Introduction to the AnAqSim Instructional Series
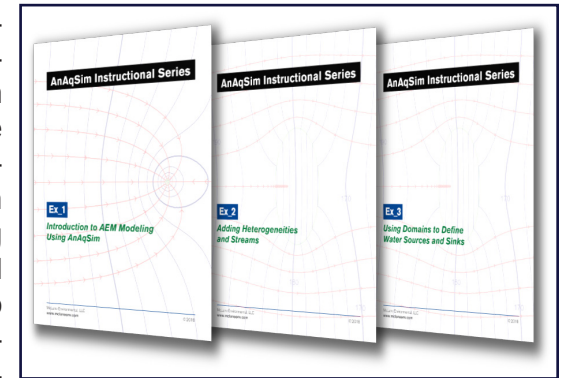
The *flex*AEM™ System is designed to introduce you to the power, accuracy and ease of use of the analytic element method (AEM) approach to groundwater modeling using the new AnAqSim AEM modeling software.

Tutorials and software tools have been developed to lead you step-by-step through the process of building and running AEM groundwater models for problems that cover the range from simple single-layer steady-state models to complex multi-layer transient simulations.

The *flex*AEM™ System also includes a toolkit of groundwater flow and aquifer response calculators. These calculators allow groundwater scientists and engineers to rapidly assess groundwater flow patterns and velocities, pumping or infiltration aquifer stresses, and remediation system designs. Training courses are also offered for those who prefer in-person hands-on instruction. Courses cover the fundamentals of the AEM method, features and capabilities of AnAqSim, and application of AEM groundwater modeling to a broad range of groundwater modeling analyses.

*flex*AEM™ tutorials, available for download and purchase from the *flex*AEM.com website, consist of exercise packages containing self-paced lessons and hands-on tutorial booklets. The training materials provide a gradual and thorough introduction to the concepts of AEM groundwater modeling, and the features and application of the AnAqSim software. Lessons are included that outline basic concepts required to properly apply AnAqSim. These concepts lead into a series of hands-on tutorials, with each tutorial focusing on the use of a particular AnAqSim feature, or exploring one or more methods for representing a common hydrologic feature using the AnAqSim set of analytic elements.

The tutorials are also designed to teach a variety of groundwater modeling techniques and "best practices." While presented within the context of the tutorial step-by-step AnAqSim instructions, the concepts and techniques learned in the *flex*AEM™ training series can be applied in any groundwater project using any selected modeling software.
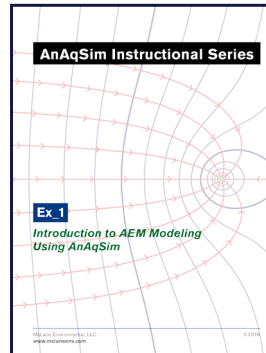
The *flex*AEM™ AnAqSim Instructional Series consists of 9 packages of exercises. Set 1 is FREE and contains a combination of introductory lessons and hands-on exercises that should get you well on your way to building Analytic Element Method groundwater models. Sets 2 through 9 introduce model building concepts and techniques, in-depth discussions of AnAqSim software features, and links to other software that can enhance and facilitate your modeling projects.

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Set 1: Introduction to AEM Modeling Using AnAqSim

This free introduction to the dozens of tutorials in the AnAqSim Instructional Series has been designed to get you started modeling using the Analytic Element Method today!

Our introductory package includes exercises and lessons that are intended to familiarize users with the AEM method using the AnAqSim modeling software, establish good modeling practices, and provide detailed instruction on how to build simple models and perform commonly used groundwater modeling analyses. Once all free training documents and model files have been downloaded, tutorials can be completed using the free AnAqSimEDU software (available from Fitts GeoSolutions). Topics covered in our introductory training package include:

- An introduction to AnAqSim tools and techniques

- Overview of the Subdomain Method

- Setting up a model

- Defining external boundaries

- Defining valley fill aquifer conditions

- Source-sink features

- Adding a steady state well

- Pathline tracing (single layer model)

- Adding horizontal anisotropy

- Contouring drawdown and mounding

The free EDU Training Package includes nine high quality exercises, four instructional lessons, all necessary modeling files, and all associated basemaps – everything you need to start modeling using the analytic element method in AnAqSim!

Set 2: Adding Heterogeneities and Streams

The Set 2 Exercise Package builds upon the concepts covered in our free Set 1 Exercise Package by providing easy to follow instructions and practical examples on how to add surface water features, heterogeneities, linear barriers, and trenches, allowing for better representations of important hydrologic features and simulation of engineered remedial systems (e.g., trenches, slurry walls, etc.). Topics covered in the Set 2 Exercise Package include:

- Adding heterogeneities (including clay layers and sand lenses)

- Adding stream networks

- Adding ponds, wetlands, and discharge areas

- Adding linear barriers (both no-flow and leaky)

- Importing river data

- Adding and analyzing flow from a trench

The Set 2 Exercise Package includes ten high quality exercises, all necessary modeling files, and all associated basemaps.

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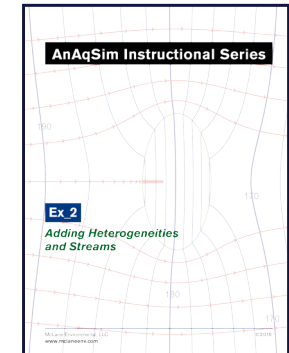
Set 3: Using Domains to Define Water Sources and Sinks

The Set 3 Exercise Package builds upon instruction covered in previous packages, providing easy to follow instructions and practical examples on how to set up model domains and define sources and sinks, techniques which are essential to analyzing complex hydrogeologic systems and developing better site conceptual models. Topics covered in the Set 3 Exercise Package include:

- Defining multiple aquifer zones with Inter-Domain boundaries

- Defining areas of model recharge and evapotranspiration

- Adding a pond or lagoon

- Adding stream features

- Adding transmissive faults

The Set 3 Exercise Package includes eight high quality exercises, all necessary modeling files, and all associated basemaps.
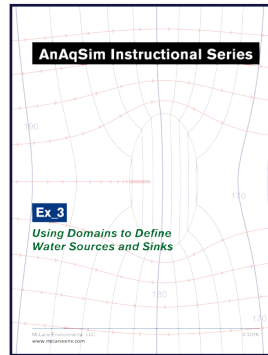
Set 4: Using Domains to Define Layers and Heterogeneities

The Set 4 Exercise Package introduces an important new area of AnAqSim's capabilities: development of multiple layer groundwater flow models. Exercises included in Set 4 demonstrate multi-layer model construction for the simulation of vertical aquifer flow, flow to wells with multiple screened intervals, and accurate representation of 3-D flow in stream-lake confluence areas. Topics covered in the Set 4 Exercise Package include:

- Creating multiple-layer models

- Multiple layer model with pumping well

- Multiple layer model with river line element

- Multiple layer model with river domain

- Stream joining a lake domain boundary

- Stream joining a lake with 3-D flow and discharge

- Flow patterns near a stream joining a multi-layer lake feature

The Set 4 Exercise Package includes six high quality exercises, all necessary modeling files, and all associated basemaps.

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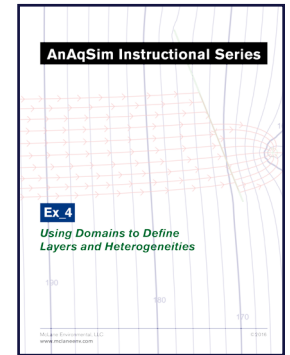
Set 5: Advanced Modeling Concepts

Recommended for more advanced users, The Set 5 Exercise Package provides instruction on more complex modeling concepts. Exercises included in Set 5 demonstrate how to calibrate groundwater models to observed conditions, create transient groundwater flow models and analyze transient conditions through time, and how to use third-type boundary conditions to represent adjoined model domains. Topics covered in the Set 5 Exercise Package include:
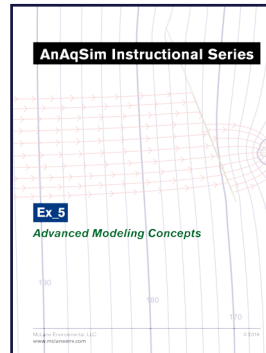
- Creating transient models

- Analysis of transient model output data

- Calibration of models to site data

- Use of vertically stepped domains to represent an aquifer with a sloped base

- How to create and utilize third-type boundary elements

The Set 5 Exercise Package includes eight high quality exercises, all necessary modeling files, and all associated basemaps.

Set 6: Advanced Visualization

The Set 6 Exercise Package will show you how to get the most out of AnAqSim's built-in graphics tools that are used to create groundwater flow models and display their results. AnAqSim's digitizing tools make it easy to draw a model on the screen, but this is made even easier and more accurate by importing a basemap of site features to guide the model development process. In addition, AnAqSim's graphic output (contours, pathlines, and flow vectors) can be modified to prepare report-ready graphics using the built-in View Manager, and can be better understood by overlaying them on a basemap which displays key hydrologic and geographic features (surface water features; potential contaminant sources or receptor locations). Topics covered in the Set 6 Exercise Package include:
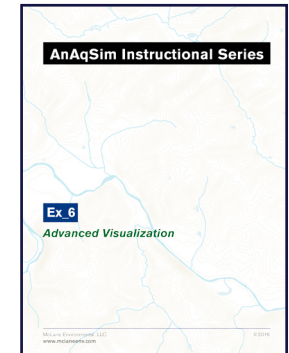
- Using the AnAqSim View Manager features to enhance graphical display

- Use of basemaps in AnAqSim to guide model boundary and element digitizing

- Pathline tracing concepts and applications

- Displaying model results over basemaps in AnAqSim

The Set 6 Exercise Package includes five high quality exercises, all necessary modeling files, and all associated basemaps.

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Set 7: EnviroInsite and AnAqSim

The Set 7 Exercise Package demonstrates the link between AnAqSim and EnviroInsite, a powerful software package that can be used as a graphical user interface for building and displaying AnAqSim models – including the full interactive 3D display of AnAqSim pathlines. Exercises in Set 7 illustrate how Enviroinsite and AnAqSim can exchange data and images to facilitate groundwater model construction and view and analyze model output. Topics covered in the Set 7 Exercise Package include:

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Ex_7
*EnviroInsite and AnAqSim*
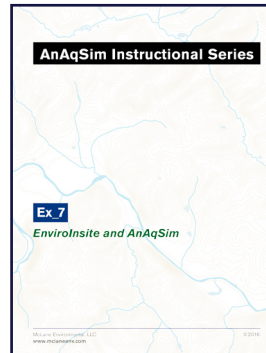
- An overview of EnviroInsite environmental data visualization software

- Digitizing model features in EnviroInsite for import into AnAqSim

- Using EnviroInsite as a graphical pre- and post-processor to access web map services for basemaps

- Exporting two and three-dimensional AnAqSim model results to EnviroInsite for display and analysis

- Creating an AnAqSim river elevation data set by digitizing points on a basemap using EnviroInsite

The Set 7 Exercise Package includes five high quality exercises, all necessary modeling files, and all associated basemaps.

Set 8: AnAqSim Feature Focus

While basic instruction on the use of tools and features in AnAqSim can be found throughout the *flex*AEM™ Exercise Packages and in the AnAqSim User Guide, the Set 8 Exercise Package provides a more in-depth look at the use of key AnAqSim features for constructing groundwater models and analyzing model results. The exercises included in the package illustrate the capabilities and use of each feature or tool with step-by-step instructions and graphics displaying the various data entry steps and output results. Topics covered in the Set 8 Exercise Package include:

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Ex_8
AnAqSim Feature Focus
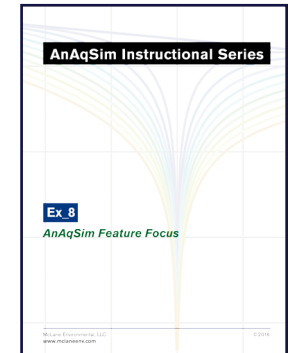
- Working with Data Grids

- Solver Setting and Checks

- Model Inspector Tools

- Analysis Tools

- Digitizing Tools

- Editing XML Model Input Files

- Exporting Model Data and Graphic Results

The Set 8 Exercise Package includes seven high quality lessons to help you to continue learning to model more complex hydrogeologic systems with AnAqSim! Mastering these tools and features will speed your model building, expand your analysis of model results, and enhance your overall AnAqSim modeling experience.

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Set 9: Saltwater Interface Modeling

The Set 9 Exercise Package focuses on the fresh-salt water interface modeling capabilities of AnAqSim including instruction on basic interface hydraulics concepts, and exercises that explore the flow of a freshwater aquifer in the presence of a dense saltwater boundary. Topics covered in the Set 9 Exercise Package include:

- The Ghyben-Herzberg principle that governs the depth and configuration of the freshwater-saltwater interface in AnAqSim

- The "sharp interface" approach applied in analytic element modeling as a representation of the salt-to-fresh transition zone in natural aquifers

- Methods for setting up single layer and multi-layer interface models

- The fully-penetrating well assumption applied in simple AEM interface models compared with the more accurate multi-layer partially penetrating well conditions that can be applied in AnAqSim

- Vertical saltwater interface upconing beneath a shallow water supply well

- Lateral saltwater intrusion in response to pumping near a coastal boundary

- The effect of different coastal boundary condition settings on Models incorporating several different coastal boundary conditions are developed to examine the effects on the simulated groundwater discharge zone at the coast

The Set 9 Exercise Package includes four high quality exercises, all necessary modeling files, and all associated basemaps.

Get Started Today!

Whether you want to explore the free tutorials or want to dive in deeper with some of the more advanced examples, *flex*AEM™ has the perfect place for you to start. Learn AEM modeling to complement your groundwater skill set, and add the ease, flexibility and power of an analytic model to your next groundwater project.

Download a set of tutorials of sign up for a training course today!

Contact Us!

For more information on the *flex*AEM™ System of training, tools, and courses visit:

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Or email Customer Service at:

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