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Upcoming Professional Courses:

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- » [Advanced Groundwater Modeling](#)
- » [GIS Data Management for Groundwater Modelers](#)
- » [Aquifer Test Analysis](#)
- » [Water Quality Data Management & Modeling](#)
- » [Finite Element Groundwater Modeling](#)

Product News

GW Contour: A Powerful Data Contouring & Visualization Program Designed Specifically for Groundwater Professionals!

GW Contour, developed by Waterloo Hydrogeologic, Inc., represents the first data interpolation and contouring program to also incorporate advanced techniques for mapping velocity vectors and particle pathlines—all within one, easy-to-use program! GW Contour offers the perfect combination of tools and techniques for groundwater and environmental professionals. To view a free demo, visit the [WHI Website](#).

Professional Applications of GW Contour:

- Graphical mapping and reporting of groundwater levels.
- Preliminary interpolation and contouring of contaminant concentrations (groundwater, soil, or air).
- Assessing groundwater flow direction and magnitude.
- Contouring data obtained from pumping tests, dataloggers, groundwater monitoring events, weather stations, groundwater models, borehole logs, etc.
- Gridding ground surface elevations for use in groundwater flow models, or GIS.
- Analyzing exposure pathways when assessing human health risk.
- Comparing conceptual interpretations with calculated interpretations.

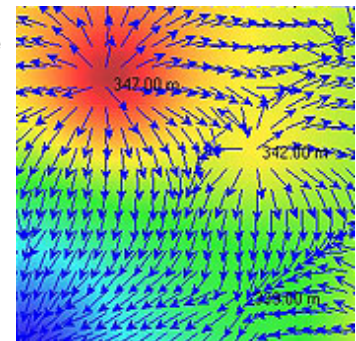
Whether contouring elevations, contaminant concentrations, or other spatially variable data, GW Contour has the techniques and tools necessary to map and report your data professionally.

Features & Benefits:

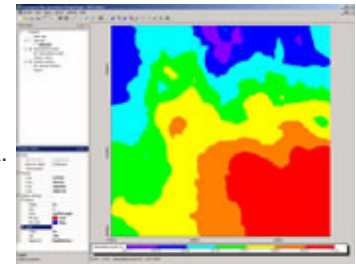
- Provides an all-in-one solution for interpolating and mapping groundwater and environmental data.
- Offers the unique ability to calculate forward and reverse particle movements.
- Capable of calculating velocity vectors (magnitude and direction), important for groundwater projects.
- Quick and easy georeferencing of raster-based images used as basemaps.
- Advanced interpolation techniques to address various data sets.
- Intuitive and logical graphical user interface design.
- Handles a wide range of environmental units.

BUY NOW AND SAVE WITH OUR SPECIAL LIMITED-TIME INTRODUCTORY PRICE.

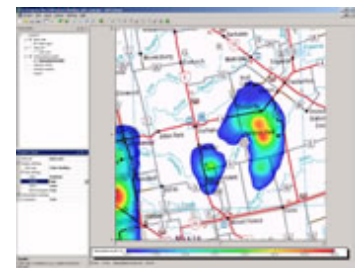
GW Contour is now available for purchase for only **US\$395!**



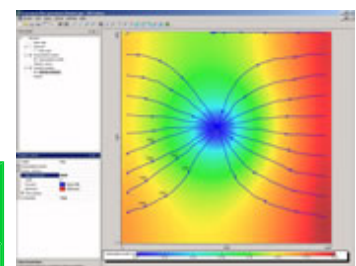
Contaminant concentrations with velocities.



Water table contours.



Mapping water quality.



Assessing flow pathlines.

- » [Model Calibration and Predictive Analysis using PEST, Visual MODFLOW & FEFLOW](#)
- » [Regulatory Review of Hydrogeology Studies](#)

Tips & Tricks

- » [GW Contour: Importing Data Sets](#)

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Multi-User, Government, and Educational Discounts available

Waterloo Hydrogeologic has been providing software solutions for groundwater and environmental professionals since 1989. Since the beginning, our users have demanded—and received—easy-to-use, intuitive software applications to address their project needs. We are proud to release GW Contour as an integral part of our industry-recognized suite of groundwater and environmental software products.



For more information, or to order GW Contour today, please contact us via phone at +1-519-746-1798, or via email at sales@waterloohydrogeologic.com.

Website: <http://www.waterloohydrogeologic.com>

Phone: (519) 746-1798



Consulting Services News

Consulting Services Uses PHREEQC to Advance an Aquifer Storage and Recovery Project in Abu Dhabi

Groundwater challenges have reduced drought-buffer supplies, threatened environments, and increased risks for people in many parts of the world. Globally dwindling water supplies and quality issues, coupled with the increasing demand for fresh water to supply future growth, have amplified the need to manage sustainable water supplies.

Continuous, long-term access to sustainable water resources requires exceptional management strategies combined with scientific expertise. As part of Schlumberger Water Services (SWS), WHI continues its mission to help manage the world's water supplies. The Water Services team is currently using its advanced technologies to improve life in Abu Dhabi in the United Arab Emirates. Abu Dhabi has grown rapidly over the last 20 years, and is increasingly conscious of its limited fresh water supply. Seawater intake plants desalinate the majority of their water; however, they require an economical method of storing surplus desalinated water.

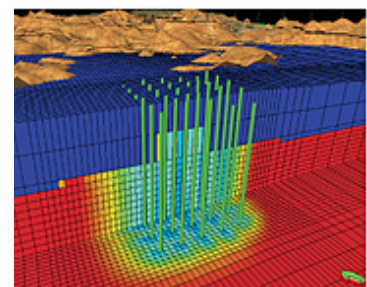
As an alternative to holding desalinated water in surface reservoirs or storage tanks, Schlumberger Water Services is working to implement an **Aquifer Storage Recovery (ASR) project** , whereby large quantities of desalinated water are injected into a carefully selected aquifer containing water with a salinity above the standards for potable water, to be safely stored until needed. In this way, fresh water can be stored at a fraction of the cost of conventional methods. Schlumberger Water Services is applying their expertise to ensure a "big-picture" understanding of the aquifer network that will maximize the project's long-term effectiveness and minimize costs.

To anticipate and quantify undesirable geochemical reactions during the injection process, SWS conducted a water compatibility study using the geochemical modeling package PHREEQC (distributed by USGS). Preliminary modeling results were presented and further advanced during a 3-day PHREEQC workshop in Abu Dhabi. The 3-day workshop culminated in a tour of the ASR site. Experts from CSIRO, Australia, and WHI provided geochemical interpretation and modeling expertise during the workshop sessions.

ASR projects represent a logical application of geochemical modeling,



Geophysical logging at ASR well
Test drilling at the ASR site.



3D schematic of an ASR system.

however few examples currently exist in the literature. Geochemical modeling provides essential insight into potential reactions between injected and host water during water injection and subsequent mixing. Common effects that should be modeled in ASR projects include mixing with the native groundwater, precipitation or dissolution of minerals present in the aquifer (e.g. due to a change of redox conditions), ion exchange, and surface reaction during the flushing process.

Schlumberger Water Service's multi-talented team is uniquely positioned to complete ASR projects like the one in Abu Dhabi. WHI brings years of experience to applying PHREEQC, which has become a de facto standard for geochemical modeling. In fact, WHI's hydrochemical interpretation package, AquaChem, was one of the first graphical interfaces to PHREEQC.

Geochemical modeling plays a crucial role in any water quality related study. WHI applies our technological expertise in this area wherever geochemical data is available and modeling represents an efficient approach to solving a given environmental problem. Future WHI plans include a link between PHREEQC and Visual MODFLOW, as well as HydroGeo Analyst, to enable fully coupled multi-species reactive mass transport modeling. These advancements will strengthen our ability to help effectively manage and sustain the world's water for future generations.



Workshop tour of the ASR site

[Learn more about WHI's Consulting Services on the WHI website!](#)

For additional information regarding Waterloo Hydrogeologic's experiences during this and other projects, please contact consulting@waterloohydrogeologic.com or visit: www.waterloohydrogeologic.com/consulting/consulting_services.htm

Phone: (519) 746-1798



Training News

WHI's Line-Up of Environmental & Groundwater Modeling Courses!

The 2006 Waterloo Hydrogeologic Open Enrolment schedule has now been set! The following list of courses will be offered over the next 6 months.

Choose from:

- » [Applied Groundwater Flow & Contaminant Transport Modeling](#)
- » [Advanced Groundwater Modeling](#)
- » [GIS Data Management for Groundwater Modelers](#)
- » [Aquifer Test Analysis](#)
- » [Water Quality Data Management & Modeling](#)
- » [Finite Element Groundwater Modeling](#)
- » [Model Calibration and Predictive Analysis using PEST](#)
- » [Regulatory Review of Hydrogeology Studies](#)

Who Can Benefit?

- » Experienced hydrogeologists with no prior groundwater modeling experience.
- » Regulators who review modeling reports.
- » Managers who want to understand what the modelers are doing.
- » Experienced modelers who want to enhance their skills.
- » Students who want to acquire new skills.
- » Lawyers who want to understand some of the technical issues.
- » Industry professionals who want to understand more about what their consultants are telling them.

For a complete list of course offerings for 2006, please visit our Training Website at: [www.](#)

waterloohydrogeologic.com/training/training.htm

Or contact Miln Harvey, WHI Training Manager, at (519) 746-1798 x233.

Can't make it to one of our Open Enrollment Courses?

Call us about our [On-Site Custom Courses](#) designed to suit your specific needs!

APPLIED GROUNDWATER FLOW & CONTAMINANT TRANSPORT MODELING



Theory and Hands-on Applications using MODFLOW-2000, MODPATH, MT3D & WinPEST

Simple to complex applications of groundwater flow and contaminant transport models are covered in this 4-day hands-on course.

Course Objectives and Benefits

- Apply Visual MODFLOW Pro to 3D groundwater flow and contaminant transport projects.
- Use MODFLOW-2000 to develop several groundwater flow models.
- Calibrate your groundwater models to observed field data.
- Use MODPATH particle tracking features to determine preferential flow paths and delineate capture zones.
- Use ZoneBudget to assess subregional water budgets within your groundwater model.
- Simulate 3D contaminant transport using RT3D, MT3DMS & MT3D99.
- Use WinPEST to improve model calibration and understand model uncertainty.

For more details about this course, [visit the course web page](#).

[Melbourne, Australia](#)

[Nov 15-17, 2005](#)

[Tokyo, Japan](#)
[Dec 13-16, 2005](#)

[Waterloo, Ontario](#)
[Jan 24-27, 2006](#)

[Vancouver, British Columbia, Canada](#)
[March 7-10, 2006](#)

Optional PEST
[Melbourne, Australia](#)
[Nov 18, 2005](#)

[Register Now](#)

ADVANCED GROUNDWATER MODELING



This 3-day course goes beyond an introduction to the development, calibration and optimization of groundwater flow and transport models to provide hands-on experience in more advanced topics.

For more details about this course, [visit the course web page](#).

[Melbourne, Australia](#)
[Nov 21-23, 2005](#)

[Register Now](#)

GIS DATA MANAGEMENT FOR GROUNDWATER MODELERS



Understanding Data Sources, Data Analysis and Visualization

This 3-day hands-on course presents an introduction to the management and analysis of groundwater data for [Visual MODFLOW](#) modelers.

For more information about this course, [visit the course web page](#).

[Dubai, United Arab Emirates](#)
[December 4-7, 2005](#)

[Waterloo, Ontario,](#)
[December 6-8, 2005](#)

[Register Now](#)

AQUIFER TEST ANALYSIS



Principles of Pumping Test Design and Techniques for Data Analysis

A wide variety of techniques can be applied to analyzing aquifer tests. This course covers the theory behind the techniques and provides an opportunity to obtain hands-on experience in analyzing aquifer test data collected from a variety of conditions.

For more details about this course, [visit the course web page](#).

[Waterloo, Ontario](#)
[Feb 1-2, 2006](#)

[Register Now](#)

WATER QUALITY DATA MANAGEMENT & MODELING



Applications using AquaChem and USGS PHREEQC

The large quantity and range of environmental groundwater data types presents a challenge to professionals who wish to develop a comprehensive interpretation of a suite of data. This course provides hands-on experience in temporal and spatial data interpretation, including the use of convenient computer software for organizing and plotting the data.

For more information about this course, [visit the course web page](#).

[Waterloo, Ontario, Canada](#)
[February 8-10, 2006](#)

[Register Now](#)

FINITE ELEMENT GROUNDWATER MODELING



Advanced Applications for Saturated/Unsaturated Flow & Transport, Density-Dependent Flow, and Heat Transport

This 4-day hands-on course includes advanced applications of groundwater flow and contaminant transport models using the Finite Element method. This course provides a more complete understanding of the use and applicability of finite elements in groundwater modeling, and includes such topics as groundwater flow and transport modeling, principles of unsaturated flow, fracture flow modeling, thermal transport, and density-dependent flow modeling. This course is ideally suited for groundwater modelers who wish to advance their modeling knowledge, and apply finite elements—using FEFLOW—to more complex modeling designs.

For more information about this course, [visit the course web page](#).

[Calgary, Alberta, Canada](#)
[Feb 14-17, 2006](#)

[Register Now](#)

Model Calibration and Predictive Analysis using PEST, Visual MODFLOW & Feflow



This 5-day course consists of 4 days of Inverse Modeling using PEST and 1 day of Applied Inverse Modeling using either Visual MODFLOW or FEFLOW. The lectures focus on the theoretical fundamentals of model calibration, and the exercises focus on the practical aspects of inverse modeling for a wide range of hydrogeologic scenarios using WinPEST.

For more details about this course, [download the course PDF](#).

[Freising, Germany](#)
[March 6-10, 2006](#)

[Register Now](#)

REGULATORY REVIEW OF HYDROGEOLOGY STUDIES



Approaches and Insights for Reviewing Modeling Reports

The overall objective of this course is to give regulators a greater understanding of how models work, and what to look for when reviewing a modeling report.

For more information about this course, [visit the course web page](#).

[Waterloo, Ontario, Canada](#)
[March 21-24, 2006](#)

[Register Now](#)

 [Get our full 2005-2006 training schedule!](#)

 [Request your free Training Course Schedule Catalog!](#)

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

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

Email: training@waterloohydrogeologic.com

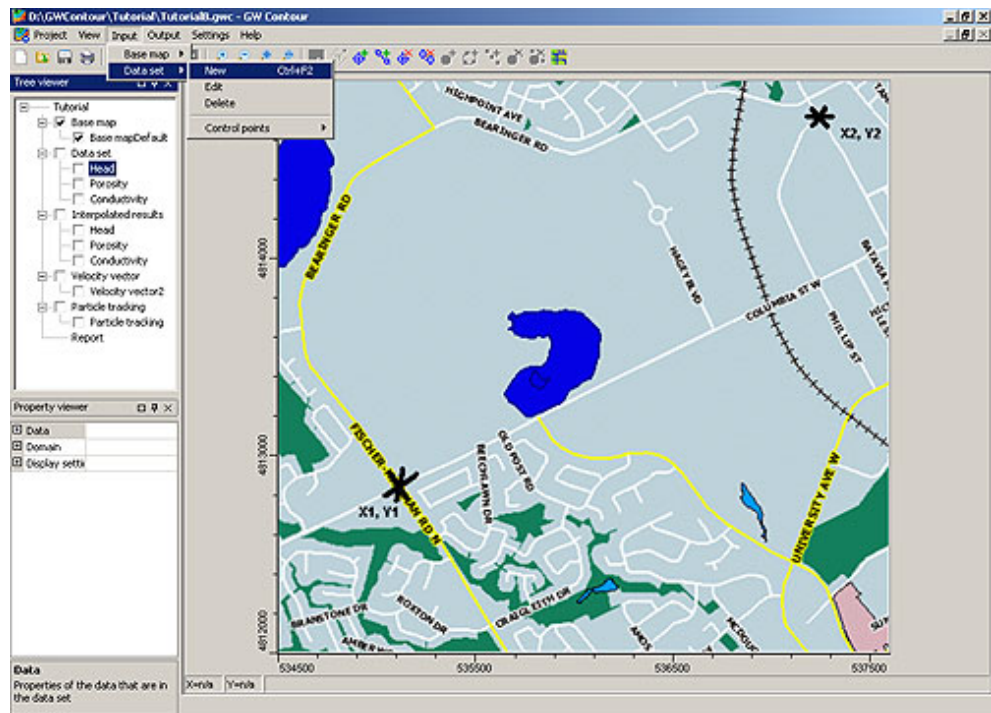
Phone: (519) 746-1798

Tips & Tricks

GW Contour: Importing Data Sets

This month's Tip is for GW Contour users; it presents the steps required for importing a general data set, such as elevation.

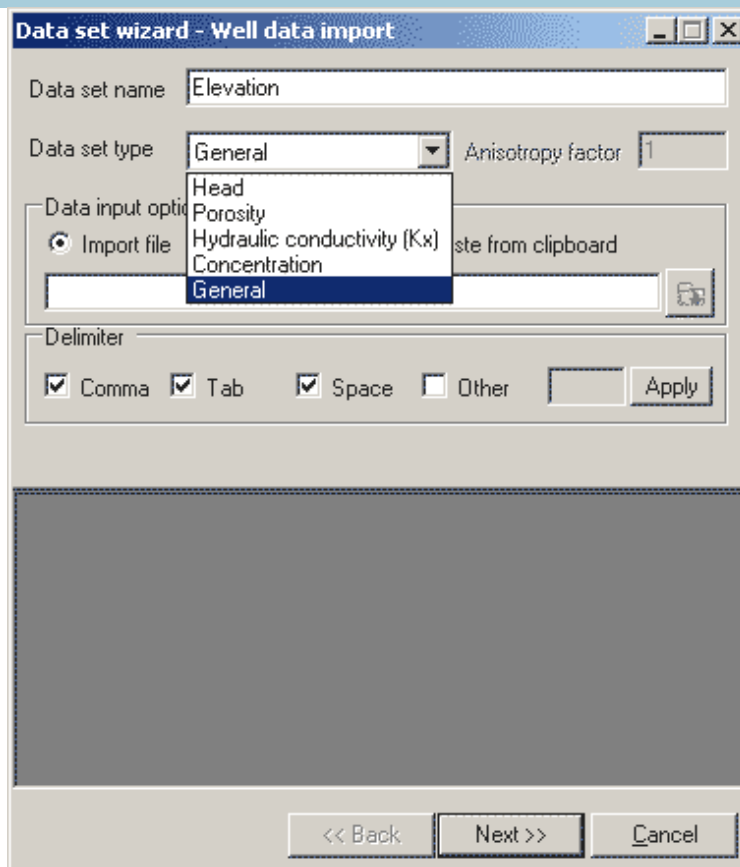
1. To import your data set, from the **Main Menu**, select **Input > Data set > New**.



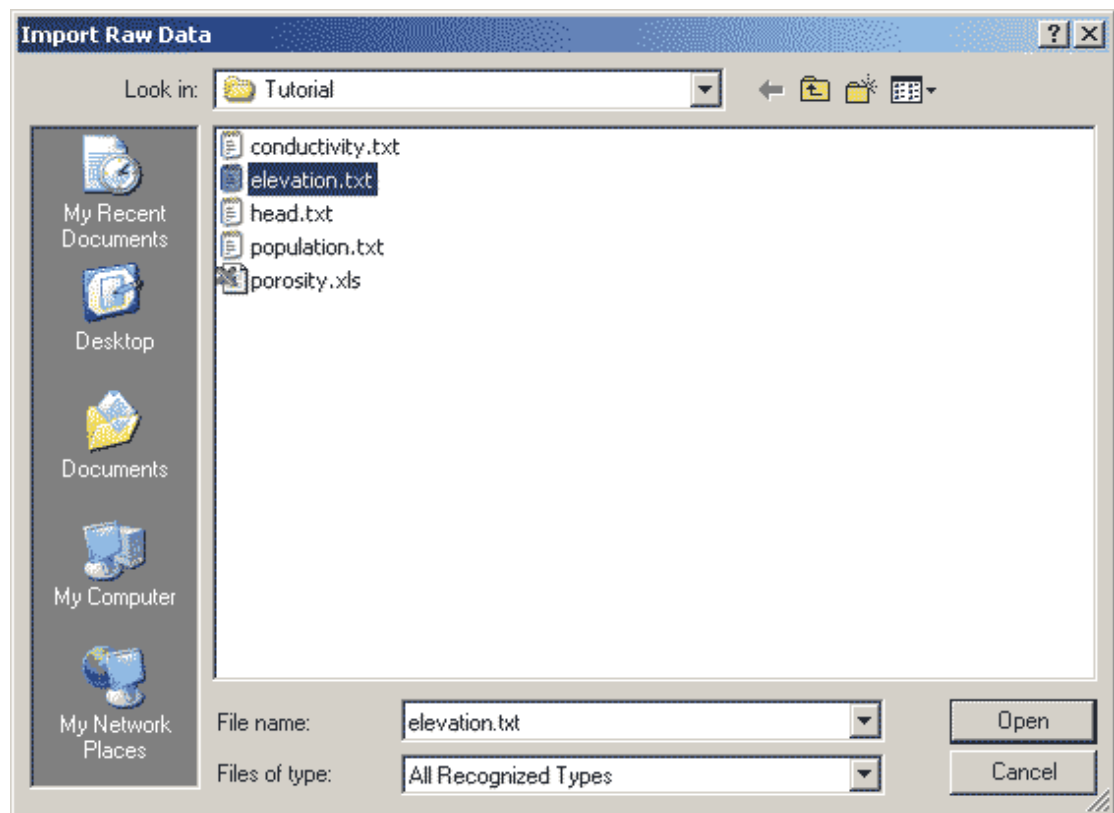
2. In the **Data set wizard - Well data import window**, enter the **Data set name** (in this case Elevation).

For this example, you will need to select **Data set type > General**.

Under **Data input options**, ensure **Import file** is selected. Then, click on the **Folder icon** to browse to your file.



3. In the **Import raw data** window, select your data file and click **Open**.



4. In the **Data set wizard - Well data import** window you will see the data from your file in columns 1, 2 and 3. Click **Next** to continue.

Data set wizard - Well data import

Data set name:

Data set type: Anisotropy factor:

Data input options:
 Import file Paste from clipboard

Delimiter:
 Comma Tab Space Other

Ignore column headers in row 1

Column 1	Column 2	Column 3
535646.83	4813320.23	298.10
536892.00	4813306.00	298.80
536420.15	4813671.51	298.00
537173.50	4813964.30	298.00
535369.60	4814739.10	297.50
535141.10	4813116.50	297.50
536309.50	4814708.30	297.30

<< Back

5. In **Data set wizard - Column matching**, ensure each Parameter and Column is matched correctly.

In this case, a Unit (m) for Value must be entered.

Click **Next** to continue.

Data set wizard - Column matching

Column match

Parameter	Column	Unit
X coordinate	Column 1	m
Y coordinate	Column 2	m
Value	Column 3	

Column 1	Column 2	Column 3
535646.83	4813320.23	298.10
536892.00	4813306.00	298.80
536420.15	4813671.51	298.00
537173.50	4813964.30	298.00
535369.60	4814739.10	297.50
535141.10	4813116.50	297.50
536309.50	4814708.30	297.30

<< Back Next >> Cancel

6. In the **Data set wizard - Grid domain definition**, confirm the Grid Extents of your data.

Beside **Display data set locations with symbols**, you may also select the checkbox, which activates the **Set marker** button. Click the **Set marker** button to choose a **New marker symbol**.

Data set wizard - Grid domain definition

Grid domain

X min m X max m

Y min m Y max m

Display data set locations with symbols

Decimals

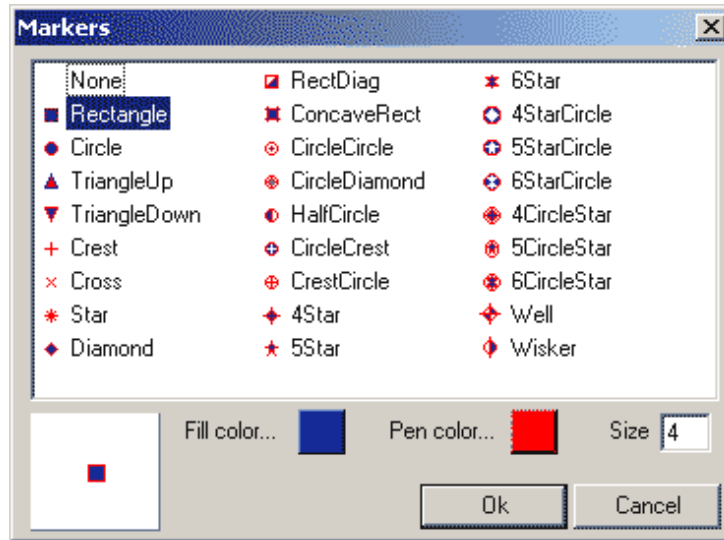
Column 1	Column 2	Column 3
535646.83	4813320.23	298.10
536892.00	4813306.00	298.80
536420.15	4813671.51	298.00
537173.50	4813964.30	298.00
535369.60	4814739.10	297.50
535141.10	4813116.50	297.50
536309.50	4814708.30	297.30

<< Back Finish Cancel

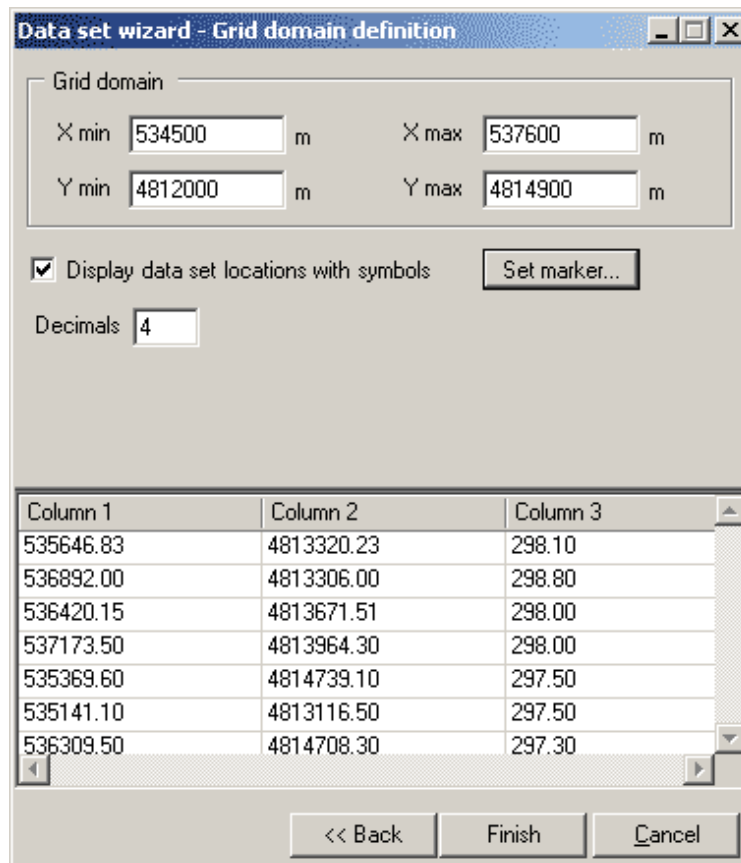
7. In the **Markers** window, you may select a new symbol from those available.

You may also edit **Fill color** and **Pen color** by clicking on the related color squares.

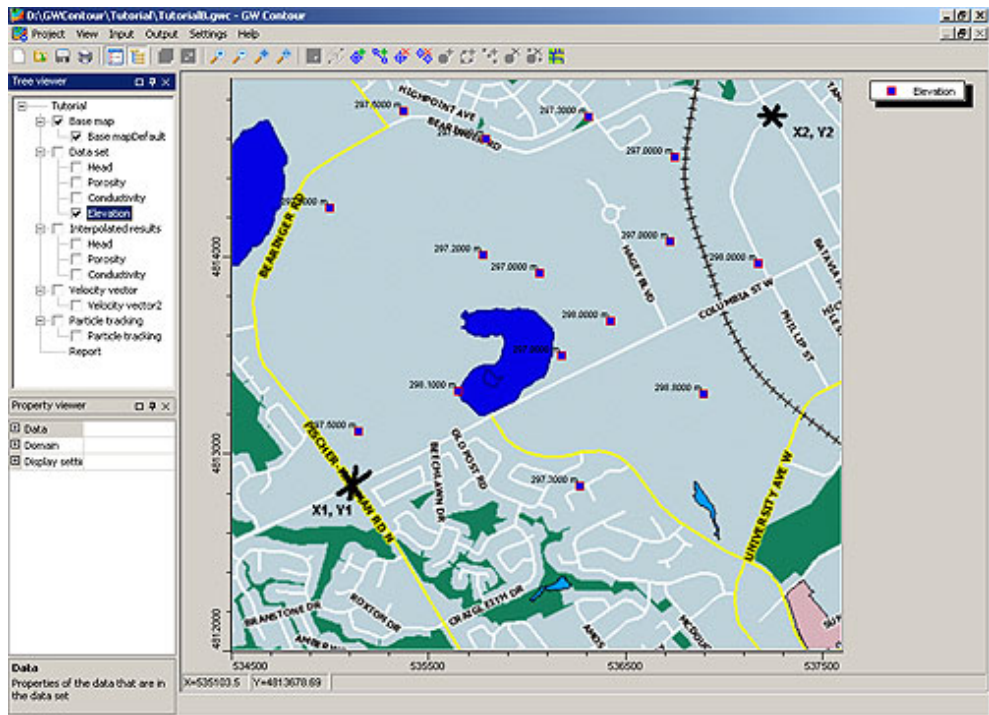
Click **Ok** to close the Markers window.



8. In the **Data set wizard - Grid domain definition** window, click the **Finish** button to complete the import.



9. The imported data is presented when selected as the active data set!



For more information about WHI's Environmental Information Technology (EIT) services:
Email: techsupport@waterloohydrogeologic.com
Web: <http://www.waterloohydrogeologic.com/support.htm>

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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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