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SOFTWARE • CONSULTING • TRAINING

WHI E-News
Waterloo Hydrogeologic Inc.



A World of Good Wishes
From your friends at Waterloo Hydrogeologic, Inc.

WHI E-News Topics

2003 December Edition

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Waterloo Hydrogeologic, Inc. is a recognized leader in the development and application of environmental software and services.

**YEAR END
SOFTWARE
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US\$700 off
WHI Software!**

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December 31st
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2003 Year End Sale! Save up to US\$700!



AquaChem
AquiferTest Pro
RISC WorkBench
Visual MODFLOW Pro
Visual HELP
and many more...

At Waterloo Hydrogeologic, we know that professionals like yourself need to stay abreast of current trends in environmental technology. That's why during this holiday season, we are pleased to offer the **2003 WHI Year End Software Sale**. Keeping up-to-date with the latest product releases and technological advancements is now more affordable than ever before. **Save up to \$700!** Check out the savings below!

Some of our products on sale are:

AquaChem - (SAVE \$100)
Groundwater quality analysis and plotting

AquiferTest Pro - (SAVE \$100)
Pumping test & slug test data analysis and plotting

FEFLOW- (SAVE UP TO \$700)
Advanced finite element, 3D groundwater flow & transport modeling

Visual HELP - (SAVE \$100)
Hydrologic evaluation and modeling of landfill profile designs

Visual Groundwater - (SAVE \$100)
3D subsurface visualization and animation

Visual MODFLOW Pro - (SAVE \$300)
World Standard for 3D groundwater flow & contaminant transport

VMOD 3D-Explorer - (SAVE \$100)
3D visualization and animation add-on for Visual MODFLOW

WHI UnSat Suite Plus - (SAVE \$200)
Unsaturated zone groundwater flow and contaminant transport

[To view our complete Year End Sale price list click here!](#)

For a no-obligation price quote or a demo CD-ROM,
please call (519) 746-1798 or write to sales@waterloohydrogeologic.com

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A Note from the President

As the end of 2003 approaches, I would like to take this opportunity to send all of our customers and business associates warm wishes for a happy holiday season. We are looking forward to 2004, as we are working on several exciting projects to enhance the number of solutions we offer for your groundwater and environmental needs.

In Software, we will be releasing several innovative upgrades to existing products, and will also be releasing at least two "best-selling" software packages for hydrogeological data management and interpretation. In Training, we've expanded our course roster to include a new Human Health Risk Assessment course and a new Model Review for Regulators course. In Consulting, our expanded team will continue to work with you, teaming up on projects or even working with you for a few hours to enhance your modeling and data management capabilities.

As always we welcome any feedback or comments you might have to help us serve you better.

Warm wishes,

Nilson Guiguer, Ph.D.
President



For more information about our Waterloo Hydrogeologic, visit our website or contact us today:

Website: http://www.waterloohydrogeologic.com/about_whi.htm

Email: info@waterloohydrogeologic.com

Phone: (519) 746-1798

Consulting News

WHI Continues to Play a Key Role in Source Water Protection

Waterloo Hydrogeologic's consulting staff are providing clients with innovative and effective solutions that are of particular relevance to source water protection. The focus of several current projects includes:

- » Characterising groundwater resources
- » Water budget quantification and future scenario assessment
- » Delineating wellhead protection areas around municipal wells
- » Mapping of aquifers that are susceptible to contamination
- » Water quality data management
- » Identifying potential point and non-point sources of groundwater contamination

Groundwater characterisation and GIS/modeling analyses developed by our staff have advanced the level of understanding of groundwater resources at a watershed scale, and defined wellhead protection areas at local scales. The results of these studies are supporting the development of environmental and land use policies, and local and regional groundwater protection strategies. As source water protection initiatives gain momentum, our consulting staff are establishing a solid reputation for providing clients with the required technical analyses and innovative graphics to support such initiatives.

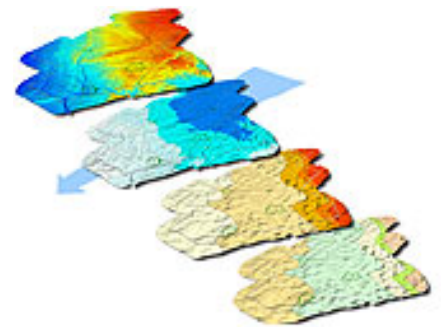
WHI's team of dedicated professional consultants includes geologists, hydrogeologists, and engineers, with specialties ranging from physical and geochemical hydrogeology to complex numerical modeling, with expertise in:

- » Groundwater Resources Management
- » Environmental Impact and Risk Assessment
- » Contaminated Site Solutions
- » Advanced Groundwater Modeling Solutions
- » Environmental Solutions for Mining
- » Environmental Data Management
- » Model Review and Litigation Support

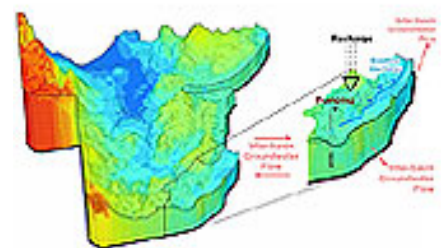
Our consulting team would be glad to discuss how we can help with your source protection, watershed management, and groundwater modeling requirements. [Please see our contact information below.](#)



GIS Mapping to Support Land Use Policy Development.



GIS Data Integration



Sub-basin Water Budget Assessment

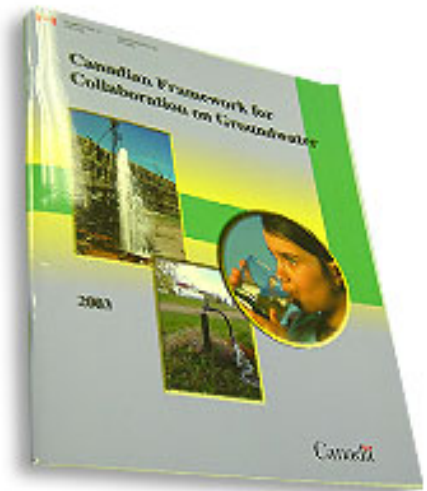
Attention Canadian Groundwater Professionals

The recently published document titled "Canadian Framework for Collaboration on Groundwater" is being distributed to groundwater professionals across Canada. A National Ad Hoc Committee - with the leadership of the Geological Survey of Canada - developed this document, which identifies goals and outlines strategic directions toward an interagency framework for collaboration. It is intended to form the basis for securing the fundamental information necessary to manage and protect groundwater resources, and for obtaining the collaborative insight, participation, and guidance of partners and stakeholders to develop the key ideas, concepts, and programs that can be strategically implemented over time.

The document is being distributed to public and private sector groundwater professionals through various channels. It is available from Geological Survey of Canada offices and on their website at www.gscq.nrcan.gc.ca/cgsi. If you are a groundwater consultant you can obtain a copy from WHI by contacting Bill Banks in our Consulting Division by telephone at (519) 746-1798 ext. 285 or by e-mail at bbanks@waterloohydrogeologic.com. Bill was a member of the extended National Ad Hoc Committee as a representative of the consulting industry. He welcomes comments from fellow consultants related to this document and the proposed national initiative.



3D Visualization to Emphasize Important Features



If you would like more information about WHI's Consulting activities and capabilities related to groundwater modeling and source protection, please visit our website or contact us today :

Website: www.waterloohydrogeologic.com/consulting/consulting_services.htm

Email: consulting@waterloohydrogeologic.com

Phone: (519) 746-1798

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Training News

Upcoming Professional Courses

Advanced Groundwater Modeling

Applying Innovative Techniques and Avoiding Common Pitfalls using MODFLOW-2000, MODPATH, & MT3D.

The advanced course builds on the topics covered in “Groundwater Modeling” and develops a higher level of skill in building and troubleshooting groundwater flow models. Ideal for “Groundwater Modeling” graduates or experienced modeling professionals.

[Waterloo, Ontario](#)
[December 3 - 5, 2003](#)

[Register Now](#)

Groundwater Modeling

3D Groundwater Flow and Solute Transport Modeling Using Visual MODFLOW Pro.

Simple to complex applications of groundwater flow and contaminant transport models are covered in this hands-on course. Ideally suited for people with beginner or intermediate level modeling experience who wish to advance their modeling knowledge and who's responsibilities include model review, planning, and project management.

[Waterloo, Ontario](#)
[February 3 - 5, 2004](#)

[Register Now](#)

Model Calibration Using WinPEST

Applied to MODFLOW and Other Numeric Models.

This course teaches strategies for calibrating groundwater models, the most time-consuming, challenging and critical phase of a modeling study. You will learn about model calibration issues in general and also how to use the parameter estimation software package WinPEST, which has been developed to enhance our ability to calibrate models and to understand the limits of that calibration.

[Waterloo, Ontario](#)
[February 6, 2004](#)

[Register Now](#)

 [To request your free 2004 Training Course Schedule Catalog, click here!](#)

For more information about our course offerings, visit our website or contact us at:

Website: www.waterloohydrogeologic.com/training/training.htm

Email: training@waterloohydrogeologic.com

Phone: (519) 746-1798

Tips & Tricks

Addressing Dry Cell Related Convergence Problems When Using MODFLOW-2000 with the LPF Package

Development of the MODFLOW-2000 groundwater model represented some very significant improvements in the process simulation capabilities of the code, and in the code itself, over its predecessor, MODFLOW-96. Although every effort was made to ensure the results from a MODFLOW-2000 model, using the Layer Property Flow (LPF) Package, would closely resemble the results of the same model using the Block Centered Flow (BCF) Package, it was inevitable that some discrepancies would exist under very specific conditions.

One of these conditions occurs when the solution to a model contains dry cells where the water table is only slightly below the bottom of the grid cells in a convertible (unconfined) layer. Although this situation will cause some solution convergence problems regardless of whether the LPF Package or the BCF Package is used, it has been our experience that the LPF Package is less likely to converge to a solution, and when it does converge it may produce significant mass balance errors and significantly different results than the BCF Package.

The reason for this discrepancy is that the BCF package requires the vertical conductance (VCONT) value to be assigned as a static model property that does not change with time, while the LPF Package calculates the vertical conductance between layers using the vertical conductivity and the saturated thickness of the convertible layers (see image **Figure 1 on right and Figure 2 below**). As a result, when the solution is iterating to find the water table position, the vertical conductance is constantly changing, and this causes the solution to become unstable. Based on the formulation of the VCONT values, this problem is more evident when the upper layer has a significantly lower vertical conductivity than the underlying layer. In this case, the vertical conductivity of the upper layer dominates the calculated VCONT value, and even small changes in the saturated thickness cause significant changes in the VCONT value.

Figure 2 shows the formula for calculating VCONT as presented in the MODFLOW-2000 Reference Manual (USGS Open-File Report 00-92)

$$CV_{i,j,k+\frac{1}{2}} = \frac{DEL R_j DEL C_i}{\frac{(1/2)THICK_{i,j,k}}{VK_{i,j,k}} + \frac{(1/2)THICK_{i,j,k+1}}{VK_{i,j,k+1}}}$$

Figure 2

If you do experience this type of problem, we recommend that you switch from using the LPF Package to using the BCF Package. This switch can be done from the Run section of [Visual MODFLOW](#) as described below:

» From the Run Module, click the **Run** menu item.

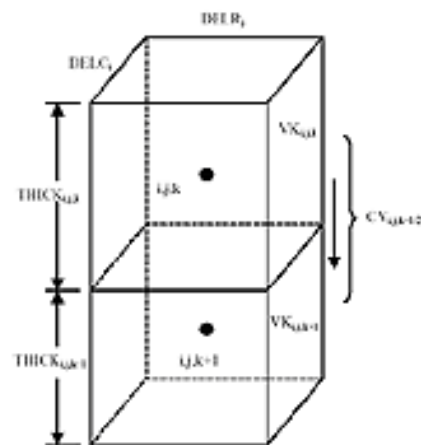


Figure 1

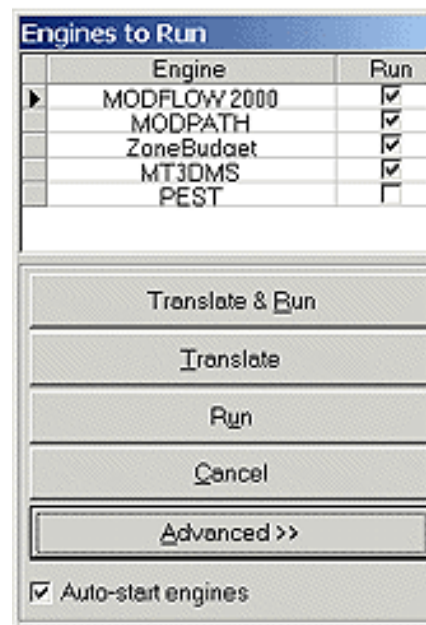


Figure 3

- » The Engines to Run dialog will appear as shown in **Figure 3** at right.
- » Click the [**Advanced**] button to view the additional Settings options, as shown in **Figure 4** at right.
- » Switch the MODFLOW-2000 Settings from **Automatic** to **User-Defined** and then click the [...] button to load the MODFLOW-2000 package's dialog as shown in **Figure 5** at right.
- » Switch the Layer Property Package from Layer Property Flow Package to Block Centered Flow Package and then click the [**OK**] button.

Now, when you choose to Translate & Run the model, it will use the BCF Package rather than the LPF Package to calculate the groundwater flow solution.

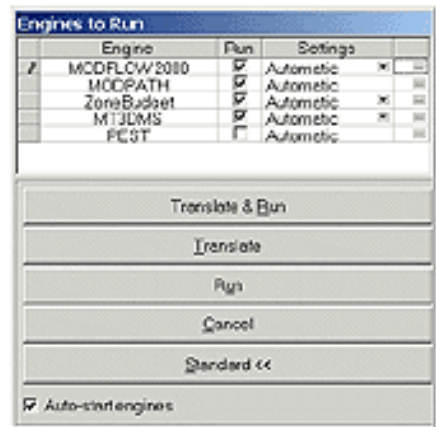


Figure 4

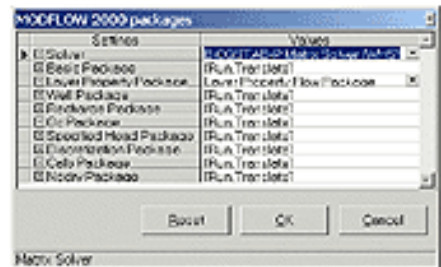


Figure 5

[Learn more about Visual MODFLOW](#)

For more information about this tip, contact us at:
 Email: techsupport@waterloohydrogeologic.com

For more information about Visual MODFLOW Pro, visit our website or contact us today:
 Website: http://www.waterloohydrogeologic.com/software/visual_modflow_pro/index.htm
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 Phone: (519) 746-1798

Thank you for reading this month's edition of WHI E-News! For more information about our products and services please use the links below!

[Visit our Website](#) - See what Waterloo Hydrogeologic Inc. has to offer!

[Software Division](#) - Check out our groundwater modeling software.

[Consulting Division](#) - Visit our Consulting Division on the web to see how we can help you.

[Training Division](#) - Visit our Training Division on the web to find a course in your area.

[Equipment Division](#) - WHI is now selling groundwater monitoring equipment.

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Waterloo Hydrogeologic, Inc.

Website: www.waterloohydrogeologic.com

Email: info@waterloohydrogeologic.com

Phone: 519-746-1798 Fax: 519-885-5262

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