Completing a Water Balance in CE-QUAL-W2

This tutorial will cover the steps needed to complete the water balance in a CE-QUAL-W2 model.

Required Files:

Process Summary

1) Run the CE-QUAL model
2) Create the observed elevations file
3) Compare the model elevations to the actual elevations
4) Run the water balance tool
5) Set up the control file to include the water balance as a distributed tributary inflow
6) Run the CE-QUAL model
7) Compare the model elevation to the actual elevations
8) Repeat steps 4-7 as necessary until the errors in water surface elevations in the reservoir are negligible

Setting up the Workspace

1) Using Windows Explorer, locate and open the folder 'Water Balance Tutorial'.
2) Inside of this folder are two folders: 'W2 Model' and 'Water Balance'. Open the folder 'W2 Model'. This folder contains the input files and executables required to run the model. Output files from a run will also be written to this folder.

Run the Model

1) Find the file W2__v32_AGPM.exe and double click the icon. This file executes the reservoir model.
2) A window titled 'CE-QUAL-W2 V3.2 Run Status' will appear. Click the "Run" button on the upper right-hand corner of the window.
3) The model begins execution. The model run will take one minute or more depending on the speed of the computer. Other programs' performance may be affected while the model is executing. The run window also includes other information about the simulation including run time. Briefly glance at the information that is displayed in this window.

4) When the model has finished execution click the "Close" button in the upper right-hand corner. The "Close" button is dimmed until the model has finished execution.

Compare Elevations

1) Located in the folder 'Water Balance Tutorial' is the Microsoft Excel spreadsheet file 'Deer Creek WSE 97-02.xls'. Open this file in Excel. The file contains macros that must be enabled in order to complete the tutorial.
2) The top row of this file shows the directory path of the 'W2 Model' folder where the CE-QUAL-W2 model was simulated. The next row is the name of the file containing the water surface elevations from the model run. To the right of these is a button labeled 'Import Model WSE Values'. This button will run a macro that will import the model WSE values to the spreadsheet. The file also has observed WSE values and a graph for comparison of observed versus model values.
3) Type the directory path of the 'W2 Model' folder where the model was run from into cell "B1". For example: *C:\ Water Balance Tutorial\W2 Model* would be the location if the tutorial folder were placed on the C drive of a computer. Do not change the file name in cell "B2" of the spreadsheet.
4) Click the 'Import Model WSE Values' button to the right of the file directory and file path.
5) The model WSE values are now imported into the spreadsheet. Examination of the graph shows the model water balance is not accurate.

Water Balance Tool

1) From the 'W2 Model' folder copy the file 'tsr_1.opt' to the 'Water Balance' folder. This output file contains the water surface elevations generated by the model during simulation.
2) In the 'Water Balance' folder are several other files including the CE-QUAL control file (w2_con.npt), the bathymetry file (bth.npt), the observed water surface elevations file (el_obs.npt), and the water balance tool (waterbalance.exe).
3) Open the 'el_obs.npt' file by double-clicking the icon in windows explorer. In the case that the file is not opened by an application read the instructions below.
    i) This file is best read by a text editor program such as Word Pad or Note Pad. After double-clicking the icon a window will appear saying: *"Windows cannot open this file"*. Two options appear at the bottom of the window. Select the option reading: *"Select the program from a list"* and then click OK.
    ii) Another window appears with a list of available programs. Select an appropriate text editor from the list. If the check box reading *"Always use the*

selected program to open this kind of file" is checked this process will not need to be repeated when opening files of the extension 'npt'. Instead the files will automatically open with the selected application.

4) The file 'el_obs.npt' contains two columns, the julian day and the water surface elevation in meters. Close the file.
5) Open the water balance tool by double clicking 'waterbalance.exe'.
6) In the water balance tool check that the Water Surface Elevation Filenames listed at the top of the tool match the filenames in the folder 'Water Balance'.
7) Click the 'Run' button. The status bar at the bottom should read *Successful Completion* when the tool finishes.
8) Two new files have been created in the 'Water Balance' folder. These files are 'el_stats.opt' and 'qwb.opt'.
9) Close the water balance tool.

Add the Water Balance to the Model

1) Copy the 'qwb.opt' file from the 'Water Balance' folder to the 'W2 Model' folder.
2) Change the name and extension of the 'qwb.opt' file to 'Qdt_Br1.npt'. This file is input into CE-QUAL-W2 as a distributed tributary inflow.
3) To activate the distributed tributary open the control file (w2_con.npt).
4) Do a search for the line DST TRIB. The line below this is as follows:

   BR 1 OFF

   Replace the word OFF with the word ON. Be sure to keep the word right-aligned.

   The 'N' in ON should be directly under the 'C' in DTRC.
5) Save and close the control file.
6) Run the W2 model by opening the executable and clicking Run.
7) When the model finishes close the W2 model screen.

Check the Water Surface Elevations

1) Open the Excel file 'Deer Creek WSE 97-02' if it is not already open.
2) Import the new WSE values by clicking the button.
3) The model elevations match the observed elevations more closely.

Solving the Water Balance Continued – Optional

Often solving for the water balance can be an iterative process. The section of the tutorial will demonstrate how to continue improving the water balance if the first solution is not satisfactory.

1) Copy the 'tsr_1.opt' file from the 'W2 Model' folder to the 'Water Balance' folder. Replace the existing 'tsr_1.opt' file.
2) Open the water balance tool by double-clicking 'waterbalance.exe'.
3) Place a check in the box for adding flows to the previous water balance. Confirm that the file name for the previous water balance is 'qwb.opt '.
4) Run the water balance.
5) After successful completion close the water balance tool.
6) Copy the 'qwb.opt' file from the 'Water Balance' folder to the 'W2 Model' folder.
7) Delete the previous distributed inflow file, 'Qdt_Br1.npt'.
8) Rename the file 'qwb.opt' as 'Qdt_Br1.npt'.
9) Run the CE-QUAL-W2 model.
10) Import the new elevations into the Excel spreadsheet.
11) Repeat steps 1-10 until a satisfactory water balance is achieved.