Aspects of Groundwater in the Yakima River Basin

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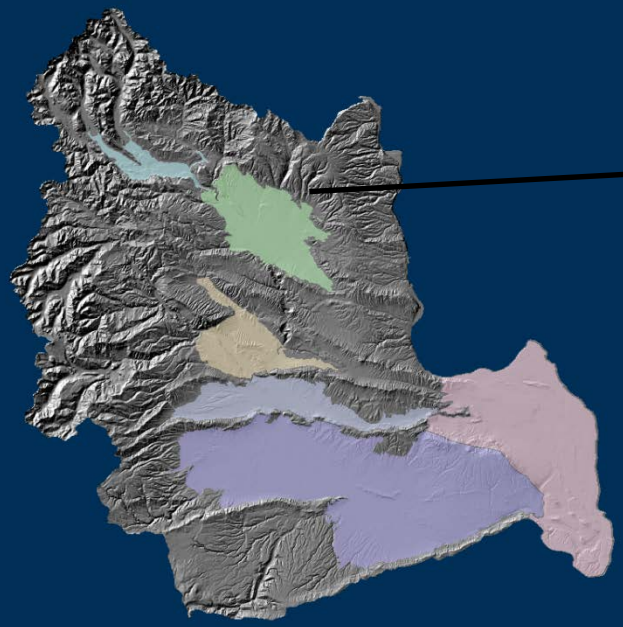
U.S. Department of the Interior
U.S. Geological Survey

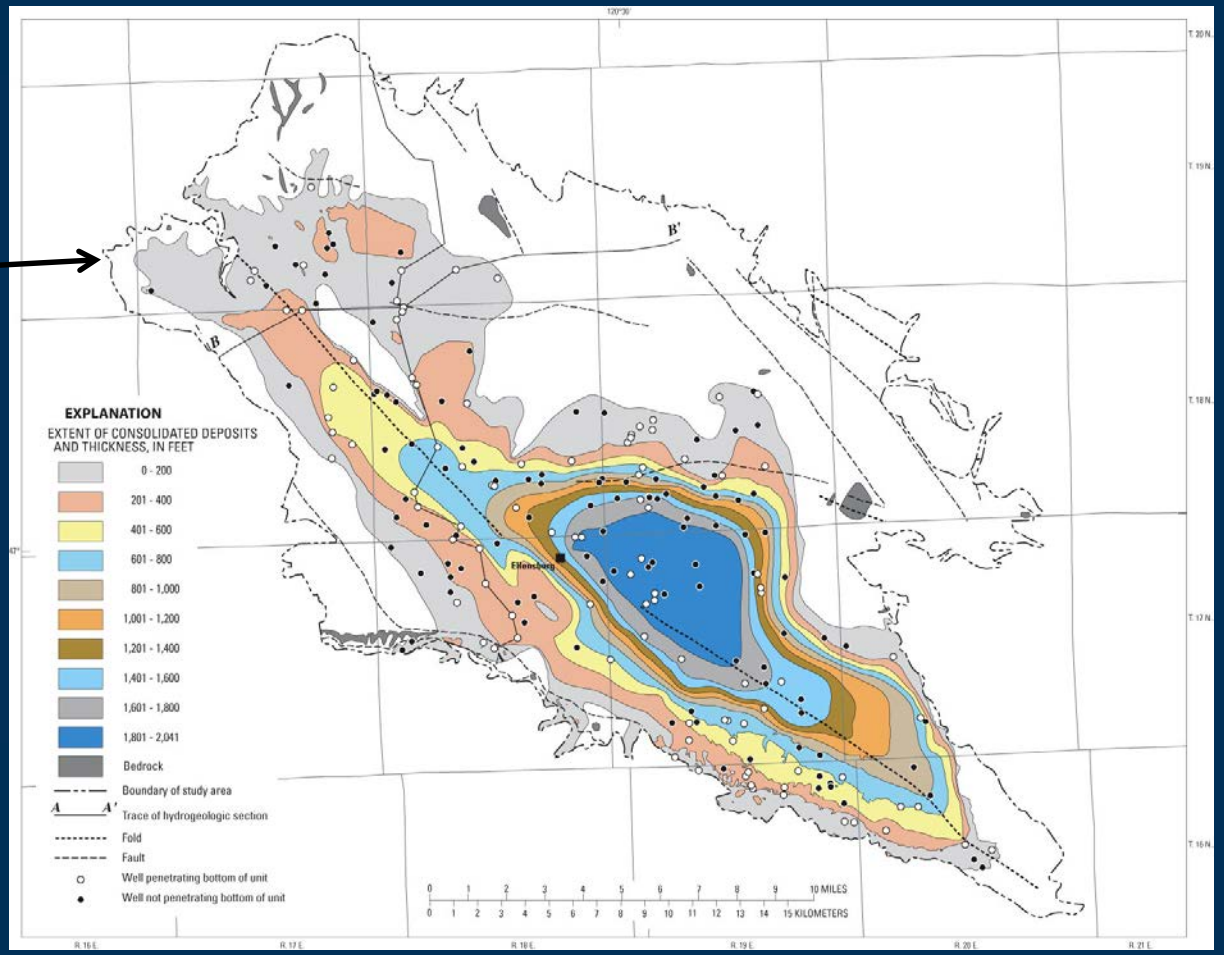
STUDY COMPONENTS

- Well information
- Hydrogeology
- Groundwater pumpage
- Groundwater recharge
- Groundwater / surface water interchanges
- Groundwater flow system, including groundwater levels
- Hydraulic characteristics
- Groundwater flow model

USGS

Hydrogeologic Framework of Sedimentary Deposits in Six Structural Basins

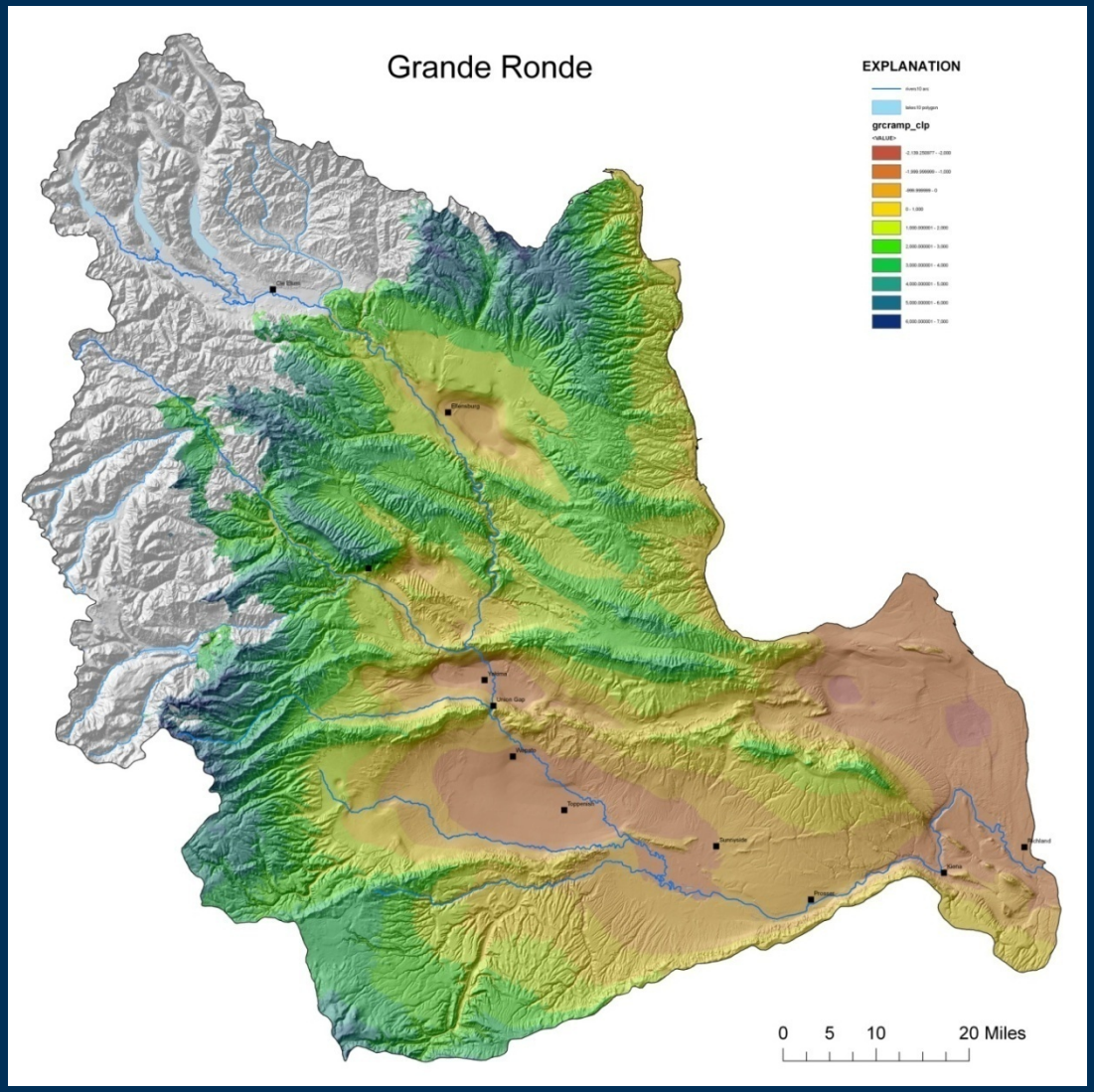




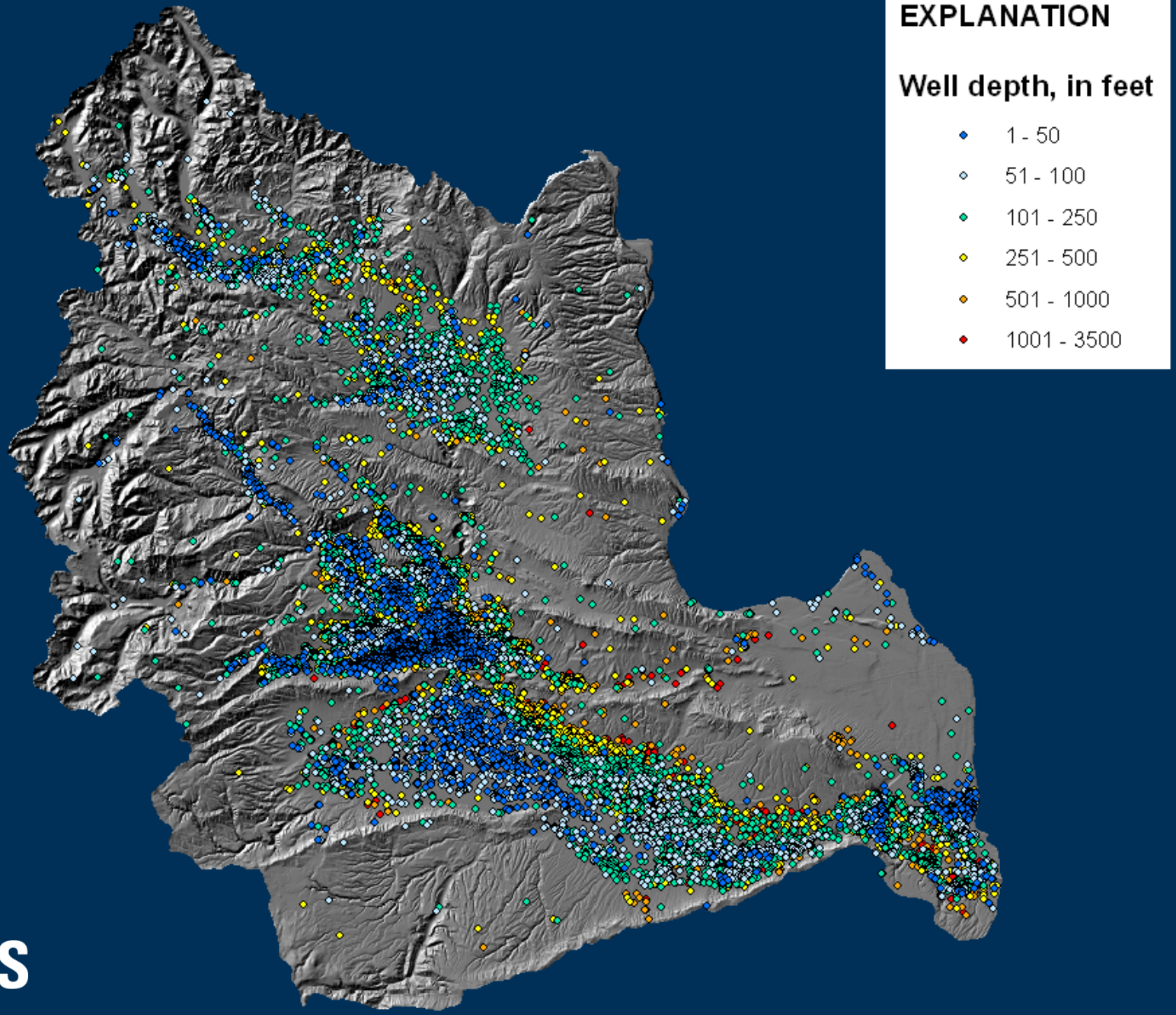
USGS

Basalt Hydrogeologic Units

Saddle Mountains unit
Wanapum unit
Grande Ronde unit

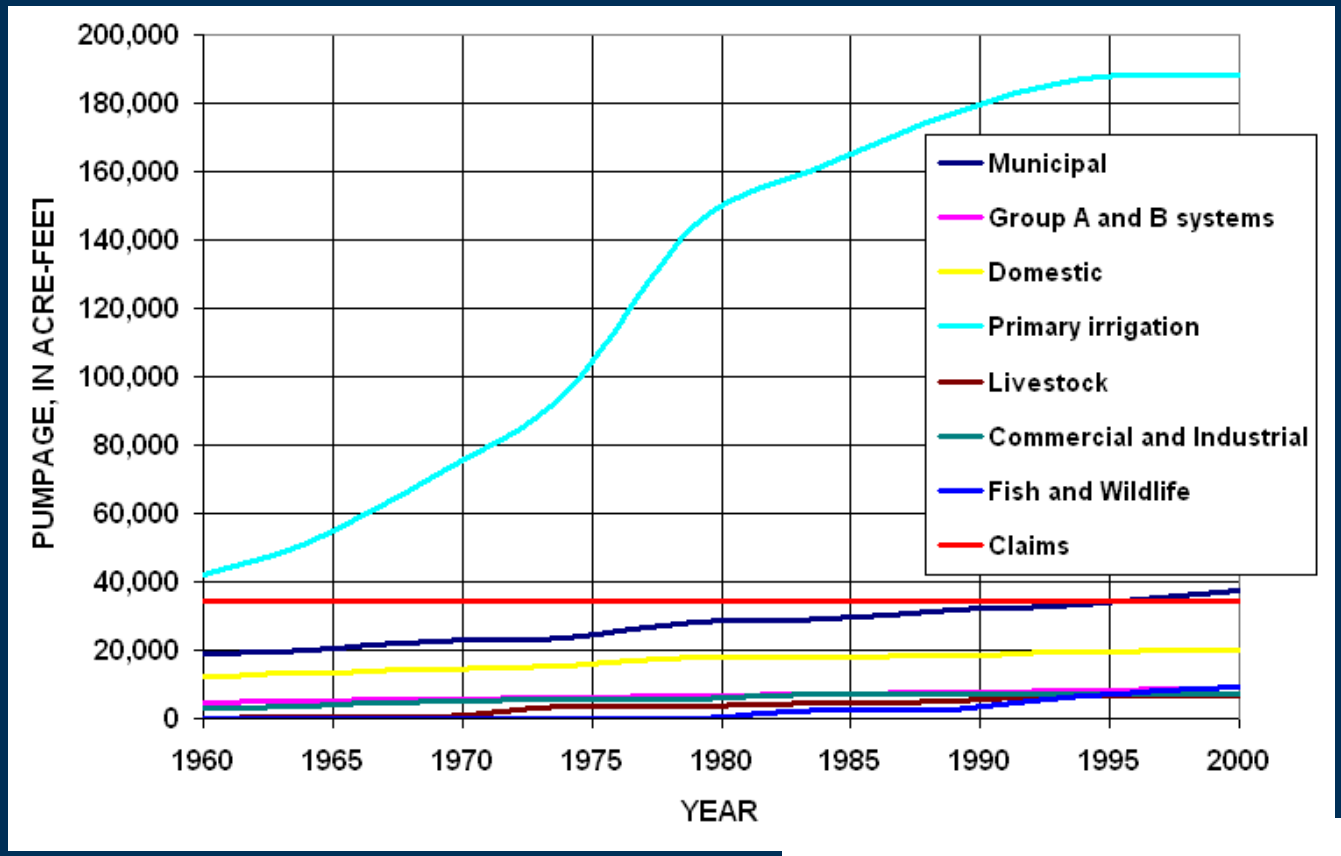


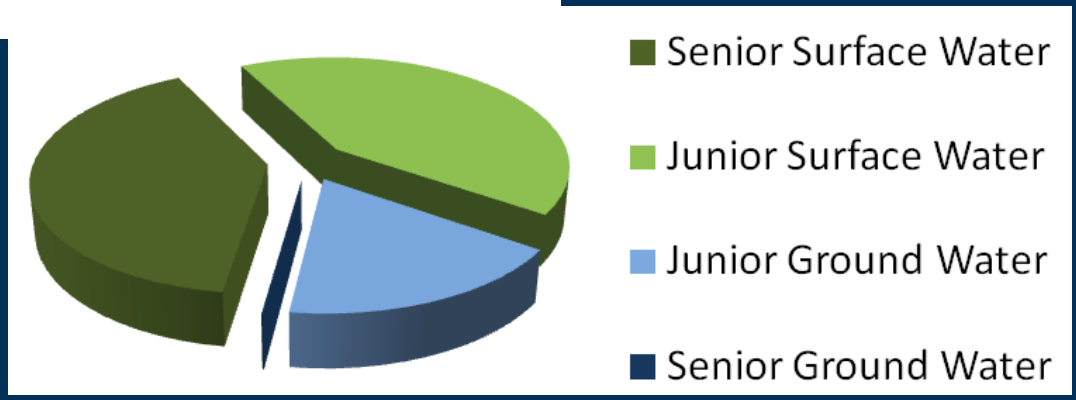
USGS


EXPLANATION
Well depth, in feet
1 - 50
51 - 100
101 - 250
251 - 500
501 - 1000
1001 - 3500

USGS

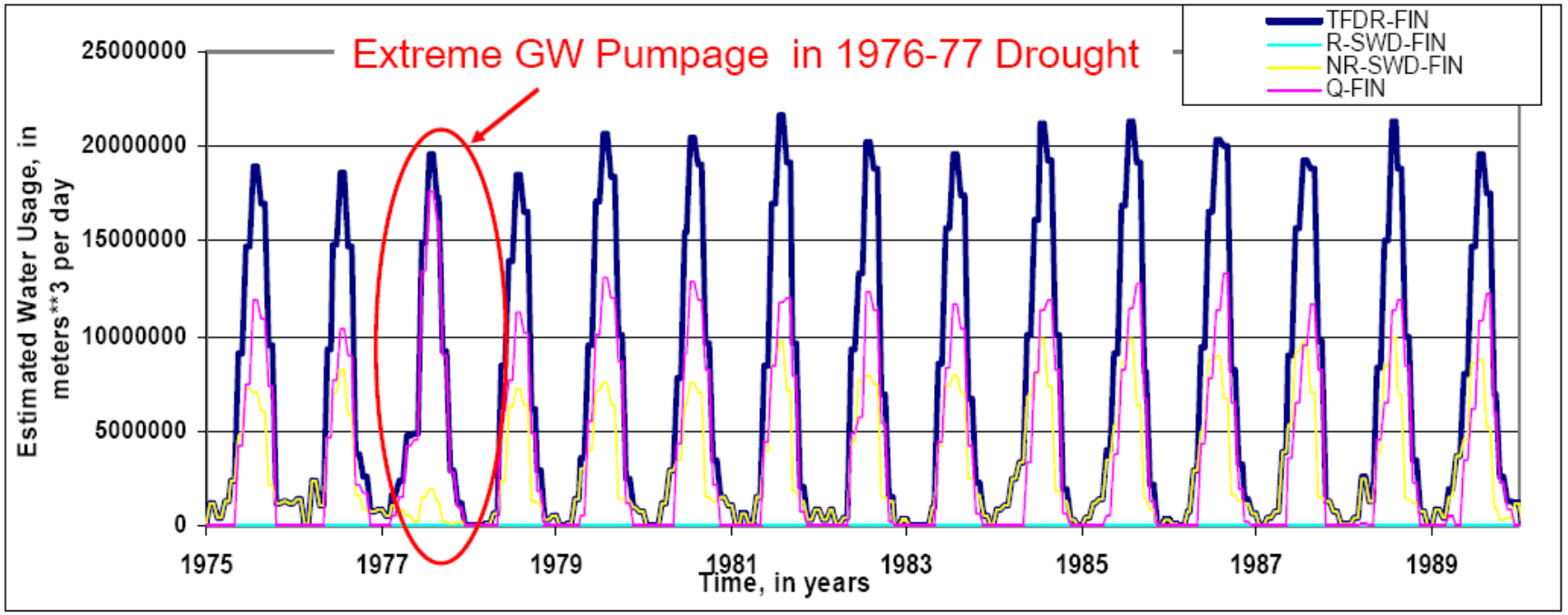
Ground-Water Usage in Yakima River Basin





USGS

Change in Dominant Water Source with Climate



Central Valley, California

HANSEN AND SCHMID, 2008

USGS

Groundwater Rights

Number	Instantaneous (GPM)	Annual (Acre-FT)	Irrigated Area (Acres)
2,874	**950,000**	**530,000**	**130,000**

Instantaneous = **1.4** Billion gallons per day
Annual = **730** Cubic feet per second
Streamflow leaving the Basin = **3,600** Cubic feet per second

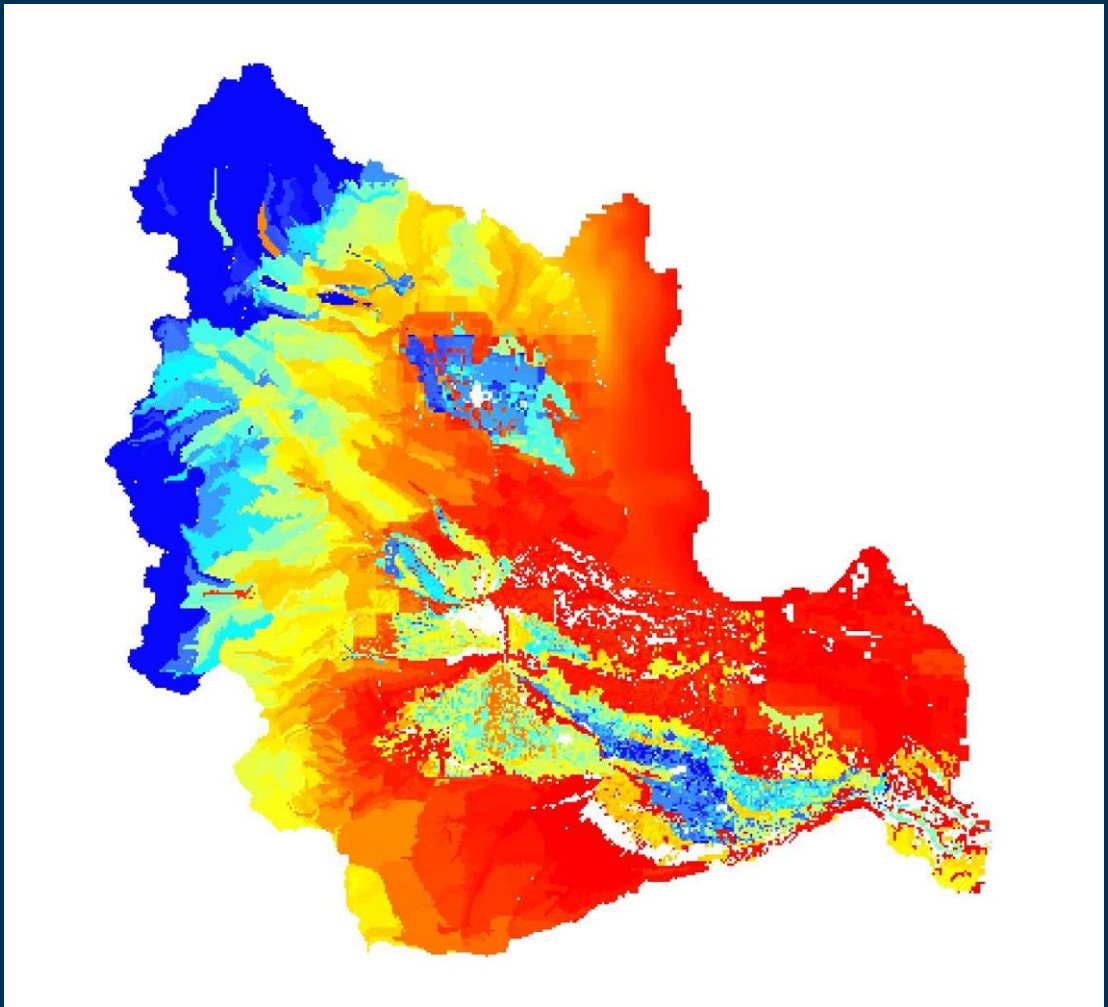
Total Surface Water rights: **5,800** Cubic feet per second

USGS

Ground-Water Recharge

Simulates
81,367 HRUs
for 41 years

1.2 billion daily values



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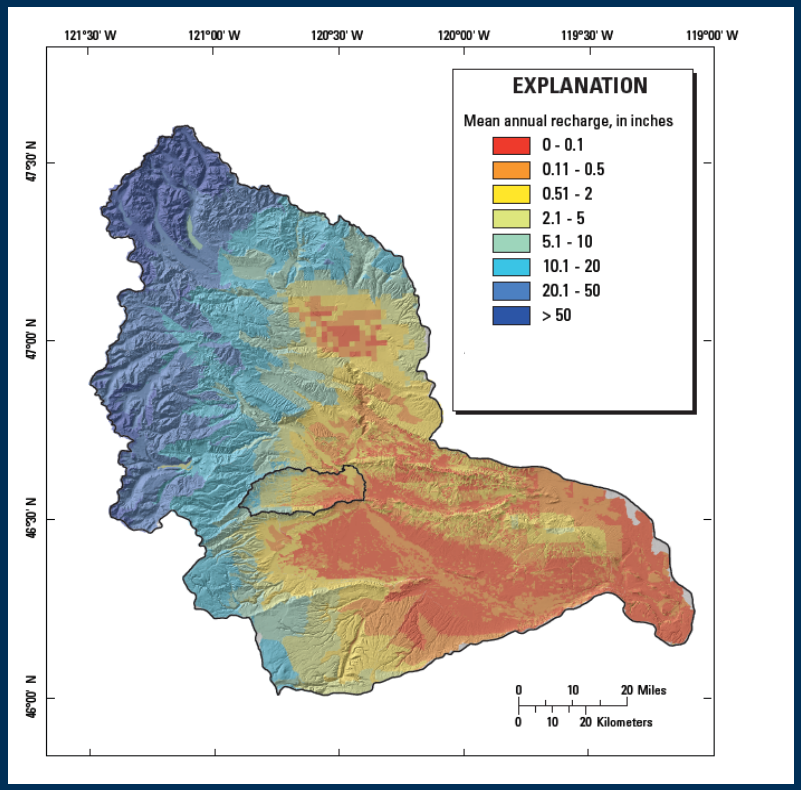
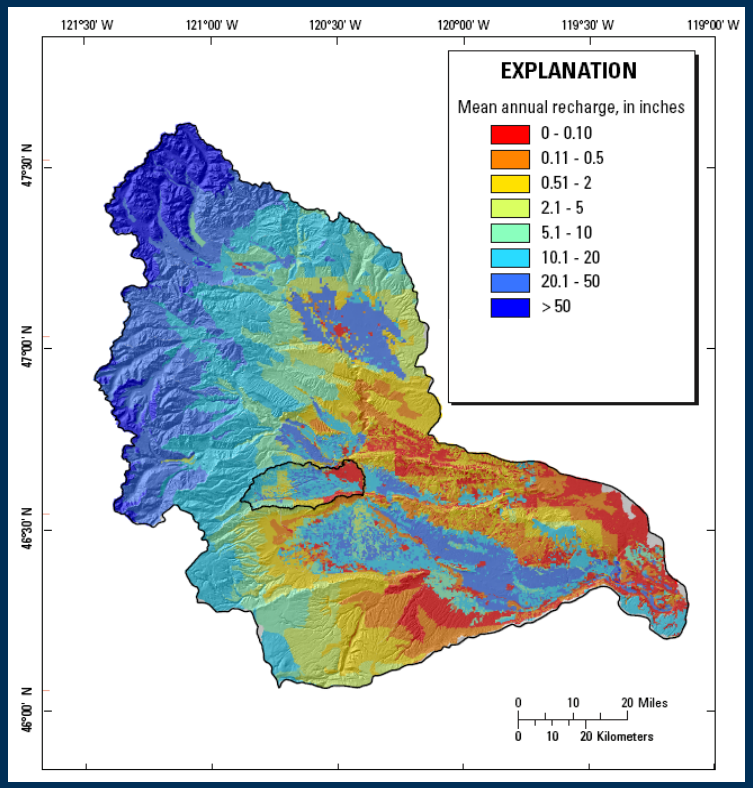
Mean Annual Recharge since 1950





Predevelopment Conditions

- 30.5 cm
- 157 m^3/s
- 3.9 million acre-feet

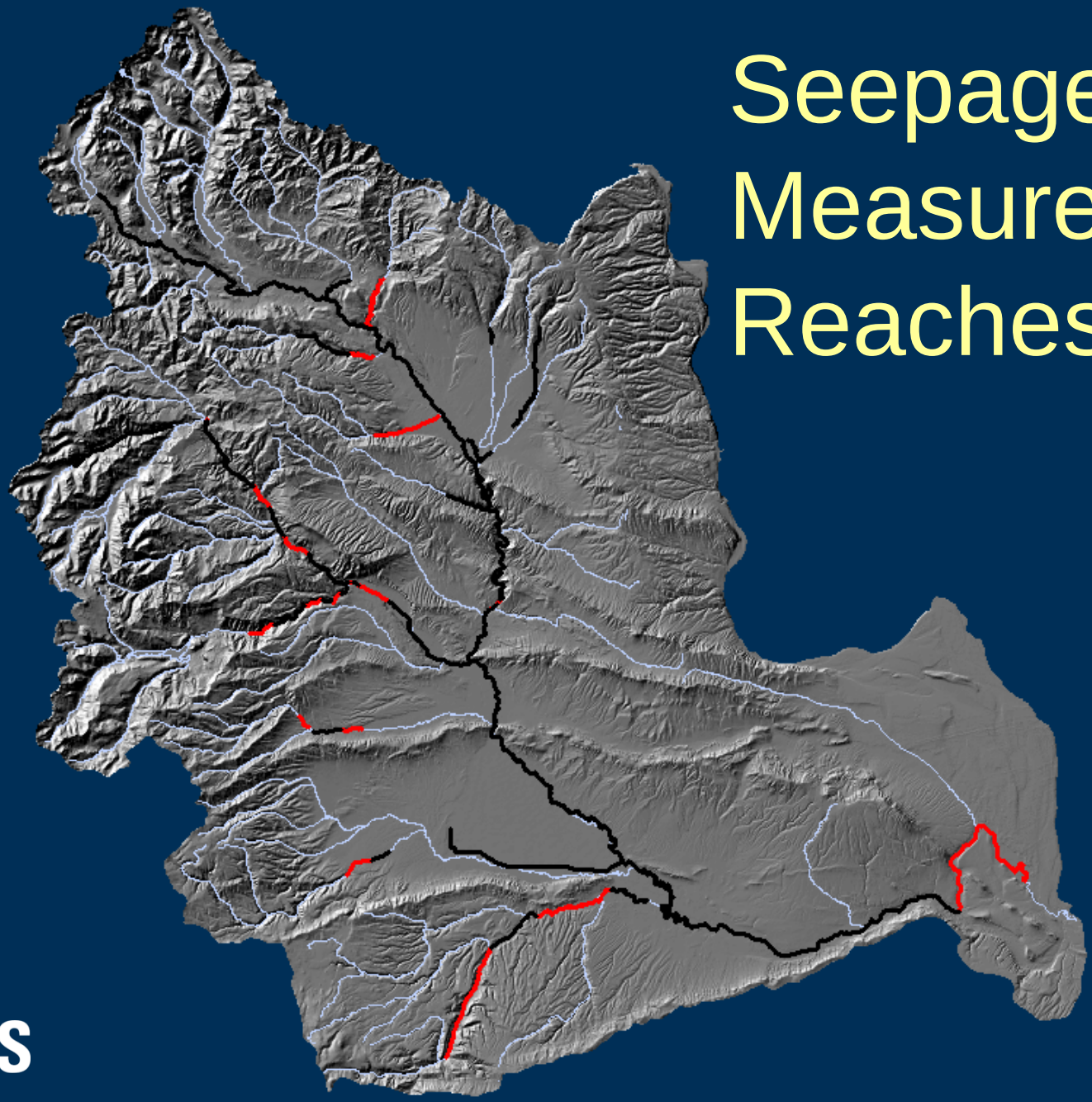
Current Conditions

- 40 cm
- 202 m^3/s
- 5.2 million acre-feet

USGS

Vaccaro and Olsen, 2007

Seepage Measurement Reaches



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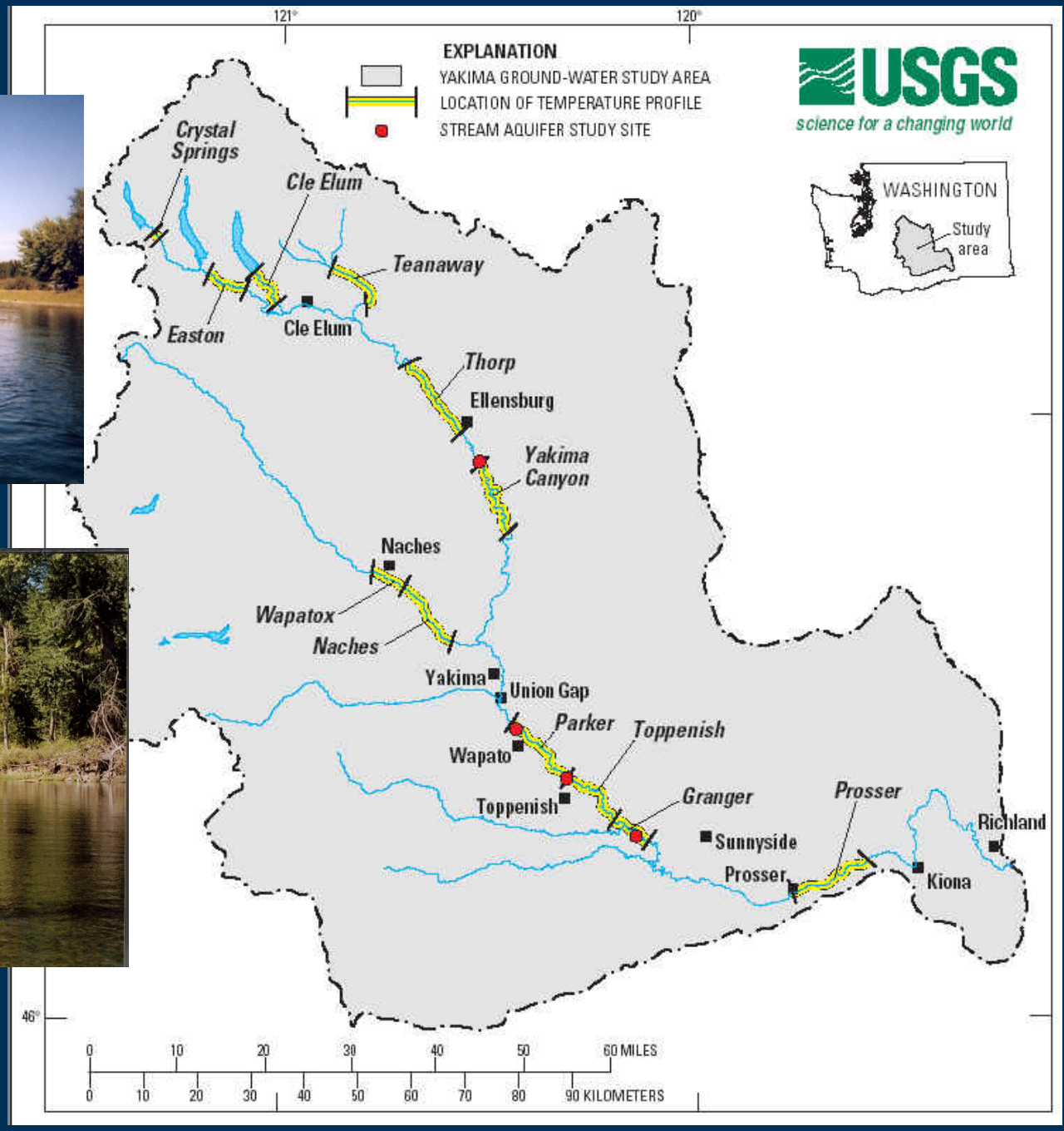
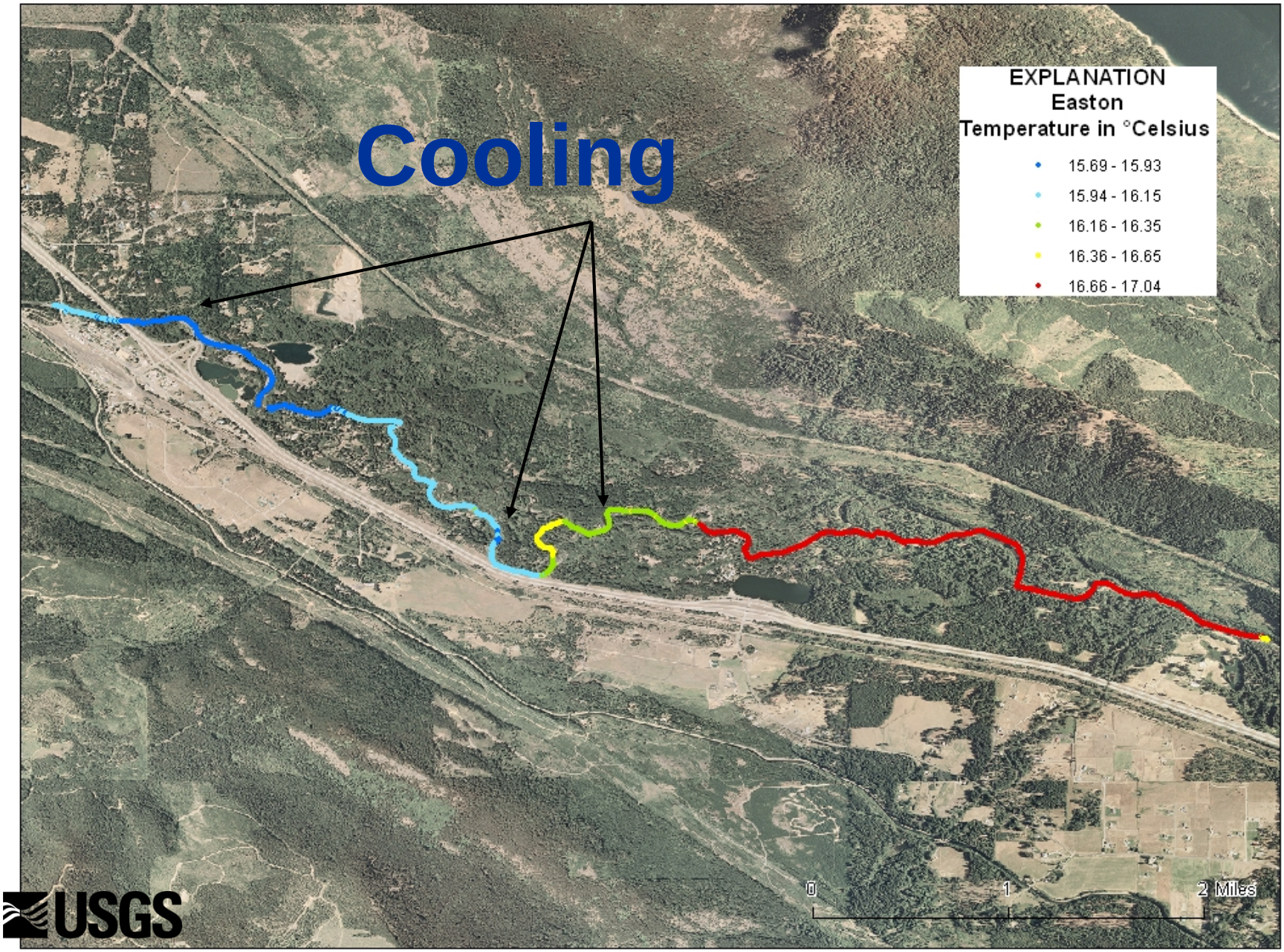
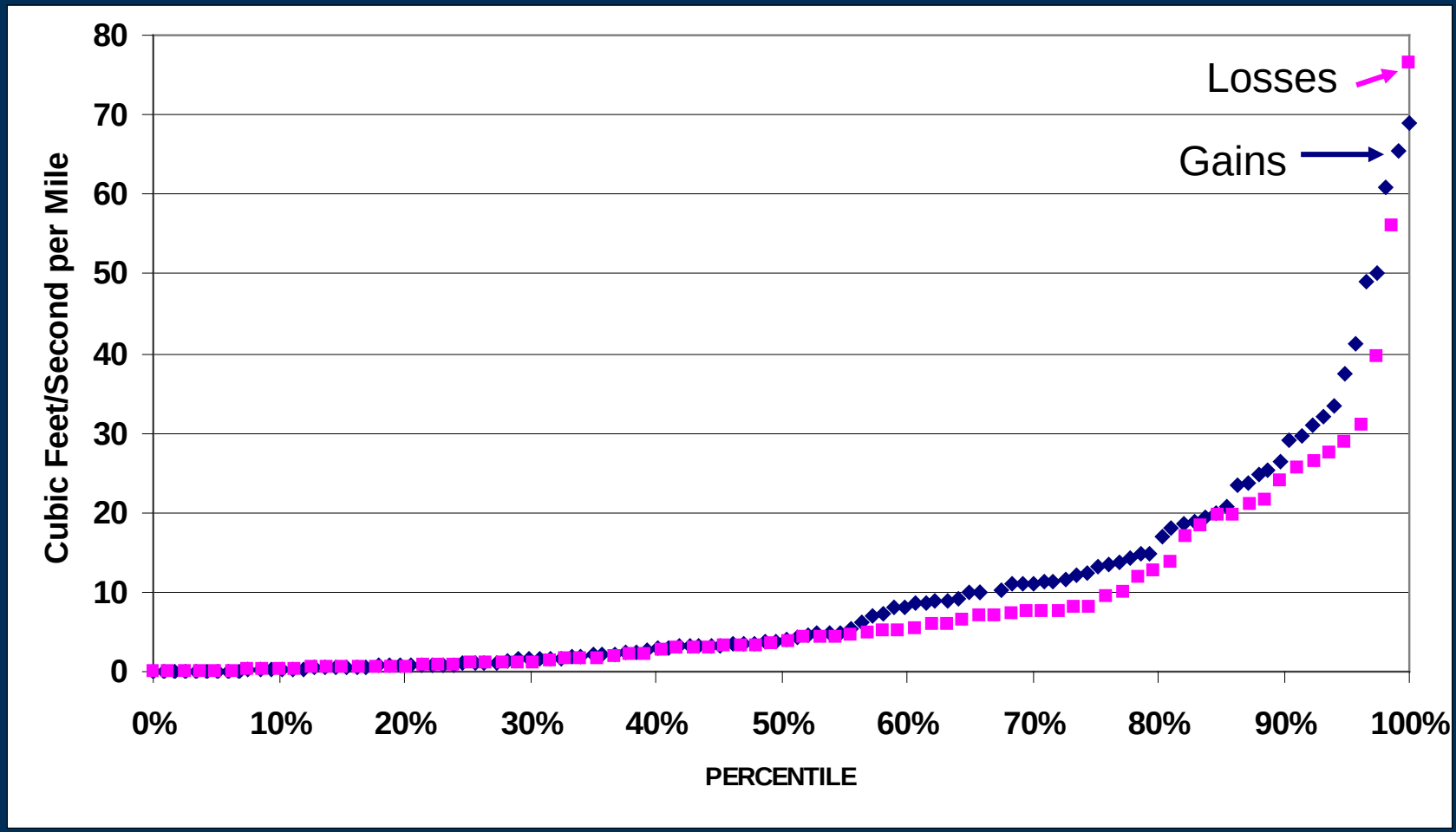

121°
120°
EXPLANATION
YAKIMA GROUND-WATER STUDY AREA
LOCATION OF TEMPERATURE PROFILE
STREAM AQUIFER STUDY SITE
USGS
science for a changing world
WASHINGTON
Study area
Crystal Springs
Cle Elum
Teanaway
Easton
Cle Elum
Thorp
Ellensburg
Yakima Canyon
Naches
Wapatox
Naches
Yakima
Union Gap
Parker
Toppenish
Wapato
Toppenish
Granger
Prosser
Sunnyside
Prosser
Richland
Kiona
46°
0 10 20 30 40 50 60 MILES
0 10 20 30 40 50 60 70 80 90 KILOMETERS

USGS


Cooling
EXPLANATION
Easton
Temperature in °Celsius
15.69 - 15.93
15.94 - 16.15
16.16 - 16.35
16.36 - 16.65
16.66 - 17.04
0
1
2 Miles
USGS

Streamflow Gains and Losses, 198 reaches



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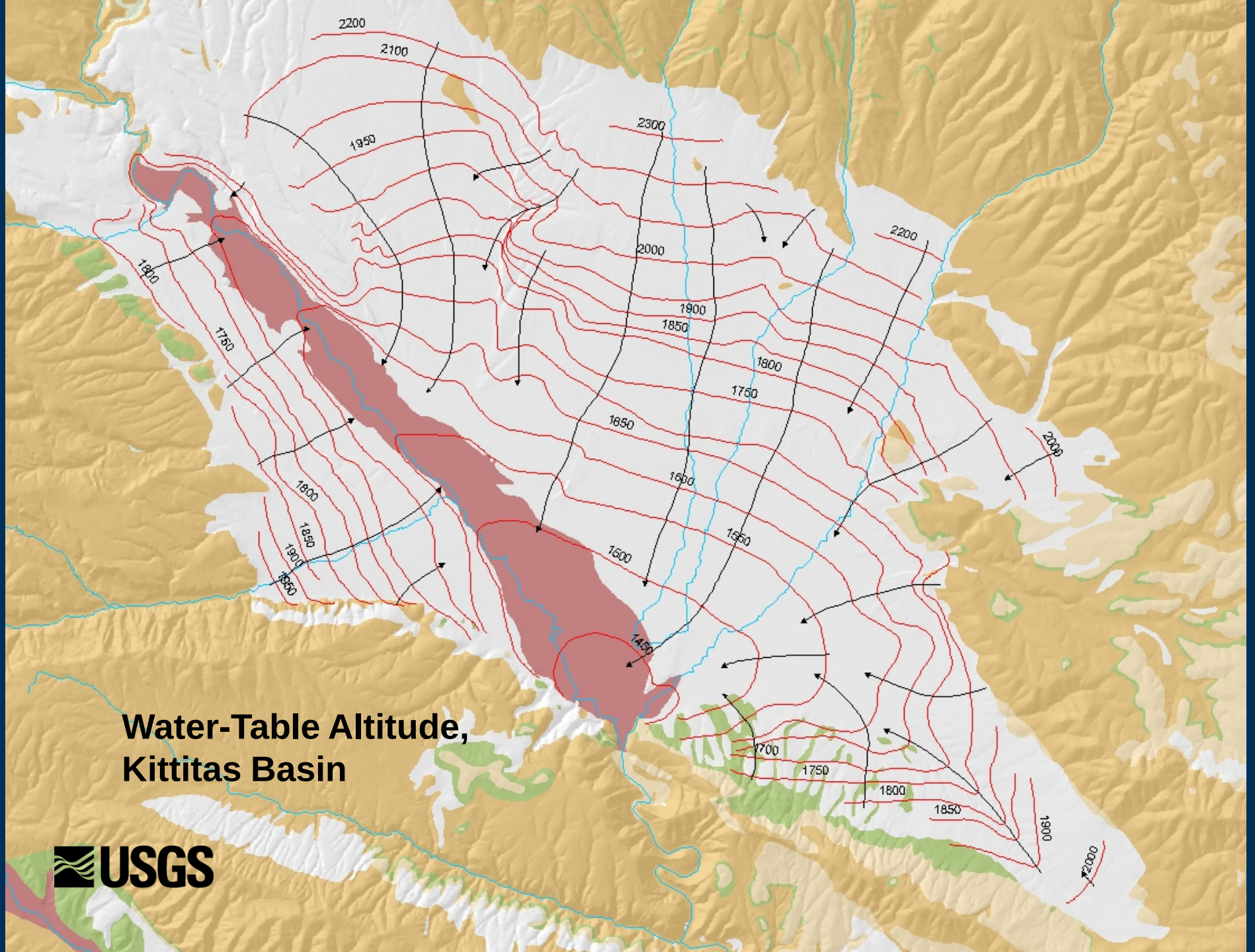
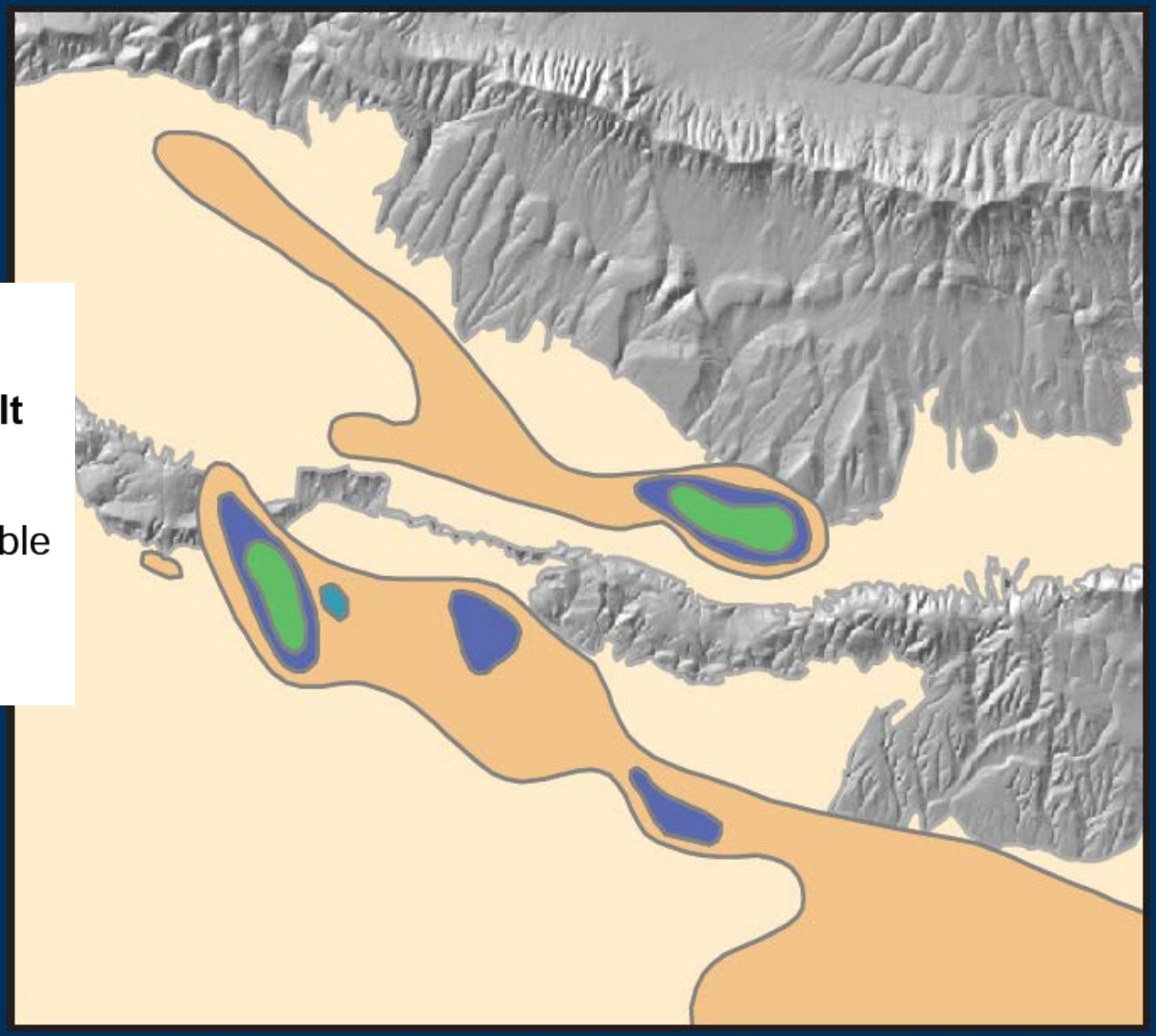


Water-Table Altitude, Kittitas Basin

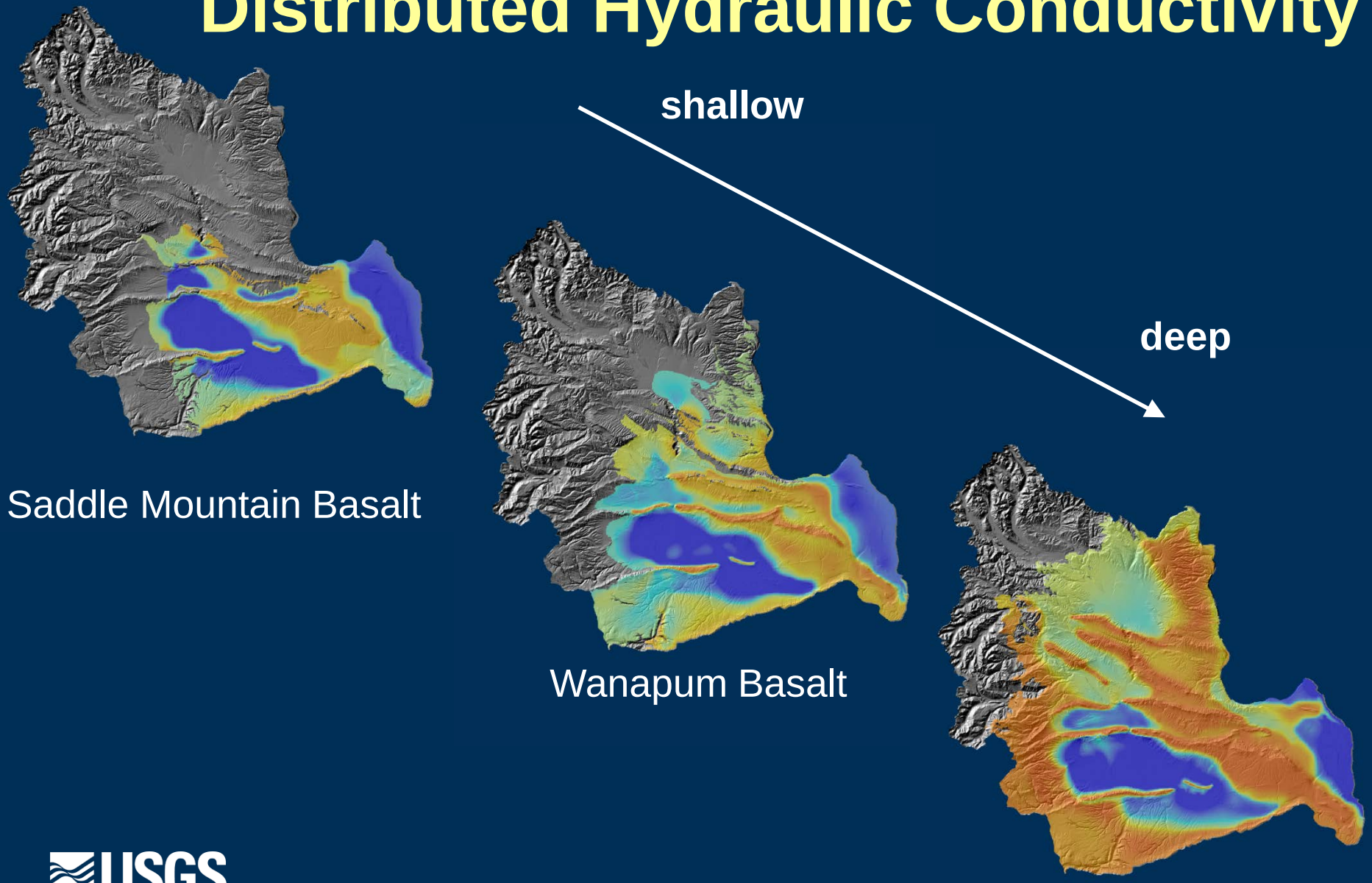
USGS

Water Level Declines



USGS

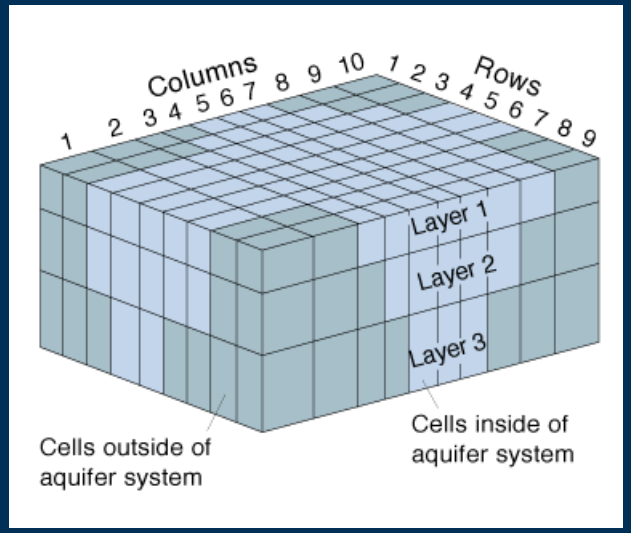
Distributed Hydraulic Conductivity



USGS

Model Dimensions

- MODFLOW-2000
- 6,900 mi^2
- 600 rows, 600 columns, 24 layers
- 1,000 ft x 1,000 ft cells
- 44 hydrogeologic units
- 4.6 billion active cells
- Simulation period: 1960-2001
- 504 1-month stress periods



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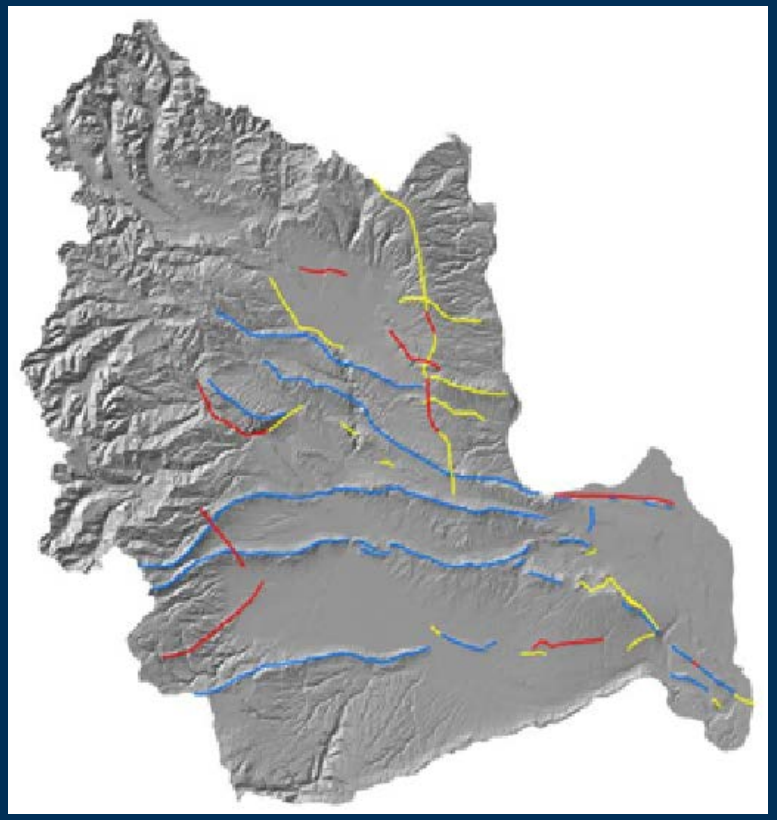
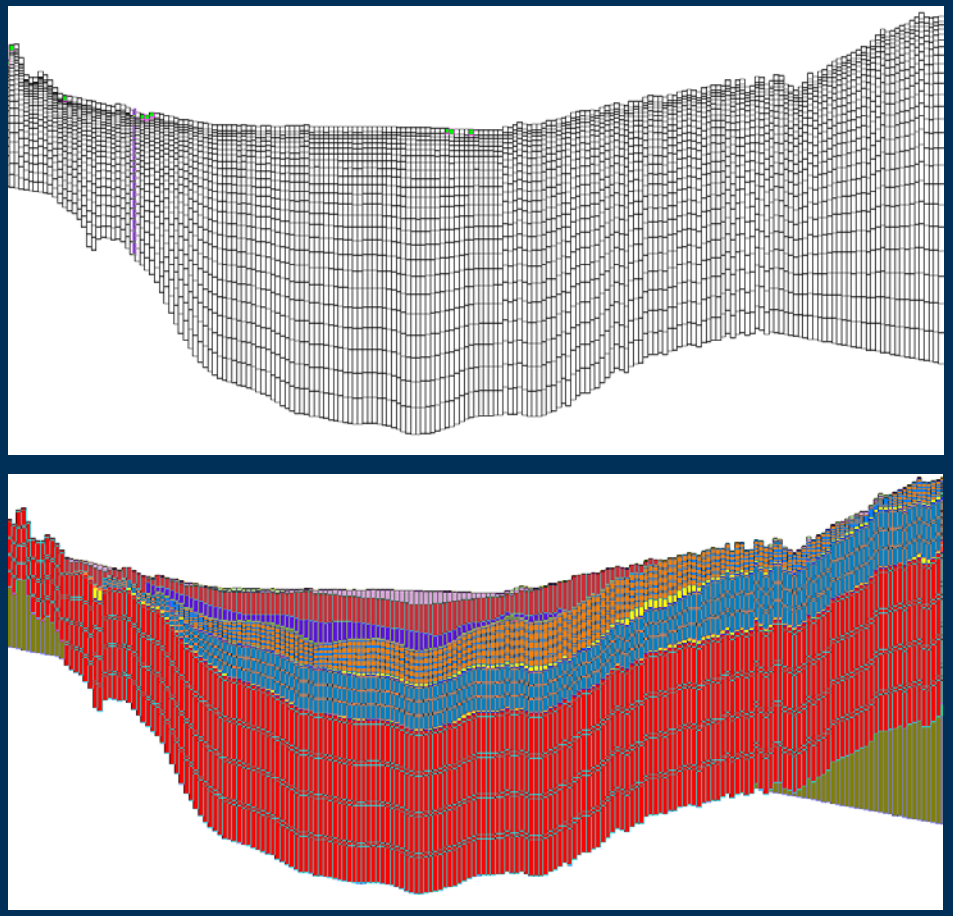
Horizontal Flow Barrier (HFB)



3,600 HFBs per model layer

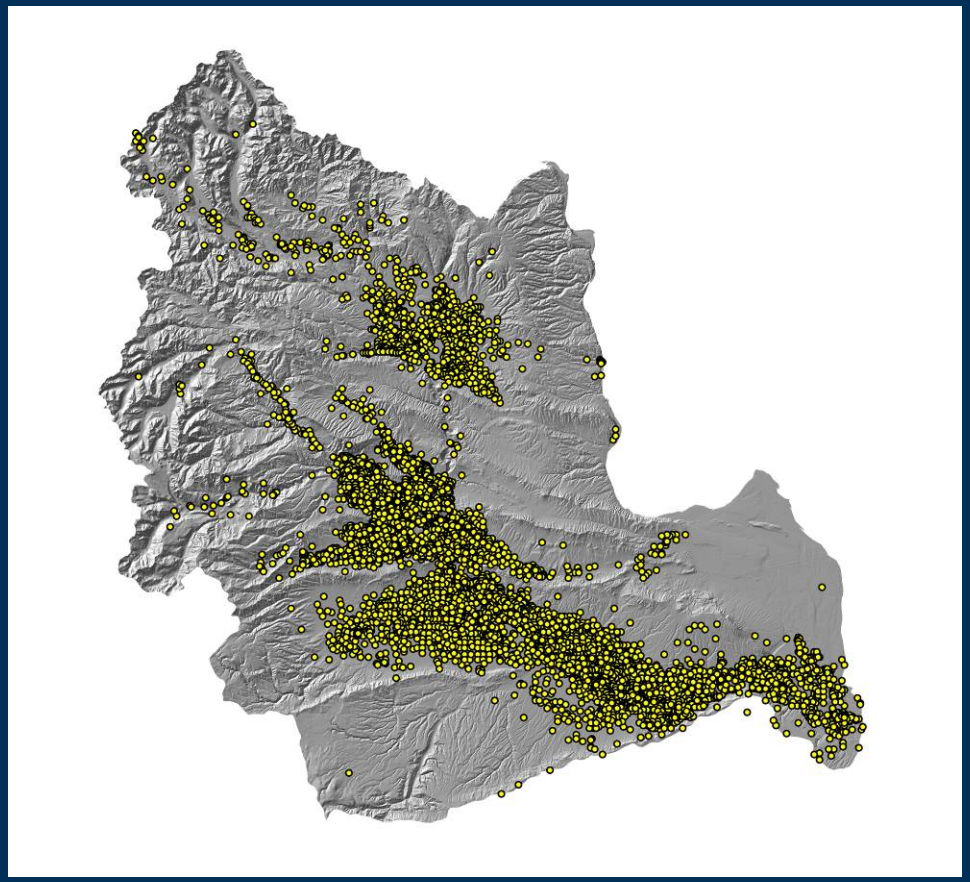
USGS

Hydrogeologic Unit Flow (HUF)



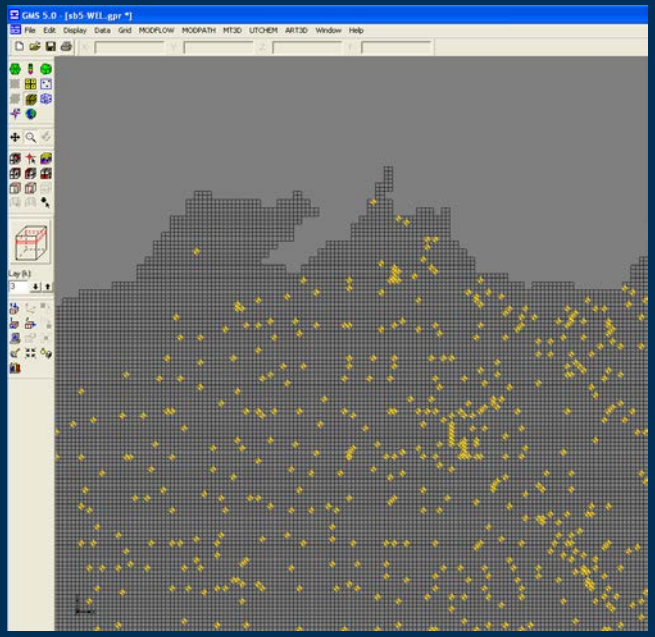
44 Hydrologic Units reduced to 24 active model layers

Well (WEL) Package



9,800 pumping wells

3.6 million monthly values



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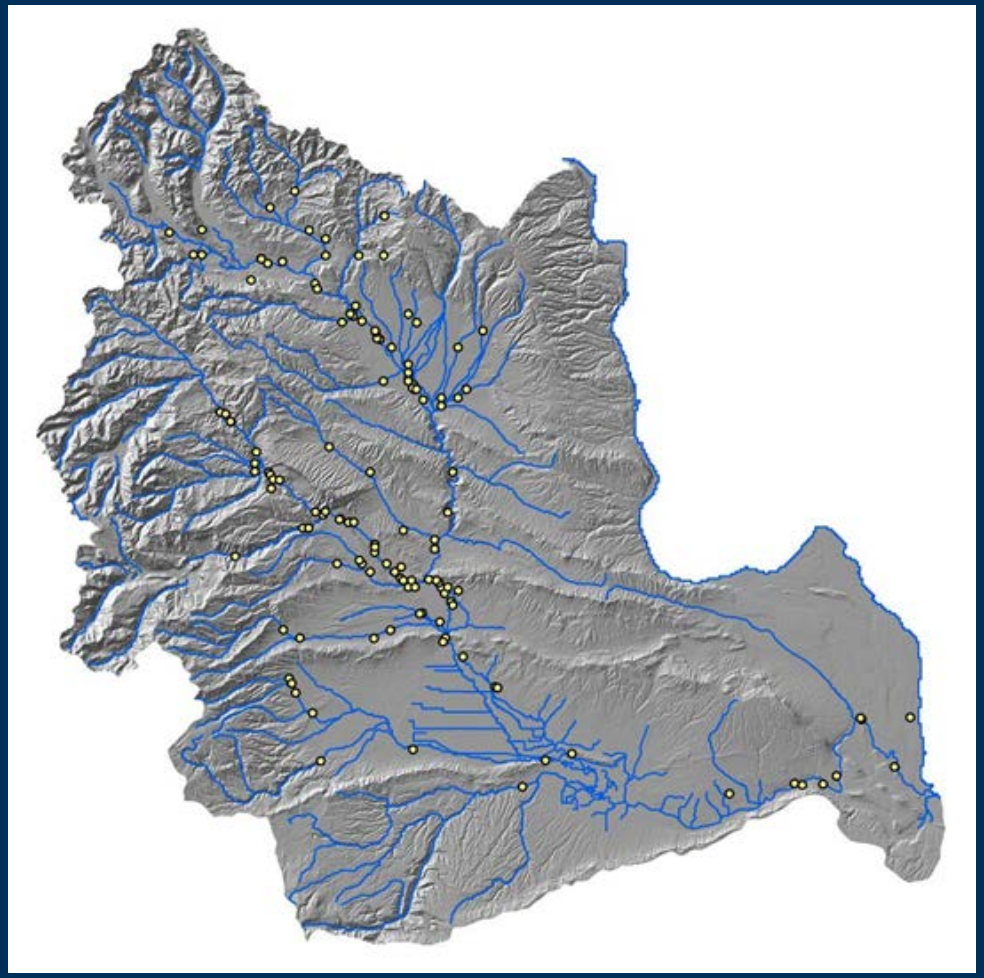
Drain and Streamflow-Routing (SFR) Package

250 stream segments
8,500 stream cells
5,000 drain cells
2,500 mi of streams
150 points of diversion



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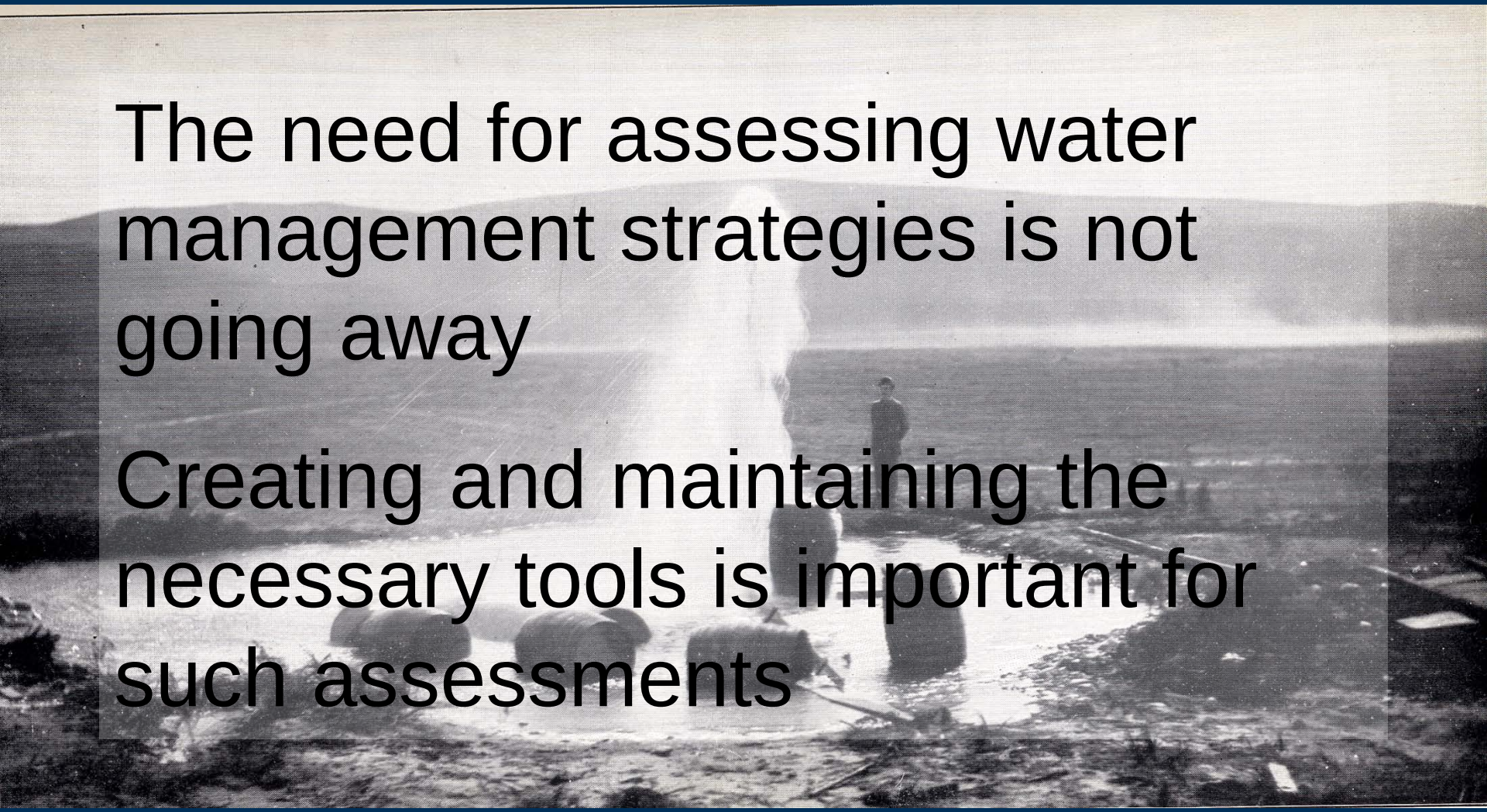
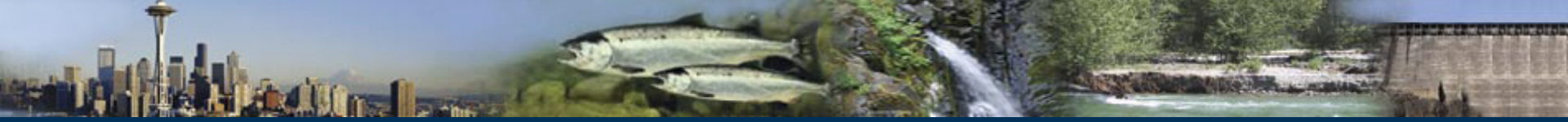
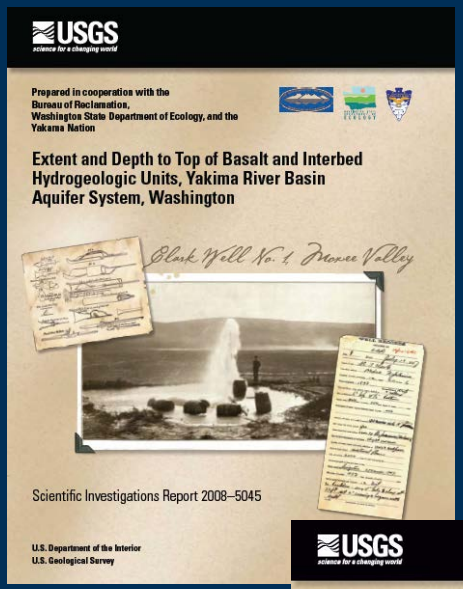


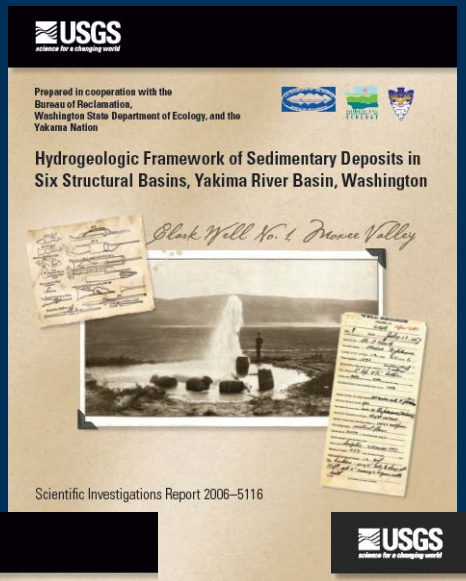
The need for assessing water management strategies is not going away

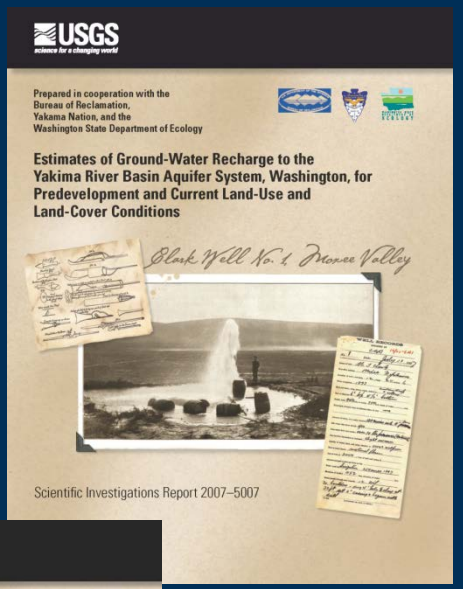
Creating and maintaining the necessary tools is important for such assessments

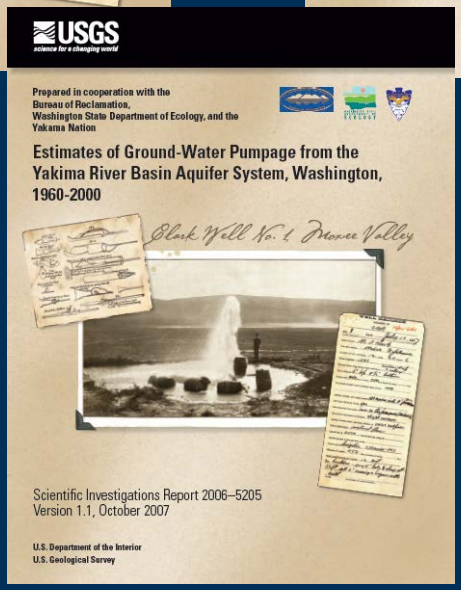
USGS

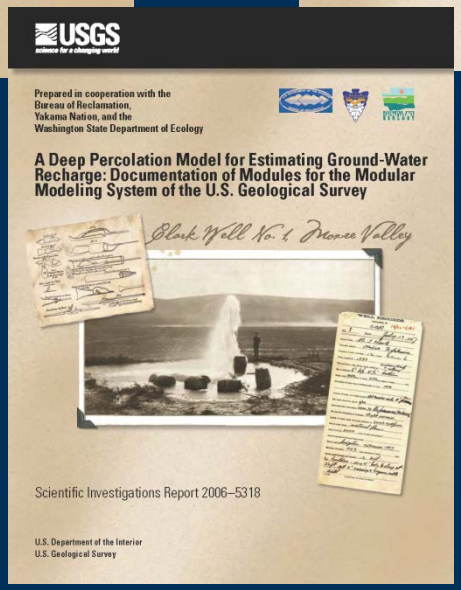












http://wa.water.usgs.gov/projects/yakimagw/