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2021 Virtual Symposium

April 20, 22, 27 & 29, 2021

2021 Conference Planning Committee

PGO gratefully acknowledges the work of the Conference Planning Committee in organizing this symposium.

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- Paul Hubley
- Imran Khan
- Roger Phillips
- Kristina Small
- Andrea Waldie
- Craig Waldie
- James Whyte
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Panel Session C

Resource Management: Infinite Wants and Minimal Wastes

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Panel Session C Co-Chairs

James Whyte, P.Geo.

Kristina Small, P.Geo.

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Presentation 1

Ontario Regulation 406/19 - Incorporating Requirements into Projects and Challenges

Pravina Singh
Group Leader
SNC-Lavalin Inc.

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Ontario Regulation 406/19 – Incorporating Requirements into Projects and Challenges Faced

Pravina Singh, SNC-Lavalin Inc.

April 27, 2021

Purpose of Presentation

- Brief overview of some of the requirements of O. Reg. 406/19 and the Soil Rules
- Review of challenges with regard to implementing the Regulation and the Rules during the planning phase
- Discussion

Soil Management in Ontario – Key Dates

- 2014: Management of Excess Soil – A Guide for Best Management Practices was published
- 2016: Excess Soil Management Policy Framework issued
- 2017: Excess Soil Regulatory Proposal issued
- 2019: O. Reg. 406/19, On-Site and Excess Soil Management, and Rules for Soil Management and Excess Soil Quality Standards (the Soil Rules) came into effect
- Jan 1, 2021: Excess soil reuse standards, reduced waste approvals, trucking requirements, receiving site rules
- Jan 1, 2022: Excess soil planning requirements in effect
- Jan 1, 2025: Restriction of deposition of clean soil in landfills other than for specific purposes
- Jan 1, 2026: End of grandfathering period for projects entered into before Jan 1, 2022

Ontario Regulation 406/19: Non-Application

- The excavation of soil that is hazardous waste or asbestos waste, both within the meaning of Regulation 347.
- The operation of a pit or quarry from which consolidated or unconsolidated aggregate within the meaning of the Aggregate Resources Act is excavated, including the use and production of recycled aggregate in the pit or quarry.
- The excavation of topsoil in accordance with a permit issued under the Aggregate Resources Act.
- The production of peat from a peat extraction operation.
- The final placement of excess soil on the bed of a surface water body.

Ontario Regulation 406/19

- Project Leader
- Pre-Planning
  - Assessment of Past Uses
  - Sampling and Analysis Plan
  - Soil Characterization
  - Excess Soil Destination Assessment
  - Exemptions
- Registry filing (Schedule 1)
- Development and implementation of tracking system
- Other requirements related to excavation, transportation and deposition at receiving sites

Ontario Regulation 406/19 – Assessment of Past Uses

- Similar in approach to a Phase One ESA; a Phase One ESA can be used in lieu of an APU. Purpose of the APU is to identify areas of potential environmental concern (APECs) that may exist within a project area, and associated contaminants of potential concern (COPCs). Depending on the project, some requirements may be difficult to implement (interviews, chain of title, MECP FOI requests) but a QP may be able to provide rationale for not meeting these requirements.
- Not required if the project relates to the excavation of soil at a stormwater management pond, or a Phase One ESA has been prepared.
- Challenges

Ontario Regulation 406/19 – Sampling and Analysis Plan

- Purpose is to identify where any excavations will occur within APECs identified by the APU, and to ensure that sufficient sampling is completed to determine concentrations of contaminants present. Minimum sampling frequencies (volume based) and mandatory contaminants of concern to be analyzed are prescribed by the Soil Rules, with other COPCs to be added based on the findings of the APU.
- Note that a sampling and analysis plan is not required if the soil to be excavated is to be deposited at a Class 1 soil management site, however, the minimum sampling requirements of the facility still have to be met
- Challenges

Ontario Regulation 406/19 – Excess Soil Characterization Report

- Documents concentrations of all parameters analyzed to determine whether soil at the project area is suitable for reuse.
- Clarification from the MECP:
  - *Section 3(1)(11) of the Soil Rules indicates "If, during the sampling and analysis of soil within an area of potential environmental concern (APEC), the qualified person determined that soil contains high concentrations of contaminants as described in subsection 2 (6) (page 26) item vi. of paragraph 7 of subsection 3 (1) in Section B of PART I of this document…"*
  - *The MECP has clarified that this reference is erroneous and should refer to Part 1, Section B, Page 22 (Sampling and Analysis Plan)*

Ontario Regulation 406/19 – Excess Soil Destination Assessment

- Purpose is to assess receiver options, as well as document the volume and quality of the soil, any processing that has or will be undertaken, and the approximate dates of commencement and completion of removal of excess soil.
- The regulation prescribes four potential receiver options:
  - Class 1 soil management site - soil bank storage site or a soil processing site;
  - Class 2 soil management site - waste disposal site, other than a Class 1 soil management site, at which excess soil is managed on a temporary basis and that is (a) located on a property owned by a public body or by the project leader for the project from which the excess soil was excavated, or (b) operated by the project leader for the project from which the excess soil was excavated;
  - Reuse site - a site at which excess soil is used for a beneficial purpose and does not include a waste disposal site
  - Local waste transfer facility, landfill or dump
- Challenges

Key Takeaways

- Regulation and rules are new and expected to evolve during implementation as lessons are learned
- Education required across the industry from Project Leaders to QPs to receiving sites on requirements of the Regulations to ensure everyone is on the same page
- Incorporation of excess soil management planning into early stages of projects necessary for project success

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Thank you

Presentation 2

Metals for a low-carbon future: from responsible mining to sustainable production and consumption of minerals

Nic Bilham

University of Exeter Business School, Camborne School of Mines, Geology for Global Development

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Metals for a low-carbon future: from responsible mining to sustainable production and consumption of minerals

Nic Bilham

27th April 2021

About me

- Postgraduate Researcher / PhD student, University of Exeter Business School / Camborne School of Mines
- Consultant – responsible sourcing of metals and minerals, resourcing the circular economy…
- Chair of Trustees, Geology for Global Development
- Council member, International Association for Promoting Geoethics
- Until 2018, Director of Policy and Communications, Geological Society of London

Geology for Global Development

- Championing the role of geology in global development
- Mobilising the geoscience community to help deliver the UN Sustainable Development Goals

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Metals and other mineral resources for a low-carbon future

- From a fossil fuel based economy to a minerals based economy…
- Batteries/energy storage – 450% increase in production of lithium, cobalt and graphite by 2050 (World Bank: Minerals for Climate Action, 2020)
- Magnets (for electric vehicles, wind farms etc) is driving global demand for rare earth elements (REEs), currently dominated by China (raising concerns about supply constraints, price volatility…)
- High performance solar PV – indium, gallium, selenium, cadmium, tellurium
- Metals needed for multiple low-carbon energy technologies (nickel, chromium, manganese, molybdenum, etc)
- More bulk metals for equipment and infrastructure (aluminium, copper, etc)

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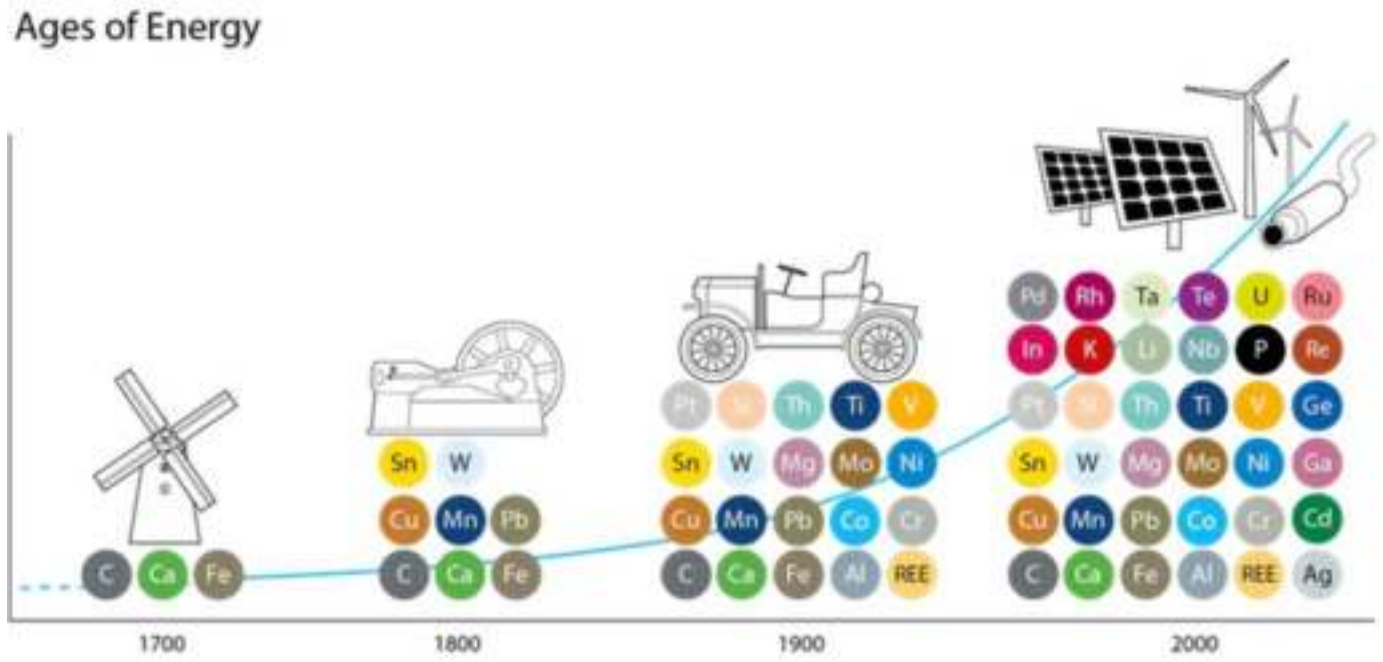
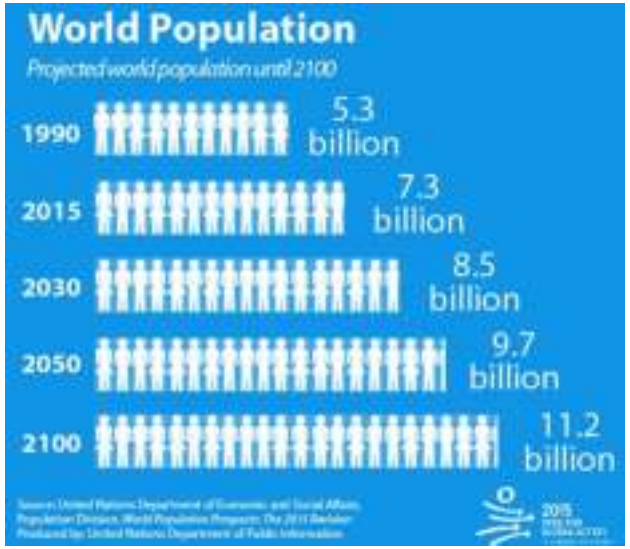
So why not just recycle?



Achzet et al (2011): Elements widely used in Energy Pathways

Ironbridge, 1779



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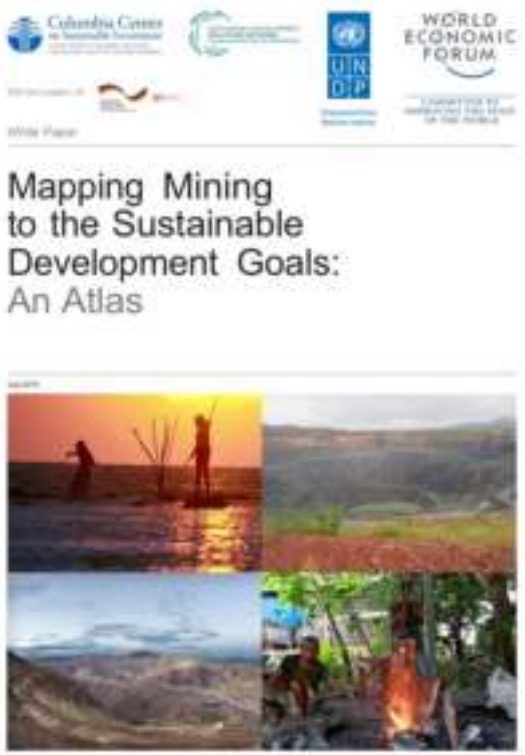
We will need to continue to mine – but how we do it really matters…



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Responsible mining

- Maximise the positive impacts of mining
- Minimise the negative impacts…
  - *Social*
  - *Environmental*
  - *Economic*

A responsible mine should…

- Make money and provide resources!
- Comply with laws (and more – follow or even lead best practice)
- Ensure financial transparency and fairness
- Engage with communities and stakeholders throughout
- Avoid environmental pollution (air, water, soil...)
- Be resource efficient (i.e. extract as much ore as possible with as little waste as possible) and manage waste responsibly
- Use energy and water efficiently and responsibly (alongside communities' other needs)
- Minimise greenhouse gas emissions
- Look after the health, safety and wellbeing of the workforce and local communities
- Provide fair labour opportunities and terms of work
- Not cause or exacerbate conflict or human rights abuses (e.g. re child labour)
- Protect and respect cultural heritage
- Plan for and deliver positive long-term legacies (beyond site remediation – employment, biodiversity, ecosystems...)

…which all mean different things for different places, communities, resources, deposit types

Many schemes and standards…

ALLIANCE FOR
RESPONSIBLE MINING

ICMM
International Council
on Mining & Metals

EQUATOR
PRINCIPLES

…just a few of them shown here!

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So why are high environmental and social standards not universally upheld?

Some ideas…

- Which schemes should mining companies engage with?
- Most schemes and standards are not visible to other supply chain actors and stakeholders – so how can high standards be ‘rewarded’ by investors, manufacturers, consumers?
- Traceability is important – but some materials are easier (or more worthwhile) to trace than others…

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Li
3
6.941
Lithium

Mining and sustainability

- Can mining be sustainable?
- Can ***not*** mining be sustainable?

Sustainable development: Brundtland Report (UN World Commission on Environment and Development, 1987)

'… development that meets the needs of the present without compromising the ability of future generations to meet their own needs'

- Mining alone cannot be characterised as 'sustainable', however carefully and responsibly it is done
- Just as it matters how we mine, it also matters what we do with stuff once we have mined it!

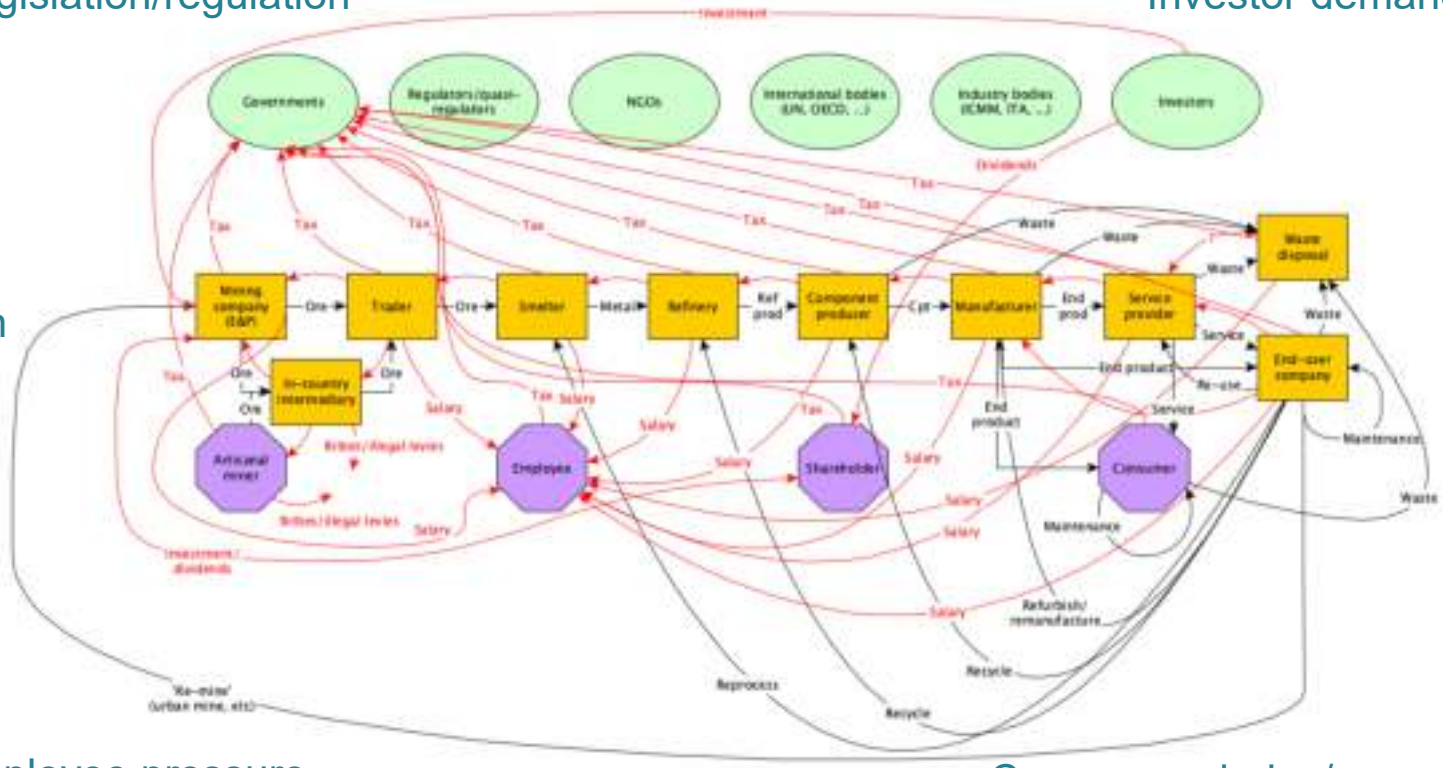
From responsible mining to sustainable production and consumption of minerals…

Legislation/regulation

Investor demands

Responsible mining/ supply and certification

Responsible sourcing and traceability



CSR reporting

Employee pressure

Leadership

Circular economy – reuse refurbish, remanufacture, recycle…

Consumer choice/pressure

Shareholder pressure

Consumer labelling

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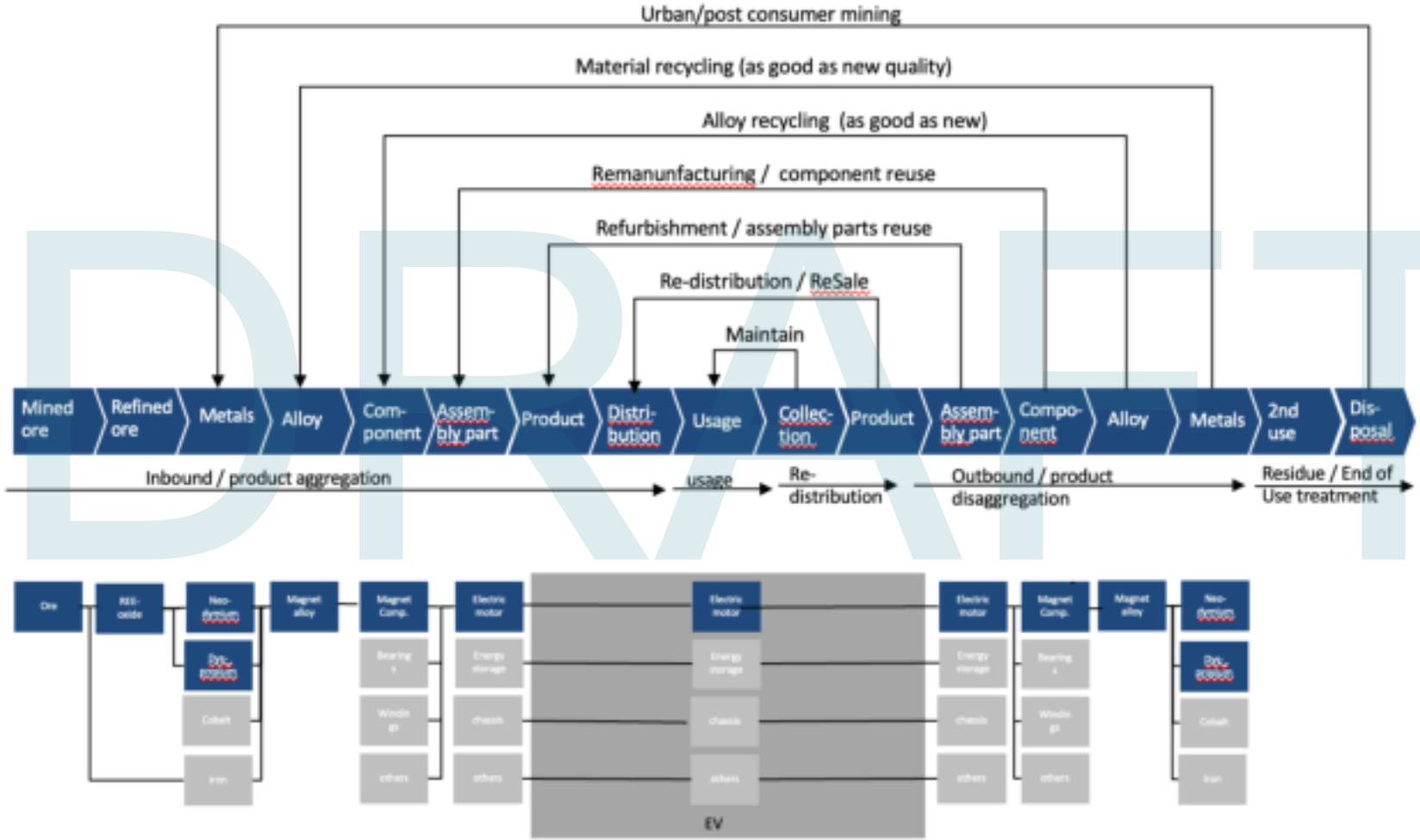
The transition to a sustainable ‘new minerals economy’ – who has a role to play?

- Mining companies
- Manufacturers
- Retailers
- Supply chain intermediaries (material processors, component manufacturers…)
- Investors
- Responsible mining and materials scheme operators
- Other NGOs
- **Governments**
- Regulators and standard-setting bodies
- International governance organisations (UN, World Bank…)
- Citizens / consumers (i.e. us!)

Case study 1: REEs in electric vehicle motor magnets (work in progress)

- Pilot study for Met4Tech (UK National Interdisciplinary Technology Metals Circular Economy Centre)
- Helping to address supply constraints / risks and sustainability impacts
- Identifying opportunities, barriers and facilitating interventions to develop UK-focused circular economy (CE) value chains
- Identifying data and information gaps – to inform work of the Met4Tech Data Observatory
- A holistic view – stewardship of mined resources, applying CE principles to mining, coordinating value chain ‘building blocks’, etc

Case study 1: Value chain mapping



Zils, Bilham et al (2021): Draft input to Met4Tech pilot study

Case study 1: Roadmap – opportunities, barriers and interventions

- Where are the biggest opportunities (economic, sustainability)?
  - *Examples: direct recovery of original-quality magnet alloy, reuse of magnets*
- Where are the 'pain points' on the value chain?
  - *Examples: difficulty of removing magnets from end-of-life (EOL) motors, lack of EOL collection infrastructure*
- What interventions could overcome these?
  - *Examples: design for CE, servitisation and leasing business models*
- Prioritise and coordinate – towards a roadmap for CE in EV magnet REEs

Case study 2: Responsible sourcing of minerals

- Global retail brand
- Strong sustainability principles (including recycling / circular economy commitments)
- Thousands of products, from hundreds of suppliers and sub-suppliers, using dozens of metals and other mineral raw materials
- Complex, global, multi-tier supply chains
- Looking beyond high-profile high-risk materials and issues (e.g. cobalt and child labour)
- *How can we prioritise and act to improve impacts from mining the materials we use?*

Case study 2: Our approach

- Summary report and literature review
- Sustainability risk intelligence tool (per product area and raw material input)
  - *Material-specific risks (i.e. particular social and environmental impacts)*
  - *Global supply chain information (e.g. supply constraints, existence of ASM – artisanal and small-scale mining)*
  - *Extent of company's knowledge of its own supply chains*
  - *Country-related mining and processing risks (e.g. regulatory, financial transparency, socio-economic)*
  - *Company's own strategic drivers (e.g. increased reliance when substituting other materials identified as unsustainable)*
- 'Deep dives' on selected materials, chosen to maximise positive sustainability impact and opportunities for learning

Case study 2: One size does not fit all…

Aluminium

- Very energy intensive – huge carbon footprint (1% of global emissions)
- Too many suppliers and sub-suppliers to trace directly
- Aluminium Stewardship Initiative – full-chain certification scheme (nothing like this yet in place for other metals)

Zinc

- A couple of key applications – for one of them, supply chains are fairly simple, so may be able to trace back to the mine
- But then what? What responsible mining standards should apply?
- We could identify and advise on some country-specific risks

Chromium

- By volume, most use is in stainless steel – dependent on global steel producers
- For one new key high-tech application, it was known to come from a specific mine
- We identified information gaps and questions to ask relating to the mine / country

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Thank you

Presentation 3

Groundwater Resource Decision Making – The Power of the Collective

Richard Gerber
Senior Hydrogeologist
Co-Program Manager, Oak Ridges Moraine Groundwater Program (ORMGP)

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Groundwater Resource Decision Making: The Power of the Collective

Richard Gerber, Ph.D., P.Geo.

27-April-2021

OakRidgesMoraine
GROUNDWATER PROGRAM
www.oakridgeswater.ca

Outline

OakRidgesMoraine GROUNDWATER PROGRAM
www.oakridgeswater.ca

"Successful resource management needs both a strong scientific basis and a practical approach."

1) Management - Current State (Groundwater)

2) Science

- Information Analysis System ⇨ Conceptual Model

3) Practical Approach

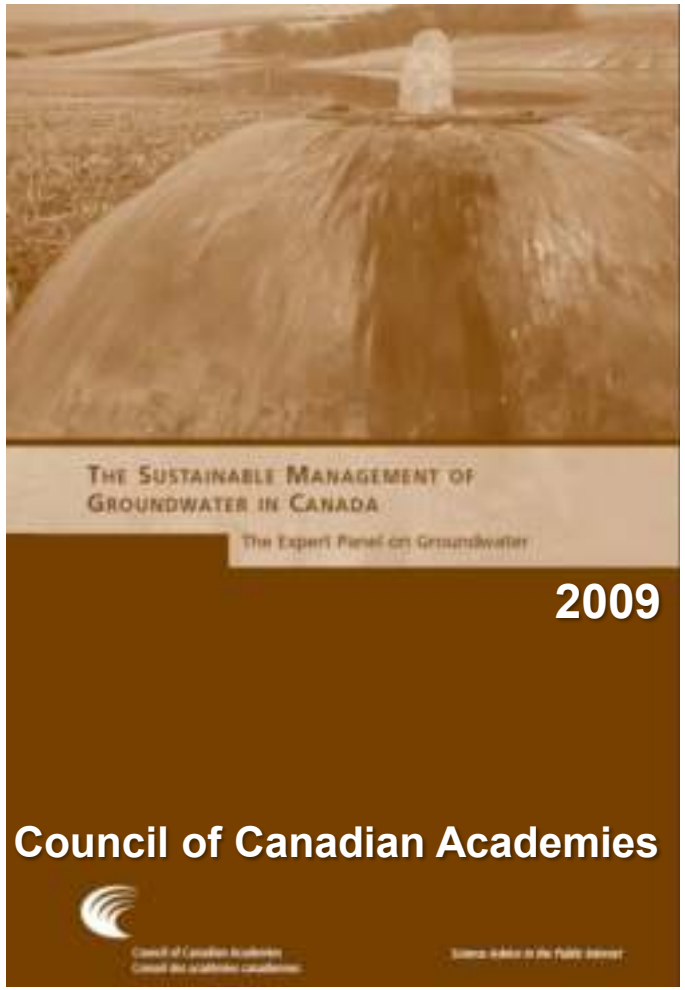
- ***Decisions/Manage & Message***
  - science, history, context, perspective;

a) GW Knowledge – capture experience, lessons learned*;*

b) GW Areas of Concern - summarize mountain of information for scientific and non-scientific community.

Water Resources Management: Current

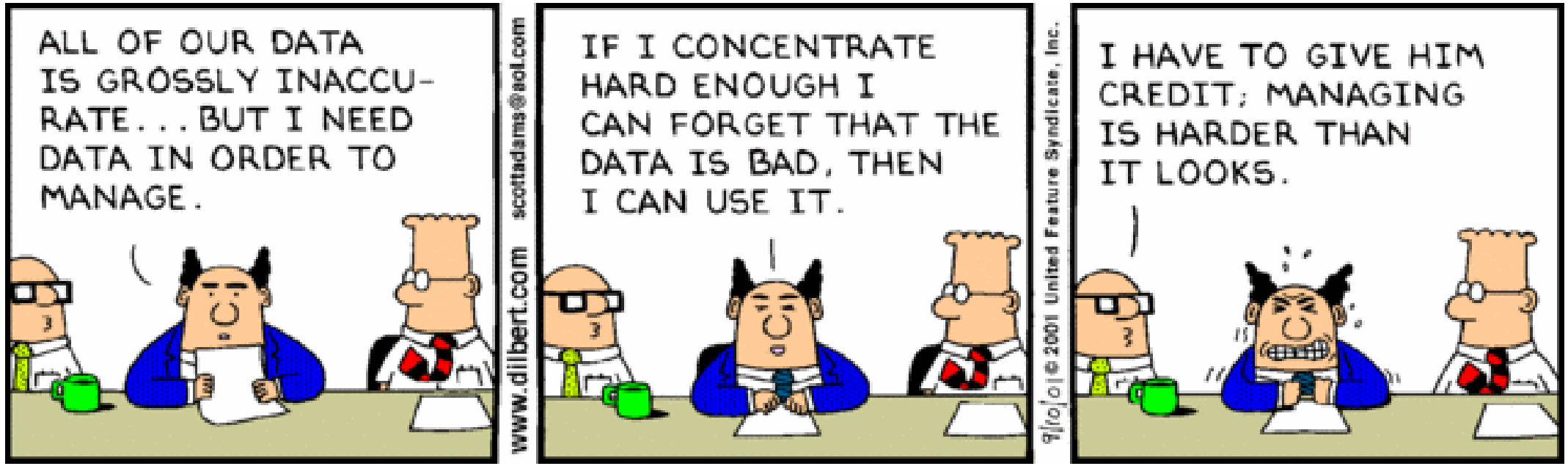
- **Fragmented – agency**
  - Federal (Env, GSC)
  - Province (OGS, MECP, MNRF, OMAFRA)
  - Municipality
  - Conservation Authority
- **Fragmented - science**
  - Groundwater/Surface water
  - Quantity/Quality
  - Data collection **repetition?**
  - Issue repetition (lessons learned?)
- **Implement**
  - Canada Water Act, 1970
  - Federal Water Policy, 1987, etc.



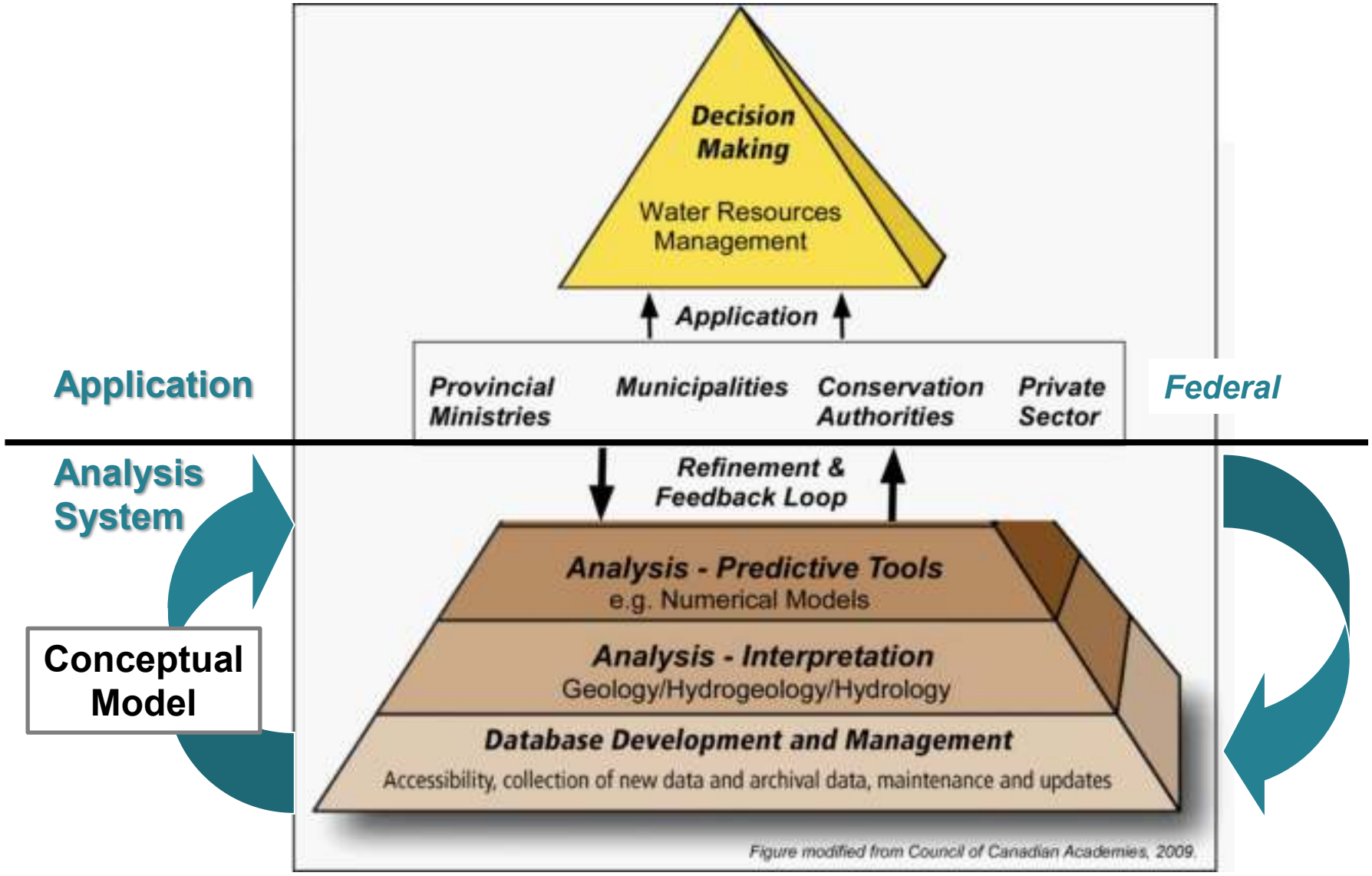
2) Science

- *"astonishing that governments have been making sweeping decisions on environmental policy for decades without environmental baseline data in the first place"* *ECONOMIST, 2000*

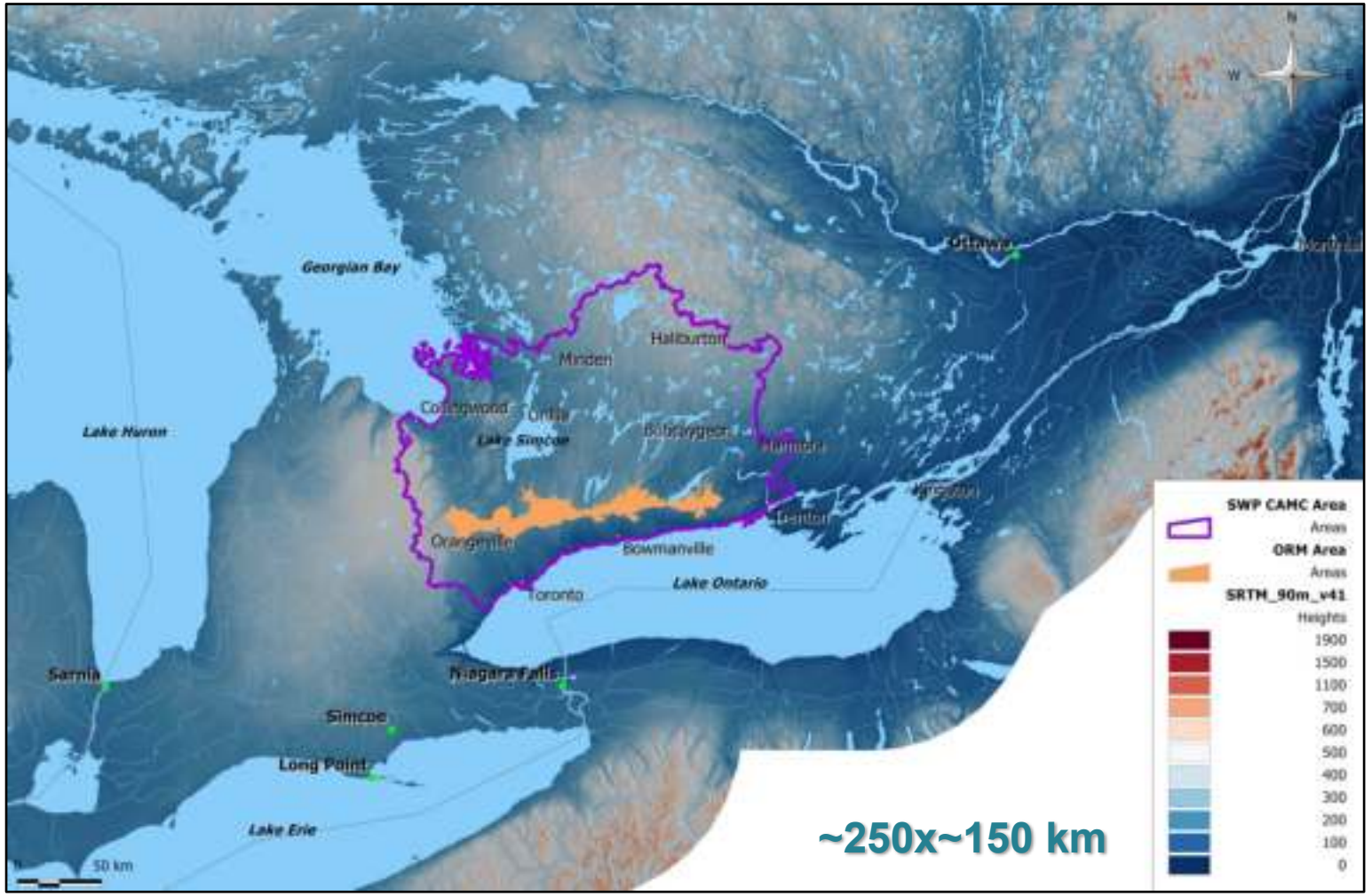
Source: Dilbert



Framework – overcome fragmentation



(Council of Canadian Academies, 2009; modified from Sharpe *et al.*, 2002



Who

MOU (2001-)
#1 ⇨ 2010
#2 ⇨ 2020
#3 ⇨ 2030

York Region
Region of Peel
working with you
DURHAM REGION
TORONTO
Central Lake Ontario Conservation
Credit Valley Conservation
Toronto and Region Conservation for The Living City
Ganaraska
Otonabee CONSERVATION
KAWARTHA CONSERVATION
LOWER TRENT CONSERVATION
Ontario

What

- Geology, Climate, Land Use, Library
- Groundwater – Quantity & Quality
- Surface Water – Quantity & Quality

(www.oakridgeswater.ca)

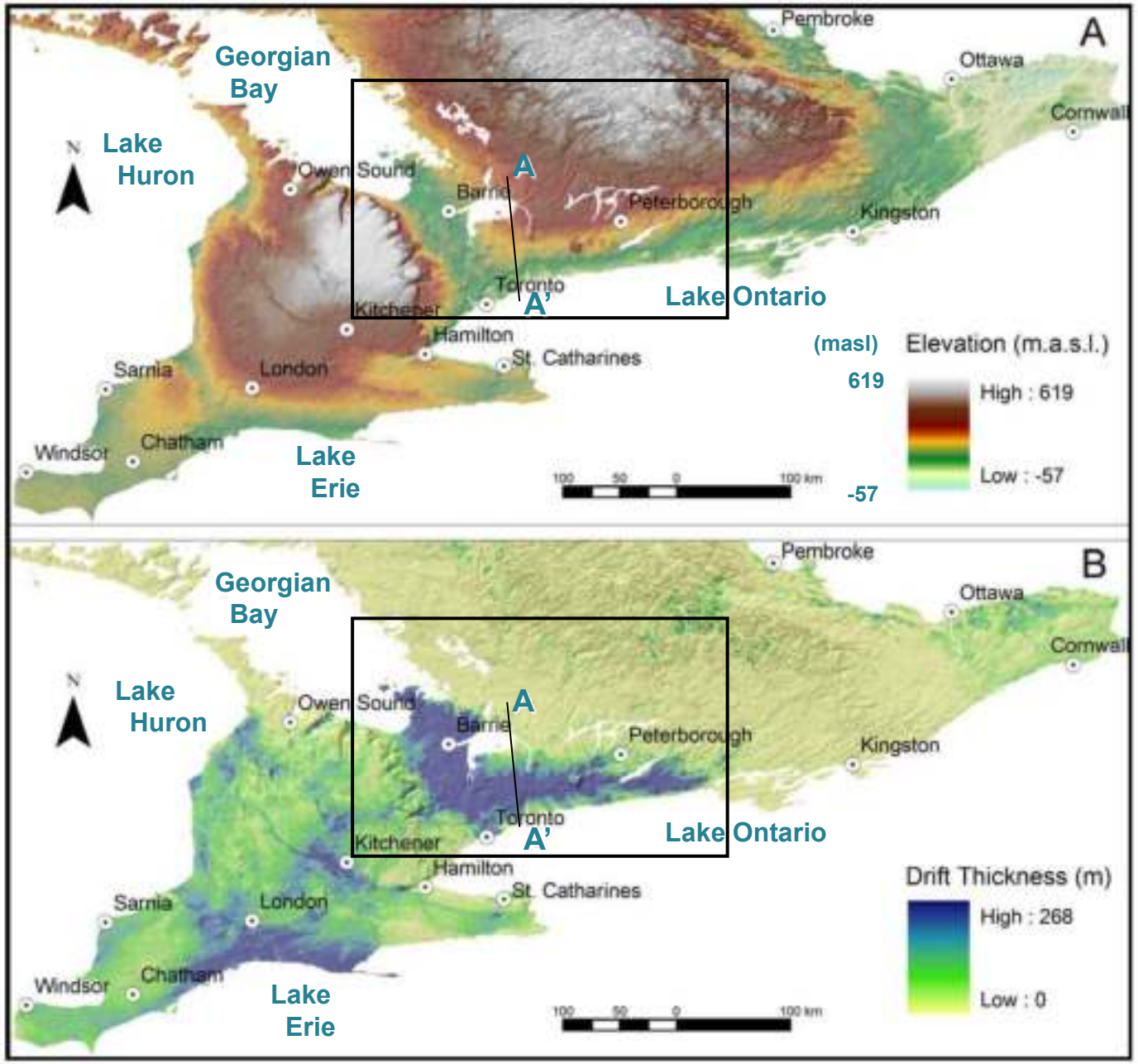
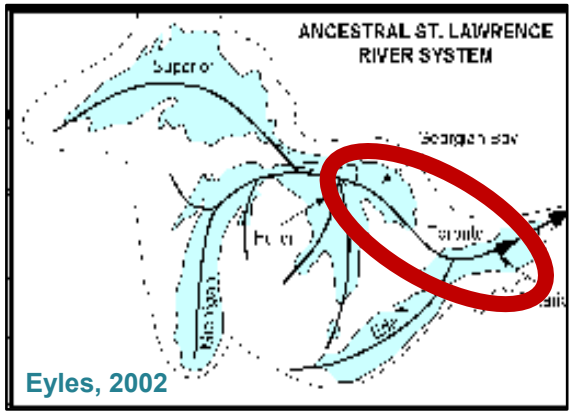
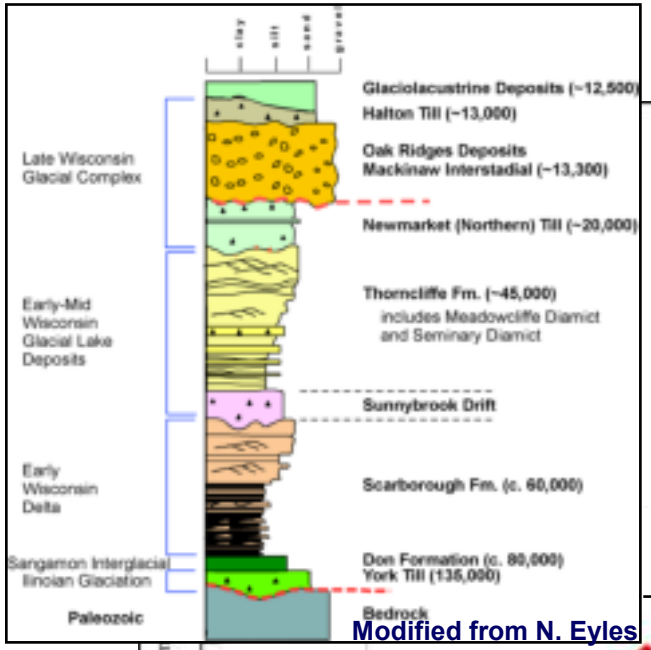


Figure from Gao *et al.*, 2006 (OGS)

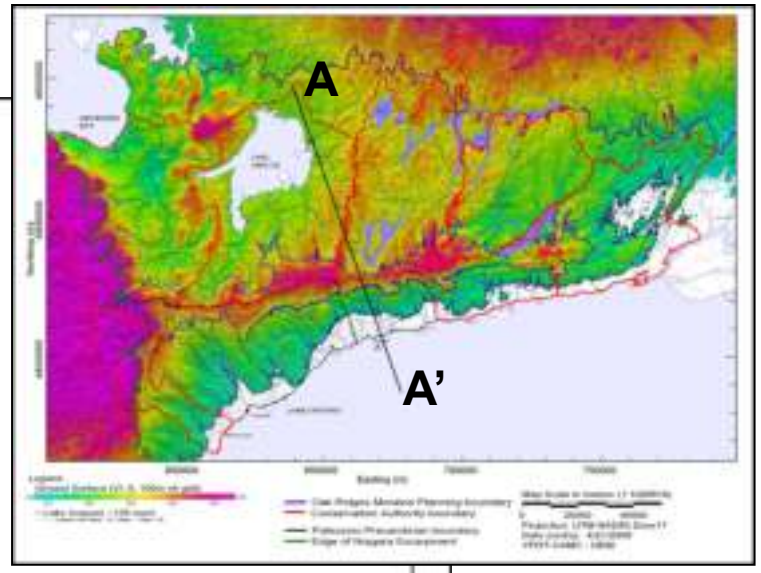


A) Bedrock Topography

B) Drift Thickness



Modified from N. Eyles

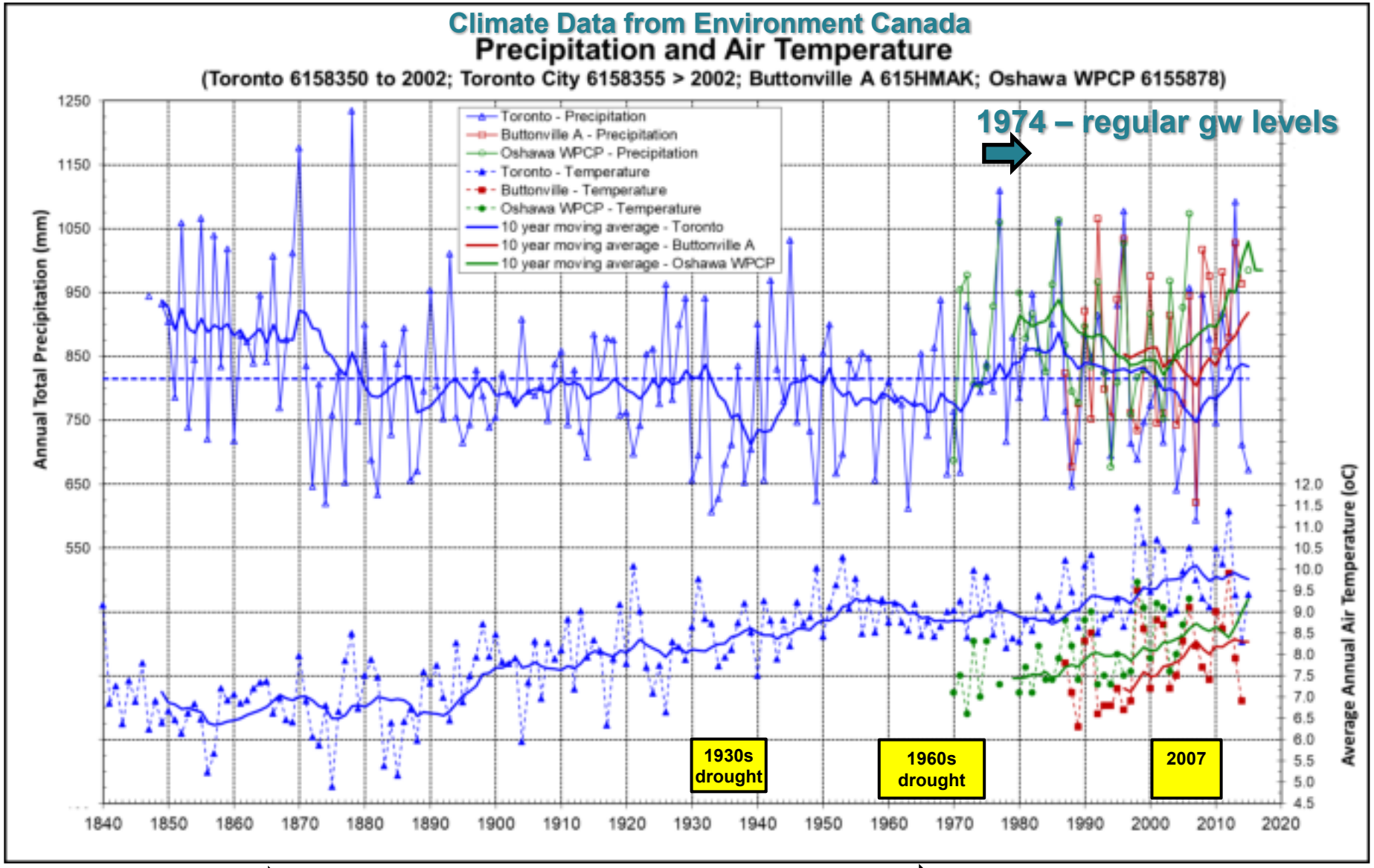


Reg'l Setting: N-S cross-section (3D geology)

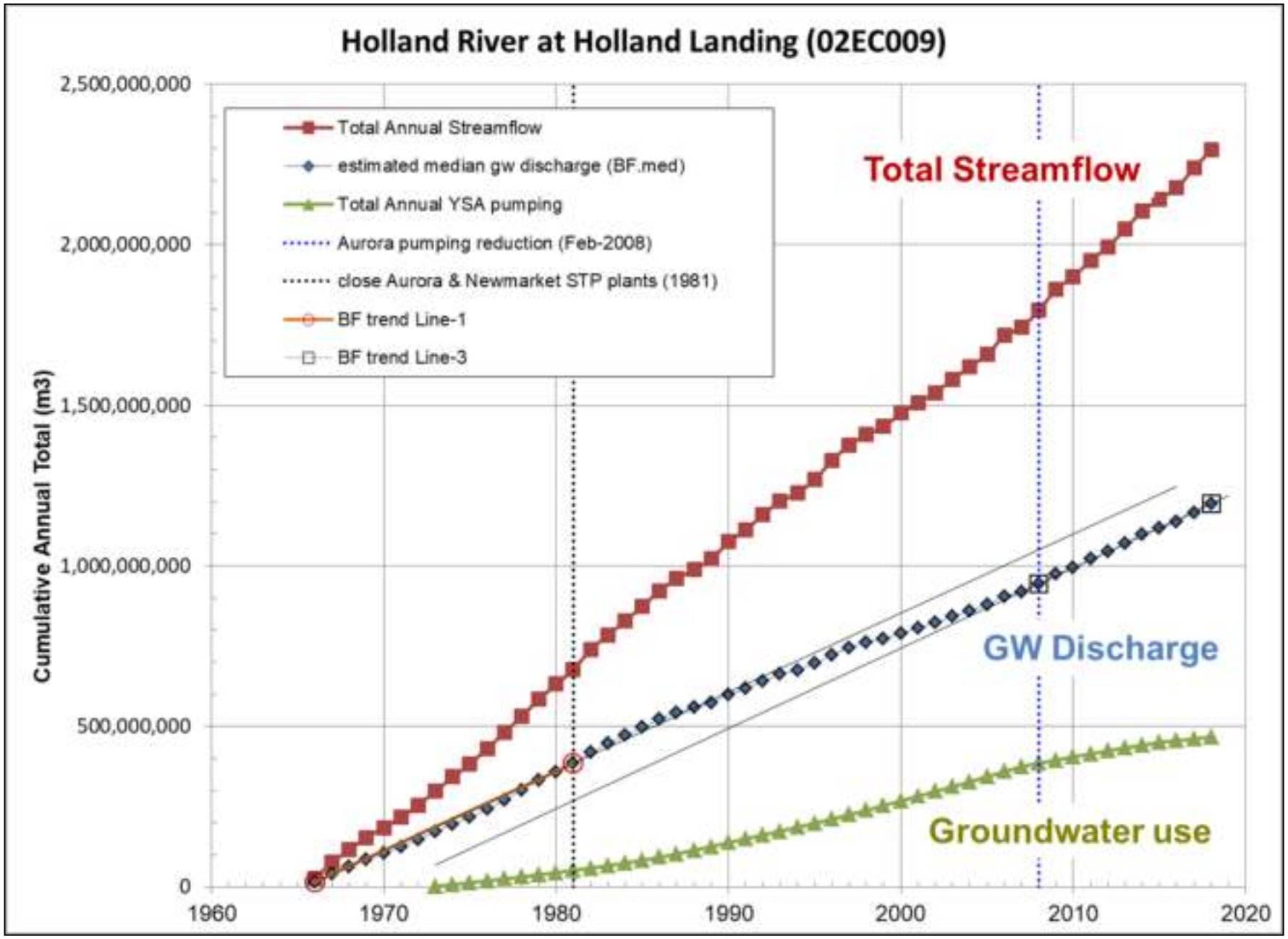
Monitoring - evolving

- **Who:** Fragmented ⇨ Collaborative (agency & science);
  - Municipality, PGMN (MECP & CA), ORMGP
- **Why:** Compliance ⇨ Flow System Understanding;
  - Permit/C of A
    - ➢ test conceptual model, transient response, trends, calibrate numerical models
- **Collection** ⇨ Flow System Understanding;
  - Cohesive Conceptual Model

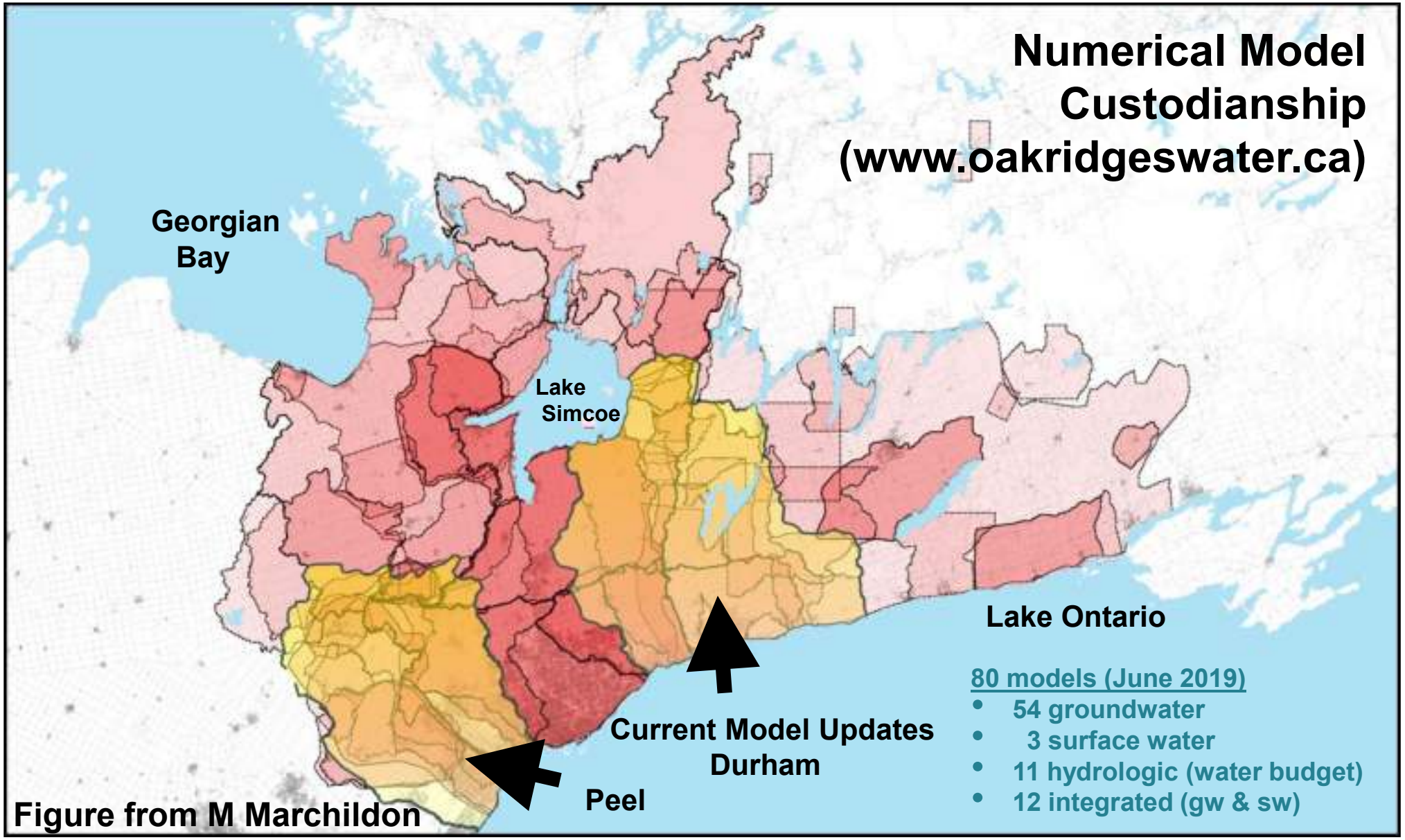
"the best time to start monitoring groundwater is ~~20~~ ~~30~~ 40 … years ago, the second best time is now"



Long-term data/trends

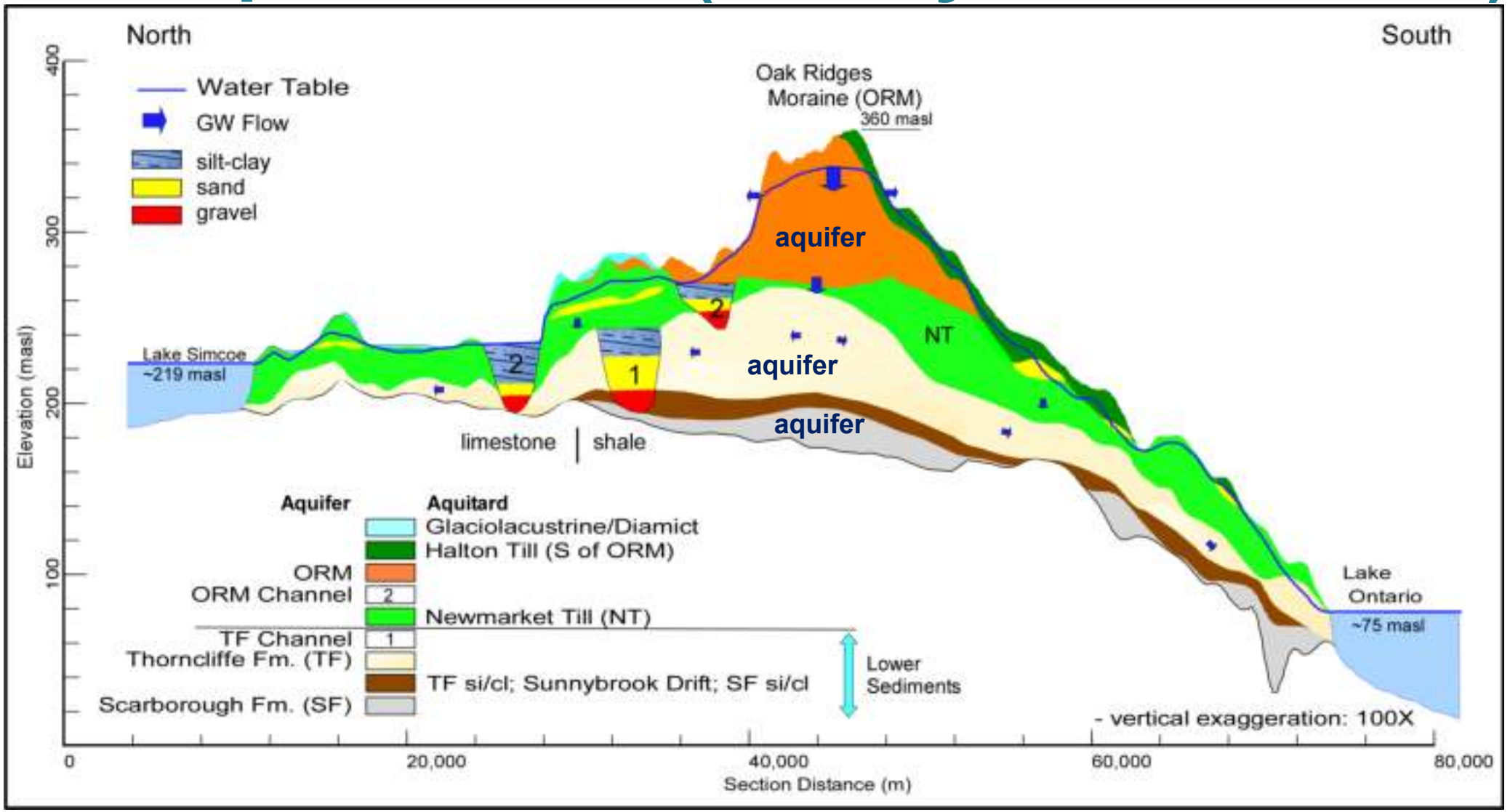


Trends; change/response?



Predictive/Analysis Tools

Conceptual Model (flow system function)



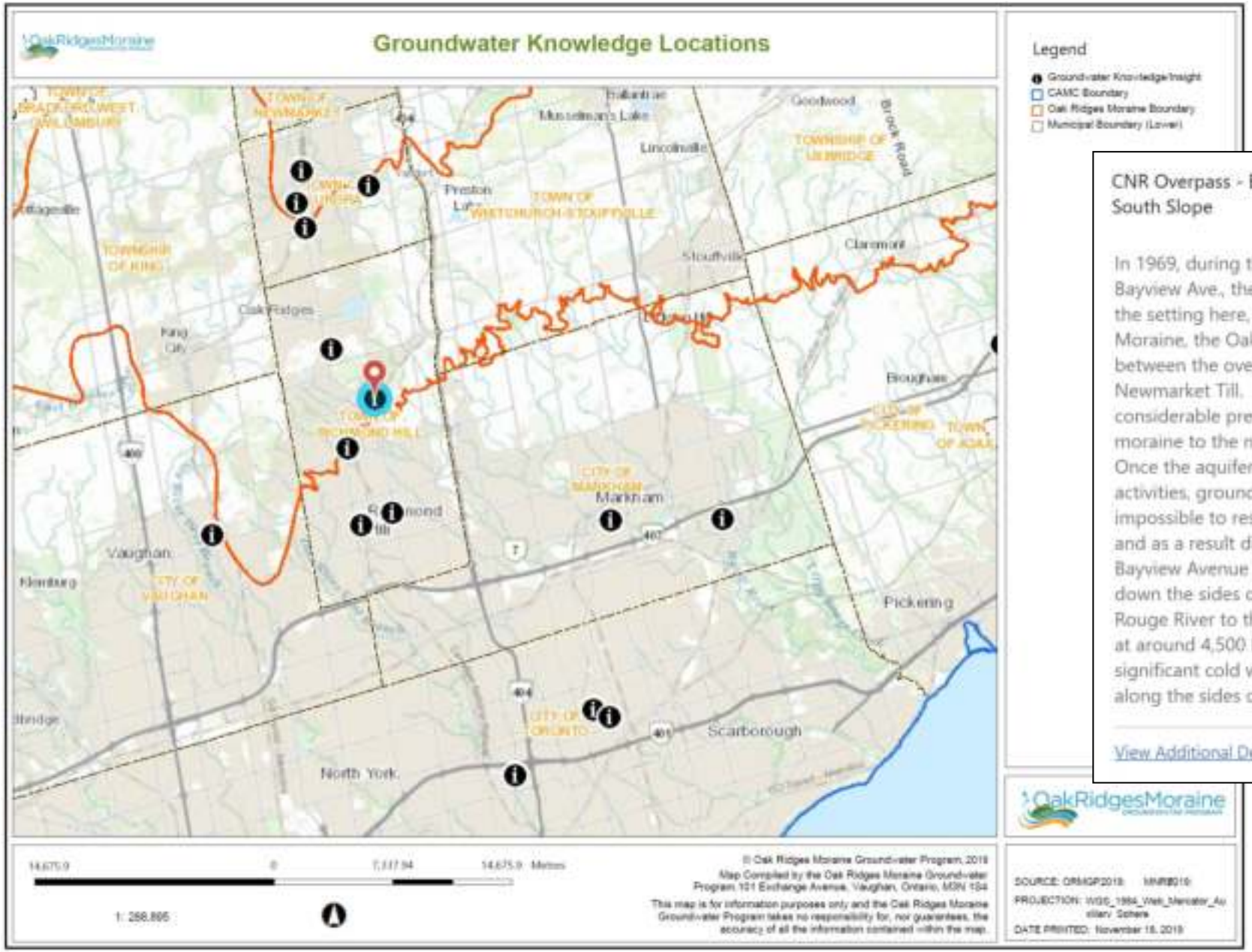
⇨Continual Refinement/Testing

3) Practical Approach

Sportsbusinessdaily.com (20200213)

- ***Problem: Lack of Integration***
  - Perception: not enough gw data to make decisions
    - Politicians, Env Commissioner, Planners, …….
  - Partners: Issue (gw 'drama/surprise') repetition
    - Avoid – Issue repetition & Data Collection repetition
  - Mountain of information: what does it all mean?
    - Connect with decision-makers, project managers, planners, etc.
- ***Attempt***
  - 'Groundwater Knowledge' locations – lessons learned
  - Where would I go to look for groundwater trouble?
    - Groundwater 'Areas of Concern' mapping

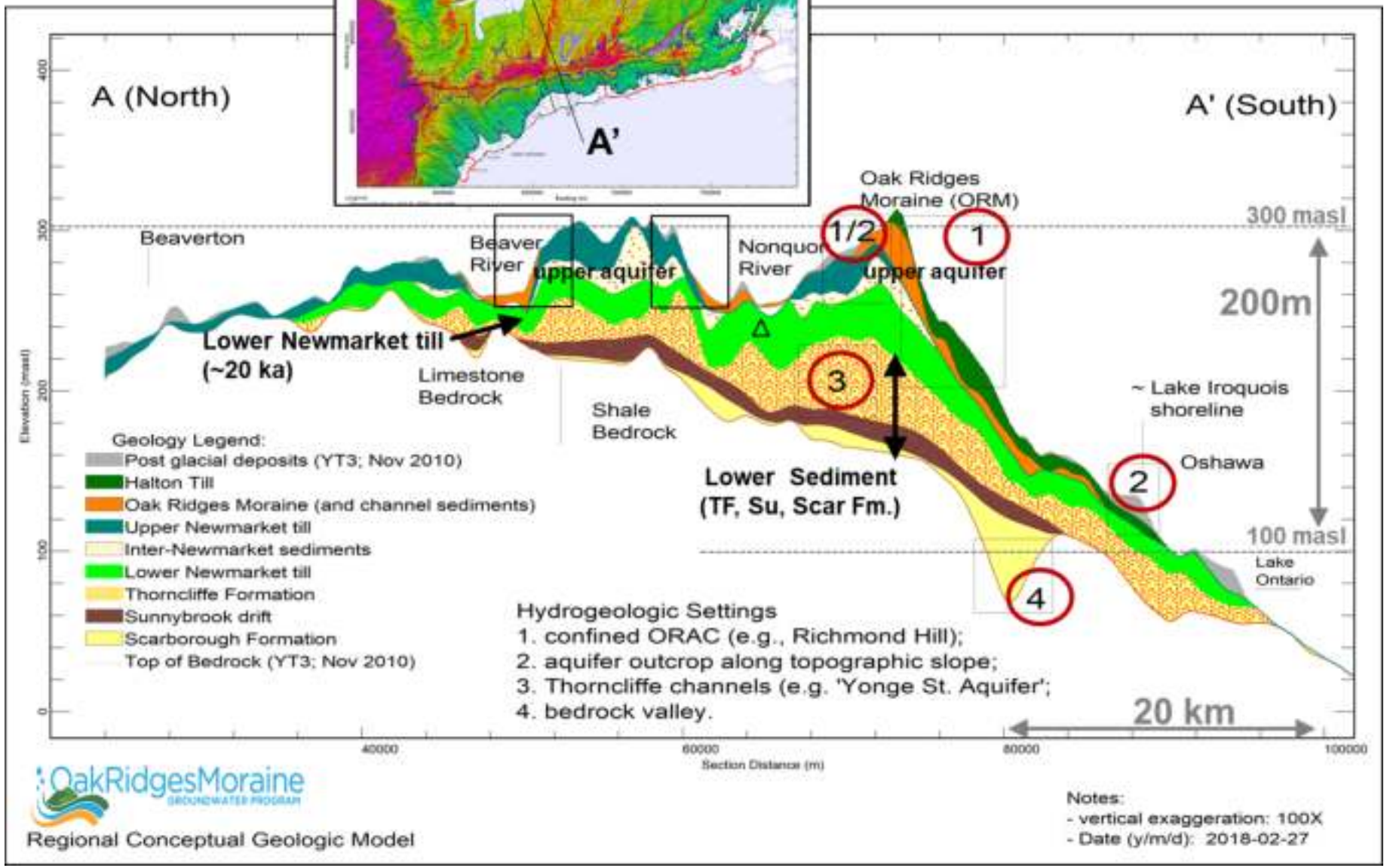
- history, message, context, perspective



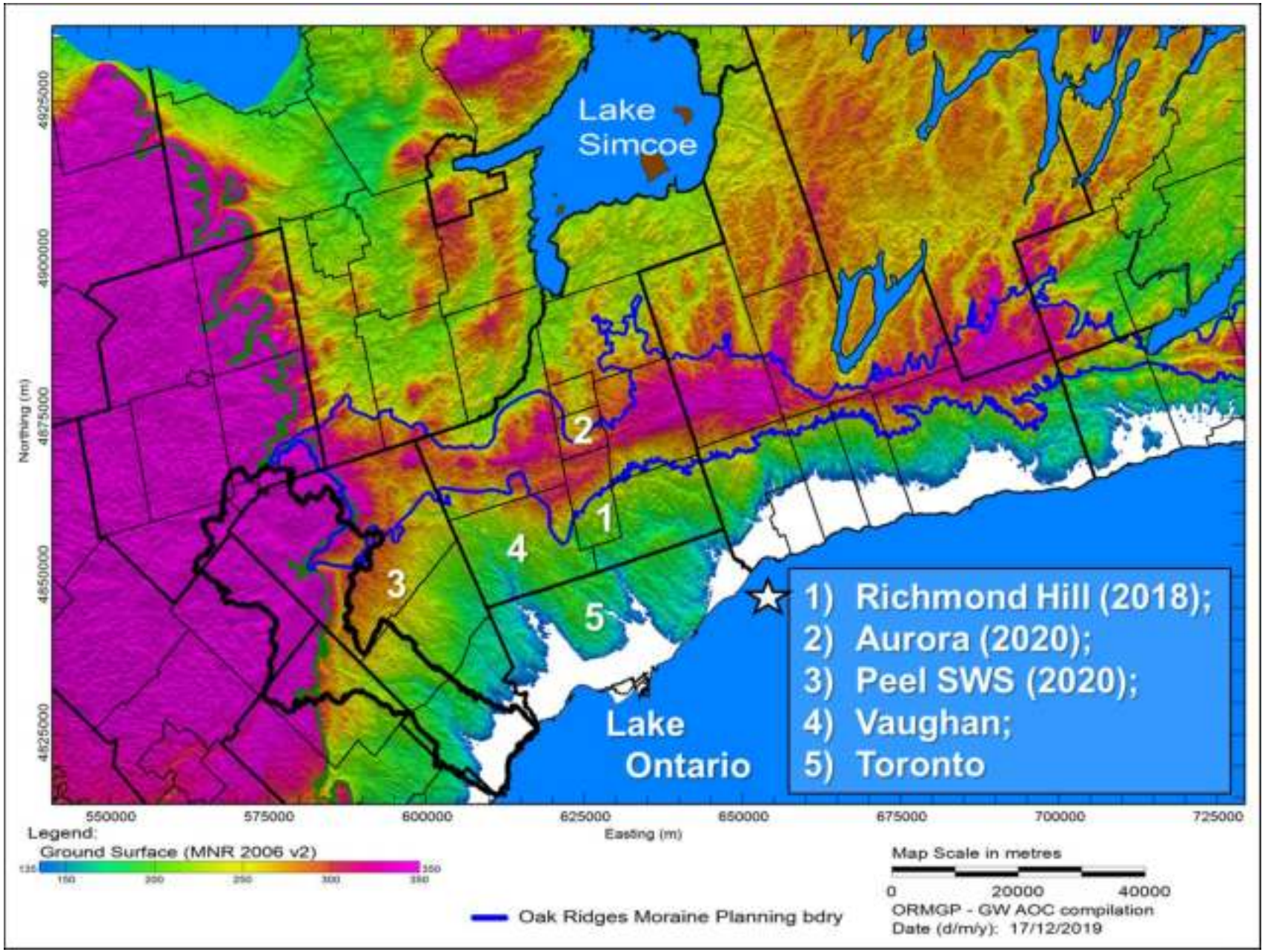
- Experience
- Lessons Learned

3a) Groundwater Knowledge

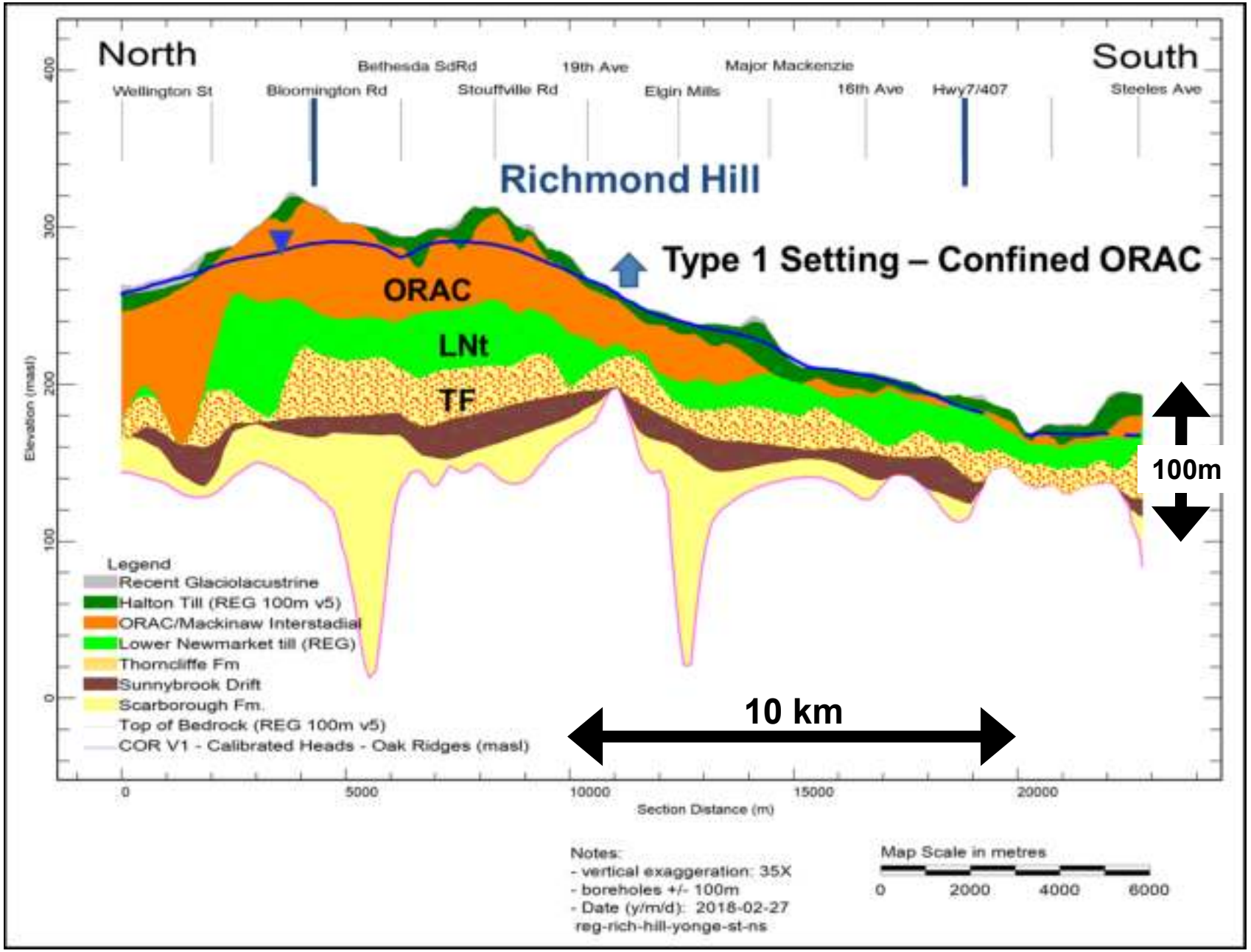
- **Hydrogeologic Settings**



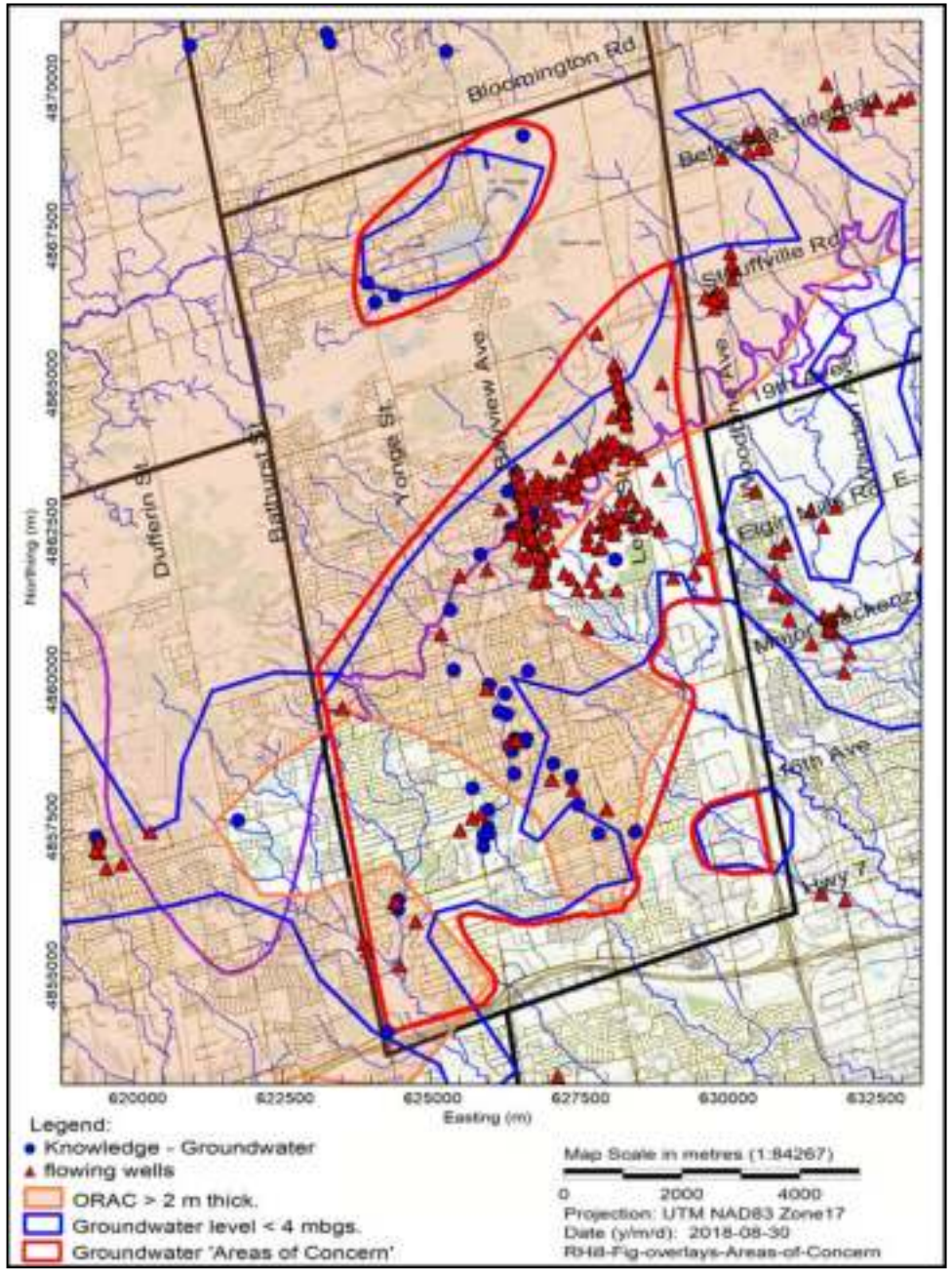
3b) GW 'Areas of Concern'

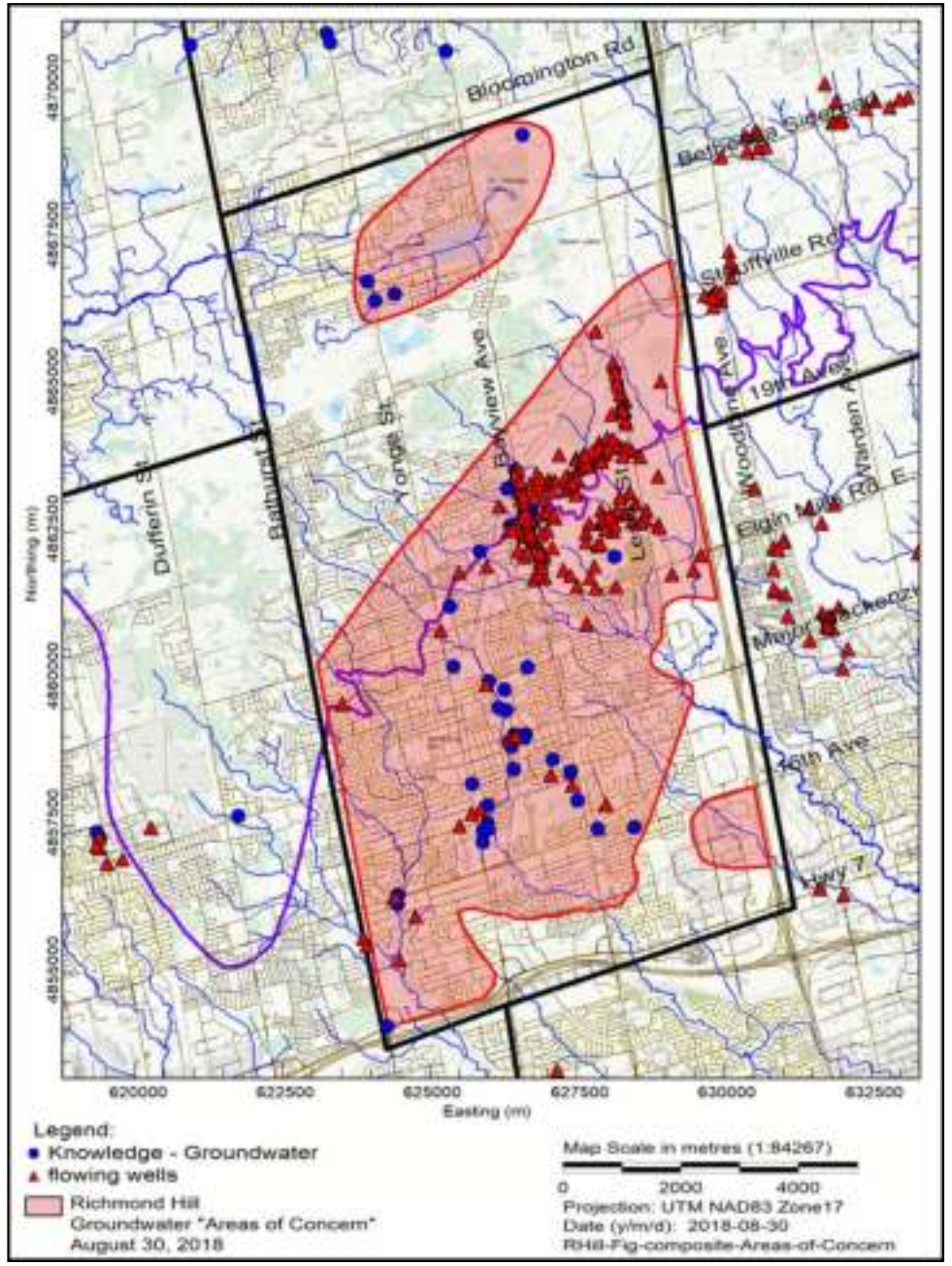


GW 'Areas of Concern' (GW trouble?)



N-S cross section along Yonge St



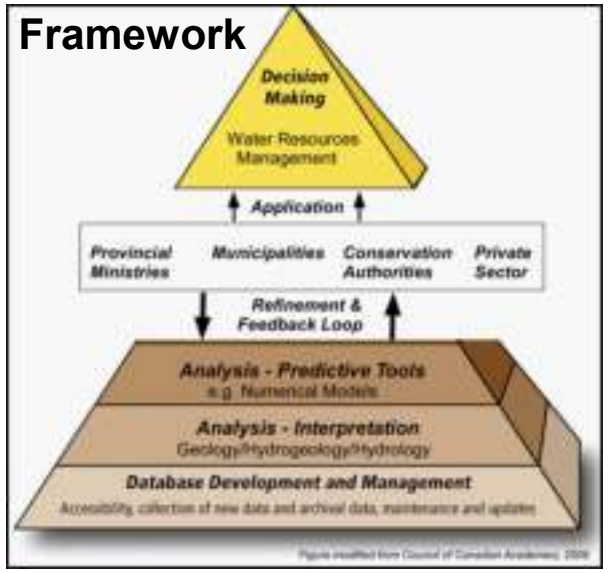


Overlay (4 factors)

Composite

Positives ⇨~Balance

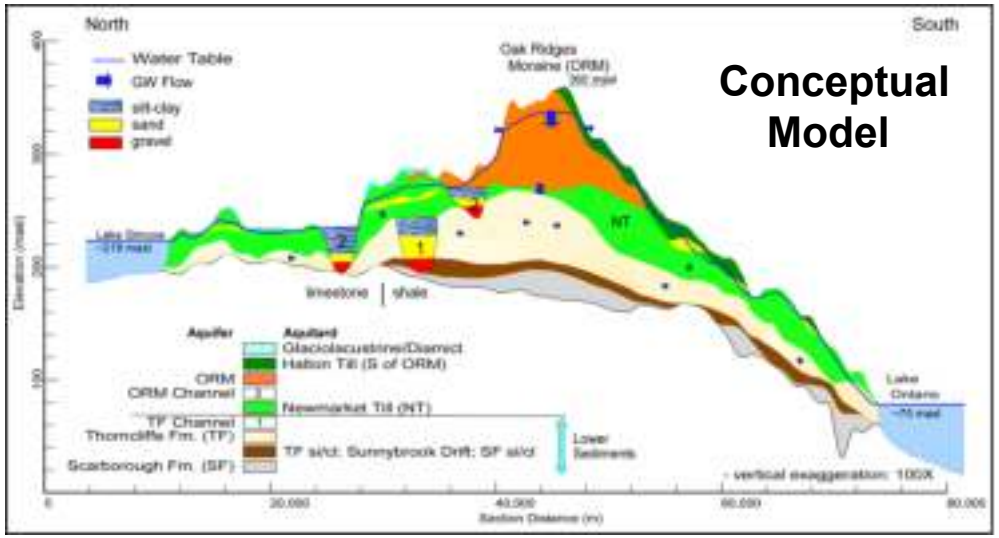
1) **Continual Dialogue:** to overcome fragmentation/repetition;
   - ORMGP (2001–): Federal (GSC), Province, Municipality, Conservation Authority, consultants;
   - Science/Practical: Framework ⇨Conceptual Model ⇨Message



2) ***Land Use:*** Niagara Escarpment Plan, ORM Conservation Plan, Greenbelt;

3) ***Water Quality:*** Source Water Protection (CWA)
   - Map contaminant sources, risk management;

4) ***Water Quantity:*** MECP Permit To Take Water
   - Track actual takings/make data available;
   - Municipal engagement/consultation.



Many pieces can add up to magic (www.oakridgeswater.ca)

OakRidgesMoraine
GROUNDWATER PROGRAM
www.oakridgeswater.ca

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Groundwater Resource Decision Making: The Power of the Collective

Thank you

Richard Gerber

27-April-2021

Presentation 4

A Simple Metal but a Complex Commodity: Lithium Deposits, Production, and Economics

James Whyte
Senior Geologist
Ontario Securities Commission

2021 VIRTUAL SYMPOSIUM

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2021 VIRTUAL SYMPOSIUM

A Simple Metal but a Complex Commodity: Lithium Deposits, Production, and Economics

James Whyte

April 27, 2021

Cautionary Statement

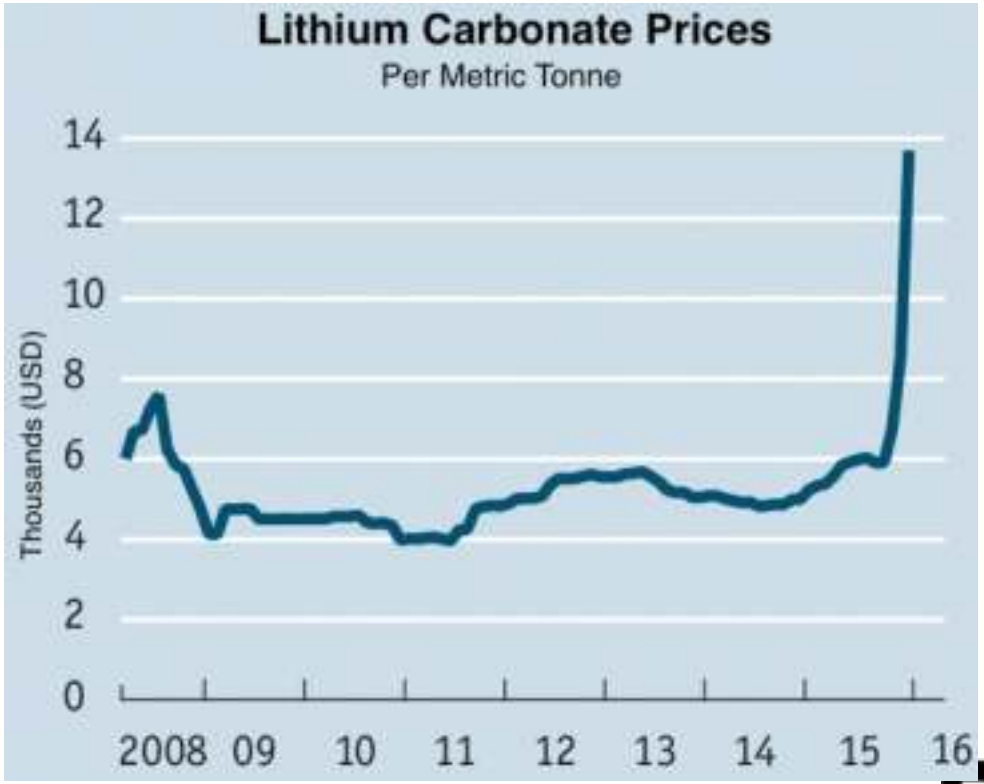
- The views expressed in this presentation are those of the presenter(s). They do not bind the OSC or its staff. These materials are provided for general information purposes only and do not constitute legal advice. Information has been summarized and paraphrased for presentation purposes. Please refer to the original documents for clarification.
- He's a regulator, after all…

Outline

- What makes lithium so interesting?
- What is its market like?
- Main models of lithium deposits
  - *Brine deposits (salars, oilfield brines)*
  - *Hard-rock (pegmatites, greisens)*
  - *Soft-rock (clay type)*
- What does this mean for the working geo?

Everyone's favourite battery metal

- In the early 2000s, lithium prices rose drastically in response to perceived future demand, mainly for batteries
- Reality set in around 2016
- But interest remains high



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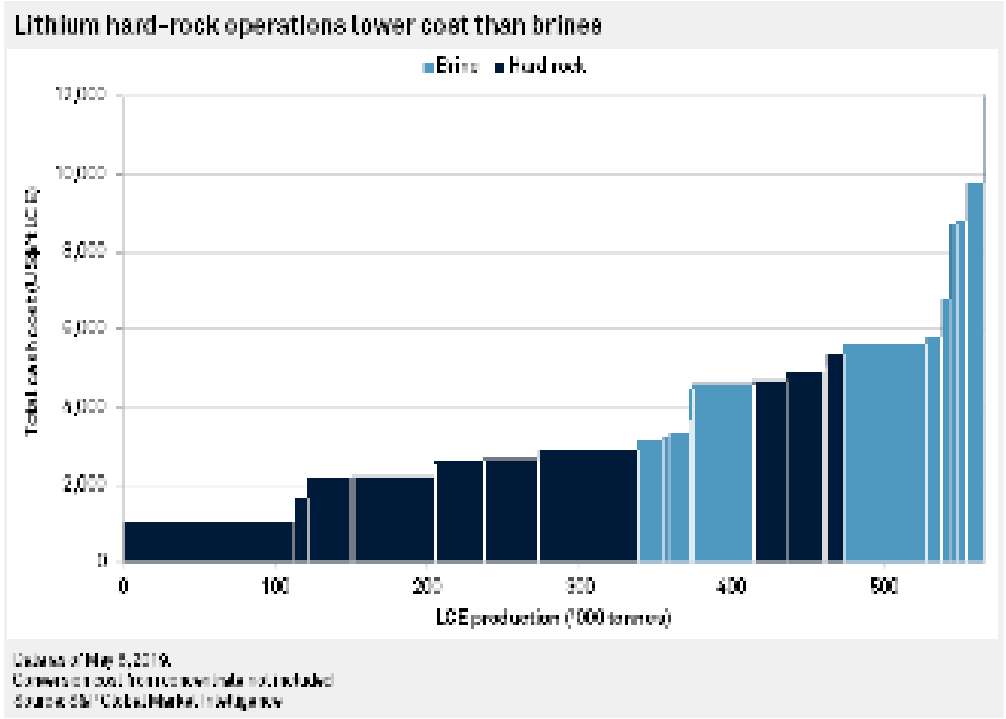
Who are the gorillas?

- Ganfeng (China – brine, hard-rock, clay)
- Tianqi (Chinese-owned – Australian hard rock)
- Sociedad Quimica y Minera (Chile – brine)
- Albemarle Corp. (U.S.A. – U.S. and Chilean brine)
- Livent (American-owned – Argentine brine)

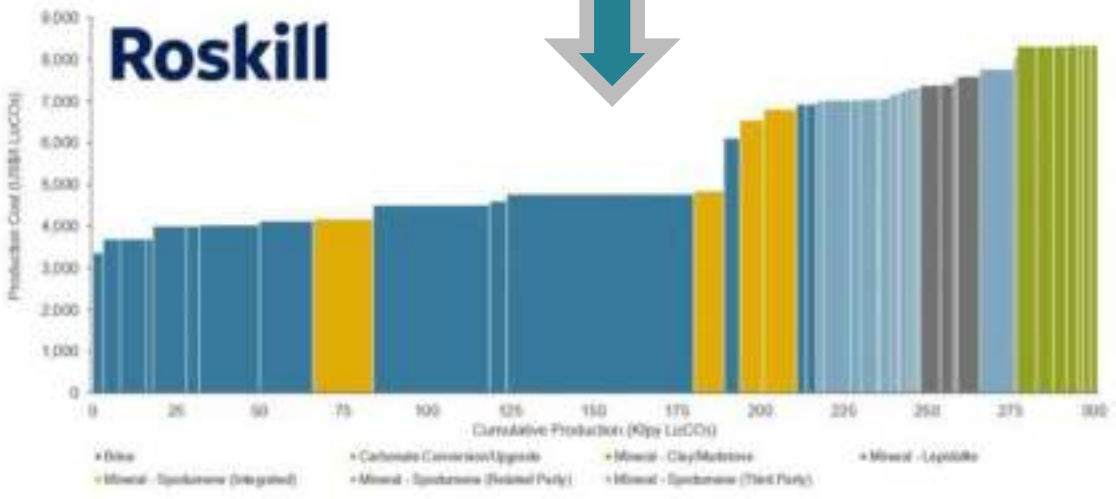
What dominates the market?

- Sometimes brine production, sometimes hard-rock



This was 2019 – brine producers in light blue

This was 2020 – brine producers in dark blue



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What are lithium deposit types, and how do they work?

- Salar brines
  - *Pump Li-bearing saline groundwater to surface*
  - *Recover by evaporation*
  - *Conversion to carbonate or hydroxide*
- Hard rock
  - *Pegmatite or greisen-type deposits*
  - *Conventional milling (flotation/separation)*
  - *Ship concentrates for conversion to carbonate/hydroxide*

And in the future?

- Oilfield brines
  - *Wastewater from crude oil wells*
  - *Extract dissolved lithium (ion exchange?)*
  - *Downstream process should be a lot like salar brines*

- Lithium-bearing clays
  - *Sediment-hosted in closed-basin environments*
  - *Leach with H_2SO_4 then recover hydroxide electrolytically*

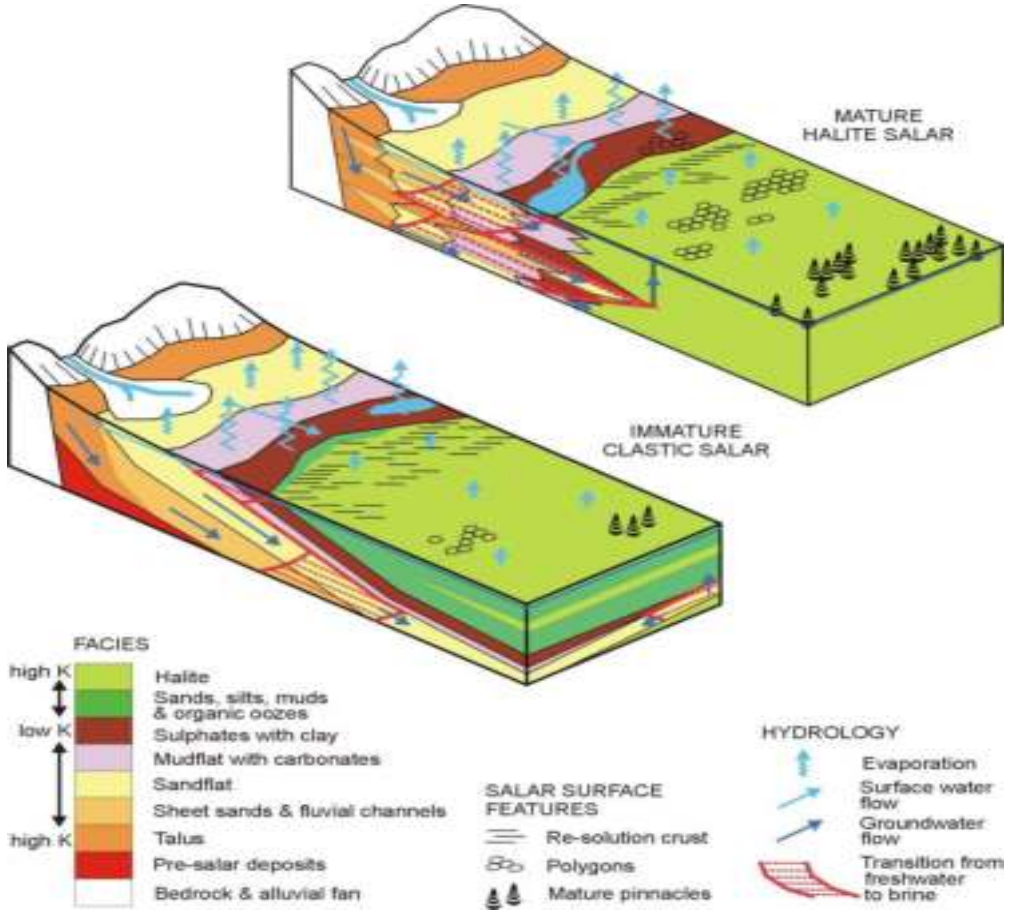
Who has the advantage?

- Established operations like the Chilean brines
- Good infrastructure in place, like Western Australia
- Close to the Vast Monolithic Consumer, China

Salar Brines: suck ‘em and sun ‘em…

Salar de Atacama, Chile; Nevada

- Saline groundwater in structurally-controlled, closed sedimentary basins
- Clastic and evaporitic strata – porous clastics and fractured evaporites are the aquifers
- Li, Na, K, Cl, Br, SO_4, BO_3
  - *0.3-1 g/L Li*
- Production from wellfields
- Recovery in surface evaporation cells



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Salar Brines: practice points

- This type is best understood by hydrogeologists with direct brine experience
  - *Direct sampling of brines, pump tests to estimate volumes*
- Reporting concerns: brine volume, concentration of species
- Effective porosity and specific yield - not all the brine will drain!
- There may be uncertainty around ownership: brines flow across property lines
- Flow decline, changes in grade over time affect resource planning and ultimately cash flow

Lithium Pegmatites
Western Australia, Quebec, Zimbabwe

- Pegmatites extending from granitic contact out to country rock
  - *usually metamorphic – very often mafic amphibolite gneisses*

- Typically narrow veins as swarms or in a “stacked sill” structure
  - *“flats” for you old Abitibi hands*
  - *cm-wide to tens of metres wide*
  - *anastomosing and full of xenoliths*

Lithium Pegmatites

Western Australia, Quebec, Zimbabwe

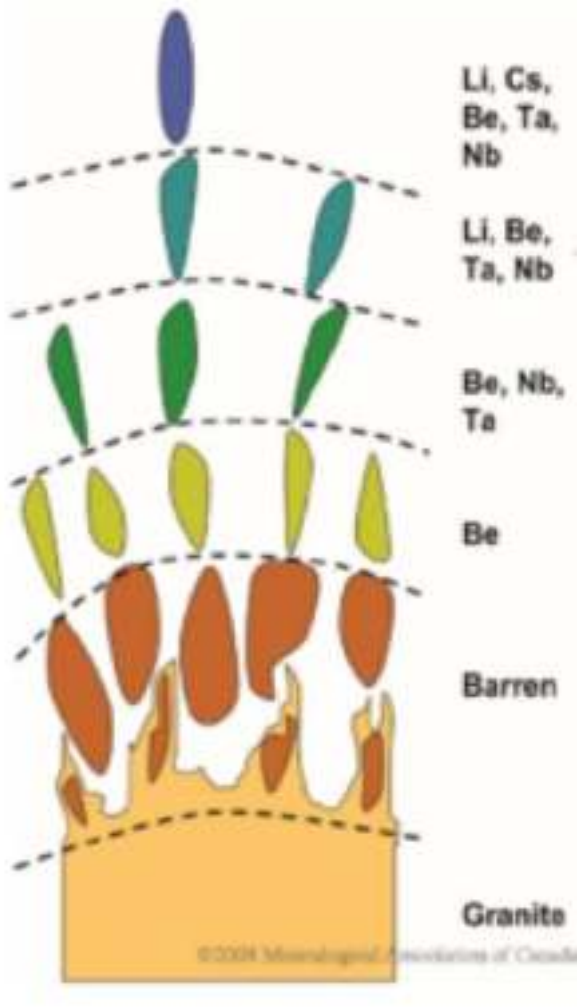
- Spodumene (high-pressure), petalite (low-pressure), lepidolite
  - *coarse-grained which leads to sampling problems*
  - *another one for the old Abitibi hands*

- Size 1-30 Mt, grades 1-2% Li_2O

- Recovery by conventional crushing and grinding, followed by froth flotation

Lithium Pegmatites

- Incompatible-element association
- Li minerals are in the most highly differentiated part of the magma
- Cs, Rb, Ta association
- Nb, Be, sometimes Mo, Bi closer to the granite contact
- There's something about ~~Mary~~ amphibolite country rock
  - *ductile deformation?*



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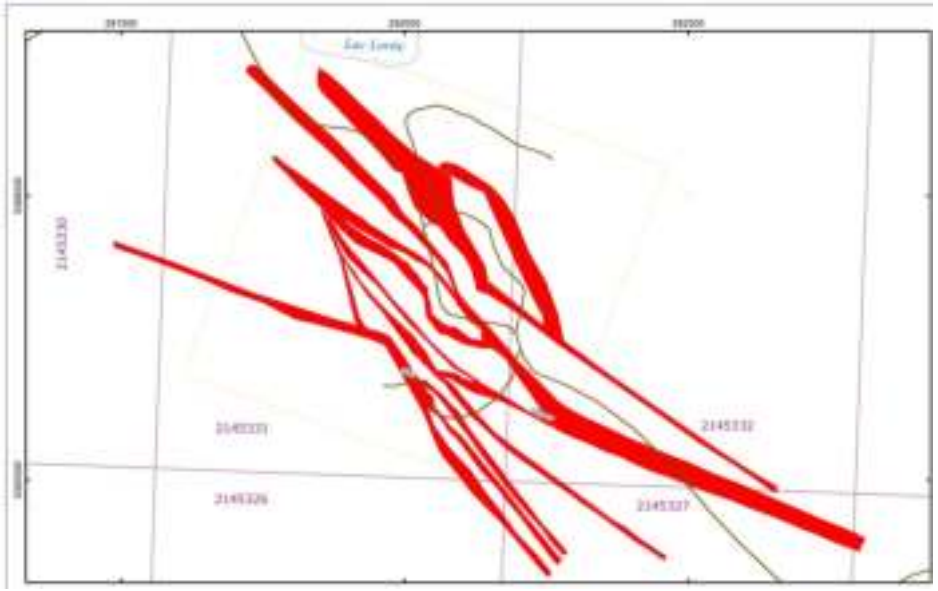
Lithium Pegmatites – practice points

- Structural control and unpredictable domaining
- Difficult to get a representative core sample because of grain size
- Old Abitibi hands will recognize the issues!
- If your veins look like the picture on the left and your block model looks like the picture on the right, you may be headed for trouble.



Lithium Pegmatites – practice points

- To estimate a pegmatite mineral resource properly the professional needs either specialized experience with:
  - *pegmatite sampling*
  - *structural interpretation of veins, dykes, sills, and stockworks*
- Or, look for closely analogous experience with complex vein systems like narrow-vein gold deposits.

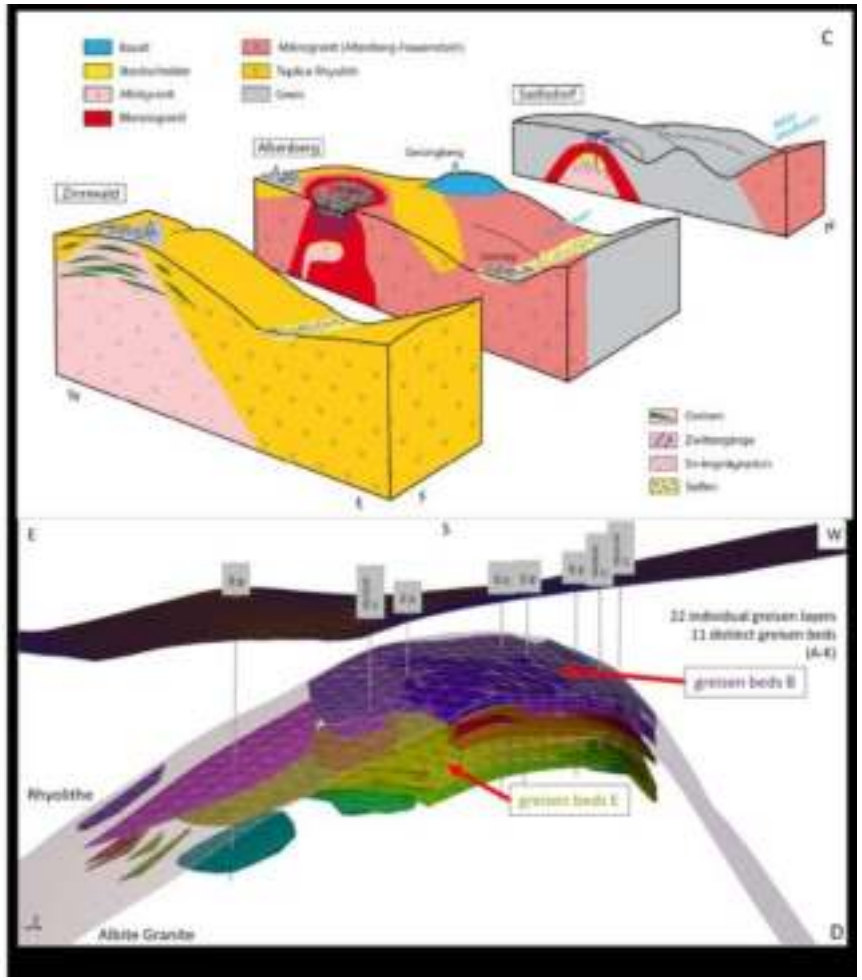
Greisen-type deposits
Zinnwald/Cinovec

- Also on contact zones of highly differentiated granite bodies
  - *S-type granites or (heresy!) granitization?*
- Breccias and stockworks, commonly
- Also veinlets and disseminations
- Zinnwaldite, lepidolite
- Zinnwald is 35Mt of 0.4% Li_2O

Greisen-type deposits
Zinnwald/Cinovec

- Also on contacts of granitic intrusions, but less as veins and more as stockworks or masses

- Similar geochemical associations – Sn as well



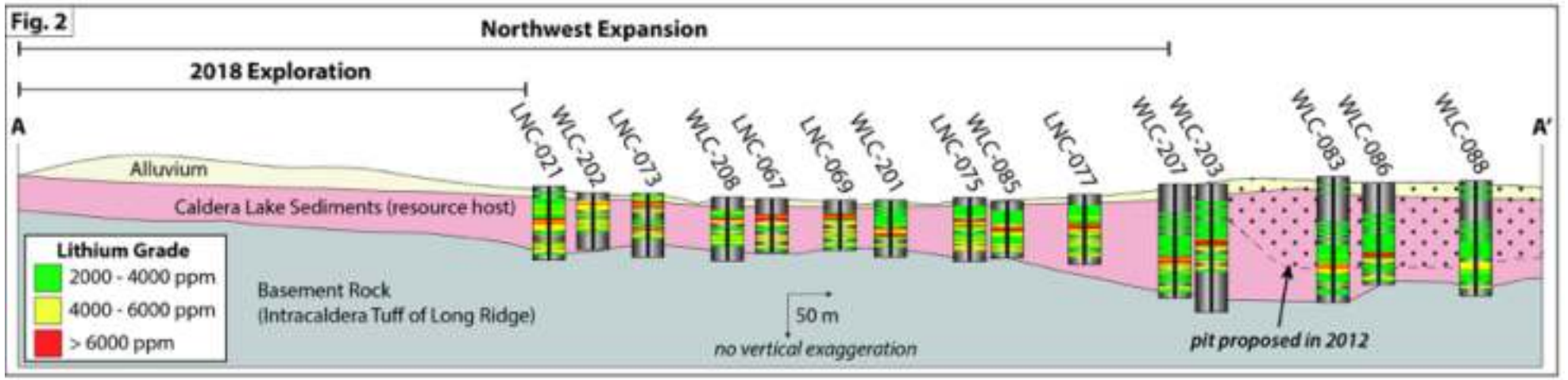
Sedimentary-hosted deposits
Clayton Valley-Thacker Pass, NV

- Same geological setting as the brines – confined basins
- Presumably igneous source
- Li-enriched sediments
- Very large tonnage
  - *Thacker Pass, 385 Mt*
  - *Clayton Valley, 1.3 Bt*
- But grades 0.1-0.4% Li_2O

Sedimentary-hosted deposits

Thacker Pass, NV cross-section

- Flat to gently-dipping sediments
- Shale and siltstone hosts
- Both oxidized and unoxidized facies
- Interbedded with volcanics (some ash layers in sediments)



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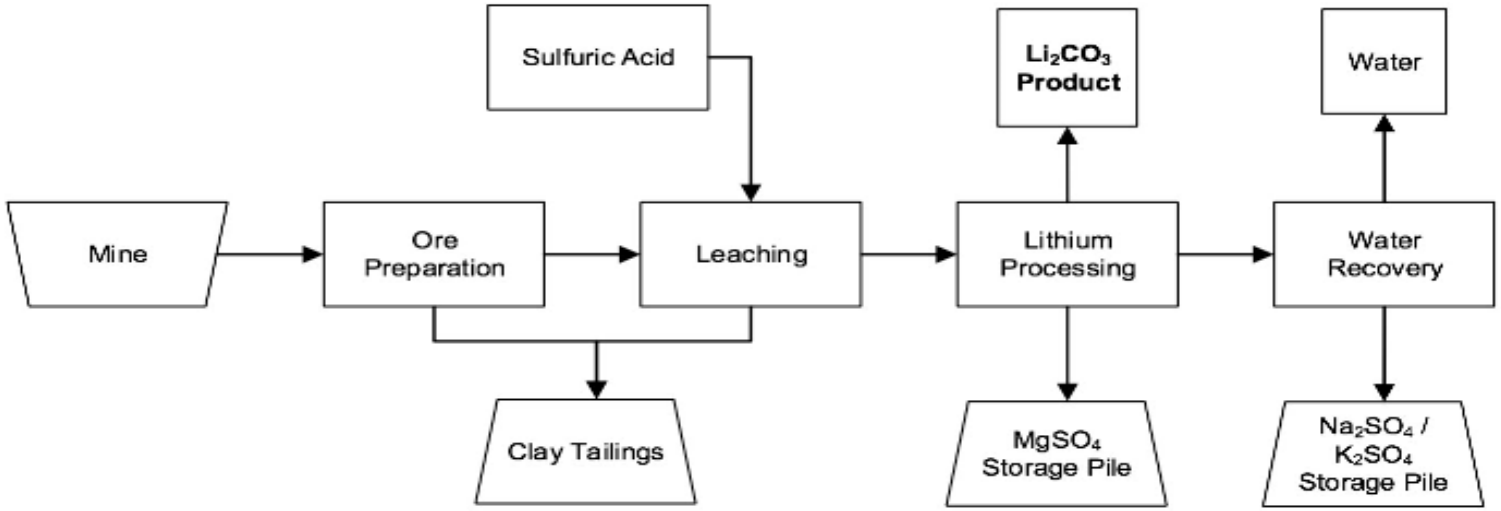
Sedimentary-hosted deposits

Thacker Pass, NV process flowsheet

- Roll crush to size
- Leach in H_2SO_4 then neutralize
- Evaporate and crystallize, remove $MgSO_4$
- Precipitate as carbonate using Na_2CO_3



Oilfield Brines

- Some oilfield brines contain dissolved lithium
- Along with everything else…Na, K, Ca, Mg (as cation species) and chloride, sulfate, carbonate, bicarbonate anions
- Li-rich brines have 5-150 mg/L dissolved Li
  - *Salar brines about 300-1500 mg/L – some up to 4000 mg/L*
- It's comin' up anyway, so there's no cost to pump
- Proposed recovery strategies:
  - *Ion exchange using Al, Mn, Ti oxides or hydroxides*
  - *Solvent extraction to organic solvents, washed with strong acid*
- It's all been pretty promotional so far.

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Thank you

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