

Overview of Water Resources including Groundwater/Surface Water Relationships

*Presentation to the CIBO Focus Group
Water Impacts on Industrial Energy
March 5, 2013*

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Presentation Outline

- Background on the USGS Water Mission Area
- USGS Water Mission Area Activities
 - Surface Water
 - Water Quality
 - Groundwater
 - Data Delivery
 - Water Use
- Drought
- GW/SW Interactions

Water Resources Mission



To provide reliable, impartial, timely information that is needed to understand the Nation's water resources. The Water Mission Area actively promotes the use of this information by decision makers to –

- Minimize the loss of life and property as a result of water-related natural hazards, such as floods, droughts, and land movement.
- Effectively manage groundwater and surface-water resources for domestic, agricultural, commercial, industrial, recreational, and ecological uses.
- Protect and enhance water resources for human health, aquatic health, and environmental quality.
- Contribute to wise physical and economic development of the Nation's resources for the benefit of present and future generations.

Why USGS?

Non-regulatory – With no regulatory or management responsibilities, USGS has been recognized since its inception in 1879 as the major national source of unbiased, consistent and rigorous science.

“Even amidst cost concerns, USGS cooperators note that they need the quality and independence of USGS products; independent monitoring and data analyses are vital to provide unbiased input to their management programs and for “government performance and review.”

National Research Council of the National Academies in *Toward A Sustainable and Secure Water Future*, 2009



U.S. Geological Survey Water Resources Offices



EXPLANATION

- Regional Offices
- Science Centers
- Field Offices
- ★ Headquarters



Hawaii



Guam

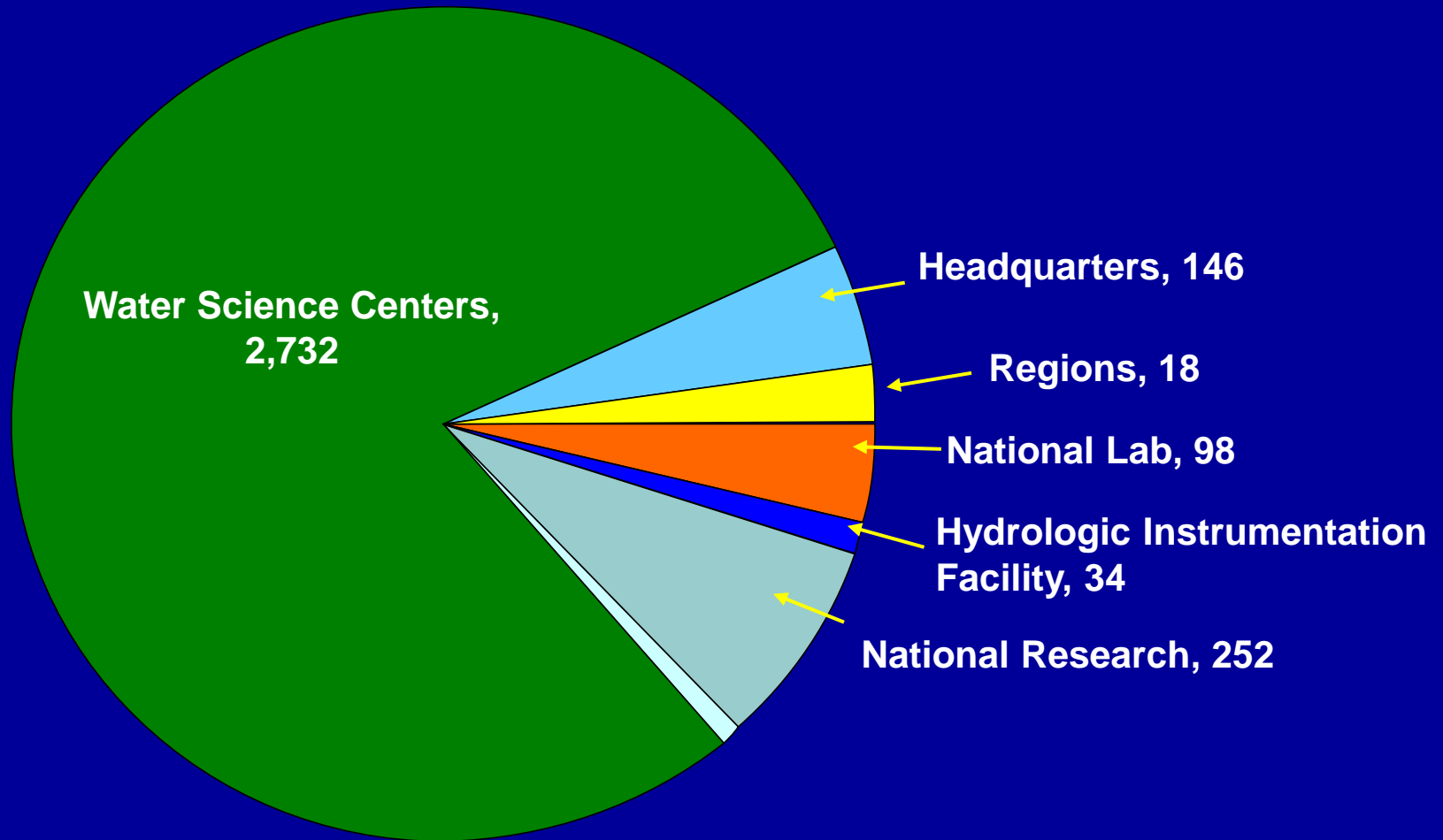


Alaska



Puerto Rico

Water Staff by Location 2010 (3305 total)

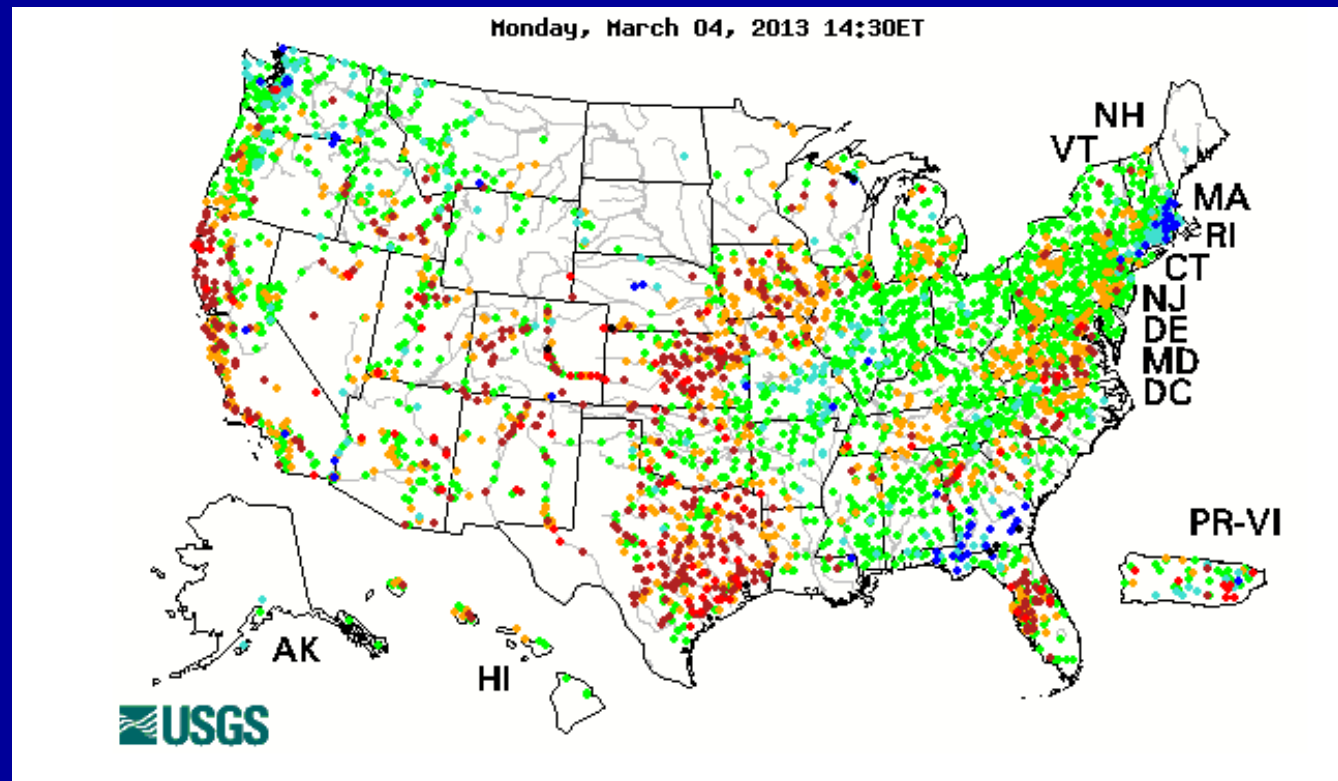


The USGS Streamgaging Network

Streamgages

8,000 gages
99 % real-time
All on web

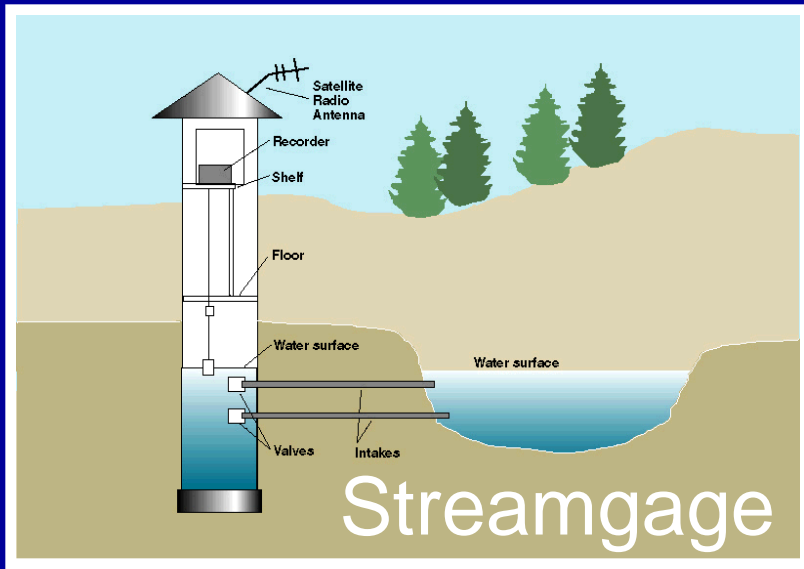
850+ Partners



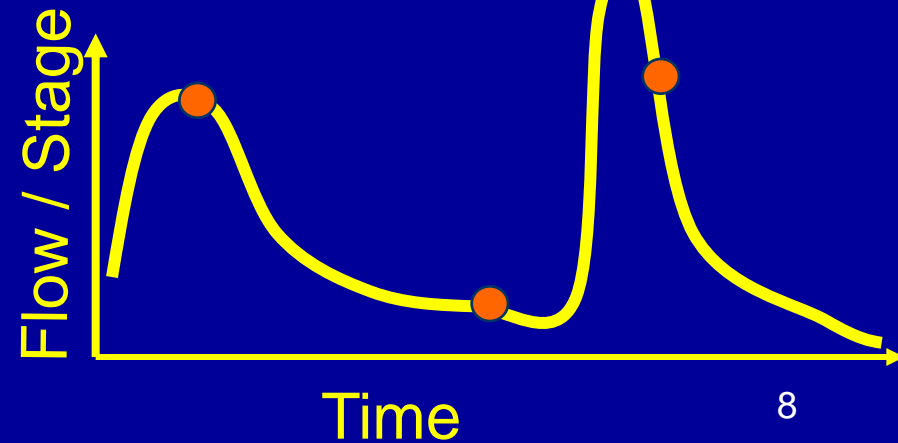
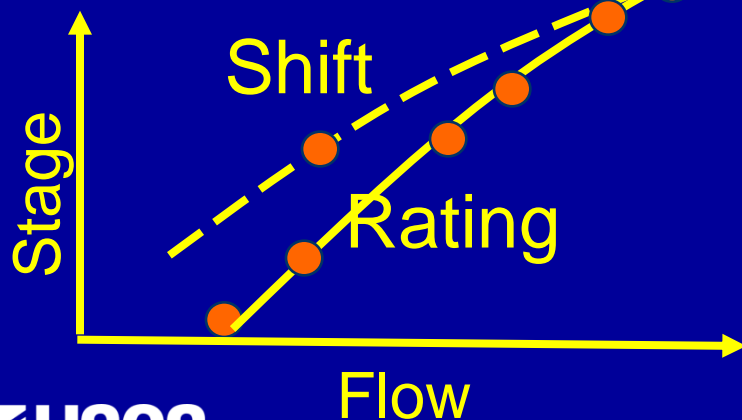
Funding Sources

State / Local Agencies	49%
Other Federal Agencies	18%
USGS Cooperative Program	16%
USGS National Streamflow Info Program	18%

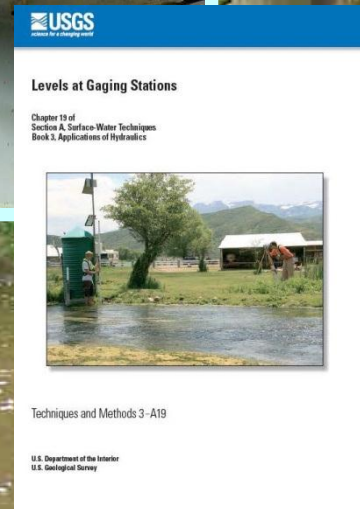
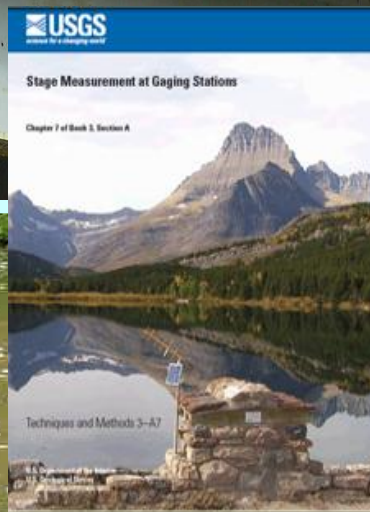
The Streamgaging Process



Flow
Measurements



Monitoring Stage

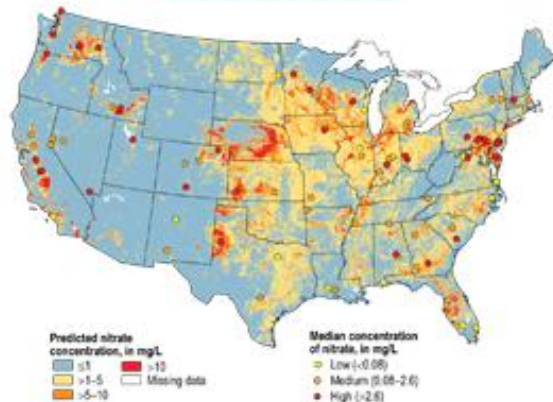


- +/- 0.02 ft. or 2% of range
- Verified by direct readings
- Record adjusted accordingly
- New technologies reduced costs

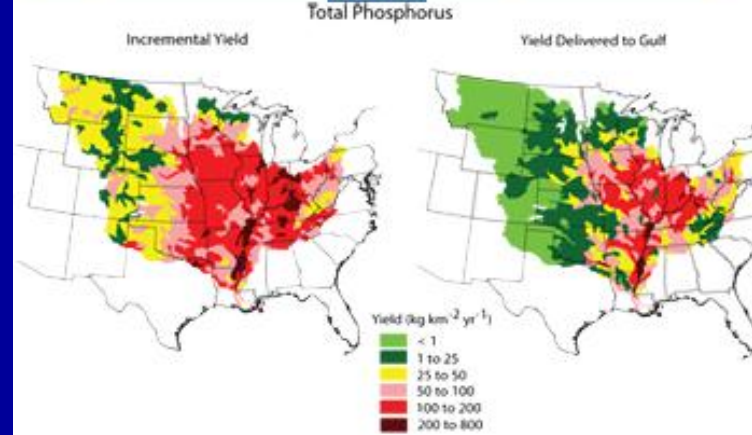
Products of the National Water Quality Assessment Program

National and Regional Assessments of Water Quality Conditions

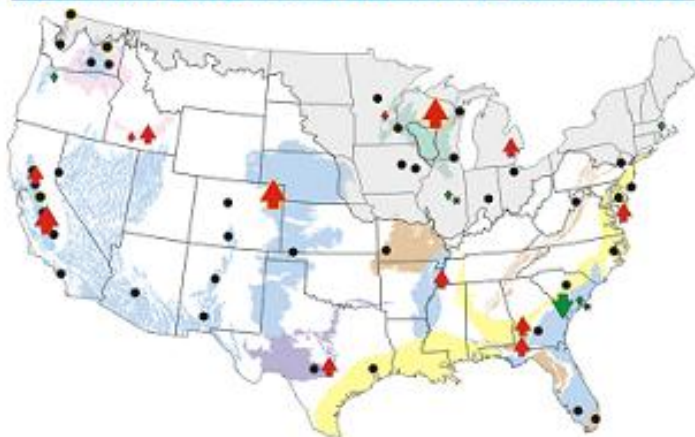
Nutrients remain elevated in the Nation's streams and groundwater



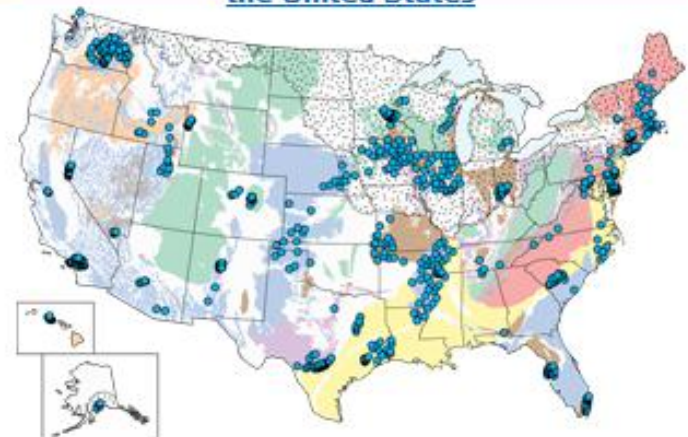
Phosphorus and Nitrogen Delivery to the Gulf of Mexico



A National Assessment of Changes in Chloride, Dissolved Solids, and Nitrate in Groundwater

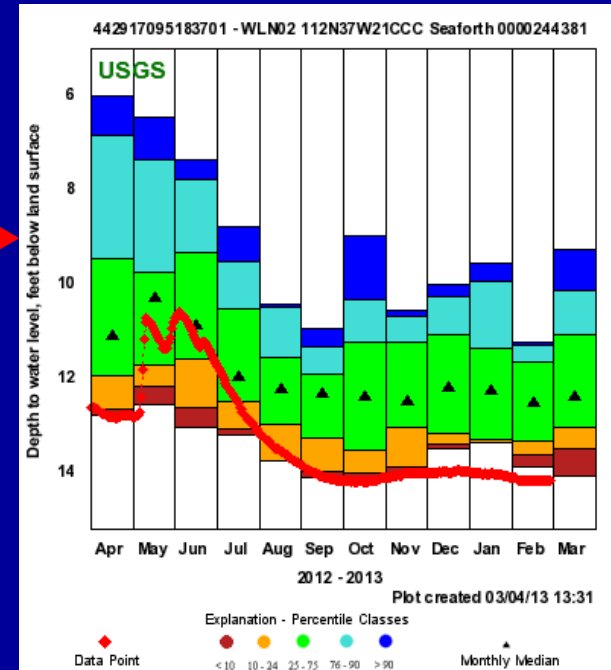
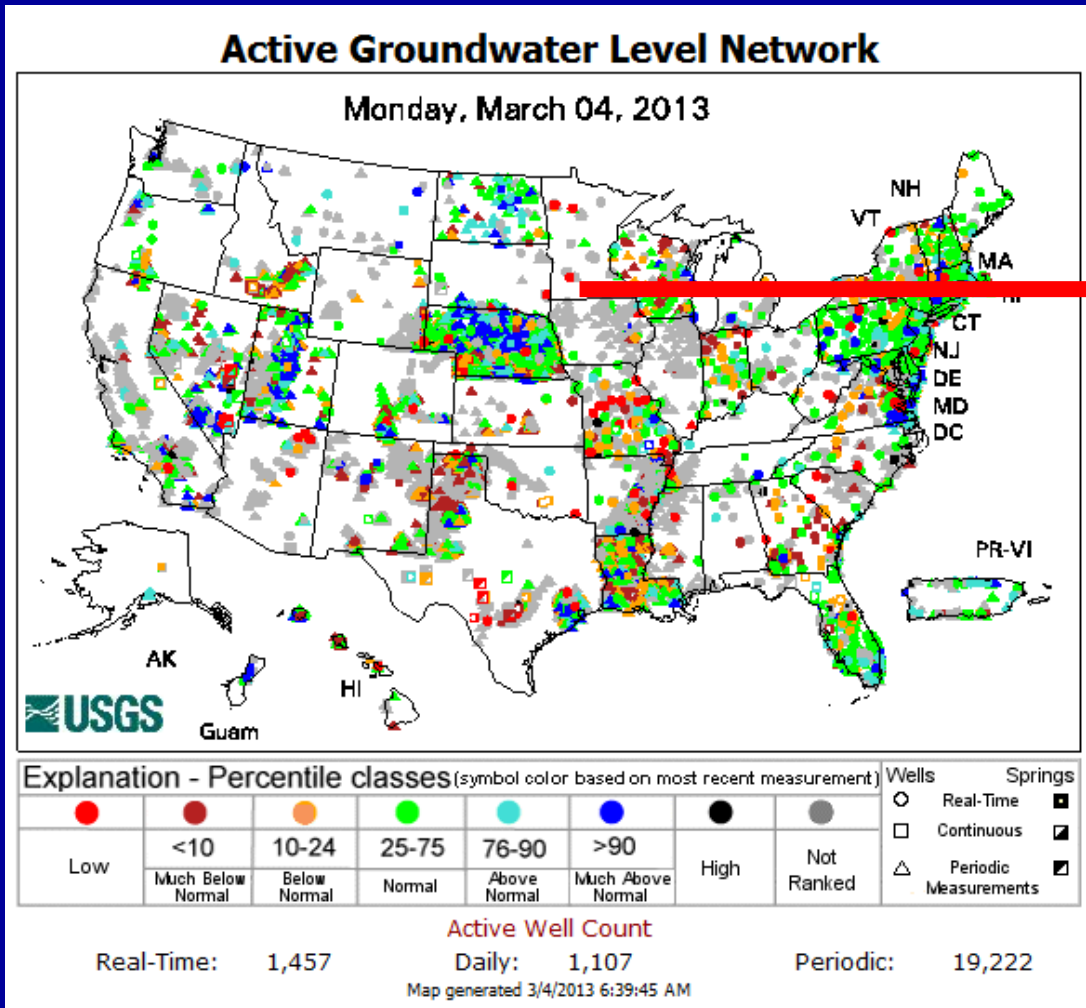


Quality of Water from Public-Supply Wells Across the United States

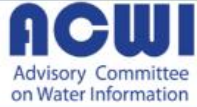




The USGS Groundwater Level Network



National GW Monitoring Network



National Ground Water Monitoring Network Data Portal (BETA)

Filter Map Data

Agency Contributing Data
ctrl + click to select more than one

- All Organization IDs
- ARKANSAS SOIL & WATER CONSERV
- IL Env't Protection Agency
- IL State Water Survey
- MT Bureau of Mines and Geology

U.S. Principal Aquifer Name
ctrl + click to select more than one

- All National Aquifers
- Ada-Vamoosa aquifer
- Alluvial aquifers
- Arbuckle-Simpson aquifer
- Biscayne aquifer

Water Level Network
ctrl + click to select more than one

- All Water Level Sub Networks
- Surveillance - Background
- Surveillance - Suspected / Anticipated C
- Surveillance - Known Changes
- Trend - Background

Water Quality Network
ctrl + click to select more than one

- All Water Quality Sub Networks
- Surveillance - Background
- Surveillance - Known Changes
- Trend - Background
- Trend - Known Changes

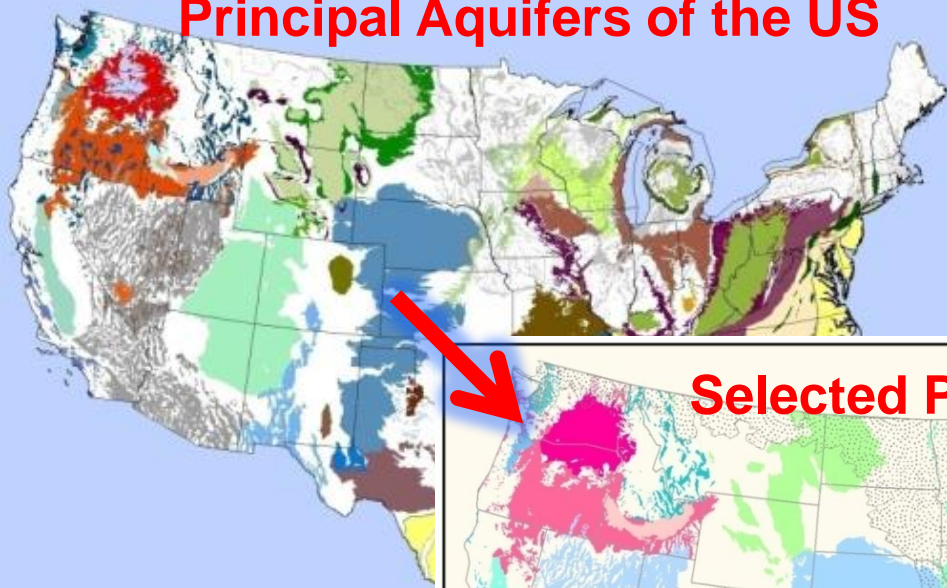
Click and drag map

Number of points meeting criteria: 2560

How Do We Make Water Level Measurements?

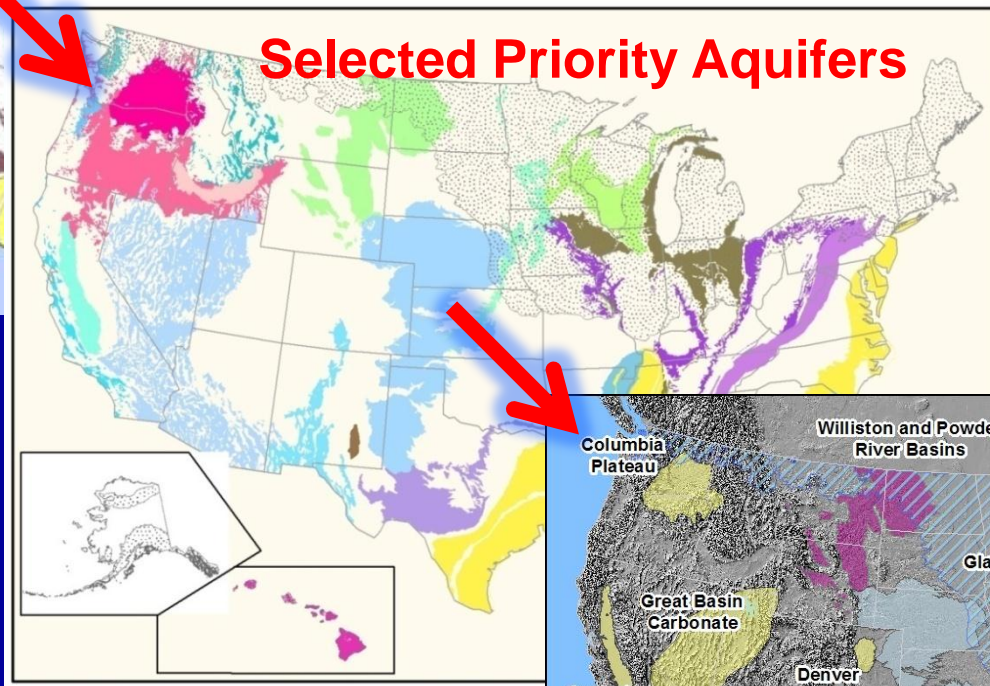


Principal Aquifers of the US

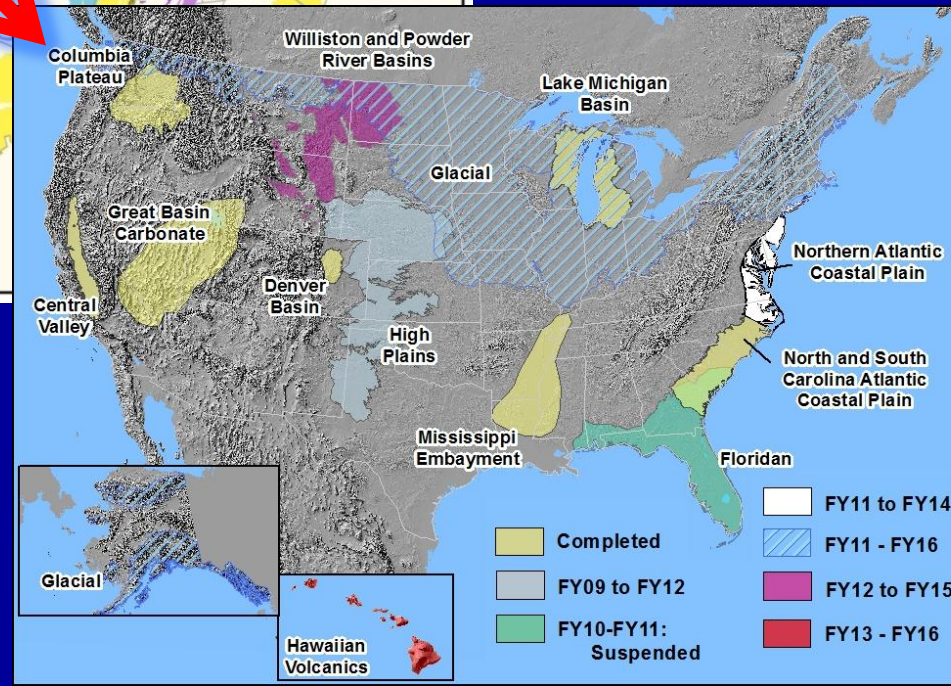


Groundwater Resources Program

Selected Priority Aquifers



Regional Groundwater Availability



Data Delivery: USGS NWISWeb

Total monitoring sites	1.57 million
Real-time sites	13,244
Real-time groundwater	1,810
Daily values	349 million
Groundwater levels	8.90 million
Water-quality samples	5.18 million
Water-quality analyses	97 million
Peak discharges (floods)	729,844

January 9, 2013



<http://waterdata.usgs.gov>

USGS NWISWeb Daily Values

Discharge	215.6 million
Stage	33.0 million
Water Levels in Wells	22.1 million
pH	3.2 million
Temperatures	19.7 million
Specific Conductance	9.1 million
Other	39.9 million

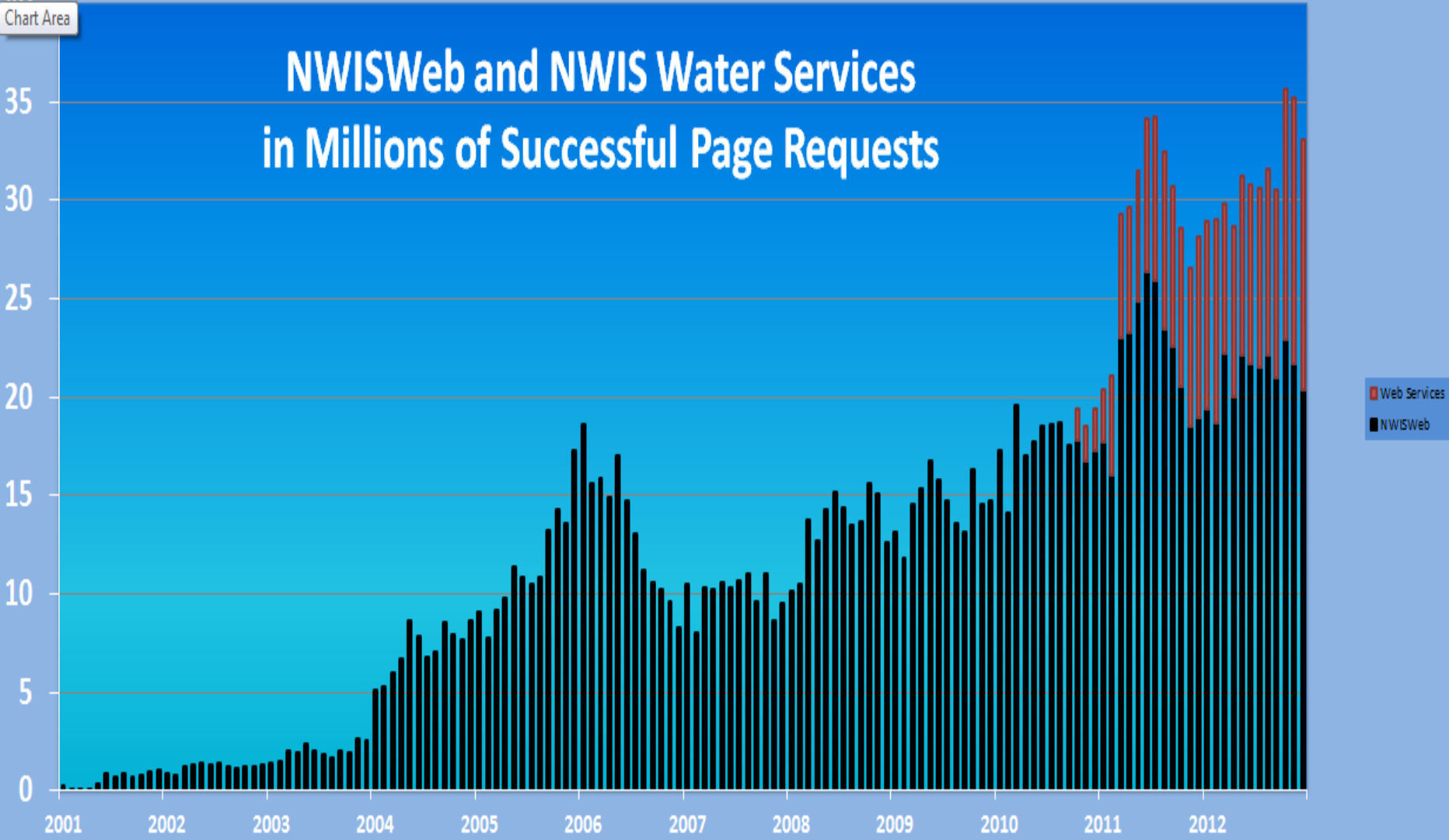
January 9, 2013



<http://waterdata.usgs.gov>

Chart Area

NWISWeb and NWIS Water Services in Millions of Successful Page Requests



<http://waterdata.usgs.gov>

Water Use

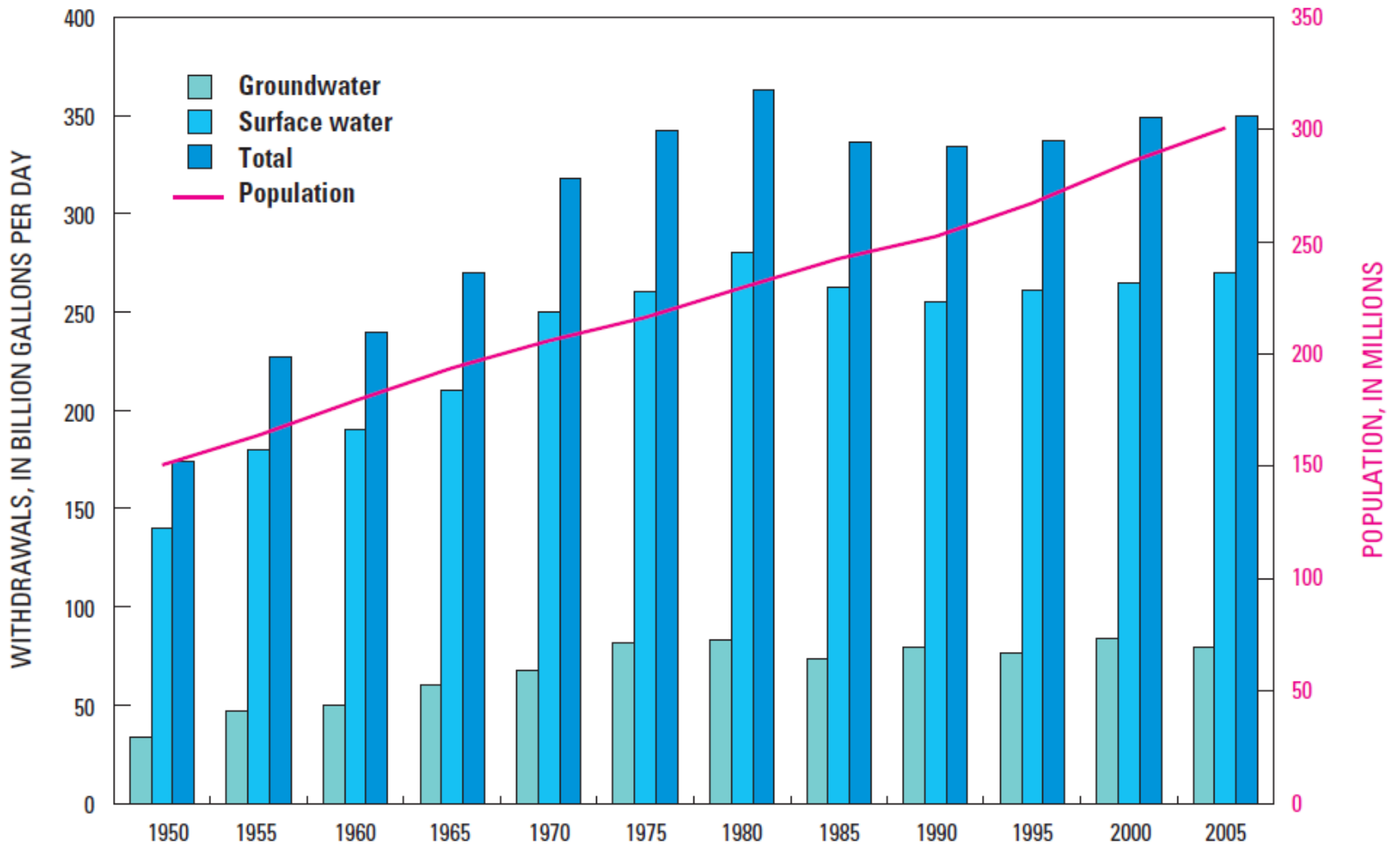
Estimated Use of Water in the United States in 2005



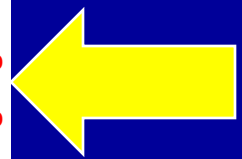
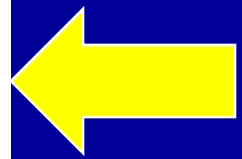
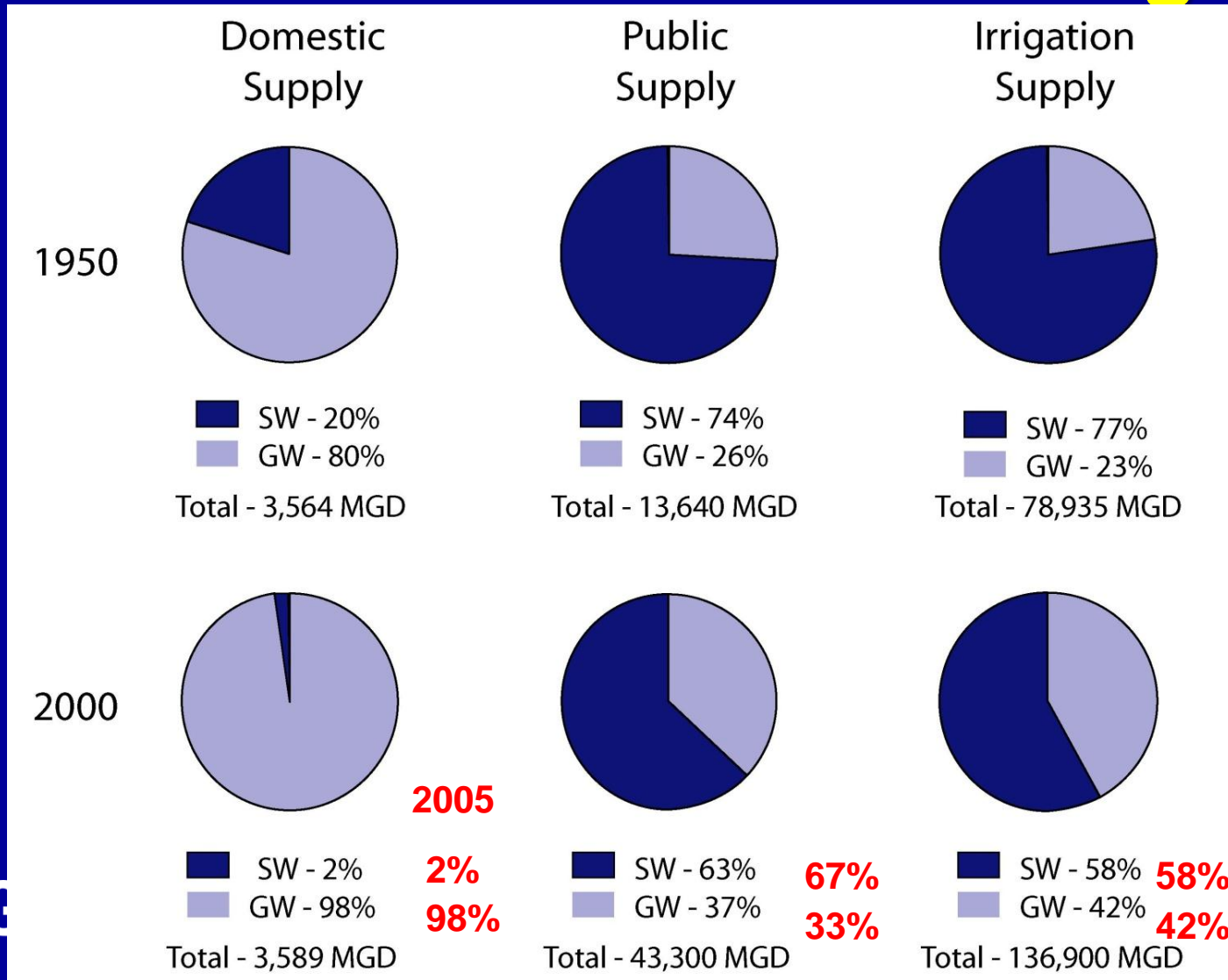
Circular 1344

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

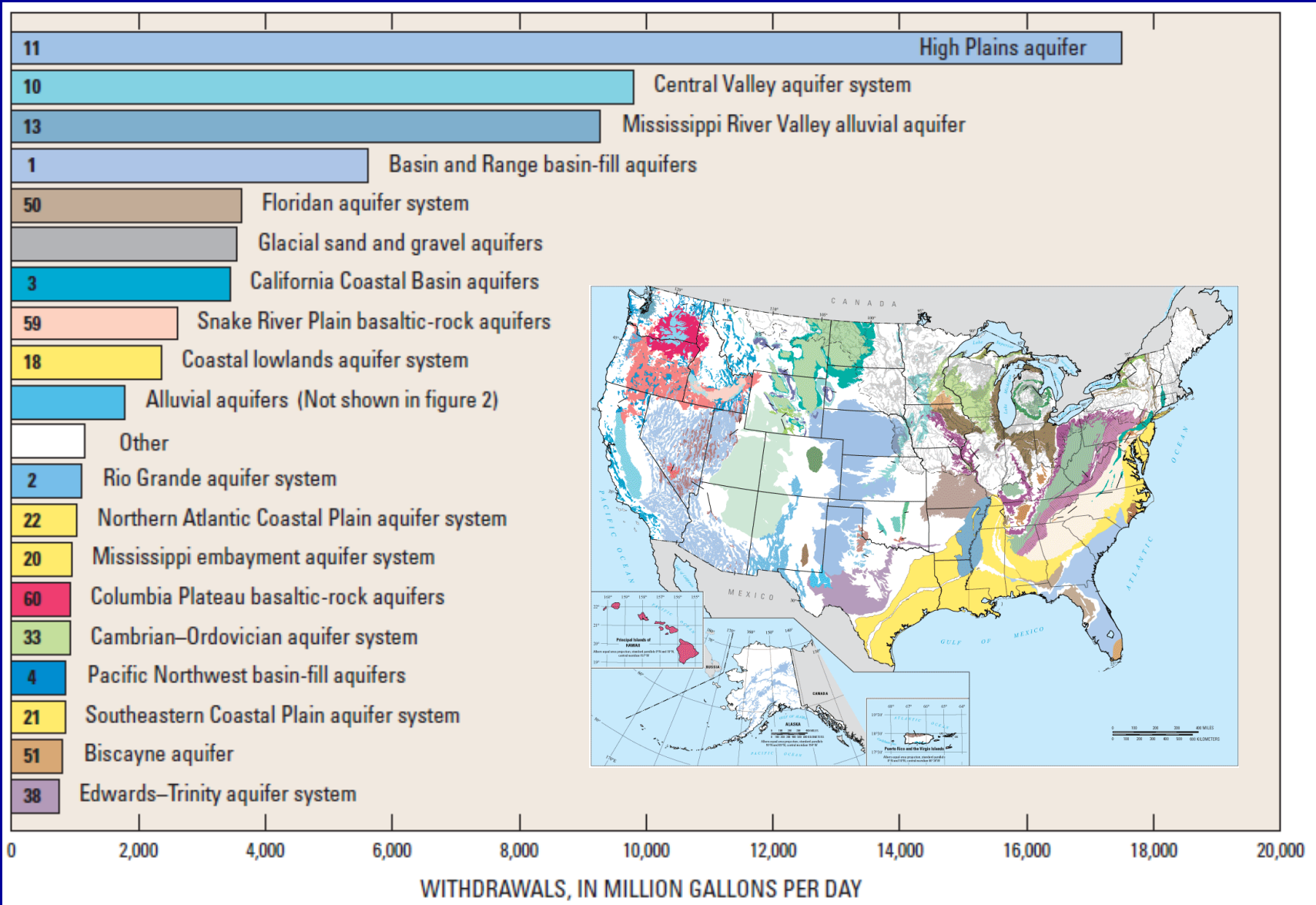
U.S. Water Use, 1950-2005



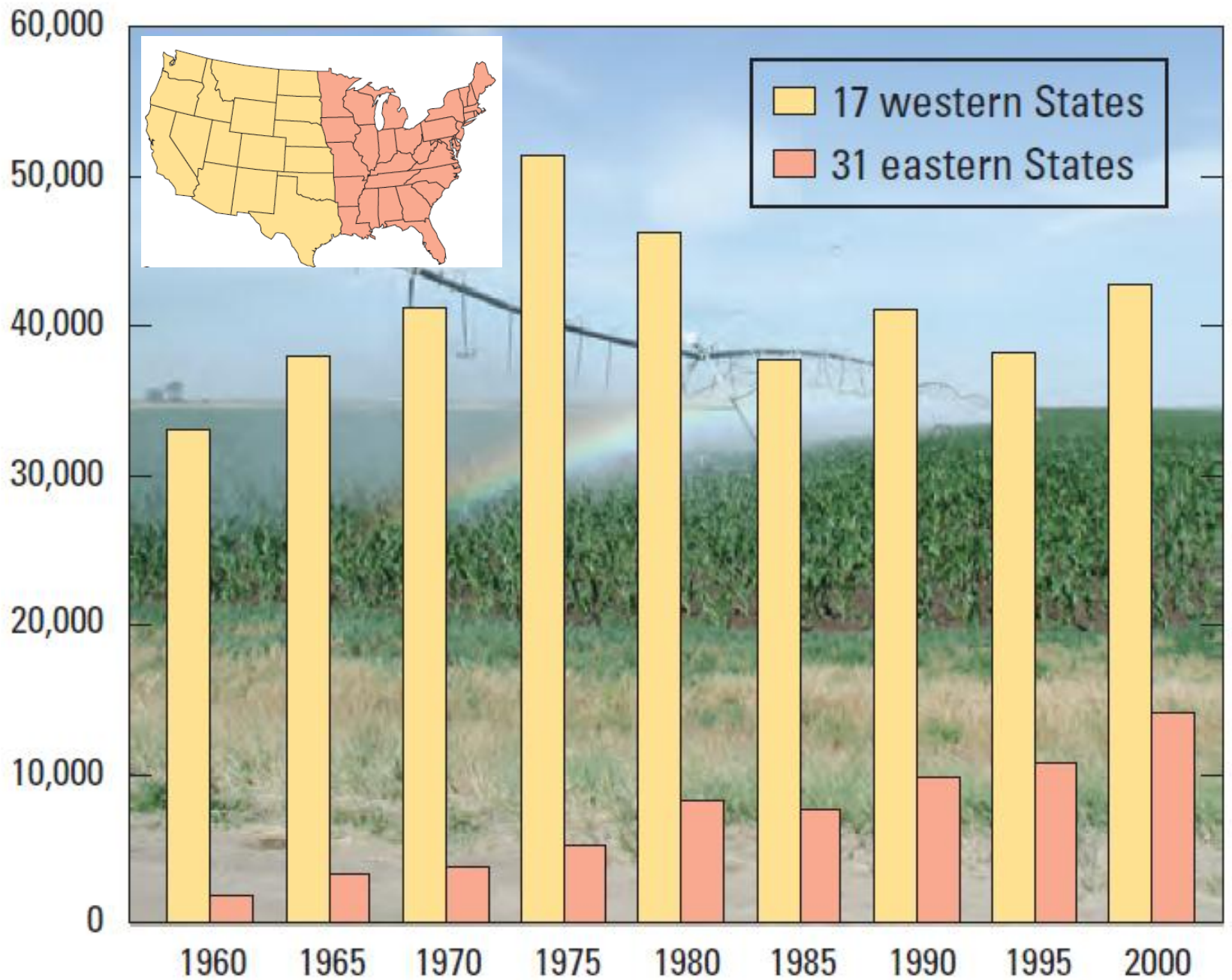
Percentage of Groundwater Withdrawals are Increasing



Groundwater Use, by Principal Aquifer



GROUND-WATER WITHDRAWALS FOR IRRIGATION,
IN MILLION GALLONS PER DAY

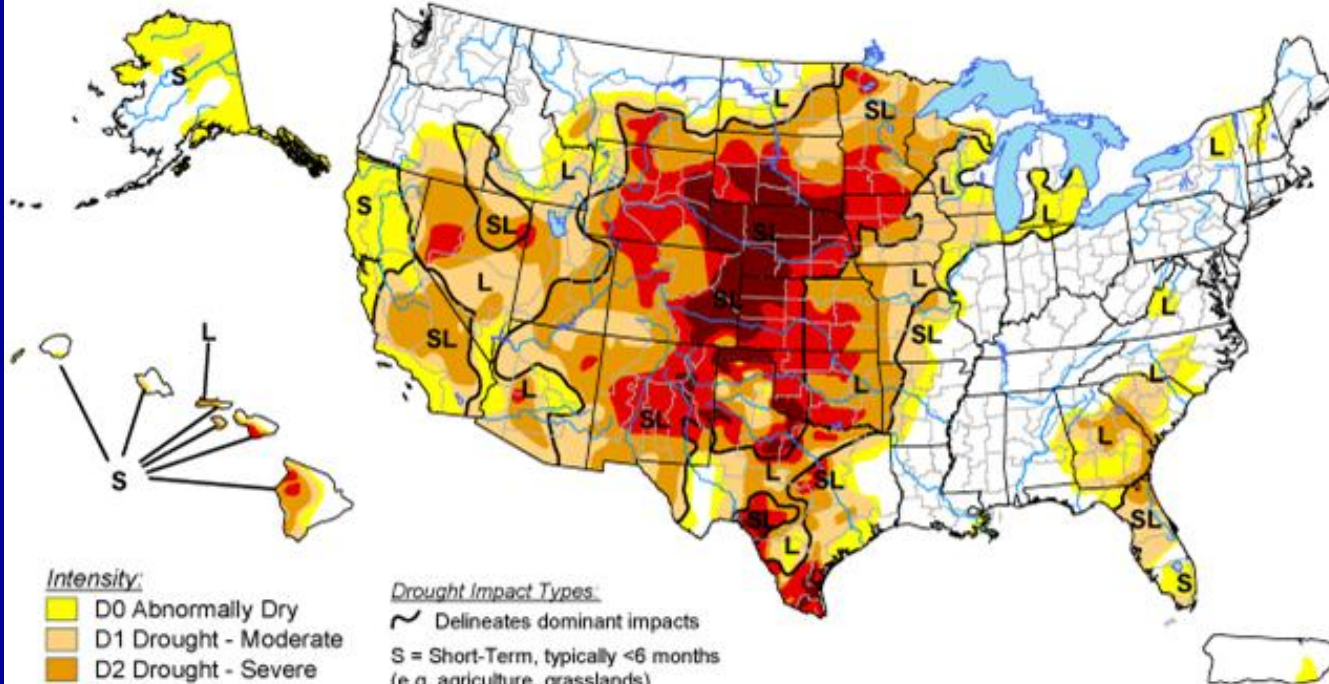


Drought

U.S. Drought Monitor

February 26, 2013

Valid 7 a.m. EST



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu/>



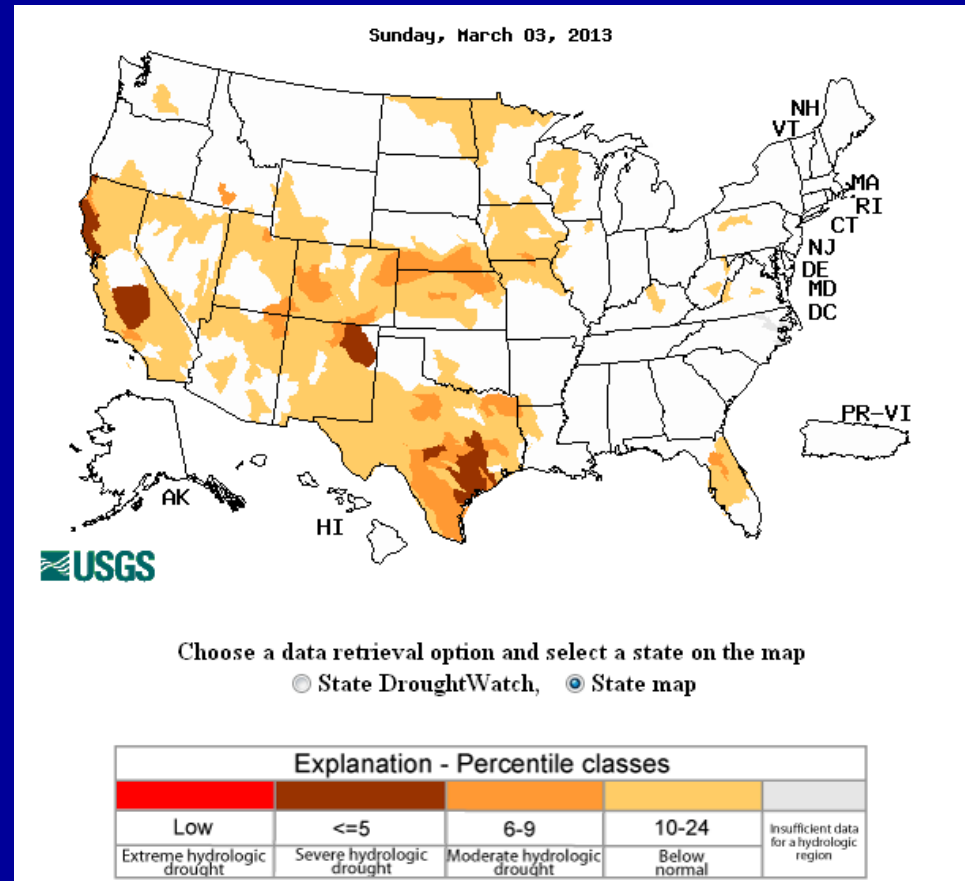
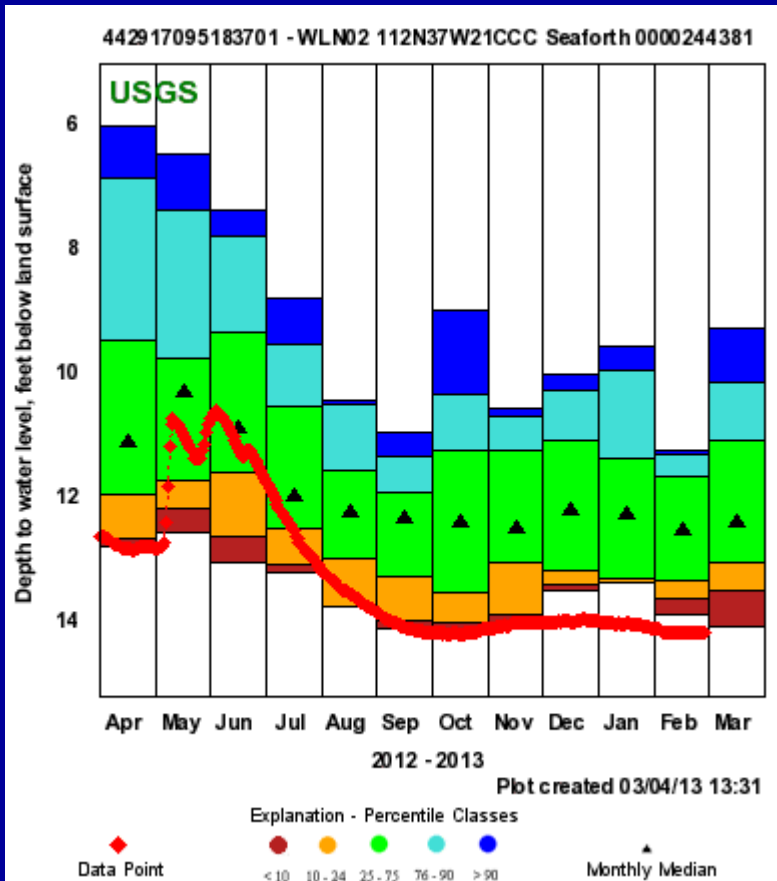
Released Thursday, February 28, 2013

Author: Brian Fuchs, National Drought Mitigation Center

Drought Impacts: USGS Tools

Water Table in Minnesota

Ranking of 7-day Streamflow



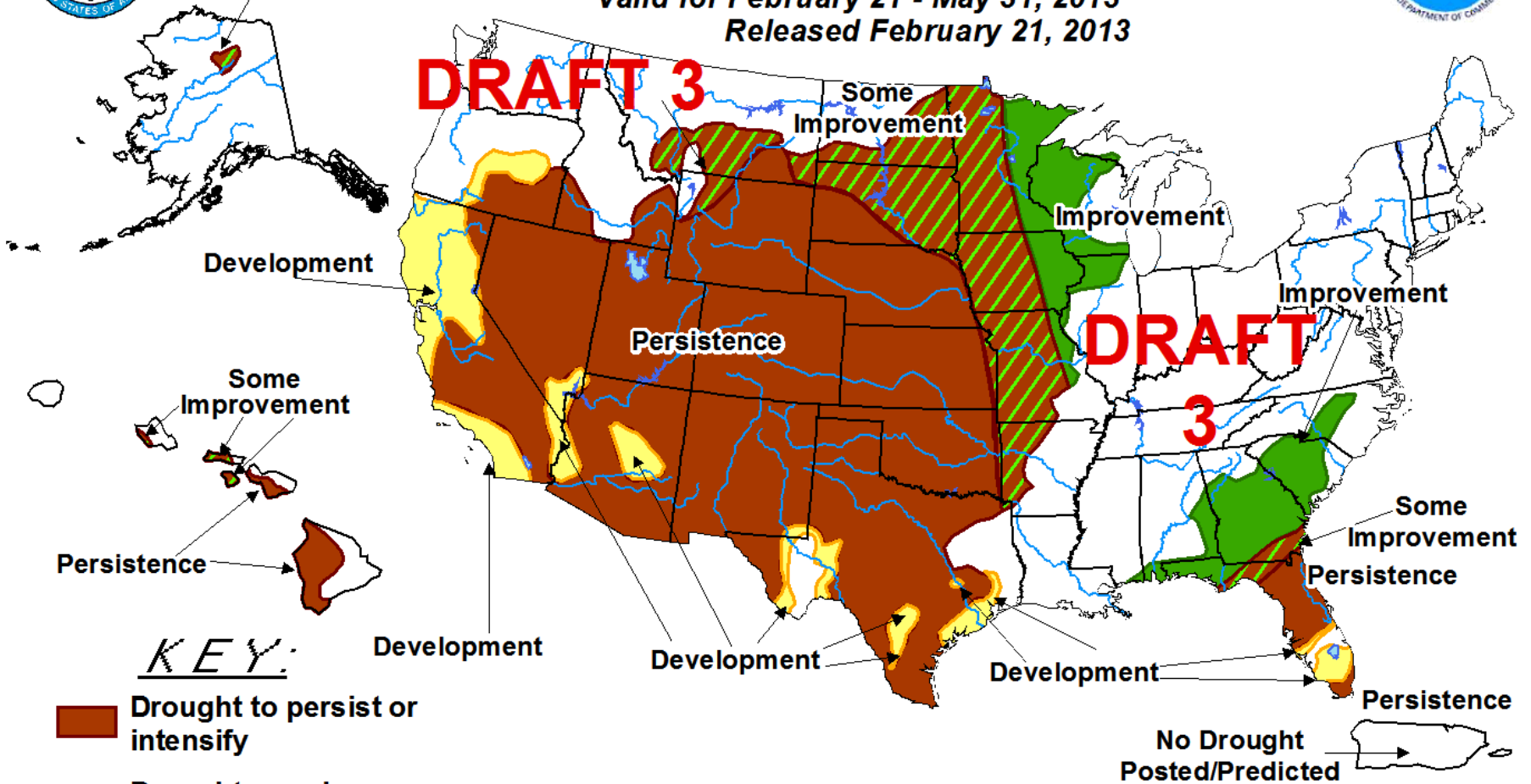


U.S. Seasonal Drought Outlook





Drought Tendency During the Valid Period

Valid for February 21 - May 31, 2013

Released February 21, 2013



KEY:

-  Drought to persist or intensify
-  Drought ongoing, some improvement
-  Drought likely to improve, impacts ease
-  Drought development likely

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events – such as individual storms – cannot be accurately forecast more than a few days in advance. Use caution for applications – such as crops – that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

Colorado River Basin Water Supply

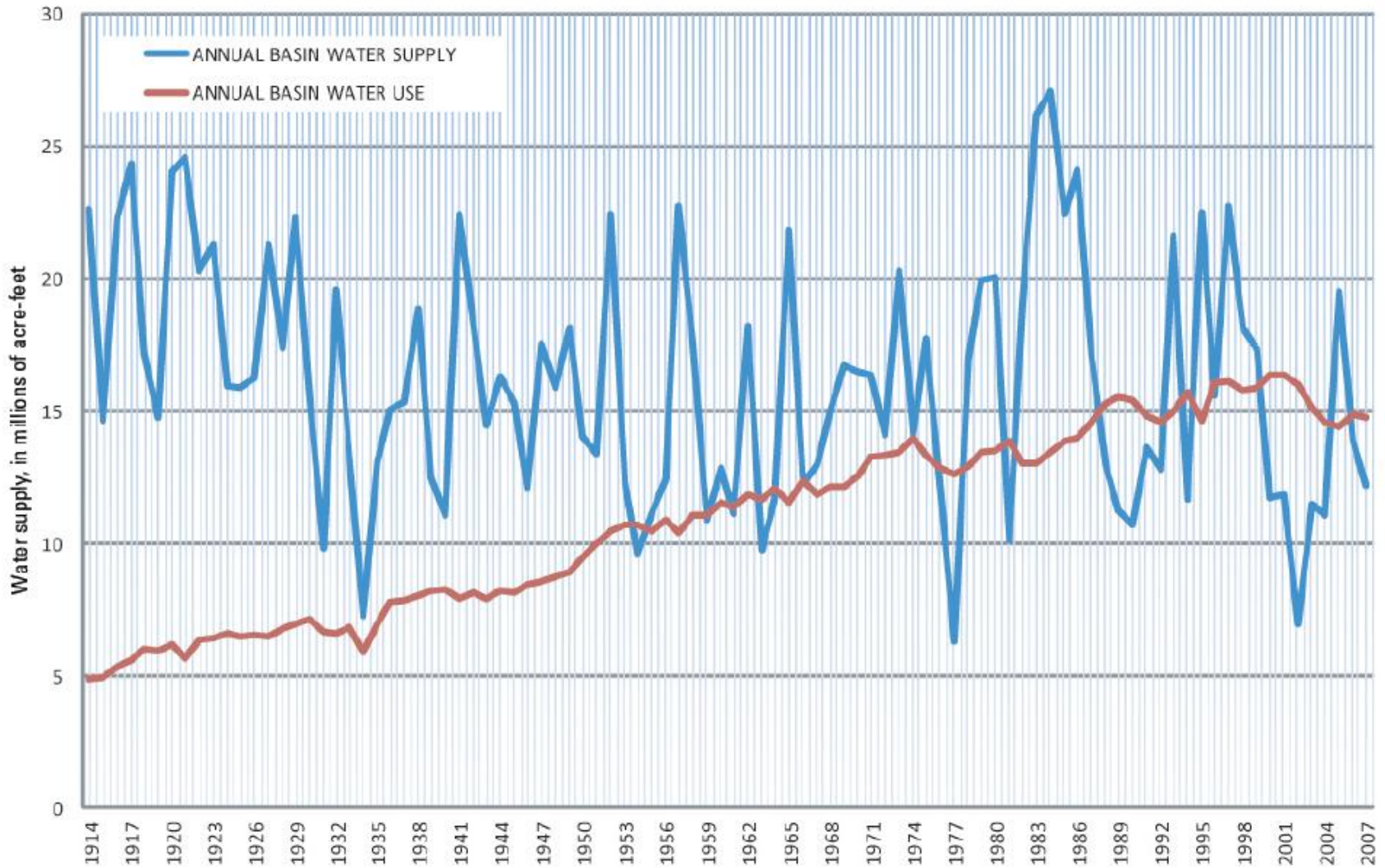
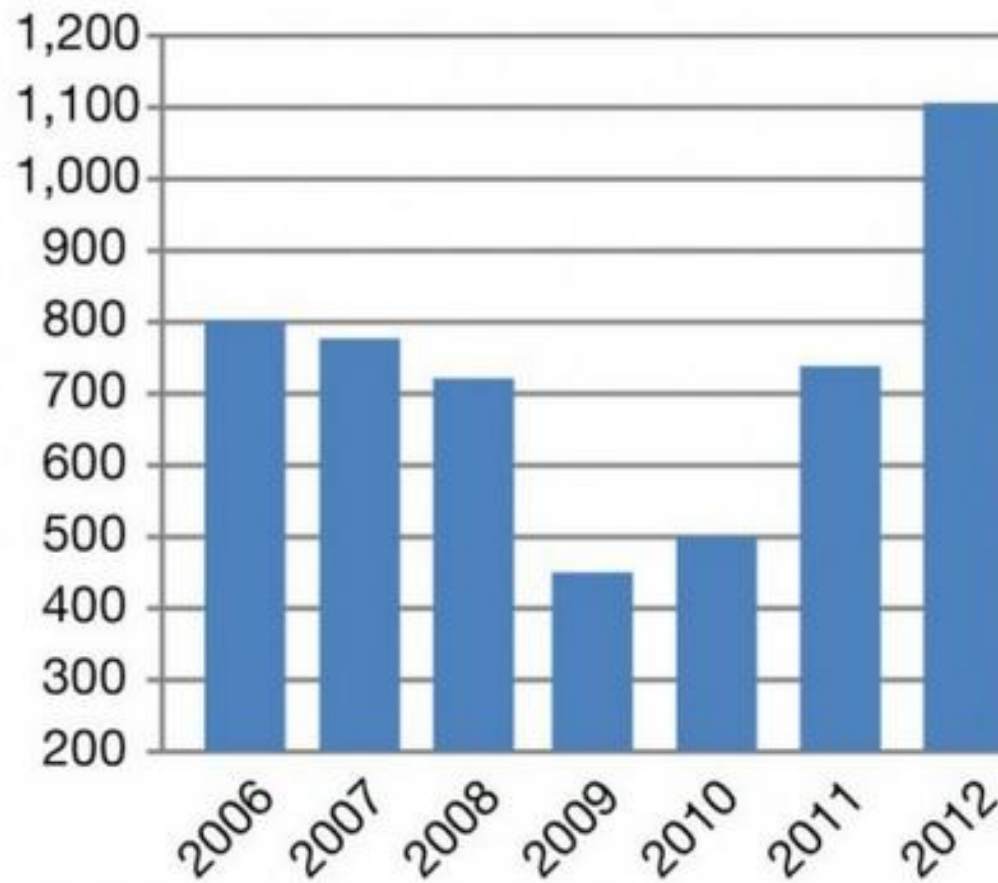


Figure 1. Colorado River Basin water supply, 1914–2007 (Bureau of Reclamation, 2011).

Other Drought Impacts

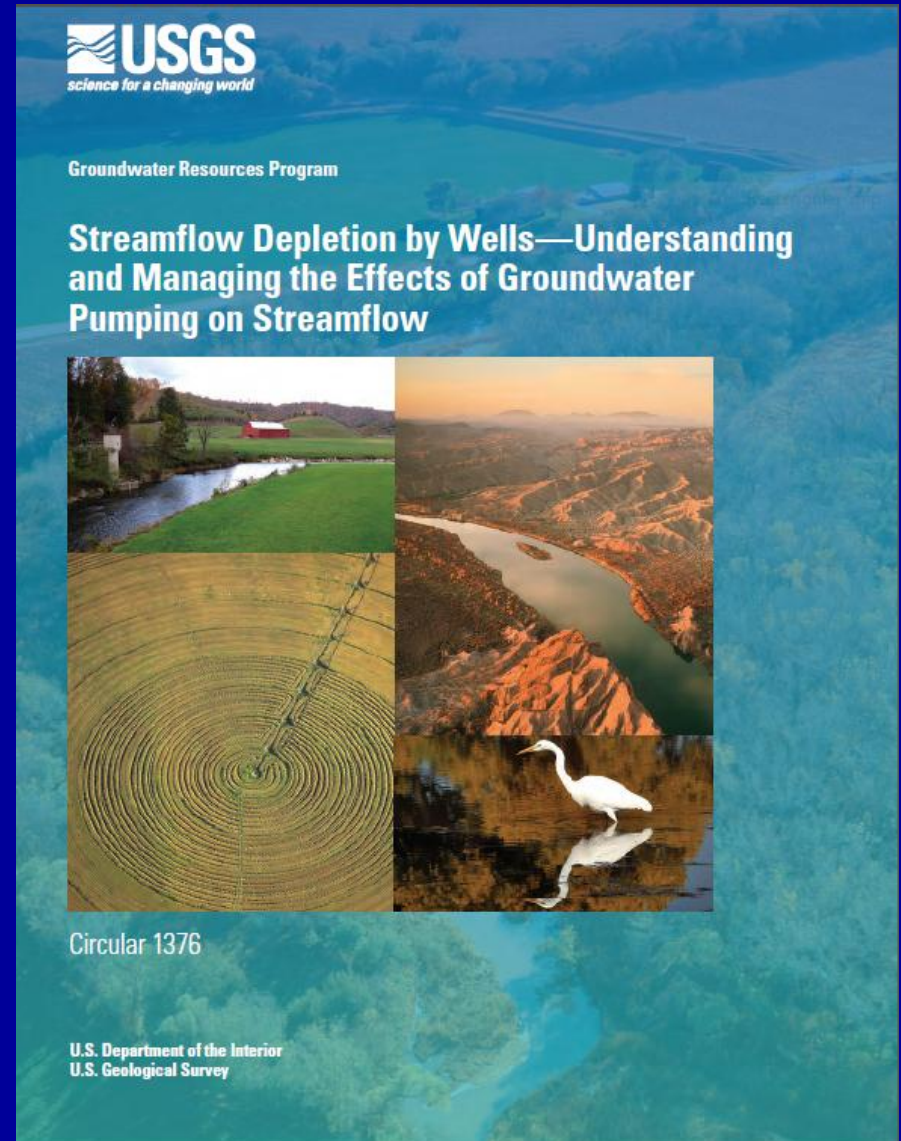
New Nebraska irrigation wells



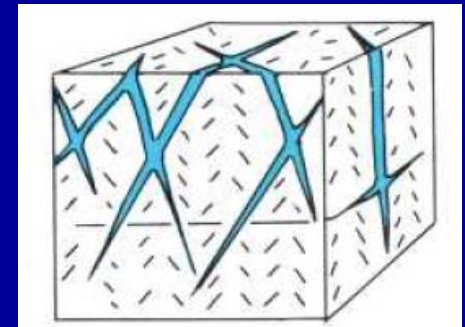
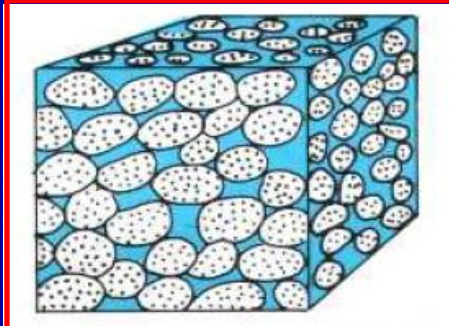
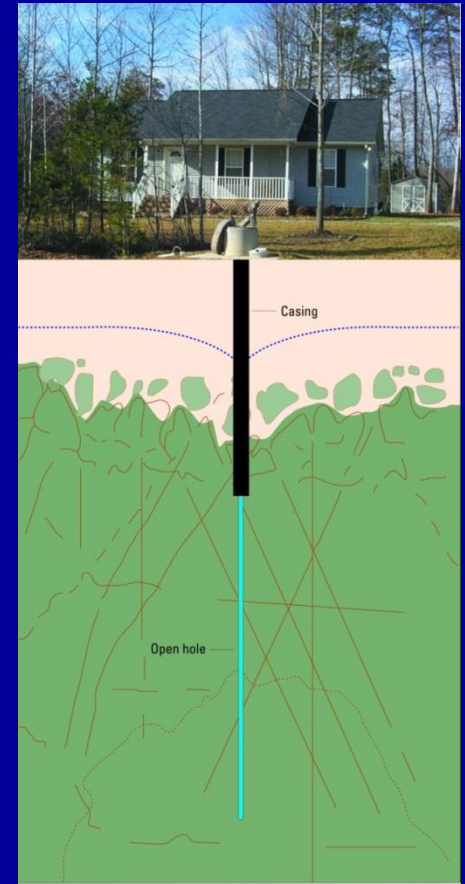
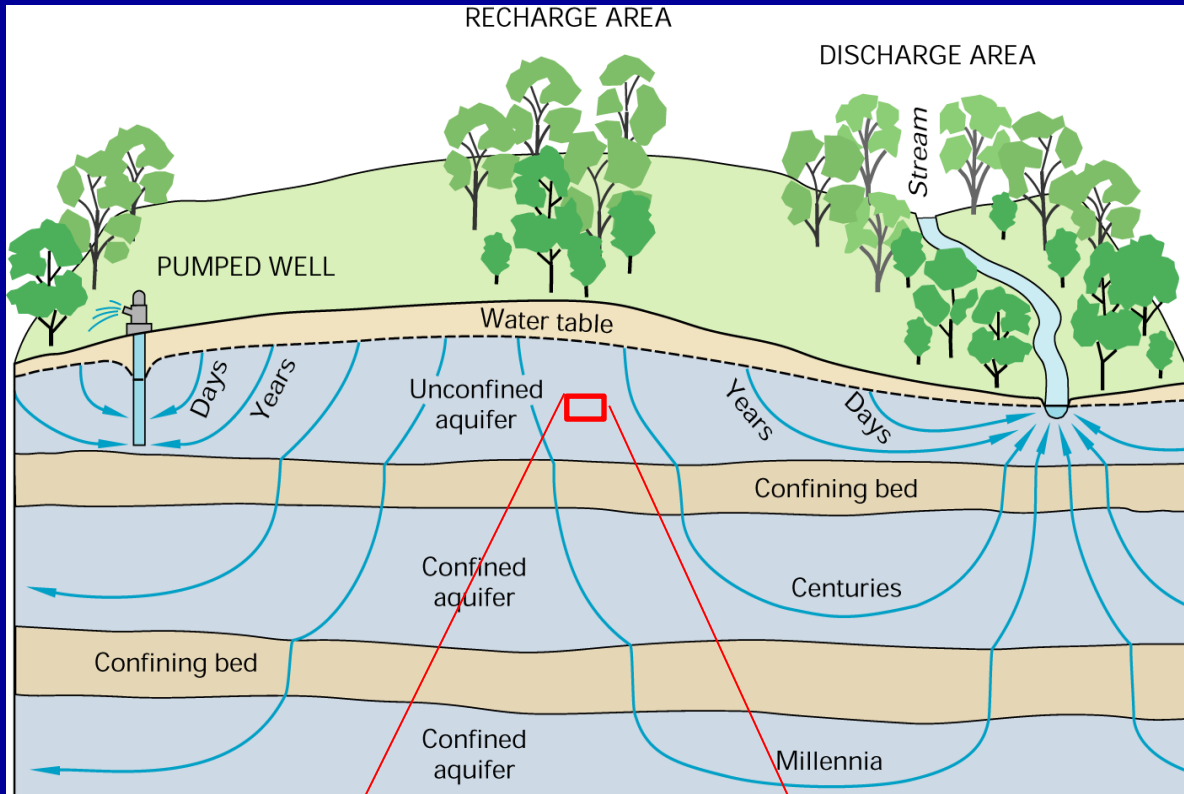
Source: Nebraska Department of Natural Resources
MARK ANDERSEN/Lincoln Journal Star

GW/SW Interactions

- Groundwater and surface are a single resource
- New USGS Circular on streamflow depletion by wells

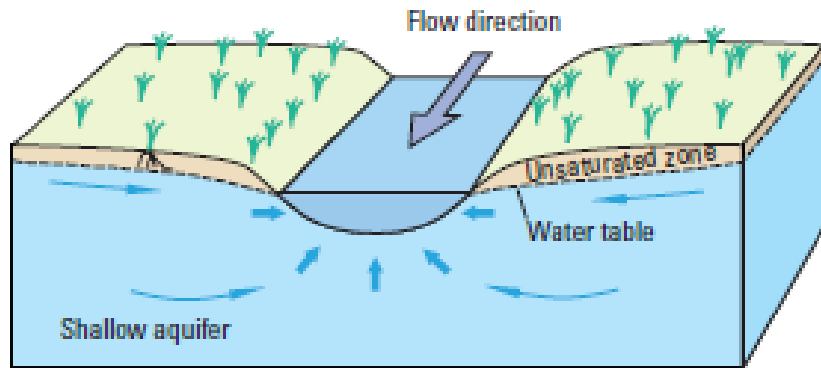


Groundwater Flow

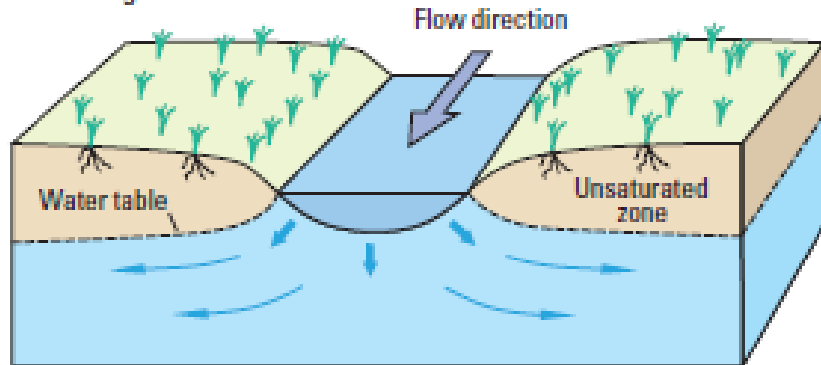


Gaining, Losing, and Disconnected Streams

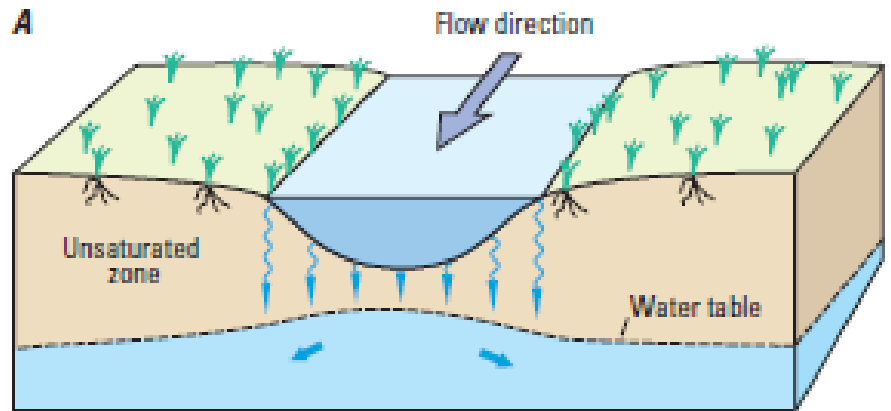
A. Gaining stream



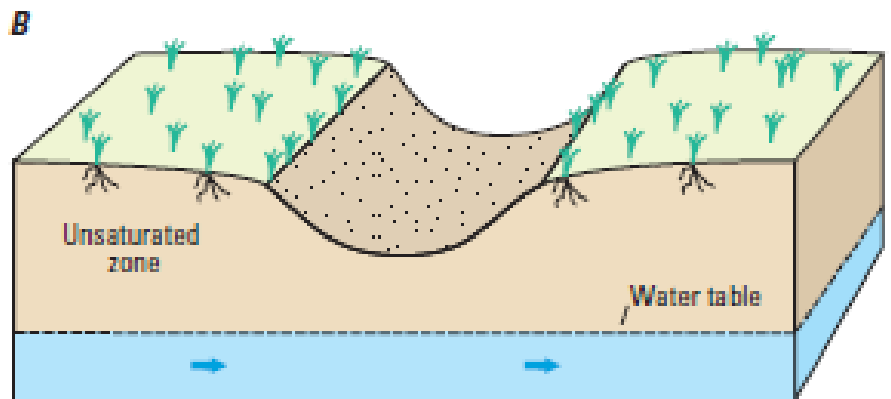
B. Losing stream



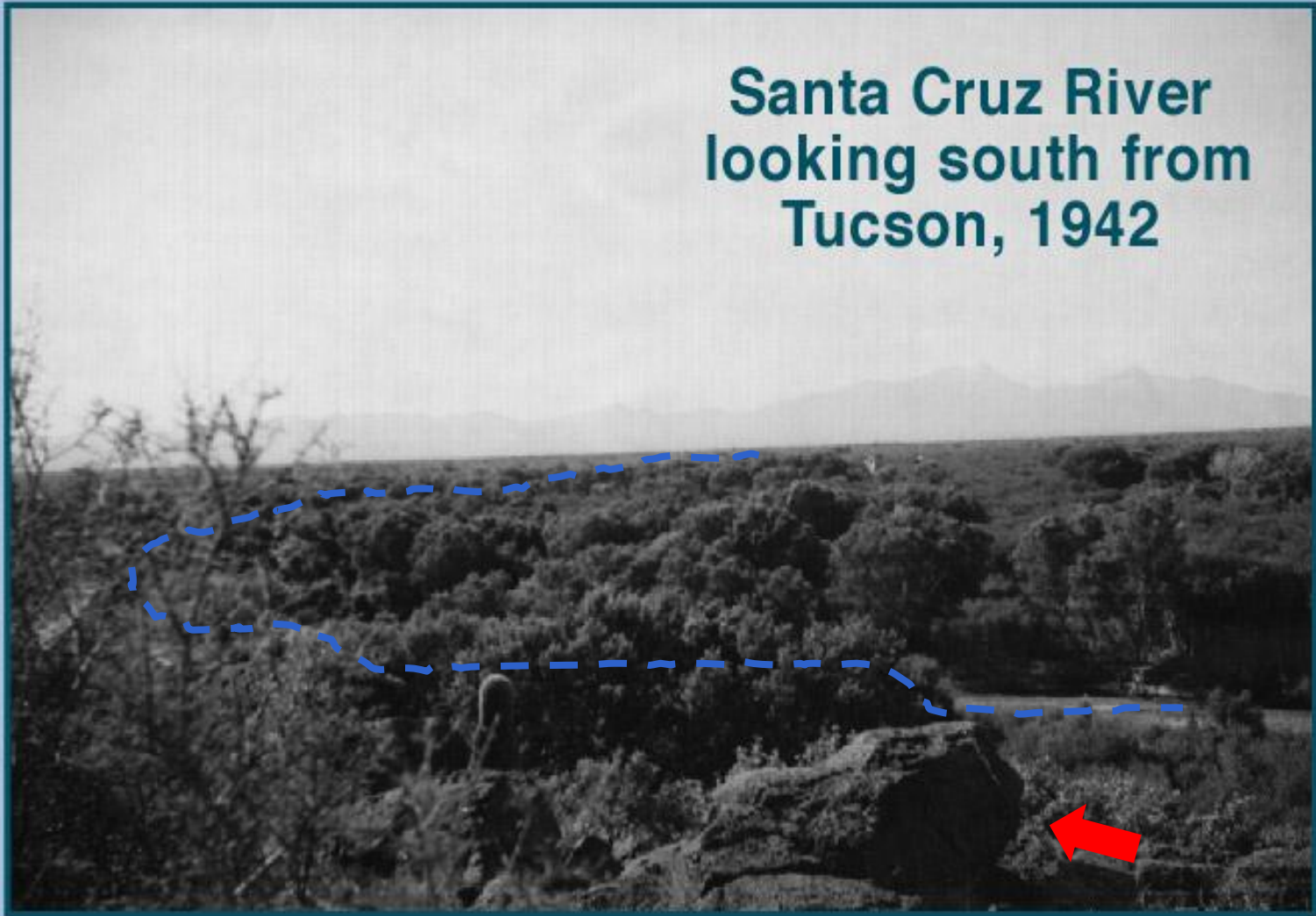
A



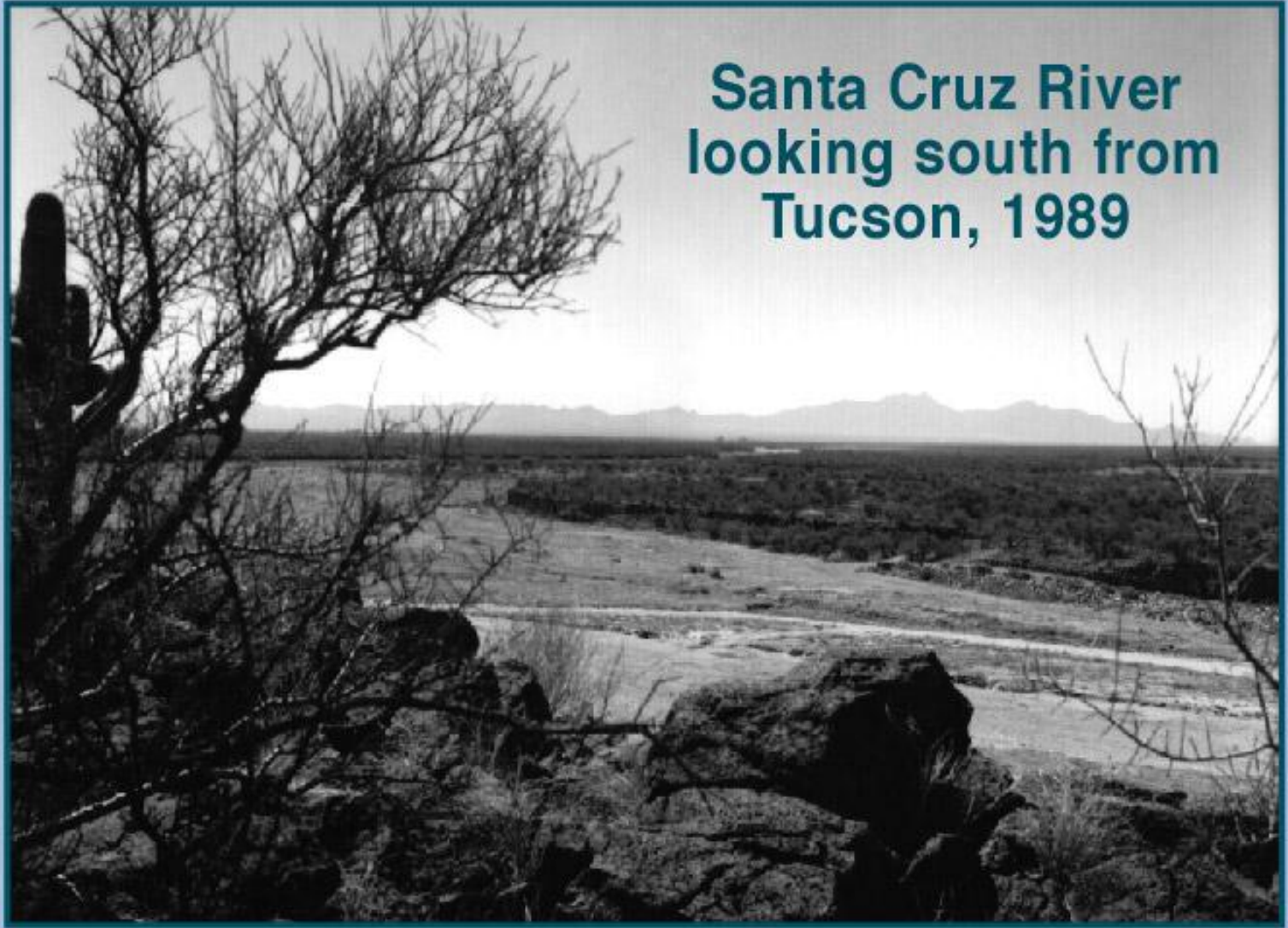
B



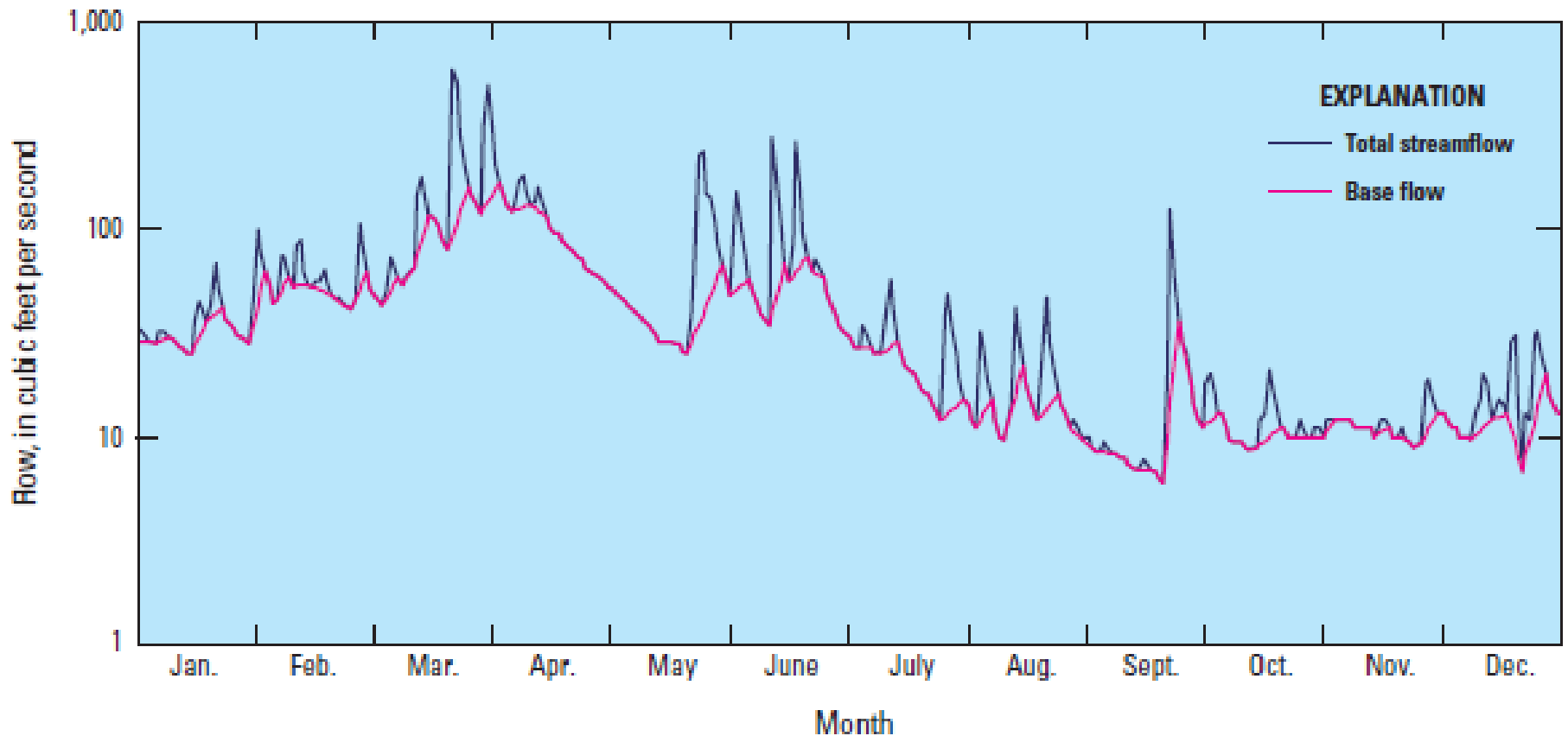
**Santa Cruz River
looking south from
Tucson, 1942**



**Santa Cruz River
looking south from
Tucson, 1989**



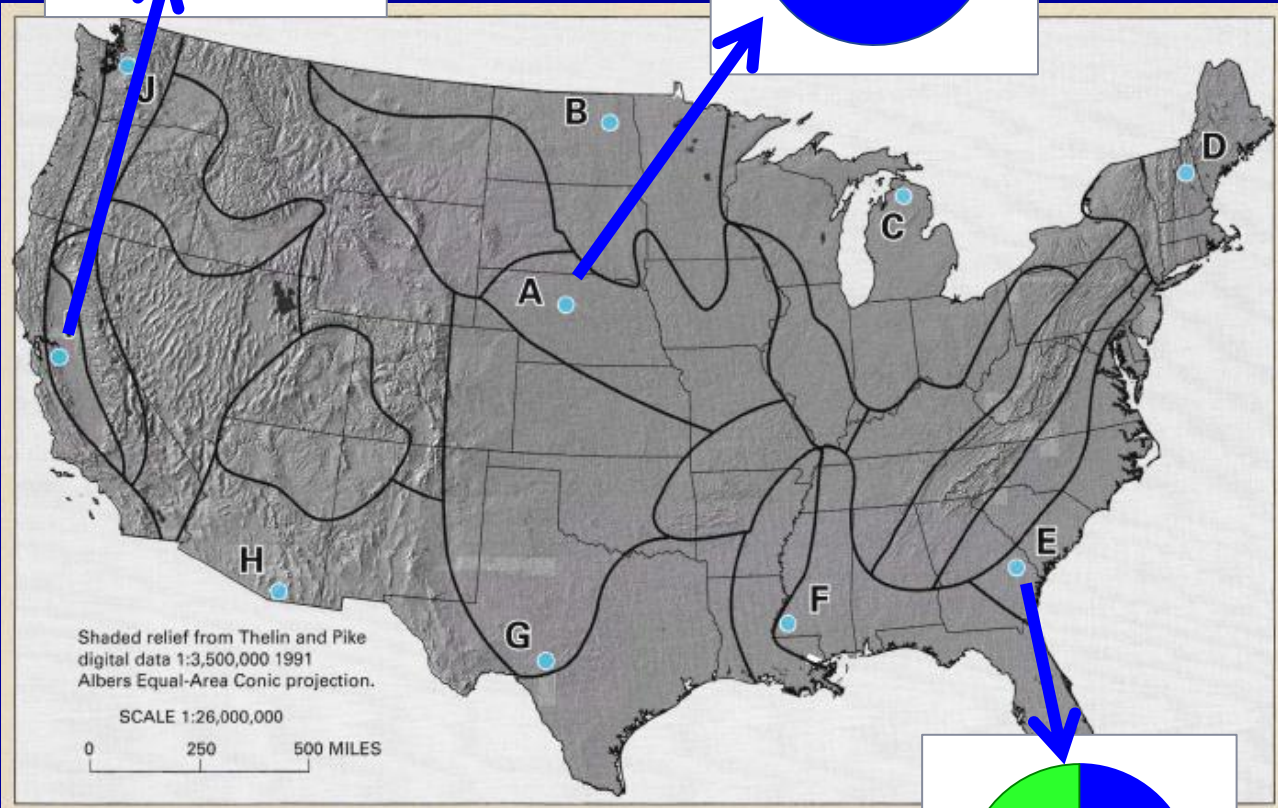
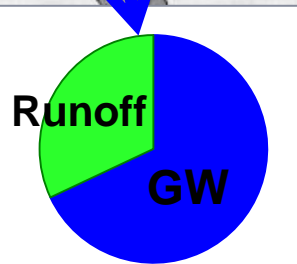
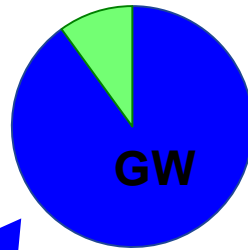
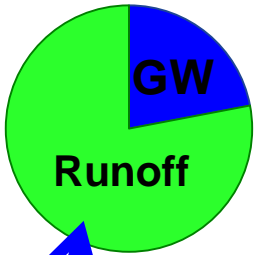
Groundwater is an Important Component of Streamflow



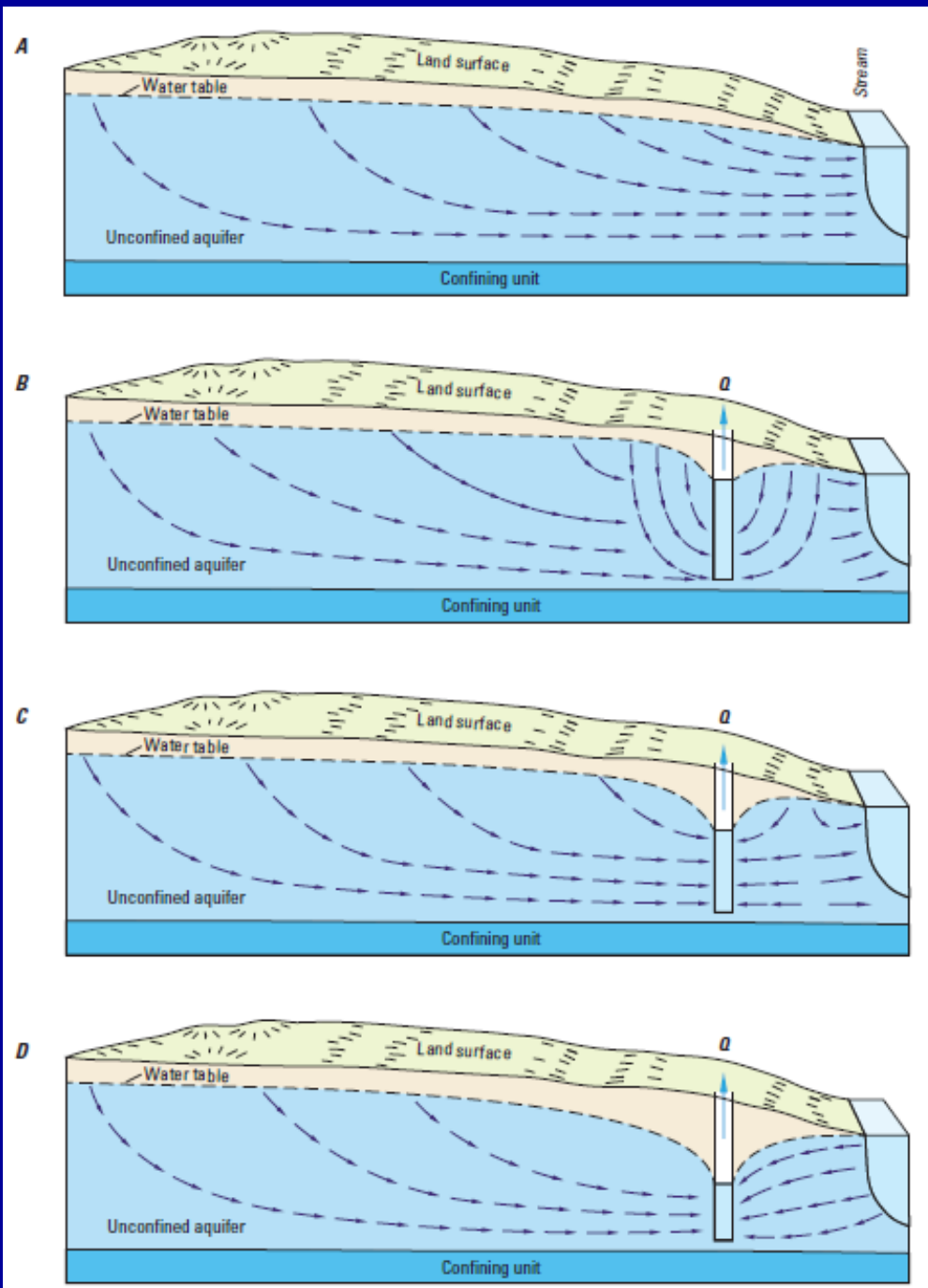
Contribution to Streamflow

54 Streams
Range 14-90%
Average 52%

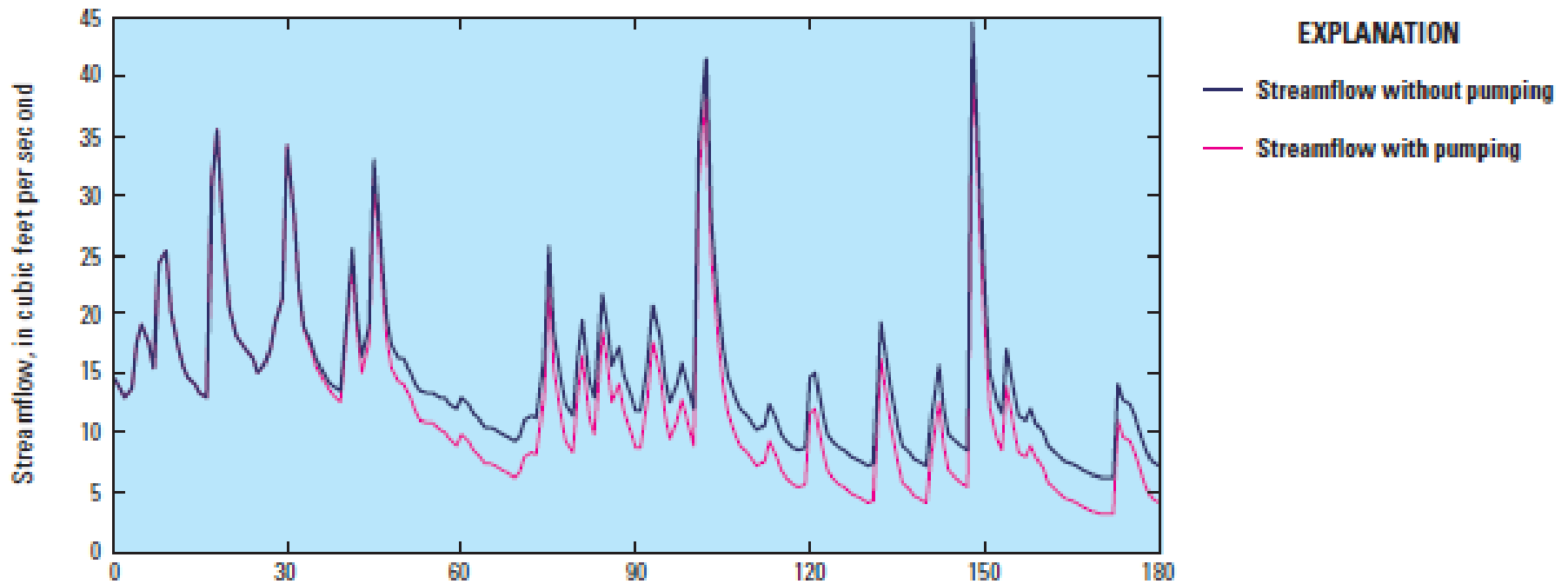
- Geology
- Physiography
- Climate



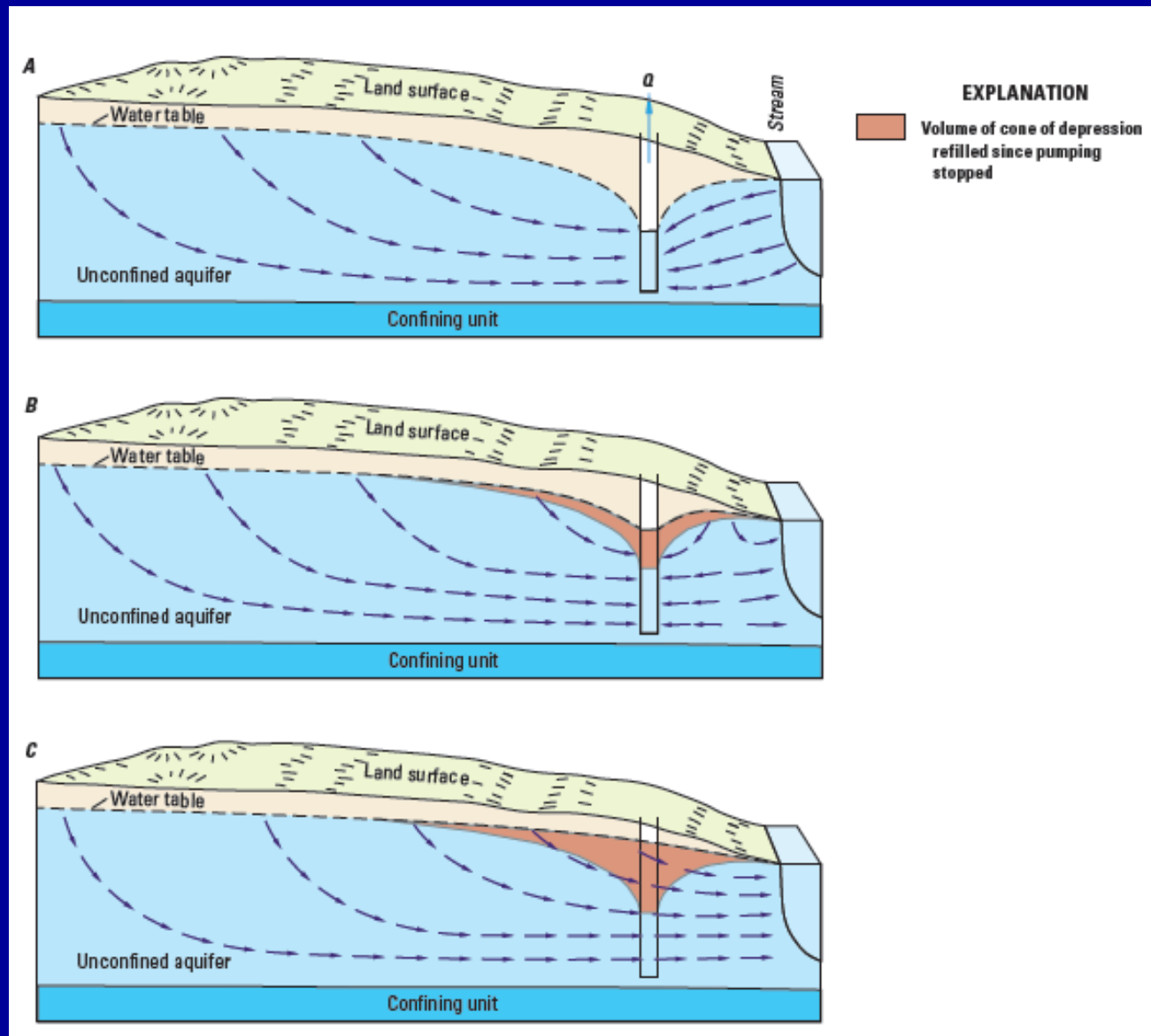
Pumping Effects on Streamflow



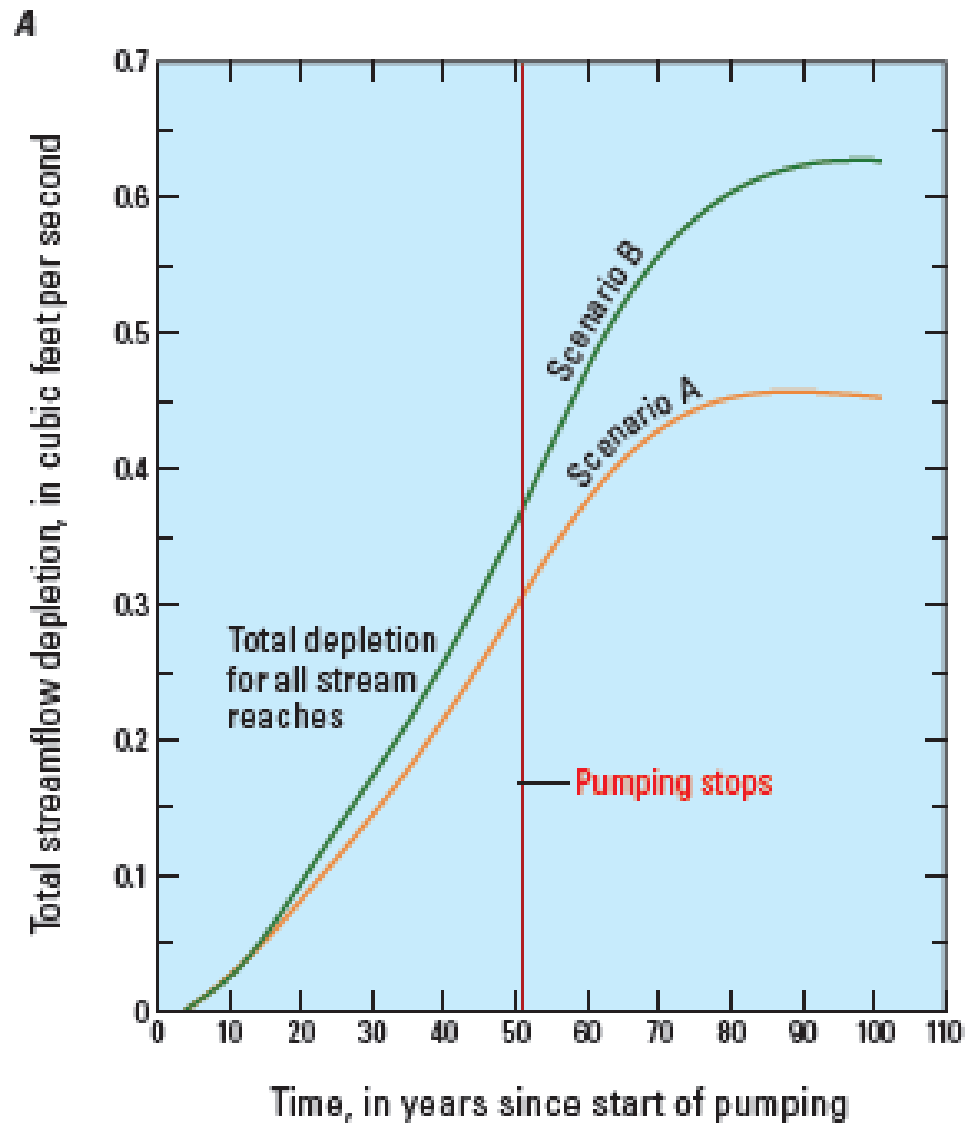
Pumping Effects on Streamflow



Streamflow Depletion after Pumping Stops



Depletion Timing: Arizona Example



Questions?

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