

Hydrologic Engineering Center

Training Course on

## **CWMS Modeling for Real-Time Water Management**

August 2018  
Davis, California

The Corps Water Management System (CWMS) is a software and hardware system to improve the Corps' water control operations decision-making process. This class provides water managers the training necessary to effectively use hydrologic, hydraulic, reservoir, and flood impact modeling software in CWMS for real-time water management. Students will learn how to setup a CMWS Watershed for modeling capabilities. Students will also learn the advanced features of modeling within CWMS, including real-time calibration and execution of modeling programs to support Corps project operations decisions. This class does not address the installation of CWMS or the development of individual models for use in CWMS.

HEC Instructors

Guest Instructors

**Monday**

8:00 – 8:45 a.m.

**INTRODUCTION AND PRE-TEST**

Class and Staff Introductions, Admin details, Pre-test.

8:45 – 9:00 a.m.

**BREAK**

9:00– 9:30 a.m.

1.1 Lecture: **OVERVIEW OF THE CORPS WATER MANAGEMENT SYSTEM (CWMS)**

General concepts, history and the background of CWMS. Major components of CWMS, including data acquisition, database, modeling. Client-server architecture, workstations, file system organization. Oracle and HEC-DSS relationships.

9:30 – 10:45 a.m.

1.2 Lecture: **OVERVIEW OF CWMS CONTROL AND VISUALIZATION INTERFACE (CAVI)**

Overview of the CWMS Control and Visualization Interface (CAVI) and its basic functionality. Common CAVI elements: menus, maps, tool bars, control panel, layers, icons, plots, tables, and time windows. CAVI components, including the Data Acquisition, Observed Data Visualization and Model Interface modules. Day-to-day operations with CWMS.

10:45 – 11:00 a.m.

**BREAK**

11:00 – 12:00

1.3 Lecture: **CAVI SETUP AND MODEL INTEGRATION**

Creating and setting up a CAVI Watershed for modeling. Integrating models into a CAVI Watershed. Setting coordinate systems, time zones, and adding background maps. Importing existing CMWS models and setting up to run in sequence: model program order, model keys, model linking, data extract, forecast runs.

12:00 – 1:00 p.m.

**LUNCH**

1:00-1:45 p.m.

1.4 Lecture: **CWMS REAL TIME MODELING**

Creating and running real-time forecasts in CMWS. Selecting time widows for model execution and computing models in a forecast. Viewing model results and creating time-series icons to display results in the map window. Posting results to the Oracle database and saving model states and updates locally and remotely.

1:45-2:30 p.m.

1.5 Workshop: **CWMS MODEL INTEGRATION & MODELING**

Open an existing CAVI watershed, and setup and adjust background maps. Explore the data visualization and acquisition modules and display various types of data in the map window. Import models and complete setup to run a forecast including: model alternative keys, model linking, data extract, forecast runs. Compute.

2:30 – 2:45 p.m. 1.5 Workshop Review

2:45 – 3:00 p.m. BREAK

~~3:00 – 4:00 p.m. 1.6 Lecture: **ST. LOUIS CWMS REAL-TIME APPLICATION**~~

~~How the St. Louis District has implemented CWMS and uses CWMS to: monitor hydromet data and watershed conditions, create forecast simulations and report results for real time operations~~

~~4:00 – 5:00 p.m. 1.7 Lecture: **RUSSIAN RIVER WATERSHED OVERVIEW**~~

~~Overview of the characteristics of the Russian River Watershed which is used as the example watershed for the workshops throughout the class. Covers geography, land use hydraulic structures, climatology and available hydromet data for the watershed.~~

## Tuesday

- 8:00 – 9:00 a.m.      2.1 Lecture:    **HEC-HMS REAL-TIME HYDROLOGIC MODEL DEVELOPMENT**
- Overview of hydrologic capabilities in HEC-HMS for CWMS, including gridded precipitation, Mod-Clark runoff, recession methods, loss methods and routing methods. Real-time calibration of hydrologic parameters and analysis of modeling results.
- 9:00 – 9:45 a.m.      2.2 Workshop: **HMS REAL-TIME HYDROLOGIC MODELING**
- Explore components and setup required to integrate an HEC-HMS model in a CWMS Watershed executing HMS with algorithms used in CWMS. Adjusting hydrologic parameters, viewing and evaluating model results.
- 9:45 – 10:00 a.m.    2.2 Workshop Review
- 10:00 – 10:15 a.m.    BREAK
- 10:15 – 11:00 a.m.    2.3 Lecture:    **MFP AND HMS IN CWMS**
- Purpose and use of MFP and HMS. Creating precipitation scenarios with MFP, and hydrologic forecast alternatives with HMS. Adjusting hydrologic parameters in CWMS through HMS. Execution of a forecast through HMS. Evaluating HMS results in the CAVI.
- 11:00 – 11:45 a.m.    2.4 Workshop: **MFP AND HMS FOR REAL-TIME CWMS MODELING**
- Within the CAVI, create precipitation and hydrologic model alternatives using MFP and HMS. Control model alternatives, make use of Zones, and execute a modeling forecast through HMS. Evaluate HMS results in the CAVI.
- 11:45 – 12:00 p.m.    2.4 Workshop Review
- 12:00 – 1:00 p.m.     LUNCH
- ~~1:00 – 1:45 p.m.      2.5 Lecture:    **HEC METVUE OVERVIEW**~~
- ~~Overview of the HEC Meteorologic Visualization Utilities Engine and its existing and future features for supporting real-time storm analysis and scenario forecasting.~~
- ~~1:45 – 2:30 p.m.      2.6 Workshop: **HEC METVUE OVERVIEW**~~
- ~~Orientation to the HEC MetVue Interface. Load subbasin shapefiles and gridded precipitation data and analyze storm totals per subbasin. Transpose and scale a storm.~~
- 2:30 – 2:45 p.m.      2.6 Workshop Review

2:45 – 3:00 p.m.

**BREAK**

3:00 – 4:30 p.m.

2.7 Lecture: **HEC-RESSIM IN CWMS**

Overview of HEC-ResSim. Capabilities and limitations of ResSim. ResSim in the modeling sequence. Importing ResSim into a CWMS watershed. Linking ResSim to HMS. Adding ResSim lookback data to the Extract List. Computing and Evaluating ResSim results.

4:30 –5:00 p.m.

2.6 Workshop: **HEC-RESSIM IN CWMS**

In an existing watershed add an HEC- ResSim model to a forecast run. Establish the modeling linking for ResSim to HMS, update the extract list information, compute a forecast run and evaluate and display the results.

## Wednesday

- 8:00 – 9:00 p.m. Complete and Review 2.6 Workshop: **HEC-RESSIM IN CWMS**
- 9:00 – 10:00 p.m. 3.1 Lecture: **HEC-RAS IN CWMS**  
Overview of HEC-RAS and its use in CWMS. Adjusting RAS parameters through CWMS. Computation of inundation maps using RAS. Creating RAS model alternatives. Viewing and evaluating results.
- 10:00 –10:15 a.m. BREAK
- 10:15-11:00 a.m. 3.2 Workshop: **HEC-RAS IN CMWS**  
Create Import HEC-RAS alternatives to the CAVI and complete RAS and RASMapper setup. Adjust model linking, create a forecast run including RAS and compute a forecast. Calibrate HEC-RAS model alternative to a historic event and view results in the CAVI and RASMapper.
- 11:00 -11:15 a.m 3.2 Workshop Review
- 11:15 – 12:00 a.m. 3.3 Lecture: **HEC-FIA IN CWMS**  
Overview of HEC-FIA and its use in CWMS. Available FIA computation methods and output reports. Connecting FIA to computed flow and stage hydrographs. Viewing and evaluating FIA computations. Creating FIA model alternatives.
- 12:00- 1:00 p.m. LUNCH
- 1:00 – 1:45 p.m. 3.4 Workshop: **HEC-FIA IN CWMS**  
Evaluate and modify existing FIA model alternatives. Connect to RAS computed hydrographs at cross sections and storage areas. Execute a modeling forecast through FIA. Viewing and evaluating FIA reports.
- 1:45 – 2:00 p.m 3.4 Workshop Review
- 2:00 – 3:00 p.m. 3.5 Lecture: **CWMS GRAPHING AND SCRIPTING**  
Overview of the graphics plots available in CWMS. User interfaces for setting plot characteristics. Saving and retrieving plot characteristics using “templates”. Applicability of templates to other data sets. Setting and using “default line styles” to set plot characteristics based on data parameter types. Modifying and adding customized graphics scripts (Perryman)
- 3:00 – 3:15 p.m. BREAK
- 3:15- 4:00 p.m. 3.6 Workshop: **CWMS GRAPHING AND SCRIPTING**  
Creating complex graphs. Saving and retrieving graphs characteristics in templates. Setting and using default line styles.

4:00- 4:15 p.m.

3.6 Workshop Review

4:15 – 5:00 p.m.

3.7 Lecture: **REAL-TIME DATA IN CWMS**

Introduction to the data side of real-time modeling in CWMS. Identifying different data types, sources of data, how data is acquired and how data is stored in CWMS.

## Thursday

~~8:00 – 9:00 a.m. 4.1 Workshop: **DAILY MODELING IN CWMS**~~

~~Typical daily operations with CWMS. Evaluating and validating observed data. Typical daily model executions and precipitation scenarios, including base flow and loss rate parameter adjustments, and reservoir release overrides. Evaluation of results.~~

9:00 – 9:15 a.m. BREAK

9:45- 11:45 a.m. 4.2 Workshop: **EVENT SCENARIO MODELING IN CWMS**

Use of CWMS during a significant event. Real-time model calibration. Add and evaluate precipitation event scenarios. ResSim reservoir operation adjustment during real-time simulations and consequences analysis using FIA.

11:45 – 12:45 p.m. LUNCH

12:45 – 3:15 p.m. 4.3 Workshop: **ASSORTED CWMS APPLICATIONS**

Students will select from the three different CWMS workshops below to bolster knowledge on the subjects:

**INTEGRATION OF CWMS MODELS IN THE CAVI:** Starting with an empty watershed students will go through the steps to import and integrate models in the CAVI to the point where a forecast can be successfully computed.

**SNOWMELT MODELING IN CWMS:** Use the CAVI and HEC-HMS to compute forecasts that account for the snow accumulation and melt process. Calibrate the HEC-HMS model using observed data and predict impacts to downstream communities from snowmelt.

**FLOODPLAIN INUNDATION FORECASTING IN CWMS:** In an emergency scenario, use HEC-RAS and RASMapper to determine forecasted stages, and forecasted inundations, for two different rainfall scenarios.

3:15 – 3:30 p.m. BREAK

~~3:30 – 5:00 p.m. 4.4 Workshop: **TEAM MODELING IN CWMS 3.1**~~

~~Use new Team Modeling features in CWMS 3.1 to create a team watershed, modify base data and create forecasts. Share base data and forecasts with other teams in the class by uploading/downloading team modeling data to and from a shared server. (, ,)~~

## Friday



8:00 – 9:00 a.m. — 5.1 Lecture: **LOUISVILLE DISTRICT CWMS APPLICATIONS**

————— Real world advice about the challenges and benefits with implementing CWMS at your district. Common stumbling blocks when implementing CWMS watersheds. Features of CWMS that are most useful tools to the Louisville district water managers.

9:30 – 9:45 a.m. — 5.2 Lecture: **CWMS UPCOMING FEATURES**

————— Discussion of the new and exciting features in the pipe for CWMS.

10:30 – 11:15 a.m. — Post Test

11:15 – 12:00 a.m. — Course Critique and Administrative Items