



National Perspectives on Water Measurement Strategies

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“The meek shall inherit the earth but not its water rights.”

--apologies to J. Paul Getty

Talk Organization

- Relevant Quotes on Measurement and Data
- “Big Four” Water Issues and Their Data Requirements – Dr. Bob Hirsch, Associate Director for Water, USGS
- Why Do We Need Water Measurements?
- Some Examples
- Water Measurement Programs – Hard Times
- USGS National Water-Use Information Program
- Oregon
- References



Relevant Quotes on Measurement and Data

“When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind.” -- Lord Kelvin (1883) Translation: “To measure is to know.”

“Not everything that can be counted counts, and not everything that counts can be counted.” – Albert Einstein

“The collection of water use data, however, has been given short shrift nationally with respect to funding and infrastructure support. Without consistent, comprehensive, and reliable water use data, appropriate decisions on water use management cannot be made.” – NRC (2002, p. 37)

Big Four Water Issues

(Dr. Bob Hirsch, USGS)

- Instream (ecological or environmental) flows (*the gridlock issue*)
- Ground water - surface water interactions, and sustainability
- Incorporation of climate change into water resources planning
- "Fixing" impaired waterways



Big Four Water Issues: Motivation

In response to the following question from a 20-something Congressional staffer to a 50-something USGS hydrologist:

“You’ve been studying water for over 100 years. Haven’t you answered all the questions?”



Data Requirements for “Big Four” Water Issues

- **Instream flows:** entire stream hydrograph, not just a few measurements of streamflow; and “ecological” measurements; quality
- **GW - SW interactions:** GW & SW levels; GW & SW flows; properties of GW, SW systems
- **Climate change:** indicators of CC (e.g., snowpack); long-term trends in streamflow, well water levels, etc.
- **“Fixing” impaired waterways:** water quality and related (land use) data; flow data; “emerging” contaminants



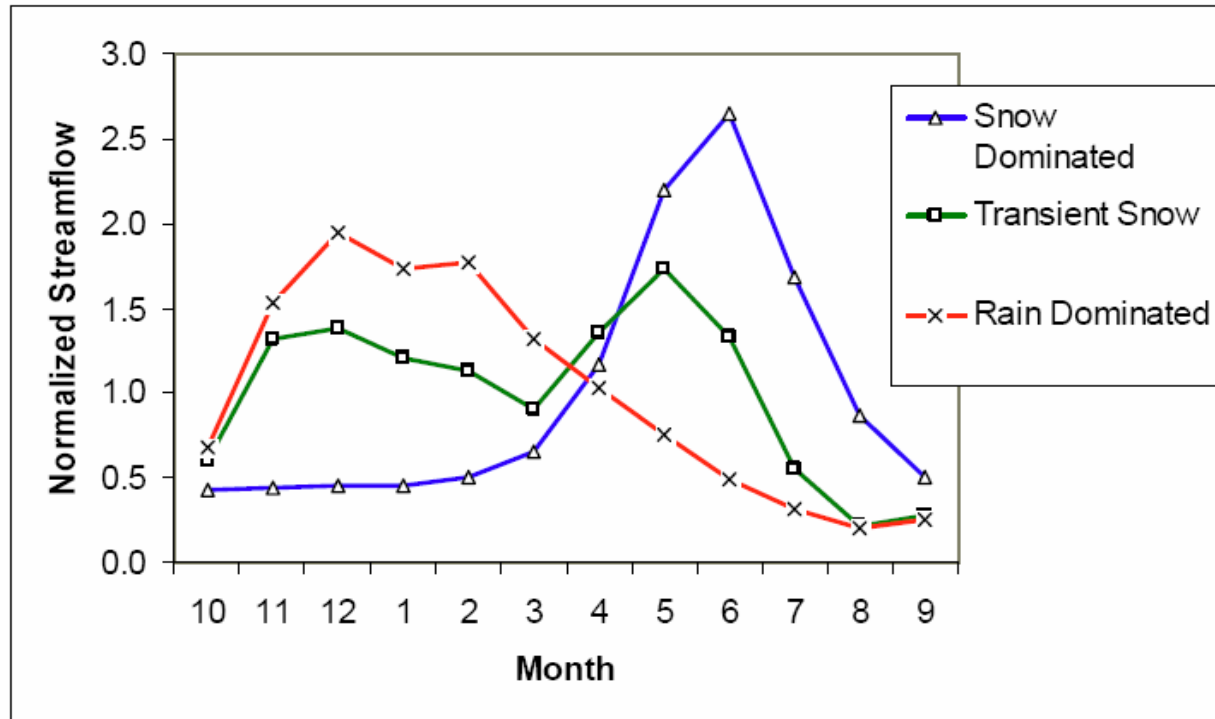


Why Do We Need Water Measurements?

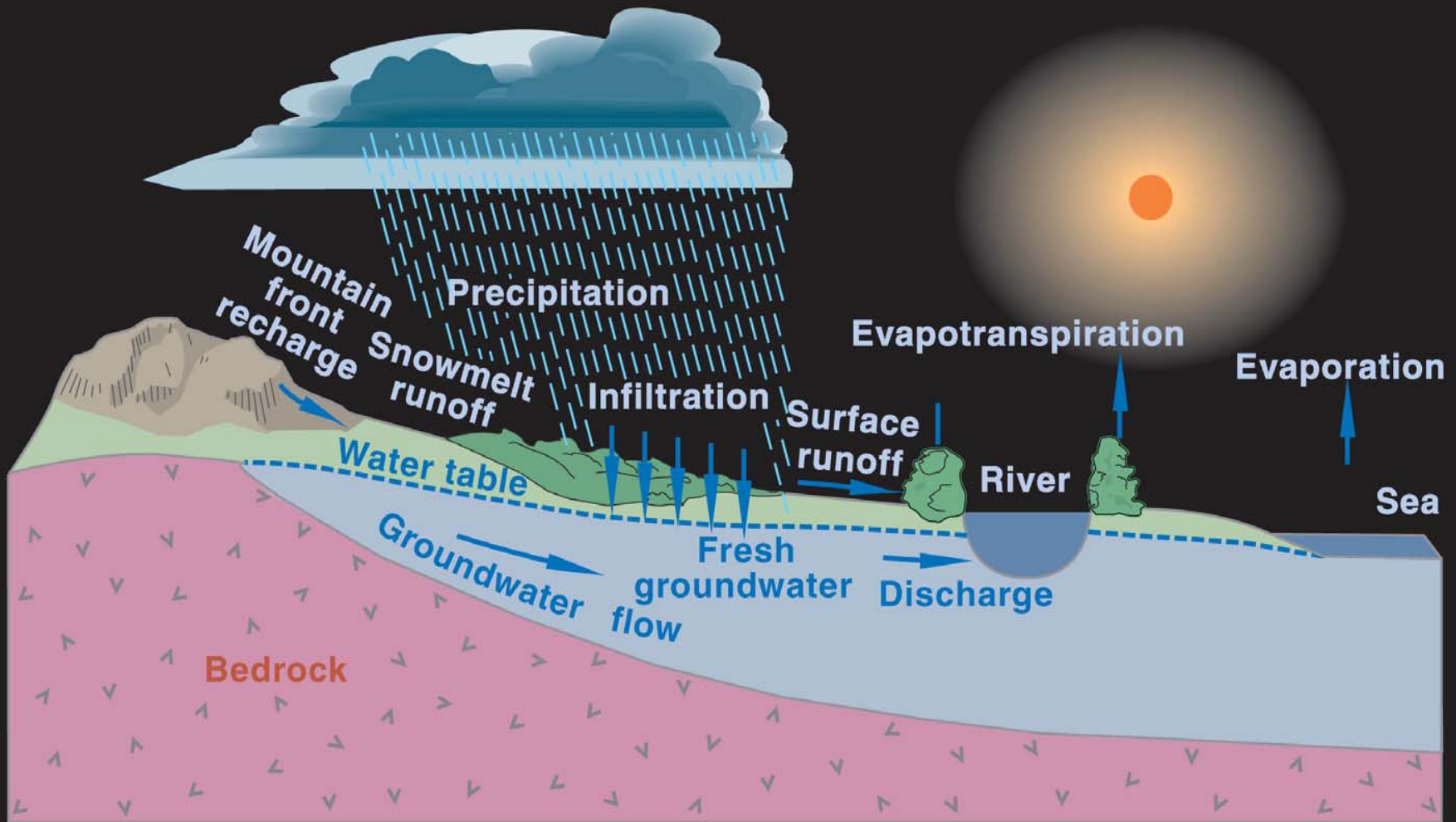
- *Provide **data***
- *Ascertain how much water you have and how good its quality is – to plan, and also to **keep others from taking or polluting your water***
- *Manage the resource wisely*
- *Assess changes (baseline data)*
- *Enforce regulations, and determine their effectiveness*
- *Assess cause-and-effect relationships*



Hydrologic Characteristics of PNW Rivers



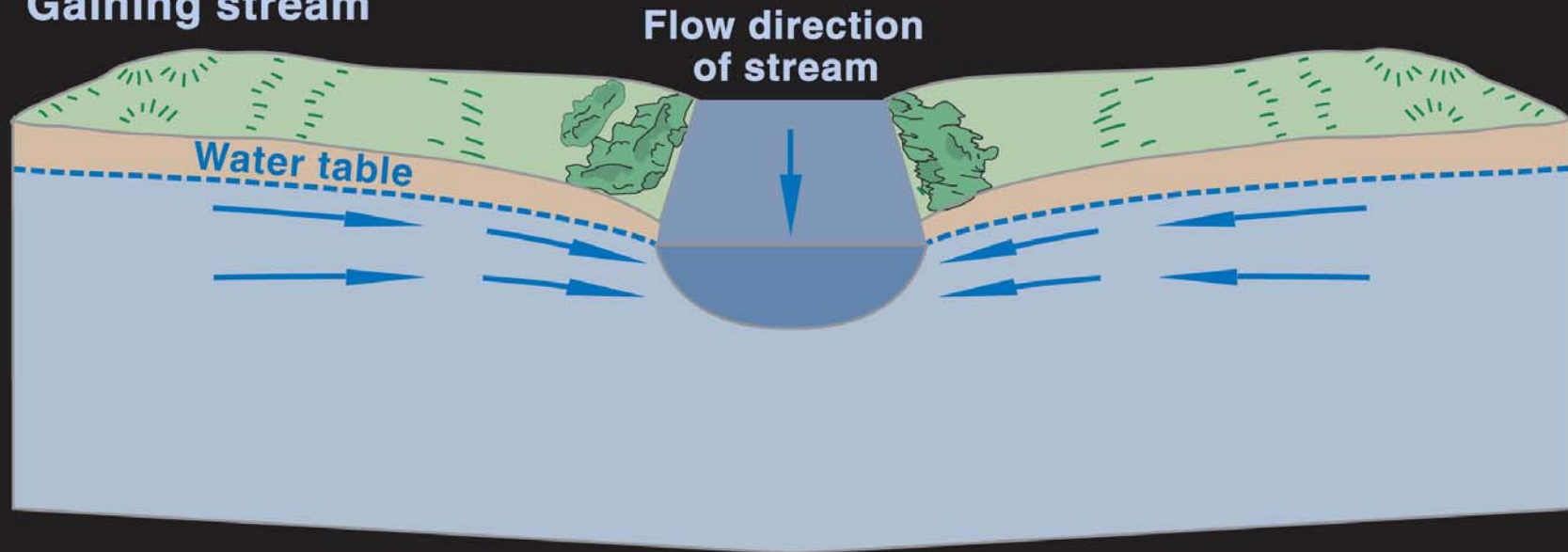
**Example of a streamflow hydrograph –
Discharge versus time
(from Palmer and Hahn, 2002)**



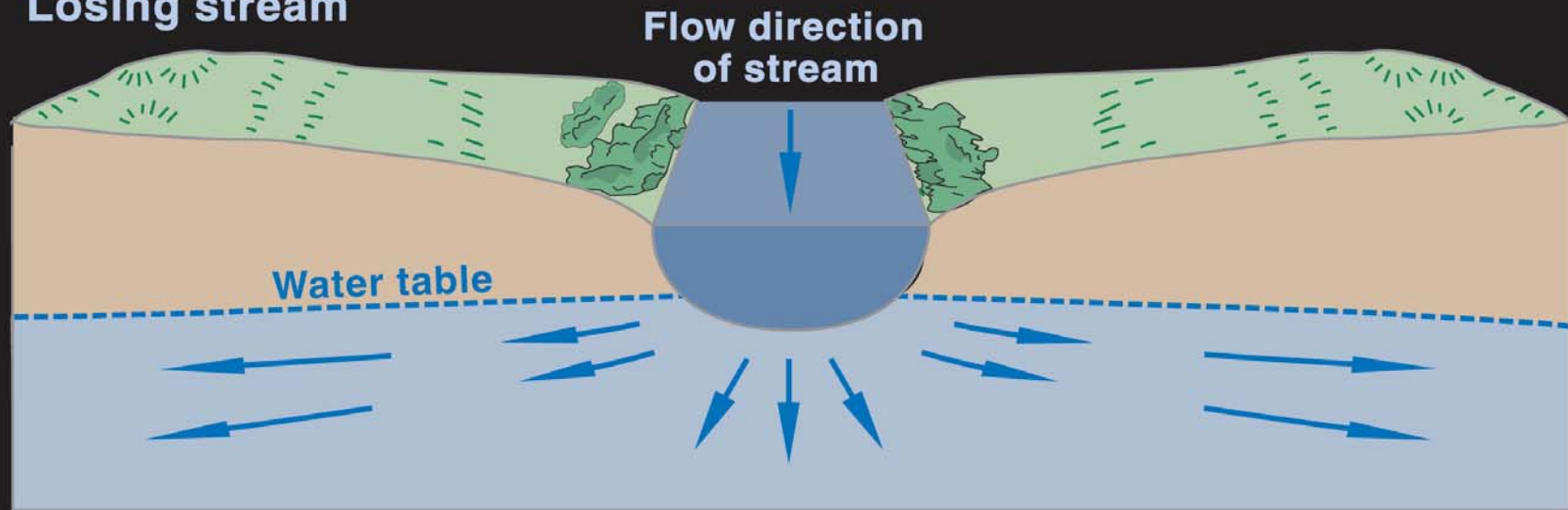
The Hydrologic Cycle

(courtesy R. Glennon)

A. Gaining stream

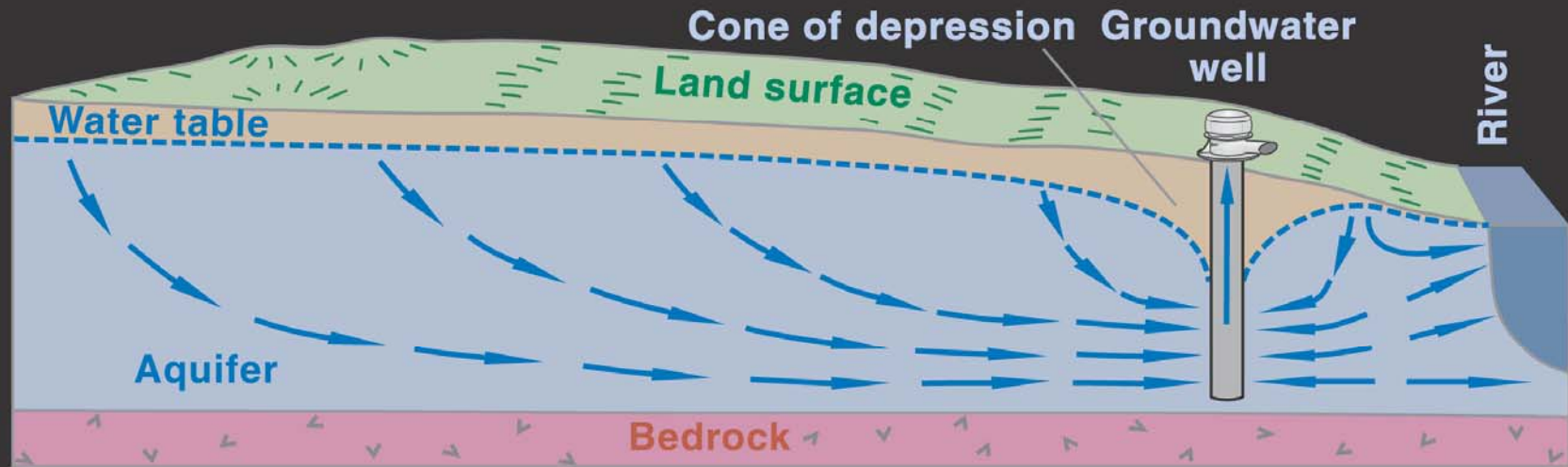


B. Losing stream

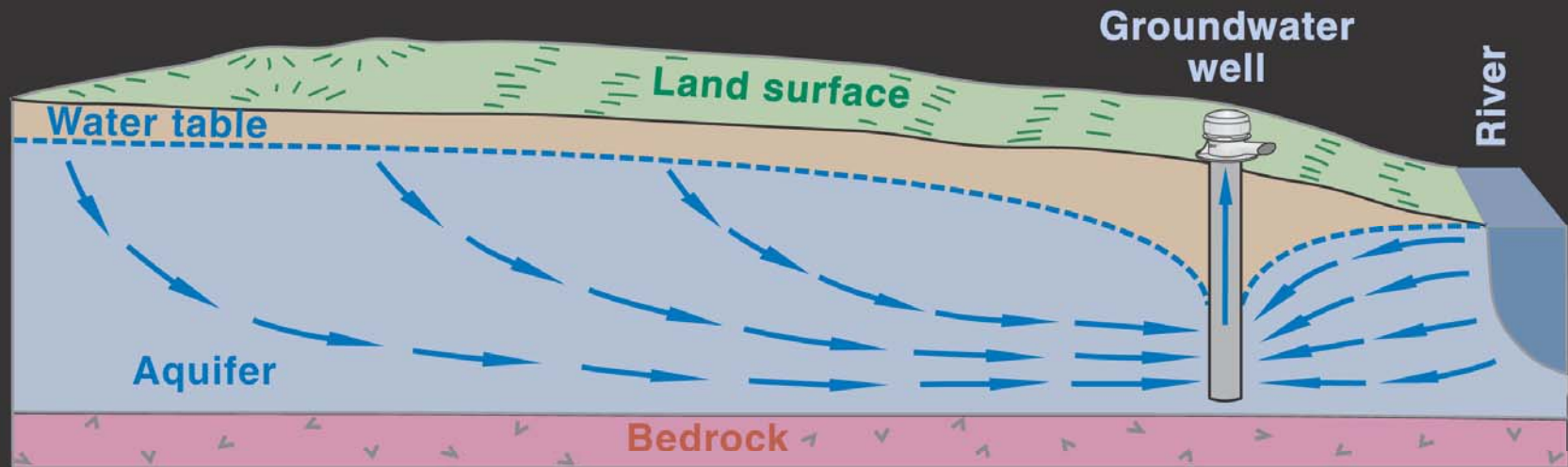


In a gaining stream (A), water discharges from the surrounding soil into the stream, but in a losing stream (B), water infiltrates the ground. (courtesy R. Glennon)

A. Onset of groundwater pumping changes the flow of water



B. Pumping draws water from stream





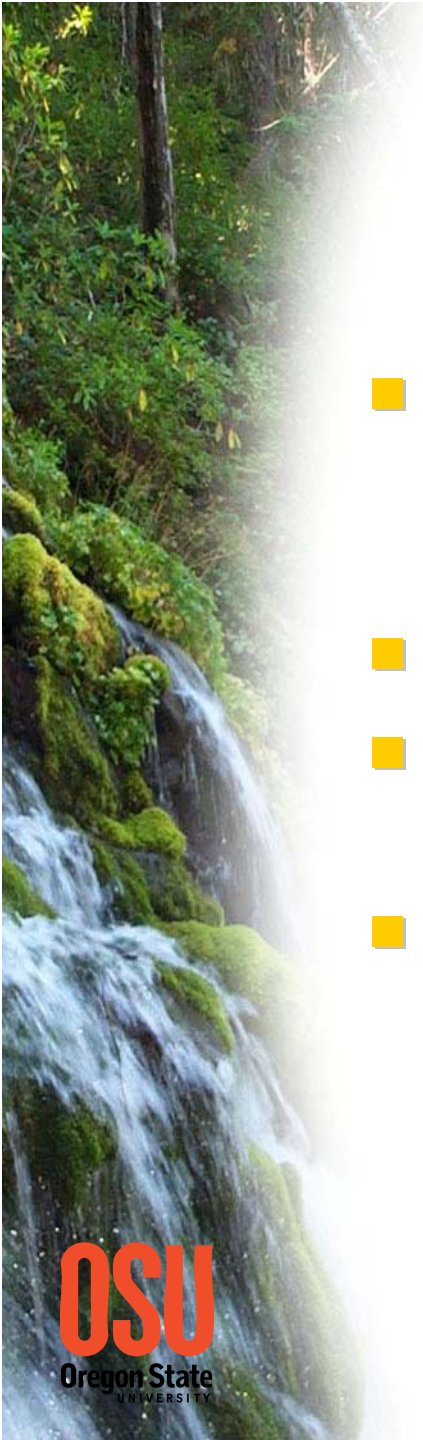
Water Measurement Programs: Hard Times, Budget Cuts

- *Perception among funders that collecting data is not “real work”*
- *Data are collected but never used*
- *No real scheme – why are we collecting this information (because we always have)?*
- *Viewed as non-essential – easy to cut portions of data-collection programs each budget cycle (“Death from 1000 cuts”)*
- *USGS: losing about 130 stream gaging stations each year, some with as much as 80-90 years of data*



Important Aspect

- ***With climate change looming, we must be able to assess how this will affect our water resources***
- ***USGS National Water Quality Assessment (NAWQA) Program: designed in response to Congressional inquiry into efficacy of Clean Water Act.***



USGS National Water-Use Information Program (NWUIP)

- Publishes *Estimated Use of Water in the United States in XXXX* every 5 years
- Poorly-funded (“stepchild”)
- Relies on voluntary submission of data by states – uneven quality
- Best state – Arkansas (Arkansas Soil and Water Conservation Commission – AR Natural Resources Commission; SW and GW)



National Research Council Review of NWUIP (2002)

- Elevate to **water use science**
- Use statistical sampling techniques where appropriate
- Evaluate uncertainties
- Encourage development of methods for measuring instream flows for ecological uses
- Expand to include water quality and effects of land use (link to NAWQA) – link water use, water quality, and land use
- Investigate use of **SPARROW** model (**SP**ATIALLY **R**eferenced **R**egressions **O**n **W**atershed attributes; Smith et al., 1997) – streamflow, water quality, land use)

Oregon

- **Statistical approaches - “gross” measurement for information, management**
- **Regulation, enforcement: need individual data points (well water levels/pumping rates, stream discharge/diversions, quality measurements)**
- **Need data for models so that predictions can be made**
- **Ancillary data (e.g., land use) must be acquired so that cause-and-effect relationships can be discerned**



References

National Research Council, 2002. *Estimating Water Use in the United States: a New Paradigm for the National Water-Use Information Program.* Washington, DC: National Academy Press, 176p.

Palmer, R., and M. Hahn, 2002. *The Impacts of Climate Change on Portland's Water Supply.* Available at:
www.tag.washington.edu/papers/papers/PortlandClimateReportFinal.pdf

Smith, R.A., G. E. Schwarz, and R.B. Alexander, 1997. Regional interpretation of water-quality monitoring data, *Water Resources Research* 33:2781-2798.



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The Oregon Water List (TOWL):

lists.oregonstate.edu/mailman/

listinfo/oregon-water-list

WaterWired blog:

www.typepad.com/waterwired