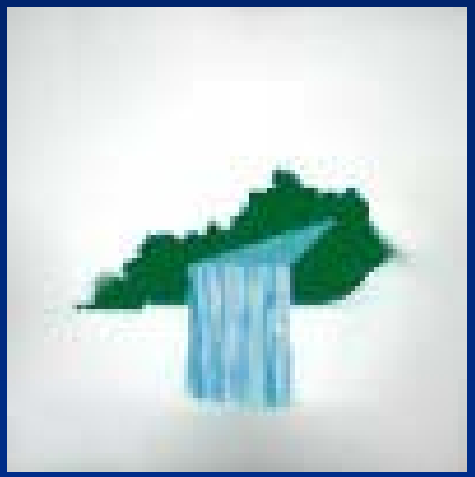
USGS
science for a changing world

Welcome to the Kentucky District

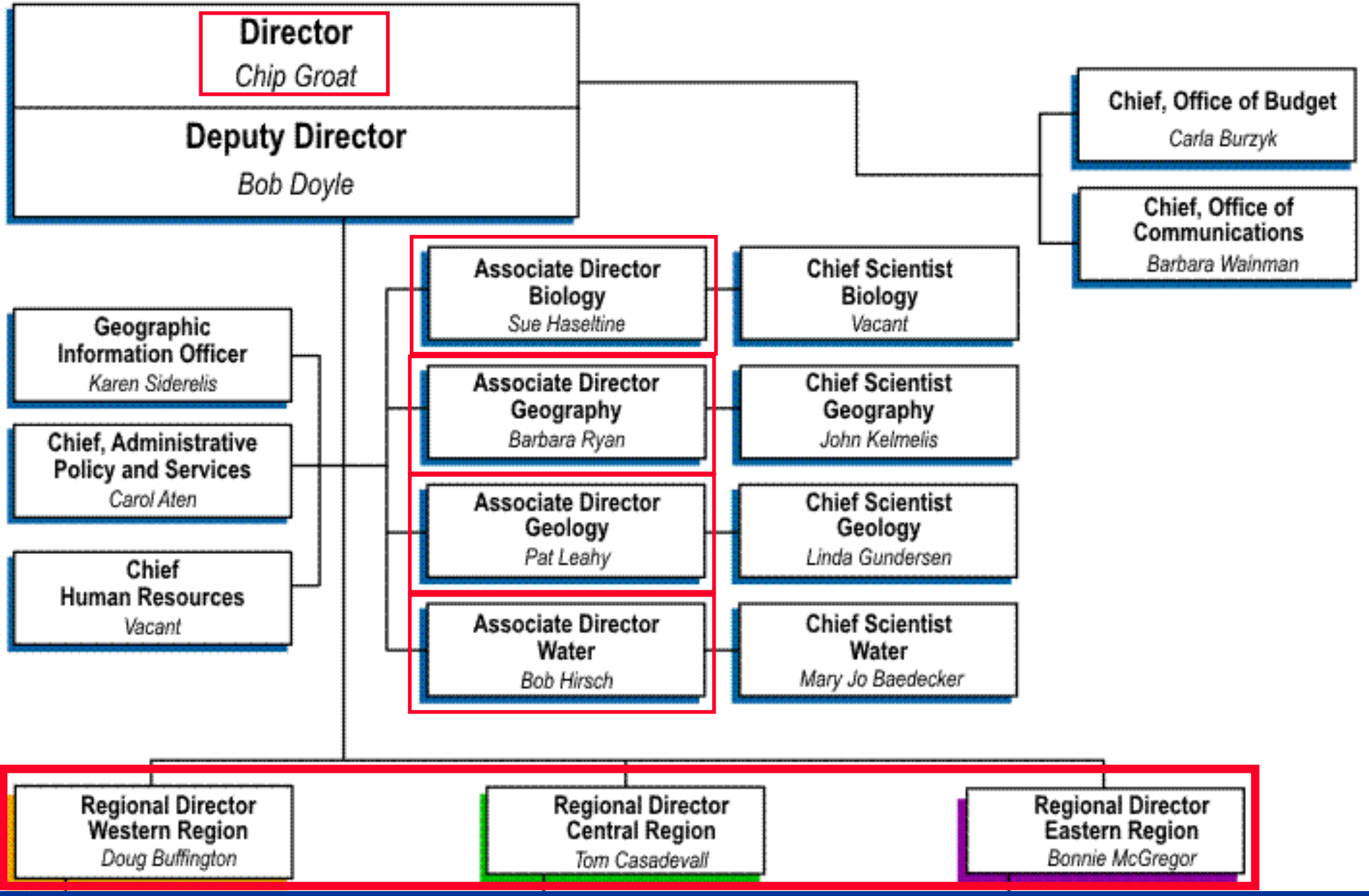
Hydrologic Workshop

October 29, 2003



U.S. Department of the Interior
U.S. Geological Survey

U.S. Geological Survey



USGS Mission

Provide local, state, and federal decision makers with unbiased, long-term, reliable scientific information to:

- Minimize loss of life and property from natural disasters
- Better understand the resource issues, especially to protect human health and enhance environmental quality
- Contribute to wise development of our Nation's resources

USGS

Long Range District Goal

- Constantly improve our understanding of the needs and issues of Kentucky's resource managers, so that we might provide a stronger scientific basis for the resources decisions they need to make

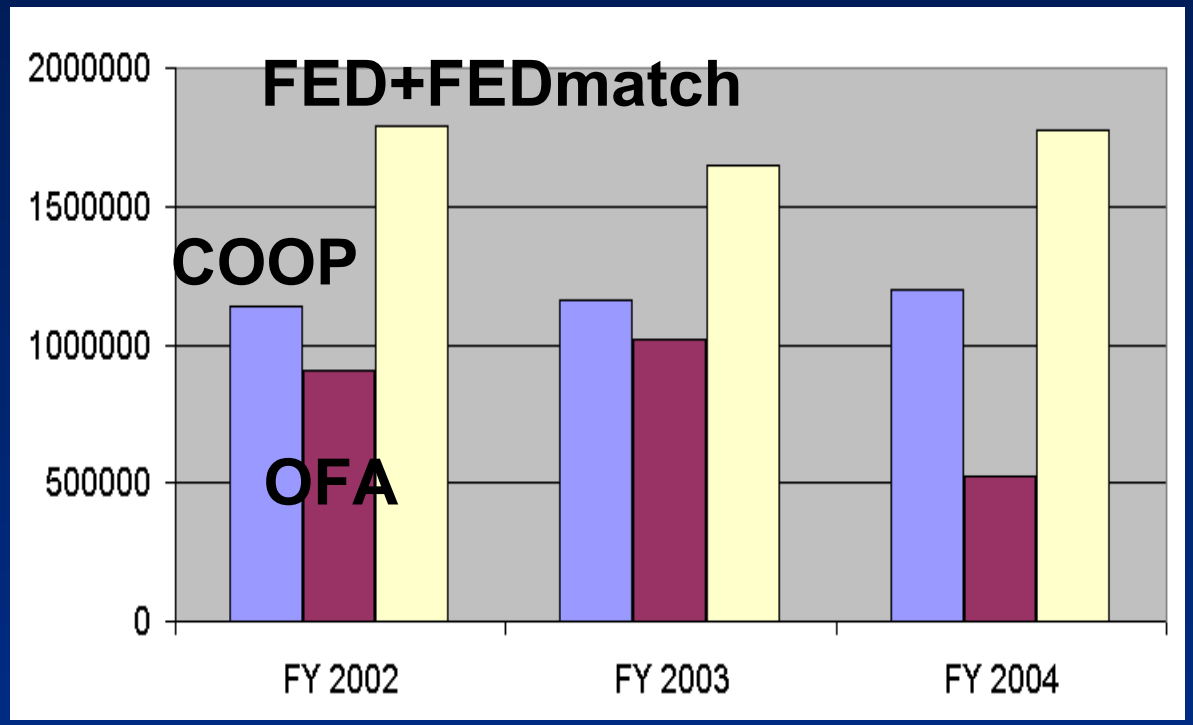
— Data, Tools, and Understanding —

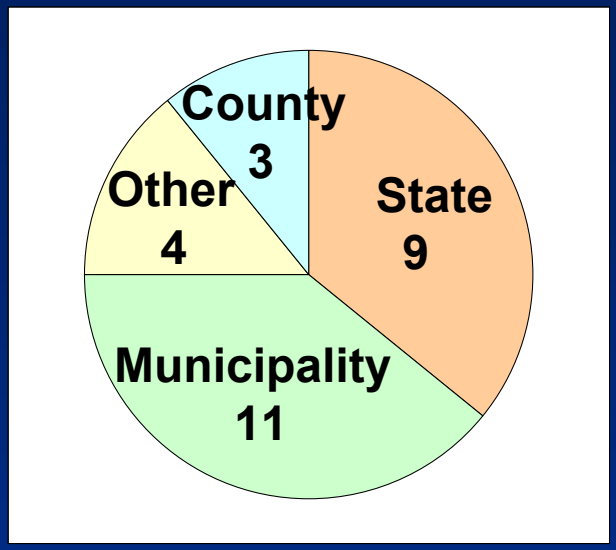
- Build on the multidisciplinary strengths of USGS
- Optimize our local capabilities in those technical areas that are of highest priority to our partners

USGS

FY02-04 Funding Sources & Customer Types

Fiscal year is October 1 thru September 30





27 Coop customers

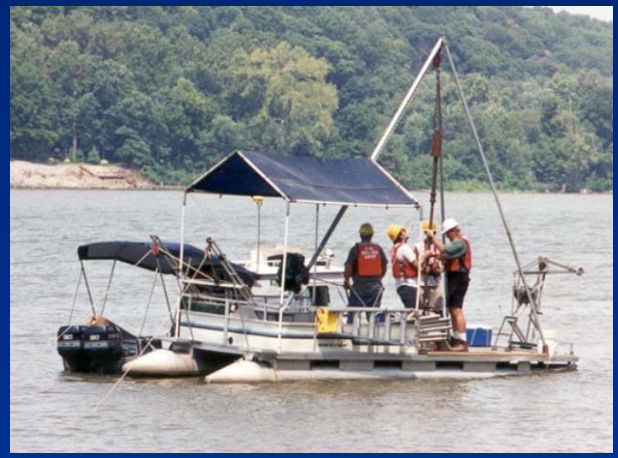
USGS

Workshop Objective

Demonstrate some of our latest tools and approaches to measure, monitor, and assess water resources systems



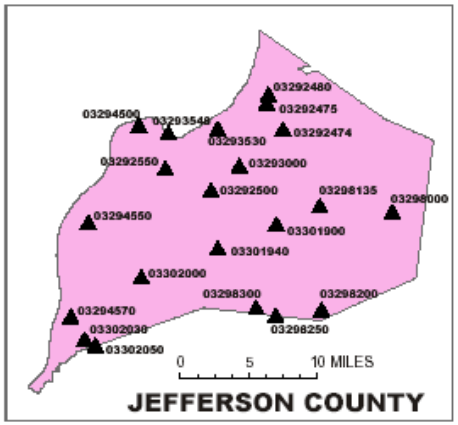


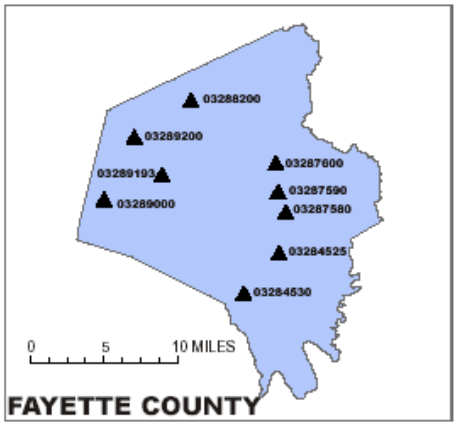



USGS

So, what do we do?

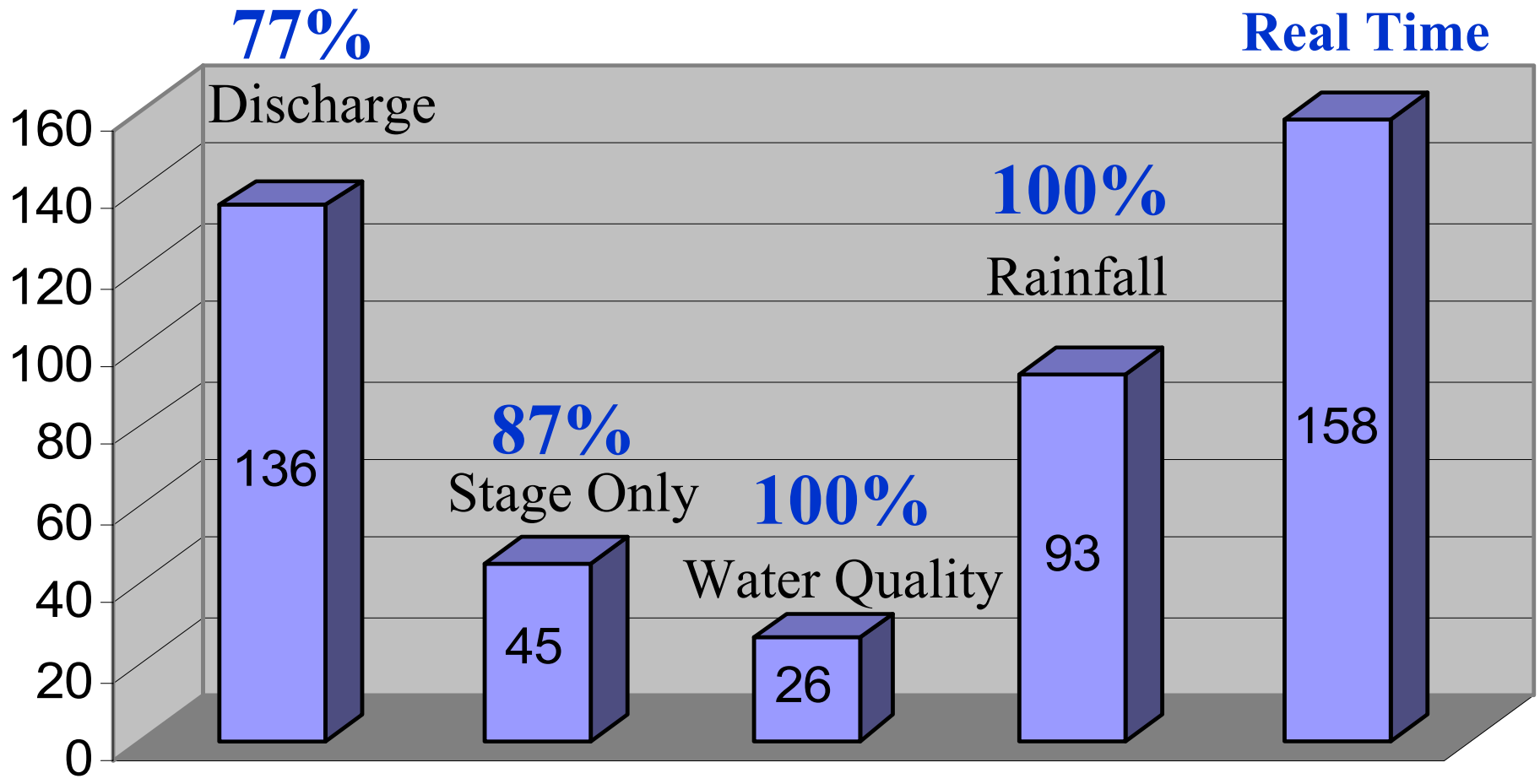
Streamflow Stations- FY03





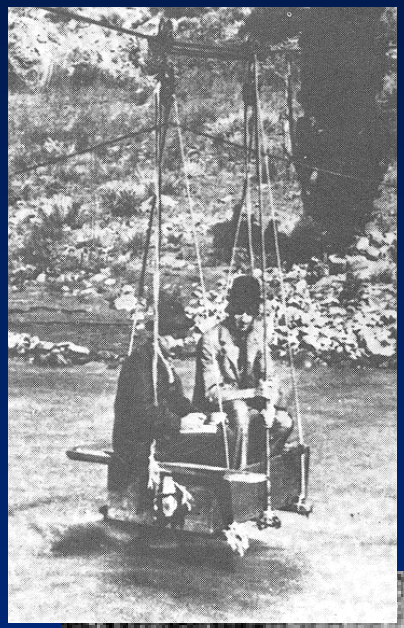
USGS

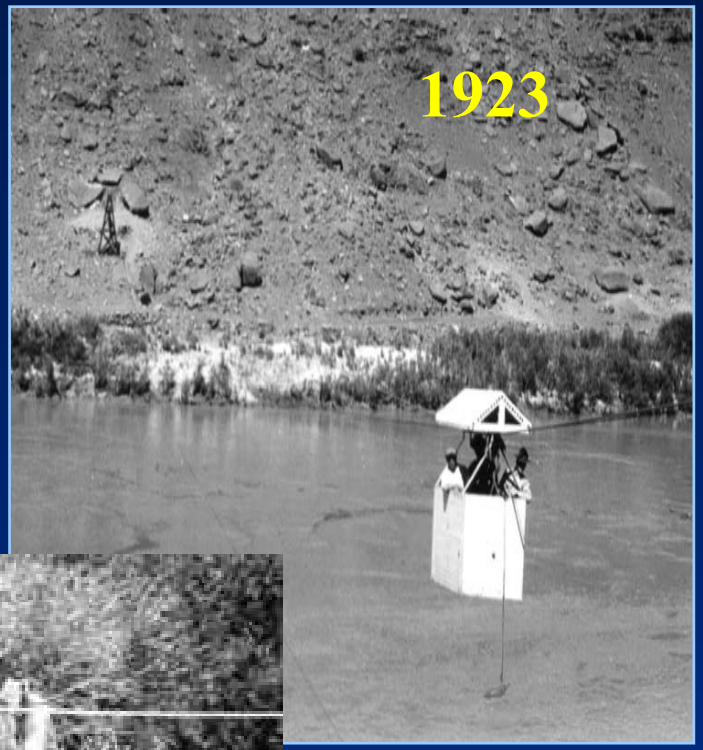
Surface Water Network in FY03

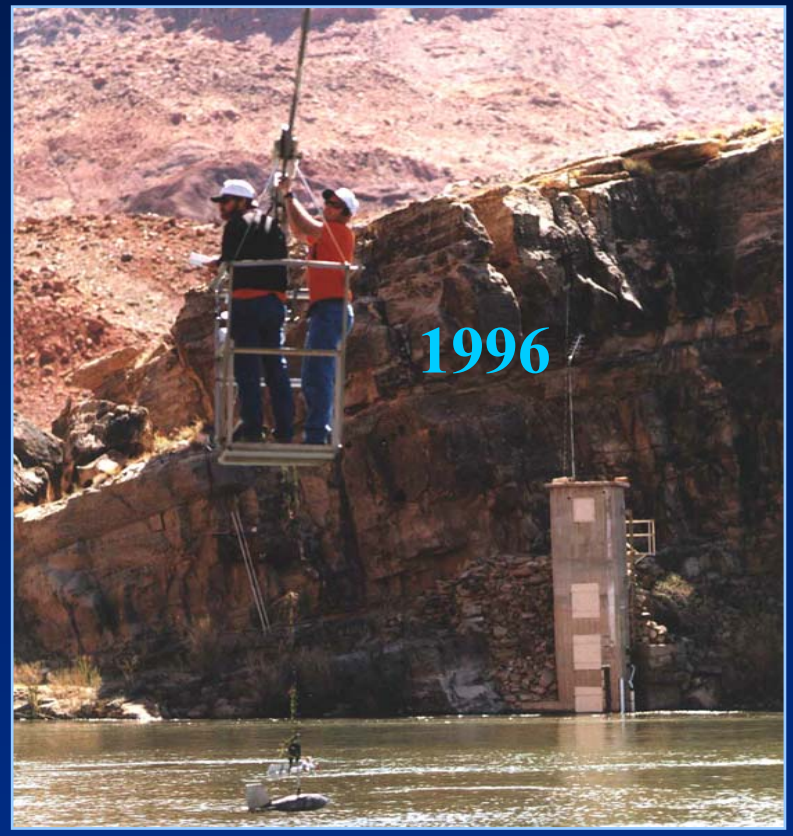


USGS

Discharge Measurement Technology: Need for Modernization





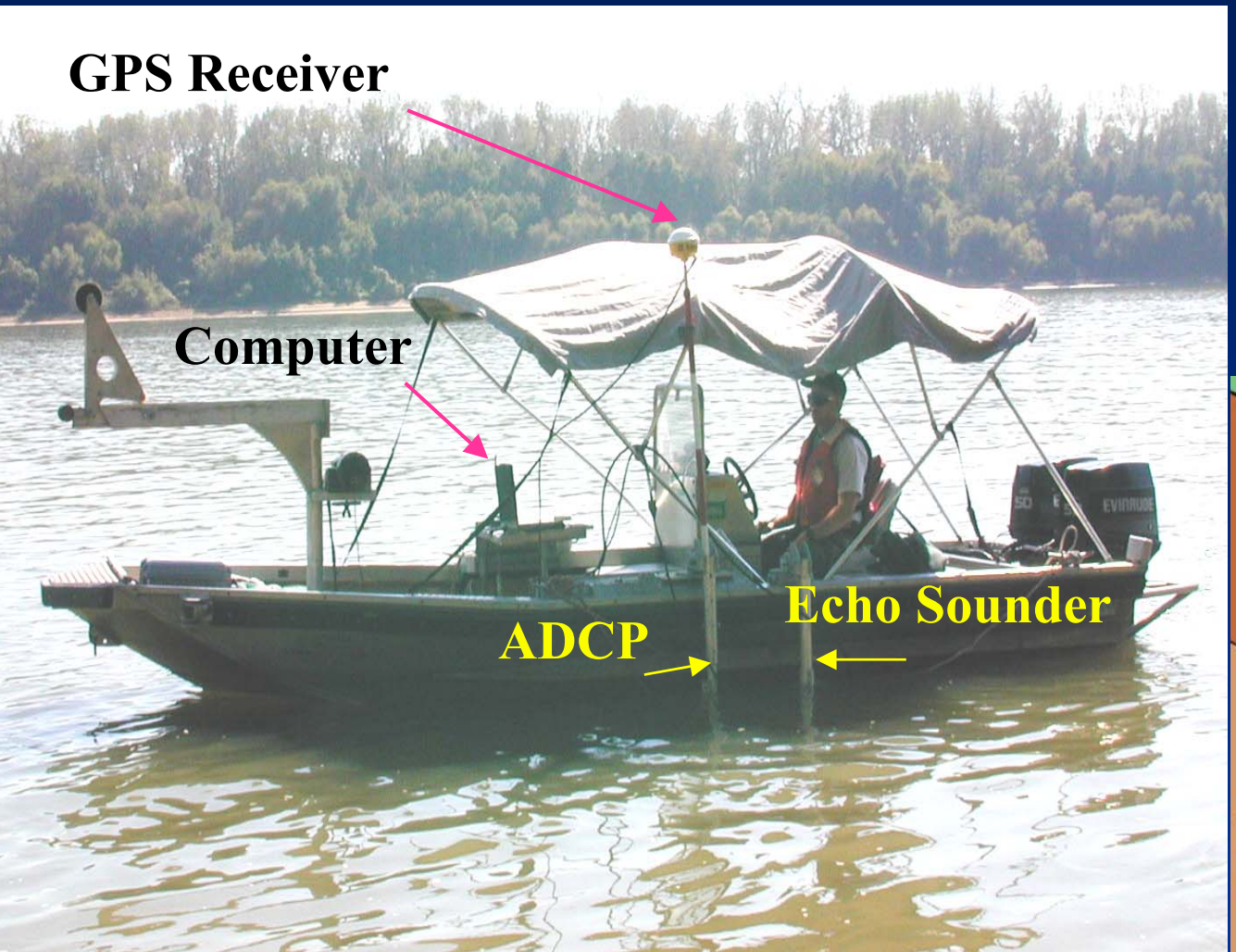


Colorado River at Lees Ferry

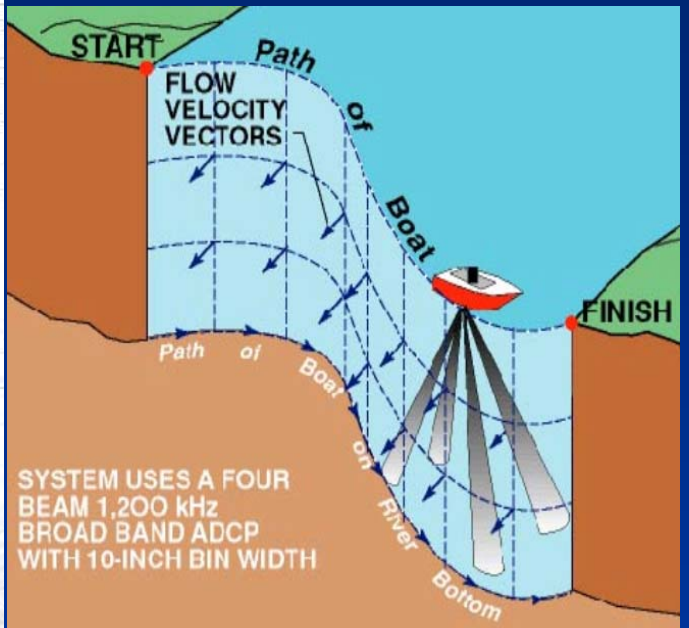
USGS

KY District is helping pioneer the use of the Acoustic Doppler Current Profiler (ADCP)

Discharge measurements that are safer, quicker, and more accurate



3-D velocity vectors for model calibration



Tethered Boat System

Remote Control Boat

Flow Tracker

Side looker

USGS

Major Advancements

- Instruments that use sound (acoustics)
- Measures velocity using the Doppler effect
- No moving parts
- Minimizes disturbance to the flow

USGS

Acoustic Doppler Velocity Meters

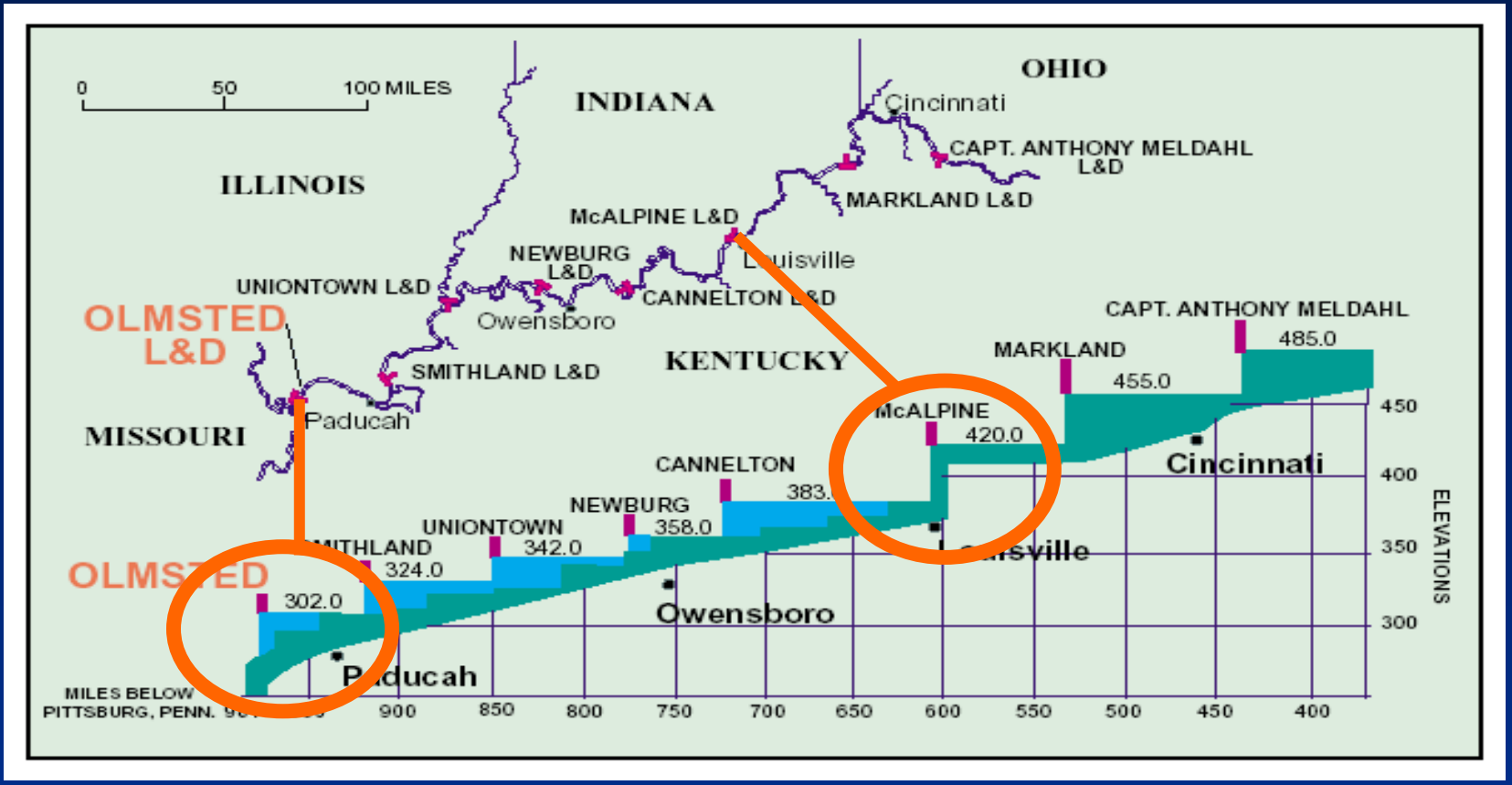
- Two to four beam current meters that collect horizontal or vertical velocity profiles;
- Can be used in fixed deployments to index-mean channel velocity or as navigational aids;
- Very useful in situations that are influenced by backwater, regulation or tidal conditions where conventional stage-discharge relationships have problems.

SonTek ADP

RDI HADCP

USGS

2-D Hydraulic Model and Sediment Transport Applications



USGS

Studies of the Ohio River Alluvium for Louisville Water Company

Water-quality sampling

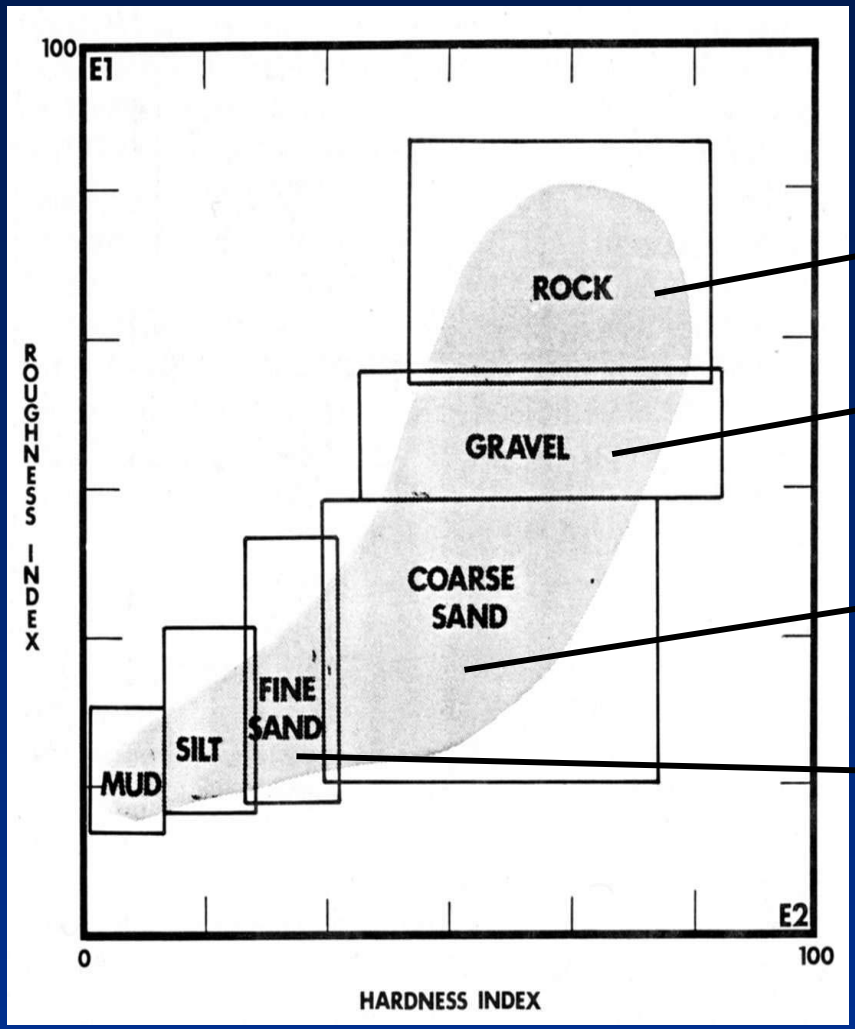
Horizontal collector well

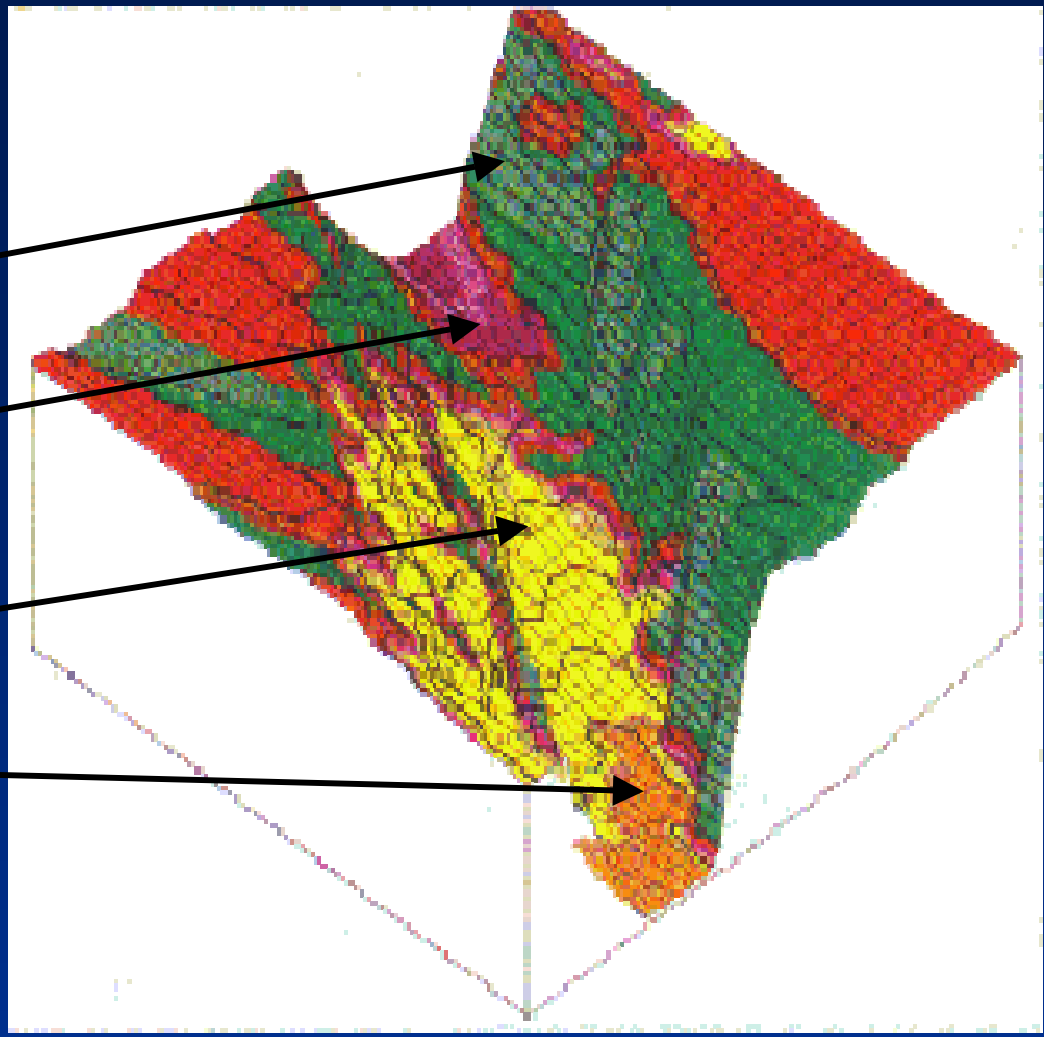
River-bed infiltration studies

Monitoring aquifer response

USGS

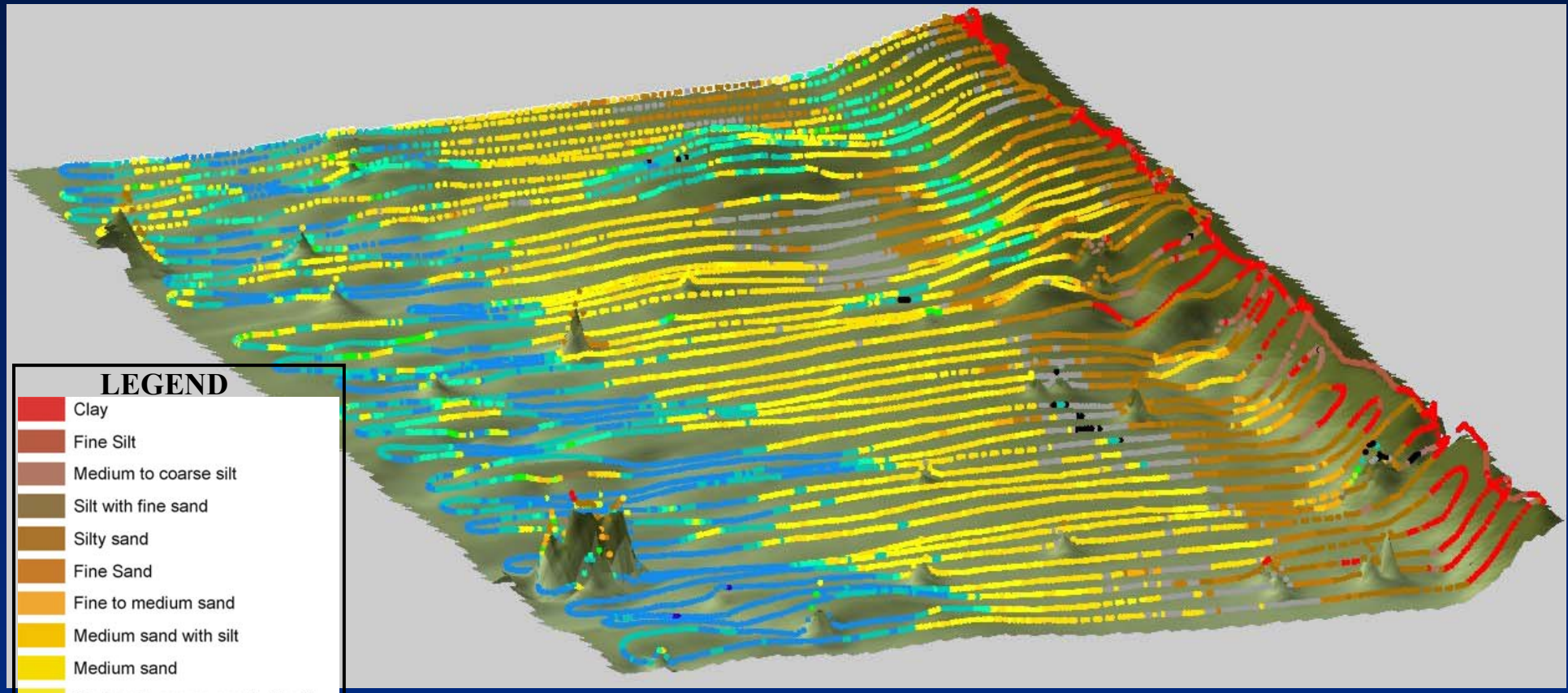
RoxAnn Streambed Classification System





USGS

RoxAnn Streambed Classification System

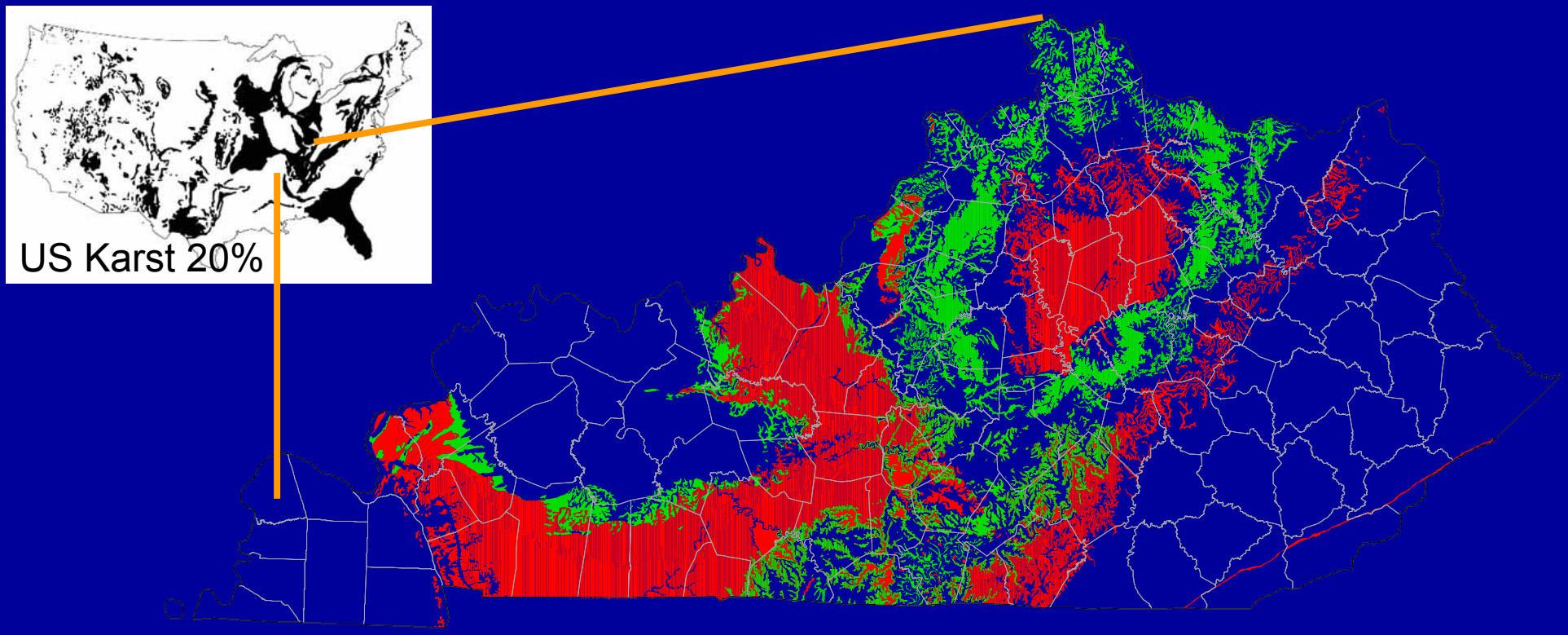


3-D View of RoxAnn Results – Ohio River Well Field

USGS

Karst Is a Significant Issue in Kentucky

55 percent of the state has potential for karst

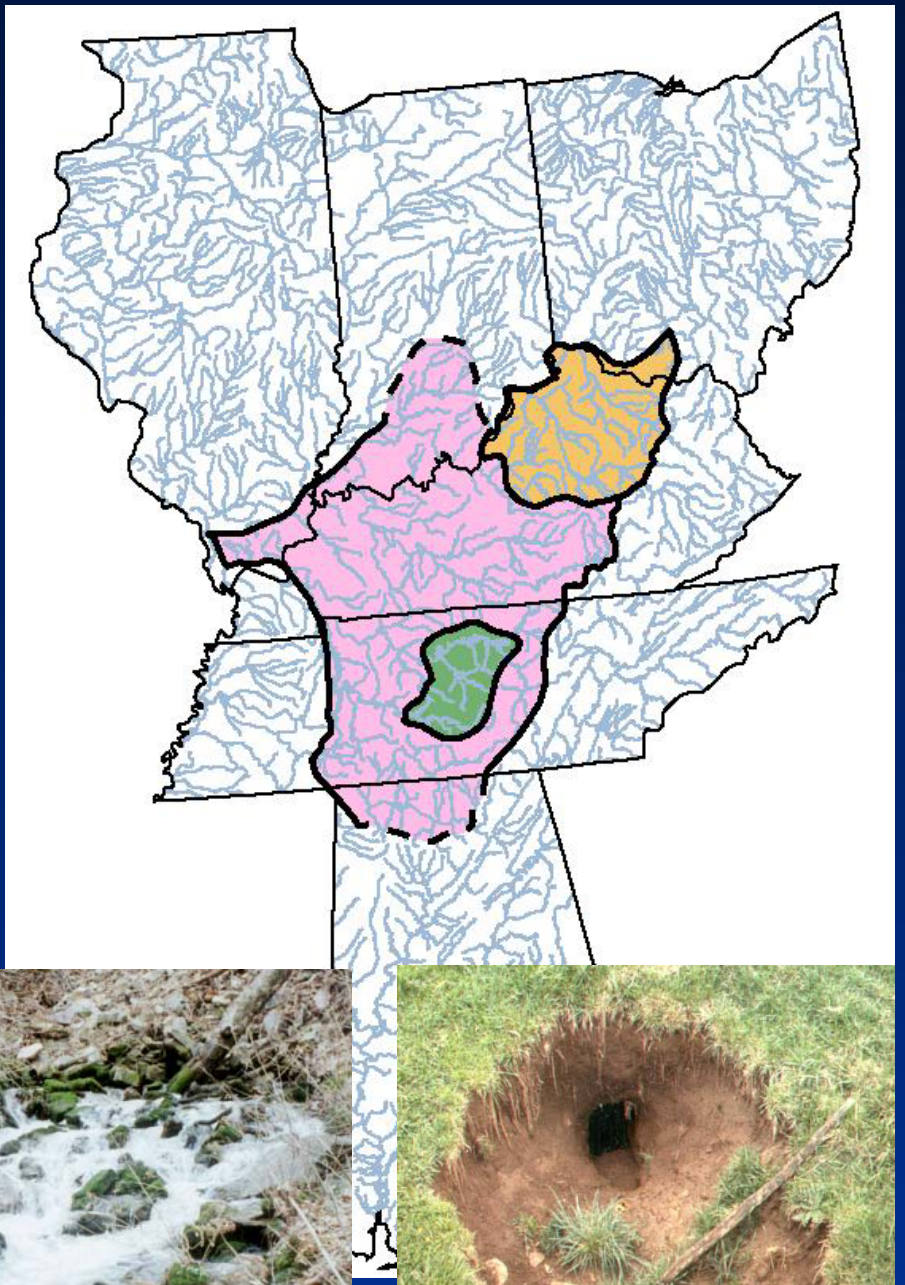


Areas shown in red have high potential for karst
Areas shown in green have moderate potential for karst
Areas shown in blue have limited potential for karst

KGS

Karst Hydrology Initiative
(USGS GW Resources Program)

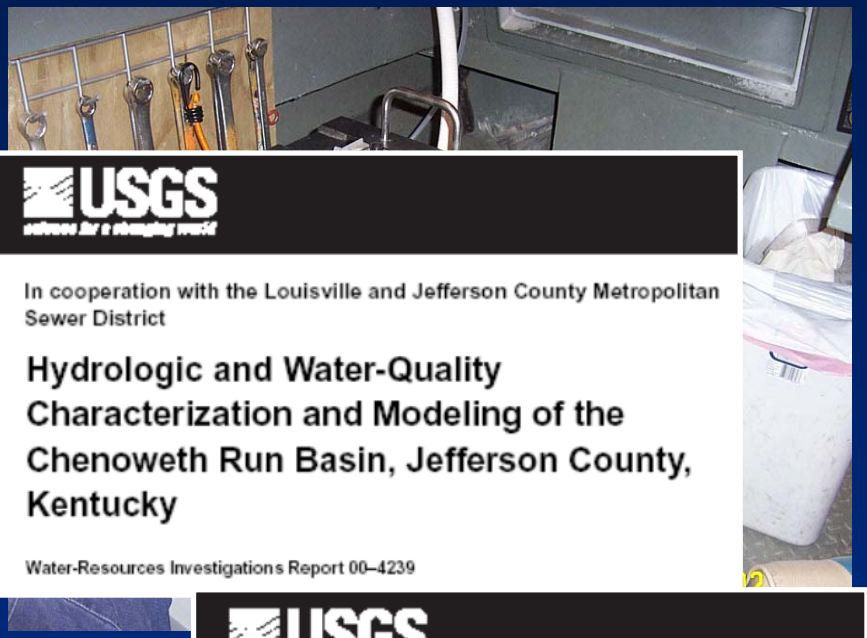
A regional study of karst terranes and aquifers of Ordovician-Mississippian age



Surface-Water-Quality

6 USGS NASQAN sites on Ohio River and tributaries

Dioxin sampling on the Ohio River and tributaries for ORSANCO, 13 sites for 3 different flow conditions



USGS

In cooperation with the Louisville and Jefferson County Metropolitan Sewer District

Hydrologic and Water-Quality Characterization and Modeling of the Chenoweth Run Basin, Jefferson County, Kentucky

Water-Resources Investigations Report 00–4239

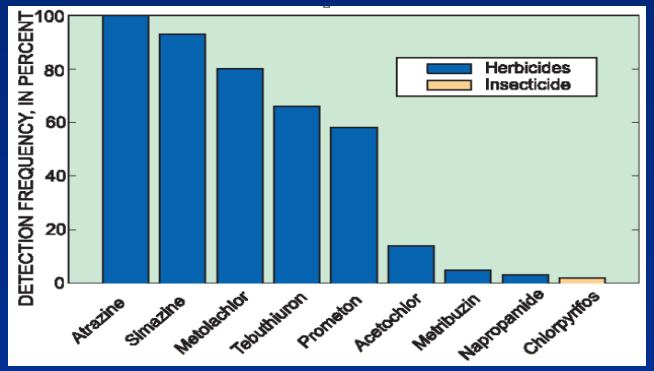
USGS

In cooperation with the Kentucky Natural Resources and Environmental Protection Cabinet—Division of Water

Estimated Loads and Yields of Suspended Solids and Water-Quality Constituents in Kentucky Streams

Water-Resources Investigations Report 01-4075

Pesticides in Karst Springs



USGS

NASQAN SUBBASIN MEAN ANNUAL YIELD, DEFINED INCREMENTALLY BY DIFFERENCE, OF ATRAZINE (39632) FOR WATER YEARS 1997–2000

Green and Cumberland River basins have some of the highest annual yields of atrazine in the US

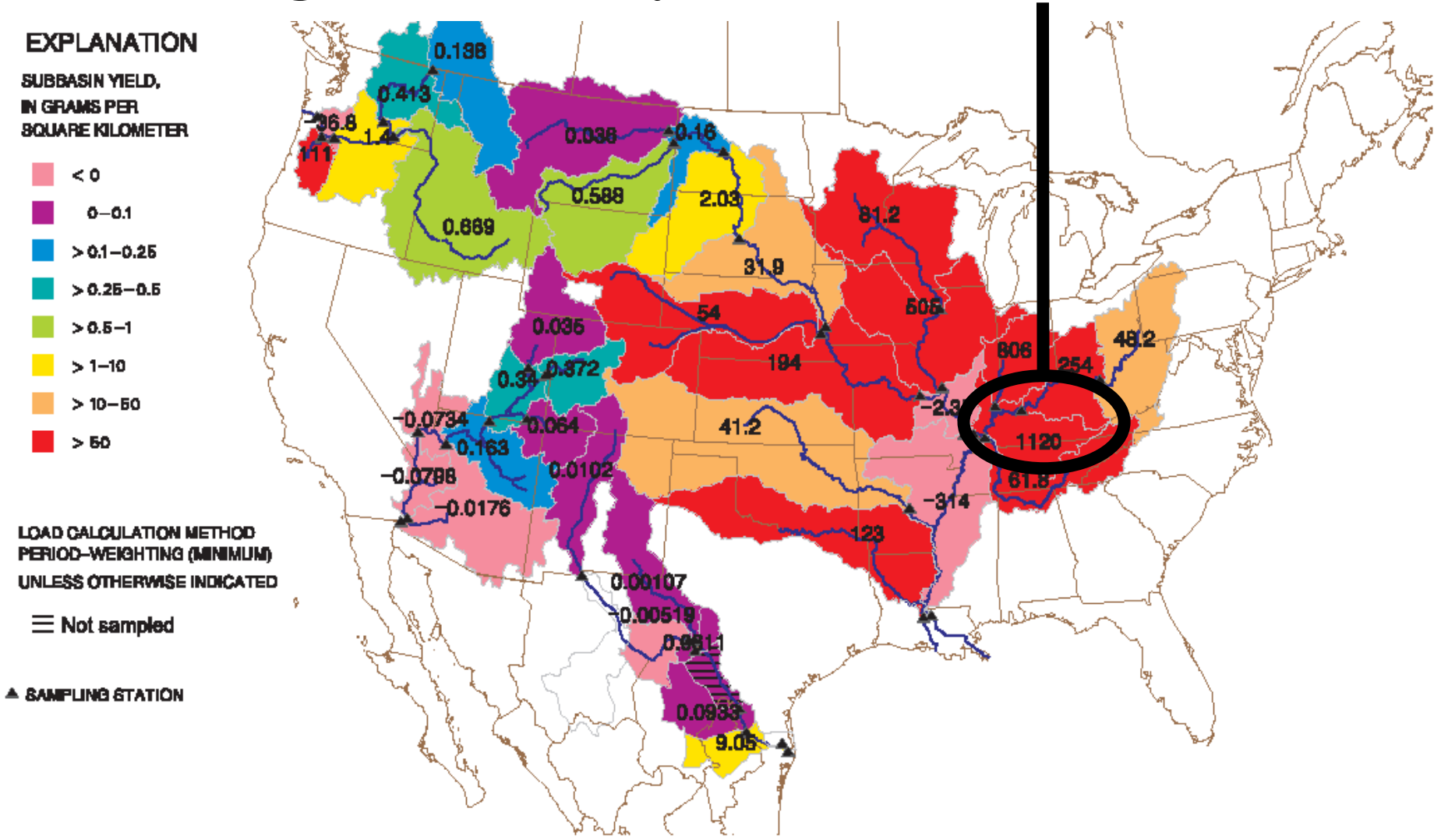
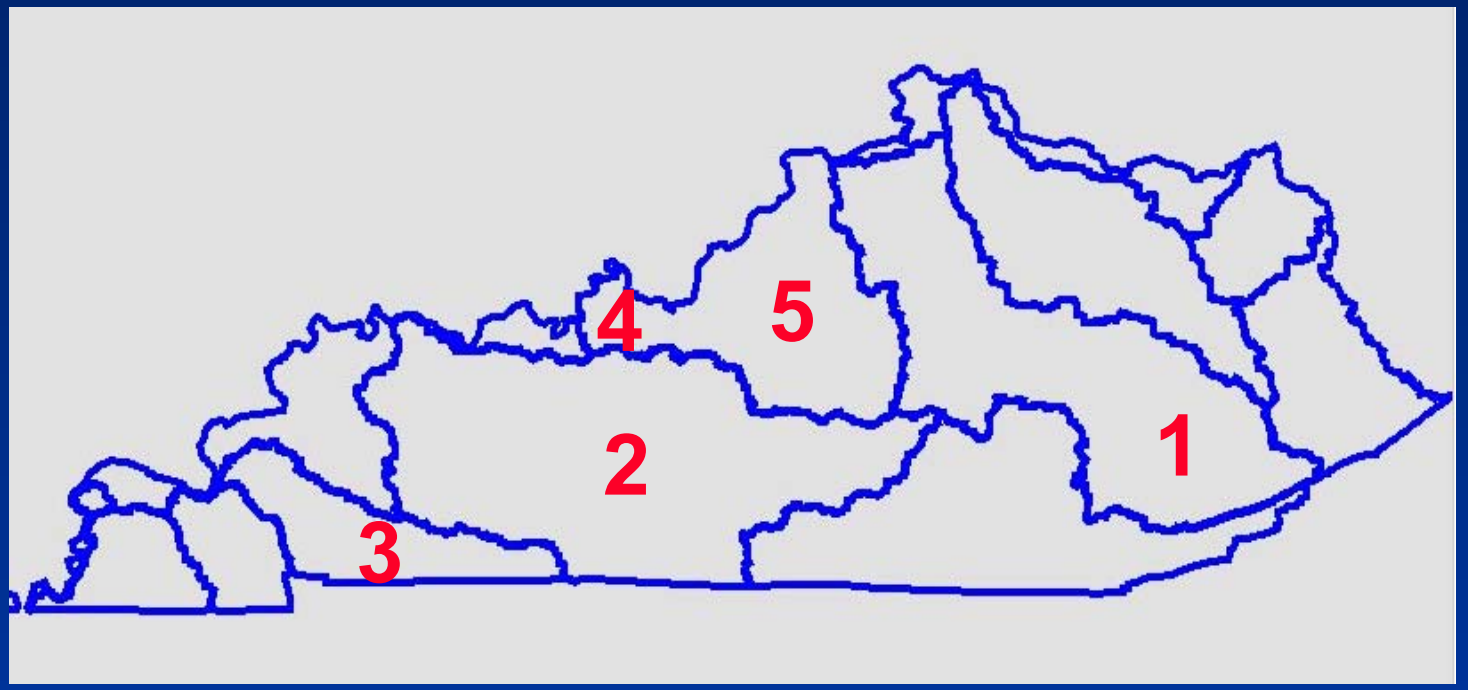


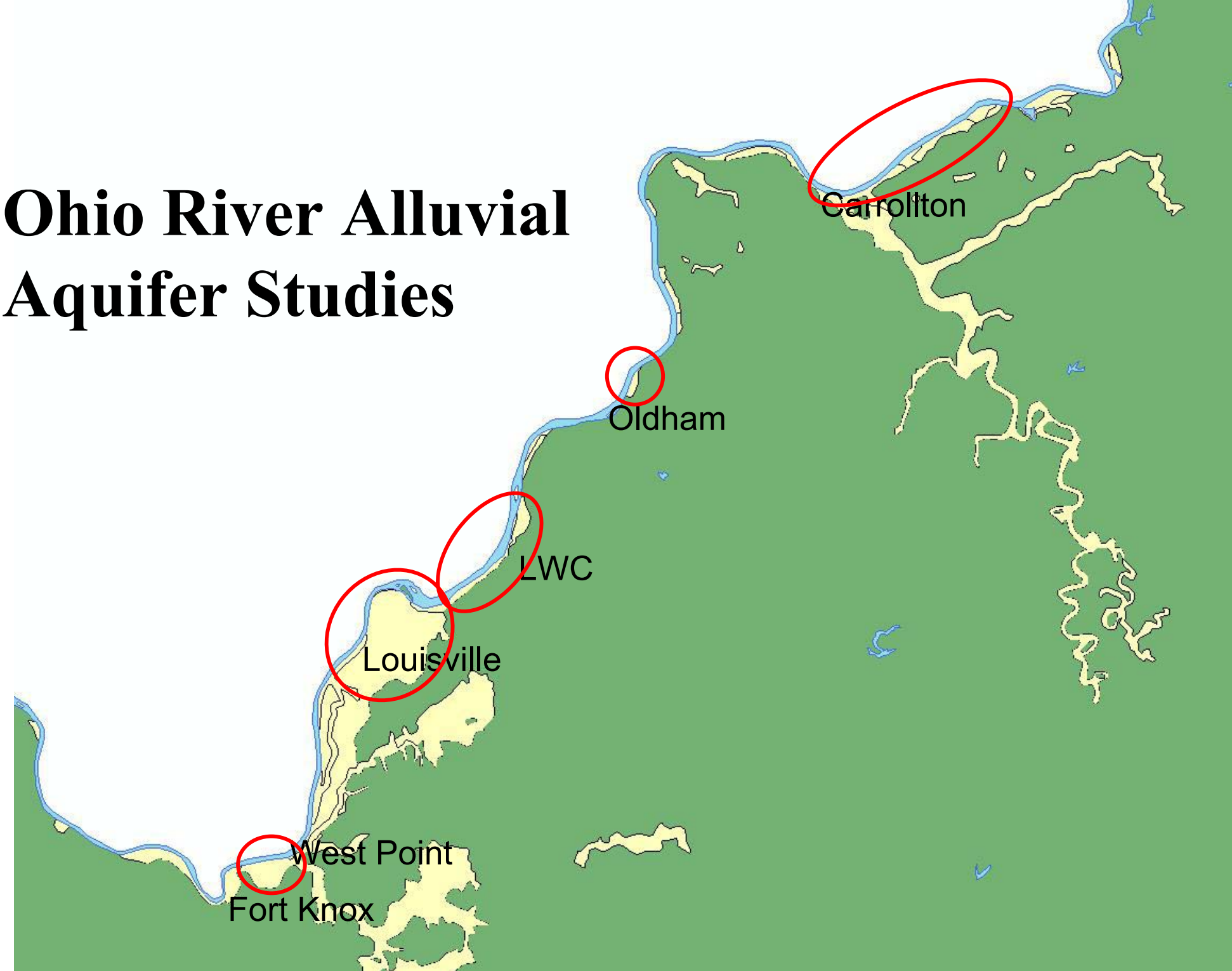
Figure 2. Atrazine yield from National Stream Quality Accounting Network (NASQAN) subbasins, 1997–2000.

Water-Quality Activities

1. Changes in WQ re: coal mine restoration, Rock Creek
2. LU-WQ relations in Mammoth Cave National Park
3. Pesticide runoff in the Little River watershed
4. Runoff quality affects on karst GW, Sinking Cr
5. GIS tool demo in upper Salt River watershed
6. Statewide N&P loads & streamstats GIS tool



Ohio River Alluvial Aquifer Studies



Ground-Water Cleanup Studies

Maxey Flats Low-Level Rad Site and Distler Brickyard Superfund Site are in their long-term data collection phase

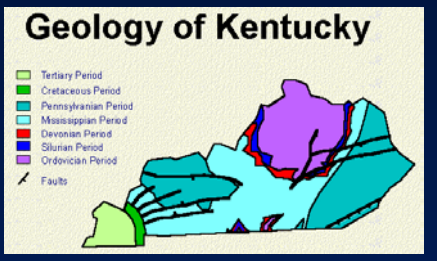
Kentucky's Sediment Lab

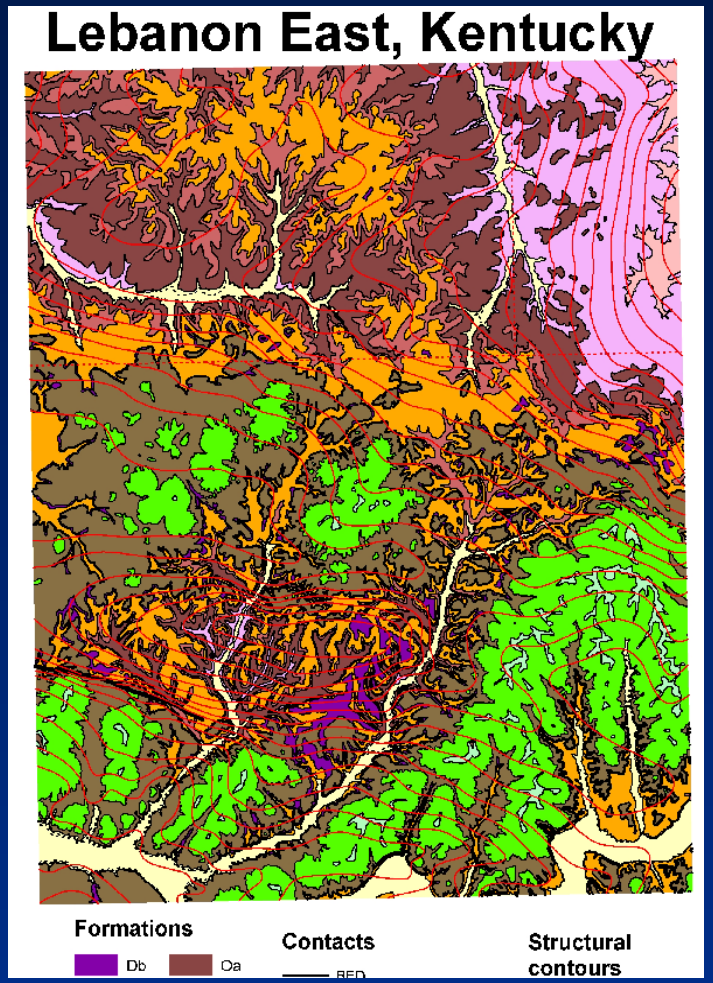
Analyses of suspended sediment concentration and particle size distribution

We have 24 USGS customers and 2 non-fed (LWC & GA), processing over 14,000 samples last year

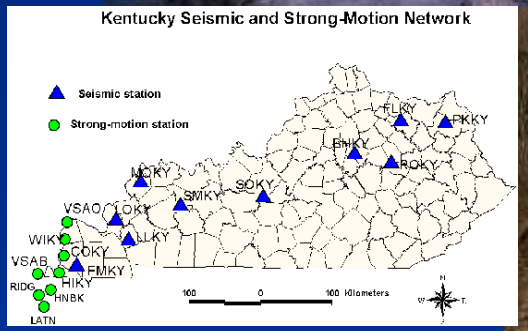
USGS

Mapping Kentucky's Geology





KGS/USGS have digitized Over 700 Kentucky Geologic Quads (1:24K)



http://www.uky.edu/KGS/home.htm

Capitalize on the new GIS data in KY

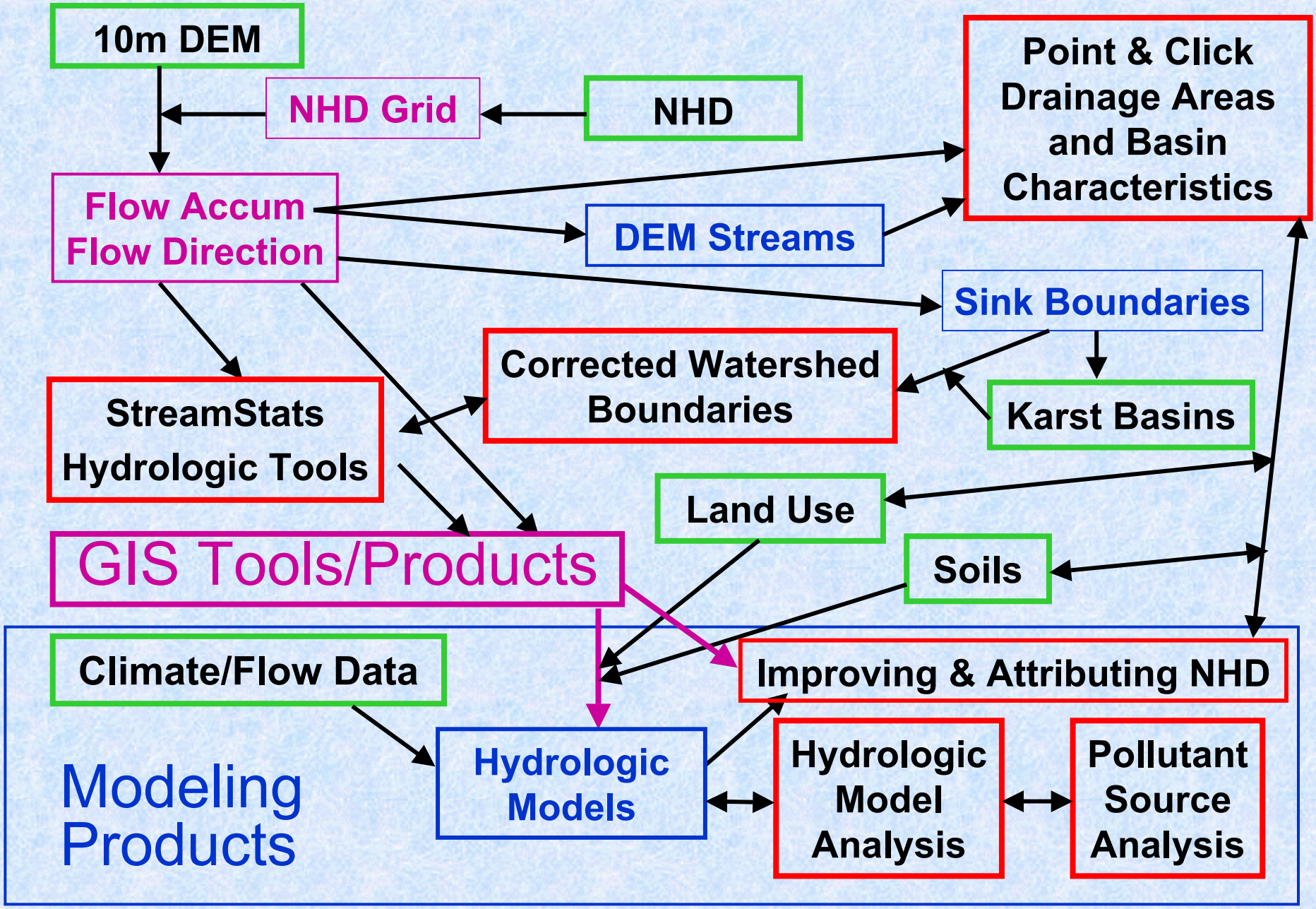
KY Digital Mapping Initiative (joint $ with USGS) – new DEM, NHD, KLS

http://www.state.ky.us/agencies/finance/depts/ogis/gisdept.htm

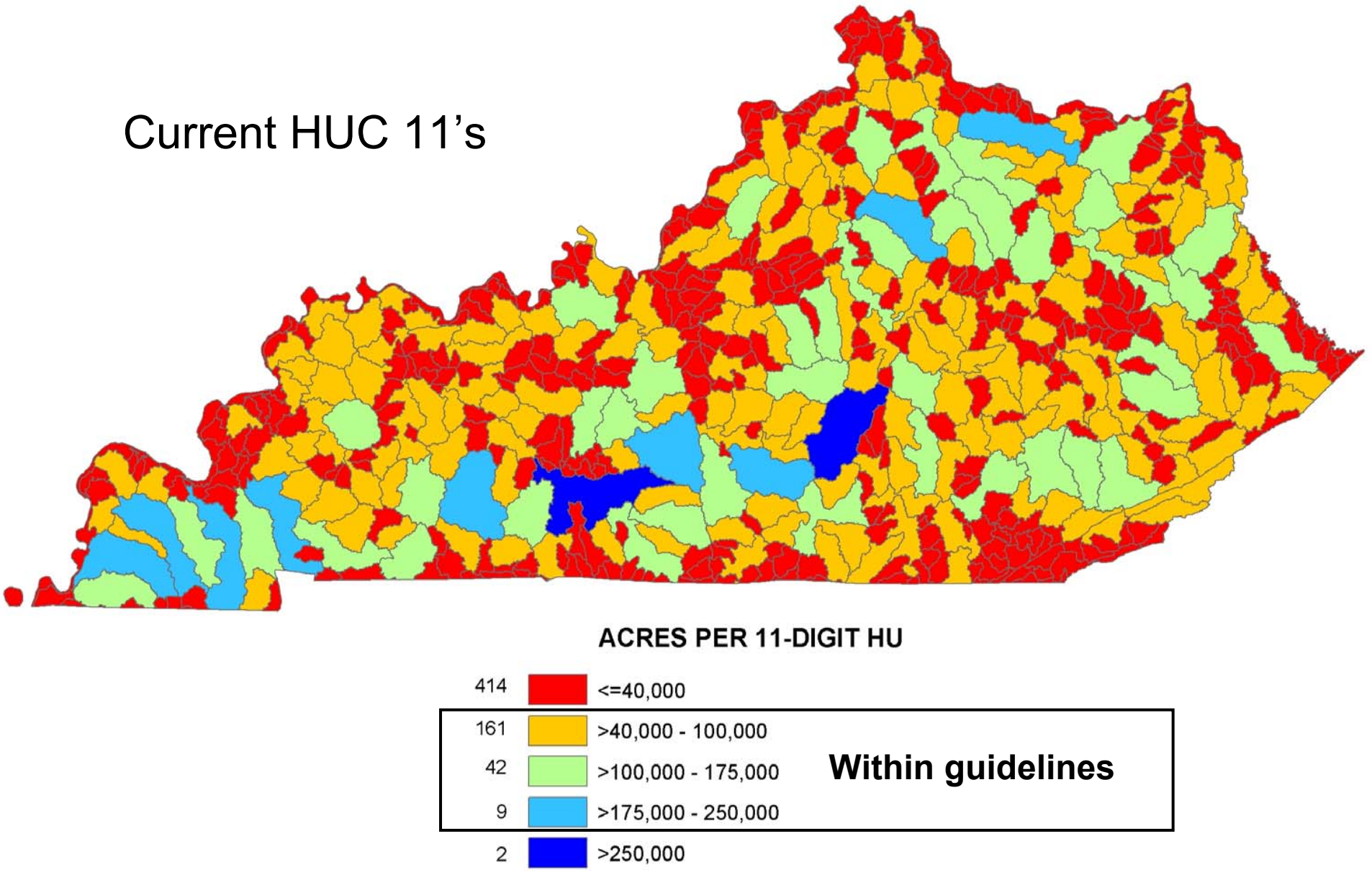
http://kls.state.ky.us

USGS

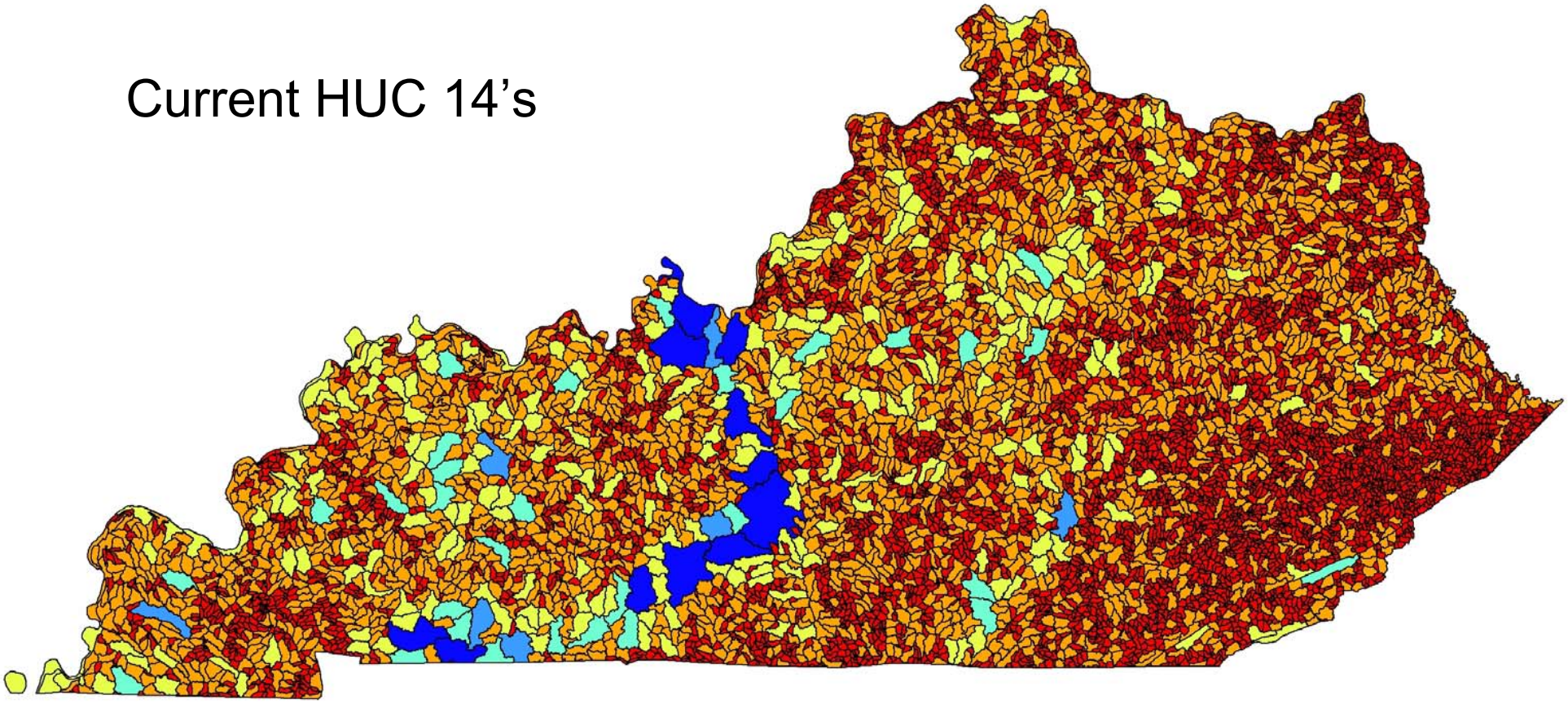
Building GIS-Based Hydrologic Tools



Current HUC 11's



Current HUC 14's



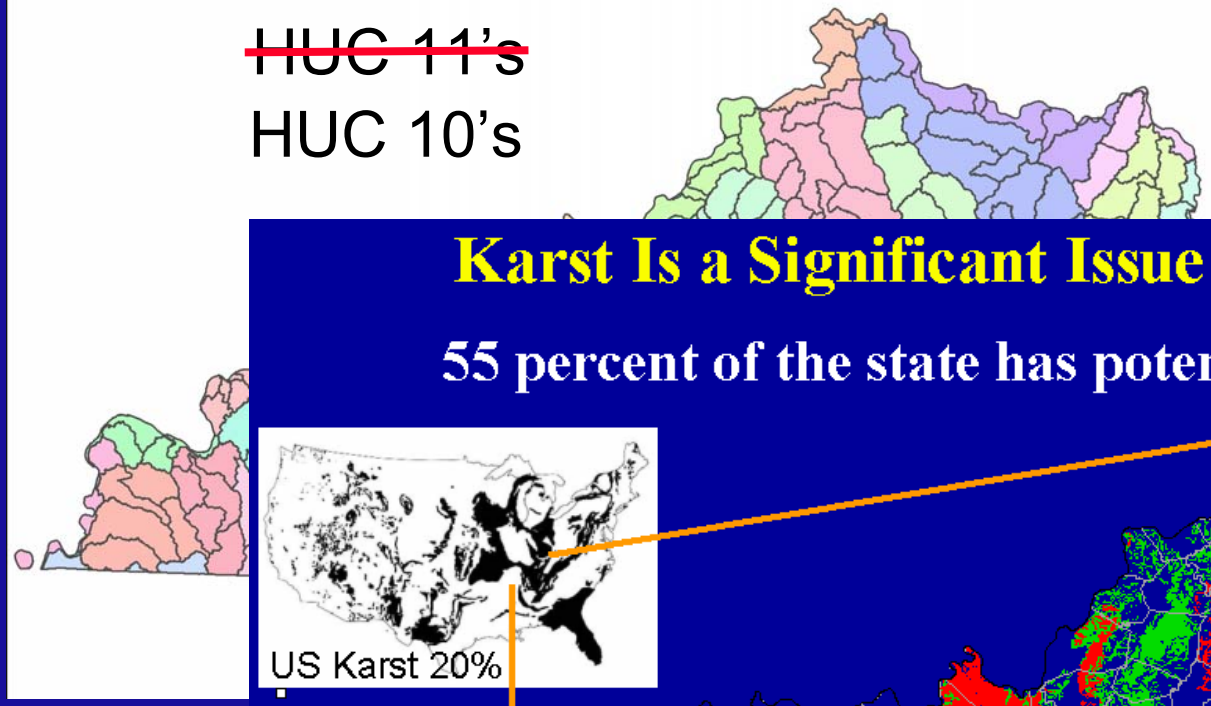
ACRES PER 14-DIGIT HU

6477		<=3200
2330		>3,200 - 10,000
253		>10,000 - 20000
31		>20,000 - 30000
7		>30,000 - 40,000
11		>40,000

Within guidelines

~~HUC 11's~~

HUC 10's



HUC basins revised with

l NHD

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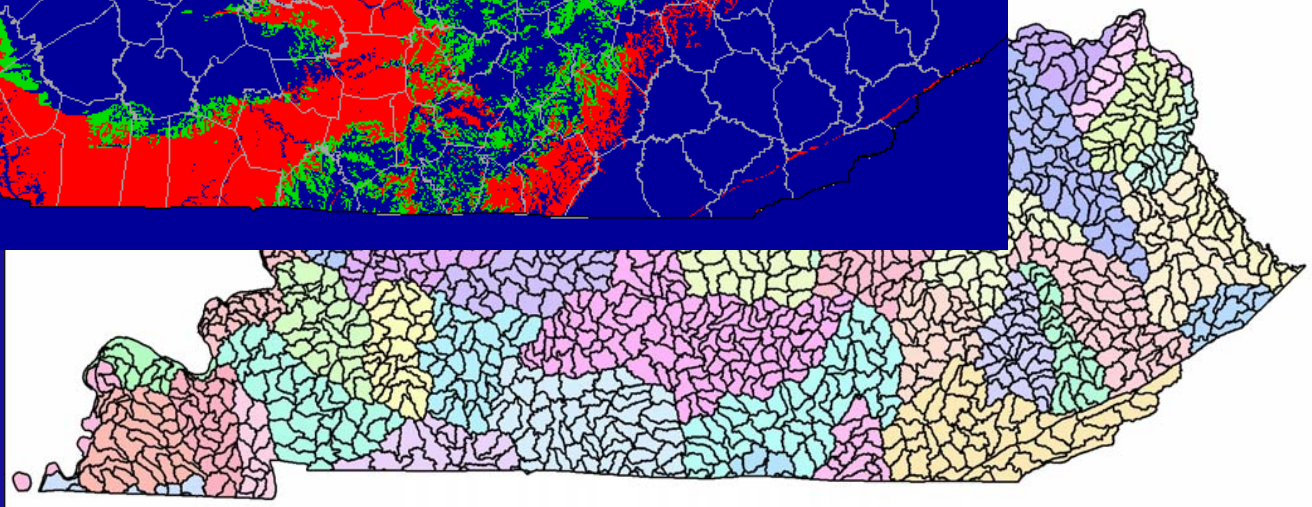
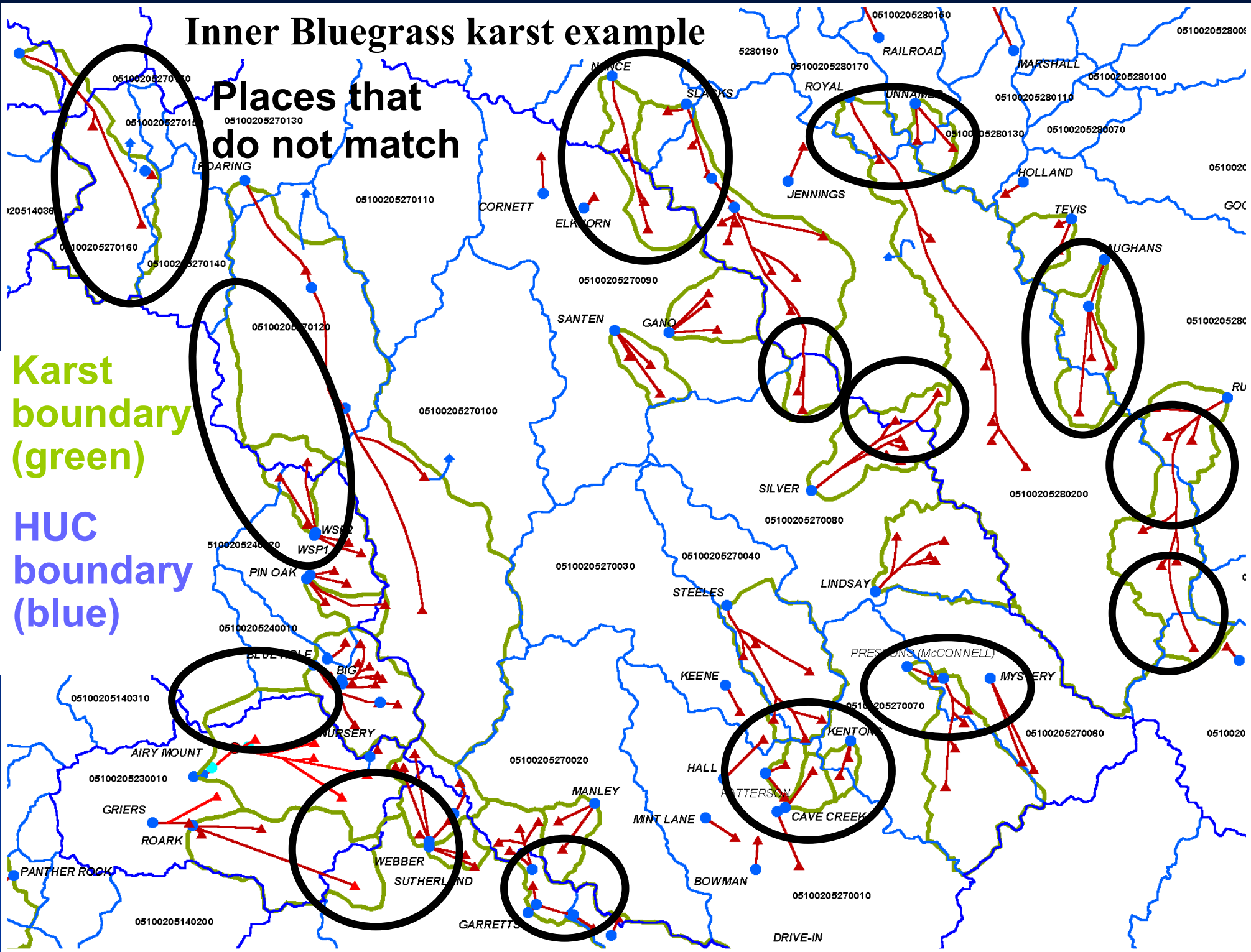
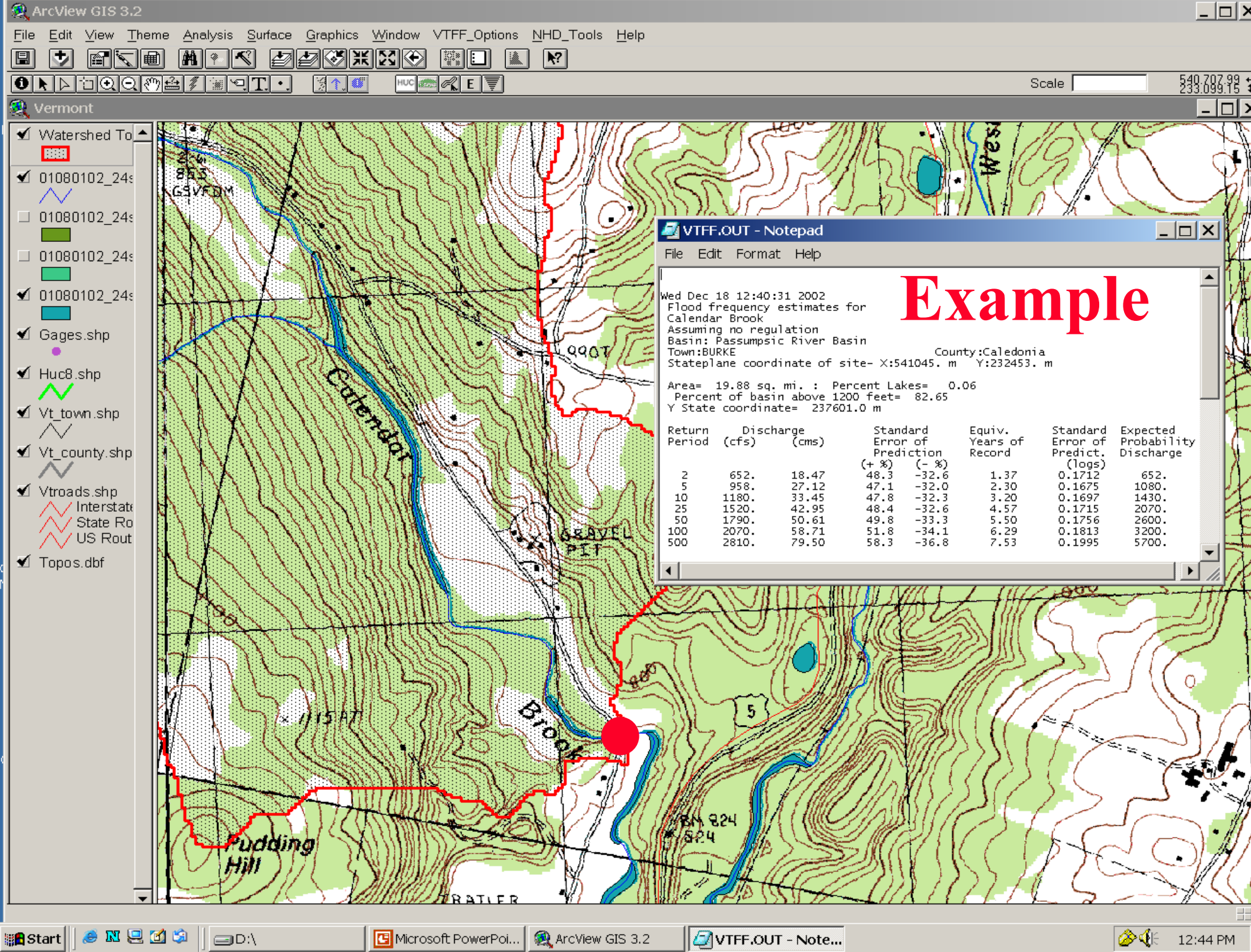



Inner Bluegrass karst example
Places that do not match
Karst boundary (green)
HUC boundary (blue)
05100205270150
05100205270130
ROARING
05100205270110
CORNETT
ELKHORN
NANCE
SLAUGHS
05100205270160
05100205270140
05100205270120
05100205270090
SANTEN
GANO
05100205270100
WSP2
WSP1
PIN OAK
05100205240010
BIG
05100205140310
NURSERY
AIRY MOUNT
05100205230010
GRIERS
ROARK
PANTHER ROCK
WEBBER
SUTHERLAND
05100205140200
MANLEY
05100205270020
GARRETTS
05100205280150
RAILROAD
5280190
05100205280170
ROYAL
UNNAMED
MARSHALL
05100205280100
05100205280110
05100205280130
05100205280070
JENNINGS
HOLLAND
TEVIS
AUGHANS
SILVER
05100205280200
05100205270080
05100205270040
05100205270030
LINDSAY
STEELES
KEENE
PRESTONS (McCONNELL)
MYSTERY
05100205270070
05100205270060
KENTON
HALL
PATTERSON
CAVE CREEK
MINT LANE
BOWMAN
05100205270010
DRIVE-IN

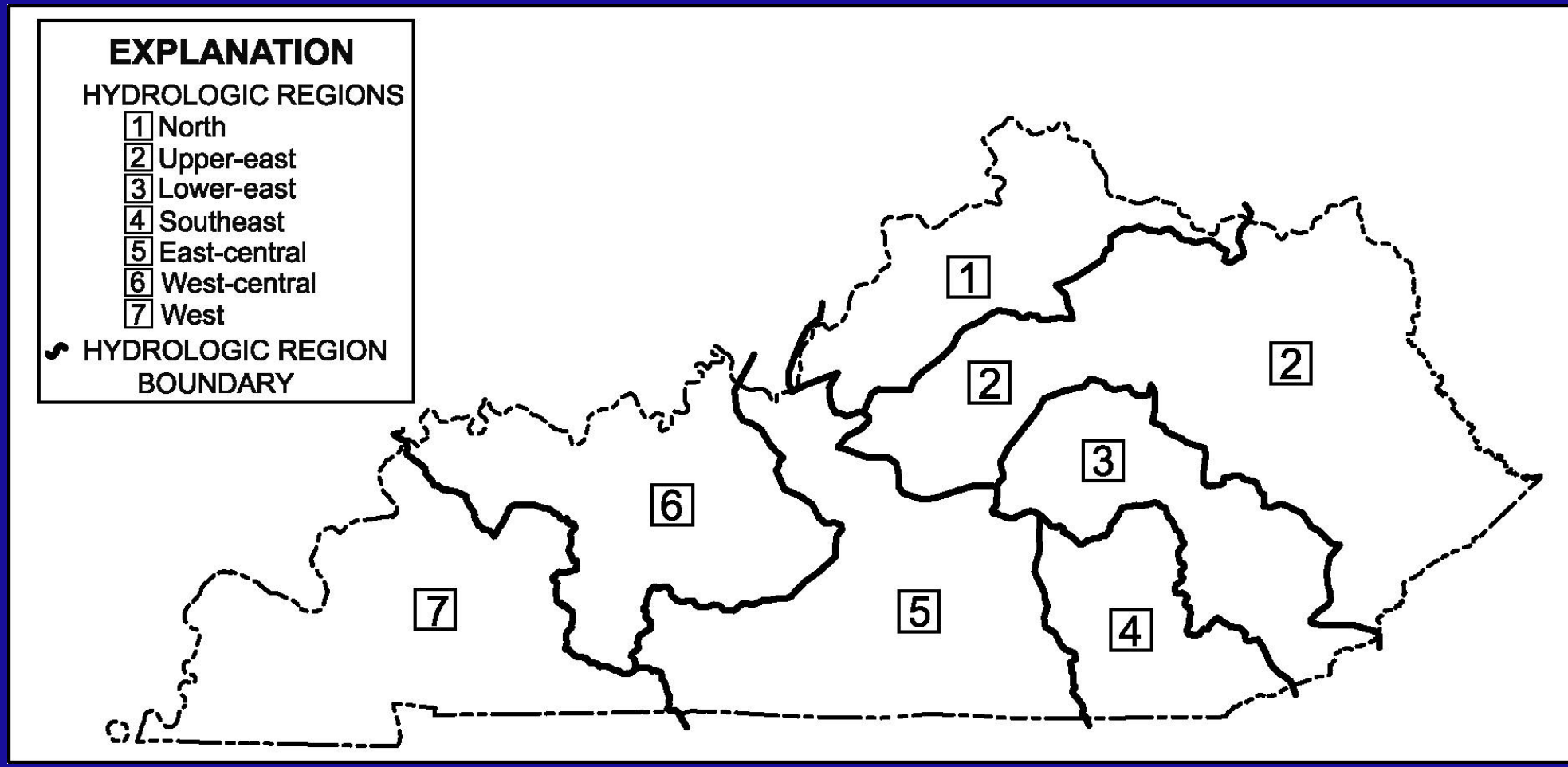
Vermont Example Peak Flow Equation

$$Q_{50} = 129\ A^{0.874}\ L^{-0.327}\ E^{0.115}$$

- Q_{50} = Peak discharge with a recurrence interval of 50 years
- A = Drainage area , mi^2
- L = 1 plus the % of basin covered by lakes or ponds
- E = 1 plus the % of basin at or above 1200 feet


ArcView GIS 3.2
File Edit View Theme Analysis Surface Graphics Window VTFF_Options NHD_Tools Help
Scale
Vermont
Watershed To
01080102_24s
01080102_24s
01080102_24s
01080102_24s
Gages.shp
Huc8.shp
Vt_town.shp
Vt_county.shp
Vtroads.shp
Interstate
State Ro
US Rout
Topos.dbf
VTFF.OUT - Notepad
File Edit Format Help
Example
Wed Dec 18 12:40:31 2002
Flood frequency estimates for
Calendar Brook
Assuming no regulation
Basin: Passumpsic River Basin
Town:BURKE County:Caledonia
Stateplane coordinate of site- X:541045. m Y:232453. m
Area= 19.88 sq. mi. : Percent Lakes= 0.06
Percent of basin above 1200 feet= 82.65
Y State coordinate= 237601.0 m
Return Period | Discharge (cfs) | Discharge (cms) | Standard Error of Prediction (+ %) | Standard Error of Prediction (- %) | Equiv. Years of Record | Standard Error of Predict. (logs) | Expected Probability Discharge
2 652. 18.47 48.3 -32.6 1.37 0.1712 652.
5 958. 27.12 47.1 -32.0 2.30 0.1675 1080.
10 1180. 33.45 47.8 -32.3 3.20 0.1697 1430.
25 1520. 42.95 48.4 -32.6 4.57 0.1715 2070.
50 1790. 50.61 49.8 -33.3 5.50 0.1756 2600.
100 2070. 58.71 51.8 -34.1 6.29 0.1813 3200.
500 2810. 79.50 58.3 -36.8 7.53 0.1995 5700.
Calendar Brook
Pudding Hill
GRAVEL PIT
Start
D:\
Microsoft PowerPoi...
ArcView GIS 3.2
VTFF.OUT - Note...
12:44 PM

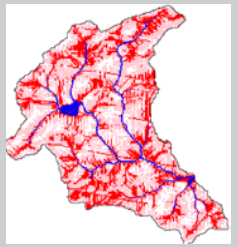
KY streamstats will incorporate published low & high flow statistics and estimates of N & P loads (SPARROW)



Example Statewide Watershed Model Configuration

Daily time series precipitation / temperature 1948-present

Pervious runoff model
TOPMODEL

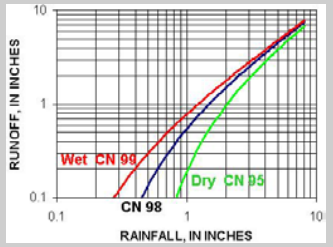


Wetness index

Spatial regression model

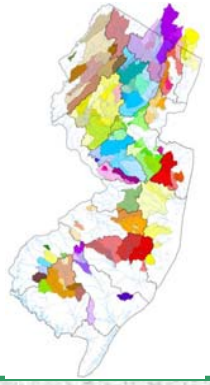
Calibration to gages

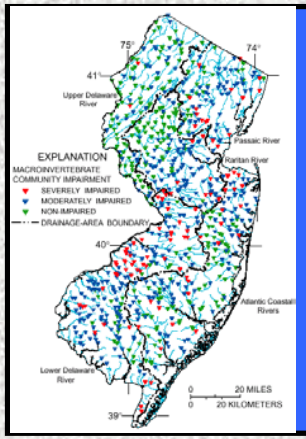
Impervious runoff model
TR-55



Daily climate station data

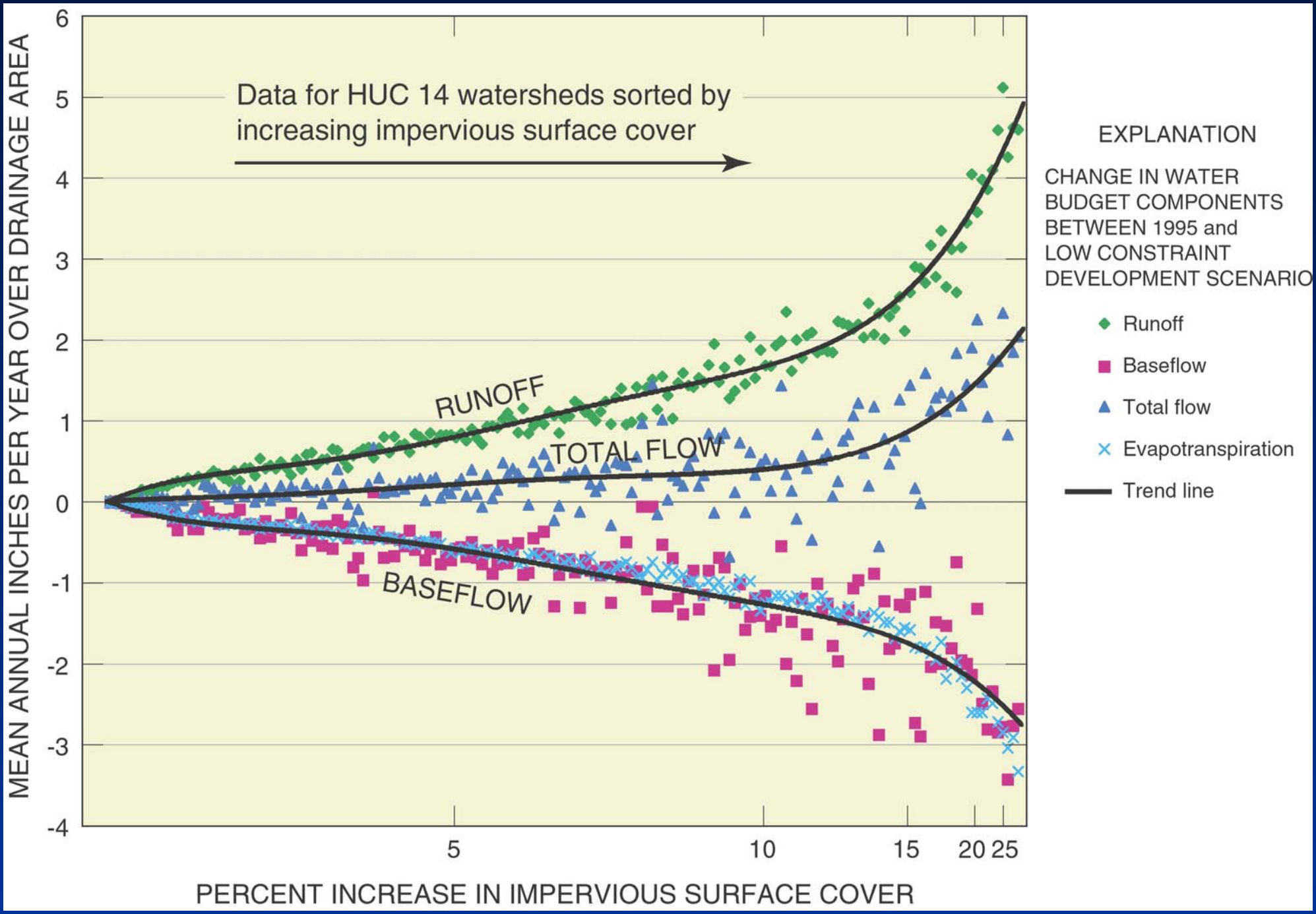
Daily flow station data





Compute streamflow statistics at 856 bio-monitoring sites to assess role of flow on impairment

Effect of Impervious Surface on Streamflow



Water Budget Analysis

- Provides a basis for evaluating change
- Accounts for water system gains and loses

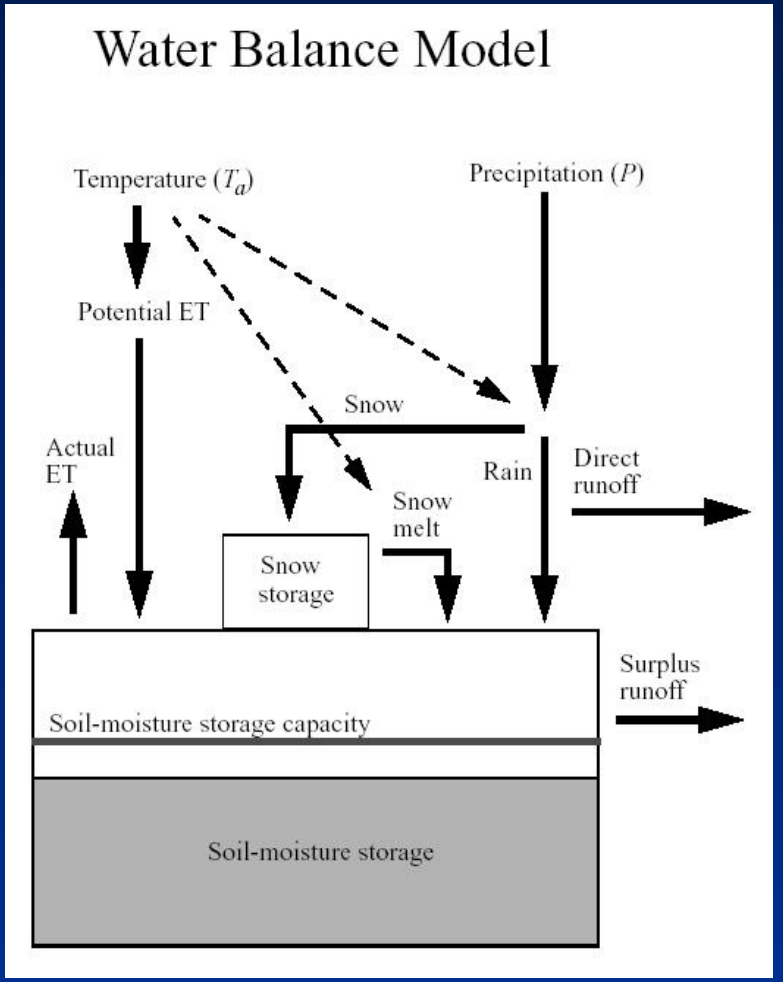
Streamflow =

Precipitation

– Evapotranspiration

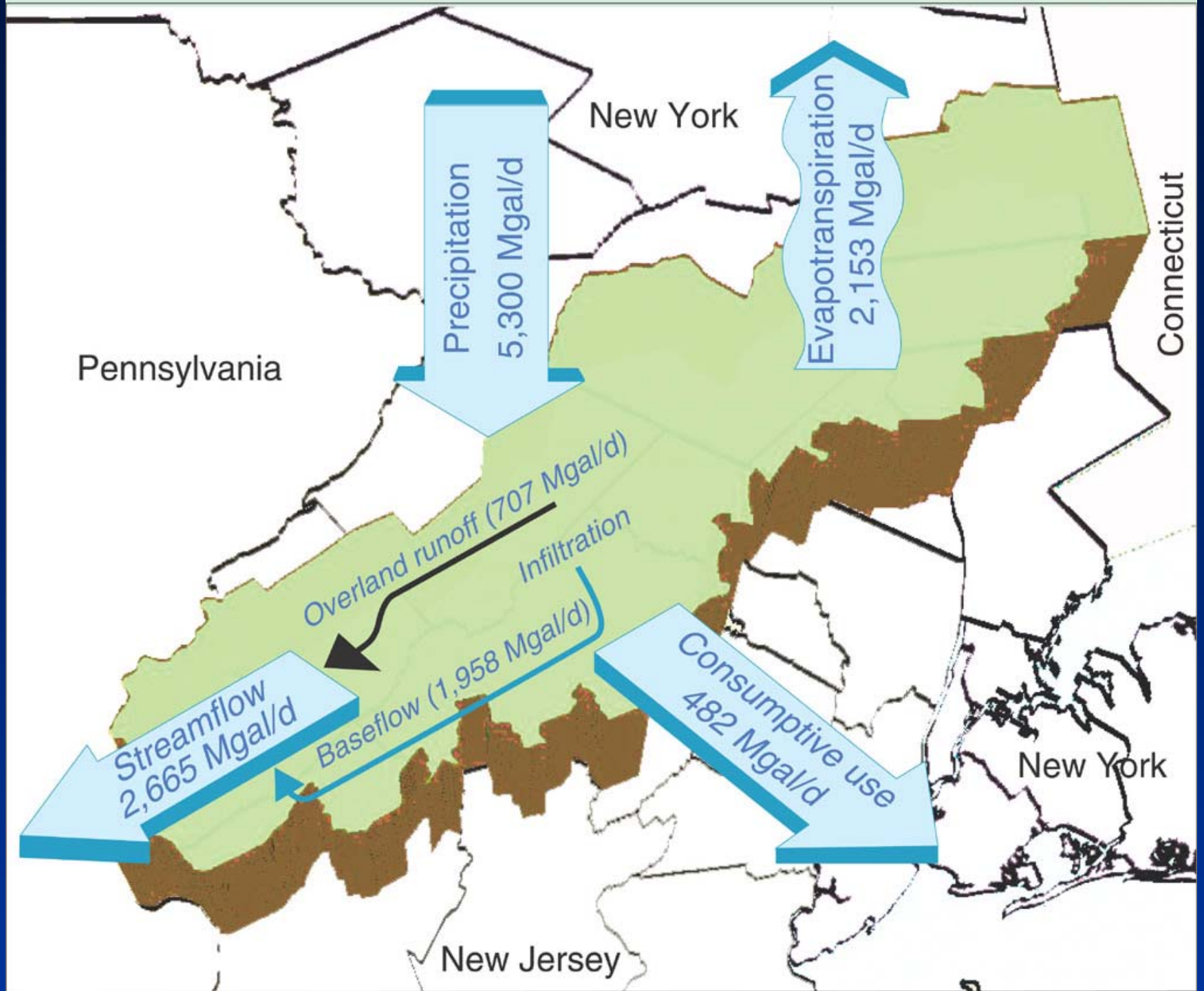
– Withdrawals

+ Return flows



USGS

New York—New Jersey Highlands regional water budget



Rapid Watershed Assessment Using Helicopter Video Mapping with GPS Tags

Don Roseboom and Tim Straub

Illinois District, USGS

USGS

Presentations in Main Conference Room

9:30 – 10:00	Welcome and overview	Mark Ayers
10:00 – 10:25	Tools for riverbank infiltration studies	Mike Unthank
10:30 – 10:55	USGS initiative to study karst systems	Chuck Taylor
11:00 – 11:25	Tools for flow and sediment modeling	Chad Wagner
11:30 – 11:55	The USGS real time data system (NWISWEB)	Mike Griffin
11:55– 12:00	Special presentation	Mark Ayers
12:00 – 1:00	Lunch	
1:05 – 2:20	Equipment and Method Demonstrations	
2:30 – 3:00	Wrap-up/Open Forum in Main Conference Room	

Equipment and Method Demonstrations

Time	Wareyard	Main Conference Room 60	Wareyard & Sediment Lab	Warehouse
1:05 – 1:20	**Ground Water Monitoring** Chuck Taylor/Doug Zettwoch	**Stream Restoration** Don Roseboom, IL District	**Water Quality Monitoring** Angie Crain/Greg McCombs	**Continuous Streamflow Gaging Station Demonstration & Streamflow Records Computation** Dennis McClain/Brian Moore
1:25 – 1:40	**Acoustic Technology** Chad Wagner/Ed Puckett	**National Map** Bruce Bauch	**Sediment Lab Room 30** Libby Shreve/Aimee Downs	
1:45 – 2:00	**Ground Water Monitoring** Chuck Taylor/Doug Zettwoch	**GIS Tools** Hugh Nelson/Mark Ayers	**Water Quality Monitoring** **Angie Crain/ Greg McCombs**	**Continuous Streamflow Gaging Station Demonstration & Streamflow Records Computation** Dennis McClain/Brian Moore
2:05 – 2:20	**Acoustic Technology** Chad Wagner/ Ed Puckett	**Stream Restoration** Don Roseboom, IL District	**Sediment Lab Room 30** Libby Shreve/Aimee Downs	