

Integrating RiverWare into CWMS

Corps Water Management System

US Army Corps of Engineers
Hydrologic Engineering Center



Participants

- Corps district offices
 - Ft. Worth
 - Little Rock
 - Albuquerque
 - Tulsa
 - KansasCity
- CADSWES
- HEC

What is CWMS?

- The Corps Water Management System
 - Data Acquisition, Visualization, Storage, and Management
 - Data Streams – Gages, USGS, NWS, ...
 - Data Storage and Management
 - Oracle & HEC-DSS
 - Watershed Modeling for Real-Time Operational Decision Making

Requirement Highlights

- RiverWare – DSS interface
- Add RiverWare to list of CWMS default models in all relevant CWMS editors
- RiverWare execution in CWMS forecast
- Pre-configured CWMS icons for RiverWare objects
- Time-series editor for RiverWare inputs
- Access to RiverWare user interface from CWMS
- RiverWare-specific plots and reports in CWMS

Activities to Date

- Functional Requirements Statement
- High-Level design document
- Programming Tasks Completed
 - HEC-DSS interface in RiverWare
 - CWMS CAVI supports Plug-in modules
 - Basic RiverWare Plug-in developed

RiverWare in CWMS Editors

The image displays four overlapping windows from the CWMS software interface:

- Model Forecast Alternative Editor:** Shows a configuration for an existing alternative. The table below lists the program and forecast alternative.
- Create Forecast Alternative:** A dialog for creating a new alternative, currently set to 'Existing' configuration. It contains a table with one row: --R--.
- Program Sequence:** A table defining the sequence of programs and their default inputs.
- Riverware Alternative Editor:** A dialog for editing a specific alternative named 'RWAlt1', with fields for description, model file, rule set, and DMI.

Program	Model Forecast Alternative
Riverware	Riverware Alt 1

Name	Key	Description
--R--	--R--	

	Programs	Default Input
1	MFP	
2	HMS	1 MFP
3	Riverware	2 HMS
4	RAS	3 Riverware
5	FIA	3 Riverware

Riverware Alternative Editor

Alternative: RWAlt1 (2 of 2)

Description:

Model File:

Rule Set:

Input DMI:

Output DMI:

Buttons: OK, Apply, Cancel

RiverWare: Time Series Editor

The screenshot displays the RiverWare software interface. The main window, titled "CWMS CAVI - HEC65 V1.3 q0pd - NorthBranch_PS10", shows a map of a river network with various gauging stations marked. A green arrow points from a station labeled "Marion" on the map to the Graphical Editor window.

The Graphical Editor window, titled "Graphical Editor", shows a time series plot of "Stage (ft)" versus "Feb2004". The plot displays a blue line representing the observed stage, which starts at approximately 7.62 ft on Feb 13, drops to about 7.48 ft on Feb 15, and then fluctuates between 7.25 ft and 7.45 ft through Feb 24. A green shaded area highlights the data for Feb 13.

Below the plot is a data table with the following columns: Date/Time, Original (ft), Estimate/Entry (ft), Revised (ft), and buttons for Estimate, Estimate All, Accept, Accept All, Add, and Delete.

Date/Time	Original (ft)	Estimate/Entry (ft)	Revised (ft)	Buttons
12Feb2004, 12:00	7.62	--	7.62	Estimate
12Feb2004, 13:00	7.62	--	7.62	Estimate All
12Feb2004, 14:00	7.62	--	7.62	Accept
12Feb2004, 15:00	7.62	--	7.62	Accept All
12Feb2004, 16:00	7.62	--	7.62	Add
12Feb2004, 17:00	7.61	--	7.61	Delete
12Feb2004, 18:00	7.61	--	7.61	
12Feb2004, 19:00	7.61	--	7.61	
12Feb2004, 20:00	7.62	--	7.62	
12Feb2004, 21:00	7.61	--	7.61	
12Feb2004, 22:00	7.62	--	7.62	

Coordinates: -255232 east, 4060984 north Remote Workspace NorthBranch_PS10 opened

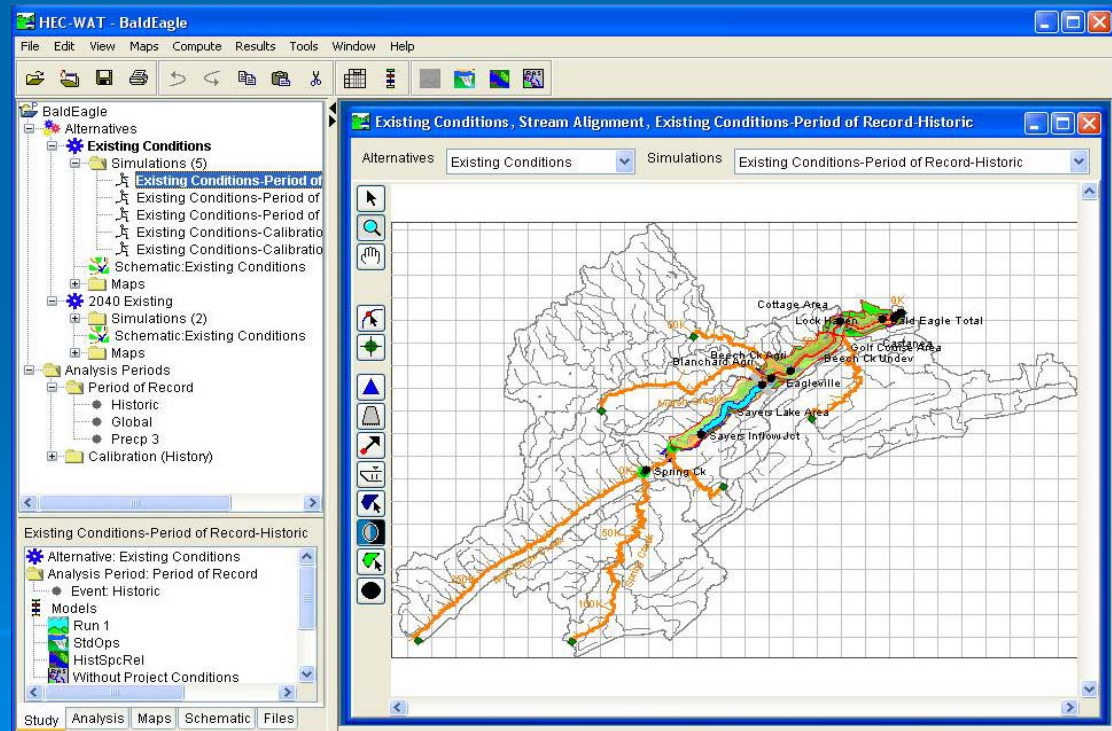
Launch RiverWare GUI

The image displays two overlapping windows from the RiverWare 4.5 software interface. The background window, titled "CWMS CAVI - HEC65 V1.3 q0pd - NorthBranch_PS10", shows a map of a river basin with various sub-basins and gauging stations. The map includes labels for "Wills Creek", "Cumberland", "Ridgely", "Pinto", "Savage", "MD Rural", "Pinto", "WV Rural", "Fiedmont", "New Creek", "Parkinson Creek", and "50K". The status bar at the bottom indicates "Coordinates: -229301 east, 4148370 north" and "Remote Workspace NorthBranch_PS10 opened".

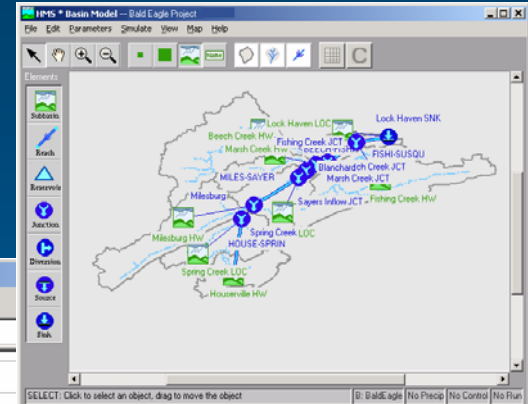
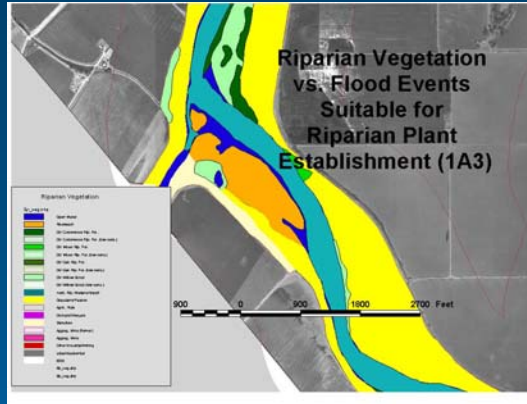
The foreground window, titled "RiverWare 4.5 - Neosho.mdl", displays a schematic diagram of the model structure. The diagram shows a network of nodes and connections. Nodes include "Marion", "Council Grove", "Marion Data", "Council Grove Data", "Council Grove_Americus", "Americus", "Americus_JohnRedmond", "John Red", "John Redmond Outflow", "John Redmond_Iola", "John Redmond Data", "Iola", "Florence", "Florence_Plymouth", "Plymouth", "Plymouth_JohnRedmond", "Neosho_Cottonwood", "Marion_Florence", "Marion Outflow", and "Council Grove Outflow". The status bar at the bottom of this window shows a "Compute Storm - Normal Ops" button and a "Scripts" area.

Potential Integration into Watershed Analysis Tool HEC-WAT

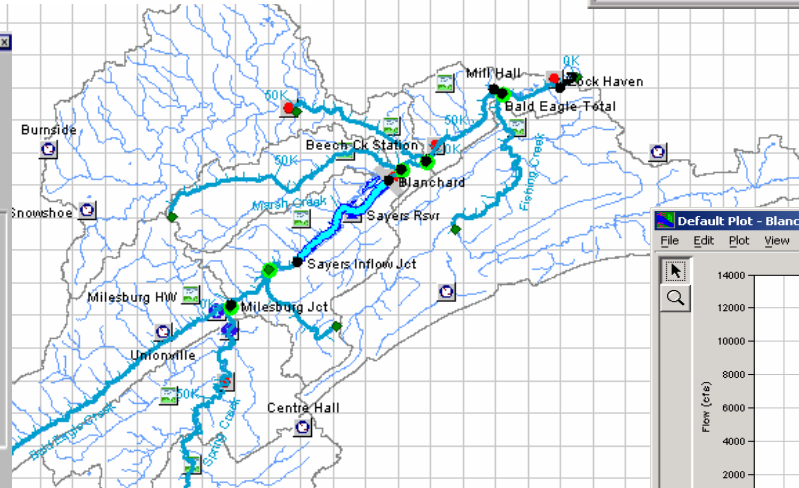
- HEC-WAT is a program that integrates models and provides for coordination and analysis for water resource studies.
- Provide a central organized repository of data / models / results.
- Designed to be used for multi-group and multi-agency as well as well as a single entity.
- Currently integrates major HEC programs, such as HMS, RAS, ResSim, etc.
- Visualization tools to compare alternatives
- Status:
 - Completing beta version
 - Peer review Spring '06
 - Documentation Summer '06
 - Beta release and distribution Fall '06



Environmental



Hydrology



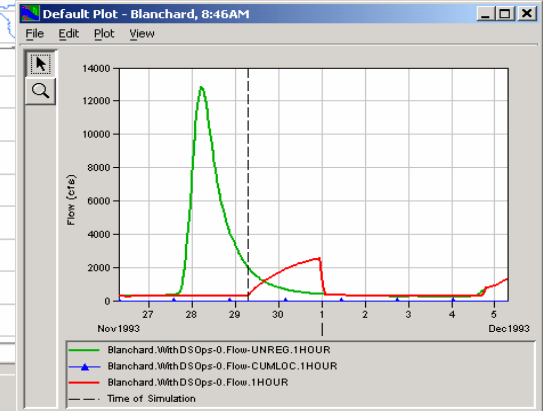
Damage by Analysis Year

Modesto
Expected Annual Damage Reduced and Distributed
for the Levee R2-3 200yr
and for Analysis Year 2000
(Damage in \$)

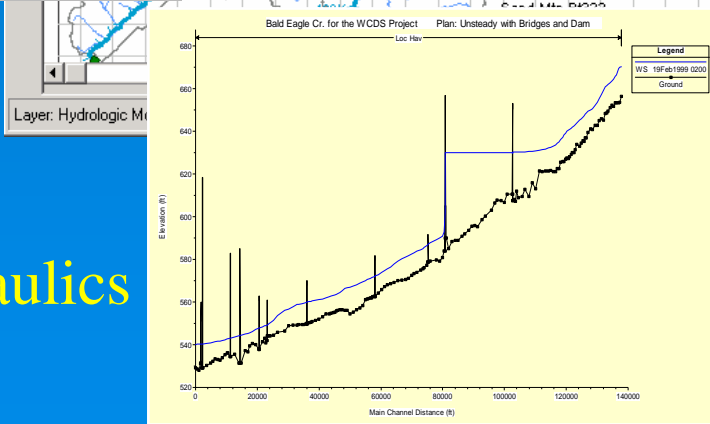
Plan was calculated with Uncertainty

Stream Name	Stream Description	Damag. Name	Damage R. Description	Expected Annual Damage			Probability Damage Reduced Exceedence Indicated Value			
				Total Without Project	Total With Project	Damage Reduced	75	50	25	
Tusolome	Stream 3 description	*T1R		268.11	268.11	0.00	0.00	0.00	0.00	
				40953.66	40953.66	0.00	0.00	0.00	0.00	
				153.16	122.31	30.84	23.18	41.17	33.21	
				277.97	155.34	122.63	109.37	137.83	128.89	
				127.87	118.59	9.27	3.69	13.30	11.27	
				1345.00	141.63	1203.45	1175.48	1250.97	1232.61	
Dry Creek	Stream 5 description	*DC 1		6.04	6.04	0.00	0.00	0.00	0.00	
				62.25	62.25	0.00	0.00	0.00	0.00	
				42294.14	40927.94	1366.20	1311.72	1423.28	1405.99	
				3460.43	3460.43	0.00	0.00	0.00	0.00	
Total for stream Tuol.										
Total for stream Dry										

**** - Computations have not been completed.
 * - Something has changed and computations need to be redone.



Flood Damage

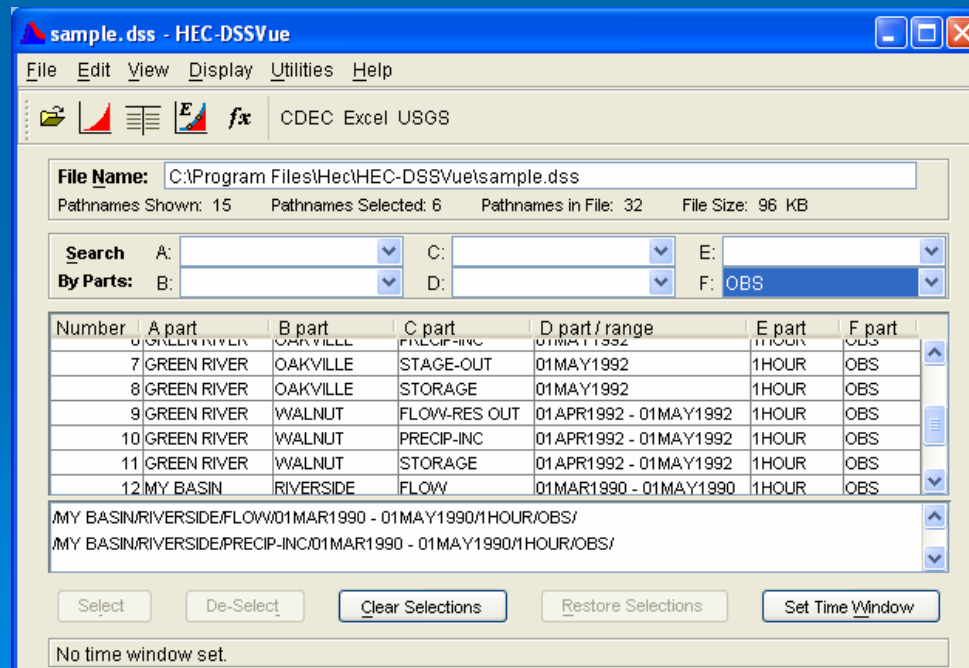


Hydraulics

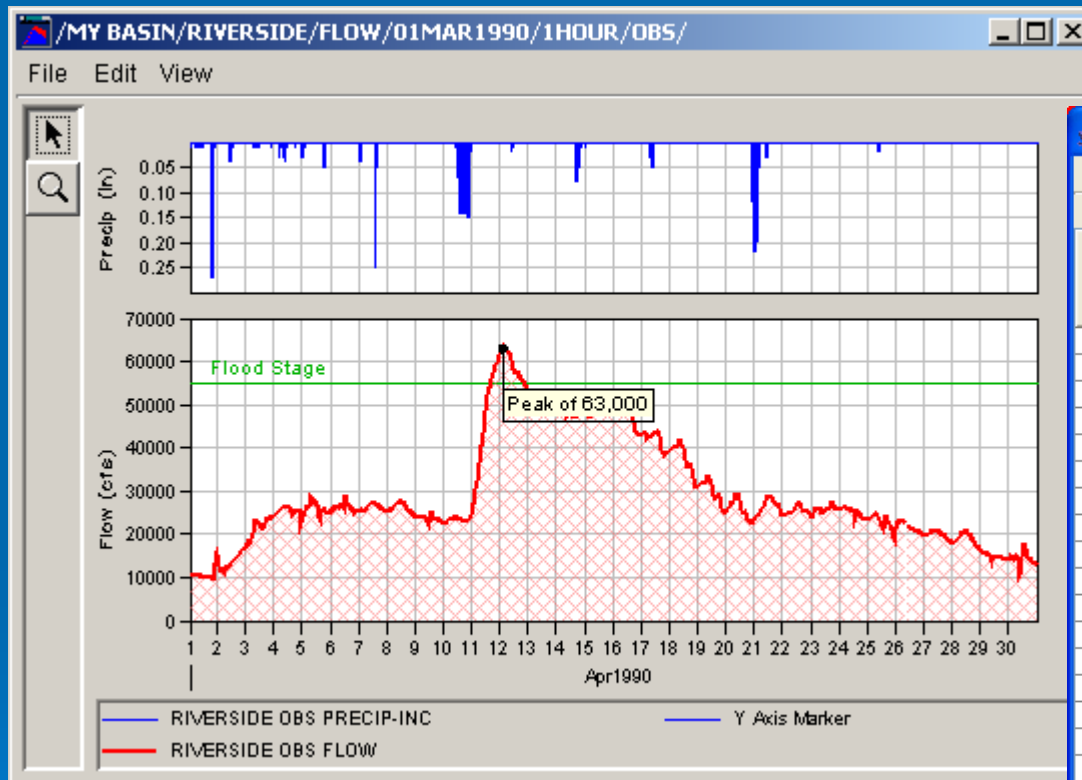
Reservoir

HEC-DSS Vue

- Graphical User Interface for HEC-DSS.
- Includes plot, tabulate, edit, math, and utility functions.
- Fully supported on MS Windows, Sun Solaris, and Linux.
- Available (for free) from HEC's web site:
<http://www.hec.usace.army.mil>

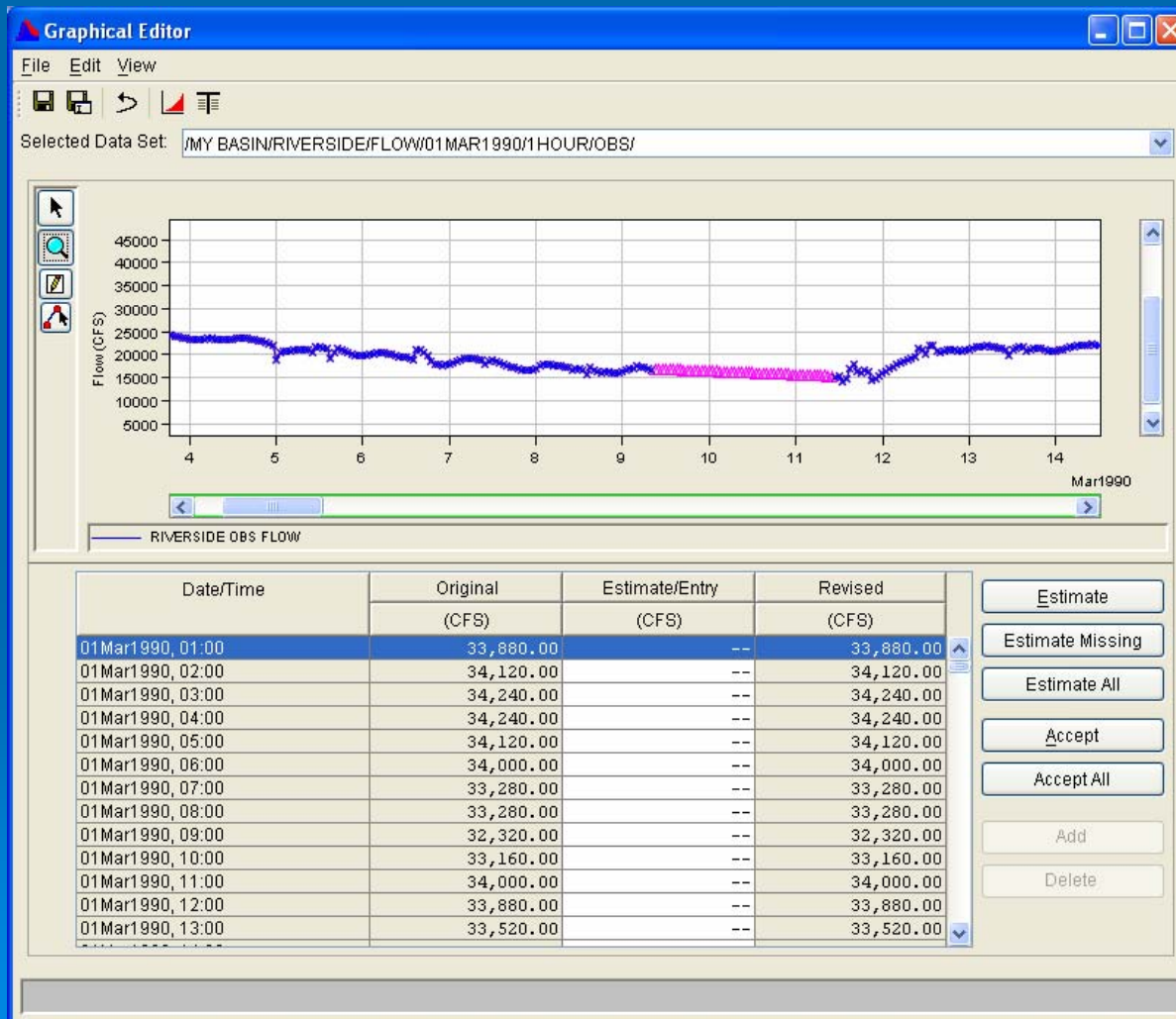


HEC-DSS Vue Data Display



Ordinate	Date	Time	RIVERSIDE PRECIP-INC OBS	RIVERSIDE FLOW OBS
Units			INCHES	CFS
Type			PER-CUM	INST-VAL
1	01 Mar 1990	01:00	0.00	33880
2	01 Mar 1990	02:00	0.00	34120
3	01 Mar 1990	03:00	0.00	34240
4	01 Mar 1990	04:00	0.00	34240
5	01 Mar 1990	05:00	0.00	34120
6	01 Mar 1990	06:00	0.00	34000
7	01 Mar 1990	07:00	0.00	33280
8	01 Mar 1990	08:00	0.00	33280
9	01 Mar 1990	09:00	0.00	32320
10	01 Mar 1990	10:00	0.00	33160
11	01 Mar 1990	11:00	0.00	34000
12	01 Mar 1990	12:00	0.00	33880
13	01 Mar 1990	13:00	0.00	33520
14	01 Mar 1990	14:00	0.00	33280
15	01 Mar 1990	15:00	0.00	32800
16	01 Mar 1990	16:00	0.00	32320
17	01 Mar 1990	17:00	0.00	31960
18	01 Mar 1990	18:00	0.00	31600
19	01 Mar 1990	19:00	0.00	31120
20	01 Mar 1990	20:00	0.00	30560
21	01 Mar 1990	21:00	0.00	30230
22	01 Mar 1990	22:00	0.00	30010
23	01 Mar 1990	23:00	0.00	29680

Graphical Editing



Data Entry

Manual Time Series Data Entry

Pathname Parts

A: GREEN RIVER B: RIVER SIDE C: FLOW

D: E: 1DAY F: SIMULATED

Pathname: /GREEN RIVER/RIVER SIDE/FLOW/1DAY/SIMULATED/

Start Date: 01Jan2000 Units: CFS

Start Time: 2400 Type: INST-VAL

Paste

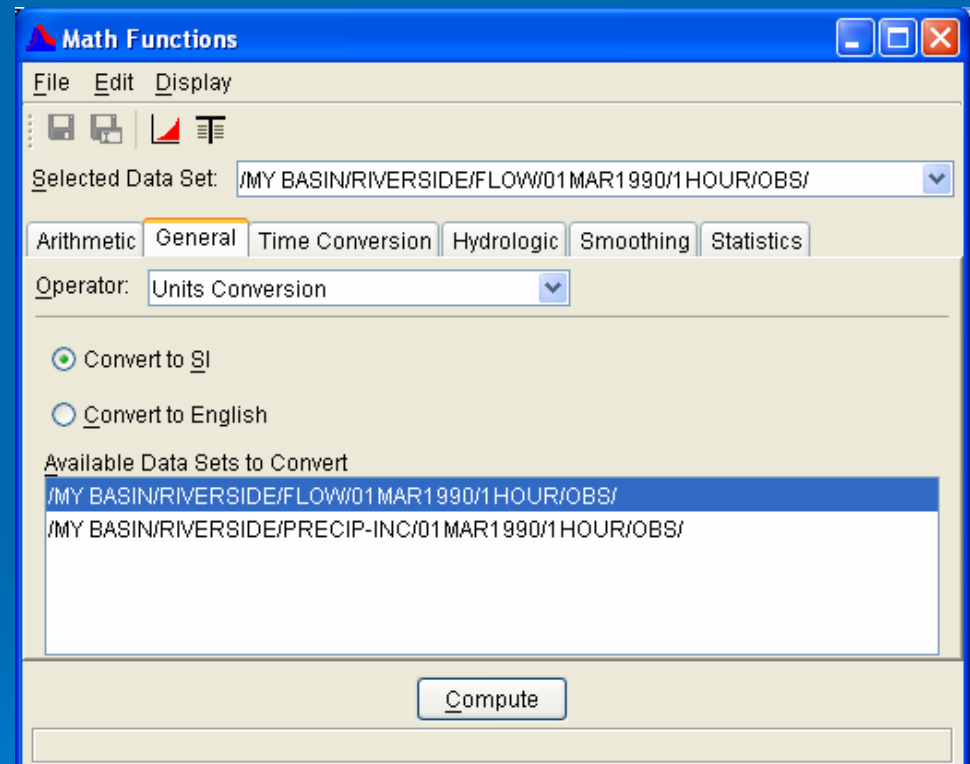
Manual Entry

Ordinate	Date / Time	RIVER SIDE FLOW SIMULATED
10	10 Jan 2000 24:00	2778
11	11 Jan 2000 24:00	3116
12	12 Jan 2000 24:00	3475
13	13 Jan 2000 24:00	3775
14	14 Jan 2000 24:00	4030
15	15 Jan 2000 24:00	
16	16 Jan 2000 24:00	
17	17 Jan 2000 24:00	

Plot Graphically Edit Save Cancel

Math Functions

- Over 50 Math operations, including
 - Arithmetic
 - Unit Conversion
 - Smoothing, estimate missing values
 - Time conversion
 - Hydrologic routing, rating table lookup
 - Multiple linear regression
 - Statistics



USGS Data Retrieval Plugin

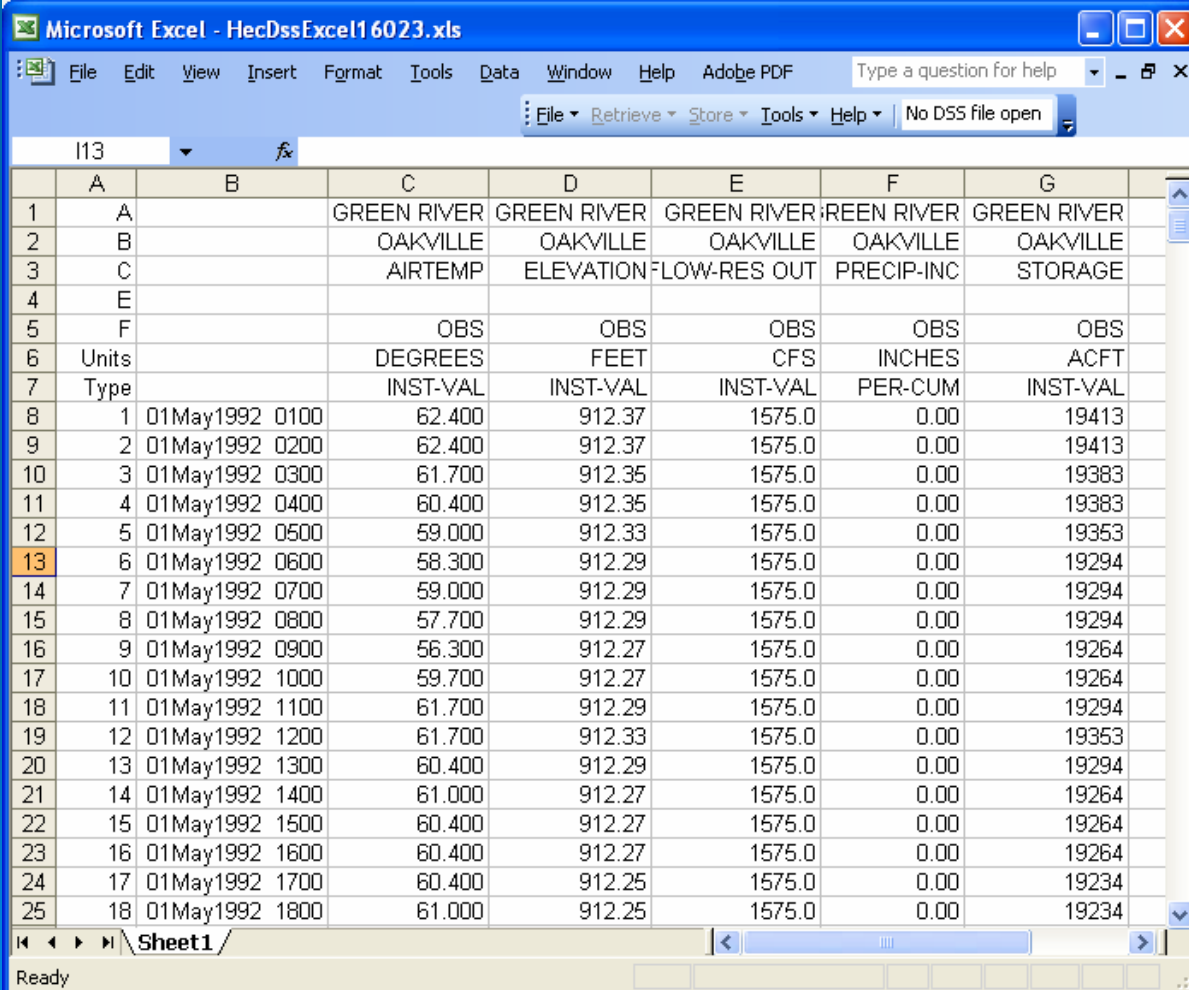
Retrieves daily and real-time data from the USGS.

Obtains USGS station numbers and names grouped by state.

The screenshot shows the 'USGS Download' application window. It features a menu bar with 'File', 'Edit', and 'Help'. Below the menu bar, there are three radio button options: 'Daily (leave dates blank for all)' (selected), 'Recent Daily', and 'Real Time'. The 'Daily' option has two date input fields labeled 'Start Date:' and 'End Date:'. The 'Recent Daily' option has a 'Days back (1-730):' input field. The 'Real Time' option has a 'Days back (1-31):' input field. Below these options is a table with the following columns: 'Get Data', 'USGS Station ID', 'River (A Part)', 'Location (B Part)', 'Parameter (C Part)', and 'Version (F Part)'. The table contains several rows of data, including stations like 'TURKEY CR.', 'TURKEY CREEK ABO...', 'BEAR CREEK', 'LITTLE DRY CREEK', 'SOUTH PLATTE RIVER', 'CHERRY CREEK', and 'SOUTH PLATTE RIVER'. At the bottom of the window, there are three buttons: 'Select All', 'Deselect All', and 'Get Data'.

Get Data	USGS Station ID	River (A Part)	Location (B Part)	Parameter (C Part)	Version (F Part)
<input type="checkbox"/>	06710995	TURKEY CR.	MOUTH OF CANYON, NR. MORRISON...	Flow	USGS
<input type="checkbox"/>	06711040	TURKEY CREEK ABO...	MORRISON C	Flow	USGS
<input type="checkbox"/>	06711500	BEAR CREEK	MOUTH, AT SHERIDAN, CO.	Flow	USGS
<input type="checkbox"/>	06711545	LITTLE DRY CREEK	GREENWOOD VILLAGE, CO	Flow	USGS
<input type="checkbox"/>	06711565	SOUTH PLATTE RIVER	ENGLEWOOD, CO.	Flow	USGS
<input type="checkbox"/>	06711590	SOUTH PLATTE RIVER	FLORIDA AVE AT DENVER, CO.	Flow	USGS
<input type="checkbox"/>	06712000	CHERRY CREEK	FRANKTOWN, CO.	Flow	USGS
<input type="checkbox"/>	06712500	CHERRY CREEK	MELVIN, CO.	Flow	USGS

Tabulating Time Series Data in MS Excel with HEC-DSS Vue



The screenshot shows a Microsoft Excel window titled "Microsoft Excel - HecDssExcel16023.xls". The spreadsheet contains a table with 7 columns (A-G) and 25 rows (1-25). The data is organized into sections for different variables: GREEN RIVER, OAKVILLE, AIRTEMP, ELEVATION, FLOW-RES OUT, PRECIP-INC, and STORAGE. Each section includes a header row for the variable name, a row for units, and a row for the data type. The main data rows (rows 8-25) show time series data for each variable, with columns for a sequence number, a date-time stamp (e.g., 01May1992 0100), and the corresponding numerical value.

	A	B	C	D	E	F	G
1	A		GREEN RIVER	GREEN RIVER	GREEN RIVER	REEN RIVER	GREEN RIVER
2	B		OAKVILLE	OAKVILLE	OAKVILLE	OAKVILLE	OAKVILLE
3	C		AIRTEMP	ELEVATION	FLOW-RES OUT	PRECIP-INC	STORAGE
4	E						
5	F		OBS	OBS	OBS	OBS	OBS
6	Units		DEGREES	FEET	CFS	INCHES	ACFT
7	Type		INST-VAL	INST-VAL	INST-VAL	PER-CUM	INST-VAL
8	1	01May1992 0100	62.400	912.37	1575.0	0.00	19413
9	2	01May1992 0200	62.400	912.37	1575.0	0.00	19413
10	3	01May1992 0300	61.700	912.35	1575.0	0.00	19383
11	4	01May1992 0400	60.400	912.35	1575.0	0.00	19383
12	5	01May1992 0500	59.000	912.33	1575.0	0.00	19353
13	6	01May1992 0600	58.300	912.29	1575.0	0.00	19294
14	7	01May1992 0700	59.000	912.29	1575.0	0.00	19294
15	8	01May1992 0800	57.700	912.29	1575.0	0.00	19294
16	9	01May1992 0900	56.300	912.27	1575.0	0.00	19264
17	10	01May1992 1000	59.700	912.27	1575.0	0.00	19264
18	11	01May1992 1100	61.700	912.29	1575.0	0.00	19294
19	12	01May1992 1200	61.700	912.33	1575.0	0.00	19353
20	13	01May1992 1300	60.400	912.29	1575.0	0.00	19294
21	14	01May1992 1400	61.000	912.27	1575.0	0.00	19264
22	15	01May1992 1500	60.400	912.27	1575.0	0.00	19264
23	16	01May1992 1600	60.400	912.27	1575.0	0.00	19264
24	17	01May1992 1700	60.400	912.25	1575.0	0.00	19234
25	18	01May1992 1800	61.000	912.25	1575.0	0.00	19234