WHI E-News
Waterloo Hydrogeologic Inc.

waterloo hydrogeologic
SOFTWARE • CONSULTING • TRAINING

WHI E-News Topics

2003 June Edition

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

Product News

Visual MODFLOW Pro with the MODFLOW-SURFACT Add-on Package - The Ultimate Solution!

Need a fully-coupled unsaturated/saturated flow model?
Dry cells causing inappropriate redistribution of pumping-rate volumes?
Experiencing model non-convergence with the standard solvers?

If you own Visual MODFLOW Pro, check out how the MODFLOW-SURFACT add-on package can help you.

The combination of Visual MODFLOW Pro 3.1 and MODFLOW-SURFACT offers the ultimate solution to address the issues stated above. As an add-on package, MODFLOW-SURFACT is designed to...

- Couple vadose zone flow with the saturated zone for better representation of "real-life" conditions.
- Address the effects of drying cells in MODFLOW by ensuring dry cells remain active in desaturated conditions.
- Improve solution convergence and dramatically reduce run times for large or complex models.

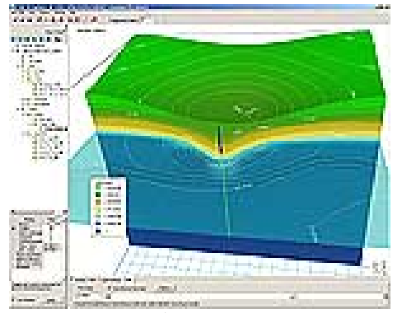
Take advantage of the new and improved capabilities wrapped with Visual MODFLOW Pro - **Order your copy of the MODFLOW-SURFACT add-on package today!**

MODFLOW-SURFACT is a comprehensive three-dimensional finite-difference flow and contaminant transport model based on the USGS modular groundwater flow model, MODFLOW.

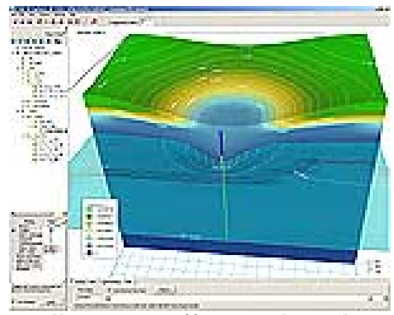
As one of its key benefits, MODFLOW-SURFACT provides automatic and correct redistribution of the total flow rate of a well screened through multiple model layers when the upper cell(s) are pumped dry.

MODFLOW-SURFACT is now available as a fully integrated add-on package to Visual MODFLOW Pro!

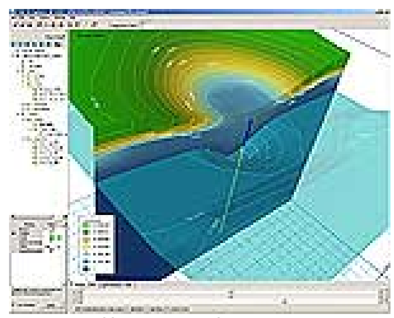
Until July 15, 2003, save $100 OFF MODFLOW-SURFACT!



3D visualization of MODFLOW-SURFACT model results.



Well pumping effects on the vadose zone (using MODFLOW-SURFACT).



Pumping effects seen from another angle.

For more information about MODFLOW-SURFACT, or our other software products, contact us at:
Email: sales@waterloohydrogeologic.com
Phone: (519) 746-1798 and ask for the special!

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Consulting News

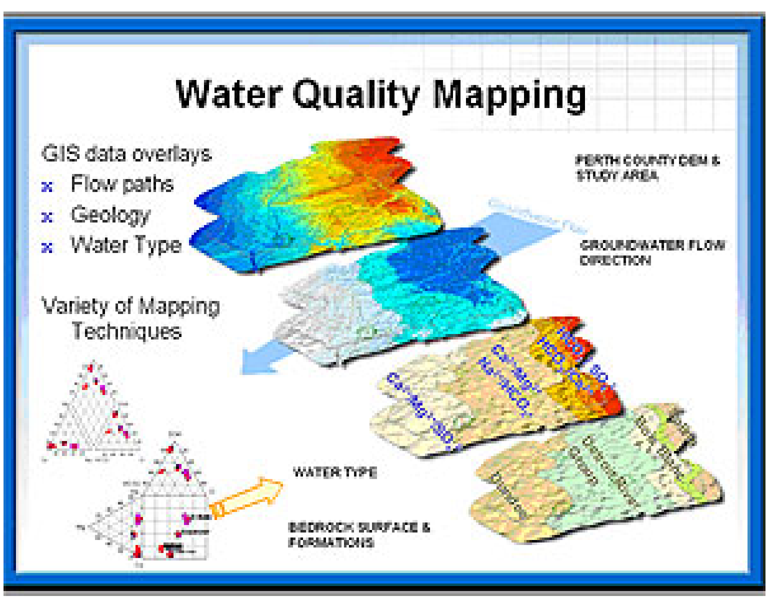
WHI Helps Complete the Groundwater Management Triangle in Ontario, Canada

As part of Ontario, Canada's on-going activities to better understand and manage groundwater resources, Waterloo Hydrogeologic, Inc. has been contracted to evaluate regional water quality across Southern and Central Ontario.

Following the Walkerton Inquiry, the quantity and protection (security) aspects of groundwater management have been addressed through GUDI, WHPA, and aquifer characterization studies (see the April 2003 E-News article entitled "*WHI Commences Niagara Peninsula Groundwater Study*). However, characterization of regional groundwater quality throughout the province has not been adequately addressed. As groundwater management efforts in the province move toward source water protection, involving all activities that impact water resources within a watershed, a baseline groundwater quality evaluation is essential.

The vision of the current project is to establish a process that will provide groundwater stakeholders throughout the province a means of visualizing available water quality data for on-going water management activities. It will involve the creation of a database to warehouse available water quality data and assessment of groundwater quality at both regional and local scales (for selected pilot study areas). The knowledge gained through this assessment will guide further water quality monitoring, data management and data analysis / presentation techniques.

Recognizing the importance and value of existing data sources and management processes, this study will establish linkages and compatibility with existing provincial, federal, and international data models. WHI is proud to be a part of this exciting endeavor.



WHI's headquarters is based in Waterloo, Ontario, Canada.

The Walkerton Inquiry is an independent Commission set up under the Ontario Public Inquiries Act to examine water supply contamination in the town of Walkerton, Ontario, Canada.

For more information about this project, please contact:
Paul J. Martin, M.Sc., P.Eng., Associate Partner, Consulting Services, WHI
Email: pmartin@waterloohydrogeologic.com
Phone: (519) 746-1798

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Training News

Upcoming Professional Courses

	Dates/Locations
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.	Japan June 25-27 Waterloo, Canada July 8-10 Johannesburg, South Africa August 6-8 Salvador, BA, Brazil August 5-8 Santiago, Chile August 12-15 Register Now
Model Calibration Using PEST 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 calbration issues in general and also how to use the parameter estimation software package PEST, which has been developed to enhance our ability to calibrate models and to understand the limits of that calibration.	Rome, Italy June 20 Waterloo, Canada July 11 Register Now

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.

Rome, Italy
June 24-27

Waterloo, Canada
July 14-16

Register Now

Click here for our full 2003 training schedule!

Click here to request your free 2003 Training Course Schedule Catalog!

For more information about our course offerings, visit our website or contact us at:
Website: www.waterloohydrogeologic.com/training/training.htm
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Tips & Tricks

Troubleshooting Plots and Symbols in AquaChem

The Challenge:

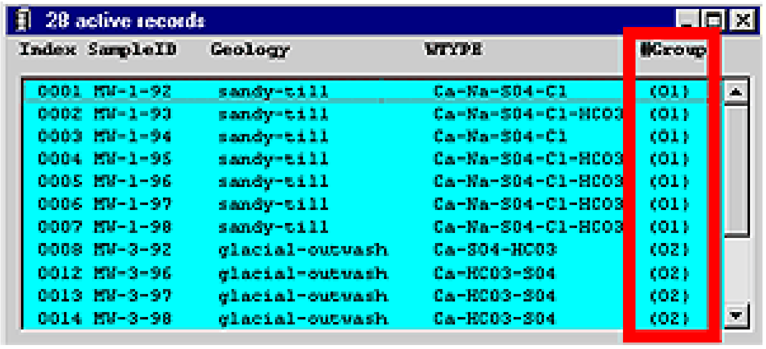
When using AquaChem v.3.7, you may have encountered instances when your sample symbols do not show up on your plots (for instance, on a Piper Diagram). This problem can occur for several reasons; use the checklist below as an aid for troubleshooting problem with your plots.

The Solution:

A. Assign symbols to your sample data:

Ensure that you have assigned symbols to your sample data. In the main records list, ensure that there is a group number appearing under the *#Group* header, as shown in Figure A.

AquaChem is the most complete software package available for aqueous geochemical data analysis, plotting and modeling!



Index	SampleID	Geology	WTYPE	#Group
0001	MW-1-92	sandy-till	Ca-Na-SO4-Cl	(01)
0002	MW-1-93	sandy-till	Ca-Na-SO4-Cl-HCO3	(01)
0003	MW-1-94	sandy-till	Ca-Na-SO4-Cl	(01)
0004	MW-1-95	sandy-till	Ca-Na-SO4-Cl-HCO3	(01)
0005	MW-1-96	sandy-till	Ca-Na-SO4-Cl-HCO3	(01)
0006	MW-1-97	sandy-till	Ca-Na-SO4-Cl-HCO3	(01)
0007	MW-1-98	sandy-till	Ca-Na-SO4-Cl-HCO3	(01)
0008	MW-3-92	glacial-outwash	Ca-SO4-HCO3	(02)
0012	MW-3-96	glacial-outwash	Ca-HCO3-SO4	(02)
0013	MW-3-97	glacial-outwash	Ca-HCO3-SO4	(02)
0014	MW-3-98	glacial-outwash	Ca-HCO3-SO4	(02)

Figure A.

If there is no Group # listed here, then you need to assign your samples to a symbol. To assign your samples to a symbol:

1. Select a sample or a group of samples.
2. Right-click on the selected samples and choose *Assign Symbol*.
3. Choose the symbol you would like to assign to these samples (you may assign different symbols to different samples).
4. You should now see a group number appear in the record list for the selected samples.
5. Repeat this step for the other samples in your database.
6. Then recreate the plot.

B. Assign measured values for each of the parameters:

Ensure all samples have measured values for each of the parameters you are plotting. For example, if you are creating a Piper diagram (as shown in Figure B) and you have not entered a value for one of the required plot parameters for a sample, then this sample will not show up on the plot.

For the Piper diagram, you must have a sample value for the following plot parameters: Ca, Na, Mg, Cl, SO4, and HCO3. Verify your sample data, then recreate the plot to see if this corrects the problem.

C. Ensure the symbols are active:

Under *Graphics > Define Symbol or Line*, ensure that the symbol you have defined is activated; active symbols will have a check mark in the box beside the symbol name.

These hints should help you to resolve problems you have had with symbols.

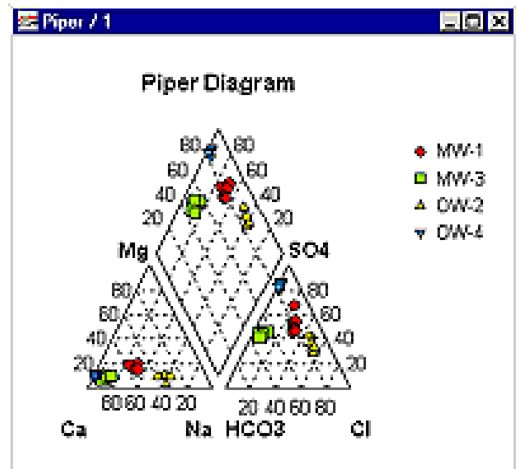


Figure B.

For more information about this tip, contact us at:
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For more information about our products, visit our website or contact us at:
Website: http://www.waterloohydrogeologic.com/software/software_main.htm
Email: sales@waterloohydrogeologic.com
Phone: (519) 746-1798

Technical Highlights

Groundwater and Indoor Air Modeling

Feature "Risk Assessment" Guest Column by Troy L. Schultz, CPG

Greetings to all the subscribers of WHI's E-News. This topic is the last in a series of articles relating risk assessment and modeling. This month, I endeavor to increase awareness of important exposure pathways that are often forgotten - those of indoor air and vapor intrusion.

Too often we focus on modeling to points of compliance for potable purposes and forget about other relevant exposure pathways. But, an exposure pathway may be present anywhere the plume comes into contact with a receptor. Let's not forget that plumes partition into several phases including:

- free phase (LNAPL or DNAPL),
- adsorbed phase (vadose zone),
- dissolved phase (aquifer), and
- potentially into a vapor phase (soil gas).

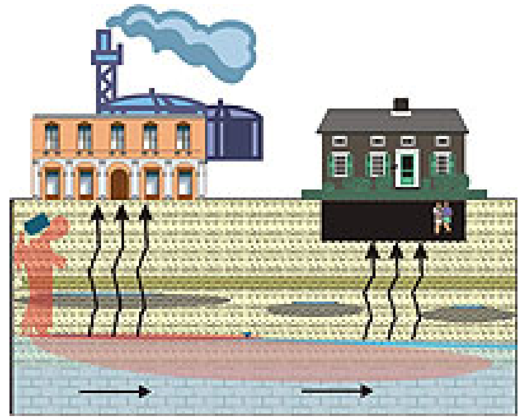
When soil or groundwater contaminated with volatile compounds exists beneath homes or other buildings, there is potential for human exposure via the vapor intrusion pathway. In the most extreme cases, these vapors can create immediate explosion hazards; in less extreme cases, the presence of very low indoor air concentrations in homes over extended periods of time can lead to chronic health problems.

Vapor intrusion pathways often dominate risk assessments in which the potential for groundwater ingestion has been eliminated because clean-up standards for ingestion pathways are typically lower than those developed for vapor intrusion. Moreover, standards based on direct contact of soils or ambient vapors are typically higher. The topic of vapor intrusion has become an increasingly important area of research in the U.S. (IDEM, 2002 / USEPA, 2003a). Recent guidance from USEPA provides resources to assess the presence of this pathway and the potential for adverse health effects (USEPA, 2002).

The evaluation of this exposure pathway was given heightened awareness after the release of a paper by Johnson and Ettinger (1991) and the development of ASTM 1739; "*Risk-Based Corrective Action*

Troy Schultz is President of BJAAM Environmental, Inc. (BJAAM). Mr. Schultz specializes in the development of site-specific standards and has given numerous lectures to various governments regarding the use and implementation of risk-based approaches to corrective actions (e.g., OhioEPA, Argentina, Brazil, etc.). He has also provided expert witness reports and testimony regarding risk assessment on behalf of companies such as Shell and BP.

Applied at Petroleum Release Sites". This paper includes an analytical screening-level model for estimating the transport of contaminant vapors from subsurface sources into indoor air spaces. This one-dimensional solution for diffusive and convective transport of vapors has been used in the development of six USEPA spreadsheets, which are available free over the Internet (USEPA, 2003b).



Due to the conservative nature of this screening-level model, many in the regulated community have sought to substitute indoor air sampling, soil gas sampling, or surface flux sampling for modeling. Each of these methodologies has their limitations. For example, indoor air sampling is plagued with background interference, soil gas with conversion to indoor air concentrations, and surface flux with limited coverage area. The following, many of which are available online, provide more guidance to these complex issues:

- Indoor air sampling:
  MADEP (2002)
- Soil gas sampling:
  SDDEH (2002) or ASTM D5314
- Surface flux measurements:
  Bart Eklund (1992)

One would typically include vapor intrusion pathways at a site when the pathway is complete "today" or may become complete in the future as new buildings are constructed over an area of impact. Additionally, as a plume expands into new areas, the pathway may become complete at some time in the future. It is critical for groundwater modelers and risk assessors to note if plume migration predictions suggest that a plume may move into residential areas or into areas designated for future development. If the potential for exposure exists, then the pathway should be considered in your risk assessment and site decision-making.

Remediation to prevent the migration of your plume into areas of potential exposure can be simulated with tools such as Visual MODFLOW Pro, when used in conjunction with the Johnson and Ettinger model (1991) or other field methods. In this manner, one can assess the potential for this pathway to become complete and to determine what concentrations of contaminants may exist in indoor air settings.

To prevent exposure or to eliminate this pathway one might also consider the application of an Institutional Control to prohibit the development of new housing or an Engineering Control to require specific engineering designs in new construction, which prohibits the migration of vapors into new buildings. These Engineering Control systems are comparable in design to radon vapor control systems (search the Internet for "radon gas mitigation").

As with all Institutional and Engineering Controls, the key to success is a mechanism for enforcement or chain of contract with the property owner and all subsequent owners of the property. This end can be accomplished in an Operation and Maintenance Agreement signed by both the regulating agency and the property owner. Furthermore, to protect construction workers, one might include a site specific Risk Mitigation Plan for all future construction activities.

I hope this information is helpful in your future site decision-making.

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USEPA, 2003b. Web Site & Tools For Vapor Intrusion Calculations.
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This article is the last in the series by Troy Schultz. WHI would like to thank Mr. Schultz for his invaluable contributions to WHI E-News!

WHI is pleased to consider contributions to our upcoming Feature Guest Columns; if you are interested in writing one of our upcoming features, please contact:
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Certified Professional Geologist
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