Towards integrated, connected, intelligent and intelligible management of regional groundwater resources

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Knowledge as a Basis for Water Management

- In Quebec (Canada), a systematic aquifer assessment program (called PACES) covered 70% of municipal land from 2009 to 2015 and the coverage should be about complete by 2021.
- The knowledge provided was meant to be used to protect and manage groundwater resources.
- Such a knowledge base is needed to undertake integrated water resources management.

Components of Water Resources Management

- Integrated water resources management must consider surface water and groundwater and their natural and anthropic stresses.
- Knowledge about the flow system must be based on weather data, surface water monitoring, anthropic activities and water use inventories, land cover and soils maps, hydrogeological characterizations, and groundwater monitoring (levels and quality).
- Understanding of the flow system and its evolution is based on a series of models and data interpretation tools about climate, ecosystems, surface and ground water, land use and water use.
- A water management plan must define regulatory and voluntary actions through a participative approach involving water stakeholders and based on an assessment of present and future impacts of water exploitation scenarios. Some of the water management tools are land use planning, definition of ecological flows, water allocation, source water protection and climate adaptation plans.

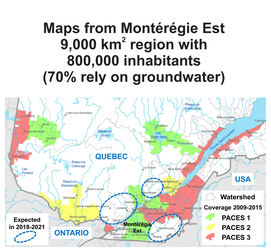
Desired Features of Water Resources Management

- Integrated: considers both surface water and groundwater.
- Connected: based on continuously available monitoring data.
- Intelligent: relies on a sound understanding of the flow system through « living » numerical models and data assimilation.
- Intelligible: technical information is « translated » to be understood by non-specialists and management plans involve all water stakeholders through participative water governance.

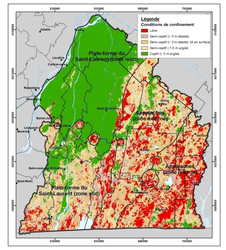
Systematic aquifer assessment program to provide the basis for water management

Examples of hydrogeological maps produced by the PACES aquifer assessment program in the Montérégie Est region

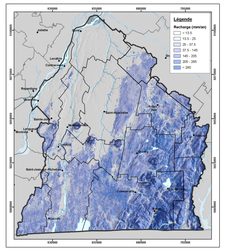
Maps from Montérégie Est
9,000 km² region with
800,000 inhabitants
(70% rely on groundwater)



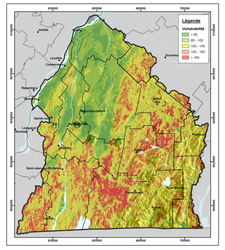
Coverage of the aquifer assessment program



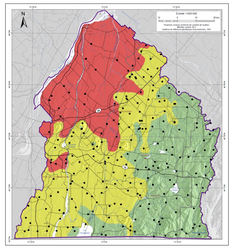
Fractured rock aquifer confinement



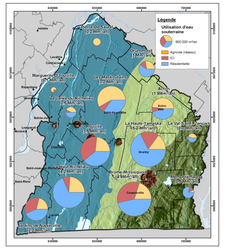
Spatially-distributed recharge (HELP)



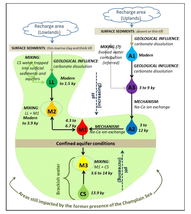
Aquifer vulnerability (DRASTIC)



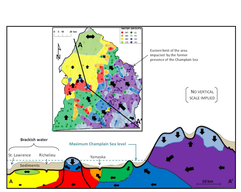
Zones of groundwater quality



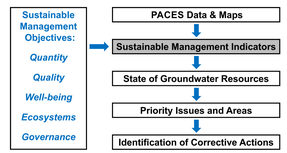
Groundwater use



Conceptual model of groundwater flow and geochemical evolution

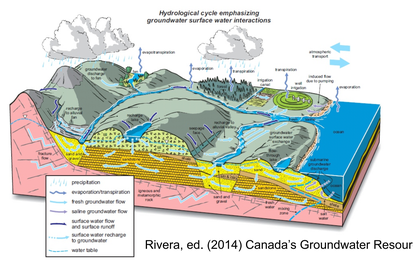


Cross-sections used to explain the conditions found in the aquifer system to stakeholders



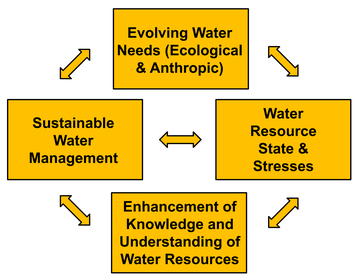
Production of indicators to translate technical results

Integrated water management

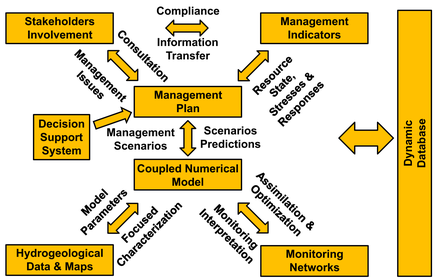


Rivera, ed. (2014) Canada's Groundwater Resources

Flow system components



Basis of sustainable water management



Integrated water management tools

Slides about this communication are available at the following link:
https://www.researchgate.net/publication/320507991_Future_regional_groundwater_resources_management_integrated_connected_intelligent_and_intelligible