# TUTORIAL – Coupled Modeling Example

==========================================================================

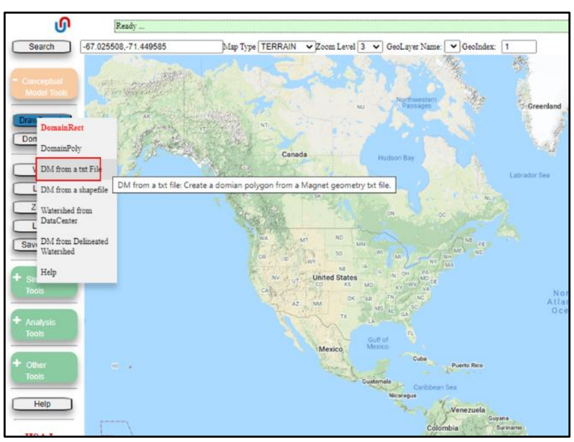
## Introduction

In this example, a simulation of surface water-groundwater coupled model is presented. The model area is around Barron Lake located in Niles, Michigan. The general model setup includes the following features:

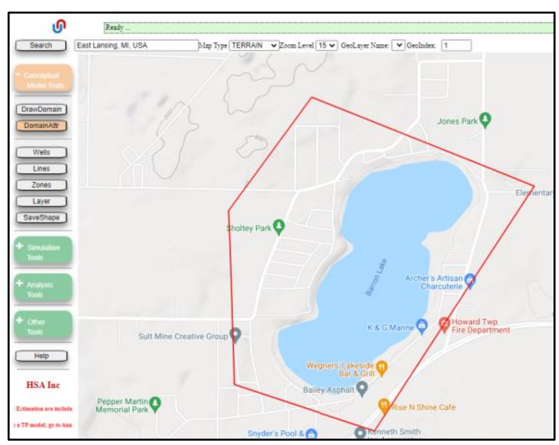
- DEM is used for the aquifer top, and a bedrock top raster based on well records is used as aquifer bottom
- Michigan statewide *Wellogic* borehole data is used to create a 3D geology model using the Transition Probability (TP) geostatistical approach, and this 3D TP model is imported to create a 3D conductivity field for the groundwater model
- Barron lake is modeled as a surface water lake
- A pumping well located near the lake pumps water from deep aquifer into the lake.
- There are lake level measurements available from 2006 to 2013 and groundwater monitoring has been carried out at 11 private wells since 2013. Only measurements in 2013 are used to calibrate the model. The groundwater monitoring wells are used to infer transient boundary conditions around the lake. The groundwater transient boundary condition is modeled as a polygon river and is imported as a shapefile.

## Modeling Steps

**1.** Download the provided .zip folder with project data to your local machine
**2.** Navigate to the IGW-NET modeling platform: [https://www.magnet4water.net/magnet](https://www.magnet4water.net/magnet)
**3.** Login to your MAGNET4WATER Account (follow the Quick Helper if needed)
**4.** Load the domain polygon using the provided text file: Domain.txt



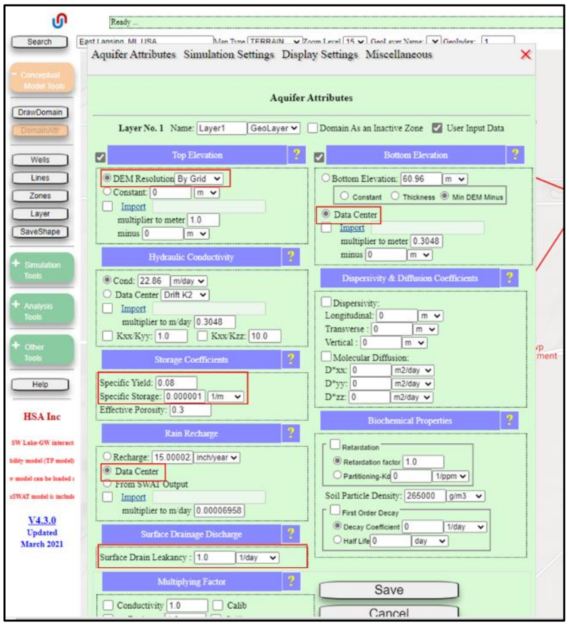
-->



**5.** Assign Domain Polygon Attributes

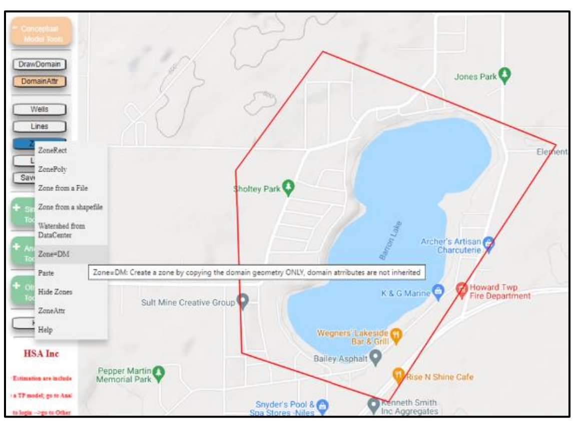
- Specific Yield: 0.08

- Conductivity: from TP (zone-based feature)… domain value will be ignored/overridden
- Specific storage: 1.e-6 1/ft
- Top elevation: DEM (default)
- Bottom elevation:  Data Center (spatial aquifer thickness layer for State of Michigan)
- Surface drainage discharge: 1 $d^{-1}$ (default value)
- Recharge -- select Data Center (spatial data layer for State of Michigan)



**6.** Create zone with identical shape/size of domain … a 'DM Zone'

a. 'Conceptual Models Tools' > 'Zones' > 'Zone=DM'



**7.** Use DM Zone to assign the 3D TP model as input for a 3D conductivity field

a. Under Flow Properties (default tab), check the box next to 'Conductivity'

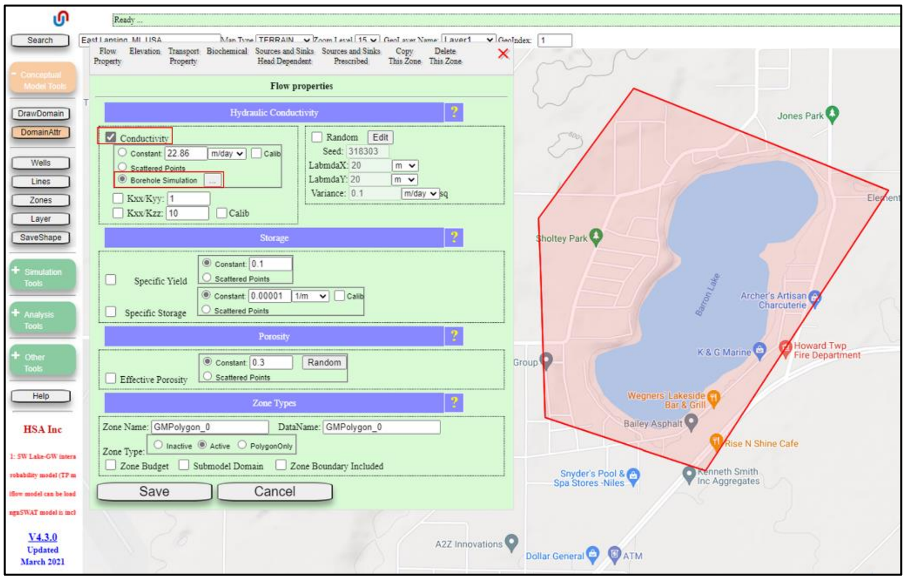
b. Select Borehole Simulation sub option and click '…' options button.  This launches the Borehole Simulation Options interface.

c. Check the box next to 'Import' and click the link to browse to and select the TP result file: BarronLakeTP.tp

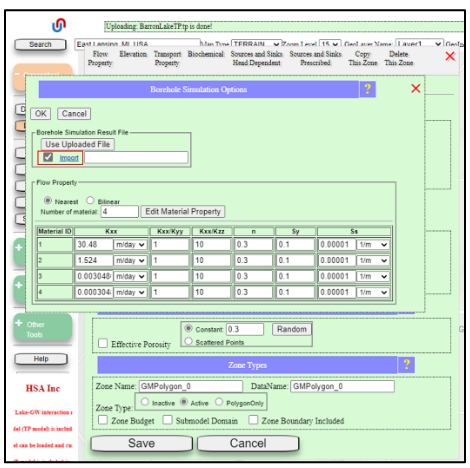
d. Assign typical x- (west-east) direction conductivity values ($K_{xx}$) typical values for the 4 material types from the geology model:

   i. Material 1: 53 ft/day || Material 2: 5 ft/day || Material 3: 0.01 ft/day || Material 4: 0.001 ft/day

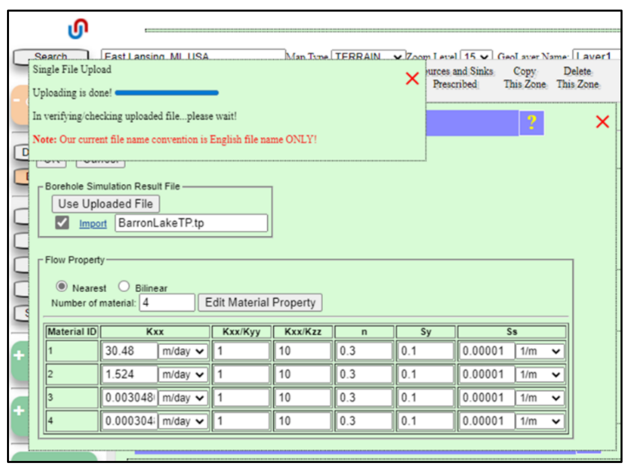
   ii. Use default values for $K_{xx}$/ $K_{yy}$, $K_{xx}$/ $K_{zz}$, etc. Click 'OK' to save changes and close the Borehole Simulation Options interface.

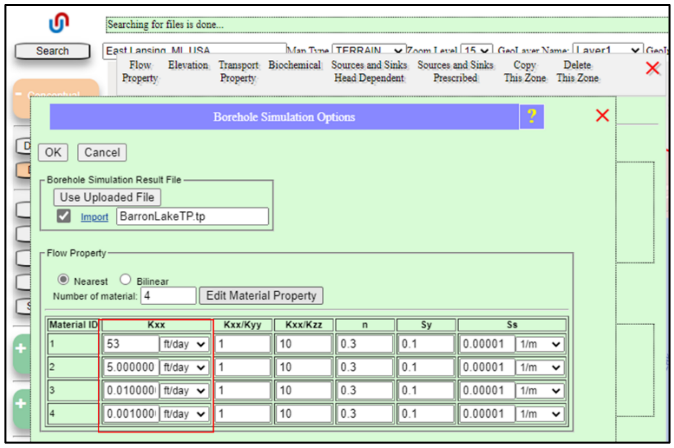



-->

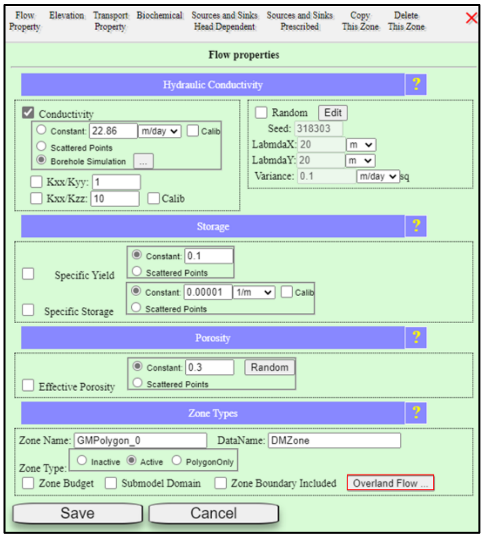



-->

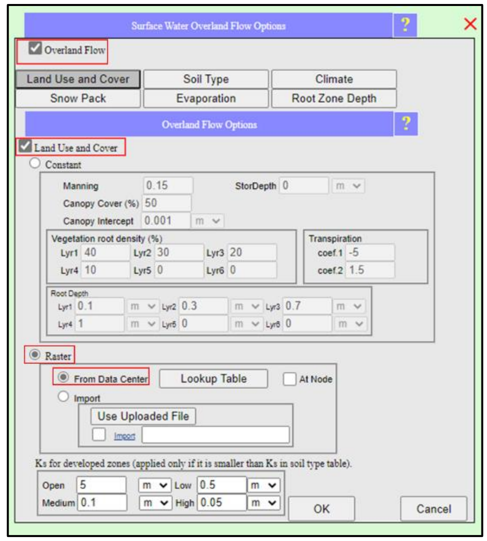


--> 

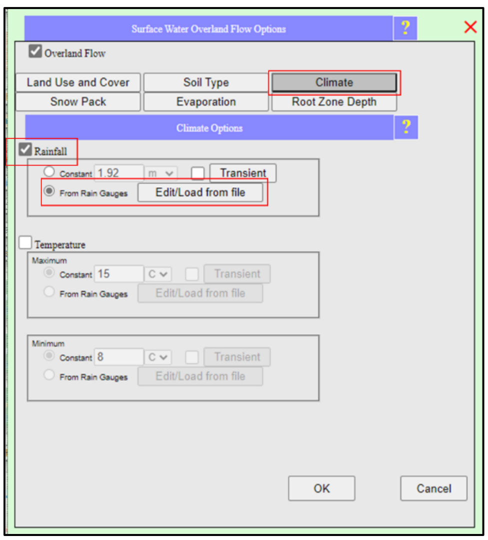

8. Use DM Zone to assign data inputs for overland / watershed modeling (recharge as input to the groundwater model; runoff as input to the lake water balance).
   a. Click the 'Overland Flow…' button towards the bottom-right of the Flow Properties tab. This opens the Surface Water Overland Flow Options menu.
   b. Check the box next to 'Overland Flow' to direct IGW-NET to simulate land surface hydrologic processes (runoff, recharge, evapotranspiration, etc.)
   c. Assign Land Use and Cover from a raster data layer available from the MAGNET4WATER Data Center
   d. Change to the Climate tab and assign Rainfall data input from the MAGNET4WATER Data Center
      i. Make sure the box next to 'Rainfall' is checked and select From Rain Gauges sub option, then click 'Edit/Load from file
      ii. The Load Time Series Data interface will appear; make sure 'From Data Center' is selected and click 'OK'
   e. Still within the Climate tab, check the box next to 'Temperature' and assign input minimum and maximum temperatures from the MAGNET4WATER Data Center (similar to process for rainfall data).
   f. Change to the Soil Type tab. Make sure the box next to 'Soil Type' is checked and select 'Raster and 'From Data Center' sub option, then click 'Lookup Table'.
      i. In the Lookup Table interface that appears, change all values in the 'CtaO' column to -1.0. This indicates to IGW-NET that the initial soil moisture contents for each soil type will be pulled from an initial soil moisture file (see below).
   g. Change to the Root Zone Depth tab. Make sure the box next to 'Root Zone depth' is checked. Then select the 'Raster' option and 'From Data Center' sub option.
   h. Change to the Evaporation tab. Make sure the box next to 'EVT' depth is checked. Then select the Priestley-Taylor Equation' option for estimating evapotranspiration. Use the default values for adjustment factors.
   i. Change to the Snow Pack tab. Make sure the box next to 'Snowpack' is checked. Use all default values.


Flow Property
Elevation
Transport Property
Biochemical
Sources and Sinks Head Dependent
Sources and Sinks Prescribed
Copy This Zone
Delete This Zone
Flow properties
Hydraulic Conductivity
Conductivity
Constant 22.86 m/day Calib
Scattered Points
Borehole Simulation
Kxx/Kyy: 1
Kxx/Kzz: 10 Calib
Random Edit
Seed: 318303
LabmdaX: 20 m
LabmdaY: 20 m
Variance: 0.1 m/day sq
Storage
Specific Yield
Specific Storage
Constant 0.1
Scattered Points
Constant 0.00001 1/m Calib
Scattered Points
Porosity
Effective Porosity
Constant 0.3 Random
Scattered Points
Zone Types
Zone Name: GMPolygon_0
DataName: DMZone
Zone Type: Inactive Active PolygonOnly
Zone Budget
Submodel Domain
Zone Boundary Included
Overland Flow ...
Save
Cancel

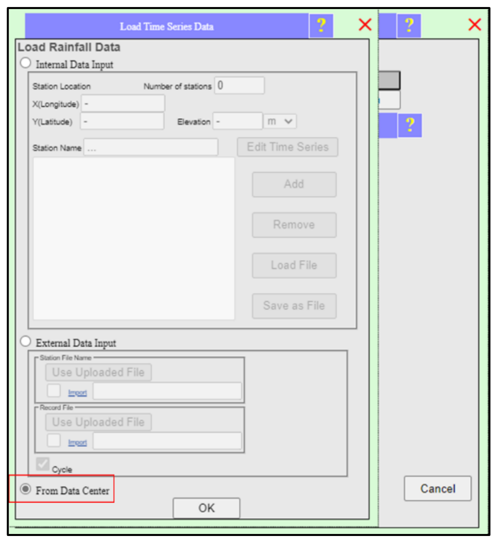
-->


Surface Water Overland Flow Options
Overland Flow
Land Use and Cover
Soil Type
Climate
Snow Pack
Evaporation
Root Zone Depth
Overland Flow Options
Land Use and Cover
Constant
Manning 0.15
StorDepth 0 m
Canopy Cover (%) 50
Canopy Intercept 0.001 m
Vegetation root density (%)
Lyr1 40 Lyr2 30 Lyr3 20
Lyr4 10 Lyr5 0 Lyr6 0
Transpiration
coef.1 -5
coef.2 1.5
Root Depth
Lyr1 0.1 m Lyr2 0.3 m Lyr3 0.7 m
Lyr4 1 m Lyr5 0 m Lyr6 0 m
Raster
From Data Center
Lookup Table
At Node
Import
Use Uploaded File
Import
Ks for developed zones (applied only if it is smaller than Ks in soil type table).
Open 5 m Low 0.5 m
Medium 0.1 m High 0.05 m
OK
Cancel

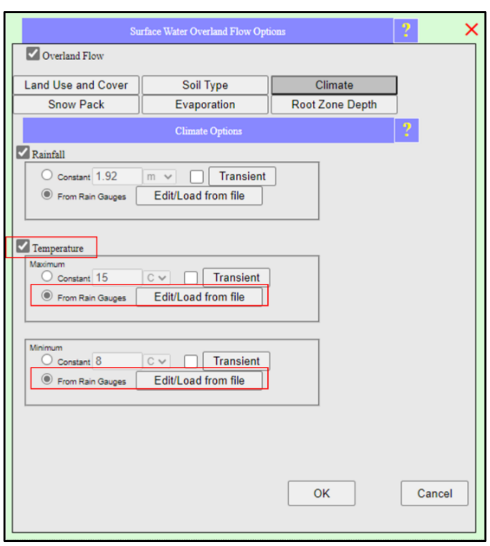
-->


Surface Water Overland Flow Options
Overland Flow
Land Use and Cover
Soil Type
Climate
Snow Pack
Evaporation
Root Zone Depth
Climate Options
Rainfall
Constant 1.92 m
Transient
From Rain Gauges
Edit/Load from file
Temperature
Maximum
Constant 15 C
Transient
From Rain Gauges
Edit/Load from file
Minimum
Constant 8 C
Transient
From Rain Gauges
Edit/Load from file
OK
Cancel

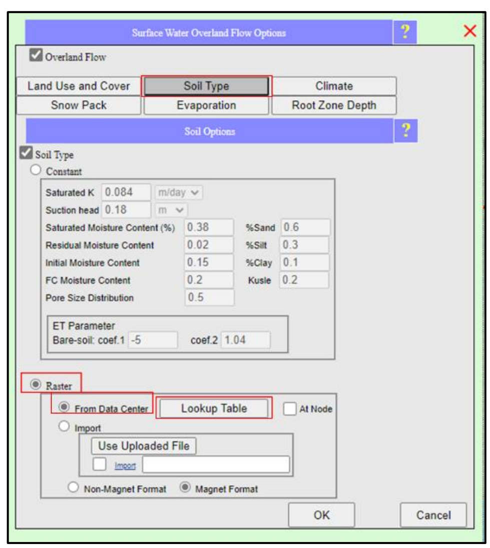
-->


Load Time Series Data
Load Rainfall Data
Internal Data Input
Station Location
Number of stations 0
X(Longitude) -
Y(Latitude) -
Elevation - m
Station Name ...
Edit Time Series
Add
Remove
Load File
Save as File
External Data Input
Station File Name
Use Uploaded File
Import
Record File
Use Uploaded File
Import
Cycle
From Data Center
OK
Cancel

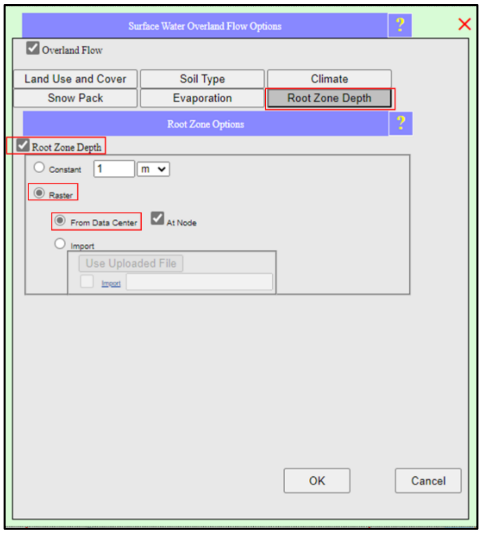
-->


Surface Water Overland Flow Options
Overland Flow
Land Use and Cover
Soil Type
Climate
Snow Pack
Evaporation
Root Zone Depth
Climate Options
Rainfall
Constant 1.92 m
Transient
From Rain Gauges
Edit/Load from file
Temperature
Maximum
Constant 15 C
Transient
From Rain Gauges
Edit/Load from file
Minimum
Constant 8 C
Transient
From Rain Gauges
Edit/Load from file
OK
Cancel

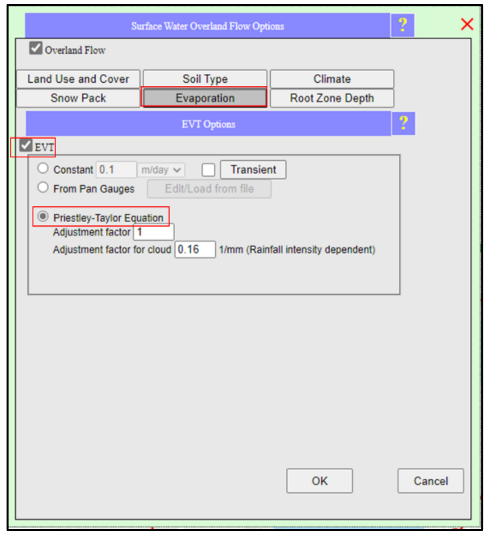
-->


Surface Water Overland Flow Options
Overland Flow
Land Use and Cover
Soil Type
Climate
Snow Pack
Evaporation
Root Zone Depth
Soil Options
Soil Type
Constant
Saturated K 0.084 m/day
Suction head 0.18 m
Saturated Moisture Content (%) 0.38
%Sand 0.6
Residual Moisture Content 0.02
%Silt 0.3
Initial Moisture Content 0.15
%Clay 0.1
FC Moisture Content 0.2
Kusle 0.2
Pore Size Distribution 0.5
ET Parameter
Bare-soil: coef.1 -5 coef.2 1.04
Raster
From Data Center
Lookup Table
At Node
Import
Use Uploaded File
Import
Non-Magnet Format
Magnet Format
OK
Cancel

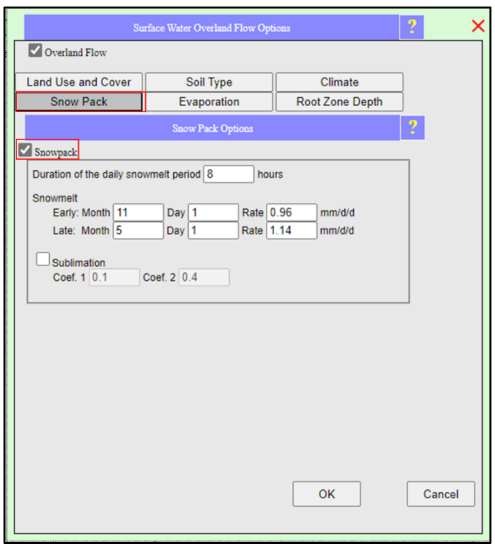
-->




-->




-->



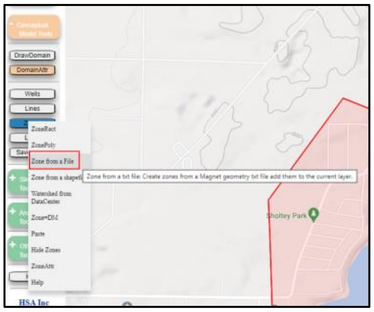
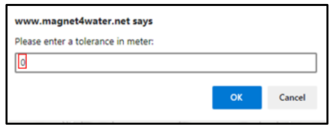

**9.** Load the lake polygon using the provided text file: BarronLake.txt:

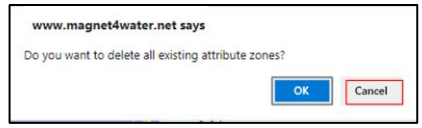
a. You will see a few prompts after browsing to and selecting the text file.

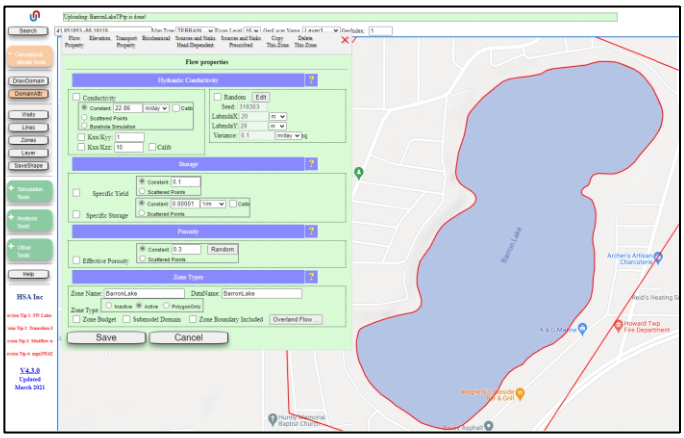
i. One will ask you to enter a tolerance (for polygon smoothing purposes). Make sure to change the tolerance to 0 before clicking ‘OK’. (No smoothing applied)

ii. The other will ask if you want to delete all existing attribute zones. Make sure to select ‘Cancel’.

b. After completing the prompts the lake polygon (zone) will be added to the map display and its Zone Attributes interface will open.


-->


-->



-->


## 10. Parameterize the lake zone

a. In the Zone Attributes interface, change to the Source and Sinks Head Dependent tab.

b. Check the box next to 'Two-way Head Dependent'. Assign an initial lake level and leakance

   i. Select the 'Const' sub option and enter a value of 230.0259392m. This is the initial lake level for coupled groundwater-lake modeling.

   ii. Enter a value of 0.1 $day^{-1}$ for lake leakance

c. Enter -999999 in the text field next to 'River Bed'. This tells IGW-NET a bathymetry (water depth) file is being used for computing lakebed elevations, with the DEM used as the reference elevation.

d. Select 'IsBathymetry' option and then check the box next to 'Import' and click the link. Browse to and select the bathymetry text file: WaterDepth.txt

e. Check the box next to the 'From coupled SW/GW modeling' button under Stage. This tells IGW-NET that stage will be computed as part of the groundwater-lake coupled modeling process.

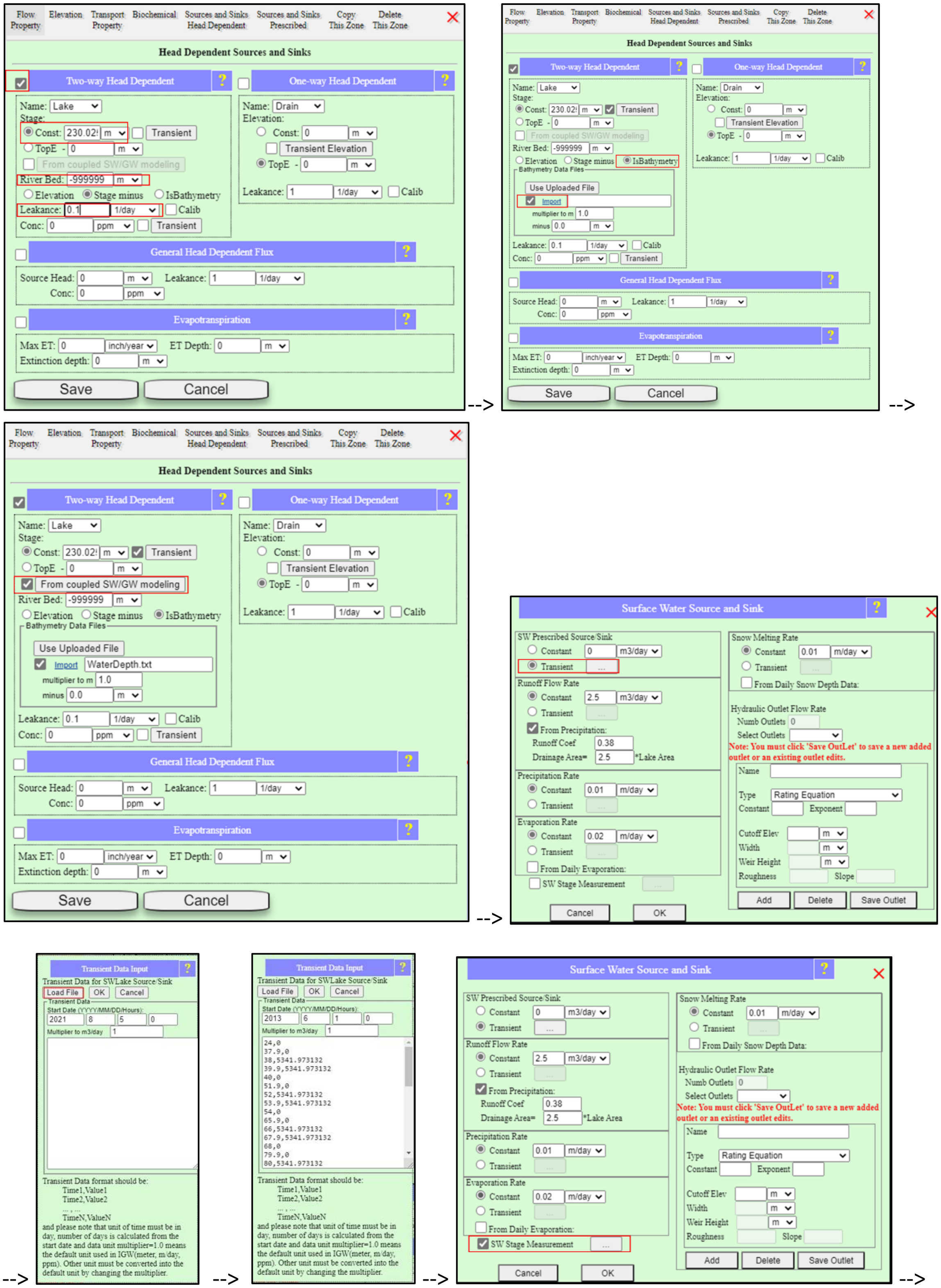
f. Click the ' From coupled…' button to open the Surface Water Source and Sink interface.

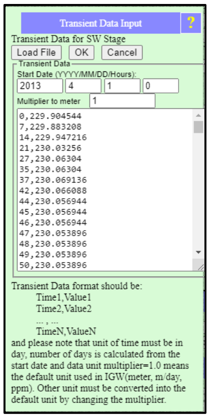
   i. Under 'SW Prescribed Source/Sink', select the 'Transient' option and click on the '…' additional options button. This opens the Transient Data Input interface.

   ii. Click 'Load File' and browse to and select the provided csv file: Qsw.csv. This loads transient pumping rate data for the water from the lake augmentation well that becomes direct input into lake. Click 'OK' to save the changes.

g. Check the box next to 'SW Stage Measurement' and click the '…' additional options button. This again opens the Transient Data Input interface. This time, browse to and select the csv file: LakeLevel2013.csv. Click 'OK' to save the changes.

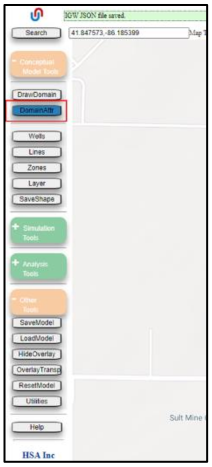
h. Use all other default settings /values in the Surface Water Source and Sink menu. Click 'OK' to save the changes.


Flow Property
Elevation
Transport Property
Biochemical
Sources and Sinks Head Dependent
Sources and Sinks Prescribed
Copy This Zone
Delete This Zone
Head Dependent Sources and Sinks
Two-way Head Dependent
One-way Head Dependent
Name: Lake
Stage:
Const: 230.02
Transient
TopE
From coupled SW/GW modeling
River Bed: -999999
Elevation
Stage minus
IsBathymetry
Bathymetry Data Files
Use Uploaded File
Import
WaterDepth.txt
multiplier to m 1.0
minus 0.0
Leakance: 0.1 1/day
Calib
Conc: 0 ppm
Name: Drain
Elevation:
Transient Elevation
General Head Dependent Flux
Source Head: 0
Evapotranspiration
Max ET: 0 inch/year
ET Depth: 0
Extinction depth: 0
Save
Cancel
Surface Water Source and Sink
SW Prescribed Source/Sink
Constant
Transient
Runoff Flow Rate
From Precipitation:
Runoff Coef 0.38
Drainage Area= 2.5 *Lake Area
Precipitation Rate
Evaporation Rate
From Daily Evaporation:
SW Stage Measurement
Snow Melting Rate
From Daily Snow Depth Data:
Hydraulic Outlet Flow Rate
Numb Outlets 0
Select Outlets
Note: You must click 'Save OutLet' to save a new added outlet or an existing outlet edits.
Name
Type Rating Equation
Constant
Exponent
Cutoff Elev
Width
Weir Height
Roughness
Slope
Add
Delete
Save Outlet
Cancel
OK
Transient Data Input
Transient Data for SWLake Source/Sink
Load File
Transient Data
Start Date (YYYY/MM/DD/Hours):
Multiplier to m3/day 1
Transient Data format should be:
Time1,Value1
Time2,Value2
TimeN,ValueN
and please note that unit of time must be in day, number of days is calculated from the start date and data unit multiplier=1.0 means the default unit used in IGW(meter, m/day, ppm). Other unit must be converted into the default unit by changing the multiplier.
-->

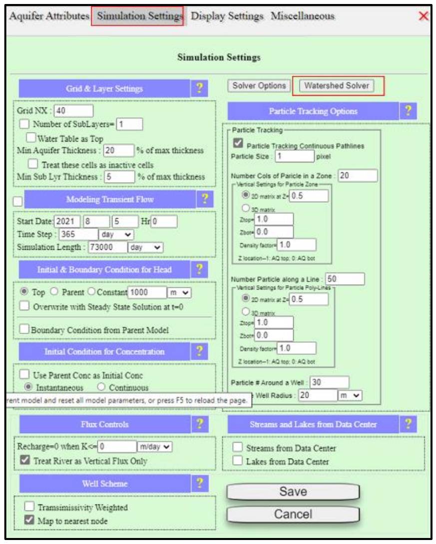



**<u>11.</u>** Set up watershed / overland flow solver for recharge and runoff modeling.

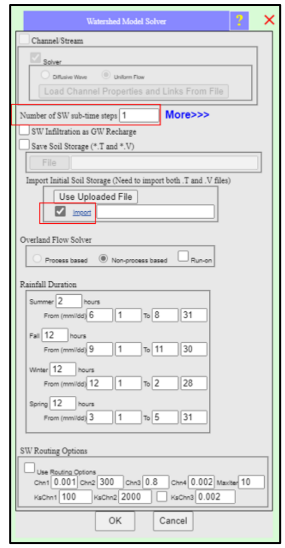
a. Open up the Domain Attributes interface
b. Change to the Simulation Settings tab and click the ‘Watershed Solver’ button.
c. Change the number of SW sub-time steps to 1 (i.e., one surface water time step for every groundwater time step)
d. Under ‘Import Initial Soil Storage’, check the box next to ‘Import’ and click on the link. Browse to and elect the provided file: Cta0000.T. When the file is done uploading, click on the link again and browse to and select: Cta0000.V.
e. Check the box next to ‘SW Infiltration as GW Recharge’
f. Use the default overland flow solver: non-processed based



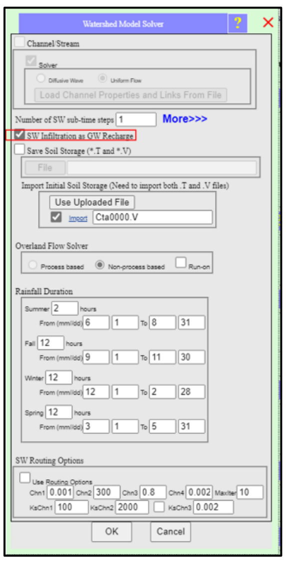

-->




-->




-->




**12.** Add the augmentation well to the groundwater model.

a. Draw a well anywhere on the map: Conceptual Model Tools > Wells > DrawWell …then clicking on the map places the well and launches the Well Input Options menu

b. Enter the correct coordinates for the well:

   i. Latitude = 41.8479458145246

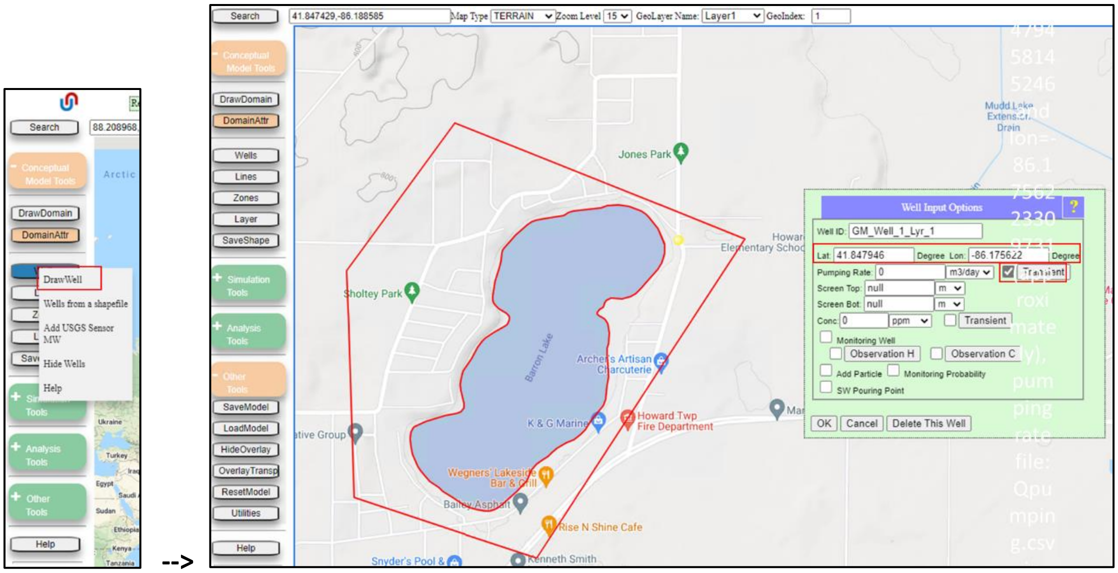
   ii. Longitude =-86.1756223309731

c. Next upload the time-varying pumping rate file:

   i. Check box next to 'Transient' and click the button

   ii. Click 'Load File' and browse to and select the provided csv file: Qpumping.csv. This loads transient pumping rate data for the lake augmentation well (water taken from the aquifer).

   iii. Click 'OK' to save the changes. Click 'OK' once more to close the Well Input Options menu. Note the updated position of the augmentation well in the map display.

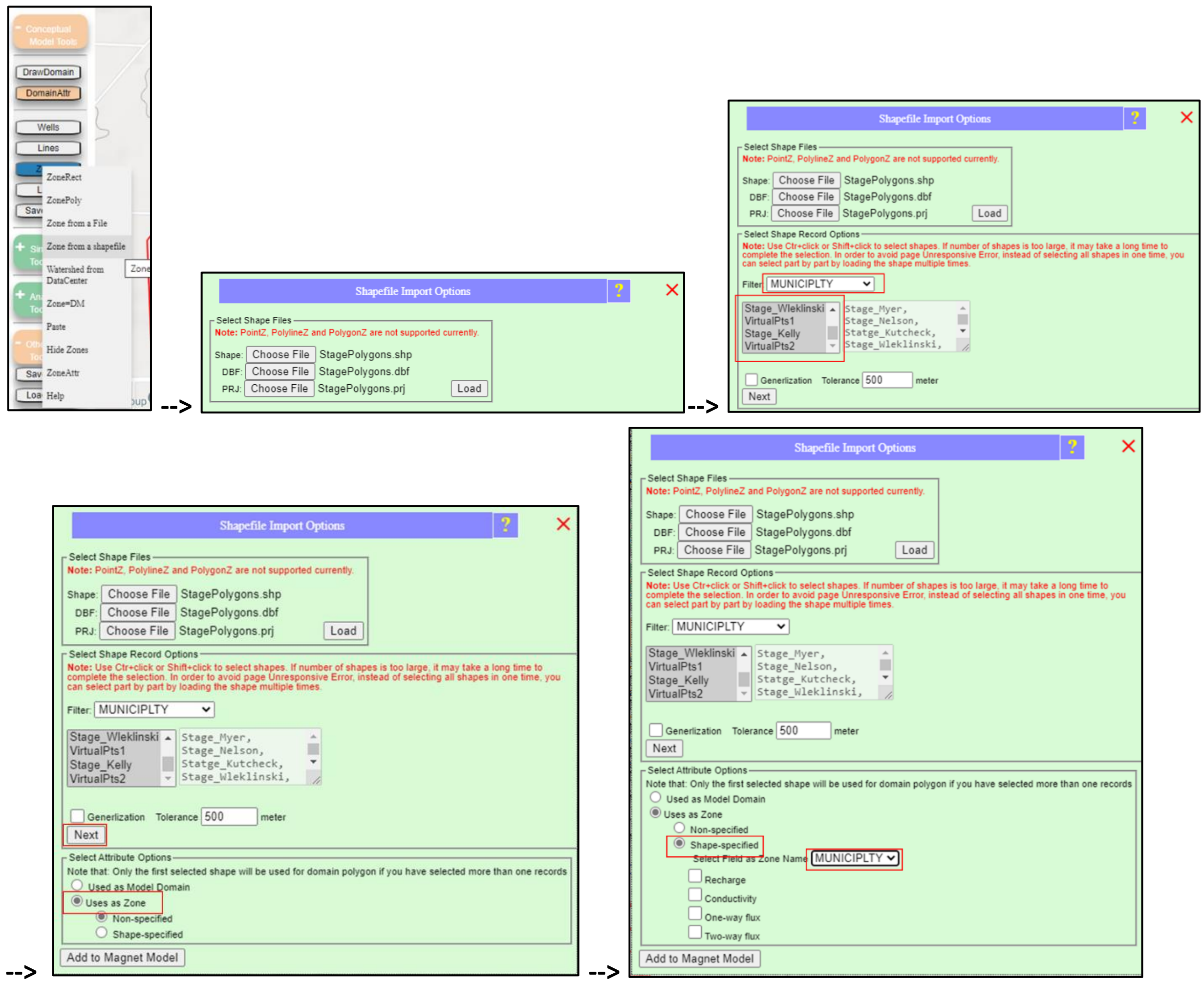


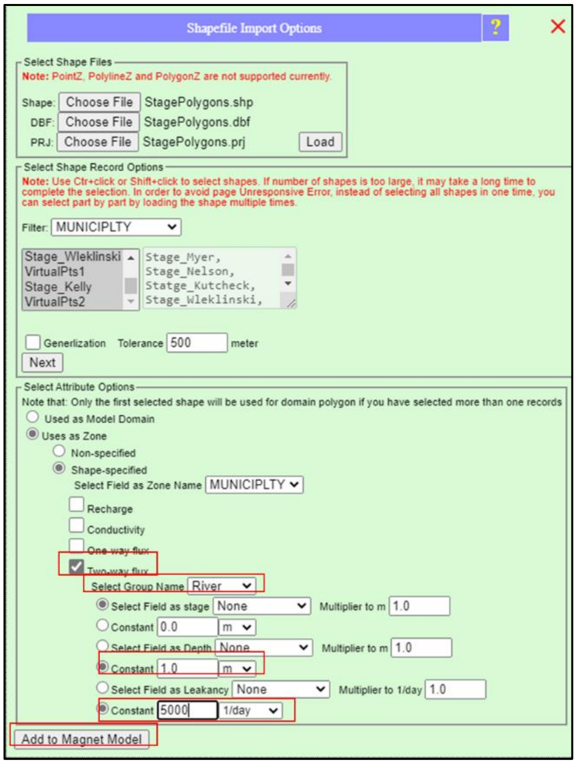

**13.** Create transient boundary conditions for the groundwater flow model.

- Time-varying boundary conditions are based on regional flow patterns (not shown here) and water level records from private water wells, and are modeled as transient "rivers" with a very high leakance (i.e., these zones mimic time-varying prescribed head boundary conditions but are conceptualized as two-way head-dependent source/sink zones).
  a. First load the zones into the map display:
     i. Conceptual Model Tools--> Zones-->Zone from a shapefile. This open the Shapefile Import Options Interface
     ii. Use the 'Choose File' buttons to upload: StagePolygons.shp, StagePolygons.dbf, and StagePolygons.prj
     iii. Select 'MUNICIPLTY' filter and select all entries in the corresponding text field. Then click 'Next'
     iv. Under 'Select Attributes Options', choose 'Used as Zone'. More sub options will appear.
     v. Choose 'Shape-specified' and again select 'MUNICIPLTY' from the drop-down menu. This tells IGW-NET to give a name to each zone based on its MUNICIPLTY entry.
     vi. Check the Two-way flux option. Use 'River' as group name to differentiate mass balance bar names in mass balance chart. Select constant water depth=1 meter and assign a constant Leakance=5000 day$^{-1}$
     vii. Click 'Add to MAGNET4WATER Model to finish the process
  b. Add time-varying "stage" data to a zone.
     i. Select a zone for editing: Click Other Tools > Utilities > Geometry unlock, then click inside of the zone for editing. A prompt will tell you which Zone you selected (based on 'MUNICIPLTY' name)
     ii. Navigate to the 'Source and Sinks Head Dependent Tab' and make sure the box next to 'Two way Head Dependent' is checked
     iii. Choose the 'Const' option, and check the box next to 'Transient' and click the button
     iv. Click 'Load File' and browse to and select the appropriate Stage csv file e.g., StageMyer.csv, StageKelly.csv, etc. This loads transient water level ("Stage") data for the zone feature.
     v. Copy the initial water level, XXXXX (0,XXXXX in data table).

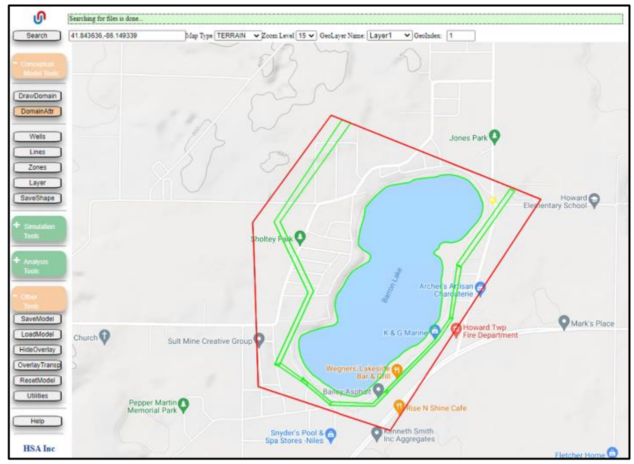
vi. Click ‘OK’ to save the changes. Then paste the initial water level into the text field next to ‘Const’. This assigns the pasted value as the initial value for transient simulation. Click ‘Save’ to finish.

c. Repeat step 13b until stage data have been added to all “boundary condition” zones.




Shapefile Import Options
Select Shape Files
Note: PointZ, PolylineZ and PolygonZ are not supported currently.
Shape: Choose File StagePolygons.shp
DBF: Choose File StagePolygons.dbf
PRJ: Choose File StagePolygons.prj
Load
Select Shape Record Options
Note: Use Ctr+click or Shift+click to select shapes. If number of shapes is too large, it may take a long time to complete the selection. In order to avoid page Unresponsive Error, instead of selecting all shapes in one time, you can select part by part by loading the shape multiple times.
Filter: MUNICIPLTY
Stage_Wleklinski
VirtualPts1
Stage_Kelly
VirtualPts2
Stage_Myer,
Stage_Nelson,
Statge_Kutcheck,
Stage_Wleklinski,
Generlization Tolerance 500 meter
Next
Select Attribute Options
Note that: Only the first selected shape will be used for domain polygon if you have selected more than one records
Used as Model Domain
Uses as Zone
Non-specified
Shape-specified
Select Field as Zone Name MUNICIPLTY
Recharge
Conductivity
One-way flux
Two-way flux
Select Group Name River
Select Field as stage None Multiplier to m 1.0
Constant 0.0 m
Select Field as Depth None Multiplier to m 1.0
Constant 1.0 m
Select Field as Leakancy None Multiplier to 1/day 1.0
Constant 5000 1/day
Add to Magnet Model

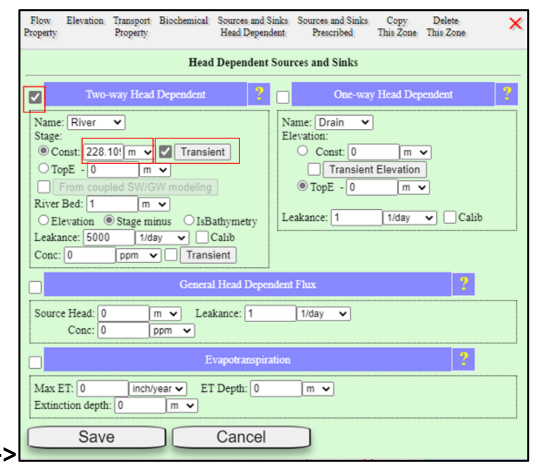
-->


Searching for files is done...
Search
41.843636,-86.149339
Map Type TERRAIN
Zoom Level 15
GeoLayer Name: Layer1
GeoIndex: 1
DrawDomain
DomainAttr
Wells
Lines
Zones
Layer
SaveShape
SaveModel
LoadModel
HideOverlay
OverlayTransp
ResetModel
Utilities
Help
HSA Inc
Jones Park
Howard Elementary School
Shoftey Park
Archer's Artisan Charcuterie
K & G Marine
Howard Twp Fire Department
Mark's Place
Church
Sult Mine Creative Group
Wegners Lakeside Bar & Grill
Bailey Asphalt
Rise N Shine Cafe
Pepper Martin Memorial Park
Snyder's Pool & Spa Stores -Niles
Kenneth Smith Inc Aggregates
Fletcher Home

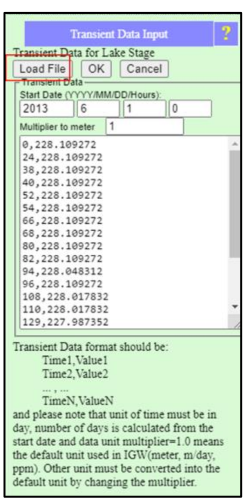
-->


Flow properties
Hydraulic Conductivity
Storage
Porosity
Zone Types
Save
Cancel
HSA Inc

-->


Flow Property
Elevation
Transport Property
Biochemical
Sources and Sinks Head Dependent
Sources and Sinks Prescribed
Copy This Zone
Delete This Zone
Head Dependent Sources and Sinks
Two-way Head Dependent
One-way Head Dependent
Name: River
Stage:
Const: 228.10 m
Transient
TopE - 0 m
From coupled SW/GW modeling
River Bed: 1 m
Elevation
Stage minus
IsBathymetry
Leakance: 5000 1/day
Calib
Conc: 0 ppm
Transient
Name: Drain
Elevation:
Const: 0 m
Transient Elevation
TopE - 0 m
Leakance: 1 1/day
Calib
General Head Dependent Flux
Source Head: 0 m
Leakance: 1 1/day
Conc: 0 ppm
Evapotranspiration
Max ET: 0 inch/year
ET Depth: 0 m
Extinction depth: 0 m
Save
Cancel

-->


Transient Data Input
Transient Data for Lake Stage
Load File
OK
Cancel
Transient Data
Start Date (YYYY/MM/DD/Hours):
2013 6 1 0
Multiplier to meter 1
0,228.109272
24,228.109272
38,228.109272
40,228.109272
52,228.109272
54,228.109272
66,228.109272
68,228.109272
80,228.109272
82,228.109272
94,228.048312
96,228.109272
108,228.017832
110,228.017832
129,227.987352
Transient Data format should be:
Time1,Value1
Time2,Value2
.... , ....
TimeN,ValueN
and please note that unit of time must be in day, number of days is calculated from the start date and data unit multiplier=1.0 means the default unit used in IGW(meter, m/day, ppm). Other unit must be converted into the default unit by changing the multiplier.

**14.** Create transient boundary conditions for the groundwater flow model.

a. Open the Domain Attributes interface and go to the ‘Simulation Settings’ tab.

b. Under ‘Grid & Layer Settings’, assign 80 grid cells in the X- (west-east) direction (NX=80) and 5 layers in the vertical direction (‘Number of SubLayers=5 and box checked).

c. Check the box next to ‘Modeling Transient Flow’ and enter the following time settings:

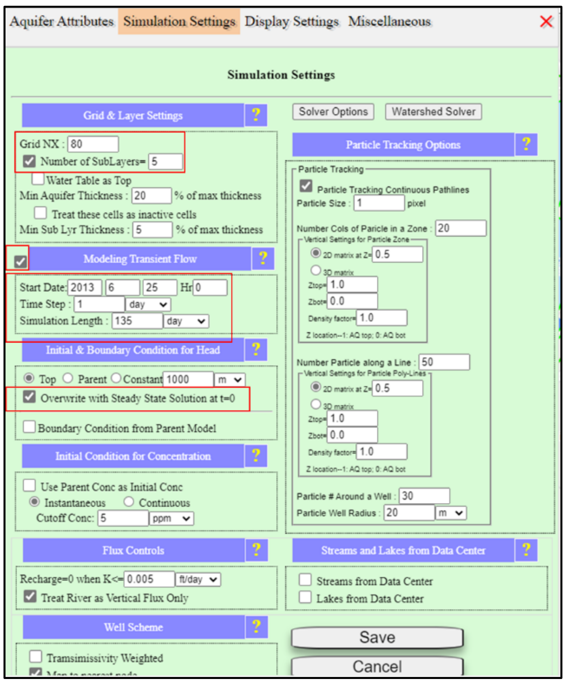
   i. Start date: 6/25/2013

   ii. Time step: 1 day

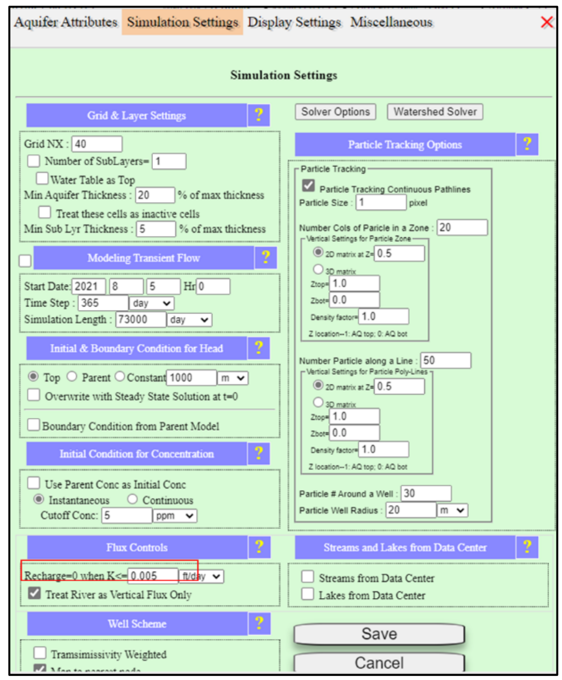
   iii. Simulation Length: 135 days

d. Check the box next to ‘Overwrite with Steady State Solution at t=0’. IGW-NET will first solve the steady state problem and use the results as the initial condition for transient simulation.

e. Change the “threshold” for recharge: ‘Recharge=0 when K<=’ 0.005 ft/day




-->




**15.** Run the simulation and view the results

a. Go to: Simulation Tools > ‘SIMULATE’

   i. Accept the suggested projection system for the model (click ‘OK’).

   ii. Follow the Status Bar (green text field at top of application) as the modeling steps are completed. Once the first time-step (1 day) is solved, the head contours and velocity vectors will appear in the model in the map display.

b. Open the charts for model analysis: ‘Analysis Tools’ > ‘Analysis’ > ‘Display Charts’. This launches the full set of charts for groundwater and surface water (lake) analysis.

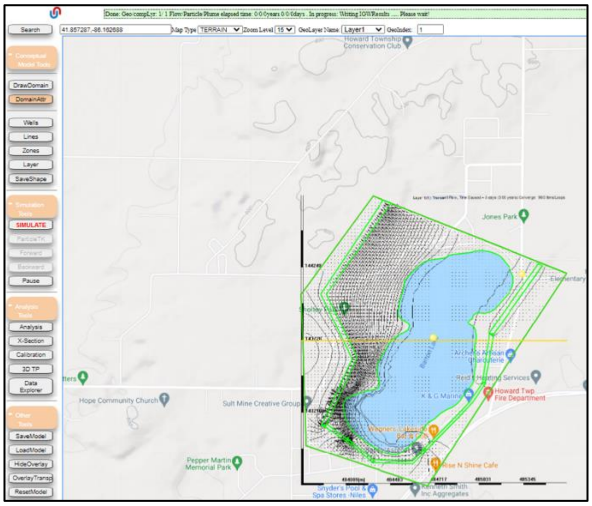
   i. Clean up the display (rearrange charts in the map display)

   ii. Click the ‘>>’ options button in the ‘Cross Section Diagram’ and check the boxes next to ‘Conductivity ($K_{zz}$)’ and ‘Big Plot’. Then click ‘Redraw’

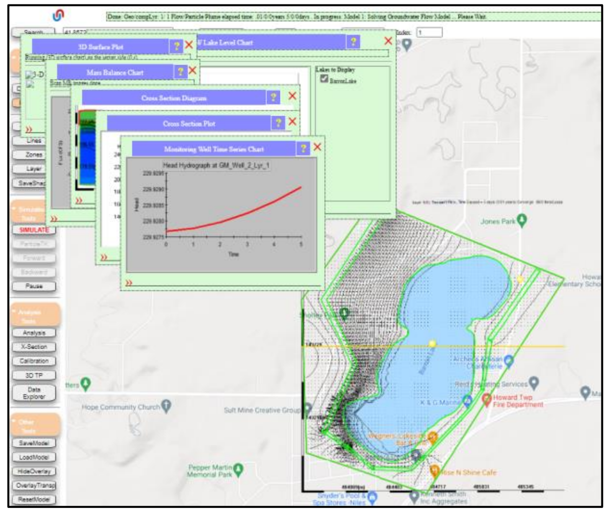
   iii. The Cross Section Diagram will update after a few moments. The colors indicate vertical conductivity (red=high; blue=low).

c. In the ‘SW Lake Chart’, again click the ‘>>’ button and then check the boxes next to ‘Show Obs Data’ and ‘Lake Budget’. Clicking ‘Redraw’ will add lake level data imported in step 10g to the SW Lake Chart and launch the ‘SW Lake Budget Chart: Barron Lake’

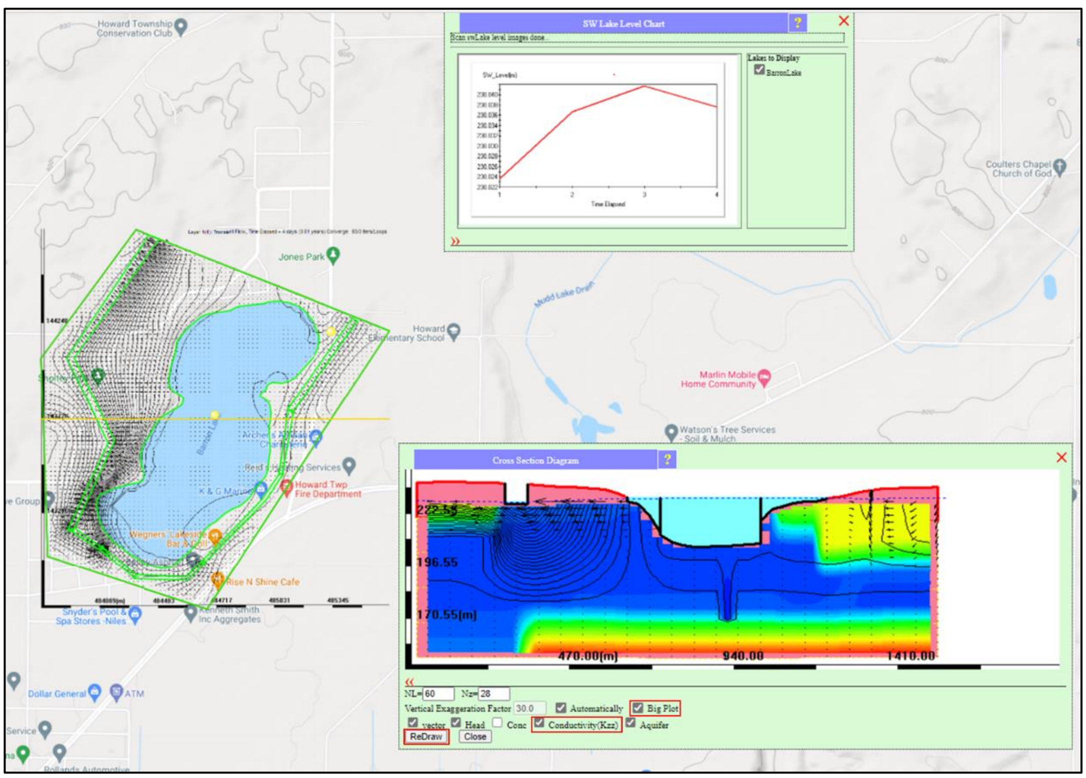
d. Observe the time-varying results in realtime, as the simulation proceeds. When the simulation is finished, you will see the prompt “Flow max simulation time reached at 135 days”. Note the good agreement between simulated and observed lake levels.

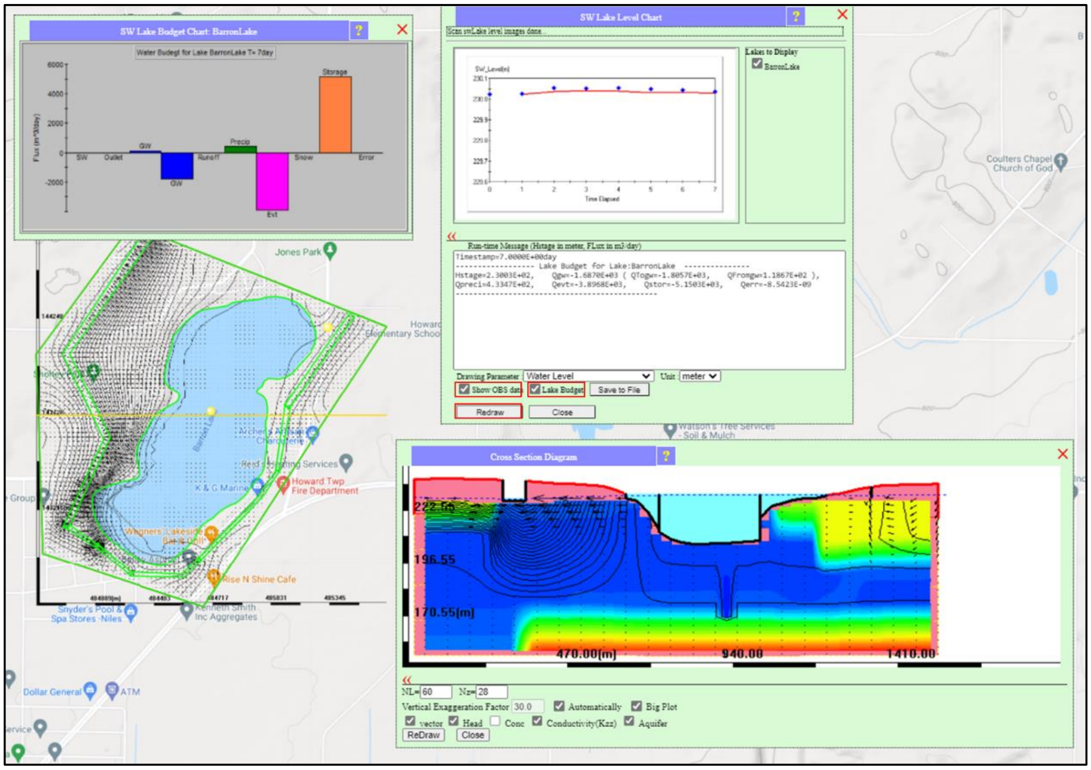


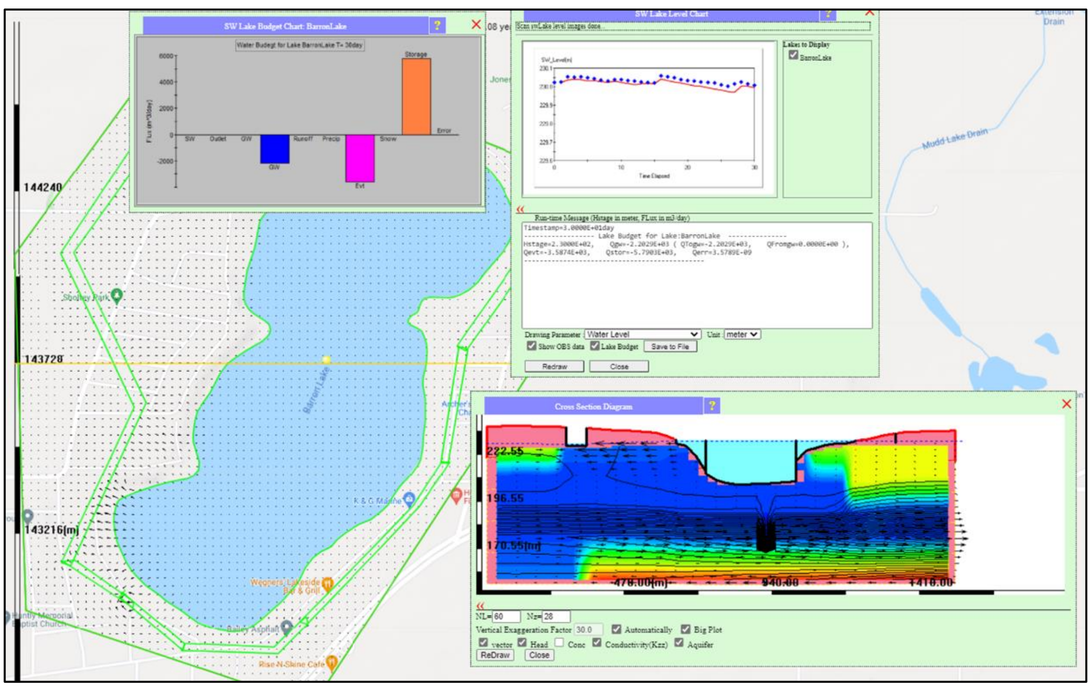
-->

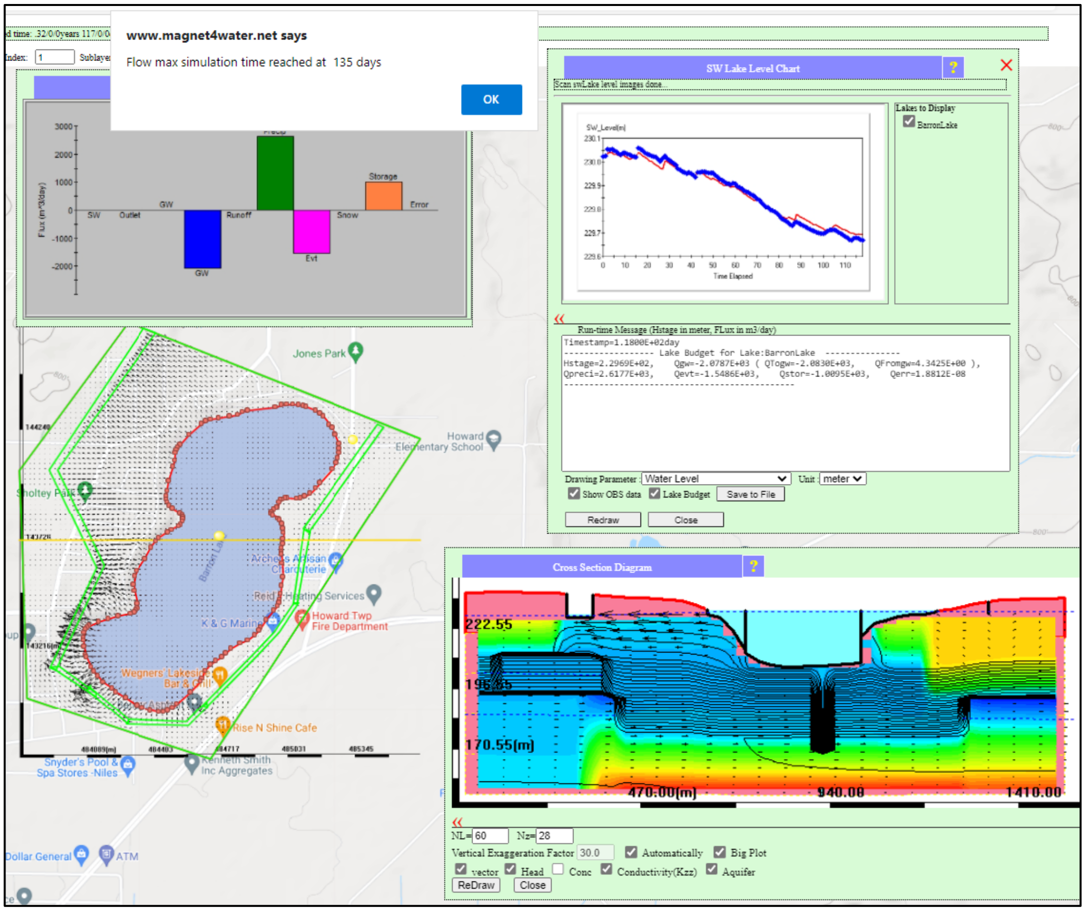


-->



--> 
SW Lake Budget Chart: BarronLake
Water Budget for Lake BarronLake T= 7day
SW Lake Level Chart
Lakes to Display
BarronLake
Drawing Parameter
Water Level
Show OBS data
Lake Budget
Save to File
Redraw
Close
Cross Section Diagram
222.55
196.55
170.55[m]
470.00[m]
940.00
1410.00
Vertical Exaggeration Factor
30.0
Automatically
Big Plot
vector
Head
Conc
Conductivity(Kzz)
Aquifer
ReDraw
Jones Park
Coulters Chapel Church of God
Howard Twp Fire Department
Rise N Shine Cafe
Dollar General
ATM

--> 
SW Lake Budget Chart: BarronLake
SW Lake Level Chart
Lakes to Display
BarronLake
144240
143728
143216[m]
Mudd Lake Drain
Cross Section Diagram
222.55
196.55
170.55[m]
470.00[m]
940.00
1410.00
Vertical Exaggeration Factor
30.0
Automatically
Big Plot
vector
Head
Conc
Conductivity(Kzz)
Aquifer
ReDraw
Close
Rise-N-Shine Cafe

--> 

www.magnet4water.net says
Flow max simulation time reached at 135 days
OK
SW Lake Level Chart
Lakes to Display
BarronLake
Run-time Message (Hstage in meter, FLux in m3/day)
Timestamp=1.1800E+02day
Lake Budget for Lake:BarronLake
Hstage=2.2969E+02, Qgw=-2.0787E+03 ( QTogw=-2.0830E+03, QFromgw=4.3425E+00 ),
Qpreci=2.6177E+03, Qevt=-1.5486E+03, Qstor=-1.0095E+03, Qerr=1.8812E-08
Drawing Parameter Water Level
Unit meter
Show OBS data
Lake Budget
Save to File
Redraw
Close
Cross Section Diagram
222.55
196.55
170.55(m)
470.00(m)
940.00
1410.00
NL= 60
Nz= 28
Vertical Exaggeration Factor 30.0
Automatically
Big Plot
vector
Head
Conc
Conductivity(Kzz)
Aquifer
ReDraw
Close
Jones Park
Howard Elementary School
Howard Twp Fire Department
Rise N Shine Cafe