



Center for Advanced Decision Support for
Water and Environmental Systems (CADSWES)

UNIVERSITY OF COLORADO **BOULDER**

New Features: Model Comparison Tool Workspace Enhancements Online Help Delivery

**2019 RiverWare User Group Meeting
Mitch Clement**

Model Comparison & Version Control

Complex Models

Evolve in time + Collaborative



Challenges

- Behavior attribution
- Parallel development
- Tandem models
- Reproducibility
- Recovery
- Change tracking



Solutions

- Understand differences between versions
- Retain history of all model file versions

Model Comparison Tool

Displays differences for two versions of a model

The screenshot shows the Model Comparison Tool interface. At the top, it displays the models being compared: A: MightyBuffaloSampleBasin.v2.mdl (Source: Open Model) and B: MightyBuffaloSampleBasin.v6.mdl (Source: Model File). Below this, the Comparison Results section shows a search and filter results table. The table has columns for Name, Status, and Type. The selected property is Buffalo Flood Control - Statements. The difference is highlighted in orange, showing a change in the IF statement logic for the Buffalo.Outflow rule.

Name	Status	Type
Fraction Return Flow Scal...	B	Scalar Slot
Name	B	Property
Description	B	Property
Value	B	Property
Fractional Return Flow Hi...	B	Series Slot
Name	B	Property
Description	B	Property
Values	B	Property
Linked Slots	B	Property
Green Valley Reach	A ≠ B	Reach
Outflow	A ≠ B	Series Slot
Linked Slots	A ≠ B	Property
New City	←	ControlPoint
Name	A ≠ B	Property
Mighty Buffalo Basin Rules	A ≠ B	RBS Ruleset
Buffalo Rules	A ≠ B	Policy Group
Buffalo Flood Control	A ≠ B	Rule
Statements	A ≠ B	Property
Channel Capacity	A ≠ B	Rule
Statements	A ≠ B	Property
Mighty Res Rules	A ≠ B	Policy Group
Priorities	A ≠ B	Property
Set Green Valley Fractio...	B	Rule
Name	B	Property
Priority	B	Property
Description	B	Property
Notes	B	Property
Is Enabled	B	Property

Selected Property: Buffalo Flood Control - Statements

A: MightyBuffaloSampleBasin.v2.mdl B: MightyBuffaloSampleBasin.v6.mdl

Located 1 difference Located 1 difference

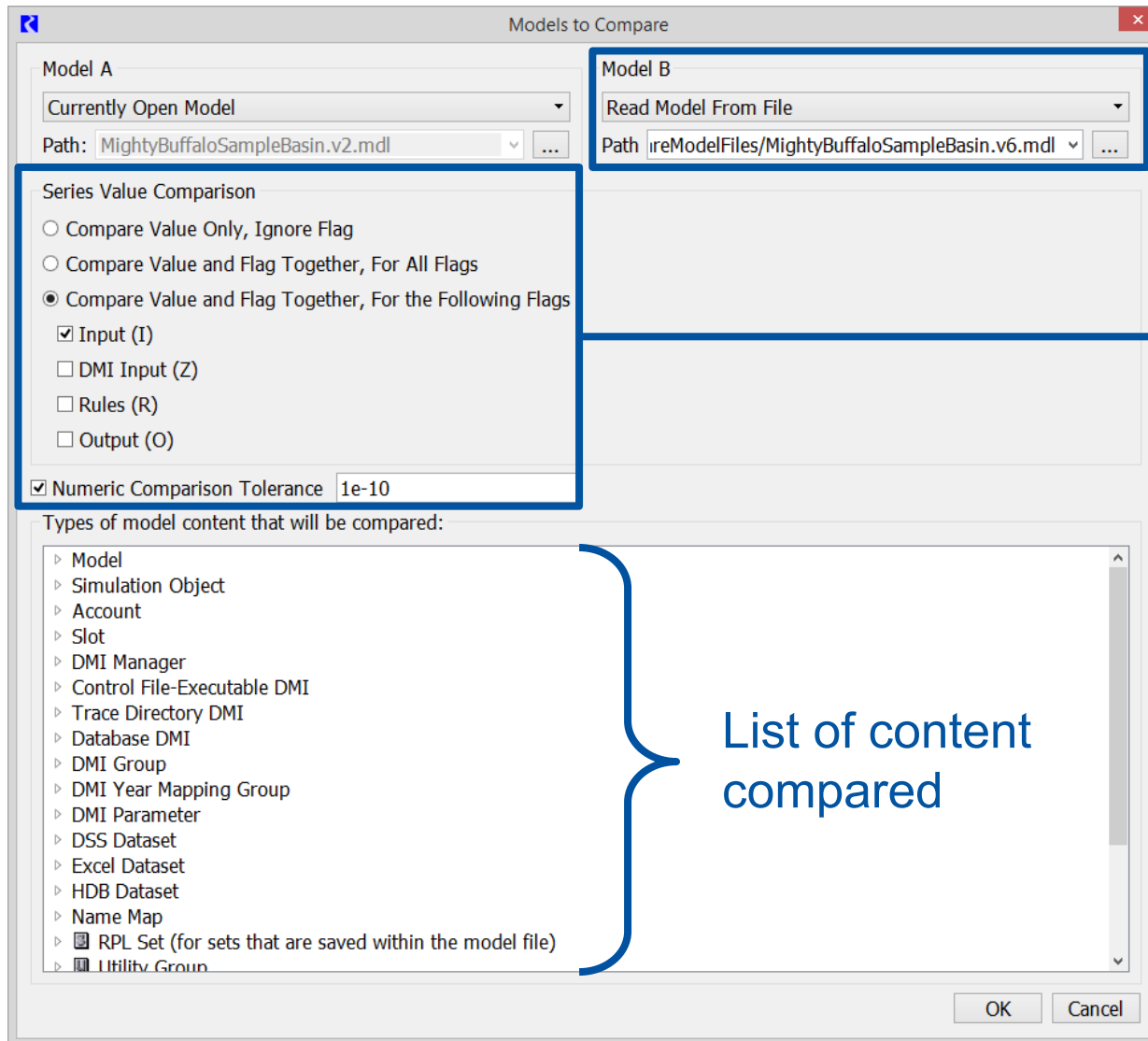
```
Buffalo.Outflow []
= IF ( BuffaloFloodSeason ( )
      AND Buffalo.Pool Elevation [ ]
      > Buffalo.Data.Flood Control Elevation [ ]
      Min
      SolveOutflow
      ( Buffalo ,
        Buffalo.Inflow [ ] ,
        ElevationToStorage
        ( Buffalo ,
          Buffalo.Data.Flood Control Elev
          Buffalo.Storage [ @"t - 1" ] ,
          @"t"
          MaxOut
          ( Buffalo )
        )
      )
END IF
```

```
Buffalo.Outflow []
= IF ( BuffaloFloodSeason ( )
      AND AboveFloodControlElevation
      ( Buffalo )
      THEN
      Min
      SolveOutflow
      ( Buffalo ,
        Buffalo.Inflow [ ] ,
        ElevationToStorage
        ( Buffalo ,
          Buffalo.Data.Flood Control Elev
          Buffalo.Storage [ @"t - 1" ] ,
          @"t"
          MaxOut
          ( Buffalo )
        )
      )
END IF
```

Development History

- 7.0: RPL Set Comparison Tool initial release
- 7.4: Model Comparison Tool initial release
- 7.5: Model Comparison Tool enhancements

Configuring the Comparison



Select a model to compare

Options for how to compare data

List of content compared

Displace Selected Difference

Results panel lists items with differences

Item

Property (selected)

The screenshot shows the Model Comparison Tool interface. At the top, it displays the models being compared: A: MightyBuffaloSampleBasin.v2.mdl (Source: Open Model, Path: D:\RiverWareModelFiles\MightyBuffaloSampleBasin.v2.mdl) and B: MightyBuffaloSampleBasin.v6.mdl (Source: Model File, Path: D:\RiverWareModelFiles\MightyBuffaloSampleBasin.v6.mdl). Below this, the Comparison Results section shows a search filter for 'Green' and a note that 68 items differ. The main area is divided into two panes. The left pane shows a tree view of the model structure with a table of differences. The right pane shows the details of the selected difference.

Name	Status	Type
MightyBuffaloSampleBasin.v2....	A ≠ B	Model
Path	A ≠ B	Property
Version	A ≠ B	Property
Border Gage	A ≠ B	StreamGage
Gage Inflow	A ≠ B	Series Slot
Linked Slots	A ≠ B	Property
City	A →	ControlPoint
Name	A ≠ B	Property
Green Valley	A ≠ B	WaterUser
Fraction Return Flow Scal...	B	Scalar Slot
Name	B	Property
Description	B	Property
Value	B	Property
Fractional Return Flow Hi...	B	Series Slot
Name	B	Property
Description	B	Property
Values	B	Property
Linked Slots	B	Property
Green Valley Reach	A ≠ B	Reach
Outflow	A ≠ B	Series Slot
Linked Slots	A ≠ B	Property
New City	← B	ControlPoint
Name	A ≠ B	Property
Mighty Buffalo Basin Rules	A ≠ B	RBS Ruleset
Buffalo Rules	A ≠ B	Policy Group
Buffalo Flood Control	A ≠ B	Rule
Statements	A ≠ B	Property
Channel Capacity	A ≠ B	Rule
Statements	A ≠ B	Property
Mighty Res Rules	A ≠ B	Policy Group
Priorities	A ≠ B	Property
Set Green Valley Fractio...	B	Rule
Name	B	Property
Priority	B	Property
Description	B	Property

Selected Property: New City - Name
A: MightyBuffaloSampleBasin.v2.mdl
B: MightyBuffaloSampleBasin.v6.mdl
Located 1 difference
New City

Displayed difference

Search and Filter Controls

Search

The screenshot displays the Model Comparison Tool interface. At the top, it shows the models being compared: A: MightyBuffaloSampleBasin.v2.mdl and B: MightyBuffaloSampleBasin.v6.mdl. Below this, the 'Comparison Results' section features a 'Search and Filter Results' box. A blue arrow labeled 'Search' points to the search input field in this box, which contains the text 'Green'. To the right of the search box, a 'Filter ...' button is highlighted, and a status message reads 'Filter applied: displaying only the 68 items that differ between the two models'. A 'Model Comparison Tool Display Filters' dialog box is open, showing filter options: 'Show only items that differ' (checked), 'Type' set to 'Is Series Slot', and 'Name' set to 'Contains Green'. The main comparison results table is visible in the background, listing various model components and their status (A vs B).

Name	Status	Type
MightyBuffaloSampleBasin.v2...	A ≠ B	Model
Path	A ≠ B	Property
Version	A ≠ B	Property
Border Gage	A ≠ B	StreamGage
Gage Inflow	A ≠ B	Series Slot
Linked Slots	A ≠ B	Property
City	A →	ControlPoint
Name	A ≠ B	Property
Green Valley	A ≠ B	WaterUser
Fraction Return Flow Scal...	B	Scalar Slot
Name	B	Property
Description	B	Property
Value	B	Property
Fractional Return Flow Hi...	B	Series Slot
Name	B	Property
Description	B	Property
Values	B	Property
Linked Slots	B	Property
Green Valley Reach	A ≠ B	Reach
Outflow	A ≠ B	Series Slot
Linked Slots	A ≠ B	Property
New City	← B	ControlPoint
Name	A ≠ B	Property
Mighty Buffalo Basin Rules	A ≠ B	RBS Ruleset
Buffalo Rules	A ≠ B	Policy Group
Buffalo Flood Control	A ≠ B	Rule
Statements	A ≠ B	Property
Channel Capacity	A ≠ B	Rule
Statements	A ≠ B	Property
Mighty Res Rules	A ≠ B	Policy Group
Priorities	A ≠ B	Property
Set Green Valley Fractio...	B	Rule
Name	B	Property
Priority	B	Property
Description	B	Property

Filter options

Data Differences: Graphical and Tabular View

Model Comparison Tool

Models
 A: MightyBuffaloSampleBasin.v2.mdl Source: Open Model Path: D:\RiverWareModelFiles\MightyBuffaloSampleBasin.v2.mdl
 B: MightyBuffaloSampleBasin.v6.mdl Source: Model File Path: D:\RiverWareModelFiles\MightyBuffaloSampleBasin.v6.mdl Select Models

Comparison Results
 Search and Filter Results
 Name Contains Ignore Case Filter applied: displaying only the 114 items that differ between the two models

Name	Status	Type
Values	A ≠ B	Property
City	A → B	ControlPoint
Name	A ≠ B	Property
Inflow	A ≠ B	Series Slot
Values	A ≠ B	Property
Outflow	A ≠ B	Series Slot
Values	A ≠ B	Property
Green Valley	A ≠ B	WaterUser
Depletion	A ≠ B	Series Slot
Values	A ≠ B	Property
Fraction Return Flow Scal...	B	Scalar Slot
Name	B	Property
Description	B	Property
Value	B	Property
Fractional Return Flow Hi...	B	Series Slot
Name	B	Property
Description	B	Property
Values	B	Property
Linked Slots	B	Property
Incoming Available Water	A ≠ B	Series Slot
Values	A ≠ B	Property
Return Flow	A ≠ B	AggSeries Slot
Values	A ≠ B	Property
Green Valley Reach	A ≠ B	Reach
Available For Diversion	A ≠ B	Series Slot
Values	A ≠ B	Property
Inflow	A ≠ B	Series Slot
Values	A ≠ B	Property
Outflow	A ≠ B	Series Slot
Values	A ≠ B	Property
Linked Slots	A ≠ B	Property
Return Flow	A ≠ B	MultiSlot

Selected Property: Outflow - Values
 A: MightyBuffaloSampleBasin.v2.mdl B: MightyBuffaloSampleBasin.v6.mdl
 Located 121 different rows Located 121 different rows

Date	Value (A)	Value (B)
03-27-1996 Wed	500.00	500.00
03-28-1996 Thu	500.00	500.00
03-29-1996 Fri	500.00	500.00
03-30-1996 Sat	500.00	500.00
03-31-1996 Sun	500.00	500.00
04-01-1996 Mon	500.00	500.00
04-02-1996 Tue	705.31	677.10
04-03-1996 Wed	568.95	540.74
04-04-1996 Thu	500.00	500.00
04-05-1996 Fri	500.00	500.00
04-06-1996 Sat	500.00	500.00
04-07-1996 Sun	505.92	500.00
04-08-1996 Mon	605.61	577.40
04-09-1996 Tue	905.86	877.64

Close

Compares Embedded RPL Sets

Model Comparison Tool

Models
A: MightyBuffaloSampleBasin.v2.mdl Source: Open Model Path: D:\RiverWareModelFiles\MightyBuffaloSampleBasin.v2.mdl
B: MightyBuffaloSampleBasin.v6.mdl Source: Model File Path: D:\RiverWareModelFiles\MightyBuffaloSampleBasin.v6.mdl Select Models

Comparison Results
Search and Filter Results
Name Contains Ignore Case Filter ... Filter applied: displaying only the 68 items that differ between the two models

Name	Status	Type
Values	B	Property
Linked Slots	B	Property
Green Valley Reach	A ≠ B	Reach
Outflow	A ≠ B	Series Slot
Linked Slots	A ≠ B	Property
New City	← B	ControlPoint
Name	A ≠ B	Property
Mighty Buffalo Basin Rules	A ≠ B	RBS Ruleset
Buffalo Rules	A ≠ B	Policy Group
Buffalo Flood Control	A ≠ B	Rule
Statements	A ≠ B	Property
Channel Capacity	A ≠ B	Rule
Statements	A ≠ B	Property
Mighty Res Rules	A ≠ B	Policy Group
Priorities	A ≠ B	Property
Set Green Valley Fractio...	B	Rule
Name	B	Property
Priority	B	Property
Description	B	Property
Notes	B	Property
Is Enabled	B	Property
Execution Constraint	B	Property
Pre-execution DMI Na...	B	Property
Post-execution DMI N...	B	Property
External Documentati...	B	Property
Stop On NaN	B	Property

Selected Property: Buffalo Flood Control - Statements
A: MightyBuffaloSampleBasin.v2.mdl B: MightyBuffaloSampleBasin.v6.mdl
Located 1 difference Located 1 difference

```
Buffalo.Outflow []  
= IF ( BuffaloFloodSeason () ) THEN  
  AND Buffalo.Pool Elevation []  
  > Buffalo.Data.Flood Control Elevation []  
  Min  
  SolveOutflow  
  ( Buffalo ,  
    Buffalo.Inflow [] ,  
    ElevationToStorage  
    ( Buffalo ,  
      Buffalo.Data.Flood Control Elevation [] ) )  
  Buffalo.Storage [ @"t - 1" ] ,  
  @"t"  
  MaxOut  
  ( Buffalo )  
END IF
```

```
Buffalo.Outflow []  
= IF ( BuffaloFloodSeason () ) THEN  
  AND AboveFloodControlElevation  
  ( Buffalo )  
  Min  
  SolveOutflow  
  ( Buffalo ,  
    Buffalo.Inflow [] ,  
    ElevationToStorage  
    ( Buffalo ,  
      Buffalo.Data.Flood Control Elevation [] ) )  
  Buffalo.Storage [ @"t - 1" ] ,  
  @"t"  
  MaxOut  
  ( Buffalo )  
END IF
```

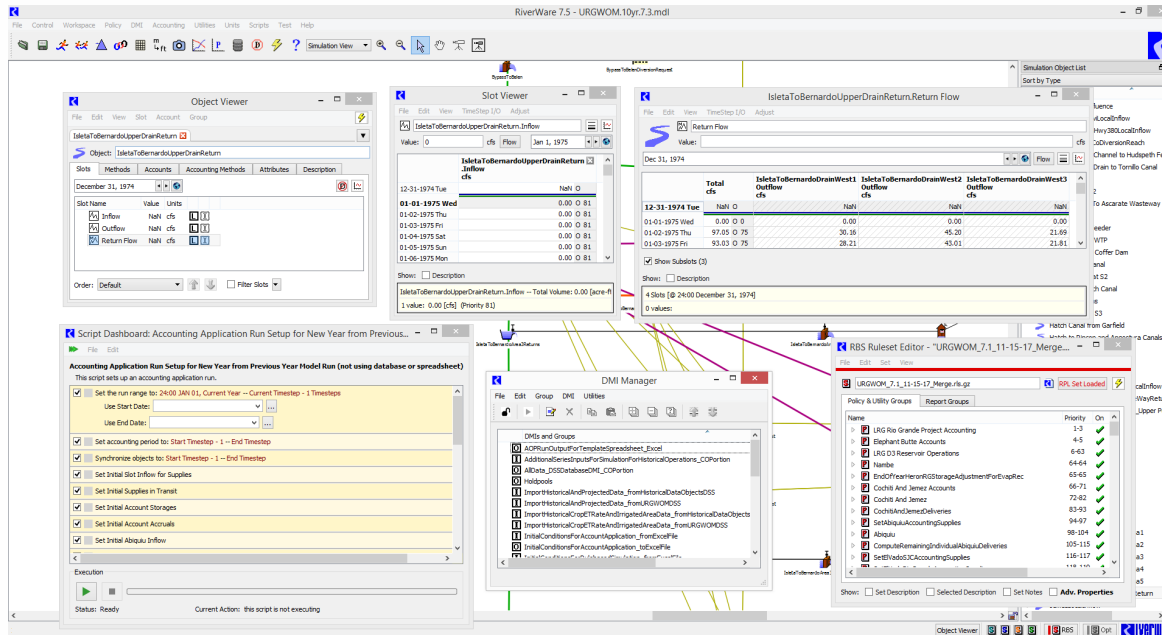
Close

Possible Model Comparison Tool Future Enhancements

- Extend comparison content
 - MRM configurations
 - Model parameters
 - Scripts
- Synchronized scrolling of property difference panels
- Additional usability features

Windowing Challenges for Multi-window Applications

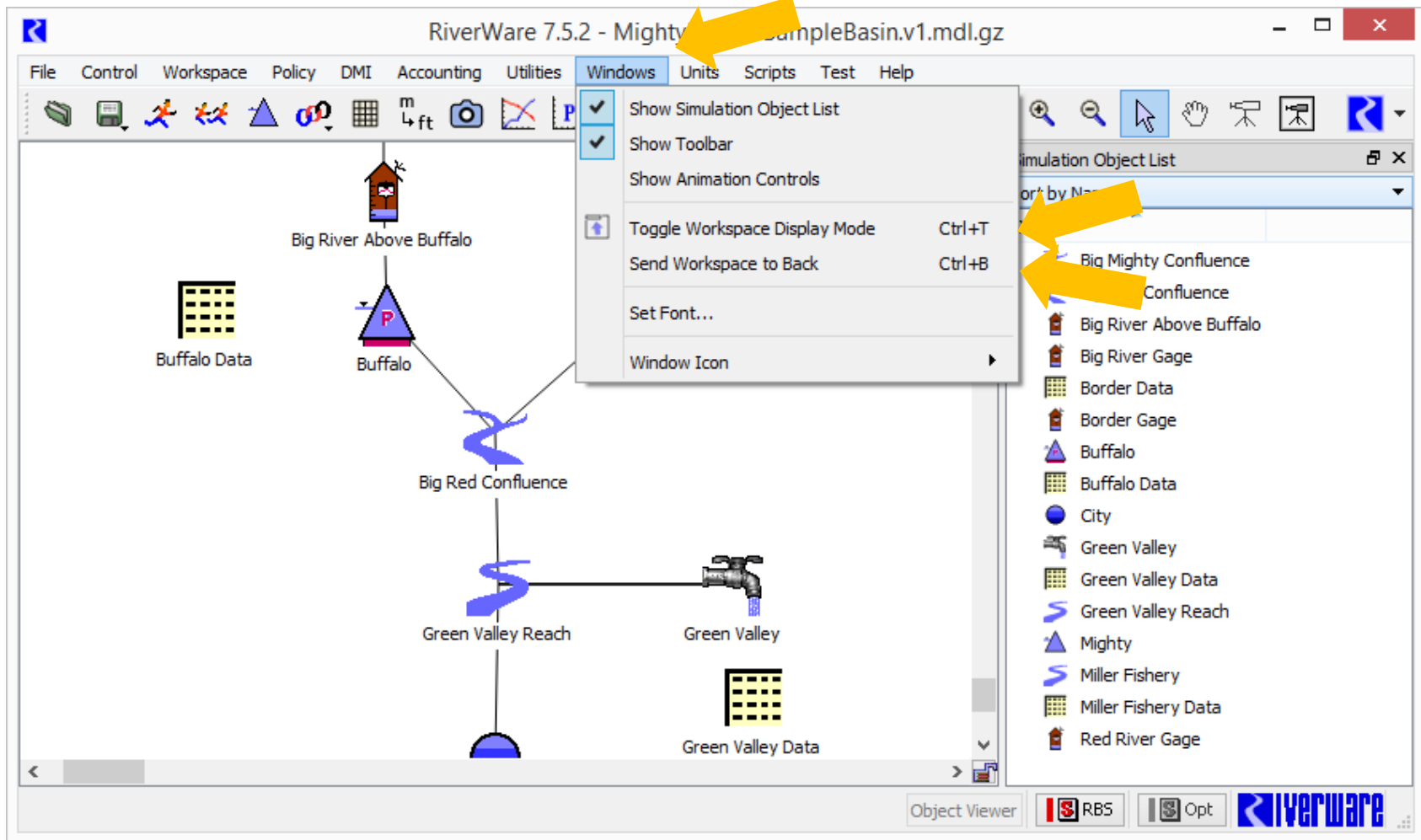
- Window overlap: workspace obscures other windows
- Window identification: which model is this Object Viewer for?



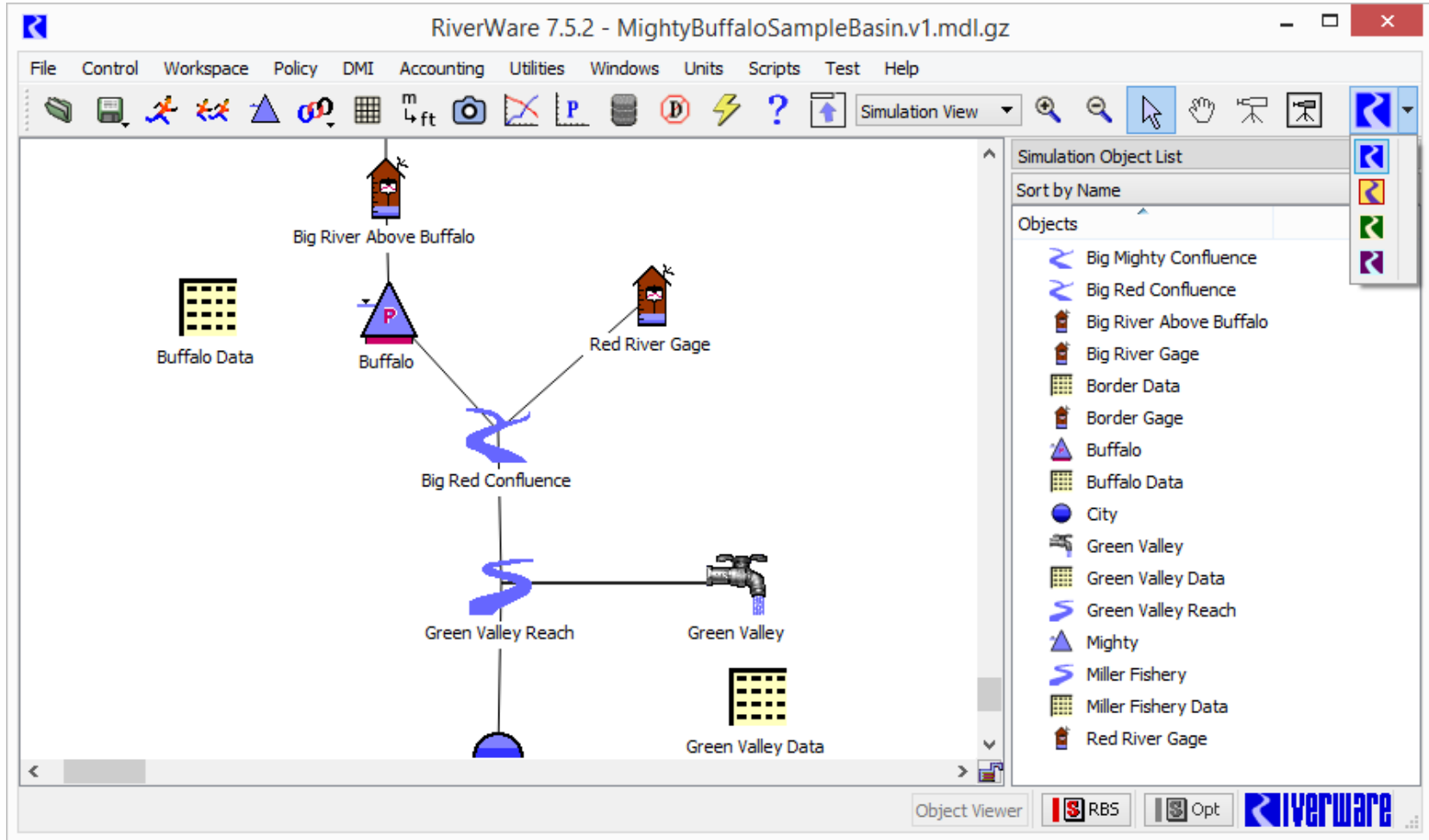
Enhancements

- Moved Workspace Windows menu
- Send Workspace to Back
- Workspace Display Mode
- Icon Color toolbar menu button
- Save Model toolbar menu button
- Per-Process taskbar button grouping

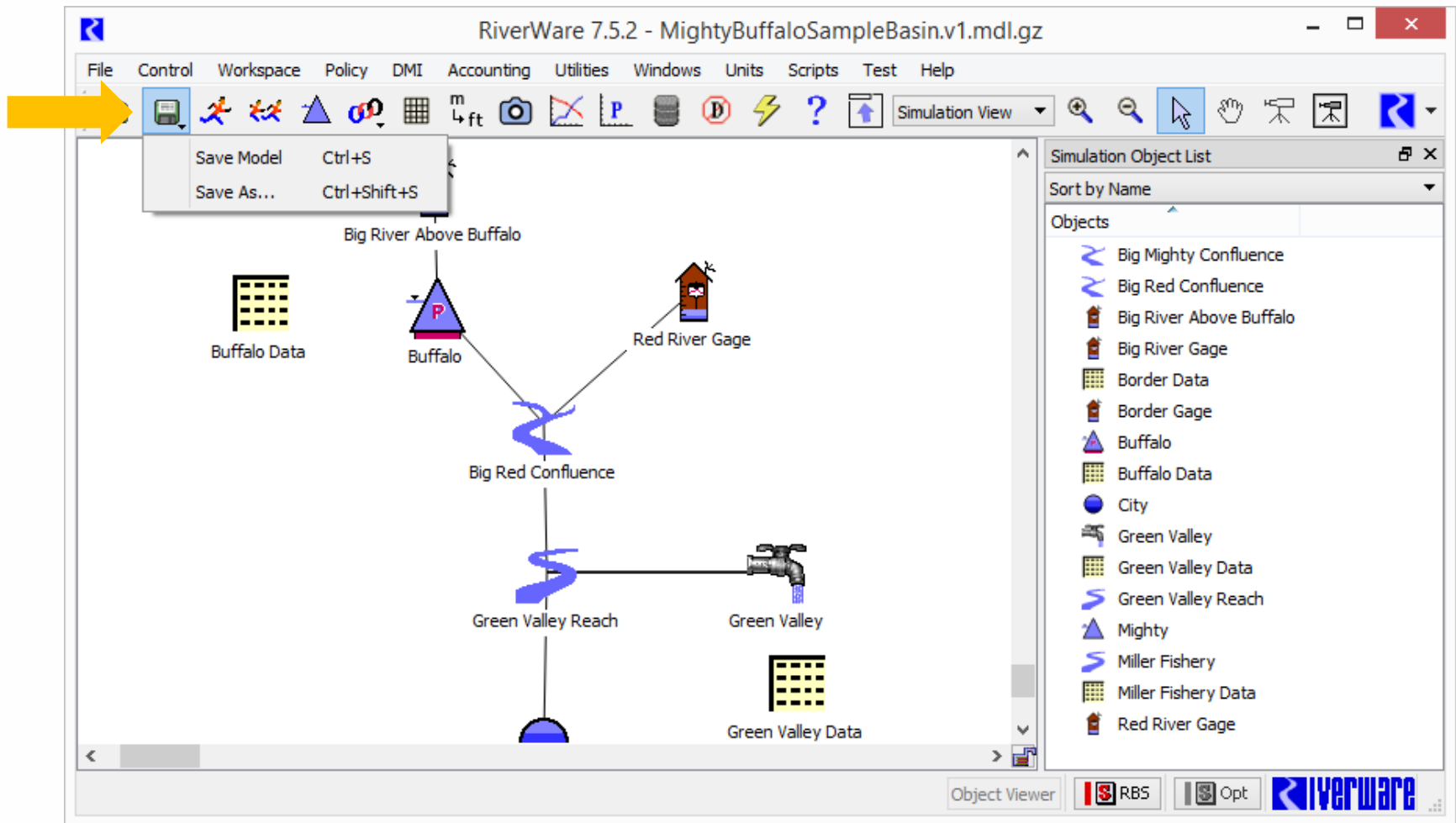
Top-Level Windows Menu



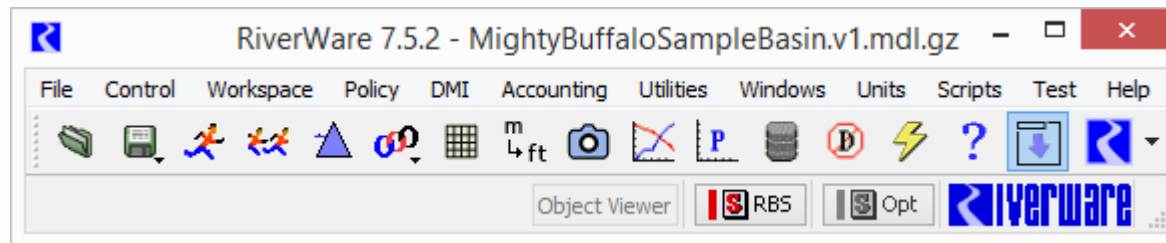
Icon Color Toolbar Menu Button



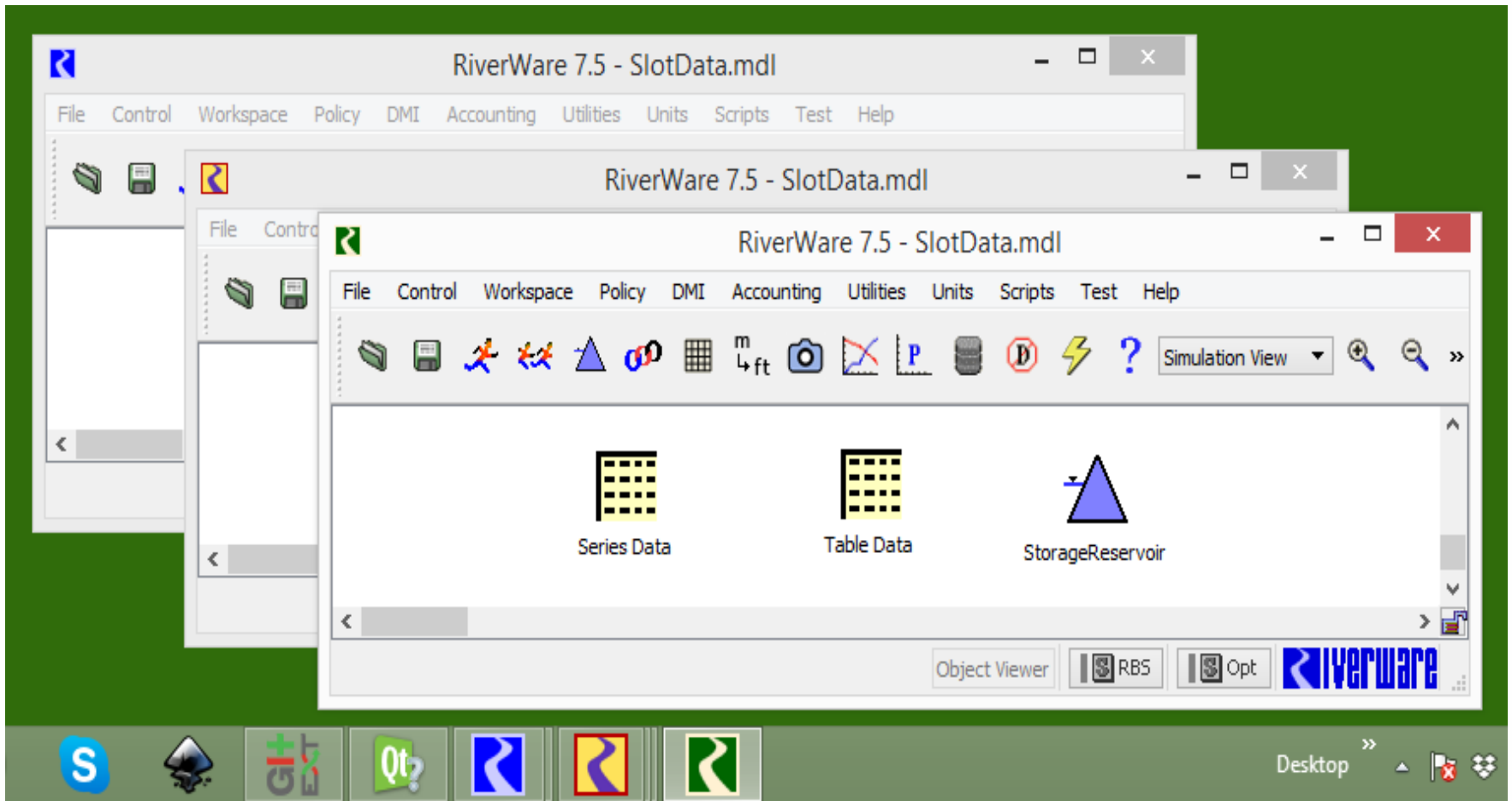
Save Model Toolbar Menu Button



Workspace Compact Display Mode



Per-Process Taskbar Icon Grouping



Additional Suggestions

- Configure Windows Layout
- User Preferences Manager
- Docking in workspace for additional windows
- Model Name menu button for main windows

Online Help: Browser-based

The screenshot shows a web browser window displaying the RiverWare 7.5 Documentation. The browser's address bar shows the file path: `file:///C:/Program Files/CADSWES/RiverWare 7.5.2/Help/index.html`. The website has a blue header with the RiverWare logo and a search bar. A left-hand navigation menu lists various topics such as 'Model Building Quick Start', 'User Interface', 'Solution Approaches', 'Objects and Methods', 'RiverWare Policy Language (RPL)', 'Output Utilities and Data Visualization', 'Data Management Interface (DMI)', 'Debugging and Analysis', 'Automation Tools', 'Accounting', 'Optimization', 'Water Quality', 'USACE-SWD Modeling Techniques', 'Release Notes', and 'RiverWISE'. The main content area is titled 'Version 7.5 Documentation' and contains three highlighted sections:

- RiverWare User's Guides**
 - [Model Building Quick Start](#)
 - [User Interface](#)
 - [Solution Approaches](#)
 - [Objects and Methods](#)
 - [RiverWare Policy Language \(RPL\)](#)
 - [Output Utilities and Data Visualization](#)
 - [Data Management Interface \(DMI\)](#)
 - [Debugging and Analysis](#)
 - [Automation Tools](#)
 - [Accounting](#)
 - [Optimization](#)
 - [Water Quality](#)
 - [USACE-SWD Modeling Techniques](#)
- RiverWare Release Notes**
 - [Release Notes, Version 7.5: What's New in RiverWare?](#)
 - [Release Notes Prior to Version 7.5](#)
- RiverWISE**
 - [RiverWISE Model Developer's Guide](#)
 - [RiverWISE Stakeholder's Guide](#)

A large blue bracket on the right side of the page groups these three sections under the text 'Reorganized Help content'. At the bottom of the page, there is a 'Contact us' section with the email address `riverware-support@colorado.edu` and a footer with the text '© The Regents of the University of Colorado' and 'Center for Advanced Decision Support for Water and Environmental Systems'.