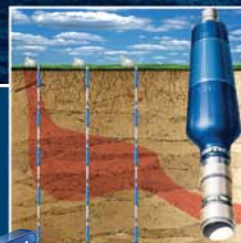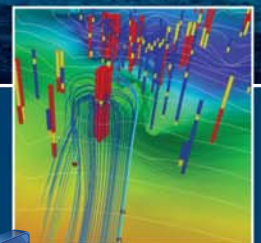# Groundwater & Environmental Products Catalog

GROUNDWATER DATALOGGERS

MULTILEVEL SAMPLING & MONITORING

GEO-ENVIRONMENTAL SOFTWARE

Streamline Your Project from the Field to the Office

Committed to *Innovation*

Schlumberger Water Services is dedicated to providing innovative and cost-effective products that support groundwater management and subsurface characterization. Our continuous investment in research and development ensures our clients receive the latest product enhancements.

ABOUT FIELD TO OFFICE

Schlumberger Water Services (SWS) follows a philosophy that hinges on the need to integrate sensors and well completion technology used in the **field** with software applications used in the **office**. SWS is dedicated to providing an integrated solution, which may involve building new software and instrumentation or connecting with third party products, in order to fill workflow gaps in water management projects.

Field to Office product integration enables water professionals to tackle a wide range of projects without being constrained by a single product. From reliable field acquisition systems to advanced three-dimensional groundwater flow models, our products are designed to work together and help you deliver your projects on time and within budget.

- Simplify data transfer from field tools to data analysis software
- Eliminate time spent on instrumentation and software compatibility issues
- Improve data quality assurance and control with flexible, pre-defined data filters
- Access customer support for all your products, and your whole project, from the same organization/support technicians
- Invest for the future – SWS products are developed to match industry needs and regulatory requirements

FOCUS ON CLIENT SUCCESS

Our Technical Support group is dedicated to providing customers in the groundwater and geo-environmental industries with specialized solutions that consider specific technical and environmental requirements, in a cost-effective manner. We recognize the value of providing our customers with outstanding service and support, and we work hard to earn your loyalty. Our friendly, full-time technical support representatives are dedicated to providing you with the level of support and service you need, when you need it, to make your project a success.

Technical Support

A dedicated team of environmental professionals ready to help you with your instrumentation and software-related questions via phone, fax, online meeting, or e-mail.

Extended Support

Expert technical advice that extends beyond traditional technical support to provide on-demand assistance with your projects.

- Optimized design and deployment of groundwater sensors, wireless data acquisition and multilevel well completions
- General model review, calibration, convergence, database template design and data importing

CONTINUING EDUCATION

Our professional training courses focus on the use and application of recognized software used by regulatory agencies, educational institutions, and consulting firms from around the world. As a company that integrates software development, consulting, and training, we can offer the latest modeling technology and analysis techniques. When you register for a training course, you will be using the latest advancements in computing technology.

Our Courses Include

- Ample opportunity for hands-on exercises plus informative, leading edge lectures
- A complete set of course notes including slides and laboratory exercises
- Knowledgeable instructors skilled at communicating ideas and concepts
- A period of time reserved for receiving professional advice on personal projects
- Opportunity to work at your own pace and have your personal questions answered
- Balanced instructor-to-student ratio of 1:15
- Optional online courses from the convenience of your home or office

Groundwater Dataloggers

Diver-NETZ

Multilevel Sampling and Monitoring

FROM THE FIELD

Dedicated to *Integration*

Schlumberger
WATER SERVICES

Our team of water professionals is dedicated to developing new technologies for groundwater management to improve your bottom line! Through our continuous investment in R&D, we deliver up-to-date products for groundwater projects of any size.

GROUNDWATER DATALOGGERS

Our complete line of Diver Dataloggers represents the latest innovation in groundwater monitoring, offering high-quality and long-term reliability in our most compact and robust housing ever!

- Micro-Diver*- ideal for small diameter wells, water level, and temperature monitoring
- Mini-Diver*- cost-effective water level and temperature recording
- Cera-Diver*- compact, corrosion-resistant, water level and temperature monitoring
- CTD-Diver*- corrosion-resistant, water level, temperature, and conductivity recording
- Baro-Diver*- recording and compensating for changes in atmospheric pressure

Diver dataloggers are supported by a suite of software for managing, graphing, QA/QC, and reporting groundwater monitoring data. See AquiferTest Pro, Hydro GeoAnalyst*, and Diver-Office Premium*.*

MULTILEVEL SAMPLING AND MONITORING

The Westbay* System is a completely versatile, multilevel monitoring technology that allows testing of hydraulic conductivity, monitoring of fluid pressure, and collection of fluid samples from multiple zones within a single borehole. Designed for reliability and defensibility, the Westbay System accommodates a wide variety of borehole conditions including diameter, depth, temperature, and chemistry considerations.

- Sample and measure at any number of discrete locations along a single borehole: 10, 20, 50...
- Collect samples without purging; avoid cross-contamination through discrete sampling
- Monitor long-term; operate at great depths
- Remove probes easily for calibration and servicing

Westbay Systems are supported by a suite of software for data management, site assessment, mapping, geological interpretation, borehole logging, and time-series plotting. See Hydro GeoAnalyst and AquaChem.*

GEO-ENVIRONMENTAL SOFTWARE

Field data obtained from Divers and Westbay Systems require robust software applications designed to work with specific file formats and parameters. The SWS suite of software products provides this integration through a series of import routines and direct data integration modules.

- Diver-Pocket* - handheld data acquisition software for Divers
- Diver-Office Premium - complete Diver data management, analysis, and reporting software
- AquiferTest Pro - pumping and slug test analysis from Diver data
- AquaChem - statistical analysis, graphing, water quality reporting, QA/QC for Diver and Westbay System data
- Hydro GeoAnalyst - complete project management, spatial and temporal data analysis, hydrogeologic interpretation, and reporting

SWS software provides support for our field products in addition to data exchange across software applications to provide a highly-efficient desktop environment.

FIELD WORKFLOW

QAQC

MULTILEVEL SAMPLING & MONITORING

DATA ANALYSIS & INTERPRETATION

ENVIRONMENTAL SOFTWARE

MODELING & SIMULATION

Data Analysis and Interpretation

Modeling and Simulations

Reporting and Presentations

TO THE OFFICE

Monitoring changes to groundwater levels and water quality

APPLICATIONS
- Long-term water level monitoring
- Groundwater monitoring network automation
- Data logging for pumping and slug tests
- Monitoring of watershed, drainage basin, and recharge areas
- Stream gauging, lake levels and reservoirs
- Harbor and tidal fluctuation monitoring
- Wetlands and stormwater run-off monitoring
- Monitoring landfill sites
- Monitoring saltwater intrusion
- Monitoring water level and salinity for aquifer storage and recovery projects

1 FIELD DEPLOYMENT **2** DATA ACQUISITION

Mini-Diver

The Mini-Diver features a compact design and impressive internal memory and can fit into virtually any groundwater monitoring well.

Use the Mini-Diver to:
- Monitor large groundwater monitoring projects where cost is an important factor
- Conveniently and automatically collect groundwater level and temperature data.

Specifications
- Ø22 mm diameter, 90 mm length
- Stainless Steel housing
- Memory capacity: 24000 measurements

Baro-Diver

The Baro-Diver ensures that you accurately capture changes in atmospheric pressure. Conveniently priced and easy to adjust, one Baro-Diver covers a radius of up to 40 km, depending on the topology.

Use the Baro-Diver to:
- Measure atmospheric pressure for barometric compensation of Divers
- Monitor long-term groundwater temperature and pressure.

Specifications
- Ø22 mm diameter, 90 mm length
- Stainless Steel housing
- Memory capacity: 24000 measurements

Micro-Diver

The Micro-Diver provides reliable, automatic measurement and recording of groundwater level and temperature data. With its compact size (only 18mm diameter), the Micro-Diver fits in almost any well.

Use the Micro-Diver to:
- Monitor small diameter wells that will not accommodate traditional dataloggers
- Log data from pumping/slug tests.

Specifications
- Ø18 mm diameter, 88 mm length
- Stainless Steel housing
- Memory capacity: 48000 measurements

Flexible Diver Installation and Data Retrieval Options

MANUAL
Stainless steel

The Diver is suspended by a stainless steel cable which is permanently mounted inside the well casing. The Diver is raised to ground surface for easy connection to the USB Reading Unit which is connected through USB to your Archer (Pocket PC) or laptop. Though cost effective, this method requires direct access to the Diver, and thus requires more manual effort and time in the field.

SEMI AUTOMATIC
Diver-Mate
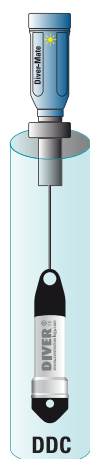
Data is transferred from the Diver through the DDC cable. At ground surface, the Diver-Mate is connected to the DDC cable to retrieve the Diver data. The Diver-Mate allows storage of data from hundreds of Divers. The Diver-Mate is connected through USB to your Archer (Pocket PC) or laptop. This method eliminates the need to raise the Diver to ground surface, thus eliminating offsets in the data upon re-deployment of the Diver; however, you still require direct access to well and opening of the well casing.

DDC

Diver Software

DIVER-OFFICE
Use the Diver-Office* desktop application to calibrate, read, and program all Divers. Download measurements onto your PC, view time series data in a plot or tabular form, and export data to a spreadsheet or groundwater modeling program.

DIVER-POCKET
Built for your portable Pocket PC, the Diver-Pocket* software reads data stored in Diver dataloggers, displays time-series plots, and exports data to various formats. Diver-Pocket Premium extends the features, with the added capability to program Divers, including measurement method, frequency and the start date/time.

t dataloggers for small or large scale groundwater monitoring networks

3 DATA QA/QC **4 DATA ANALYSIS** **5 REPORTING**
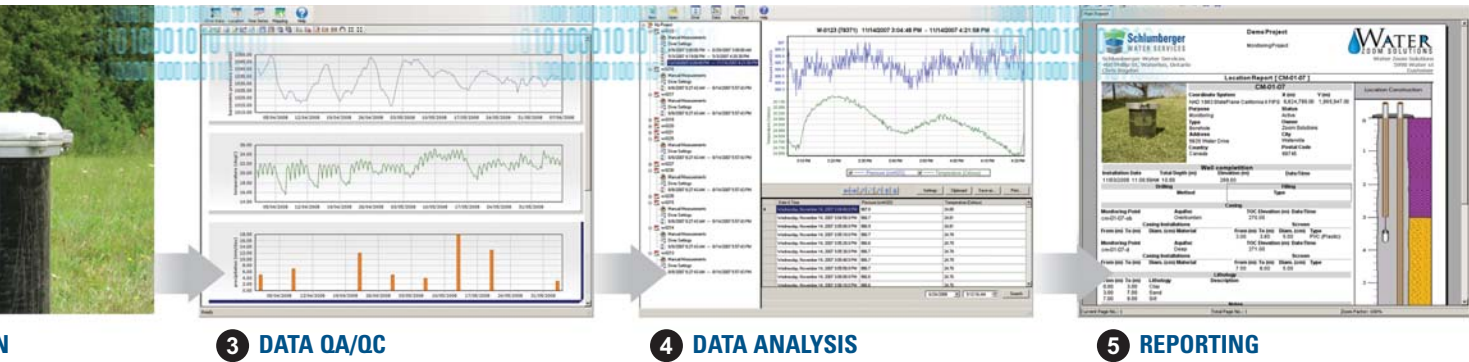
Cera-Diver

The Cera-Diver is designed to withstand potentially corrosive groundwater conditions while delivering exceptional reliability and accuracy when measuring water levels and temperatures.

Use the Cera-Diver to:
- Provide a cost-effective alternative to groundwater monitoring in saltwater intrusion environments
- Log data from pumping/slug tests

Specifications
- Ø22 mm diameter, 90 mm length
- Ceramic (ZrO_2) housing
- Memory capacity: 48000 measurements

CTD-Diver

The CTD-Diver is a fully stand-alone datalogger with built-in memory, battery, and sensors. The ceramic casing allows the CTD-Diver to perform even in the most corrosive environments.

Use the CTD-Diver to:
- Measure water levels, conductivity, and temperature
- Monitor desalination
- Assess saltwater intrusion

Specifications
- Ø18-22 mm diameter, 135 mm length
- Ceramic (ZrO_2) housing
- Memory capacity: 48000 measurements

Collect Collaborate Communicate

Monitor your groundwater without boundaries

Diver-Office Premium

Diver-Office Premium is a complete Diver data management, analysis, and reporting software that works with Diver dataloggers in a number of applications including:

- Harbor and tidal fluctuation monitoring
- Wetlands and stormwater run-off monitoring
- Long-term water level monitoring
- Groundwater monitoring network automation
- Aquifer storage and recovery projects
- Saltwater intrusion projects
- Monitoring landfill sites

HIGHLIGHTS:
- **Diver Data Management** - program all types of Divers, read Diver data, and perform barometric compensation.
- **Time Series Visualization** - import and manage time-varying data for groundwater elevation, temperature, and conductivity.

- **Monitoring Well Data Management** - create, modify, and display well location data, borehole lithology, well construction design (with one or more screens and Divers) on a well profile view.
- **Expanded Data Options** - capture a full range of environmental variables affecting groundwater recharge including precipitation, evaporation, discharge, and manual measurements.
- **QA/QC and Statistics** - easily identify and correct data anomalies, understand spatial and temporal trends, and gain confidence in the data assessments.
- **Report Automation** - quickly generate reports that incorporate logo and company details, site photos, well completion and lithology profiles, monitoring data, sampling dates, and other information.

- **Data Flexibility** - export well profiles to image files, export time-series to MS Excel™ and import data from MS Access™ and MS Excel™.

Westbay System

1 Packer
2 Measurement Port
3 Pumping Port

BEYOND TRADITIONAL MONITORING

For over 30 years, the **Westbay System** has provided professional consultants and industry with the ability to develop a detailed understanding of hydrogeologic conditions, groundwater flow, and potential contaminant migration in deep, complex aquifers. Developing a concise understanding often requires having the ability and flexibility to sample and test numerous discrete zones in a single well.

The Westbay System is a versatile, subsurface characterization technology that allows testing of hydraulic conductivity, monitoring of fluid pressure, and collection of fluid samples from multiple zones within a single borehole. The Westbay System can accommodate a wide variety of borehole conditions including a range of diameters, depths, temperatures, and aqueous geochemical conditions.

WESTBAY SYSTEM ADVANTAGES

- Obtain measurements and samples at any number of discrete locations along a single borehole: 10, 20, 50...
- Collect samples without purging
- Designed for long-term monitoring
- Engineered to operate at great depths
- Reduced drilling and installation costs with minimal site disturbance
- Removable probes allow for convenient calibration and servicing
- Built-in defensible QA/QC procedures
- Avoid cross-contaminating through discrete sampling
- Ideal in challenging environments such as landslides, artesian conditions, permafrost, etc.
- Suitable for vertical, inclined, or deviated boreholes

GET THE COMPLETE PICTURE

Well Completion

Our modular casing system consists of blank pipe segments in variable lengths with multiple packers, couplings, and valved ports, which are used to seal each borehole into multiple zones and provide access for monitoring, sampling, and testing. The system's modular design provides complete versatility in the number and position of zones to be isolated.

Portable Probes

A family of portable, wireline-operated tools are run inside the casing to take measurements, collect samples, and carry out tests. Sensors and sampling devices may be calibrated and serviced for long-term reliability.

Technical Support Services

Westbay System specialists will discuss your specific site and project requirements, help you design your completions, and provide on-site assistance for installation and QA testing along with continuous technical support. To speak with our technical experts, call us or e-mail sws-westbay@slb.com.
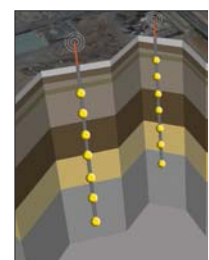
Designed for *Reliability* and *Defensibility*

Engineered for versatility, long-term monitoring, and high-resolution results
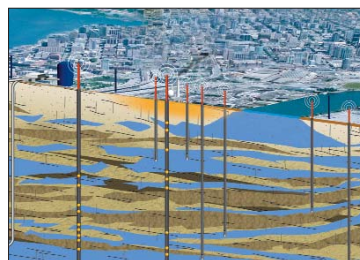
Site assessment
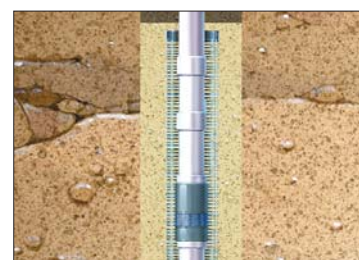
Monitoring well design

Three-dimensio

PROFESSIONAL APPLICATIONS

Industrial

The Westbay System offers a three-dimensional network of monitoring zones providing the data necessary to observe groundwater and contaminant flow behavior on a macroscopic scale. This detailed data allows project managers and environmental engineers to optimize remediation systems.

Mining

The ability to measure pore pressures, collect fluid samples, and test hydraulic conductivity makes Westbay Systems the ideal technology for mining projects. Applications include site characterization for environmental impact assessment, tailings and waste ponds management, monitoring of leach operations, and closure analyses. Geotechnical applications include mine dewatering, pit slope stability, and construction of tunnels and shafts.

Civil and Geotechnical

The Westbay System provides detailed fluid pressure data required for monitoring slope stability, subsidence, and drainage. The system is suitable for monitoring groundwater pressures at large dams, landslides, underground tunnels and various civil engineering projects.

Carbon Sequestration

With its ability to access an unlimited number of monitoring zones, the Westbay System is uniquely suited to meet the challenges involved with subsurface monitoring related to geologic sequestration of CO_2. The system also enables a wide variety of advanced hydrogeologic tests to be carried out.

VALUE-ADDED SERVICES

Schlumberger Water Services offers technology and services to support virtually all stages of groundwater monitoring networks. From Westbay System completions to data acquisition and analysis, our tools and expertise will help you make the most of your investment.

Site Assessment

Initial site assessments offer baseline data necessary for characterizing the site. Westbay Systems are equipped with tools to characterize the hydrogeologic conditions of the site, and optimize well placement.

Design & Deployment

Westbay Systems are completely customizable for each unique hydrogeologic condition. The versatility in design minimizes overall construction and deployment costs.

Data Acquisition

Westbay Systems are engineered to collect and record pressure measurements and samples from any number of monitoring zones within a single borehole.

Interpretation

Accurate data interpretation is critical to supporting decisions. Westbay Systems provide reliable and highly accurate data for understanding the groundwater flow regime.
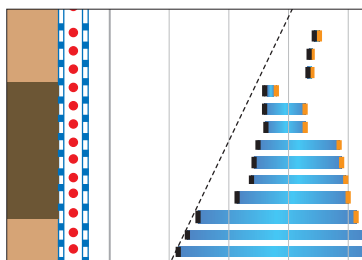
Reporting & Decision Making

HydroManager*, a data management system, provides the ideal platform for management of Westbay System data for decision support and web-based information distribution.
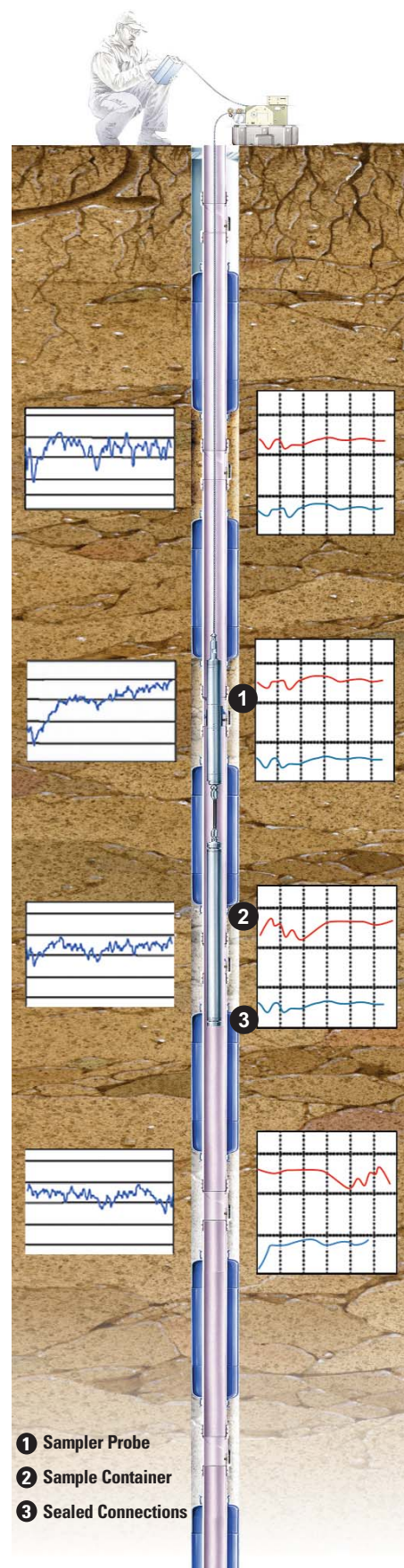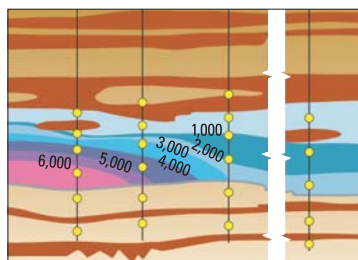
1 Sampler Probe
2 Sample Container
3 Sealed Connections
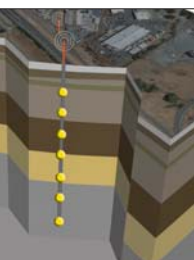
nsional network

Multiple zone monitoring

Subsurface characterization

6,000 5,000 4,000 3,000 2,000 1,000

Hydro GeoAnalyst

Advanced environmental data management, analysis, visualization, and reporting

PROFESSIONAL APPLICATIONS:

- Manage data for local, state, and federal groundwater monitoring networks
- Manage data associated with remediation projects
- Manage well construction details and registration information
- Analyze borehole data acquired for mineral exploration
- Interpret geologic and hydrostratigraphic data
- GIS mapping and reporting of aquifer extents and geologic formations
- Store sanitary landfill monitoring data
- Evaluate and report the spatial distribution of water quality parameters
- Groundwater vulnerability assessment and protection planning
- Report downhole data (borehole lithology, geophysics, concentrations, etc.)
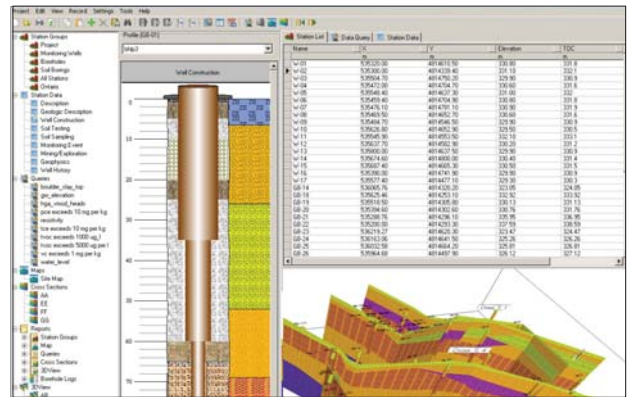
OVERVIEW

Hydro GeoAnalyst (HGA) is a comprehensive data management, visualization, and reporting application designed for efficient management of groundwater and environmental data. With the HGA desktop solution you get the highest level of performance and a completely scalable solution to meet your groundwater project demands! Hydro GeoAnalyst is an all-in-one desktop concept that provides one-click access to many powerful features.

MULTIPLE TASKS. ONE PACKAGE.

Perform flexible multi-format data imports; conduct powerful search queries; create detailed cross-sections, time-series, and borehole log plots. Hydro GeoAnalyst is the ultimate companion for professionals looking for robust, yet easy-to-use, integrated tools to manage, analyze, and report complex environmental and groundwater data.

FLEXIBLE DATABASE AND QUERYING

HGA's template manager allows you to customize the data structure to meet your needs. The easy-to-use yet powerful SQL querying utility gives you direct access to the well locations and data you need.

- Build your own database schema or work with existing Environmental, U.S. E.P.A. Region 2 & 5 schemas
- Add/remove/edit tables and fields in the database
- Define look-up lists for soils and chemicals
- Quickly generate dynamic queries for managing well groups and chemical exceedences
- Retrieve, export, map, or print queried results
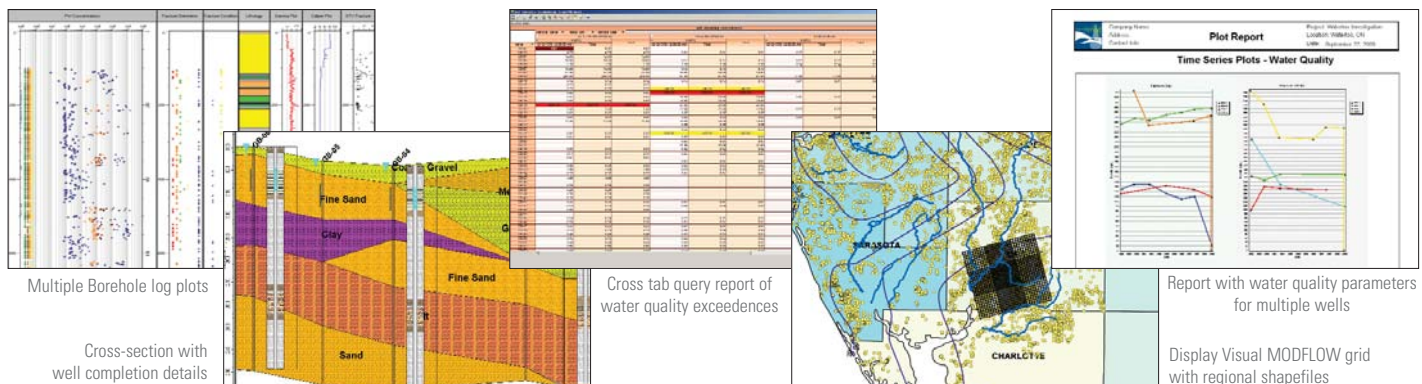
PREPARING FOR THE FUTURE

Extracting information from legacy projects can be challenging when the information is scattered in many sources in various formats. HGA offers a systematic approach to storing, organizing, managing, and retrieving vital data for future use. This translates to increased flexibility and easy, immediate access to information.
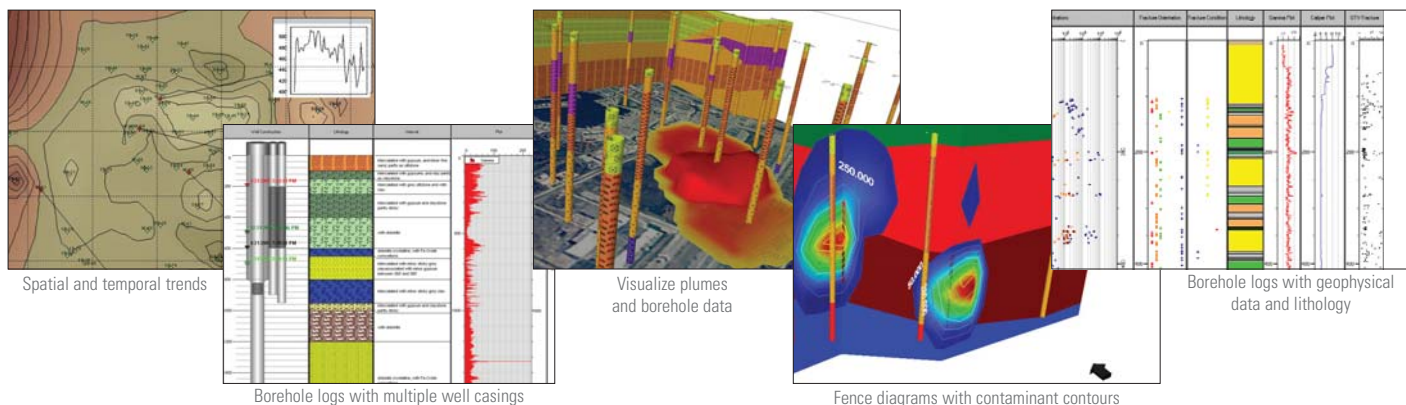
ALL-IN-ONE SOLUTION

- **Project Wizard**: easy-to-follow wizard for creating projects
- **Data Transfer System**: imports and validates all project data in virtually any format
- **Template Manager**: create and manage database fields and tables
- **Materials Specifications Editor**: manages all soil classifications and color patterns
- **Query Builder**: performs on-the-fly, map-ready data queries
- **QA/QC Lab Assessment**: analyze blank, duplicate, and spiked samples
- **Map Manager**: for GIS mapping, contouring, gridding, thematic mapping, etc.
- **Cross-Section Editor**: interpret geologic, hydrogeologic and model layers - ideal for use with Visual MODFLOW!
- **HGA 3D-Explorer**: 3D visualization and animation of your boreholes, fence diagrams, and transient contaminant plumes
- **Borehole Log Plotter**: borehole log design and plotting
- **Report Editor**: fully customizable reports, time series graphs, tables, maps, etc.
- **User Access Management**: create user profiles and groups, and define permissions
- **AquaChem Link**: pass data from HGA to AquaChem for plots or statistical analyses

"Hydro GeoAnalyst can be a very effective management tool for groundwater and environmental data.....a software platform that can organize the historical as well as future data into one centralized management system is ideal for ongoing projects. "

Niagara Peninsula Conservation Authority, Ontario, Canada

Multiple Borehole log plots

Cross-section with well completion details

Cross tab query report of water quality exceedences

Report with water quality parameters for multiple wells

Display Visual MODFLOW grid with regional shapefiles

Spatial and temporal trends

Borehole logs with multiple well casings

Visualize plumes and borehole data

Fence diagrams with contaminant contours

Borehole logs with geophysical data and lithology

COMPELLING GRAPHICS AND REPORTS

High-Impact Maps - visualize recharge areas, contours of water table and contaminant hot-spots in full color and with great detail

Seamless Graphs and Tables - quickly generate dynamic time-series plots and send to a report. Design and execute cross-tab queries and export to MSExcel™ or HTML format for printing

Precise Cross-Sections - display geologic or hydrogeologic layers for accurate interpretation

Immediate Borehole Log Plots - graphically display your borehole logs using customized templates and pass to report designer for printing

Impressive 3D Rendering - generate breath-taking three-dimensional displays and animations

HGA'S WIDE RANGE OF USERS

Water Supply Managers – can efficiently address regulatory requirements to provide clean sustainable water.
- Map pumping well locations and wellhead capture zones from Visual MODFLOW
- Map recharge areas and analyze regional water quality trends
- Report groundwater levels and quality data
- Develop contingency plans in drought conditions

Government Agencies – HGA offers powerful environmental assessment features to help authorities and legislators accurately define zoning and land use policies.
- Map environmentally sensitive areas
- Compare land use plans with zoning regulations
- Characterize subsurface environments, identify risks, and develop long-term water usage plans

Environmental Consultants – engineers and hydrogeologists have a complete set of tools to satisfy the needs of their clients.
- Interpret and display accurate geologic and subsurface conditions
- Create complete soil and water reports for remediation sites
- Manage data from monitoring programs including water levels and concentrations
- Interpret model layers for Visual MODFLOW

Mining Professionals – HGA provides continuous data management and mapping to support mining operations.
- Easily assess changes in water quality
- Complete subsurface interpretations
- Store siteplans, roads, building layouts, etc.
- Prepare permits and compliance reports

HydroManager

WEB-BASED DATA ACCESS

HydroManager is a fully customizable web-based information management system that provides secure, centralized access to your water resources data from anywhere in the world. HydroManager leverages your investment in existing technology; its open standard architecture and flexible design allow integration with almost any other third-party or proprietary databases and modeling structure.

Each HydroManager installation is fully customized to meet your unique needs. Reliable security features protect your sensitive project data from undesired access; user profiles and role definitions ensure each user sees only their pertinent data.
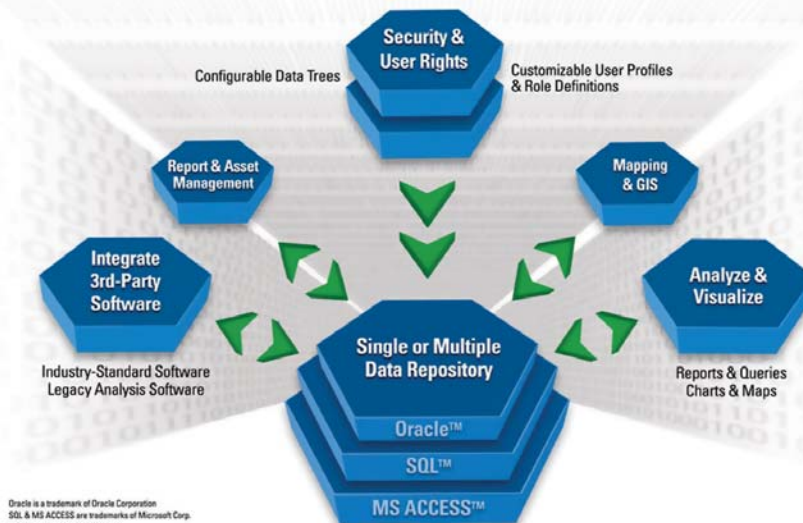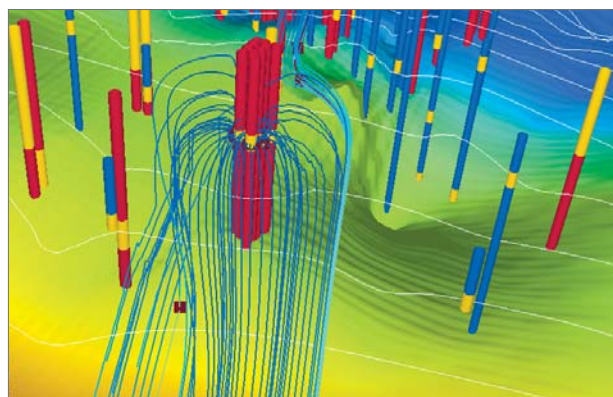
Visual MODFLOW Premium

Industry standard three-dimensional groundwater flow, contaminant, and heat transport modeling

PROFESSIONAL APPLICATIONS:

- Evaluate groundwater remediation systems (pump & treat, funnel & gate)
- Design and optimize mine dewatering
- Delineate well capture zones for domestic water supply development
- Determine contaminant fate and exposure pathways for risk assessment
- Aquifer Storage and Recovery (ASR)
- Simulate buoyancy effects of storing fresh water in saline aquifers
- Simulate natural attenuation of contaminated groundwater
- Predict impacts from saltwater intrusion in coastal zone aquifers
- Assess groundwater circulation in deep mines and geothermal anomalies
- Simulate cation exchanges (water-rock interactions) during ASR

OVERVIEW

Visual MODFLOW Premium, an industry standard in 3D groundwater flow and contaminant transport modeling, seamlessly integrates powerful numeric engines with advanced graphical tools for building, calibrating, and evaluating aquifer systems.

MODEL DESIGN AND INPUT

- Interactive model display (2D and 3D views)
- Import raster and vector sitemaps
- Import MODFLOW packages
- Efficient grid creation and optimization
- Import and interpolate elevation data using Natural Neighbor, Kriging, or Inverse Distance methods.
- Use shapefiles to define well locations, flow properties, and boundaries.
- Import data in row, column, layer format for properties and boundary conditions.

RESULTS AND INTERPRETATION

- Export gridded data to numerous file formats: XYZ, Arrays, Surfer .GRD, TecPlot .DAT
- Export contours and pathlines to .SHP, .DXF
- Export cell attributes to .SHP
- Generate .AVI animations of transient results
- Generate professional reports with customized logo, legend, header/footer.

INTEGRATED TOOLS

- **MODFLOW-2000/2005**: three-dimensional groundwater flow simulations
- **MODPATH**: particle tracking
- **SEAWAT**: 3D variable-density, transient groundwater flow and heat transport
- **MT3D99**: 3D mass transport model for simulating advection, dispersion, and chemical reactions
- **MT3DMS**: for multi-species contaminant transport simulations
- **RT3D**: simulate reactive transport including rate-limited sorption and sequential decay
- **PHT3D**: 3D multi-component model for reactive transport in saturated porous media
- **MNW (Multi-Node Well)**: designed to help simulate well screens that span multiple layers
- **GMG Solver**: designed to optimize memory usage and reduce simulation run times
- **SAMG** (Systems Algebraic Multi-Grid): for large, complex models optimized to run with MODFLOW-2000/2005 or SEAWAT projects
- **VMOD 3D-Explorer**: advanced three-dimensional visualization and animation tool
- **WinPEST**: Windows-based version of PEST for automated model calibration, sensitivity analysis, and predictive analysis

- **Lake and Stream Routing Package**: for surface water and groundwater interactions
- **MGO**: optimize pumping and injection well rates and locations; ideal for dewatering or evaluating contaminant clean-up options
- **Zone Budget**: sub-regional water budget calculations and dynamic plots and graphs

ADD-ON POWER FEATURES

- **Hydro GeoBuilder***[*†]: fully-integrated grid-independent conceptual model design
- **MODFLOW-SURFACT**[†]: three-dimensional variably-saturated flow or soil vapor flow simulations, with PCG5 solver
- **MIKE 11**[†]: the basic river network/channel modeling component of MIKE 11 is integrated, providing the tools for integrated surface water - groundwater flow

INTEGRATION WITH FIELD TO OFFICE

- Import Diver data for calibration of the model
- Incorporate cross-sections from HGA as input for numerical model layers
- Import pumping wells from HGA database
- Import recharge data from Visual HELP
- Pre-process input for a PHT3D simulation using AquaChem
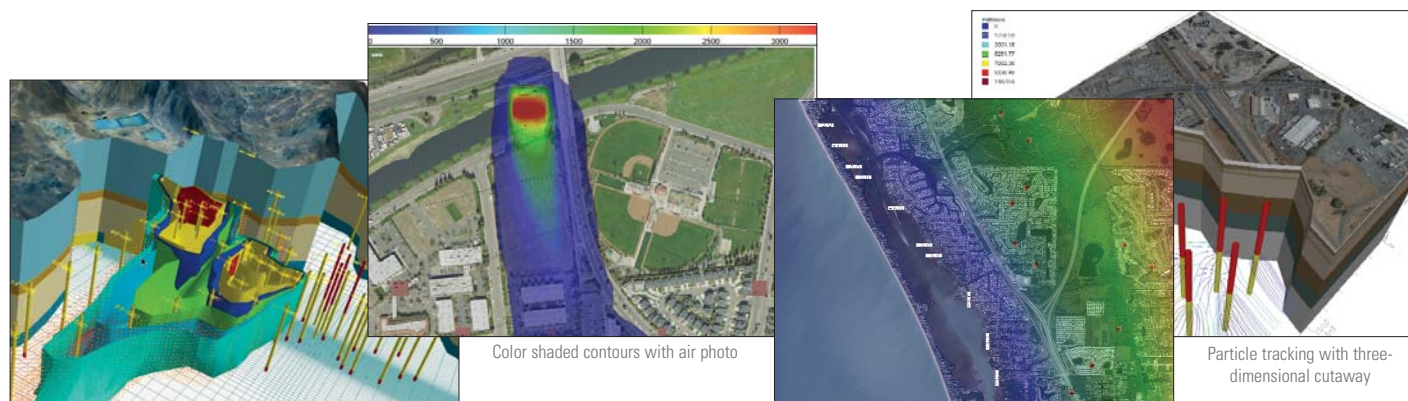
Three-dimensional plume migration


Color shaded contours with air photo

† Sold separately

Saltwater intrusion in coastal regions

Particle tracking with three-dimensional cutaway

Hydro GeoBuilder

Conceptual model development for FEFLOW and MODFLOW

HIGHLIGHTS:

- Design the conceptual model structure, flow properties, wells, and boundaries, and convert to input for FEFLOW or MODFLOW
- Automatically generate the FEFLOW mesh or MODFLOW grid from multi-layered pinchout and discontinuous layers based on your raw data
- Generate layer elevations that deform to the geology or are layer-independent
- Convert between UTM, State Plane, Geographic, and Gaus Kruger co-ordinates
- Automatically assign appropriate flow materials in regions of pinchouts
- Work with flexible units for length, conductivity, and flow rates
- Easily assign tens or hundreds of multi-layered wells to the finite element mesh or finite difference grid, with appropriate screen locations and pumping rates
- Compare borehole data from the conceptual model with the grid or mesh
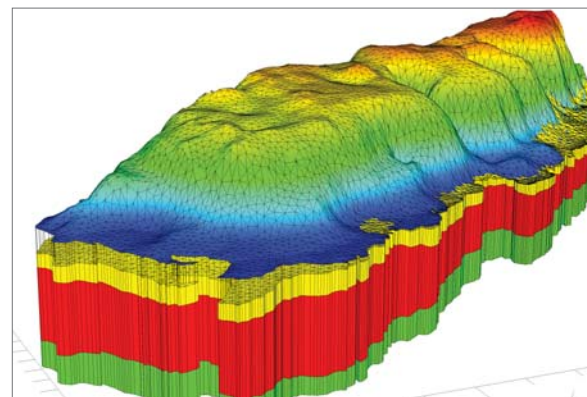
OVERVIEW

Hydro GeoBuilder provides a conceptual modeling environment for MODFLOW or FEFLOW™ to streamline the process of defining flow properties, boundaries, pumping wells, and three-dimensional finite element meshes and grids.

Hydro GeoBuilder Advantage

From raw data, to the conceptual model, to the numerical model, Hydro GeoBuilder will dramatically improve the time it takes to build the groundwater model. Working with grid and mesh-independent data, you will quickly capture the essence of the groundwater flow system without being constrained by a particular grid/mesh size or type. With Hydro GeoBuilder the tedious tasks of populating the three-dimensional grid and finite element mesh are done automatically, allowing you to focus on conceptualization and interpretation.

- Define pinchouts and lenses and automatically populate the correct elements and grid cells
- Easily define multi-layered pumping wells
- Modify the size or location of your model and generate input for FEFLOW or MODFLOW

ACCELERATE THE WAY YOU BUILD YOUR MODFLOW AND FEFLOW MODELS

The Hydro GeoBuilder suite of features and tools will allow you to:

- Import borehole data and interpolate points to create geologic surfaces
- Work with flexible coordinates and units for flow materials, pumping rates, lengths
- Convert the conceptual model to FEFLOW (.FEM) file or MODFLOW package files
- Generate geological surfaces from cross-sections defined in Hydro GeoAnalyst
- Import XYZ points with attributes from spreadsheets, databases, and text files
- Import .SHP and .DXF files to define the model area, flow materials, recharge zonations, etc.
- Interpolate XYZ Points using Natural Neighbor, Inverse Distance, or Kriging
- Import ASCII .GRD and Surfer .GRD files as input for layers or distributed properties
- Display raw data in two-dimensional or three-dimensional graphic-rich viewers
- Import raster images and display in two-dimensions or draped in three-dimensions

BENEFITS

With traditional MODFLOW and FEFLOW modeling the input is assigned to the grid or mesh, posing challenges when the grid or mesh is inadequate or your modeling objectives change. Using Hydro GeoBuilder, model input is defined conceptually, independent of the simulator, which provides the following benefits:

- **Reduce Effort** - Define pinchouts and lenses using shapes and surfaces and automatically convert to the appropriate grid cells or elements
- **Save Time** - Use existing raw data as superelements, and use Triangle[1] to automatically generate the finite element mesh and slice elevations from the conceptual model
- **Expandable** - As your project objectives change, modify the type or size of grid and mesh or change simulators and easily generate input for a MODFLOW model or FEFLOW model
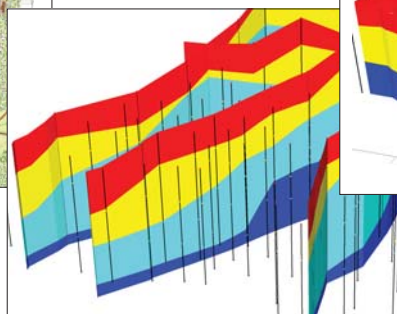
"Hydro GeoBuilder is an excellent companion product for FEFLOW and will streamline the model creation process."
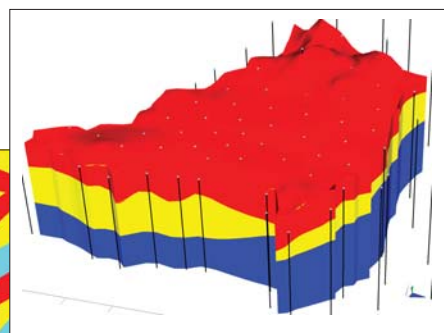*-Hans-Jörg Diersch, DHI-WASY*

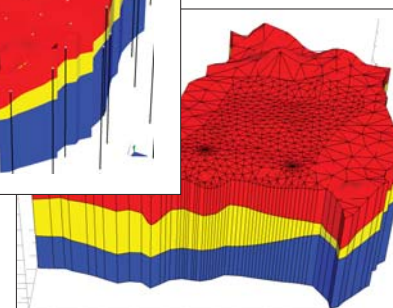Use GIS data as input for geologic layers, flow materials, and pumping wells

Import and interpret borehole and cross-sectional data

Create geologic formations with volume estimates

Refine mesh around wells and boundaries. Define slice elevations from geologic layers.

FEFLOW is a Trademark of DHI-WASY. [1]Triangle is copyright of Jonathan Richard Shewchuk

AquaChem

Water quality analysis, plotting, and reporting

PROFESSIONAL APPLICATIONS:

- Analyze and report aqueous geochemistry of municipal groundwater supply wells
- Report analytical lab results of samples from contaminated sites
- Manage water quality data from sanitary landfills
- Identify mineralization trends for mining exploration
- Analyze and plot water quality data
- Identify water quality guideline exceedences
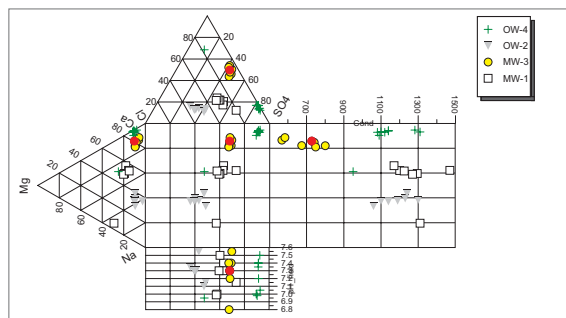
OVERVIEW

AquaChem is used to analyze, plot, and report water quality data and features a fully customizable database of physical and chemical parameters. AquaChem also features a close integration with the popular USGS PHREEQC code for geochemical modeling.

DATA INPUT AND ANALYSIS

AquaChem uses the common measured values (cations and anions) for each sample to calculate additional geochemical values including:
- Water Type, Sum of Anions, Sum of Cations, Ion Balance
- TDS, Hardness, Alkalinity, Common Ion Ratios
- Sodium Adsorption Ratio, Magnesium Hazard, Oxygen Saturation
- Scaling indexes such as Langelier Index and Ryznar Stability Index

Statistical analyses include:
- Summary Statistics: Confidence Interval, Number of Non-Detects
- Trend Analysis: Linear Regression, Sen's Test, Mann Kendall
- Outlier Tests and Tests for Normality

PLOTTING

- Multiple parameter plots: Piper, Durov, Ternary, Schoeller
- Correlation plots: XY Scatter, Ludwig-Langelier, Wilcox, and Depth Profile
- Summary plots: Box and Whisker (Multiple Parameters, Multiple Stations, Temporal), Frequency Histogram, Quantile, Detection Summary
- Time-Series plots (multiple parameters, multiple stations, statistical)

- Single sample plots: Radial, Stiff, and Pie, with option to plot on a sitemap
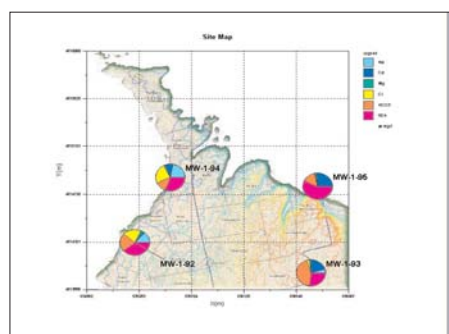
GEOCHEMICAL MODELING USING PHREEQC

AquaChem has an interface to PHREEQC for geochemical modeling.
Calculate saturation indices, pH, eH within AquaChem, or use sample data as input for an advanced simulation using PHREEQC-I or PHREEQC for Windows.
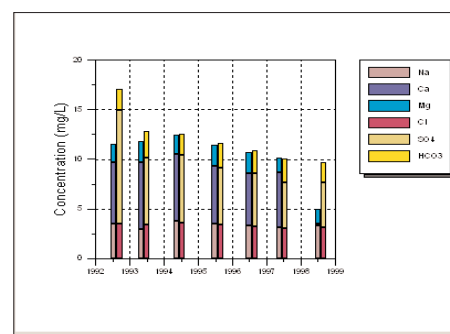
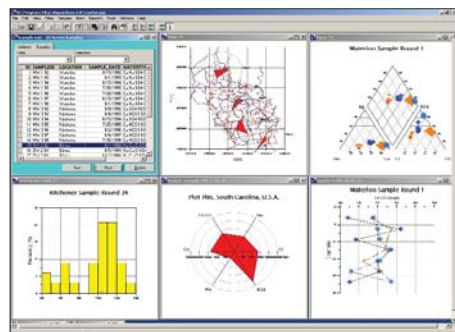**Chosen by the United Kingdom's Environment Agency and the U.S. Office of Surface Mining!**
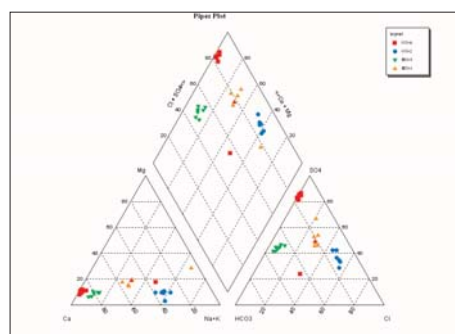
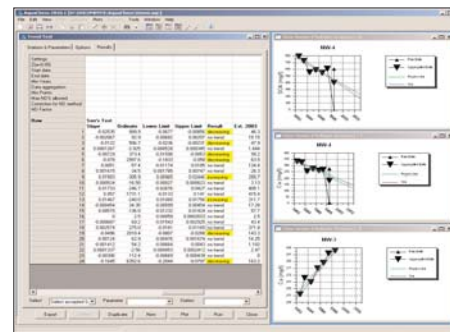Piper plots

Thematic maps displaying pie charts

Cation/Anion stacked bar charts

Multi-plot views with site maps

Chemical exceedences reports

Trend analysis

AquiferTest Pro

Pumping and slug test data analysis

PROFESSIONAL APPLICATIONS:

- Analyze pumping test or slug test data to estimate the hydraulic conductivity, storativity, and transmissivity of an aquifer
- Assess and compare pumping test data using a wide number of solution methods for an improved understanding of the aquifer
- Predict water table drawdown at future well locations
- Contour pumping well drawdown and well interferences
- Prepare professional pumping test and slug test reports

OVERVIEW

AquiferTest Pro is an easy-to-use program for analyzing and reporting pumping test and slug test data. AquiferTest Pro offers all the features and tools in one program to calculate the hydraulic properties of your aquifer.

DATA IMPORT AND ANALYSIS

- Import data from: Excel™, ASCII, TXT, any Diver series datalogger, or virtually any other datalogger on the market
- Diagnostic Graphs: perform on-the-fly comparison of field data vs. diagnostic graphs to provide a quick assessment of the aquifer
- Derivative Analysis: graphically display drawdown or type curve derivatives for assessment of pumping test data
- Statistical analysis: Show scatter plot of observed vs calculated drawdown

## EVALUATE MULTIPLE PUMPING TEST AND AQUIFER CONDITIONS

AquiferTest Pro uses the following characteristics to automatically identify the optimal analysis method for your site.

- Aquifer Type (confined, unconfined, leaky, or fractured)
- Aquifer Extent (infinite, recharge boundary, and barrier boundary)
- Isotropy (isotropic, anisotropic)
- Discharge (variable, constant)
- Well Penetration (fully, partially)
- Data Type (recovery, drawdown)

Available Analysis Methods

- Confined: Theis, Cooper Jacob
- Unconfined: Neuman, Boulton
- Leaky: Hantush-Jacob (Walton), Hantush with Aquitard Storage

- Fractured Flow: Warren Root, Moench
- Wellbore Storage: Papadopulos - Cooper, Agarwal (Skin Effects)
- Recovery: Agarwal Recovery, Theis Recovery
- Slug Tests: Hvorslev, Bouwer-Rice, Cooper-Bredehoeft-Papadopulos, Butler
- Step-Drawdown Tests for Well Losses: Hantush-Bierschenk
- Horizontal Wells: Clonts & Ramey
- Specify Capacity Test

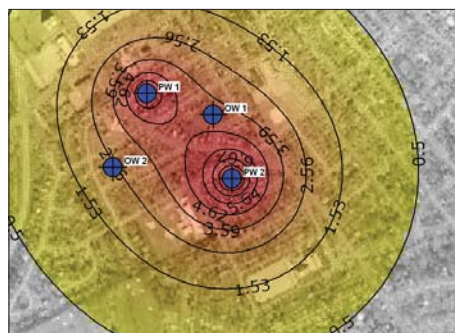Fractured Aquifer Analysis: Moench
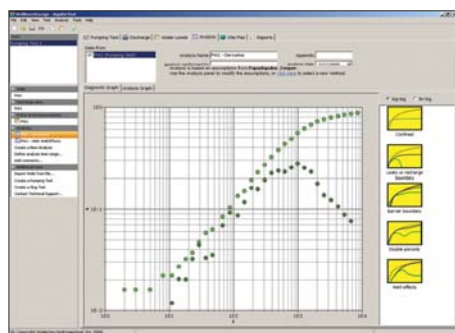
Plot drawdown and derivative data to interpret aquifer conditions
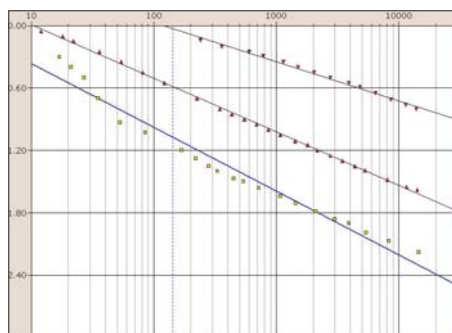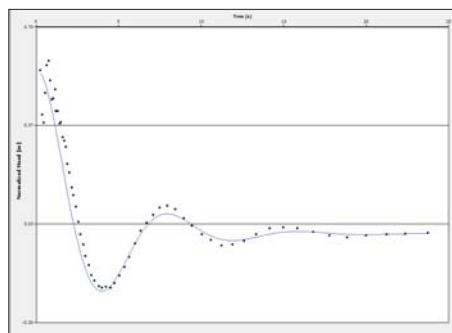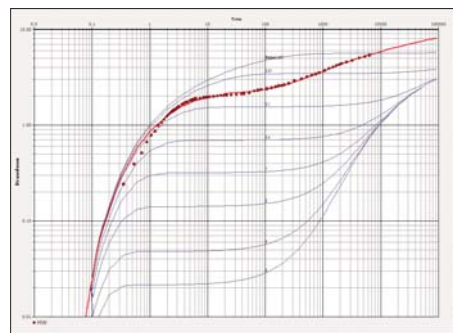

Confined analysis
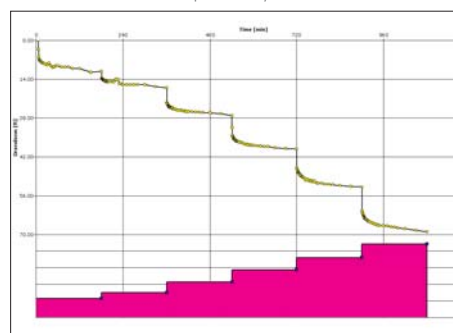
Step drawdown test

Display well interference as contours or color shading over a sitemap

Butler slug test with oscillations

Unconfined Analysis: Neuman

Visual HELP

Hydrologic landfill design and optimization

PROFESSIONAL APPLICATIONS:
- Optimize the hydrologic design of sanitary landfills
- Estimate leachate flow rates and volumes in a landfill
- Evaluate the effectiveness of landfill materials/liners
- Determine the effectiveness of landfill caps, considering slope, vegetation, and climate conditions
- Predict seasonal infiltration and recharge rates through the vadose zone and use as input for Visual MODFLOW
- Generate statistically reliable weather data

OVERVIEW
The U.S. EPA's HELP model (Hydrologic Evaluation of Landfill Performance) has become the international standard for modeling landfill hydrology and estimating groundwater recharge rates. Visual HELP* is a Windows™-based solution for modeling, evaluating, and optimizing landfill design, predicting leachate mounding and evaluating potential leachate seepage to the groundwater table.

HIGHLIGHTS
With Visual HELP you can:
- Graphically create profiles representing various parts of a landfill
- Automatically generate statistically reliable weather data using the built-in interactive GIS-based International Weather Generator
- Run complex model simulations to estimate volume and flow rates through landfill layers under variable weather conditions
- Interpret and analyze the model results using daily, monthly, and yearly plots of simulated data
- Automatically generate professional reports of your model results using the built-in Report Generator
- Predict site-specific seasonal effects on groundwater recharge rates

Visual HELP is an excellent companion product for groundwater flow models such as Visual MODFLOW. Now, groundwater professionals have the tools to truly improve the reliability and quality of their models.

MODEL RESULTS AND REPORTING
- Daily, monthly, and yearly flow rates and volumes are available for reporting using a powerful graphing component
- Model results include time-series data for: Surface Data (surface storage, snowmelt, runoff, infiltration, evapotranspiration, vegetation growth, and soil moisture storage) and Subsurface Data (lateral layer drainage, percolation through specific layers, leakage through geomembrane liners, and average head in specific layers)
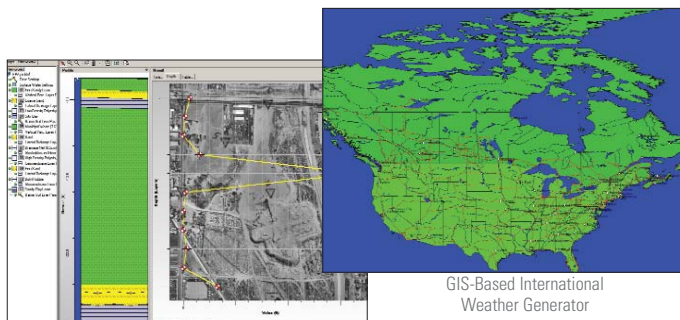
Multi-view window with materials profile and water storage plots

GIS-Based International Weather Generator

UnSAT Suite

Vadose zone flow and transport

PROFESSIONAL APPLICATIONS:
- Model pollutant fate and transport of leaky UST's
- Simulate vertical migration and volatilization of VOCs from accidental spills
- Predict impacts on groundwater supply wells from pesticide and herbicide application
- Develop contaminant loading rates for groundwater flow models (Visual MODFLOW Premium)
- Estimate aquifer vulnerability

OVERVIEW
UnSat Suite* combines SESOIL, VLEACH, VS2DT, and PESTAN into a revolutionary graphical environment specifically designed for simulating one-dimensional groundwater flow and contaminant transport through the unsaturated zone. Each model is optimized to run as a native Windows™ application within an easy-to-use graphical interface.

Vadoze Zone Profiling

Leachate Breakthrough Curves for multiple profile scenarios
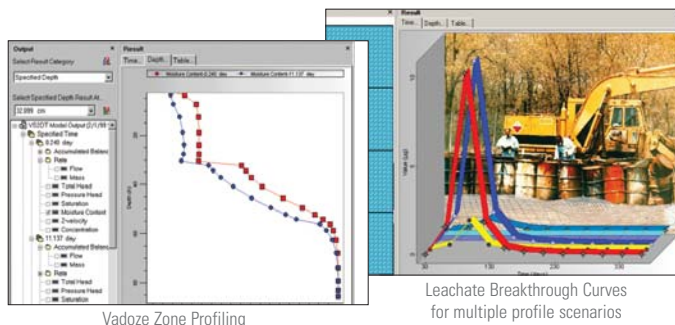
VADOSE ZONE ANALYSIS MODELS
- SESOIL is a seasonal compartment model for simulating long-term pollutant fate and migration in the unsaturated soil zone. SESOIL provides a comprehensive treatment of unsaturated zone contaminant transport processes including contaminant washload, volatilization, air diffusion of VOCs, sorption, degradation, cation exchange, hydrolysis, and metal complexation
- VLEACH (Vadose zone LEACHing) is a one-dimensional finite difference model for simulating the vertical mobilization and migration of dissolved organic contaminants through the vadose zone. It allows you to evaluate potential groundwater impacts and predict volatilization of VOCs
- VS2DT (Variably-Saturated 2D flow and solute Transport) is a finite difference numerical model for simulating steady-state or transient unsaturated flow and transport through multi layer, heterogenous soil conditions
- PESTAN (PESTticide ANalytical) is a one-dimensional analytical model developed by the U.S. EPA for assessing the impact of pesticides on soil and groundwater. To aid model development, a list of parameters for common pesticides are included (e.g. Endosulfan, Atrazine, etc.)

MODEL RESULTS AND REPORTING
- Select from a complete suite of graphical reporting tools for analyzing, interpreting, and printing the simulation results
- Graphically display all modeling results using a customizable plotting component for generating time-series graphs and depth-series graphs
- Use the fully integrated Report Generator to instantly produce a detailed report with model profile properties, supporting graphics, and simulation results

Download trials and learn more at www.swstechnology.com

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WATER SERVICES