Center for Advanced Decision Support for
Water and Environmental Systems (CADSWES)
UNIVERSITY OF COLORADO **BOULDER**

Integration with USACE CWMS, HEC-RTS, and HEC-WAT

2023 RiverWare User Group Meeting

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Modeling Frameworks

- Frameworks allow models to work together
  - Modeling different processes
  - From different agencies
  - Written in different languages
  - Have different interfaces
  - Have different data formats
- Often, the framework provides an interface for visualization and model control

Adapters

- Model integration is implemented using **adapters**
- A model adapter is the software that “bridges” between the framework and the model
  - Controls model execution
  - Communicates between the framework and models
  - May convert data to a common format

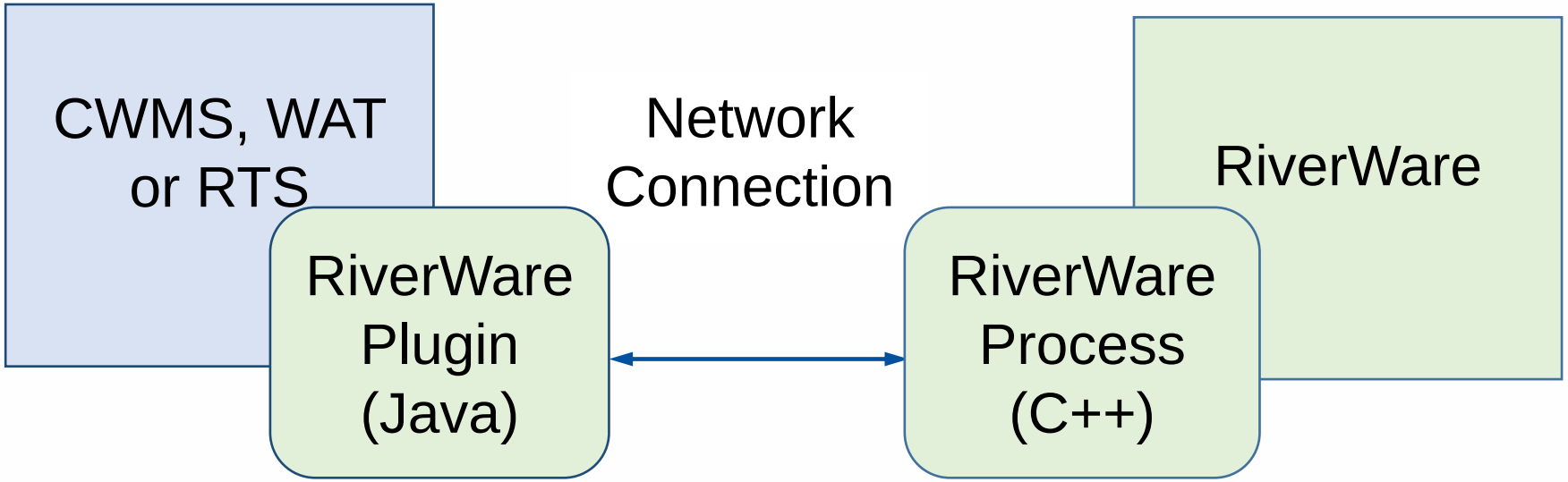
Some Modeling Frameworks

- USACE CWMS
- USACE HEC-RTS
- USACE HEC-WAT

- Deltares Delft-FEWS
- RiverSMART

Adapter Architecture

CWMS, HEC-RTS, and HEC-WAT Plugin executes RiverWare as server, communicating with RiverWare across a network connection



Corps Water Management System (CWMS)

- USACE modeling framework that integrates these and other models together
  - HEC MFP – Precipitation forecast
  - HEC HMS – Rainfall runoff
  - RiverWare
  - HEC RAS – Flood inundation
  - HEC FIA – Flood Impacts Analysis

- Typically used for short-term operations
- Only available to USACE offices

- CWMS RiverWare Plugin:
  v1.8 released Sep 2021

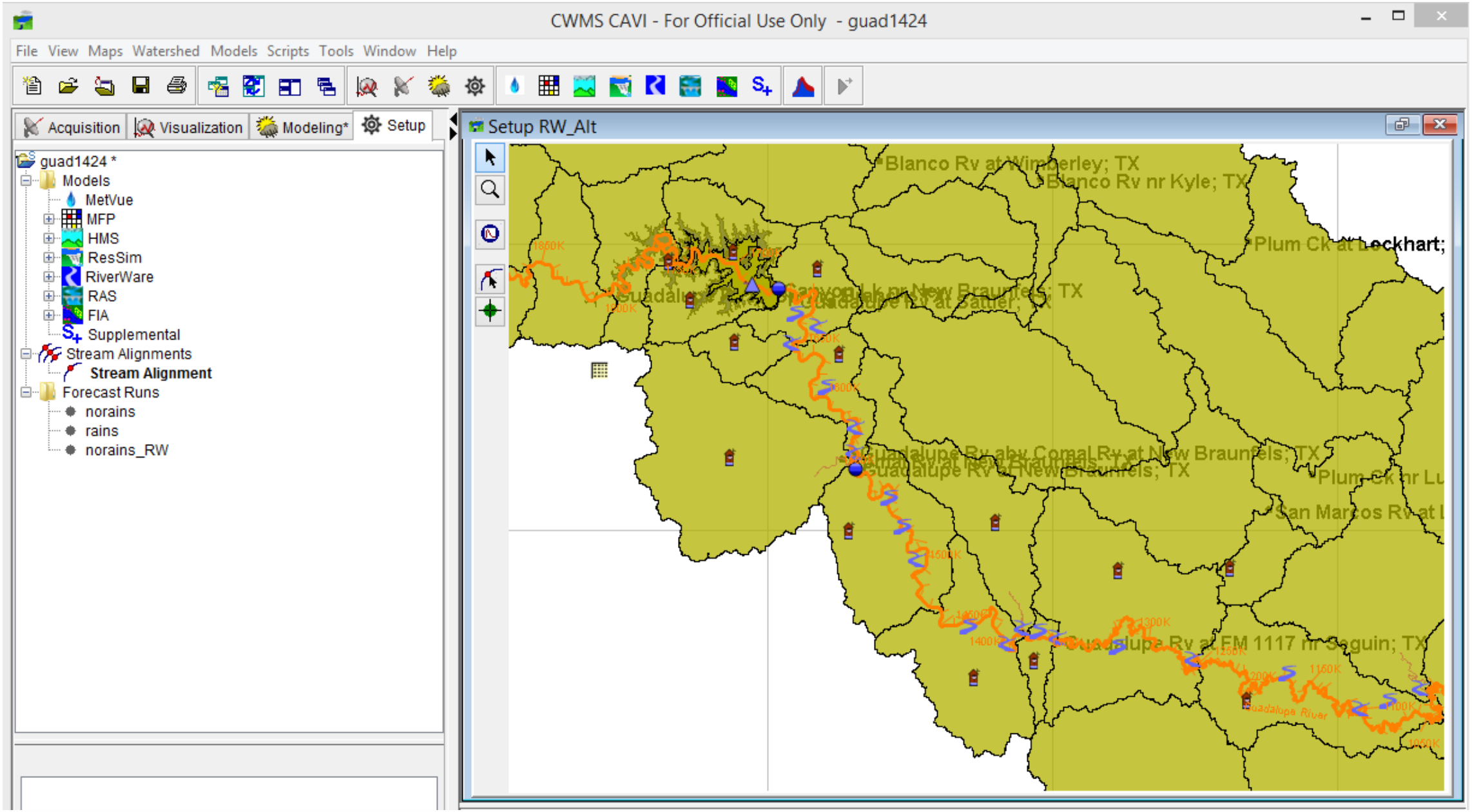
USACE HEC – RTS

- **R**eal **T**ime **S**imulation
- Public version of CWMS
- RTS RiverWare Plugin: v1.1 Released 9/2021

CWMS / RTS Adapter Version 2.0

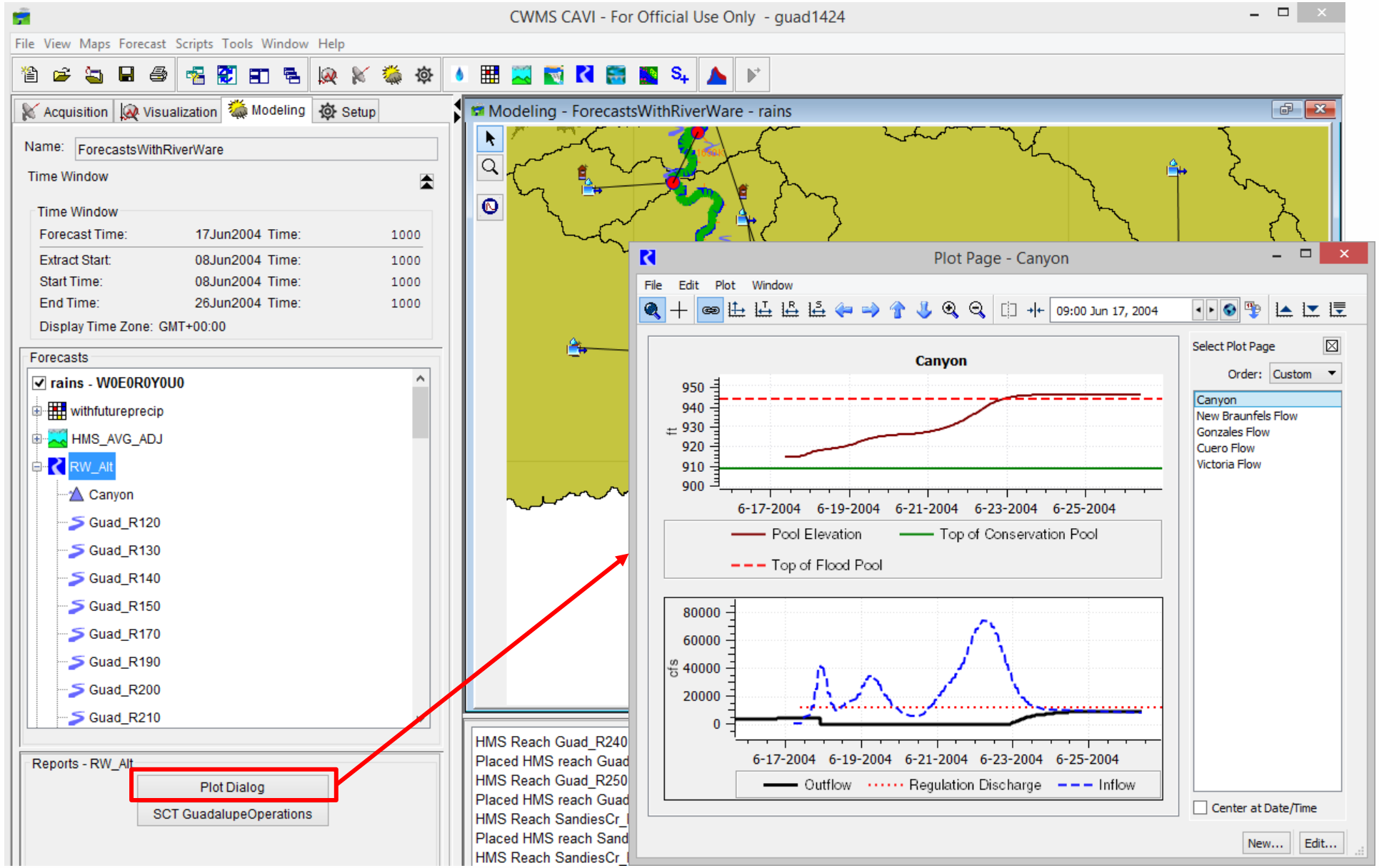
- Work-in-progress to release one common application for both tools:

  “HEC-RTS and CWMS RiverWare Plugin”
- Version 2.0
- To be released 9/2023


CWMS CAVI - For Official Use Only - guad1424
File View Maps Watershed Models Scripts Tools Window Help
Acquisition
Visualization
Modeling*
Setup
guad1424 *
Models
MetVue
MFP
HMS
ResSim
RiverWare
RAS
FIA
Supplemental
Stream Alignments
Stream Alignment
Forecast Runs
norains
rains
norains_RW
Setup RW_Alt
Blanco Rv at Wimberley; TX
Blanco Rv nr Kyle; TX
Plum Ck at Lockhart;
Guadalupe Rv at Sattler; TX
Guadalupe Rv abv Comal Rv at New Braunfels; TX
Guadalupe Rv at New Braunfels; TX
San Marcos Rv at
Guadalupe Rv at FM 1117 nr Seguin; TX
Guadalupe River

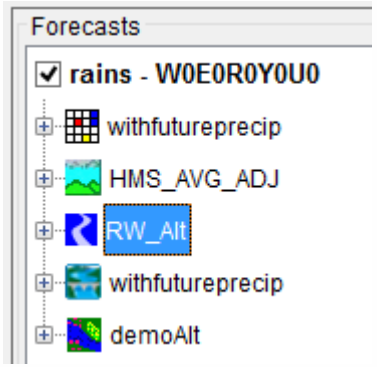
CWMS Interface opens these RiverWare Dialogs

- SCT
- Scripts
- RPL Sets
- Objects
- Plots
- Output Canvas
- Charts
- Workspace
- Diagnostics

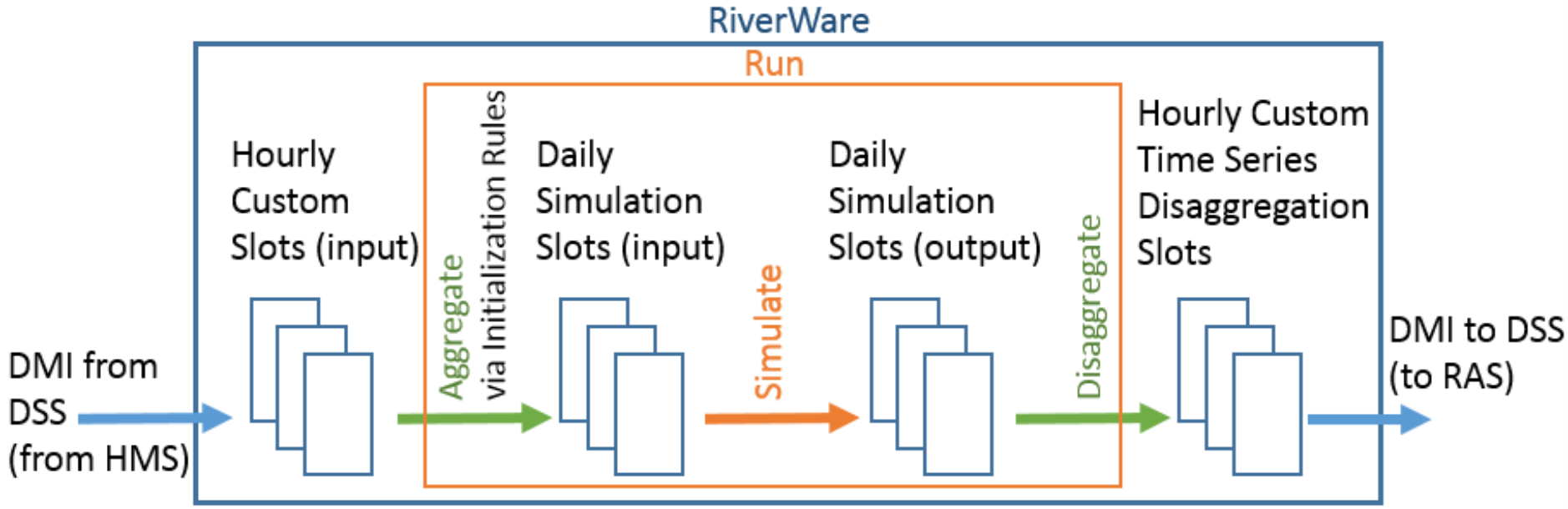

CWMS CAVI - For Official Use Only - guad1424
File View Maps Forecast Scripts Tools Window Help
Acquisition
Visualization
Modeling
Setup
Name: ForecastsWithRiverWare
Time Window
Time Window
Forecast Time: 17Jun2004 Time: 1000
Extract Start: 08Jun2004 Time: 1000
Start Time: 08Jun2004 Time: 1000
End Time: 26Jun2004 Time: 1000
Display Time Zone: GMT+00:00
Forecasts
rains - W0E0R0Y0U0
withfutureprecip
HMS_AVG_ADJ
RW_Alt
Canyon
Guad_R120
Guad_R130
Guad_R140
Guad_R150
Guad_R170
Guad_R190
Guad_R200
Guad_R210
Reports - RW_Alt
Plot Dialog
SCT GuadalupeOperations
Modeling - ForecastsWithRiverWare - rains
HMS Reach Guad_R240
Placed HMS reach Guad
HMS Reach Guad_R250
Placed HMS reach Guad
HMS Reach SandiesCr_
Placed HMS reach Sand
HMS Reach SandiesCr_
Plot Page - Canyon
File Edit Plot Window
09:00 Jun 17, 2004
Canyon
ft
950
940
930
920
910
900
6-17-2004 6-19-2004 6-21-2004 6-23-2004 6-25-2004
Pool Elevation
Top of Conservation Pool
Top of Flood Pool
cfs
80000
60000
40000
20000
0
6-17-2004 6-19-2004 6-21-2004 6-23-2004 6-25-2004
Outflow
Regulation Discharge
Inflow
Select Plot Page
Order: Custom
Canyon
New Braunfels Flow
Gonzales Flow
Cuero Flow
Victoria Flow
Center at Date/Time
New...
Edit...

CWMS "Compute"

- Each model is run in sequential order
- Data is automatically loaded
  - Input data from previous model
  - Output data sent to the next model
- All models use HEC-DSS for data transfer
- RiverWare uses DSS Database DMIs



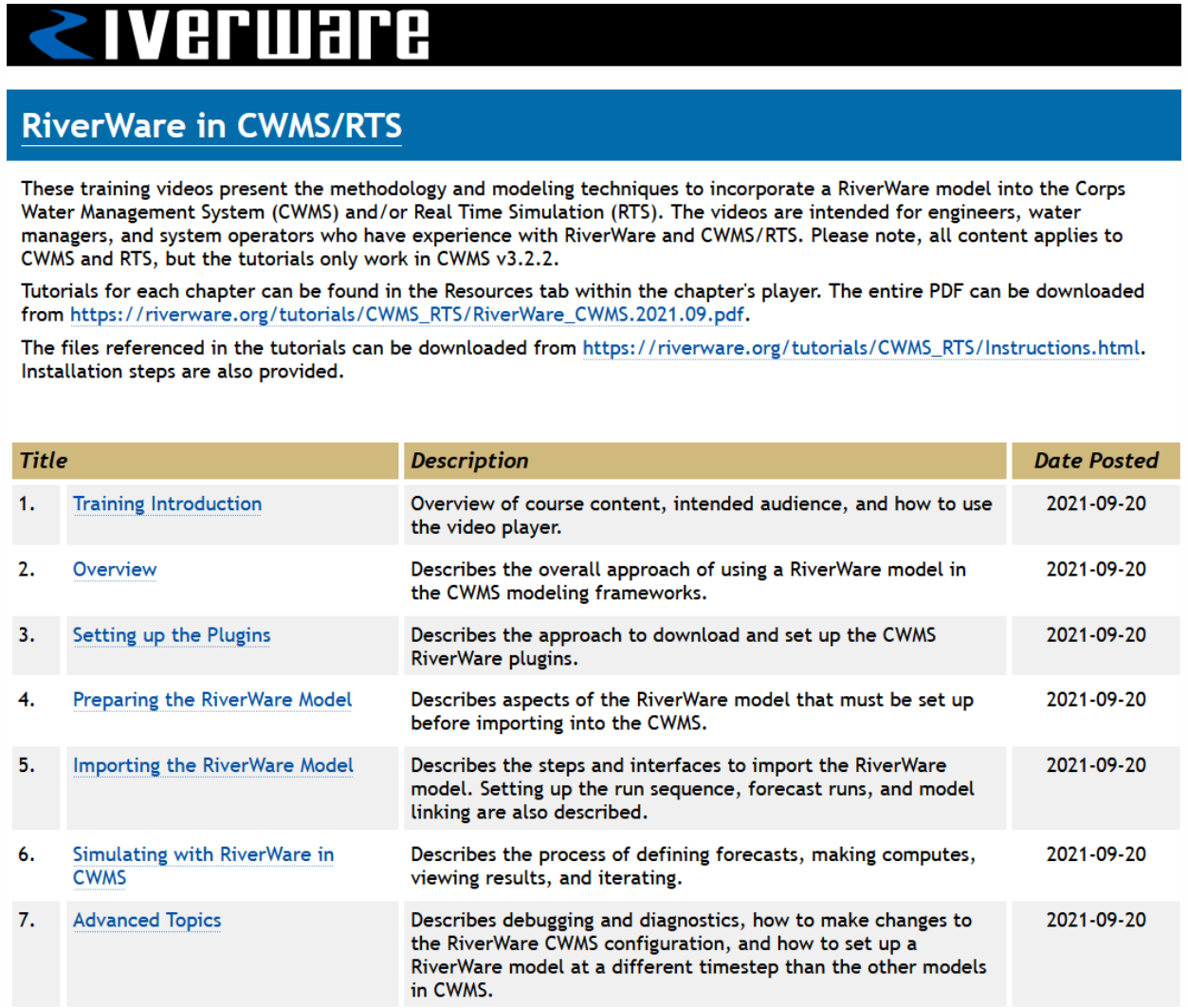
Aggregation / Disaggregation



- Methodology developed to run RiverWare model at different timestep size than CWMS model.
- Run daily RiverWare model in an hourly CWMS/RTS study
- Hasn’t been tested extensively

Training Modules

- Video training modules on https://riverware.org/tutorials/CWMS_RTS/index.html



RiverWare

RiverWare in CWMS/RTS

These training videos present the methodology and modeling techniques to incorporate a RiverWare model into the Corps Water Management System (CWMS) and/or Real Time Simulation (RTS). The videos are intended for engineers, water managers, and system operators who have experience with RiverWare and CWMS/RTS. Please note, all content applies to CWMS and RTS, but the tutorials only work in CWMS v3.2.2.

Tutorials for each chapter can be found in the Resources tab within the chapter's player. The entire PDF can be downloaded from https://riverware.org/tutorials/CWMS_RTS/RiverWare_CWMS.2021.09.pdf.

The files referenced in the tutorials can be downloaded from https://riverware.org/tutorials/CWMS_RTS/Instructions.html. Installation steps are also provided.

	Title	Description	Date Posted
1.	Training Introduction	Overview of course content, intended audience, and how to use the video player.	2021-09-20
2.	Overview	Describes the overall approach of using a RiverWare model in the CWMS modeling frameworks.	2021-09-20
3.	Setting up the Plugins	Describes the approach to download and set up the CWMS RiverWare plugins.	2021-09-20
4.	Preparing the RiverWare Model	Describes aspects of the RiverWare model that must be set up before importing into the CWMS.	2021-09-20
5.	Importing the RiverWare Model	Describes the steps and interfaces to import the RiverWare model. Setting up the run sequence, forecast runs, and model linking are also described.	2021-09-20
6.	Simulating with RiverWare in CWMS	Describes the process of defining forecasts, making computes, viewing results, and iterating.	2021-09-20
7.	Advanced Topics	Describes debugging and diagnostics, how to make changes to the RiverWare CWMS configuration, and how to set up a RiverWare model at a different timestep than the other models in CWMS.	2021-09-20

HEC – WAT

- **W**atershed **A**nalysis **T**ool
- Planning version of CWMS/RTS
- v1.1 released 9/2021
  - No Flood Risk Analysis (FRA) computes
- v1.2 to be released 9/2023
  - Includes FRA computes – Monte Carlo simulation for uncertainty
  - Needs realistic testing: WAT study with RiverWare model and FRA compute

Questions

- What is needed from these tools?
- Who is using CWMS or RTS?
- Who is using WAT?