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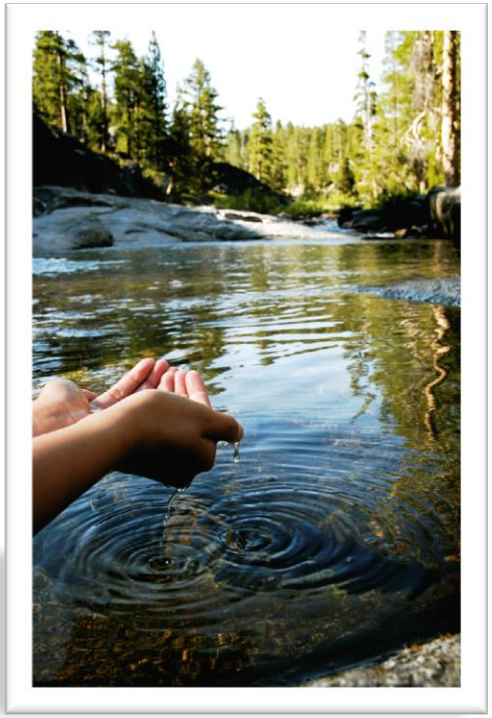


Protection de la resource en eau potable en Ontario, perspectives d'une consultante

Nell van Walsum

Le 11 janvier, 2012, Montreal

Nell van Walsum

M.Sc., Hydrogeology

- University of Waterloo (1987)

WESA

- Project Manager
  - Water Resources
  - Contaminant Hydrogeology
  - Source Water Protection
- President

WESA/Envir-Eau

- Founded in 1976 in Ontario
- Opened offices in Quebec in 1990
- 2 offices in Québec, 5 in Ontario, 1 in NWT, 1 in Central America (El Salvador)
- 140 professionals in environment, occupational health and safety
- A couple of dozen hydrogeologists (M.Sc. et Ph.D)

Experience in Source Water Protection

- Regional Water Budgets
- 3-D Geologic Model development
- 3-D Hydrogeologic Model development
- Delineation of protection zones
  - Well Head Protection Areas (groundwater)
  - Intake protection zones (surface water)
- Vulnerability assessment
- Threats assessment

Source Water Protection – A Consultant's Perspective

- Context: Summary of methodology employed in Ontario to delineate source water protection areas

- Overview of four principal components in the process
- Challenges I perceived in each of the 4 components
- How can we best use our resources to protect our source waters?

Source Water Protection

Definition ~

Protecting source water from contamination or overuse.

Walkerton & The O'Connor Commission

- May, 2000: a municipal drinking water system was contaminated with E.Coli. This tragedy killed 7 people and more than 2000 were ill.
- O'Connor Commission proposed recommendations in 2 phases
- Jan. 2002: *The Events of May 2000 and Related Issues* (28 recommandations)
- May 2002: *A Strategy for Safe Drinking Water* (93 recommandations)

O'Connor Commission: Implications

New laws and regulations in Ontario (*Clean Water Act, Nutrient Management Act, Safe Drinking Water Act)*

- Improved communications between various departments (i.e. Health and environment)
- More formal training and certification related to water distribution services
- Watershed-based planning aimed at protecting municipal water sources (surface and groundwater)

Source Protection: Implementation

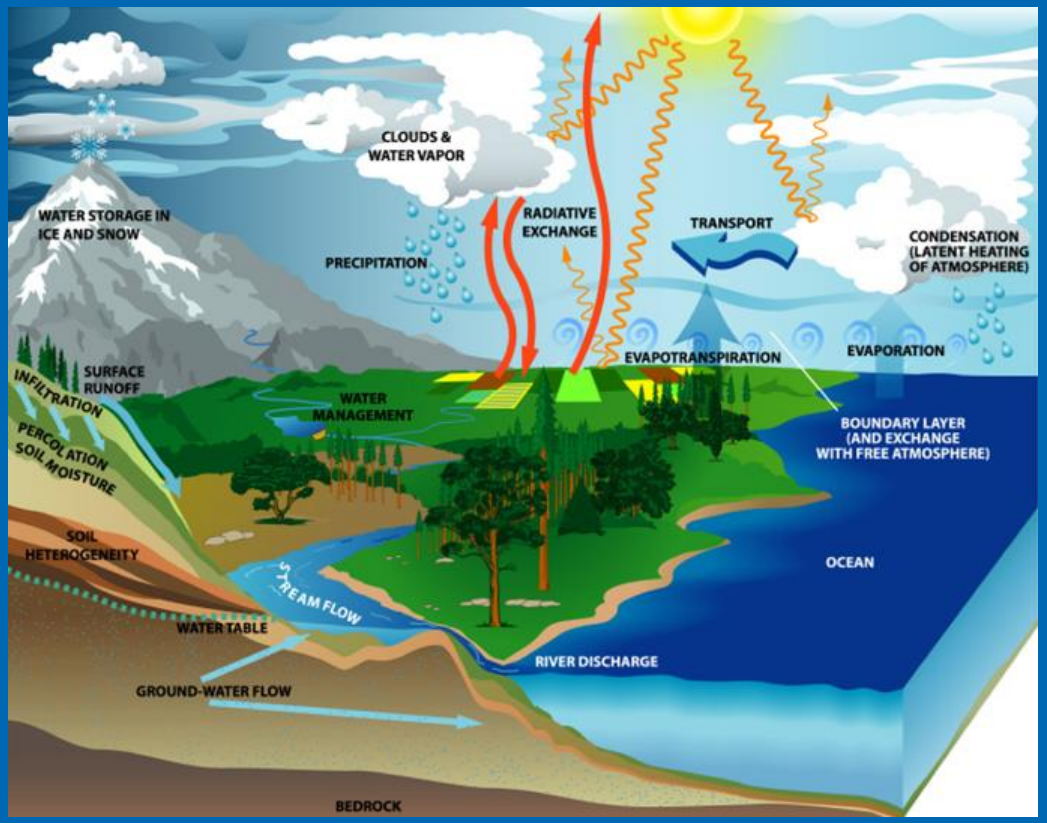
- Financial Source: Province
- Management of the funds ($$): Municipalities
- Conservation Authorities (CA's) provided technical support to the municipalities
  - Provided a communication between municipalities and the province
  - Managed the data bases
  - Managed the technical projects
- CA's: cross political boundaries

Technical Steps (6)

1. Watershed characterization
2. Assess vulnerability of groundwater
3. Assess vulnerability of surface water
4. Complete an inventory of potential threats
5. Risk Assessment
6. Water Budget and water quantity assessment

1. Watershed Characterization

- Geology
- Topography
- Physiography
- Soils
- Hydrology
- Aquatic ecology
- Water quality
- Land Use
- Climate
- Surface water/ groundwater interactions etc.



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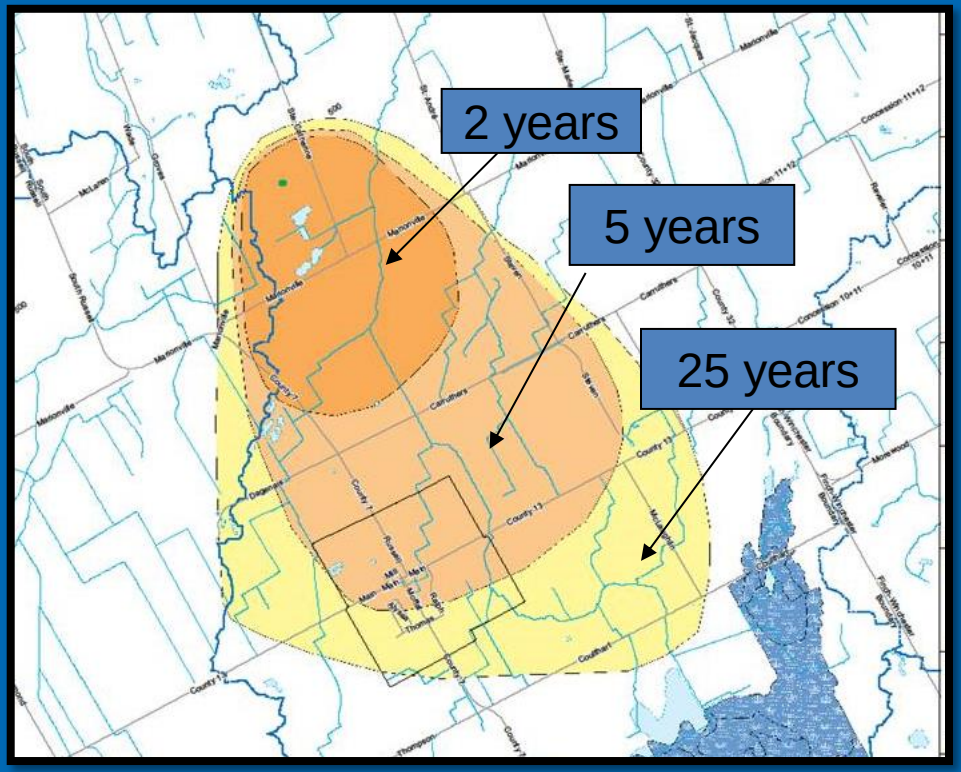
Watershed Characterization

- Essentially a data collection exercise
- Only collected existing data
  - GIS (mostly from the province)
  - Well data (database provided by the province)
  - Consultant Reports
  - Published Reports

2. Assess Vulnerability of Groundwater

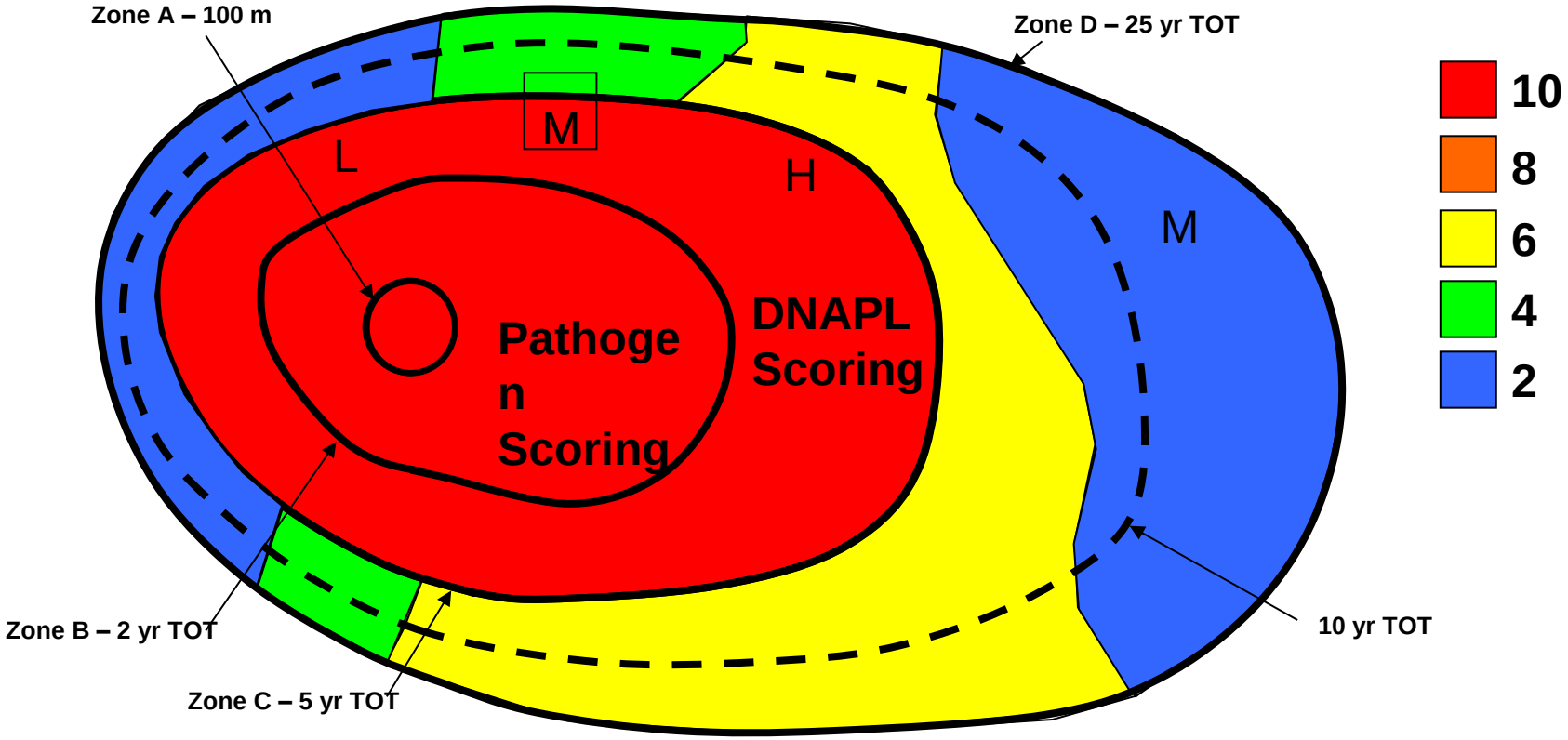
- Delineation of Well head protection areas
- Horizontal travel time



Assess Groundwater Vulnerability

- Assess vertical travel time – is there any barrier to vertical travel?
- Build a strong conceptual model based on existing information
- Vulnerability Assessment. Results greatly dependant on data between the aquifer and the surface – data not as readily available.

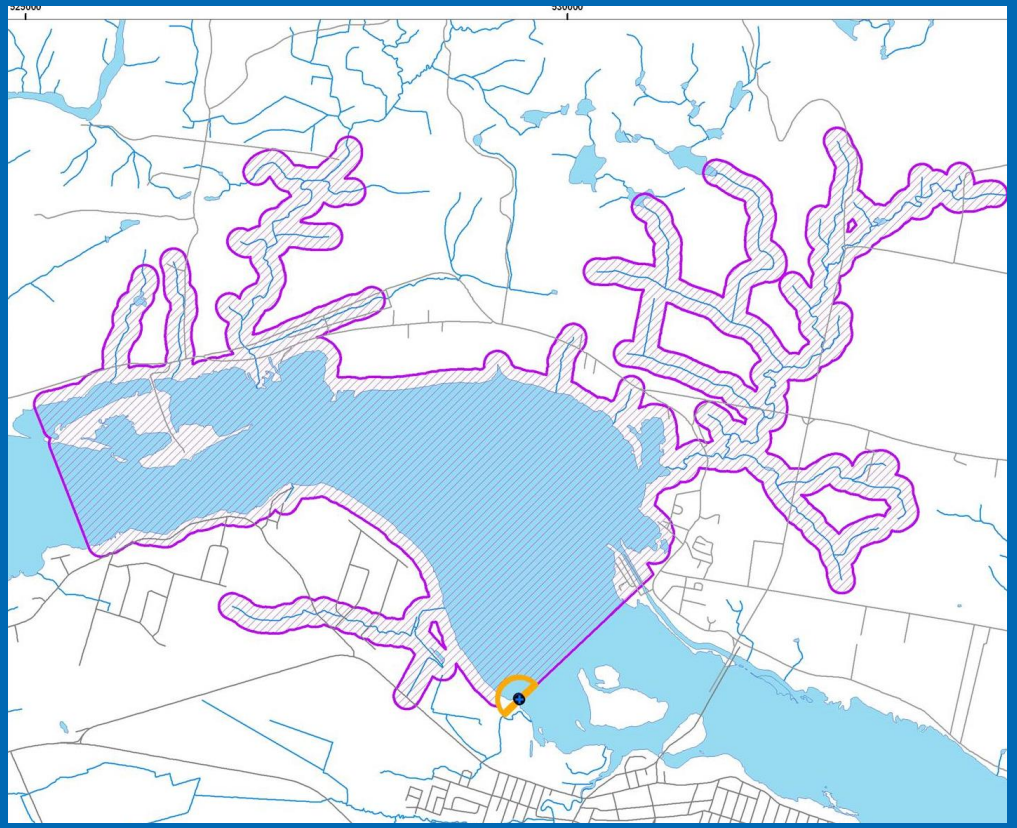
WHPA Vulnerability Scoring



Vulnerability Assessment Method	WHPA Zone	HIGH Intrinsic Vulnerability	IV score	MEDIUM Intrinsic Vulnerability	IV score	LOW Intrinsic Vulnerability	IV score
N/A	Zone A	10					
N/A	Zone C (DNAPL only)	10					
ISI / AVI or (*Hydrogeo. Assessment*)	Zone B	< 30 *(High)*	10	30 to 80 *(Medium)*	8	>80 *(Low)*	6
	Zone C		8		6		4
	Zone D - 10 year		(6)		(4)		2
	Zone D - 25 year		6 (4)		4(2)		
TOT – Based (Only)	N/A	Zone B - 2 year WHPA	10	Zone C – 5 year TOT	8	10 year TOT	(6)
						Zone D – 25 year TOT	6 (4)

3. Surface Water Protection Zone

- Delineation of Surface Water Intake Protection Zones



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Surface Water Vulnerability

- Travel time to the “intake”
- Characteristics of the soil, topography
- Man made conduits (sewers, ditches, etc)

Source Water Protection
10 years funded

Questions and Challenges

- My interpretation of the technical “components”

The Big Picture

- Challenges of each “component”

Nell's 4 Components

1. Data
2. Conceptual Model
3. 3-D Analysis and delineation of the "line on the map"

----- Boundary between Technical and Policy-----

4. Policy/program implementation

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1. Data

- Foundation of study/analysis

Challenges:

- $$
- Ownership (continuity)
- Storage
- Sharing and QA/QC

Data

Need for collaboration/integration

Data provided by the MOE

- - Well Logs
- - Certificates of Approval
- - Other official Studies

→Provides important 3-D data, geology, hydrogeology, geochemistry

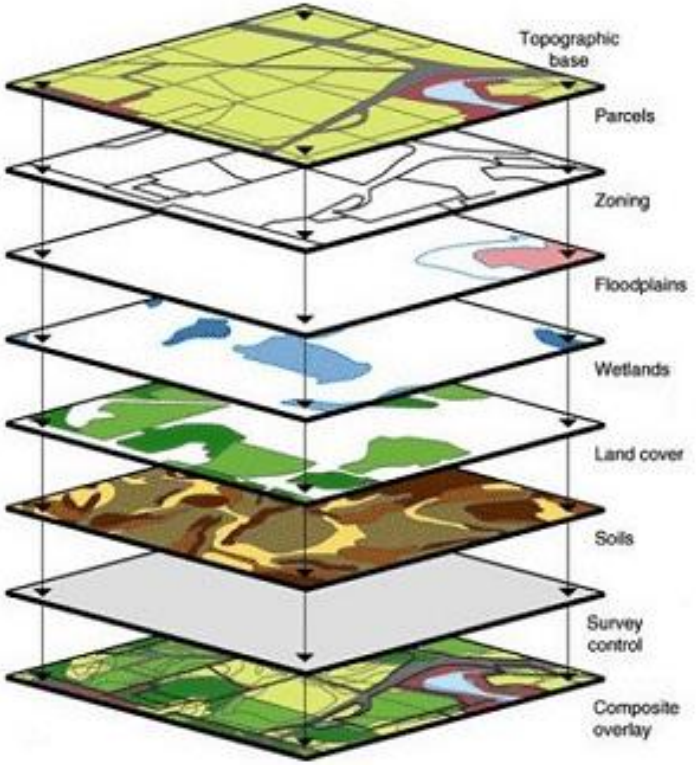
→Punctual in time and space

Data

MNR (GIS Information)

- Topography
- water courses
- land use
- vegetative cover
- etc..

→ Surficial (2-D)



Data

Existing Consultant Reports, official reports not captured by Government Organizations

- Digital Library
- Catalogue of information with basic referencing

Data – Digital Library

PDF Reports

Database listing descriptive data

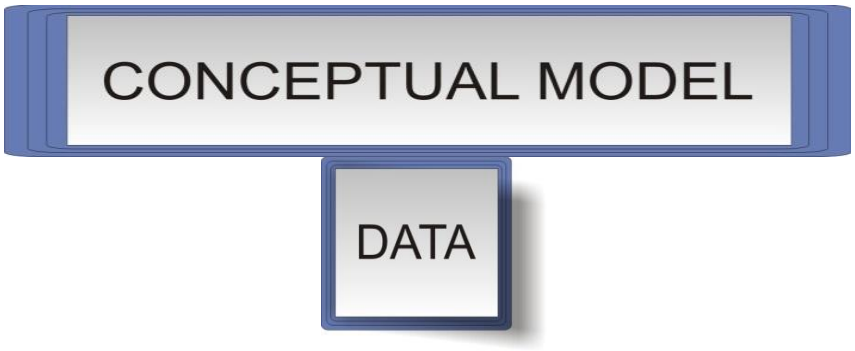
- Author, title, year, agency
- Municipality, township, county
- Well logs, hydraulic conductivity data, geophysical data, geochemistry, etc
- Eastern Ontario now has over 2,500 reports

Data – Summary of Challenges

- Very expensive to collect
- There is existing data and information/often difficult to access
- Regular QA/QC
- Meta data
- Continuity. Difficult to justify temporal data. Essential to understand trends (climate, agriculture, global impacts, etc)

2. Conceptual Model

- Regional Studies
- Conceptual model often goes beyond boundaries of “data” concentration
- Require global understanding of interrelated physical systems



Conceptual Model

Challenges:

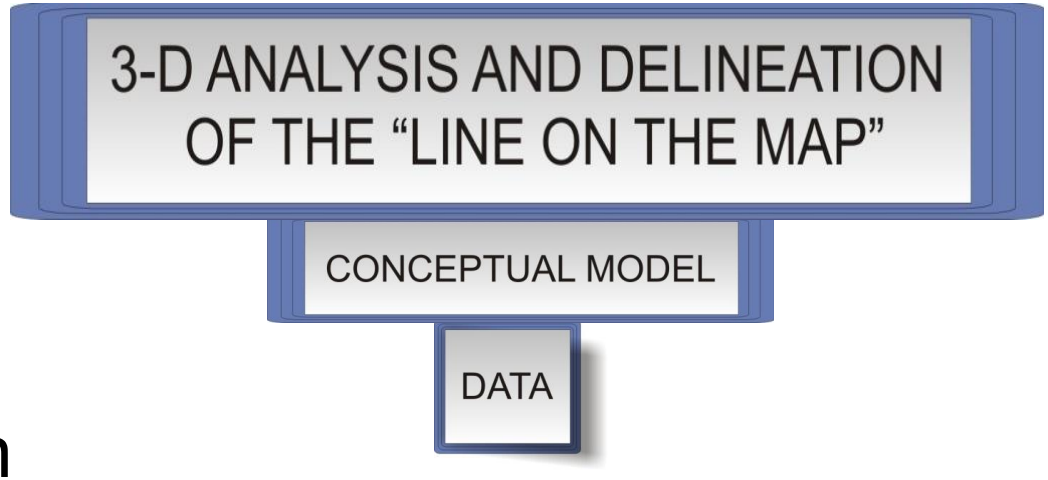
- Scale is regional (10's of Km's)
- Data is usually sparse given the scale
- Typically do not have complete understanding of all interrelated physical systems (geology, climate, hydrology, land use, planning, etc)

Conceptual Model

- To everyone's advantage to communicate early in the process between all parties. Waiting until the "report" is complete defeats the purpose.

3. 3-D Analysis and delineation of the “line on the map”

- Building upon the conceptual model – and extending to a predictive assessment.
- Culmination of technical studies: produce the “line on the map”



3-D Analysis and delineation of the “line on the map”

One Key Challenge: Uncertainty

- Quantification of uncertainty
- Communication of uncertainty
- Managing the concept of uncertainty
- Where does “uncertainty” belong in the process?

Uncertainty

- many different methods to assess and quantify uncertainty
- Often very technical and difficult for the lay person to comprehend

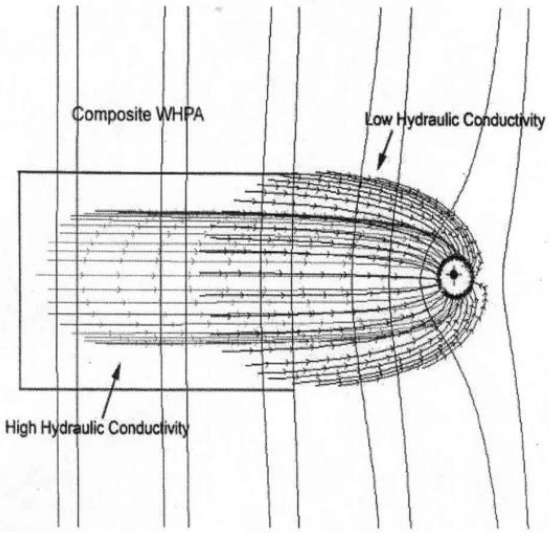


Figure 12. Simulated wellhead protection areas using range of hydraulic conductivities.

Uncertainty in the delineation of Well Head Protection Areas

Uncertainty assessment: a requirement in Ontario.

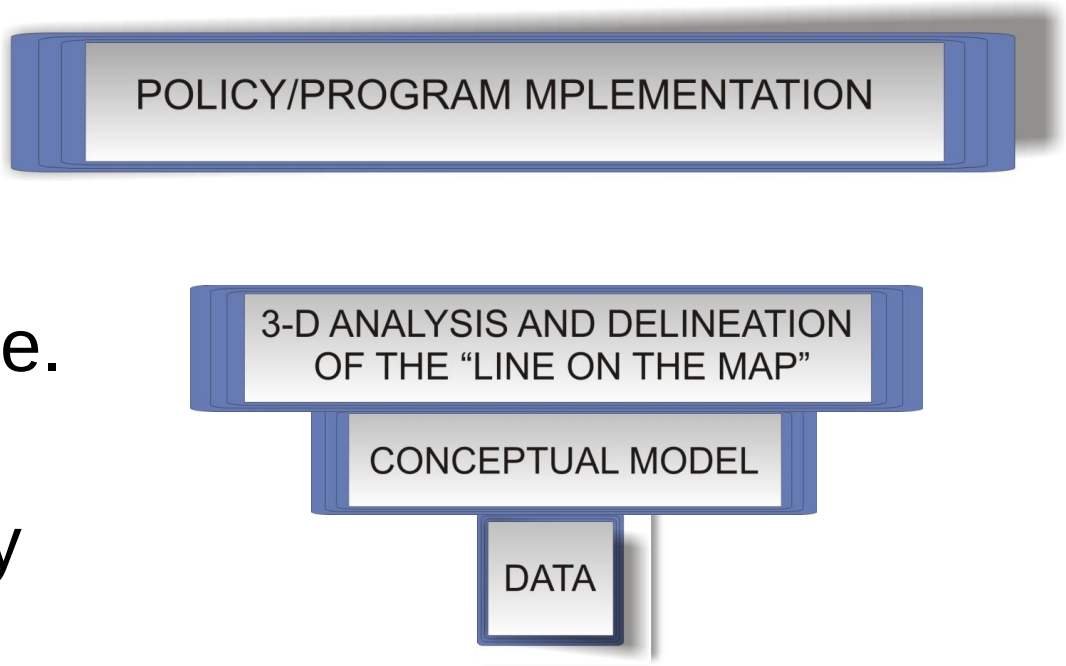
- People addressed this notion differently in different regions. Result: very different WHPA's (some were much more conservative than others).
- The "line on the map" is the boundary between the technical assessment and policy implementation.
- Typically the "line" gets transferred, and the 100's of pages of technical supporting documentation are left behind, including the "notion" of uncertainty

4. Policy/program implementation

The “line on the map” is now policy

Uncertainty and all assessment has lost context and relevance.

The “line” is a sharp boundary without any consideration for uncertainty.



Policy/program implementation

Components of Program implementation:

- Land use: restrictions
- Implementation plan: Best management practices
- Communication: education

Policy/program implementation

- Land use restrictions:

need to protect source water from critical threats.

- Planning to discourage

future development of potential sources.

Policy/program implementation

- Best management practices

Policy/program implementation

- The line on the map is now policy
- Communication and Educating the public

Objective – Source Water Protection

- Objective: As a result of the *Clean Water Act* , Communities in Ontario are required to develop source protection plans in order to protect their municipal sources of drinking water. These plans identify risks to local drinking water sources and develop a strategies to reduce or eliminate these risks.

Critical areas to protect: high vulnerability and high risk

Observations – Ontario Experience

- Involved since 2001, 10 years of provincial funding
- The “end” was not defined before the project started.
- In the end, identified most significant threats (high vulnerability and greatest risk for potential for impact). The focus is now on those most significant threats.
- The “line on the map” defines a distinct boundary.
- Not much money left to address data gaps where data is needed the most

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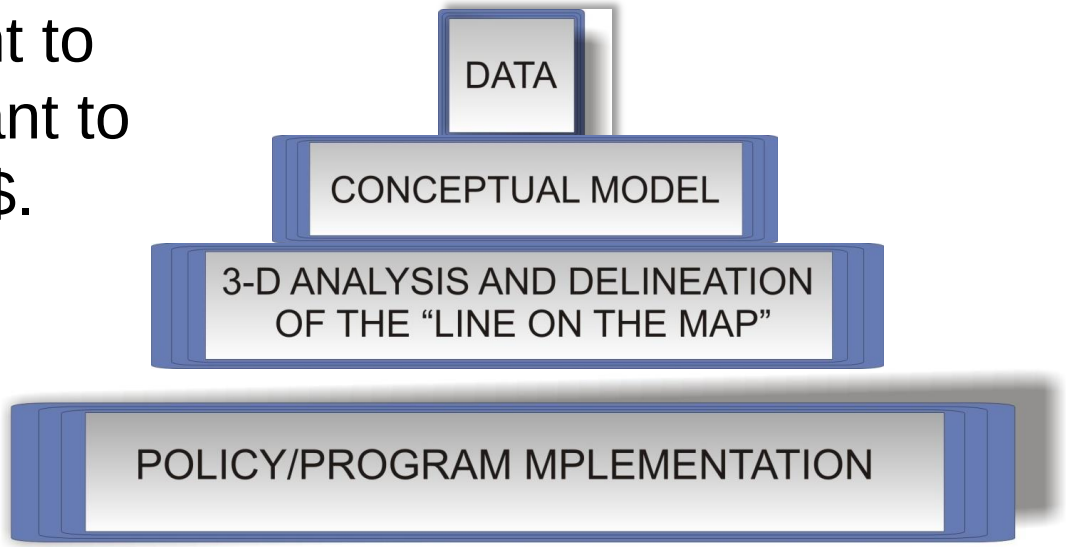
Have the “end” in mind

Policy

1. Decide what we want to do and where we want to spend resources $$$.
2. How are we going to protect the source water?
3. What mitigative measures are we willing to fund?



The Line on the Map...

3-D analysis and delineation of the “line on the map”

1. How do we want to assess uncertainty?
2. What are we going to do with this information? Is this of use to the planners?
3. Should WHPA’s be “conservative” or best estimate?

“Conceptual” Model – be inclusive

1. Get advice from experts.
2. Collaborate to complete the conceptual model.
3. A conceptual model will identify “sensitive” areas and areas of “risk”
4. Use this knowledge to prioritize areas to attain new data

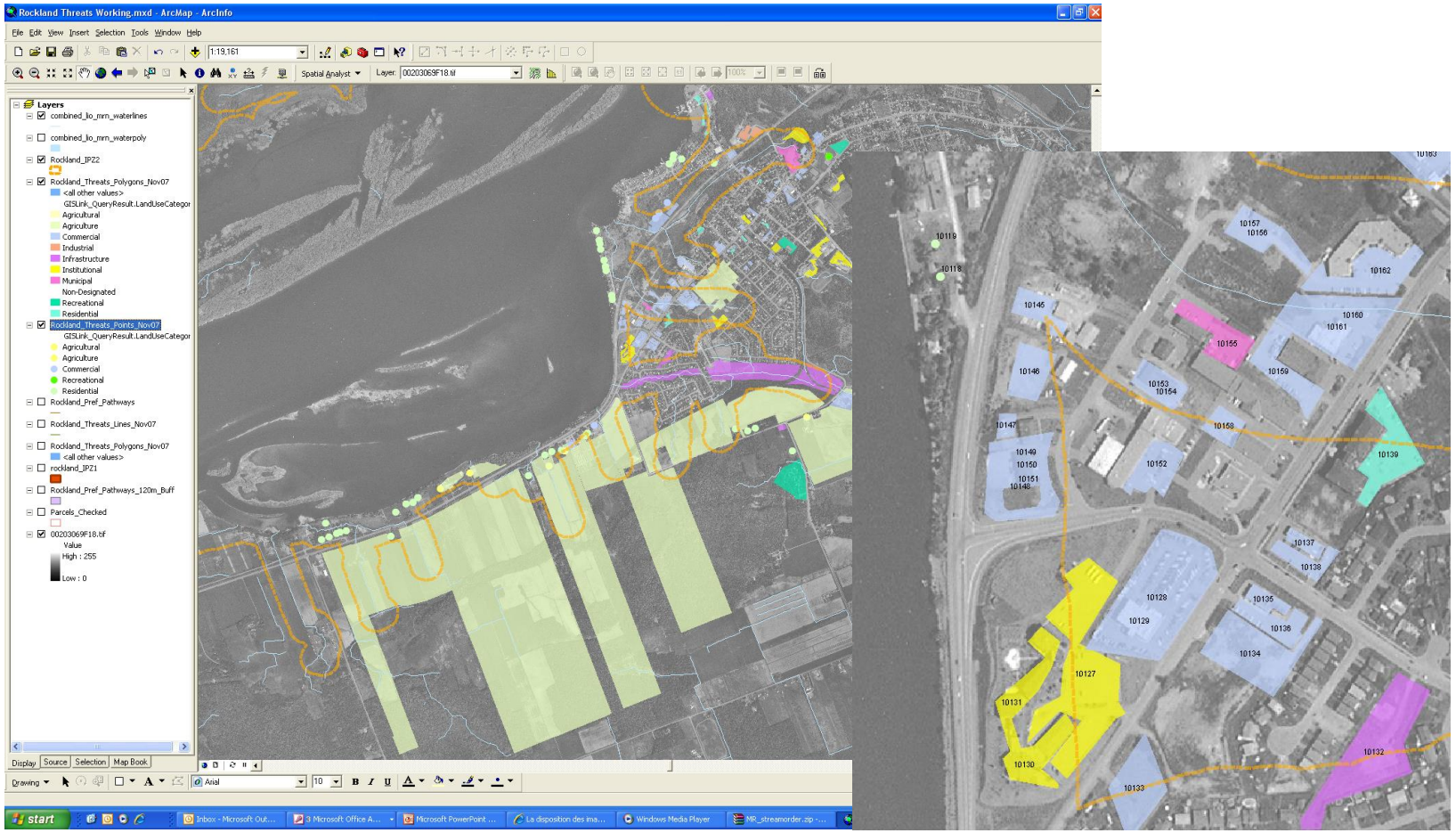
Data is the foundation – retain resources for data acquisition

1. Data is available, accessing it is a challenge
2. Prioritize collection of new data to sensitive areas (and aquitards)
3. Build a database and digital library
4. Share information to minimize costs
5. Assign responsibility for central data management

Source Water Protection

Protecting source water from contamination or overuse.

Questions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Layers
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Agricultural
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Institutional
Municipal
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