

Quick Users Guide to the NFSEG Automated Water-Use Permit Simulation Tool: Step-by-Step Procedures

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Please report any errors to Paul Bremner (pbremner@sjrwmd.com) or Lanie Meridith (imeridith@sjrwmd.com) at the St Johns River Water Management District, Douglas Durden (Douglas.Durden@srwmd.org) at the Suwannee River Water Management.

Software Requirements:

ArcGIS Desktop, version 10.0 or later, installed on your local machine (or a computer that you connect with remotely that has ArcGIS installed on it).

Overview of Steps:

Note to the User: If this is the first time running the tool or an update, please read the more detailed instructions (below) first.

1. Navigate to the top-level tool directory
2. Create a formatted User input csv file. Name is flexible, but no spaces are allowed in the name. The "user_input_files" folder is provided with example input files and is the recommended location for new input files.
3. Double-click on the batch file "sim_cup_initiate.bat" to open the tool console
4. Fill-in the User input filename, select whether to replace an existing results directory which possesses the same name as the User input file, and select a projection as prompted
5. Monitor the output in the console to ensure no errors occur, process takes about 10-20 minutes for each well depending on the size of withdrawal/injection.

6. A completion message appears at the end of a run. The console pauses to allow inspection of the output. If no errors occurred (signified by an error statement on the console) then the User has the option to either enter another User input file to run, or type **exit** to close the console. There is no limit to the number of times new input files may be processed before exiting the console. Each run is processed in its own results directory with its own logfile.
7. Each successful run generates a results directory containing an mxd map of the change in head water levels, two output csv files, and the logfile.

NOTE: Before clicking on the batch file to start the tool, close all related Excel and ArcMap files that are used to setup the Permitting Tool. Any open files could cause program errors. Also, it is sometimes necessary to save Excel csv files in MSDOS csv format.

NOTE: This tool is setup to run the NFSEG v1.1 groundwater model. Using a different model will cause unpredictable errors.

NOTE: The Suwannee River Water Management District (SRWMD) and St Johns River Water Management District (SJRWMD) utilize two different map projections in GIS. X,Y coordinates must correspond to the correct projection. Input the selection when prompted at the command line.

1 = SRWMD is used for State Plane North

2 = SJRWMD is used for UTM Zone 17N meters

Detailed Instructions:

[Initial Setup / Installation of the Tool](#)

NOTE: This process only needs to be done once per tool update.

NOTE: This tool uses the Python that is bundled with ArcMap 10.0 or newer. The tool automatically searches for the location of this Python. If that is unsuccessful, then ERRORS will occur. Ensure that ArcMap's Python is able to be found before running the tool (see steps below).

1. Navigate to the Tool's GitHub repository (https://github.sjrwmd.com/pbremner/nfseg_auto_cup_tool) and download the zip file. After the download is complete, unzip the tool to a directory on the local machine's hard drive. The tool unzips into its own directory, referred to as the *top-level tool directory*. The portion of the default Windows PATH when unzipping is usually not necessary. Unzip the tool and enter the top-level tool directory.
NOTE: Microsoft Edge or Firefox are the preferred browsers to use to access the District's GitHub webpage. You may receive a security warning when visiting the

page, please proceed to the webpage. If you are using Microsoft Edge, click 'Details' and 'Go on to webpage' to visit the webpage.

pbremner / nfseg_auto_cup_tool

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This repository hosts the District's Regulatory automated tool to calculate changes in groundwater availability and other drawdown effects due to well additions or deletions (cup - consumptive use permit) within the NFSEG groundwater model.

61 commits 6 branches 0 releases 1 contributor

Branch: master New pull request Create new file Upload files Find File Clone or download

Clone with HTTPS Use SSH

Use Git or checkout with SVN using the web URL.

https://github.sjrwmd.com/pbremner/nfseg

Open in Desktop Download ZIP

Paul Bremner Updated SR input file and further cleaned cup.gdb

| | | |
|----------------------------|---|--------------|
| docs | Organized the docs folder | |
| gis | Updated SR input file and further cleaned cup.gdb | |
| input_and_definition_files | Removed unused | |
| misc | Initial commit. Added all tracked files | |
| src | Removed unused | 19 hours ago |
| user_input_files | Updated SR input file and further cleaned cup.gdb | 16 hours ago |
| .gitignore | Updated SR input file and further cleaned cup.gdb | 16 hours ago |

2. Check that the top-level tool directory includes (at a minimum) the following:
 - docs (folder) containing this Quick Users Guide
 - gis (folder)
 - input_and_definition_files (folder)
 - model_update.zip (zip file)
 - src (folder)
 - user_input_files (folder)
 - sim_cup_initiate.bat
 - setup.bat
3. Setup the tool for use by double-clicking the *setup.bat* script in the top-level directory. A message may appear warning you about running the script. Click the **Run-Anyway** option (sometimes this option only appears after clicking **More**). The setup script does the following:
 - a. Search for the Python bundled with ArcGIS.
 - b. Automatically generate a file called *PY_PATH_autogen.txt* to store the PATH. Though the simulation tool does not require the auto-generated file (the tool auto searches for Python when the file is not present), having this file available will decrease the tool runtime significantly. If Python could not be found, then a **Failure** message will appear. If this occurs, or if the version is not the one desired by the User, it will be necessary to manually

- set Python in the tool to resolve the issue. Please contact the tool maintainers for help.
- c. Unzip the model data directory.

How to setup the User Input File

The User input file is a comma-separated-value (.csv) file created in MS Excel, or equivalent, that lists all the wells needing to be processed for a permit. Table 1 shows an example of the Excel file format, and example csv files are also provided in the *user_input_files* folder included in the tool download. The name given to the file is not important, but the name must NOT contain spaces. Instead, use underscores in place of spaces. A descriptive filename of the permit simulation is recommended. The name assigned to the User input file is used to create a new results directory outside of the top-level tool directory. The results directory name appends “_results” to the base User input file name. Within the results directory, two csv files are output summarizing the results of the simulation, both of which will be prepended with the base of the User input filename. A logfile with all output from the console is written to the results directory and named with the base User input filename. An mxd map (dh.mxd) showing the change in head in model layers 1 and 3 from the simulation is output to the results gis folder.

For example, if the input filename is:

“sim_cup_input_example_srwmd.csv”

then the results directory will be named:

“sim_cup_input_example_srwmd_results”

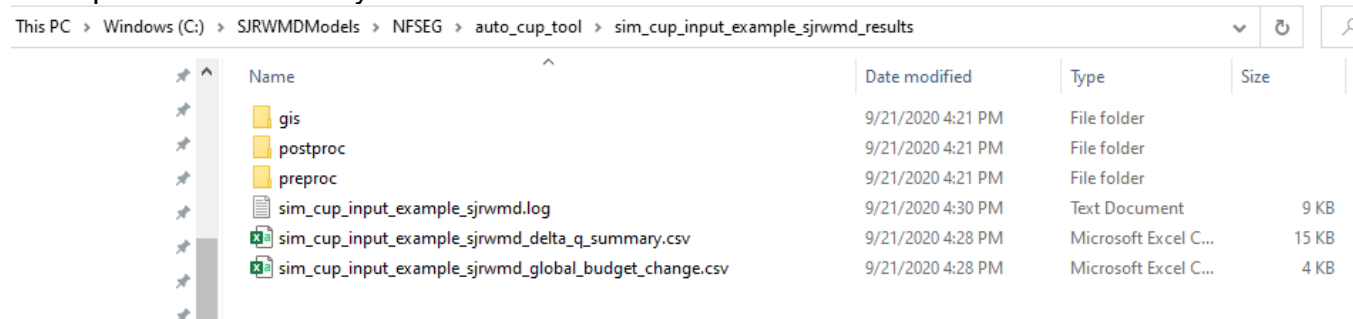
and the two output csv files and log file will be named:

“sim_cup_input_example_srwmd_delta_q_summary.csv”

“sim_cup_input_example_srwmd_global_budget_change.csv”

“sim_cup_input_example_srwmd.log”

Example results directory:



| Name | Date modified | Type | Size |
|--|-------------------|----------------------|-------|
| gis | 9/21/2020 4:21 PM | File folder | |
| postproc | 9/21/2020 4:21 PM | File folder | |
| preproc | 9/21/2020 4:21 PM | File folder | |
| sim_cup_input_example_srwmd.log | 9/21/2020 4:30 PM | Text Document | 9 KB |
| sim_cup_input_example_srwmd_delta_q_summary.csv | 9/21/2020 4:28 PM | Microsoft Excel C... | 15 KB |
| sim_cup_input_example_srwmd_global_budget_change.csv | 9/21/2020 4:28 PM | Microsoft Excel C... | 4 KB |

The Rows of the User input file are as follows:

- Row 1 contains the Permit ID and Name.

- *Row 2* contains a set of header field names describing what information needs to be filled out by the User. The field names **MUST** be in the order and spelling shown in the example.
- *Rows 3+* contain all the need-to-be-processed wells, one well per row.

The Columns of the well data portion (rows 3+) of the User input file are as follows:

- *Col A – WellKey* – an integer counter for each well
- *Col B – WellId* – an identifier for each well
- *Col C/D – Xcoord/Ycoord* – Cartesian coordinate representation of the Lon/Lat well coordinates. For each well, use a GIS program such as ArcMap, to obtain the X,Y coordinates within the NFSEG model.
- *Col E – layer* – model layer the well will interact with
- *Col F – Q_mgd* – amount of water flowing through the well [units = million-gallons-per-day].

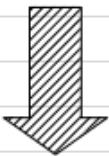
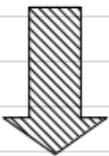
IMPORTANT: The Suwannee River Water Management District (SRWMD) and St Johns River Water Management District (SJRWMD) utilize two different map projections in GIS. Make note of which projection was used in GIS and input the selection when prompted at the command line.

1 = SRWMD is used for State Plane North

2 = SJRWMD is used for UTM Zone 17N meters

NOTE: Use a positive Q_mgd value for withdrawal, and a negative value for injection.

Table 1 User input file example. File should be created in MS Excel, or equivalent, and be saved as a .csv file.

| | A | B | C | D | E | F |
|----|----------------|---|-------------|-------------|-------|--------|
| 1 | 2_345_123456_1 | Testing123 | | | | |
| 2 | WellKey | WellId | XCoord | YCoord | layer | Q_mgd |
| 3 | 987654 | w00160 | 436759.1709 | 3284314.454 | 3 | 1.2345 |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | |  More  | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |

[Running the Water-Use Simulation Permit Simulation](#)

The Automated Water-Use Permit Simulation Tool runs a batch script within a Windows Command Prompt console. In the background, the batch script runs a Python script that controls the processing workflow and manages output. Successive input files may be processed without limit, where each new User input file is able to be entered once the current process is completed. The following are the steps to activate and run the tool:

1. Navigate to the top-level directory of the tool
2. Double click on the batch file *sim_cup_initiate.bat*. A console will pop-up on the screen. When first opened, the tool may take a few moments to initialize before prompting for User input.

```
C:\WINDOWS\system32\cmd.exe
Reading from file PY_PATH_autogen.txt
arcpy Python version found: C:\Python27\ArcGIS10.6\python

=====
NFSEG AUTOMATED WATER-USE PERMIT SIMULATION TOOL

This is the main script used to evaluate the impact of adding
new wells to the NFSEG model.

This script is designed to read a user supplied csv file
containing the id, location, and withdrawal rate of the wells
requesting a permit.

New wells are processed utilizing MODFLOW. Results are
summarized in two csv files and an updated mxd. The log and
output files are written to a new results directory.
1. <results>\<user_input_filename>_delta_q_summary.csv
2. <results>\<user_input_filename>_global_budget_change.csv
3. <results>\gis\dh.mxd

For questions contact:
PMBremner - pbremner@sjrwmd.com
LMeridth - lmeridth@sjrwmd.com
DDurden - Douglas.Durden@srwmd.org
=====

Please supply an input csv file name:
```

3. Follow the prompts to input both the User input csv filename, whether to proceed with overwriting an existing results directory possessing the same name (overwrite is currently the only option), as well as the map projection that corresponds to what was used in GIS to obtain the X,Y coordinates of each well. Push Enter after each prompted input.

```
C:\WINDOWS\system32\cmd.exe
C:\MY_CODES\RegTools\nfseg_auto_cup_tool-master>echo off
Reading from file PY_PATH_autogen.txt
arcpy Python version found: C:\Python27\ArcGIS10.6\python

=====
NFSEG AUTOMATED WATER-USE PERMIT SIMULATION TOOL

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LMeridth - lmeridth@sjrwmd.com
DDurden - Douglas.Durden@srwmd.org
=====

Please supply an input csv file name: user input files\sim cup input example sjrwmd.csv
```

```
Select C:\WINDOWS\system32\cmd.exe

C:\MY_CODES\RegTools\nfseg_auto_cup_tool-master>echo off

Reading from file PY_PATH_autogen.txt

arcpy Python version found: C:\Python27\ArcGIS10.6\python

=====
NFSEG AUTOMATED WATER-USE PERMIT SIMULATION TOOL

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  1. <results>\<user_input_filename>_delta_q_summary.csv
  2. <results>\<user_input_filename>_global_budget_change.csv
  3. <results>\gis\dh.mxd

For questions contact:
    PMBremner - pbremner@sjrwmd.com
    LMeridth - lmeridth@sjrwmd.com
    DDurden - Douglas.Durden@srwmd.org
=====

Please supply an input csv file name: user_input_files\sim_cup_input_example_sjrwmd.csv

Preexisting results with the jobname C:\MY_CODES\RegTools\sim_cup_input_example_sjrwmd_results will be overwritten. Proceed?
( Y = yes , N = no )
Y

=====
NFSEG AUTOMATED WATER-USE PERMIT SIMULATION TOOL

This is the main script used to evaluate the impact of adding
new wells to the NFSEG model.

This script is designed to read a user supplied csv file
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New wells are processed utilizing MODFLOW. Results are
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  1. <results>\<user_input_filename>_delta_q_summary.csv
  2. <results>\<user_input_filename>_global_budget_change.csv
  3. <results>\gis\dh.mxd

For questions contact:
    PMBremner - pbremner@sjrwmd.com
    LMeridth - lmeridth@sjrwmd.com
    DDurden - Douglas.Durden@srwmd.org
=====

Please supply an input csv file name: user_input_files\sim_cup_input_example_sjrwmd.csv

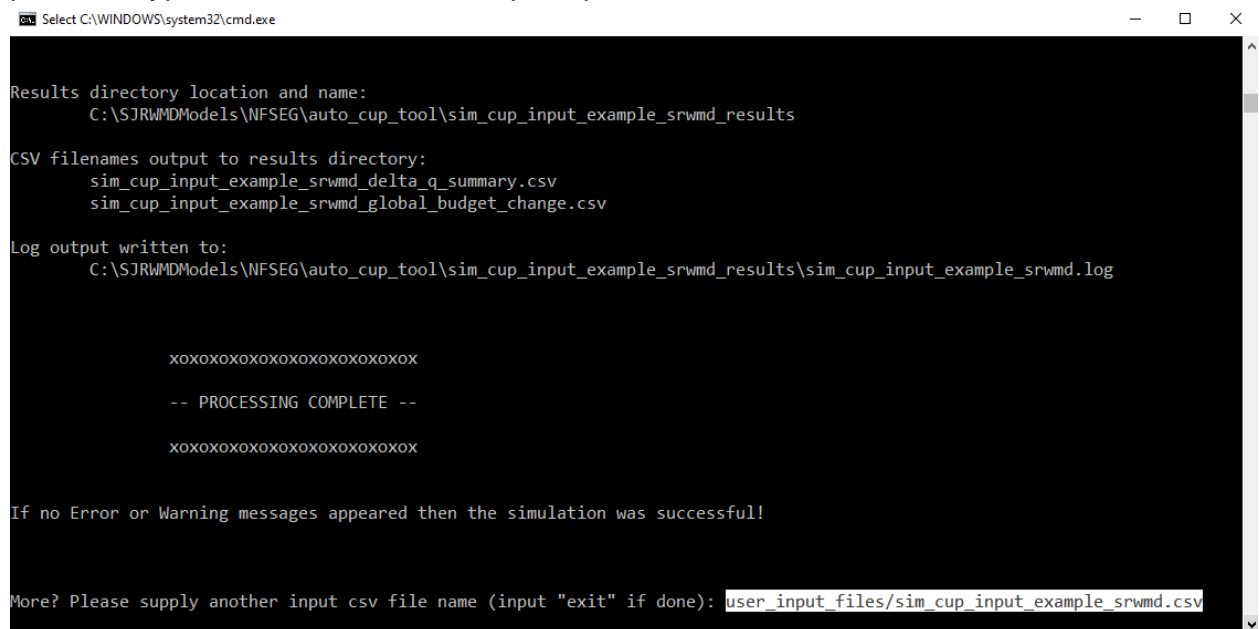
Preexisting results with the jobname C:\MY_CODES\RegTools\sim_cup_input_example_sjrwmd_results will be overwritten. Proceed?
( Y = yes , N = no )
y

Creating or replacing C:\MY_CODES\RegTools\sim_cup_input_example_sjrwmd_results

Please input the map projection type used - in all caps - or the associated number
(options are 1=SRWMD or 2=SRJWMD. Different names result in a poetic exit): 2
```

4. The simulation proceeds to run. Monitor the output to ensure no error messages appear. If the simulation was successful, then the output files will be written to the new results folder one level above the top-level tool directory, and a

completion message will appear in the console. The output files will be prepended with the User input filename. The user will then be prompted to supply another User input file for processing. If there is no additional user input file to process, type **exit** in the command prompt or close the command terminal to exit.



```
Select C:\WINDOWS\system32\cmd.exe

Results directory location and name:
  C:\SJRWMDModels\NFSEG\auto_cup_tool\sim_cup_input_example_srwm_results

CSV filenames output to results directory:
  sim_cup_input_example_srwm_delta_q_summary.csv
  sim_cup_input_example_srwm_global_budget_change.csv

Log output written to:
  C:\SJRWMDModels\NFSEG\auto_cup_tool\sim_cup_input_example_srwm_results\sim_cup_input_example_srwm.log

  XXXXXXXXXXXXXXXXXXXX

  -- PROCESSING COMPLETE --

  XXXXXXXXXXXXXXXXXXXX

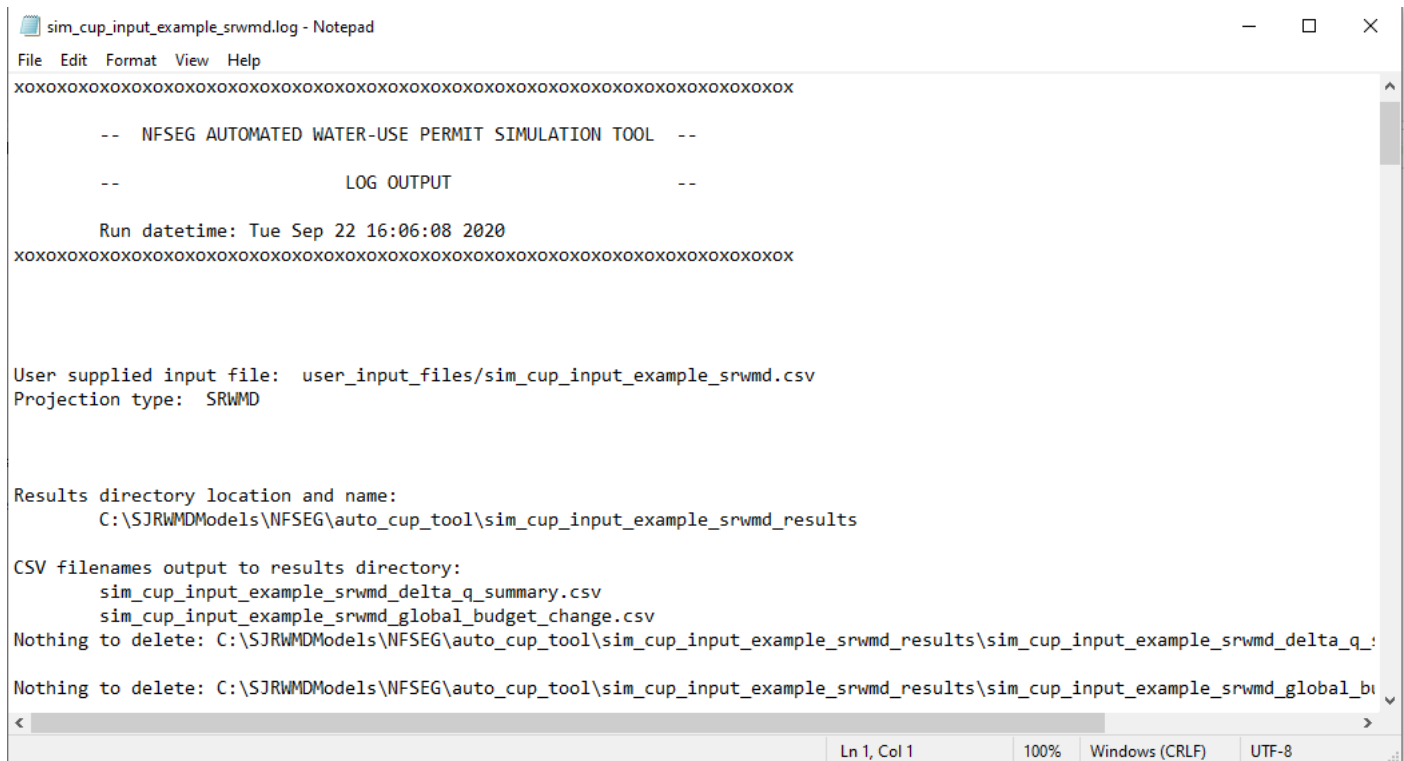
If no Error or Warning messages appeared then the simulation was successful!

More? Please supply another input csv file name (input "exit" if done): user_input_files\sim_cup_input_example_srwm.csv
```

[Water-Use Simulation Permit Simulation Log File](#)

Output from the console, including any error messages, is written to a log file in the results directory that is named with the base User input filename. Error messages and warning messages usually start with one of the following terms: “ERROR”, “Warning”, or “Traceback”. If an error occurs during execution of the tool, and it is not obvious why the error occurred, then the logfile should be examined for additional information. If errors persist, the log file and a description of the issue should be emailed to the tool maintainers.

Example log file:



```
sim_cup_input_example_srwm.log - Notepad
File Edit Format View Help
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
-- NFSEG AUTOMATED WATER-USE PERMIT SIMULATION TOOL --
-- LOG OUTPUT --
Run datetime: Tue Sep 22 16:06:08 2020
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

User supplied input file: user_input_files/sim_cup_input_example_srwm.csv
Projection type: SRWMD

Results directory location and name:
C:\SJRWMModels\NFSEG\auto_cup_tool\sim_cup_input_example_srwm_results

CSV filenames output to results directory:
sim_cup_input_example_srwm_delta_q_summary.csv
sim_cup_input_example_srwm_global_budget_change.csv
Nothing to delete: C:\SJRWMModels\NFSEG\auto_cup_tool\sim_cup_input_example_srwm_results\sim_cup_input_example_srwm_delta_q_
Nothing to delete: C:\SJRWMModels\NFSEG\auto_cup_tool\sim_cup_input_example_srwm_results\sim_cup_input_example_srwm_global_bu
Ln 1, Col 1 100% Windows (CRLF) UTF-8
```

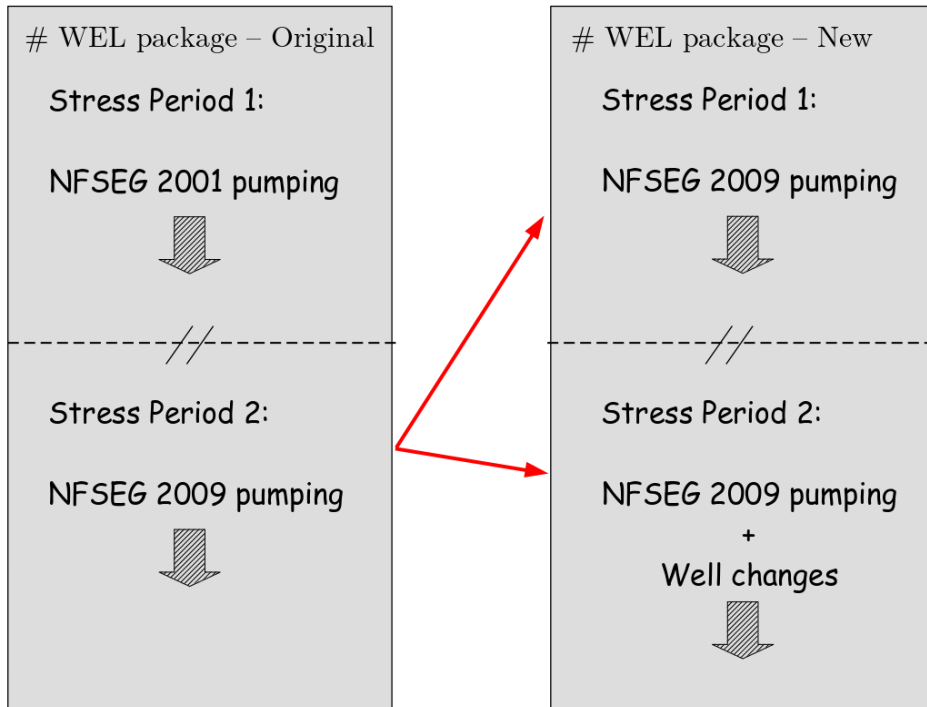
Tool Operations and Results

The NFSEG Automated Water-Use Simulation Tool uses MODFLOW to calculate changes in groundwater availability and other drawdown effects due to well additions or deletions (CUP - consumptive use permit) within the NFSEG groundwater model domain. The tool calculates the cumulative effects of adding one or more new CUP wells within the NFSEG model area, and summarizes results in the following outputs:

- Change in Water Budget
- Change in flow at river and spring flow gages
- Change in head water levels in model layers 1 and 3

The tool can be split into three stages:

1. **Preprocessing** – Processing the input CUP wells in order to setup a new MODFLOW WEL Package. The new WEL Package starts with the calibrated NFSEG 2nd Stress Period (2009), which becomes the new Stress Period 1. The new 2nd Stress Period repeats Calibrated NFSEG 2nd Stress Period plus all the CUP well modifications:



2. **Execute MODFLOW** – Utilize the new WEL Package, but all other packages are unchanged.

3. **Postprocess the results** – Extract and process the global water budget and flow changes from the *.lst* and *.hds* files.

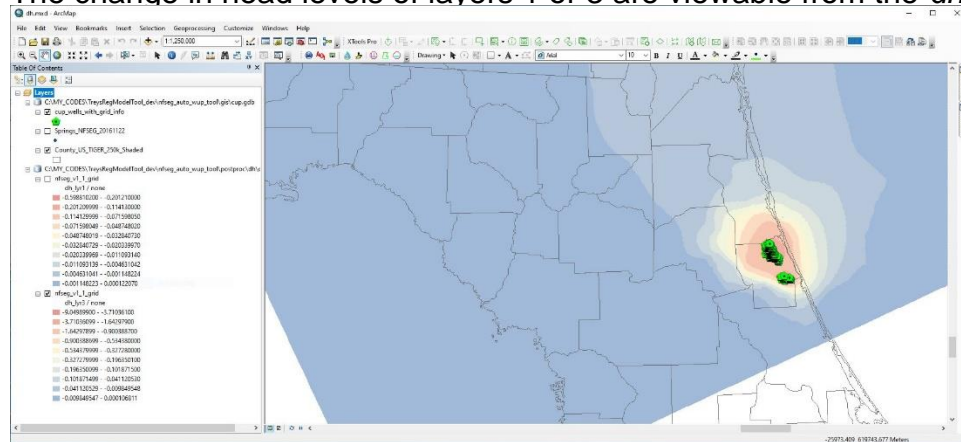
a. The global water budget is summarized in the
<user input filename> global budget change.csv (see example):

| J | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|----|-----------------|------------|------------|----------------|------------|----------------|------------|------------|-------------------|-------------------|------------|------------|--------------|-------------|--------------------|--------------------|
| 1 | bc_flux_type | flux_units | timeStep_1 | stressPeriod_1 | timeStep_2 | stressPeriod_2 | in_rate_1 | in_rate_2 | in_rate_1_minus_1 | in_rate_2_minus_1 | out_rate_1 | out_rate_2 | net_rate_1 | net_rate_2 | net_rate_1_minus_1 | net_rate_2_minus_1 |
| 2 | CONSTANT HEAD | cfm | 1 | 1 | 1 | 2 | 58922484 | 58922604 | 120 | 140176128 | 140172416 | -3712 | -81253644 | -81249812 | 3832 | -0.02 |
| 3 | DRAINS | cfm | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 986734720 | 986689792 | -44928 | -986734720 | -986689792 | 44928 | -0.27 |
| 4 | ET | cfm | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 2611415808 | 2611369984 | -45824 | -2611415808 | -2611369984 | 45824 | -0.28 |
| 5 | HEAD DEP BOUNDS | cfm | 1 | 1 | 1 | 2 | 174854640 | 174857904 | 3264 | 674131728 | 674134976 | -18752 | -499299088 | -499277072 | 22016 | -0.13 |
| 6 | MNHW2 | cfm | 1 | 1 | 1 | 2 | 3644703.75 | 3644517.5 | -186.25 | 19595294 | 19595108 | -186 | -15950590.25 | -15950590.5 | -0.25 | 0 |
| 7 | RECHARGE | cfm | 1 | 1 | 1 | 2 | 5298147328 | 5298147328 | 0 | 0 | 0 | 0 | 5298147328 | 5298147328 | 0 | 0 |
| 8 | RIVER LEAKAGE | cfm | 1 | 1 | 1 | 2 | 217602304 | 217606160 | 3856 | 1165426688 | 1165385344 | -41344 | -947824384 | -947791184 | 45200 | -0.27 |
| 9 | STORAGE | cfm | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | WELLS | cfm | 1 | 1 | 1 | 2 | 54044196 | 54044196 | 0 | 209716688 | 209881712 | 165024 | -155672492 | -155837516 | -165024 | 1 |

b. The change in flow is summarized in
<user input filename> delta q summary.csv (see example):

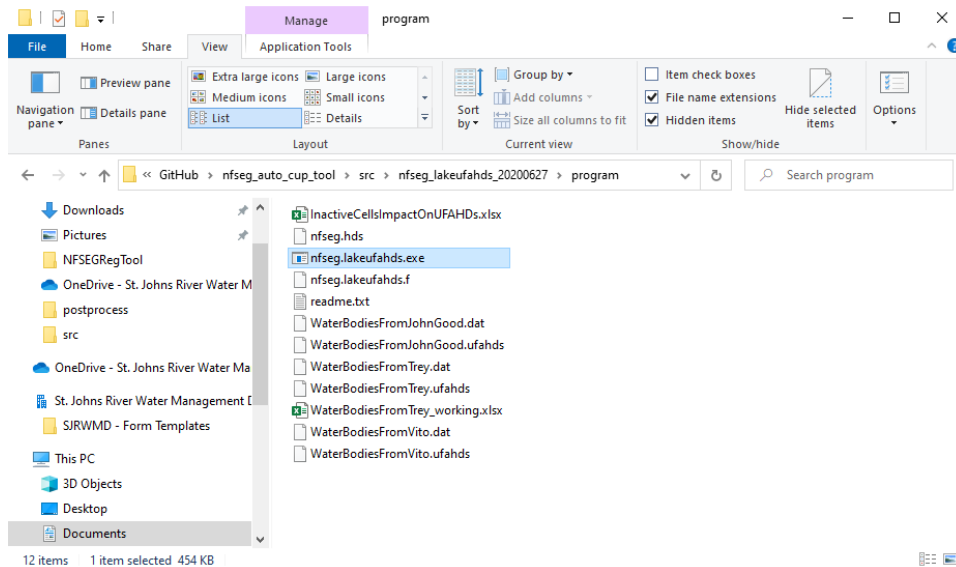
| J | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|----|----------------|--|-----------------------------------|-----------------------------|------------------------------|--|---|---|---|---|---|---|---|---|---|---|
| 1 | station_number | station_name | simulated_flux_base_condition_cfs | simulated_flux_with_cup_cfs | simulated_change_in_flow_cfs | simulated_change_in_flow_as_fraction_of_flow | simulated_change_in_flow_as_a_fraction_of_cup | | | | | | | | | |
| 2 | 2315000 | savannah river near benton | -10844063.83 | -10844055.12 | 8.71 | -0.000001 | 4.560081 | | | | | | | | | |
| 3 | 2315500 | savannah river at white springs | -14057591.11 | -14057563.86 | 27.25 | -0.000002 | 14.266615 | | | | | | | | | |
| 4 | 2317620 | alapaha river near jennings fla | -70118809.49 | -70118777.36 | 32.13 | 0 | 12.214317 | | | | | | | | | |
| 5 | 2319000 | withlacoochee river near pinetta fla | -7263267.35 | -72634928.86 | 338.49 | -0.000005 | 177.214919 | | | | | | | | | |
| 6 | 2319394 | withlacoochee river nr lee | -110119308.1 | -110118303.8 | 1004.29 | -0.000001 | 551.968792 | | | | | | | | | |
| 7 | 2319500 | savannah river at ellaville | -260075507.4 | -260072360.3 | 3207.07 | -0.000012 | 1679.047888 | | | | | | | | | |
| 8 | 2319800 | savannah river at downing park | -270122613.4 | -270115339.4 | 6273.97 | -0.000012 | 1714.072283 | | | | | | | | | |
| 9 | 2320000 | savannah river at furaville | -285509495.7 | -285506189.3 | 3306.37 | -0.000012 | 1751.035157 | | | | | | | | | |
| 10 | 2320500 | savannah river at brantford | -338422933.9 | -338419497.7 | 3436.17 | -0.00001 | 1788.529404 | | | | | | | | | |
| 11 | 2320700 | santa fe river near graham | -329526.635 | -329526.788 | 0.153 | -0.000046 | 97.091929 | | | | | | | | | |
| 12 | 2321000 | new river near lake butler | -1437561.57 | -1437532.06 | 29.51 | -0.000021 | 15.449828 | | | | | | | | | |
| 13 | 2322700 | chuckawba river at us hwy27 near hildreth | -23341434.1 | -23341201.6 | 232.5 | -0.00001 | 121.72403 | | | | | | | | | |
| 14 | 2322500 | santa fe river near worthington springs | -3752652.45 | -3752425.368 | 226.97 | -0.000042 | 81.268242 | | | | | | | | | |
| 15 | 2321975 | santa fe river at us hwy 441 near high springs | -12640148.06 | -12647062.51 | 1085.547 | -0.000086 | 568.331254 | | | | | | | | | |
| 16 | 2322500 | santa fe river near fort white | -62517471.06 | -62515986.31 | 1484.747 | -0.000024 | 777.33262 | | | | | | | | | |
| 17 | 2322800 | santa fe river near hildreth | -96587560.66 | -96585803.61 | 1757.047 | -0.000018 | 919.894962 | | | | | | | | | |
| 18 | 2323000 | savannah river near wilcox | -471961137.4 | -471935917.3 | 2500.117 | -0.000011 | 2722.491789 | | | | | | | | | |
| 19 | 2323592 | savannah river ab gosper river nr suwannee | -514120004.3 | -514113440.2 | 6564.117 | -0.00001 | 2756.004802 | | | | | | | | | |
| 20 | 2313700 | waccasassa river nr gulf hammock | -10891330 | -1089133.6 | 495.4 | -0.000046 | 259.88799 | | | | | | | | | |
| 21 | 2324000 | steinbutchee river near cross city | -5377135.34 | -5377135.34 | 0 | 0 | 0 | | | | | | | | | |

- c. The change in head levels of layers 1 or 3 are viewable from the *dh.mxd*:



Lake-UFA Head Extraction

A separate, standalone tool that extracts the Lake-UFA head levels is bundled with this Tool. To navigate to the extraction tool, start from the top-level tool directory and enter into the subdirectory *src\mfseg_lakeufahds\program*:



To use the extraction tool:

- Copy the heads file produced by the MODFLOW run into the extraction tool program directory:
 - From the results directory, copy *postproc\dh\mfseg_auto.hds* to the tool program directory
 - Rename as *mfseg.hds*.
- Double click the Fortran executable file, *mfseg.lakeufahds.exe*, to run the extraction tool.
- Once the process is complete, the output may be moved back to the results directory.

Currently, the tool processes from three lists of lakes, and creates an output file for each of them. Each output filename has the suffix *.ufahds*. Below is an example of the input and output files.

- The input file (left) lists the NFSEG grid rows and columns, as well as the area that make up each lake. Each lake has a unique ID.
- The output file (right) lists the average UFA head levels for each Stress Period beneath each LakeID

| LakeID | row | col | AreaRatio |
|--------|-----|-----|-------------|
| 1 | 667 | 346 | 0.410721207 |
| 1 | 667 | 347 | 0.589278793 |
| 2 | 600 | 326 | 0.053270891 |
| 2 | 600 | 327 | 0.006602863 |
| 2 | 600 | 328 | 0.003736122 |
| 2 | 601 | 326 | 0.039475764 |
| 2 | 601 | 327 | 0.356996443 |
| 2 | 601 | 328 | 0.176070058 |
| 2 | 602 | 327 | 0.140998759 |
| 2 | 602 | 328 | 0.165612569 |
| 2 | 603 | 327 | 0.035219784 |
| 2 | 603 | 328 | 0.022016745 |
| 3 | 675 | 350 | 0.509295915 |
| 3 | 676 | 350 | 0.490704085 |
| 4 | 589 | 319 | 6.70597E-05 |
| 4 | 589 | 320 | 0.132416504 |
| 4 | 590 | 319 | 0.006522296 |
| 4 | 590 | 320 | 0.546793444 |
| 4 | 590 | 321 | 0.260882152 |
| 4 | 591 | 320 | 0.018746438 |
| 4 | 591 | 321 | 0.034572106 |
| 5 | 701 | 278 | 6.28791E-05 |
| 5 | 701 | 279 | 0.019981238 |
| 5 | 702 | 279 | 0.106869094 |

| LakeID | UFA_Head_SP1 | UFA_Head_SP2 |
|--------|--------------|--------------|
| 1 | 23.8704357 | 24.7402954 |
| 2 | 69.9009933 | 74.5878448 |
| 3 | 21.2288990 | 24.4777107 |
| 4 | 69.6874466 | 74.3994217 |
| 5 | 48.1977463 | 48.5087814 |
| 6 | 22.2289505 | 24.7310505 |
| 7 | 22.8607140 | 22.3173275 |
| 8 | 15.7438049 | 23.0309467 |
| 9 | 72.7342072 | 75.3918839 |
| 10 | 11.4555864 | 23.4530048 |
| 11 | 24.3875427 | 25.1051426 |
| 12 | 17.7533169 | 23.3330002 |
| 13 | 24.1949825 | 25.7409439 |
| 14 | 24.3068466 | 24.9916973 |
| 15 | 68.5091934 | 73.8273163 |
| 16 | 12.6061964 | 10.3338537 |
| 17 | 43.3857880 | 43.3238335 |
| 18 | 23.6748753 | 22.5554409 |
| 19 | 19.7126598 | 20.0445385 |
| 20 | 21.3537884 | 20.9330502 |
| 21 | 19.1483555 | 23.1949768 |
| 22 | 20.8523998 | 24.2726402 |
| 23 | 75.4661865 | 79.8236313 |
| 24 | 25.9441757 | 26.3947144 |