

**GIS Tools Available Now to Support HH&C
or
Geospatial Integration of Hydrology &
Hydraulics Tools for Multi-Purpose, Multi-
Agency Decision Support**

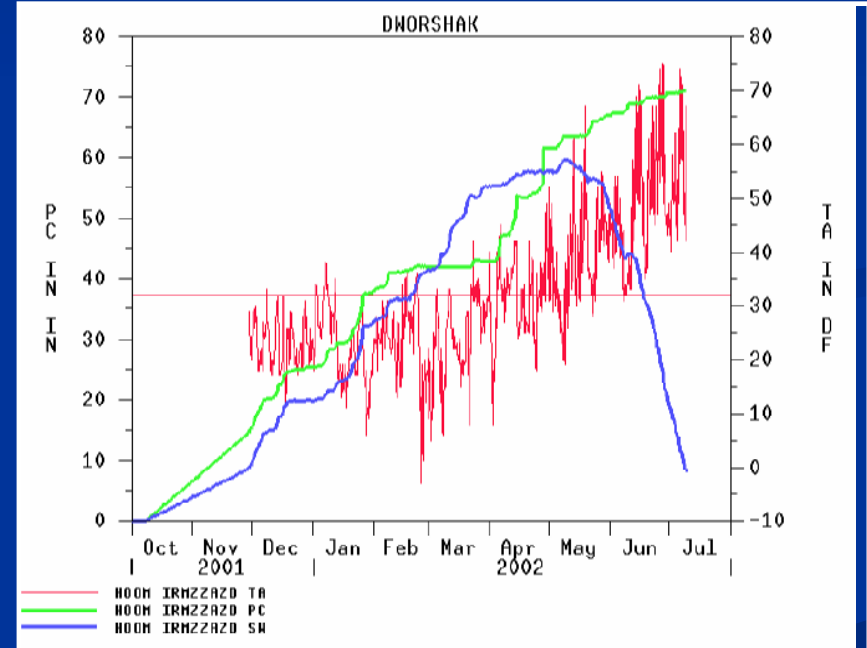
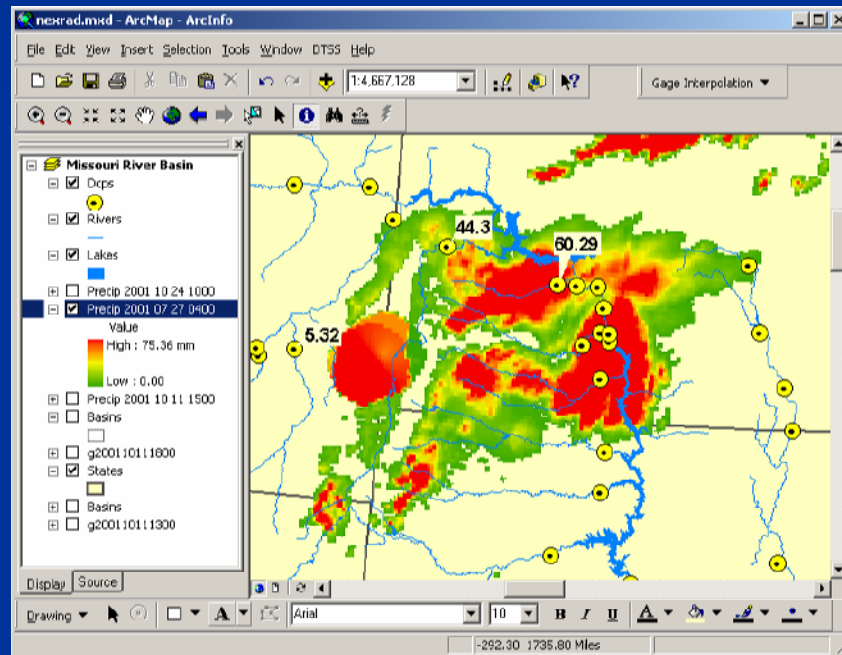
Timothy Pangburn, Joel Schlagel, Martha
Bullock, Michael Smith, and Bryan Baker

2005 Tri-Service Infrastructure Systems Conference &
Exhibition
HH&C Track
3 August 2005

Outline

- ArcGIS Applications
 - Hydrologic Processors
 - Reservoir Inundation Calculator
- CorpsViewWeb
- CorpsMap
- NAE CWMS Applications
- Missouri River Geospatial Decision Support Framework
- Future Viewers

Distributed Input for Hydrologic Models using Object-Oriented Tools



Object-Oriented Tools for Interpolation of Meteorological Parameters for Hydrologic Modeling

The screenshot displays the ArcMap interface with the following components:

- Main Window (tul_st.mxd - ArcMap - ArcInfo):** Shows a map of precipitation total for 01 Jan 97. A red polygon highlights a specific area. The Layers panel on the left includes:
 - sub-basins
 - Transform Reference Grid (Value: High: 58.669998, Low: 1.730000)
 - river
 - Precip Total (01 Jan 97 1400) with a legend:

<VALUE>
0 - 2.98
2.99 - 8.48
8.49 - 15.58
15.59 - 22.23
22.24 - 28.42
28.43 - 35.29

- Dworshak.mxd - ArcMap - ArcInfo:** Shows a watershed map with a 'Precip Bias, Prsn - May' layer. The Layers panel includes:
- Dworshak Basin
 - Canyon Rgr Sta Gage
 - gage_rfcl point
 - gage_rfcl_ta
 - gage_rfcl_sw
 - gage_rfcl Precip
- river
- Watersheds
- Precip Bias, Prsn - May (Value: High: 6.929134, Low: 2.007874)
- Hillshade of Elev
- Elev
- cutdemf2kft
- cutdemf2k
- staterc
- Bias Grid Dialog Box:** Shows settings for interpolation:
- Point Layer: gage_nicl Precip
- DSS Join Field 1: pathname
- Bias Grid: Precip Bias, Prsn - May
- Buttons: Start Interpolation, Cancel

Translation dx = 107294.384 dY = 53108.311 -1977211.71 -1531849.67 2830125.85 Meter

Reservoir Inundation Calculator Background

- Developed in collaboration with the US Army Engineer District, Los Angeles
- ESRI ArcGIS extension
- Calculates inundation GIS layers and area and capacity values for reservoir water levels

Reservoir Inundation Calculator Interface

Reservoir Inundation Calculator
U.S. Army Corps of Engineers

Main Metadata About

DEM Layer:

Vertical units: US survey feet meters

Intersect layer:

Connect layer:

Levee layer:

Levee-top field:

Start elevation:

End elevation:

Step:

Output folder:

Output prefix:

Output

Depth shapefiles Interval:

Extent shapefiles

Depth grids

Generalize shapefile lines

Coordinate system: DEM's Geographic

Table/report format: Simple Standard

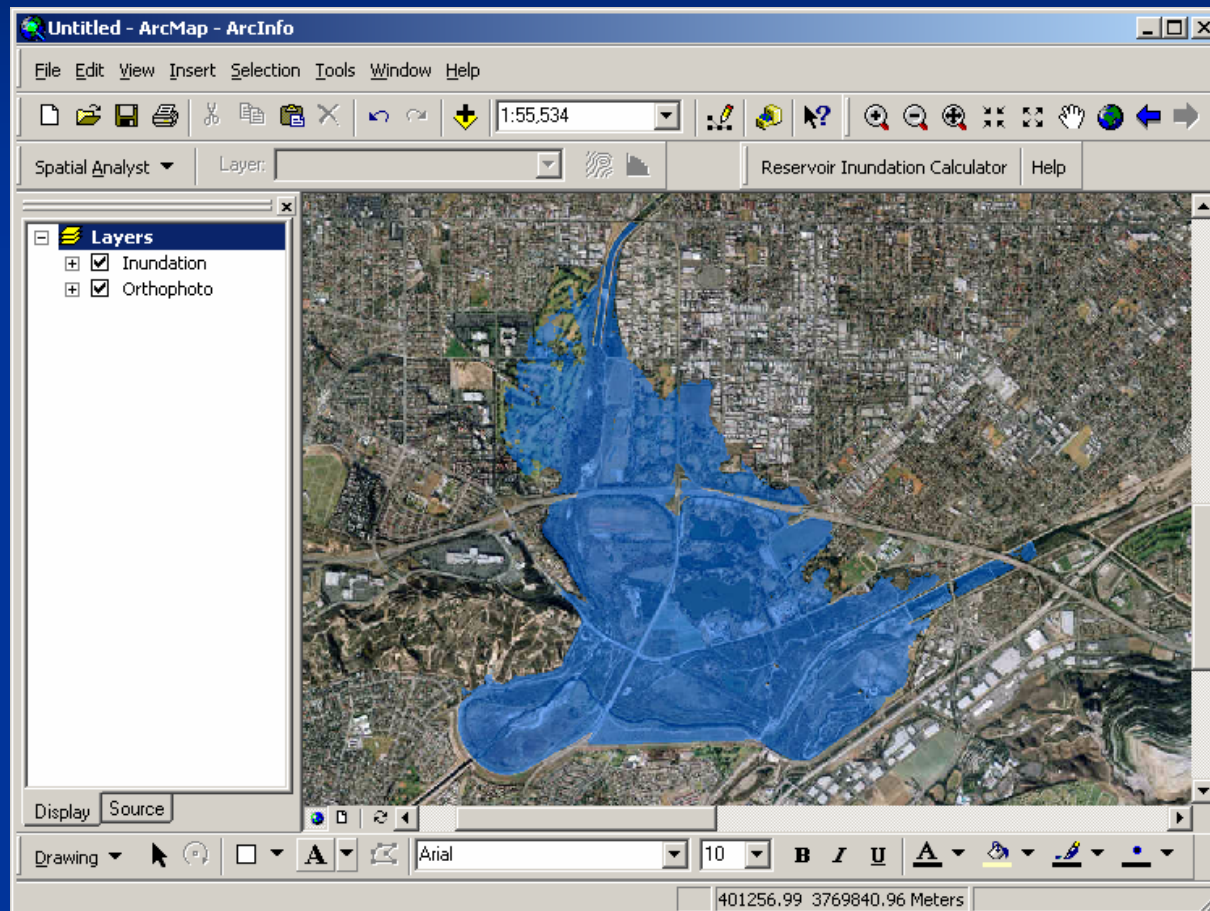
Export shapefiles/tables to Oracle

Database name:

User ID: Password:

Output prefix tip: Prefix to use for output GIS folder, layers, tables and reports.

Reservoir Inundation Calculator GIS Output Example



Reservoir Inundation Calculator Report Output Example

Great Day Reservoir, CA - Capacity Table

Survey date: July 15, 2004

Elevation in feet, Capacity in acre-feet

Elev	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
210	6717	6795	6873	6952	7032	7112	7193	7274	7357	7441
211	7527	7615	7703	7792	7882	7972	8062	8153	8245	8337
212	8430	8523	8616	8710	8805	8900	8996	9092	9189	9286
213	9384	9483	9582	9682	9782	9883	9985	10087	10189	10292
214	10396	10500	10606	10714	10823	10933	11044	11155	11267	11380
215	11493	11607	11721	11835	11951	12066	12183	12300	12418	12536
216	12655									

Report Details

Reservoir name: Great Day Reservoir

Reservoir state: CA

Report created by: Tim Baldwin

Organization: US Army Corps of Engineers

Reservoir Inundation Calculator run date: September 29, 2004

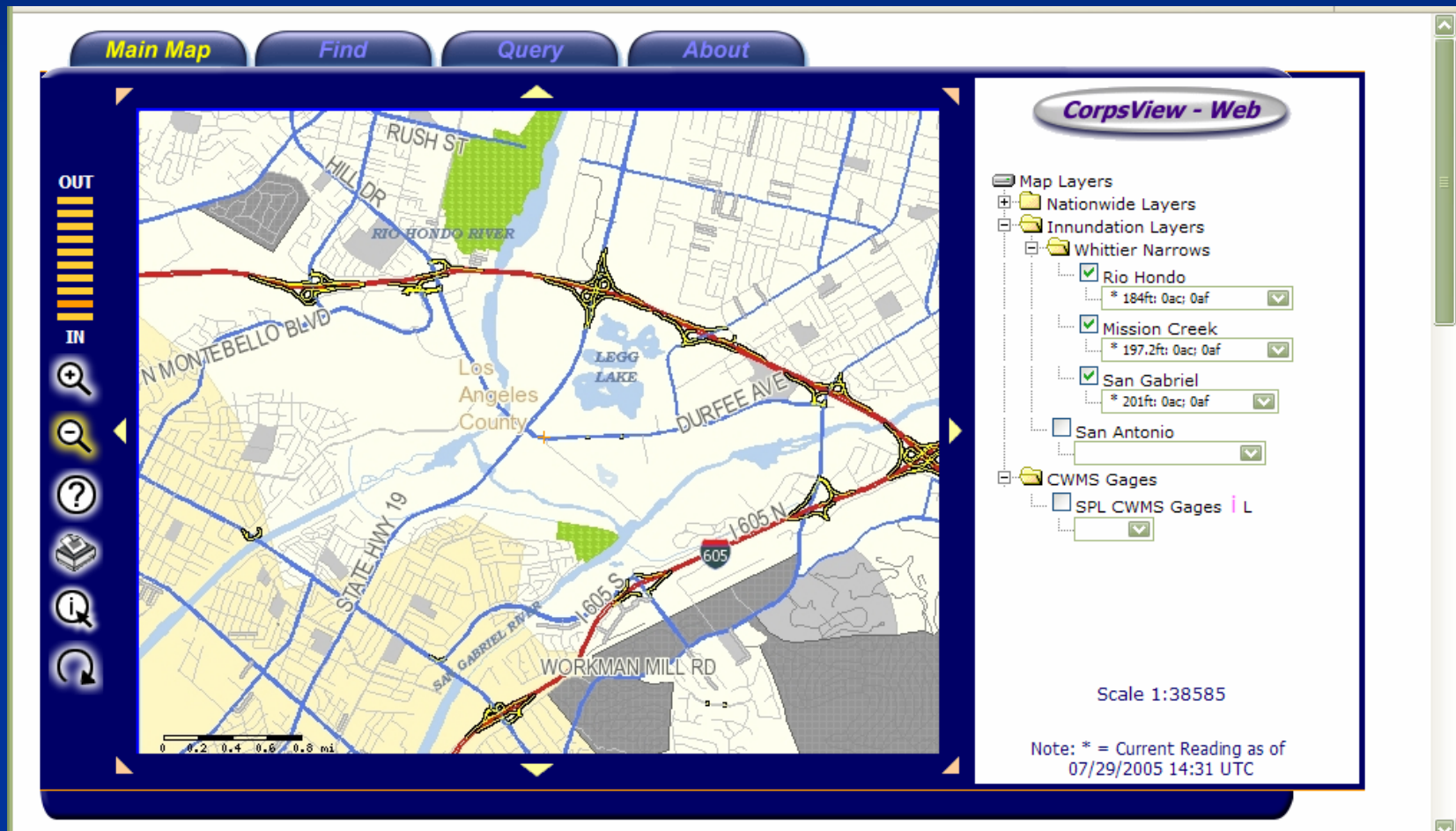
Vertical datum of elevation used in Calculations: NGVD29

Survey date: July 15, 2004

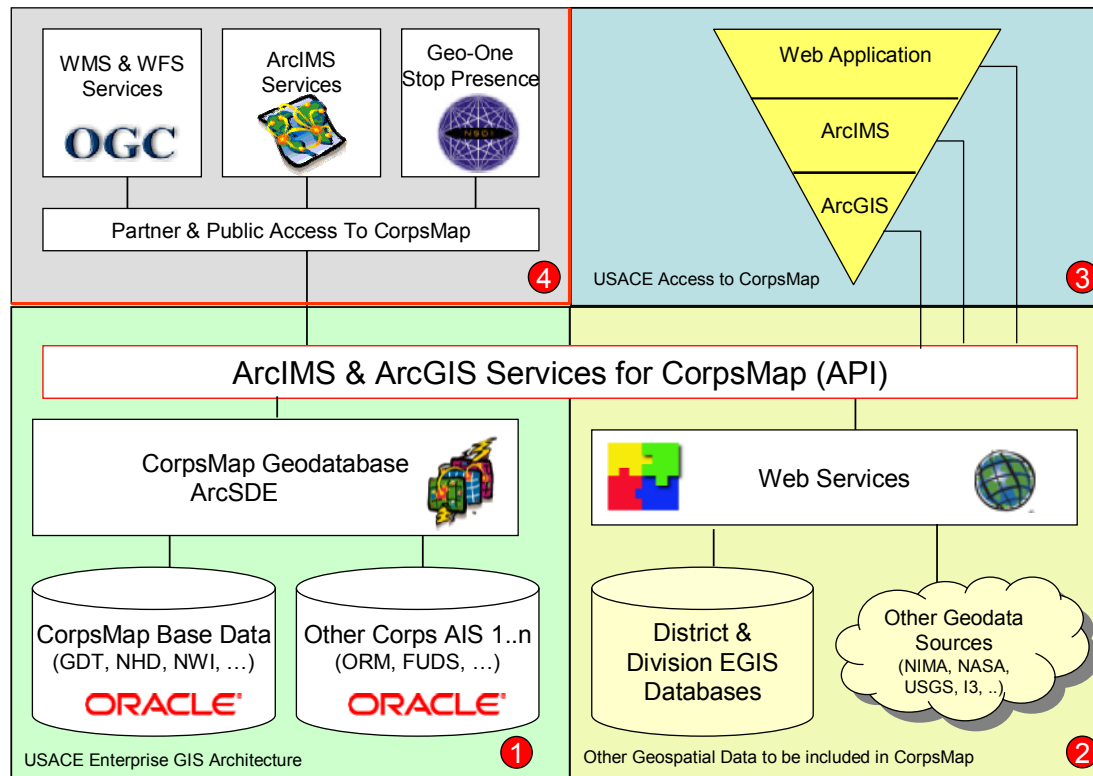
Survey description: LIDAR

Survey source: Hard Working Surveyor Company

Output of ArcGIS Inundation Calculator visualized with CorpsView and integration with CWMS Real-time Conditions



A Database Driven Remote Sensing & GIS Architecture for Basin-Wide Studies



CorpsMap Portal

CMV2 Development - Microsoft Internet Explorer


File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites


Address <https://maps.crrel.usace.army.mil:4445/cmdev/intro.main> Go

CorpsMap

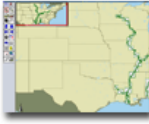
Map Browser IENC Map Browser Find Data Catalog



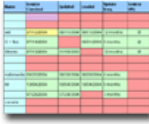
Map Browser
Browse USACE spatial data.



Find
Find NID dams, Corps projects, counties, GNIS places, and other locations by name.



IENC Map Browser
Browse Inland Electronic Navigational Charting (IENC) data.



Data Catalog
Get information on the data used in CorpsMap.

Done Internet

CorpsMap Map Browser

The screenshot shows a web browser window titled "CMV2 Development - Microsoft Internet Explorer". The address bar is empty. The browser's menu bar includes "File", "Edit", "View", "Favorites", "Tools", and "Help". The toolbar contains icons for "Back", "Forward", "Home", "Search", "Favorites", "Print", and "Refresh".

The main content area features the "CorpsMap" logo and a navigation menu with "Map Browser" (selected), "IENC Map Browser", "Find", and "Data Catalog".

The central map is titled "Map of United States" and shows a detailed view of the Washington, D.C. area. Labeled locations include Frederick, Baltimore, Gaithersburg, Leesburg, Rockville, Annapolis, Bowie, College Park, Arlington, Washington D.C., Alexandria, Manassas, AQUIA CREEK, VA, and BRETON BAY, MD. A scale bar at the bottom of the map indicates 0, 6, 12, 18, 24, and 30 miles. Below the map, the scale is set to "1,218,481" with a "Go" button.

To the right of the map is a "Map Layers" panel. Under "Base Maps", the following layers are checked: "Detailed Roads", "Detailed Water", "Urban Areas", and "Cities". The "Cities" layer is expanded to show four population categories: "Pop. > 1,000,000", "Pop. 500,000 - 999,999", "Pop. 100,000 - 499,999", and "Pop. 25,000 - 99,999". Other unchecked layers include "US Highways", "State/County Roads", "Lakes", "Rivers/Streams", "DOQQ Zone 13", and "DRG Zone 13".

At the bottom of the browser window, the status bar displays "Coordinates (AEA): X = 1618488.65 Y = 1975085.99" and the "Internet" icon.

NAE CWMS Oracle-driven Web Site / Real-time Data Map



[Real Time Data Map](#)

[Real Time Data List](#)

[Project/Gate Data](#)

[Release Schedule](#)

[Precipitation Data](#)

[Project Statistics](#)

[Historic Floods](#)

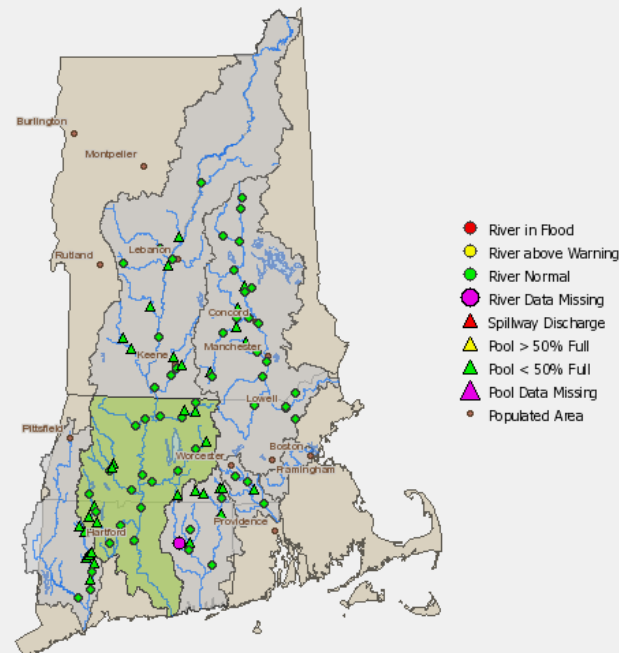
[Geotech](#)

[Mapping](#)

[RRT Home](#)

New England District Corps of Engineers Reservoir Regulation Team

Lower Connecticut

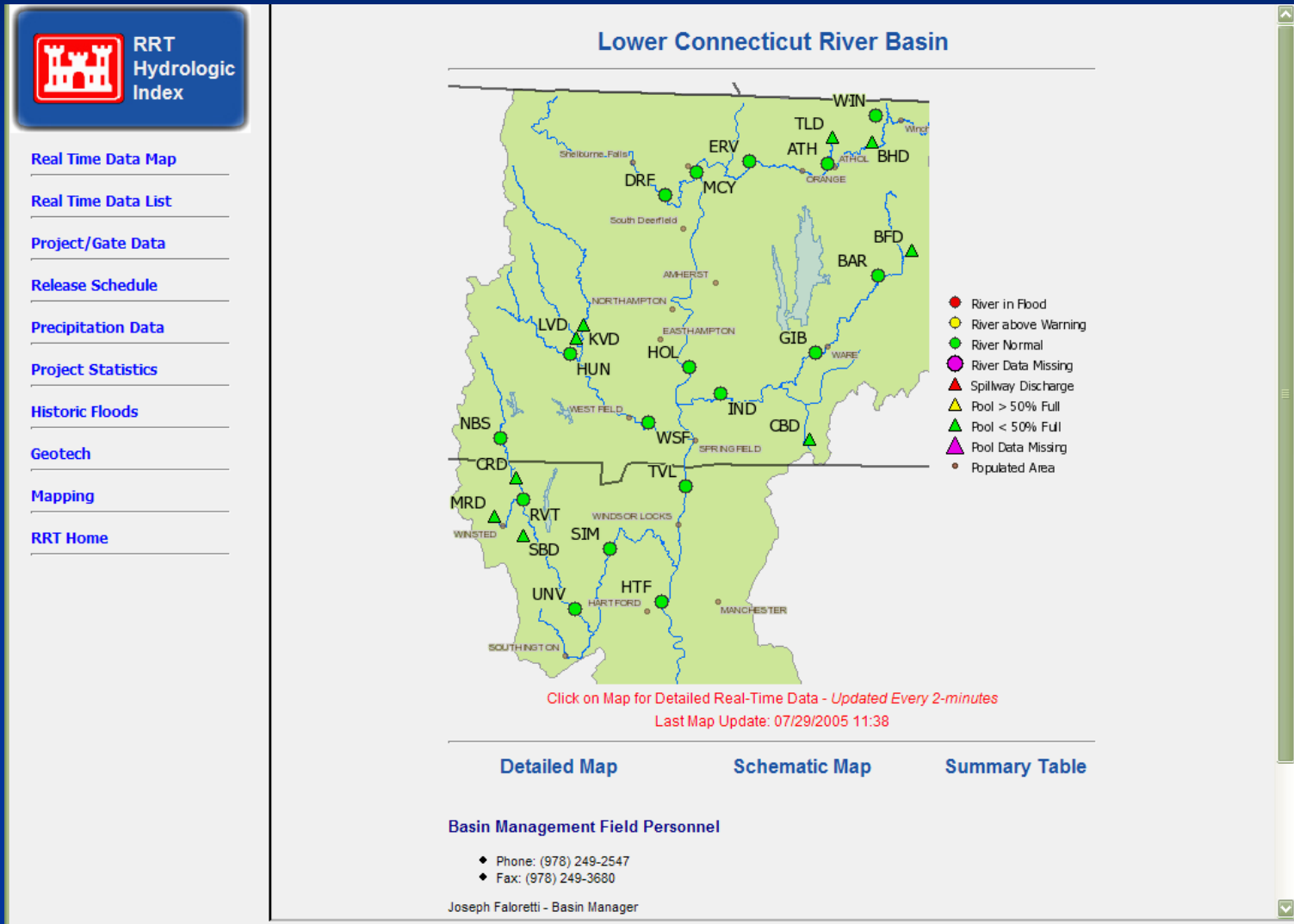


Click on Basin for Detailed Real Time Data -- Updated Every 2-minutes

Last Map Update: 07/29/2005 11:37

[Project Status](#) [River Status](#) [Forecast Status](#) [Precip/Temp Status](#)

Individual Basin Display of NAE CWMS Web Site



Real-time and Historical CWMS Data Access



RRT
Hydrologic
Index

[Real Time Data Map](#)

[Real Time Data List](#)

[Project/Gate Data](#)

[Release Schedule](#)

[Precipitation Data](#)

[Project Statistics](#)

[Historic Floods](#)

[Geotech](#)

[Mapping](#)

[RRT Home](#)

Birch Hill Dam, Millers River

- ◆ [Birch Hill Dam Home Page](#)
- ◆ [Real Time Graphs](#)
 - ◆ [Hydrologic Data](#)
 - ◆ [Air Temp and Precip. Data](#)
- ◆ [Real Time Tabular Data](#)
- ◆ [USGS Data for the Birch Hill Dam, Millers River](#)

Birch Hill Dam								
Drainage Area:							175 sq. miles	
Channel Capacity:							2800 cfs	
Storage:							5.34 in	
Normal Pool:							0 Feet	
Gate Settings for July 28, 2005 07:00 am								
	Gate1	Gate2	Gate3	Gate4	Gate5	Gate6	Gate7	Gate8
	3.0	3.0	3.0	3.0				
Date (EDT)	Pool(ft)	Storage(%)	in. Remaining	Tailwater(ft)	Outflow(cfs)	Inflow(cfs)	Precip(in.)	Temp(F)
Jul-27-2005 06:00 pm	1.20	0	5.34	4.25	115	107	44.01	87.7
Jul-27-2005 10:00 pm	1.20	0	5.34	4.24	112	108	44.18	89.7
Jul-28-2005 02:00 am	1.22	0	5.34	4.26	117	121	44.18	71.1
Jul-28-2005 06:00 am	1.24	0	5.34	4.27	119	123	44.18	64.6
Jul-28-2005 10:00 am	1.26	0	5.34	4.28	121	125	44.18	60.5
Jul-28-2005 02:00 pm	1.24	0	5.34	4.27	119	115	44.18	68.1
Jul-28-2005 06:00 pm	1.22	0	5.34	4.26	117	113	44.18	71.5
Jul-28-2005 10:00 pm	1.18	0	5.34	4.24	112	104	44.18	74.8
Jul-29-2005 02:00 am	1.18	0	5.34	4.23	110	106	44.18	66.3
Jul-29-2005 06:00 am	1.18	0	5.34	4.24	112	112	44.18	58.3
Jul-29-2005 10:00 am				4.23	110			
Report generated July 29, 2005 10:40 am								
Maximum 24 Hr Drawdown Rate (5 feet/day): 59 cfs + Inflow (cfs) = cfs								

[Rating Curve Gate1](#)

[Project Spec. Data](#)

[Project Photos](#)

[Data Collection Platform Information](#)

Historical CWMS Data Plotting



[Real Time Data Map](#)

[Real Time Data List](#)

[Project/Gate Data](#)

[Release Schedule](#)

[Precipitation Data](#)

[Project Statistics](#)

[Historic Floods](#)

[Geotech](#)

[Mapping](#)

[RRT Home](#)

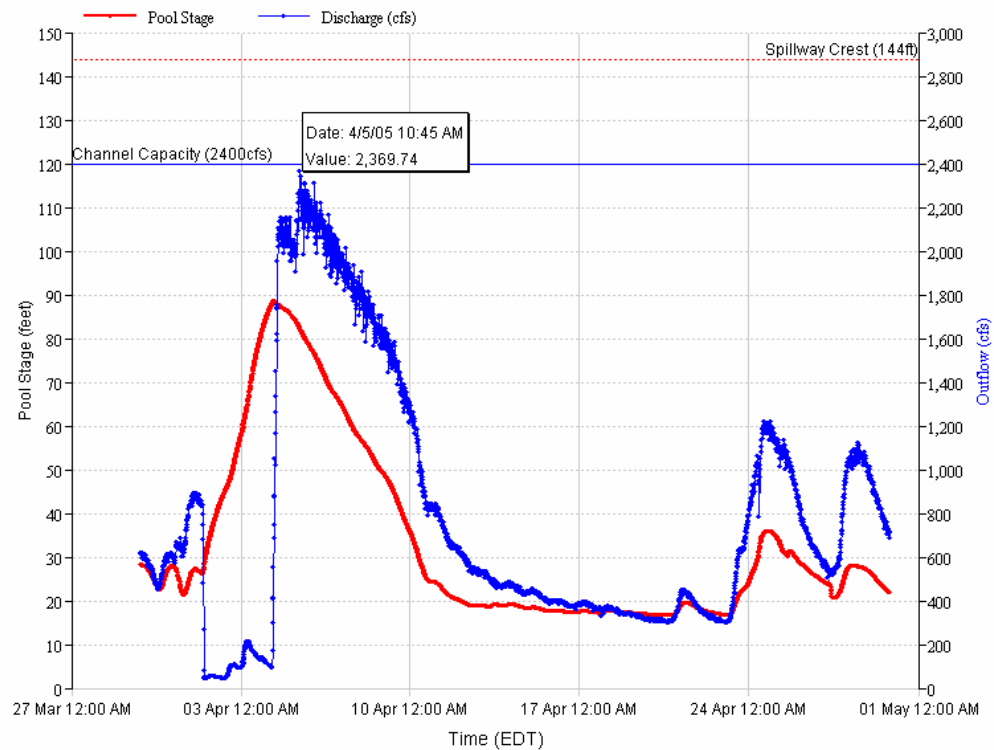
Select Location:

Number of Days:

End Date:

Data for Gage Union Village Dam, Ompompanoosuc River
from 30-MAR-05 to 29-APR-05 (mouse-over to display an info panel)

Drainage Area= 126 sq. miles



Gage Management Utility – Maintenance History for Every Site



Reservoir
Regulation
Team

Hydro Data

Weather

Snow/Ice

Hurricane/Tides

Bulletins & Reports

Recreation

Administration

Emergency Operations

Contact Us

NAE Home

RRT Home

Inventory and Service Data for Birch Hill Dam

Quick Select: --

Navigation Search Administration Logout

Equipment Inventory

DCP (Data Collection Platform) Currently Installed

[Add DCP](#)

DCP Manufacturer	DCP Model	Software Ver.	DCP Barcode	DCP Serial Number	Move To Storage	Maintenance
Sutron	Xpert		52368	040138		
Sutron	G3121-A Satlink Trans./DCP		52403	040270		

Accessories (sensors etc.) Currently Installed

[Add Accessory](#)

Accessory Manufacturer	Accessory Model	Accessory Barcode	Accessory Serial Number	DCP Serial Number	Move To Storage	Maintenance
Sutron	8080-0005-1 Voice Modem		024344	040138		
Sutron	5800-0520 Shaft Encoder	35927	989496	040138		
Precidia	232 Precidia Network Modem		00011E0A0AE0	040138		
Sutron	8080-0003-1 Analog I/O Module		BHDANA	040138		
Sutron	8080-02-1 Digital I/O Module		033073	040138		
Precidia	232 Precidia Network Modem		00011E001ED3	040138		

Photos

DCP Programs

Maintenance History



US Army Corps
of Engineers®

Maintenance History



US Army Corps
of Engineers®

DCP Maintenance History

Date	Technician	Location	Category	Maintenance Performed	DCP	Description
04 May, 2005	Brian Waz	BHD	Replace	Replace Cable	Sutron G3121-A Satlink Trans./DCP SN: 040270	Installed a 15-foot Low Loss Cable.
27 Apr, 2005	Greg Harlon	BHD	Problem	No Phone Comm.	Sutron G3121-A Satlink Trans./DCP SN: 040270	Missing some ST transmissions, GPS sync problem. Brian will
28 Mar, 2005	Steve Simmer	BHD	Calibrate	Calibrate Encoder	Sutron Xpert SN: 040138	Unit must have reset over the weekend. Pool and precp sens reset. Called Jeff P on 3/28 to recal pool stage.

Accessory Maintenance History

Date	Technician	Location	Category	Maintenance Performed	Accessory	Description
09 Feb, 2005	Brian Waz	BHD	Problem	Hardware Needs Repair	Sutron 8080-0005-1 Voice Modem SN: BHDMOD	Connection problems, new modem sent to replace.

Missouri River Fish and Wildlife Recovery Plan - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address https://maps.crrel.usace.army.mil:4445/moriver_dev/MORIVER_DEV.display.main# Go

Google Search Web 83 blocked AutoFill Options

Missouri River Fish and Wildlife Recovery Plan

Home | Feedback | Log Out

Home **Map Interface** Model Results Data Utilities Spatial Data Catalog Site Administration

Layer Menu | **Map Legend**

- Map Layers
 - Base Data Layers
 - METAR Weather Data
 - Hydrography
 - Rivers
 - National Hydrography Dataset
 - River Mile Points
 - River Mile Points 1960
 - DTM
 - Structures
 - Dikes
 - SWH Notches
 - Rectified Channel Line
 - Revetments

Scale 1:14,757

CWMS Database Connectivity Tools Search and Zoom Tools **Map Format Tools**

Map Format Tools

Map Size: Select...

Zoom to a River Reach: Rocheport

Missouri River Fish and Wildlife Recovery Plan - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media Mail Print Print Preview Print Setup

Address https://maps.crrel.usace.army.mil:4445/moriver_dev/MORIVER_DEV.display.main# Go

Google Search Web 83 blocked AutoFill Options

Missouri River Fish and Wildlife Recovery Plan

Home | Feedback | Log Out

Home **Map Interface** Model Results Data Utilities Spatial Data Catalog Site Administration

Map Navigation: [Zoom In] [Zoom Out] [Home] [Previous View] [Next View]

Layer Menu

- Structures
 - Dikes
 - SWH Notches
 - Rectified Channel Line
 - Revetments
 - DNR Labels
 - Municipal Water Intakes
 - Intakes
 - Select filter... ▼
 - Boat Ramps
 - Select filter... ▼
- Water Control Data
- Imagery
- Species Tracking
 - Sturgeon Population

Map Legend

Scale 1:14,757

CWMS Database Connectivity Tools

Search and Zoom Tools

Map Format Tools

Map Format Tools

Map Size: Select... ▼

Zoom to a River Reach: Rocheport ▼

Missouri River Fish and Wildlife Recovery Plan - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media Print Mail News RSS

Address https://maps.crrel.usace.army.mil:4445/moriver_dev/MORIVER_DEV.display.main# Go

Google Search Web 83 blocked AutoFill Options

Missouri River Fish and Wildlife Recovery Plan

[Home](#) | [Feedback](#) | [Log Out](#)

[Home](#)
[Map Interface](#)
[Model Results](#)
[Data Utilities](#)
[Spatial Data Catalog](#)
[Site Administration](#)

Layer Menu

- Species Tracking
- Model Results
 - Rocheport (cfs)
 - 50,000
 - Bakers Bend (cfs)
 - 50,000
 - Doniphan (cfs)
 - 50,000
 - Nebraska City (cfs)
 - 45,000
 - Blair (cfs)
 - 45,000
 - Vermillion (cfs)
 - 45,000
 - Yellowstone (cfs)

Map Legend

Scale 1:4,992

CWMS Database Connectivity Tools

Search and Zoom Tools

Map Format Tools

Map Format Tools

Map Size: Select...

Zoom to a River Reach: Rocheport

Missouri River Fish and Wildlife Recovery Plan - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address https://maps.crrel.usace.army.mil:4445/moriver_dev/MORIVER_DEV.display.main#

Google Search Web 83 blocked AutoFill Options

Scale 1:1,127,035

Cities
Counties
Roads
USACE Divisions/Districts
Recreation Areas
Federal Land
METAR Weather Data
Hydrography

CWMS Database Connectivity Tools Search and Zoom Tools Map Format Tools

CWMS Database Connectivity Tools

Select a CWMS Database: Data Status: Current as of 03/25/2005 08:45:04am

Study Type	Project	Forecast Date
<input type="radio"/> Higher Adjusted Basic	Big Bend Dam	31-MAY-05
<input checked="" type="radio"/> Basic	Fort Peck Dam	
<input type="radio"/> Lower Adjusted Basic	Fort Randall Dam	
	Garrison Dam	
	Gavins Point Dam	
	Oahe Dam	

Pool Elevation: → 550 m (1805 ft)

Identify exposed

Exposed Intakes	Alert Status Elevation	More Information	Zoom on Map
City of Parshall	1814 ft	- Click for information -	- Click to Zoom -
Paradise Point Rural Water Assn (new extension)	1840 ft	- Click for information -	- Click to Zoom -

Missouri River Fish and Wildlife Recovery Plan - Microsoft Internet Explorer

Address: https://maps.crrel.usace.army.mil:4445/moriver_dev/MORIVER_DEV.display.main#

Scale 1:952,675

CWMS Database Connectivity Tools Search and Zoom Tools Map Format Tools

CWMS Database Connectivity Tools

Select a CWMS Database: Data Status: Current as of 03/25/2005 08:45:04am

Study Type	Project	Forecast Date
<input checked="" type="radio"/> Higher Adjusted Basic	Big Bend Dam Fort Peck Dam Fort Randall Dam Garrison Dam Gavins Point Dam Oahe Dam	<input type="text" value="31-JUL-05"/>
<input type="radio"/> Basic		
<input type="radio"/> Lower Adjusted Basic		

Pool Elevation: →

Identify exposed:

Exposed Boat Ramps	Alert Status Elevation	More Information	Zoom on Map
Beaver Creek	1592 ft	- Click for information -	- Click to Zoom -
Beaver Creek	1598 ft	- Click for information -	- Click to Zoom -
Beaver Creek	1585 ft	- Click for information -	- Click to Zoom -
Bob's Resort	1585 ft	- Click for information -	- Click to Zoom -
Bush's Landing	1593 ft	- Click for information -	- Click to Zoom -

Missouri River Fish and Wildlife Recovery Plan - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address https://maps.crrel.usace.army.mil:4445/moriver_dev/MORIVER_DEV.display.main# Go

Missouri River Fish and Wildlife Recovery Plan

[Home](#) | [Feedback](#) | [Log Out](#)

[Home](#) [Map Interface](#) [Model Results](#) [Data Utilities](#) [Spatial Data Catalog](#) [Site Administration](#)

How reach locations were decided upon, model used, timeframe for data, update frequency, and all other summary information.

[Upload Model Results Data](#) [Download Model Results](#) [Model Calculations](#)

Model Calculations

Select a Reach	Select a Flow Rate
Bakers Bend	50,000 cfs

[Calculate](#) [View Calculation Methods](#)

→ Total Area Where

<input checked="" type="checkbox"/> Depth	<input checked="" type="checkbox"/> Velocity
<i>falls within</i> 5-10 ft	<i>falls within</i> Select range...
OR	AND
--	Select value...
	<=
Calculate	2 ft/sec
→ 34.12 acres	Select value...
	0 ft/sec
	.5 ft/sec
	1 ft/sec
	2 ft/sec
	3 ft/sec
	4 ft/sec



“Transforms The Web:” RS/GIS Absorbs

Keyhole 2 LT

File Edit View Window Help

My Keyhole Keyhole Measure Search

File Tour

New Open Play Stop Prefs

- My Places
 - Whittier Narrows
 - SPL Whittier Narrows
 - Mission Crrek: Stage=197.2
 - Rio Hondo: Stage=184.2
 - San Gabriel: Stage=200.9
 - NAE CWMS
 - EngLink
 - default
 - My Searches

Rio Hondo: Stage=184.2

No description provided

Transparency
Clear [Slider] Opaque

Keyhole #VIDIA.

Image © 2005 DigitalGlobe
Image © 2005 EarthSat

©2004 keyhole.com

Pointer 34°01'32.24" N 118°03'42.73" W elev 207 ft Streaming [Progress Bar] 85% Eye alt 2365 ft

- Roads
- 3D Terrain
- Borders

Zoom [Slider]

Tilt [Slider] 90°

street, address or POI

city, state, zip/postal

country

GO Clear

CorpsMap/EngLink – BYO BaseMap

Cannot find server - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <https://maps.crrel.usace.army.mil/mds/gmaptest.gmap?g=englink> Go Links >>

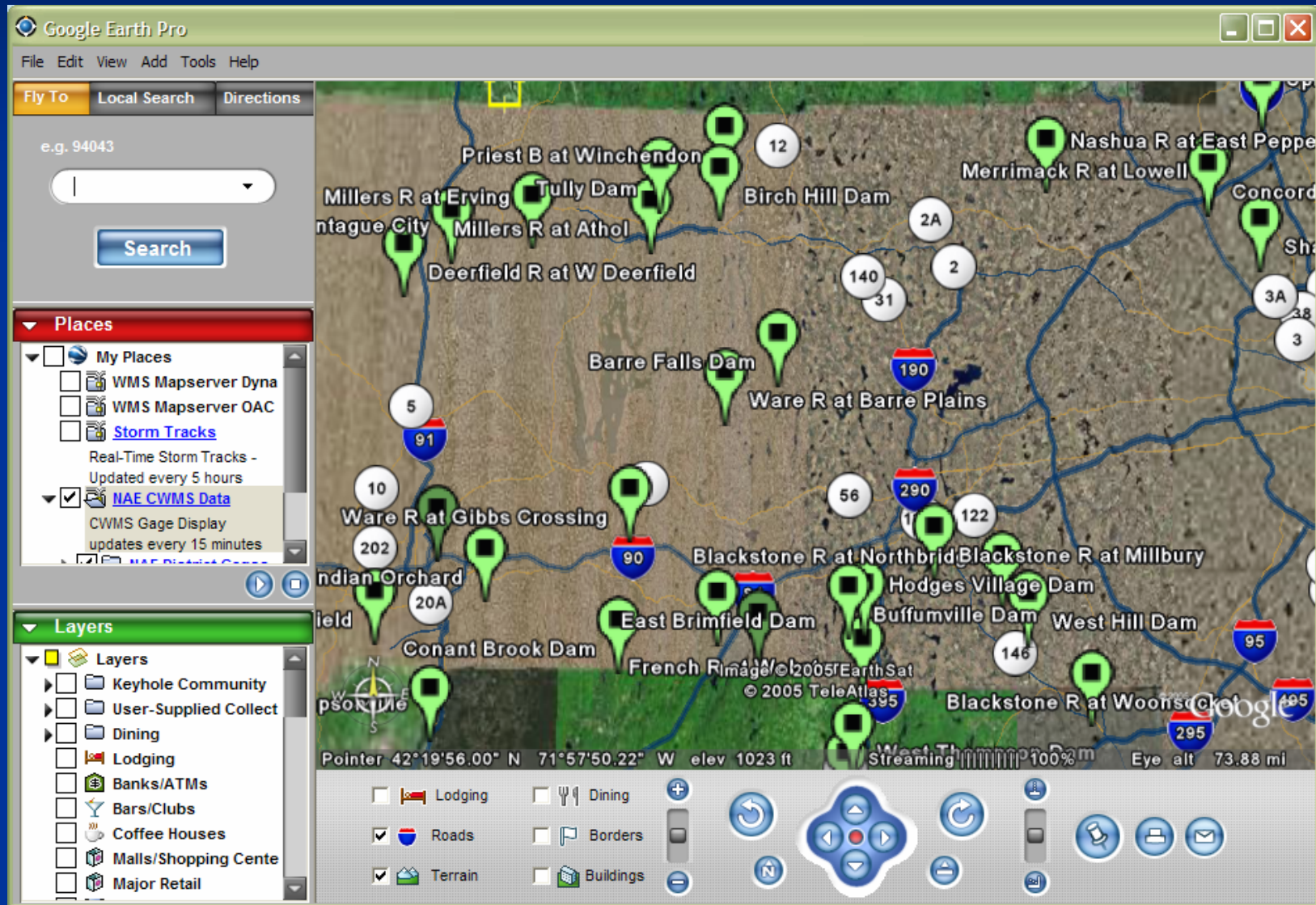
ENGLink Event:
McAlpine Cofferdam Accident on Mar 31, 2005

- Jan-Feb 2005 Flood Fight on May 12, 2005
- Navigation Hazard on Mar 18, 2005
- Fukuoka Earthquake on Mar 21, 2005
- Folly Beach Rehabilitation on Mar 24, 2005
- Hunting Island Rehabilitation on Mar 25, 2005
- Spring Floods of 2005 on Mar 29, 2005
- NY/NJ Spring Floods 2005 on Mar 29, 2005
- ACF Flood 2005 on Mar 30, 2005
- McAlpine Cofferdam Accident on Mar 31, 2005
- MD and PA Spring Flooding 2005 on Apr 02, 2005
- Exercise TOROEE 2

Map - Satellite **New!**

Done Internet

NAE CWMS Stations Mapped via Google Earth



Detail View of NAE CWMS Gage on Google Earth

Google Earth Pro

File Edit View Add Tools Help

Fly To Local Search Directions

e.g. 94043

Search

Places

- Connecticut R at Wells River
Gage: WLS on Jul 29, 2005 09:30 am Type: Streamgage Current
- Shawsheen R at Wilmington
Gage: WMT on Jul 29, 2005 09:15 am Type: Streamgage Current
- Blackstone R at Woonsocket
Gage: WMS on Jul 29, 2005 09:15 am Type: Streamgage Current

Layers

- Keyhole Community
- User-Supplied Collect
- Dining
- Lodging
- Banks/ATMs
- Bars/Clubs
- Coffee Houses
- Malls/Shopping Cente
- Major Retail

Shawsheen R at Wilmington

Gage: WMT on Jul 29, 2005 09:15 am Type: Streamgage Current

Conditions: 2.03 ft

[View Data Page](#)

Directions: [To here](#) - [From here](#)

Shawsheen River near Wilmington, MA

Shawsheen-R at Wilmington

Richardson Pond

Mud Pond

2ND Ave

4TH St

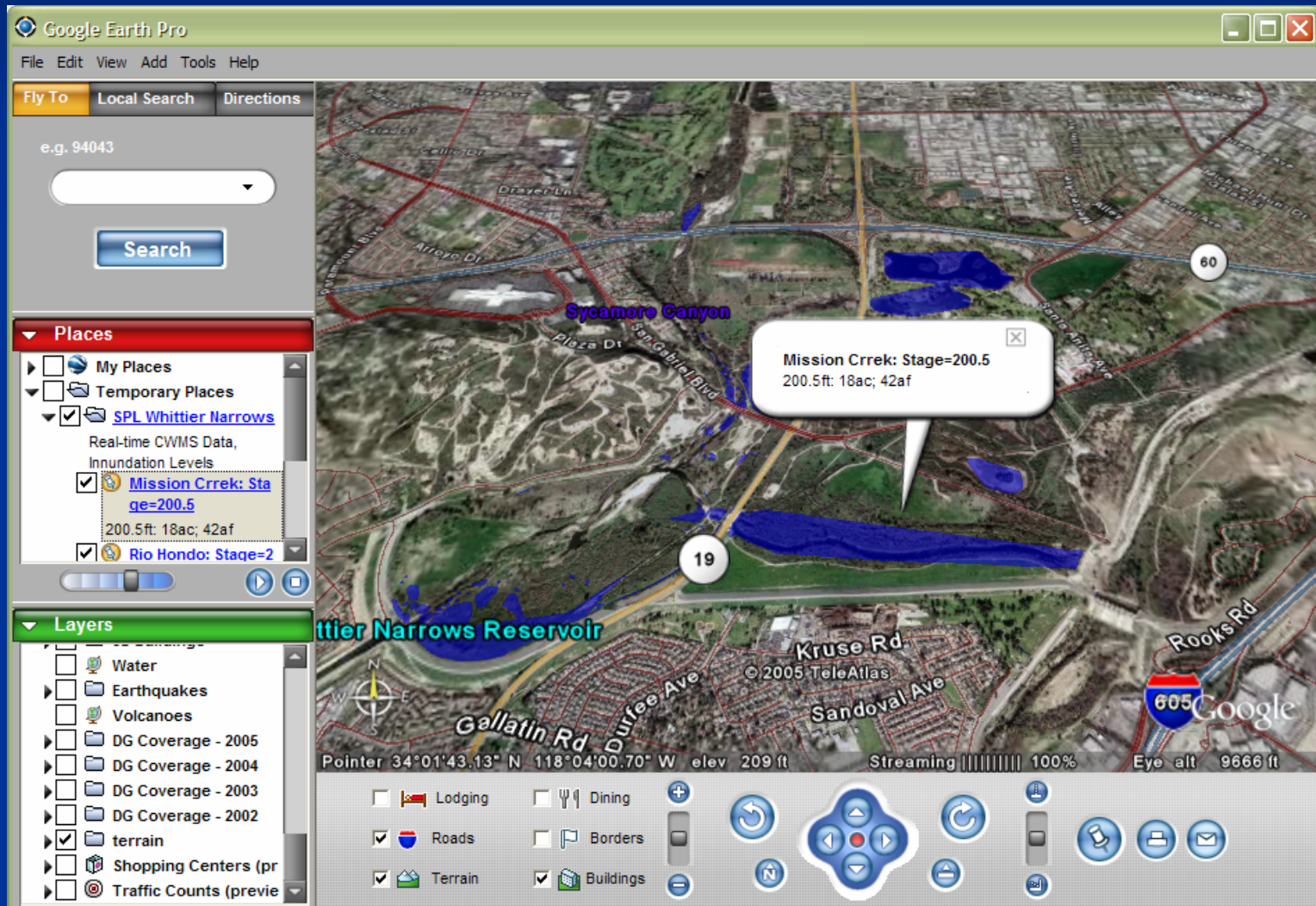
Image MassGIS, Commonwealth of Massachusetts EOE

Pointer 42°34'04.97" N 71°12'55.00" W elev 89 ft Streaming 100% Eye alt 4754 ft

Lodging Dining Roads Terrain

Borders Buildings

Whittier Narrows Visualization at Higher Stage Levels



Comments/Questions?