TUTORIAL 5 – Contaminant Transport Modeling

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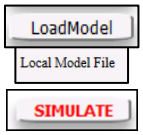
This tutorial demonstrates the use of MAGNET to perform plume/contaminant transport modeling. Various types of contaminant sources are shown, such as an instantaneous source, a continuous source, and an injection well. A cross-section profile model showing the migration of the plume is shown, and also a monitoring well that provides a "breakthrough" curve.

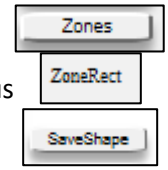
The flow model created in a previous tutorial (Tutorial 2 – Nested Models) is used to illustrate this example.

Hypothetical Plumes – Fort Custer, Michigan

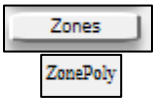
- *Step 1* – load and simulate the regional model from a previous tutorial (see Tutorial 1), then load the nested submodel (Figure 1) and apply 'Boundary Conditions from Parent Model' in the Default Model Input Parameters and Display Options Menu (see Tutorial 2).



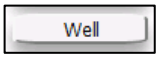
- *Step 2* – Use the 'ZoneRect' and 'SaveShape' buttons to add a zone in the south-central portion of the model domain River. Assign this as continuous source of 500 ppm (see Figure 2).



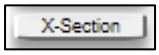
- *Step 3* – Use the 'ZonePoly' and 'SaveShape' buttons to add a zone in the south-eastern portion of the model domain River. Assign this as instantaneous source of 1500 ppm (see Figure 2).



- *Step 4* – Add an injection well to the model domain using the 'Well' button (yellow dot – see Figure 2).

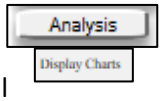


- *Step 5* – Add a monitoring well to the model domain just beyond the continuous source.
- *Step 6* – Draw a cross-section through the continuous source and the downstream area.

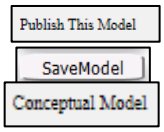


- *Step 7* – Submit the model for simulation.

- *Step 8* – Click the 'Analysis' button, then select 'Display Charts' from the submenu. This launches a number of windows for analyzing modeling results, including the Full Cross-Section and Monitoring Well chart* (see Figure 3).



- *Step 9* – Publish/save the final submodel model for future use



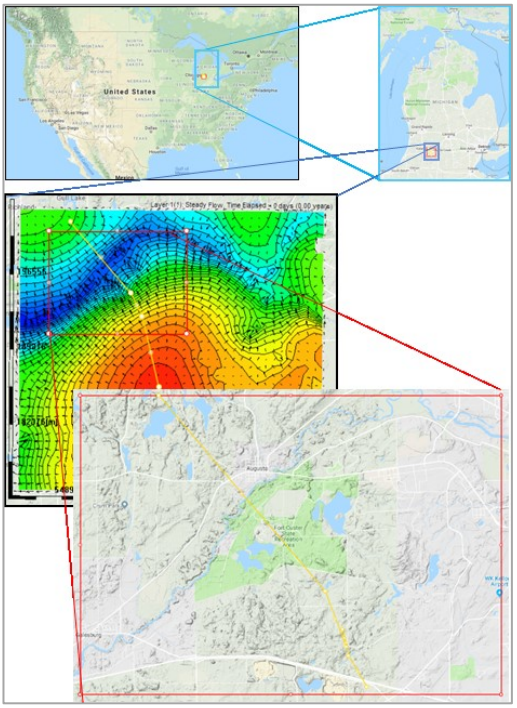


Figure 1 (right): Flow model, loaded into the MAGNET modeling environment.

Additional Details:

- Use the 'Transport Property' and when creating a zone to assign molecular diffusion and local dispersion coefficients potentially useful for solute transport modeling potentially useful for solute transport modeling.
- Similarly, use 'Biochemical' tab when creating a zone to retardation and 1st-order decay coefficients.
- Monitoring wells are useful for visualizing time-series concentration data, but also for comparing simulated head dynamics to time-series observations (see Tutorial 8 – Model Performance)
- Relevant sections in MAGNET manual:
    - Step 1: Section 7.1
    - Step 2-3: Section 4.2
    - Steps 4-5: Section 4.3
    - Step 6: Section 5.4
    - Step 7: Section 5.1
    - Step 8: Section 6.1
    - Step 9: Section 7.1 & 7.2

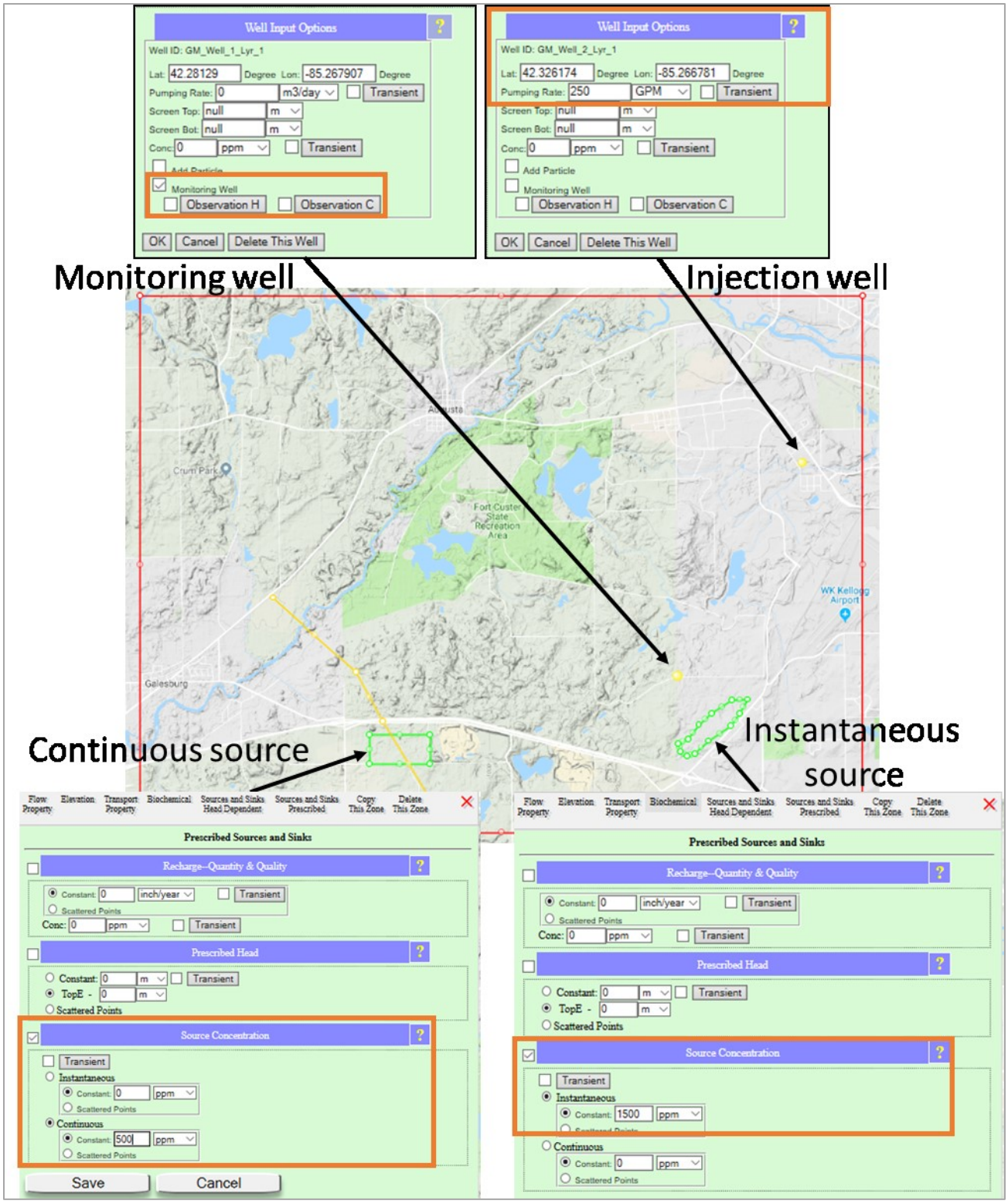


Figure 2: Adding plumes/sources of contamination. A monitoring well is also placed to observe the concentration breakthrough curve of the instantaneous source. A cross-section is drawn through the continuous source.

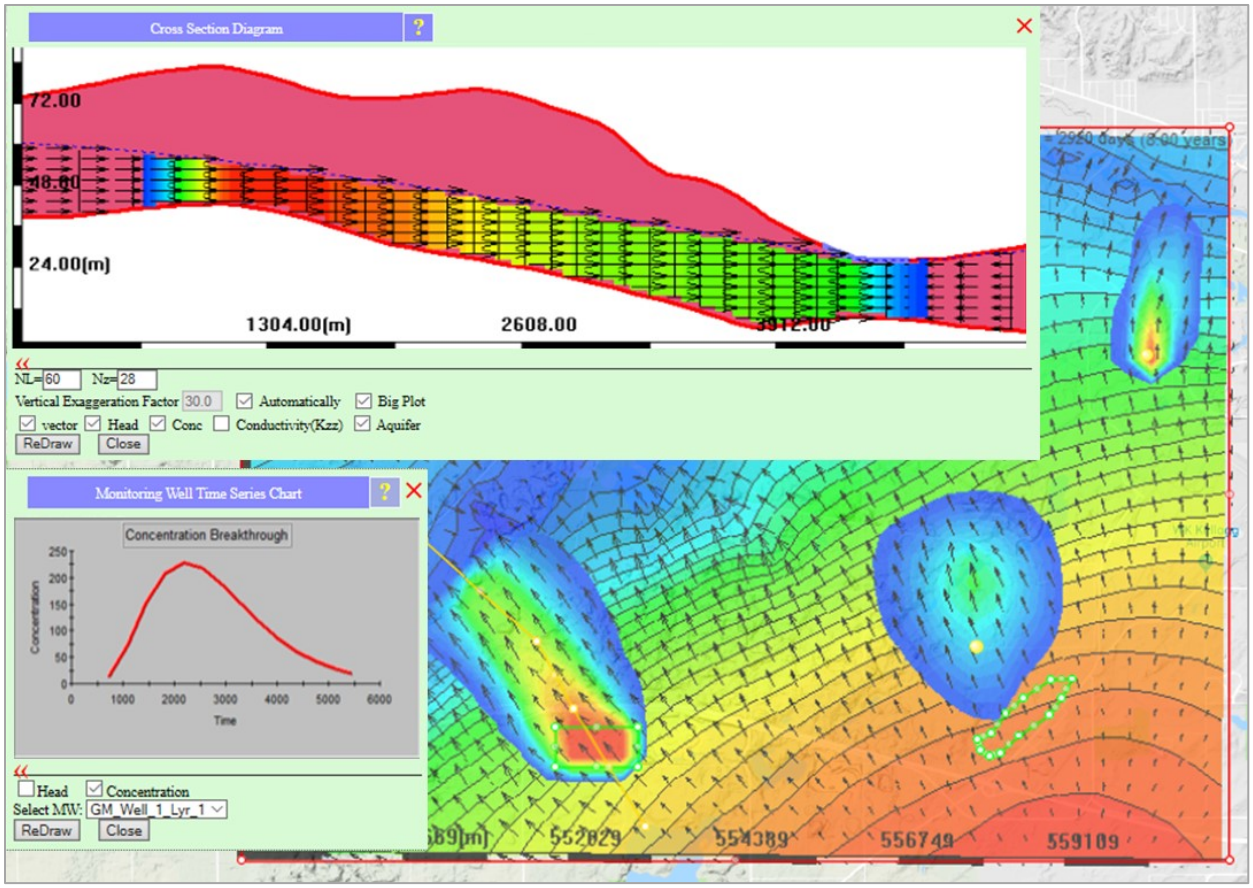


Figure 3: Contaminant transport results, including a cross-section profile model showing the migration of the plume, and also a monitoring well that provides a “breakthrough” curve of the contaminant plume.