.
- **Form a chapter in the RSA report**
- **Articulate,** where information is available, the current issues, trends, drivers and pressures influencing conditions of SEE components.

SAOS Regional Strategic Assessment Report

December 2013

- **Present the cumulative effects assessment of three energy production scenarios** in the SAOS on the SEE components
- Explore potential **management options**
- **Provide guidance** for further scenario analysis that will support the development of an **SAOS sub-regional plan**

Acknowledgments

RSA Teams members that contributed to the content of the presentation (AESRD in-house modellers**)**

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- **Yaw Okyere**

Cumulative Effects and People