Catawba WARMF Model 6.7c Setup and Run Information

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Introduction

The Catawba WARMF model Version 6.7c (Catawba_Cal_Apr2014.wsm) is a calibrated water quality model for the Catawba Basin downstream of Lake Wylie to the Lake Wateree tailrace. The model application was updated to include a simulation time-frame through September 2012 by Systech Water for SCDHEC. Systech calibrated the model for the period 10/01/2003 – 09/30/2012, focusing on the main stem of the Catawba River and the reservoirs.

All inputs critical to the model [meteorological stations, managed flow (Hydro-generation station and water withdrawals) and the air quality site] were updated for the entire basin. Model inputs for all major point sources, select flow gages, and water quality monitoring sites were also updated for the entire basin. Additionally minor point sources, most flow gages and water quality sites in the Lower Catawba Basin were updated.

Water quality for sub-watersheds in the upper Catawba (Lake Wylie and upstream catchments, streams, and lakes) can be simulated, although these outputs do not affect that of the lower Catawba because the link between the upper sub-watersheds and the lower basin has been removed at the Wylie Dam. Water flow and constituent loads from Lake Wylie are input into the lower basin from boundary files (Wylie_Boundary.orh and Wylie_Boundary.orc).

Installation of Model

Download the model setup file (Catawba_WARMF-6.7c_Apr2014_Final.exe) and scenario zip file (Catawba Scenarios.zip) from the specified site.

Install WARMF by running the setup file. The default locations for the installation are C:\WARMF-6.7c\ (model executables) and C:\WARMF-6.6\Catawba\ (scenario and input files).). We recommend changing the second file location to C:\WARMF-6.7c\Catawba\. The setup will over write any folders with the same names.

The model setup will create the model calibration scenario and output files (Catawba_Calb_Apr2014.*). These files will allow the user to view the output without running the model or to run the calibrated model. To view the simulation results, select 'Output' under Mode on the Menu Bar, and double click on the stream or lake segment. Available water quality parameters will be displayed on the left side of the screen. The interface can be used to create text files of the data.

The Catawba Scenarios.zip file has the coefficient and output files for several scenarios discussed later in these instructions and the permit limit point source files for point sources with phosphorus limits. Unzip and copy the files into the C:\WARMF-6.7c\Catawba\ folder. You will be able to view the results of these scenarios and run them if you choose.

If you wish to use the TMDL Module, please contact Wayne Harden at hardencw@dhec.sc.gov. SCDHEC will e-mail you the model executables for Windows XP and/or 7 and instructions on setting up and using the TMDL module.

Opening and Running Model

Start up the model as previously described. On the Menu bar, click on File and then Open. Double click on: 'Catawba_Cal_Apr2014.wsm' in the \Catawba\ folder. This brings up the calibrated model application. Usually you will be working in the Engineering Module, so choose it from the dialog box. You can change modules later.

Additional scenarios and output data are provided as listed and described in Table 1. Use the Manager under Scenario on the menu bar of WARMF to add and open scenarios in WARMF. You can have up to four scenarios open at once. Also use Scenario to run the active scenario file.

Included in the .zip file bundle are the calibrated model scenario as received from Systech Water Resources, a permitted limits scenario, existing condition scenarios, and several load reduction scenarios. The calibrated model, permit limits, and baseline model with only active point sources were simulated for the entire calibration period (10/02/2003-09/30/2012). This is also true for the load reduction from permit scenarios. The load reduction from existing and the associated baseline scenario were simulated for 01/02/2007 – 09/30/2012 period, which is time-frame for which the permitted phosphorus load to the system has been relatively stable. This necessitates a model warm up scenario (Warm Start in WARMF) for each of the scenarios.

As shown in Table 1, the principal differences between the various scenarios are the input files (either DMR that is actual loads or permit loads) and the simulation period. The load reduction scenarios also differ from the baseline or permit loads by the parameter multipliers that reduce the input loads from the point sources (PS) and nonpoint sources (NPS). The model default value for these is 1 (or equivalent to 100% of the load or a 0% reduction of the load). For the reduction scenarios the appropriate multipliers were changed. For the FCR_P_Permit-1 scenario the phosphate PS multiplier was set to 0.4 (60% reduction) and the NPS to 0.77 (40% reduction in anthropogenic NPS). For the FCR_N_Permit-1 scenario the PS multiplier was set to 0.57 (43% reduction) and the NPS multiplier to 0.9 (20% reduction in anthropogenic NPS) for NH3, NO3, and organic carbon (organic nitrogen is a fraction of organic carbon in WARMF). The NPS multipliers were calculated so as to reduce the anthropogenic portion of NPS by the

targeted percentage using a spreadsheet that uses the percentage of total NPS represented by the anthropogenic NPS sources as determined by WARMF.

Table 1. Scenarios and descriptions provided with the lower Catawba WARMF Model

Scenario Name	Description	Point Sources	P Data Source	N Data Source	Simulation Period
Catawba_Calb_Apr2014.coe	Calibrated Model as provided by Systech	All	DMRs	DMRs	10/01/03 - 09/30/12
Catawba 2014 PermitLimits.coe	Permit Limits Model	Active	Permit Limits	Extrapolated to Design Flow	10/01/03 - 09/30/12
Catawba_Calb_Active_PS_2015.COE	Baseline Model with only Active Point Sources	Active	DMRs	DMRs	10/01/03 - 09/30/12
Existing_warmup.coe	Warm Start Scenario for Baseline Period	Active	DMRs	DMRs	10/01/03 - 12/31/06
Existing_2007-12.coe	Baseline Model for 2007-12 Period	Active	DMRs	DMRs	01/01/07 - 09/30/12
FCR_P_Permit-1.COE	Phosphorus Reduction from Permitted Loads for Fishing Creek Reservoir	Active	Permit Limits	Extrapolated to Design Flow	10/01/03 - 09/30/12
FCR_N_Permit-1.COE	Nitrogen Reduction from Permitted Loads for Fishing Creek Reservoir	Active	Permit Limits	Extrapolated to Design Flow	10/01/03 - 09/30/12
FCR_P_Existing-1WrmST.COE	Warm Start Scenario for Phosphorus Reduction from Existing Loads for Fishing Creek Reservoir	Active	DMRs	DMRs	10/01/03 - 12/31/06
FCR_P_Existing-1.COE	Phosphorus Reduction from Existing Loads for Fishing Creek Reservoir	Active	DMRs	DMRs	01/01/07 - 09/30/12
FCR_N_Existing-1WrmST.COE	Warm Start Scenario for Nitrogen Reduction from Existing Loads for Fishing Creek Reservoir	Active	DMRs	DMRs	10/01/03 - 12/31/06
FCR_N_Existing-1.COE	Nitrogen Reduction from Existing Loads for Fishing Creek Reservoir	Active	DMRs	DMRs	01/01/07 - 09/30/12