

Editor's MESSAGE

Welcome to the new face of our GW Newsletter. The new look not only complies with ESS standards, but I hope you will also find it more attractive (I do). This fifth edition marks the second year of our Groundwater Program. I can summarize the situation of the program since our last newsletter in April, with three important events: the program's new budget, the extensive field campaigns, and the involvement of our partners across Canada.

Last April, I shared my expectations for a higher budget for the second year, and I was not disappointed. Our managers did indeed reward us with a slightly higher budget. I must say, however, that even keeping the same level as the previous year would have been already a success, given that other programs saw their budgets decreased.

But the better part of the story is our partners' involvement, who, in addition to providing in-kind support, started to allocate some real cash in the projects that we develop together; thus, by de facto increasing the overall funding available for the same cause. Some of our provincial partners (N.S., QC, ON, B.C.) as well as OGDs (AAFC, EC, Parks), and even international collaborators (USGS), have provided funds and staff to cover parts of some of our projects. I take this opportunity to openly and publicly acknowledge their support.

The summer, now ending 🔀, brought a myriad of field campaigns from the Atlantic to the Pacific. Given that this is the second year of most of our current regional-aquifer assessments, the need for field data reached its peak. At least 8 research teams spent most of the summer on the field performing tests, coring, mapping, taking photos (scientific photos, that is) and enjoying our short but beautiful summer. Some field stories with photos (not scientific) are briefly presented in this issue.

For the benefit of our readers, I present a map of the aquifers whose assessments have been so far completed, as well as those to be competed in 2006. A few figures summarize some of the current results.



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Alfonso Rivera, Chief Hydrogeologist and Groundwater Program Manager

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WE ARE ON THE WEB !

Launch of the Groundwater website

As of October the 1st the Groundwater program's website is accessible at : <u>http://gwp.nrcan.gc.ca</u>. Send us your feedback and suggestions.



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New initiatives and funding successes

GRIP (Government Related Initiatives Program)

The Canadian Space Agency has recently funded a collaborative ESS-GRIP project to develop and test methods for the use of remote sensing in groundwater assessments. This 2-year project includes the production and validation of satellite based maps of land cover, vegetation structure and density, and soil characteristics over 20% of key regional aquifers across Canada. The project also aims to use these parameters within quantitative regional groundwater recharge models. Software tools developed in the course of the project and best practice guidelines for satellite parameter mapping will be published for the benefit of future regional groundwater assessments.

Contact: Richard Fernandes (rfernan@nrcan.gc.ca)

GAOB (Groundwater Assessment Okanagan Basin)

The Groundwater Program has initiated a new regional groundwater assessment project in the Okanagan Basin in close collaboration with the B.C. Ministry of Water, Land and Air Protection (WLAP). The main goal of this new project is to assess the groundwater resources within the Basin's unconsolidated and bedrock aquifers. This is consistent with federal and provincial goals to increase current groundwater knowledge in populated regions to assist with sustainable groundwater management and protection. Information and data generated in this project will assist local governments in developing and implementing groundwater protection and management. The Okanagan region is part of the list of 30 Canadian regional aquifers identified by the ESS Groundwater Program. In that list, a «key» regional aquifer is an aquifer that responds to ESS priorities.

Contacts: Steve Grasby (<u>Sgrasby@nrcan.gc.ca</u>) and Vicky Carmichael (<u>Vicki.Carmichael@gems6.gov.bc.ca</u>)

Navigating Pathways from Rocks-to-People, Science-to-Policy approach to water sustainability

The Groundwater Program and the Pathways project of the ESS Sustainable Development through Knowledge Integration Program (SDKI) have partnered to aid sustainable water resource management and future growth strategy planning in the Okanagan Basin and Gulf Islands Regions of B.C. The objective of the partnership is to help planners and policy makers address issues related to the vulnerability and sustainability of regional aquifers. To meet these aims, targeted groundwater studies are being initiated in association with university, provincial, regional, municipal, and industrial partners in the study areas. This knowledge is then utilized in the Pathways decision framework, where science models of groundwater are integrated with policydriven management models. For example, water variables such as recharge and precipitation rate are coupled to social variables such as water demand, population distribution, etc., in specific localities to model the water budget. Spatial decision-support software tools that allow 'what-if' modeling over geographic areas are then applied to enable generation and comparison of alternate planning scenarios, e.g. drought situations, unexpected population growth or various population distributions, ultimately to meet specific social needs of stakeholders. Web-based technology is also deployed to aid deliberation over the various scenarios, and to access to data, results, and communications. Identification of stakeholder needs and adaptation of the decision tools and models to these needs, is facilitated by the Pathways team and its partners. The approach is currently being prototyped via a partnership with the BC Ministry of Water, Land and Air Protection (groundwater section), the Islands Trust (regional planning authority) and member communities of the Gulf Island groundwater district in southwestern British Columbia, and will contribute to regional futures scenario models being developed for the Georgia Basin by the UBC Sustainable Development Research Initiative.

Contact: Boyan Brodaric (brodaric@nrcan.gc.ca)



Figure 1: Integration of the Gulf Islands intrinsic susceptibility model within a socio-economic and planning tool – CommunityViz.

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RésEau

On Tuesday, June 29, GSC-Quebec welcomed representatives of the National Water Research Institute (Burlington) and the Water Quality Monitoring Branch (Gatineau) of Environment Canada. The purpose of the meeting was to define the role of NRCan in the RésEau project, coordinated by EC, and to discuss NRCan's possible participation in the national report on groundwater quality, the drafting of which is expected to begin shortly; our work on the characterization of regional aquifers and the national groundwater database could contribute substantially to this report. At the end of this meeting, it was agreed that NRCan would make the following commitments within the framework of the RésEau project. This collaboration and any future collaborative efforts will be credited to the collaboration agreement between GSC and NWRI.

- O Provide ongoing content expertise, messaging, advice and partnership support for existing and future RésEau deliverables that have groundwater resource implications; leadership on content for incorporation of a groundwater component into RésEau.
- O Coordinate introduction of ResEau, and establish and maintain an ongoing dialogue with Canadian groundwater community as it relates to demonstration projects to increase awareness and foster interest.
- O Provide the point of contact for the development and implementation of groundwater related project(s) under RésEau.

Contacts: Alfonso Rivera (<u>arivera@nrcan.gc.ca</u>) and Éric Boisvert (<u>eboisver@nrcan.gc.ca</u>)

Climate Change Action Fund

The study of the nitrogen cycle of at-risk aquifers in Prince Edward Island, under the direction of Martine Savard, led to the obtaining of a Climate Change Action Fund grant for a project to study the consequences of climate change on the nitrate contamination of potable water. This three-year project will be conducted in collaboration with Agriculture and Agri-Food Canada and the provincial environment department.

Contact: Martine M. Savard (<u>msavard@nrcan.gc.ca</u>)

United States Geological Survey

Discussions held during the USGS National Groundwater Meeting, in Denver June 20-25, 2004 (see below) resulted in formal participation by the USGS in the Châteauguay transboundary aquifer study. The USGS will allocate 50K\$ to map the New York segment of the aquifer (45% of total surface), and this data will be included in a global hydrogeologic map with consistent sets of units and properties in the U.S. and Canada. The data, maps, and other related information will be shared by the two surveys and will be integrated in the Canadian



Contacts: Alfonso Rivera (arivera@nrcan.gc.ca) and Miroslav Nastev (mnastev@nrcan.gc.ca)

Visibility of the Groundwater Program

Earth Sciences Sector participation in regional symposium on water in the Châteauguay watershed. Organized by the Société de conservation et d'aménagement du bassin de la rivière Châteauguay (SCABRIC) [Châteauguay Watershed Management Agency], this symposium on Saturday, October 3, attracted about one hundred participants. SCABRIC's mission is to improve the quality of soil and water in the Châteauquay watershed. The Quebec provincial government's water policy, which was adopted to reform the governance of water, advocates integrated, watershed-based water management and supports the activities of such government, local, regional and public consultation and coordination organizations. ESS was one of the organizations funding the symposium, and Miro Nastev gave a presentation on the inventory project being conducted jointly with the Quebec department of the environment (MENV) to gain a deeper understanding of the recharge, dynamics, vulnerability and sustainability of groundwater resources in the Châteauquay watershed. The symposium was a most appropriate forum for publicizing the goals and achievements of the project to a very interested audience whose members are sensitive to regional issues surrounding conflicting groundwater usage: the environmental problems of Ville Mercier, commercial bottling permits that are currently under assessment, the impact of hog farms and intensive agriculture, and so forth.

Participation of the Groundwater Program in the U.S. Geological Survey National Groundwater Meeting. Alfonso

attended the USGS National Groundwater Meeting, in Denver June 20-25, 2004 and was invited to present a keynote speech during the plenary session, during which he presented an overview of the program and knowledge derived from the assessment of 6 regional aquifers. 280 groundwater scientists across the US attended this meeting that was aimed at communicating on-going and planned scientific activities to staff and providing training. During the plenary session, the director of the Water Division (USGS) analyzed the driving issues and change drivers, presented future trends and directions and stressed the importance of water assessments, increased access to data and public understanding and awareness of groundwater

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Upcoming IAH meetings in Quebec City and Mexico

Outputs of the Groundwater Program will be luminaries of this year's two meetings of the International Association of Hydrogeologists (IAH). The first one is the XXXIII IAH International congress to be held in Zacatecas, Mexico October 11-15, whose theme is ad hoc to our GWP vision: «Groundwater Flow: Understanding from local to regional scales». Steve Grasby and Alfonso Rivera, as well as other partners (U of Calgary), will make presentations on groundwater studies from Canada. See: <u>http://indy2.igeograf.unam.mx/aih/</u>

The second one is the yearly IAH Canadian Chapter conference to be held this year in Quebec city, 24-27 October. This conference will be a distinctive one, given the 3 special sessions and the number of papers submitted in those sessions. Regional Groundwater Resources in particular has 17 papers from aquifer assessments across Canada (from GSC studies and provincial studies); and many others from GW management and protection; major contaminated sites, fractured media; and climate change. This will be an excellent opportunity for meeting with colleagues, GWP partners and other stakeholders. See: www.geoquebec2004.org

Milestones from the Groundwater Program

Figure 2 shows the map of Canada with the location of the regional aquifers whose assessments have been completed in 2004, whereas Figure 3 shows the regional aquifers currently under study, to be fully assessed by 2006. Figure 4 is a sample of current results from the assessments, showing regional withdrawals in m³/y, two other large aquifers from the USA and Mexico are shown for comparison purposes. These numbers are part of a larger analysis based on the assessments with regional key indicators of groundwater availability (quantity in space and time). Full results and descriptions will be published in the near future; you will be informed through the Program's newsletter.











GROUNDWATER INVENTORY

Figure 4. A sample of current results from regional aquifers completed

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Outreach

New Waterscape poster initiated for Calgary region. On May 20, 2004 the Geological Survey of Canada Groundwater Program hosted a workshop in Calgary to design a new public information poster for the Bow River Basin, Alberta. The Bow River Basin includes the metropolitan Calgary area, Canada's fastest growing urban region. The meeting included representatives of Alberta Environment, the Bow River Basin Council, Climate Change Central, both Calgary School Boards, Calgary Science Centre and the Geological Survey of Canada. The Bow River Basin Waterscape poster will be part of the new national «Waterscape» poster series fashioned after the highly successful Geoscape poster series. The purpose of each poster is to promote water stewardship and science-based decision-making regarding water resources and provide an educational tool tailored to communities across Canada.

Participation of the Groundwater Program in the conference of the Canadian Science Writers Association.

The CSWA Annual Conference was held at Ryerson University, in Toronto on June 5-7 under the theme « the Science of Water and How it Affects Ours Lives ». This conference provided ample opportunities through oral and poster presentations to present ESS research activities aimed at increasing knowledge on the sustainability and vulnerability of Canada's groundwater reserves. Alfonso Rivera, authored an article «Surface and groundwater, a sine gua non for Canada's development» that was published in a special conference edition of «Science Link», the Association's newsletter. His article can also be downloaded at: http:// www.sciencewriters.ca/sciencelink/may2004.pdf. Environment Canada and Natural Resources Canada were partners of the conference, and in recognition of their support, were allowed promotional booths and two poster sessions to present their research activities. This conference proved very useful to present the objectives and accomplishments of the groundwater program and to introduce ESS groundwater experts to an audience of science communicators.

Short stories of summer field campaigns

Châteauguay June 11. The Châteauguay project team welcomed nearly 50 participants to an excursion led by Miroslav Nastev. Aside from the team's scientific collaborations with various university and government partners, this particular initiative is part of a series of 33 hydrogeologic watershed mapping projects that will be conducted by the Quebec department of the environment over the next 15 years. The Châteauguay project is in the second of a planned three years. The project is also the subject of ongoing collaboration with the United States Geological Survey (USGS). The specifics of the area of study are: groundwater's 65% contribution to the water supply; the risk of a gradual decline in groundwater levels due to climate change, and vulnerability to contamination from intensive agriculture and future development

projects. The aim of the project is therefore to increase our knowledge of groundwater and to develop tools that will help bolster sustainable development, while contributing to the inventory of the principal aquifers in Quebec and Canada. Work conducted in the summers of 2003 and 2004 led to the development of a conceptual model of groundwater flow, the identification of a discontinuous aguifer in the recharge zone, the location of flowing wells, an estimation of the mean productivity of wells in the region at 150 m³/day, and the positioning of the top of the aquifer at 25 metres. Four stops enabled participants to familiarize themselves with the various themes of the project, particularly the work on the vertical profile of transmissivity within the rock, pump tests, recharge, groundwater quality, the core logging done by a USGS team, and the geological setting. It should be noted that the project also includes an original sociological component that will address problems pertaining to water usage and bottling.



Remote sensing in Châteauguay

Satellite remote sensing offers the potential of mapping regional aquifer surface properties such as land cover, soils and vegetation density. The «Remote Sensing in Support of Groundwater Assessment» project, with support from the Canadian Space Agency, is collaborating with the Quebec Ministry of Environment to map these parameters over the Châteauguay aquifer, south of Montreal. Miroslav Nastev, Richard Fernandes and Rasim Latifovic have coordinated a joint field campaign to gather in-situ data in support of these satellite products. Measurements of vegetation

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structure and density were conducted at over 100 plots using a digital hemispherical camera based system developed at Canada Centre for Remote Sensing. These measurements are now being used to produce 30m resolution satellite maps required as input to regional groundwater recharge models.

Paskapoo Groundwater Study: The main part of fieldwork conducted during the summer of 2004 was examining outcrops of the Paskapoo Fm in the Calgary to Red Deer area. This allows a better understanding of the stratigraphic architecture that makes up the aquifer system. In general, outcrops are difficult to find and, where they do exist, are poorly exposed. Still most large exposures have now been visited. Additional fieldwork included measurements of fracture orientation as well as fracture density at various outcrops. Given the importance of fracture control on flow systems in the aquifer, this will provide some critical data. Fieldwork is continuing into the fall, including cooperative work with the University of Calgary on water level surveys north of Calgary and in the Sylvan Lake area near Red Deer. In conjunction with this work, water samples are being collected to better characterize natural variability in water quality.

Okanagan Basin: This was the first year of planning for a cooperative project with BC MWLAP on groundwater resources in the Okanagan Valley, B.C. A field trip was run in June in order to see first hand the major groundwater issues in the basin and to meet with key stakeholder groups. The successful trip traveled from the US border to the north end of the basin. Several key aquifers in the region where examined in conjunction with discussion on development pressures. One of the highlights of the trip was a tour of a well drilled by the GSC in 1965 that encountered a high-pressure artesian aguifer. The well failed with water discharging at 30 l/s, and required 2 years of work to finally bring it under control (a warning for future drilling in the area!). At the end of the trip, a planning meeting was held to develop an outline of priority research needs within the basin.





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