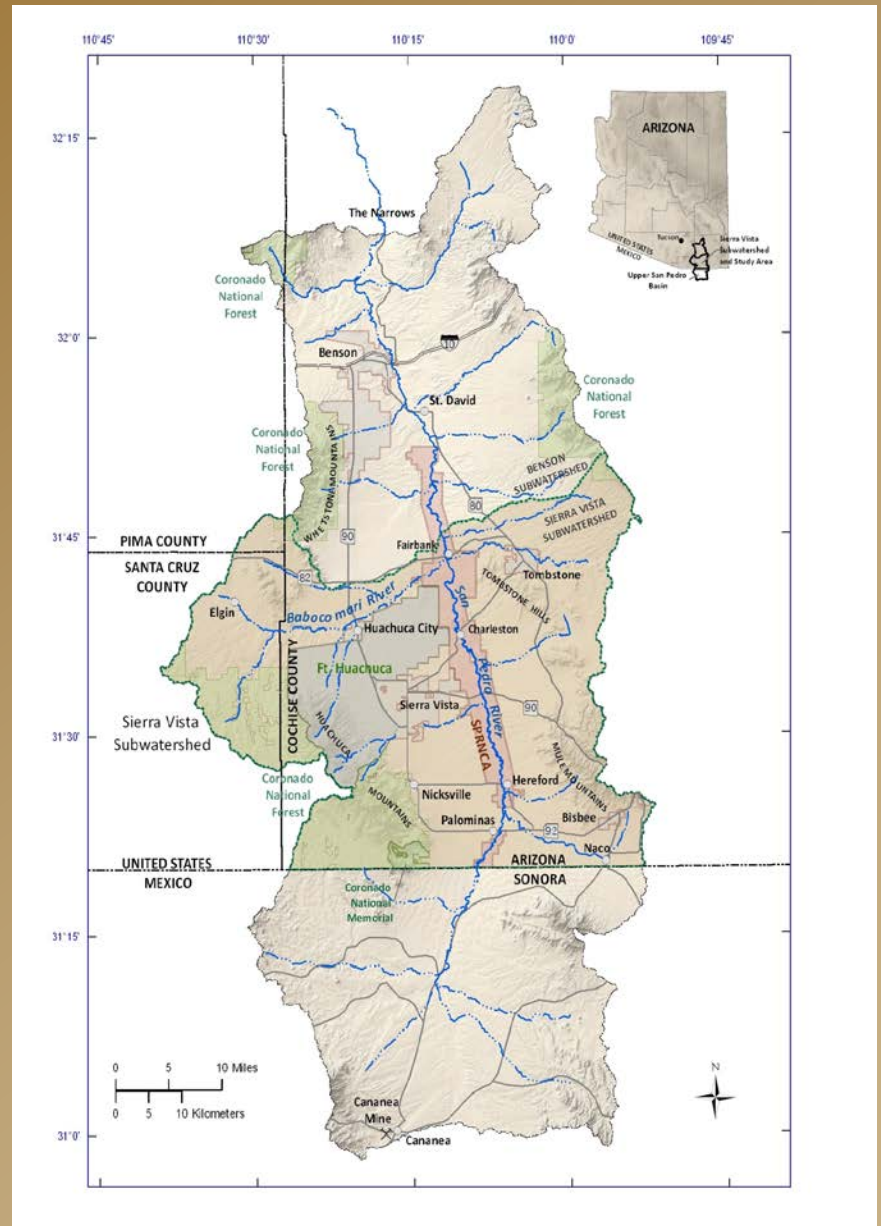
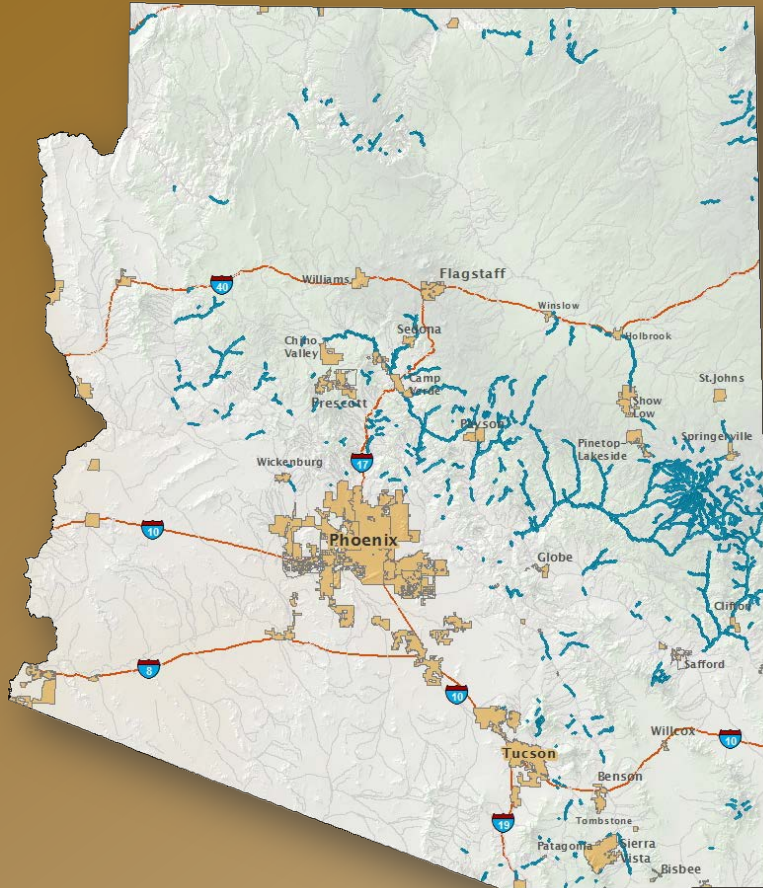
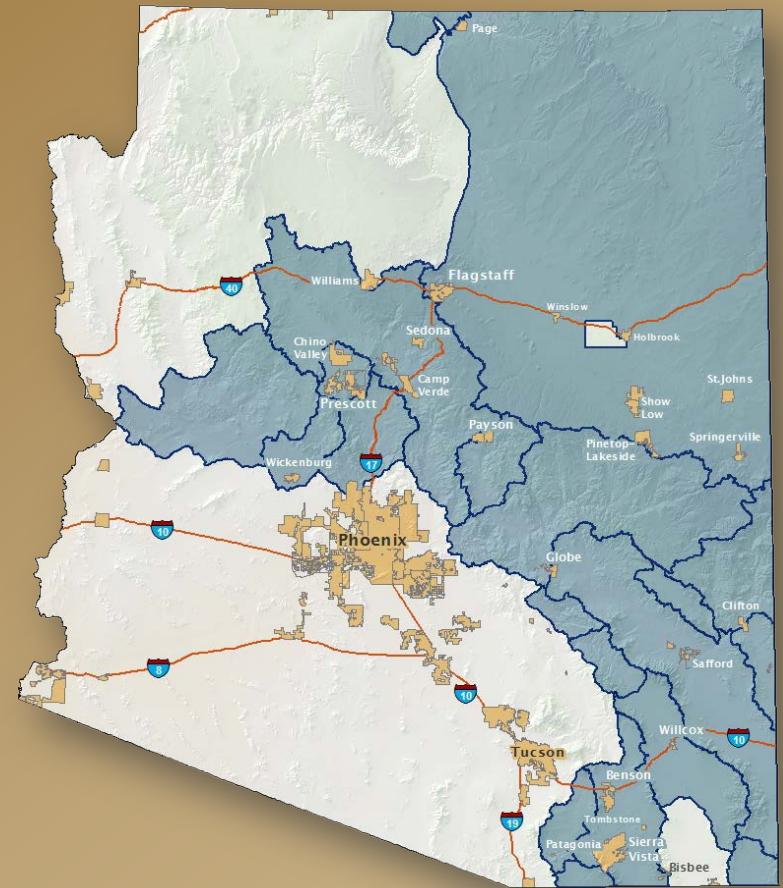


# Upper San Pedro River, Arizona:





**3,000 + miles of perennial rivers**

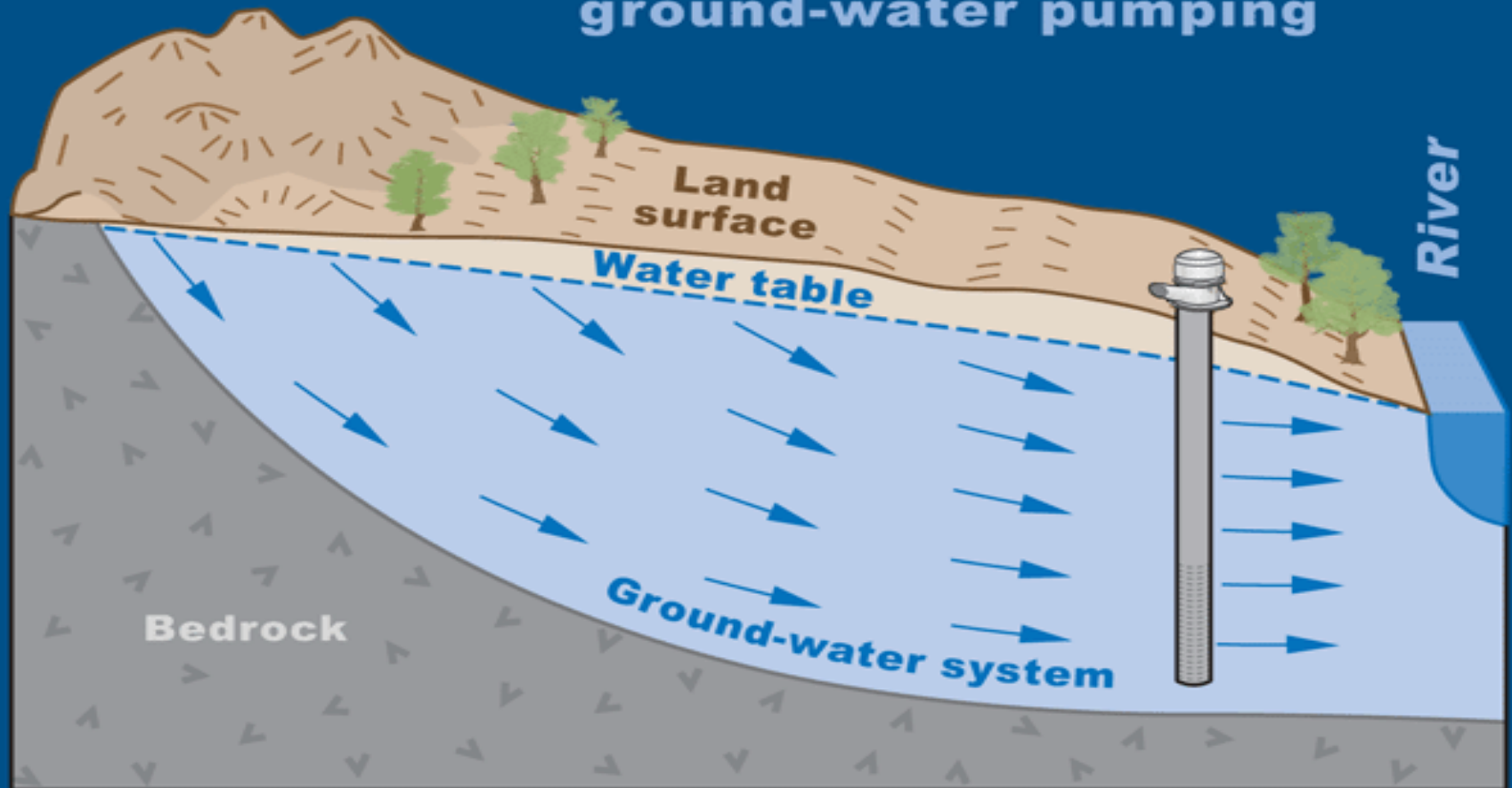


**At-risk basins in 2035**

Results from Arizona's Water Resources Development Commission, 2011



## Equilibrium change caused by ground-water pumping



## Upper San Pedro Partnership

21 agencies and organizations that cooperate in the identification, prioritization, and implementation of comprehensive policies and projects to assist in meeting the water needs of the Sierra Vista Sub-watershed of the San Pedro River.

Bella Vista  
Ranches/Water

Bureau of Land  
Management (BLM)

U.S. Geological  
Survey

Audubon Arizona

Arizona State Land  
Department

U.S.D.A. Agricultural  
Research Service

National Park Service

U.S. Forest Service

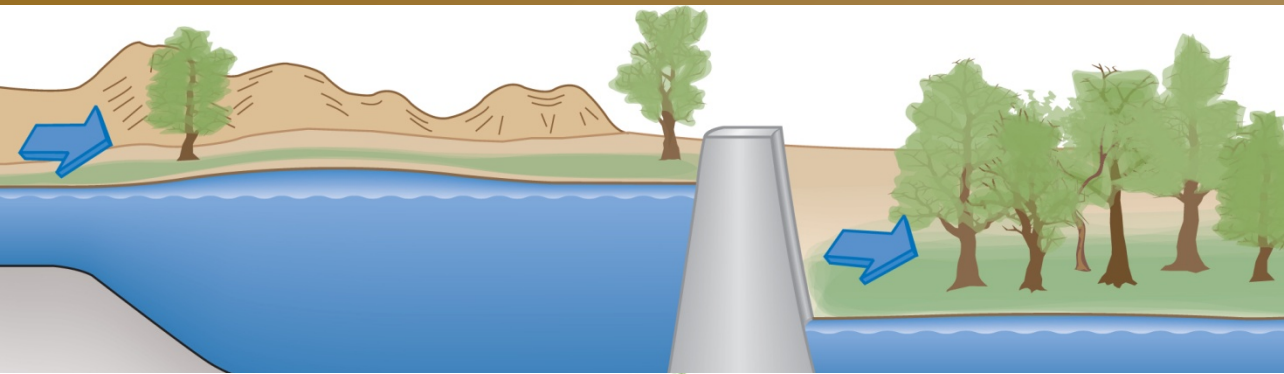
The Nature

# Groundwater Sustainability

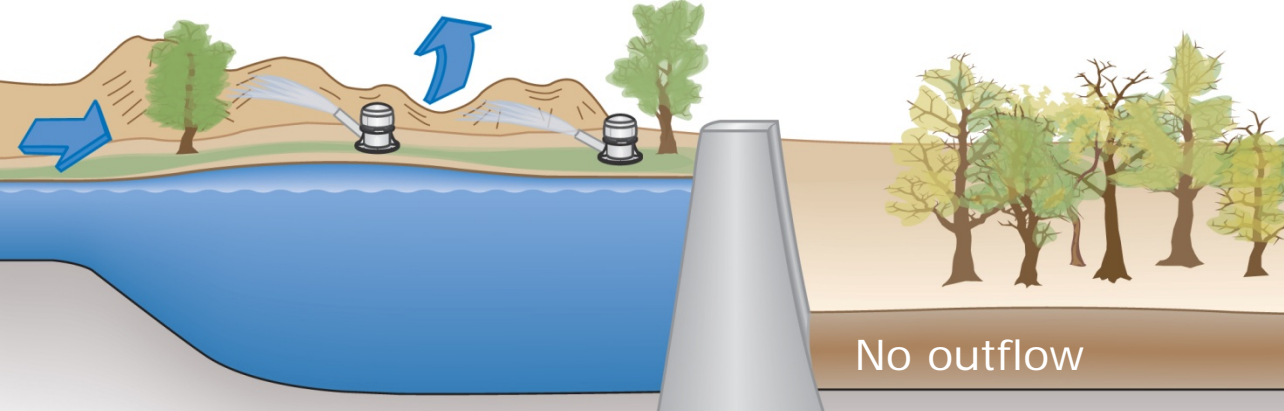
Development and use of groundwater in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences

*-U.S. Geological Survey, 1999*

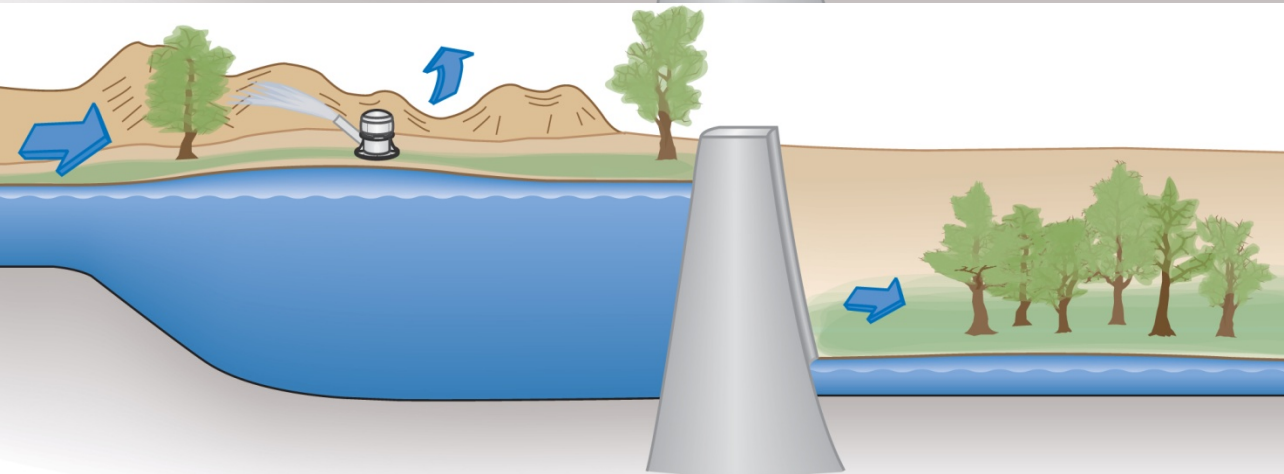
# Sustainable Yield of Groundwater



No Pumping



Pumping=Inflows



Sustainable yield assumes  
the consequences are  
acceptable

# In the Past Decade...

- Groundwater deficit was 12,000 AF/YR in 2002
- Reduced by more than 50% by 2011
- Yields from management measures approximately 9,000 AF/YR
- Started with the “no regrets” projects, low hanging fruit



**The Partnership provides incentive grants for water conservation projects to businesses and institutions across the watershed, including rainwater harvesting projects at schools**







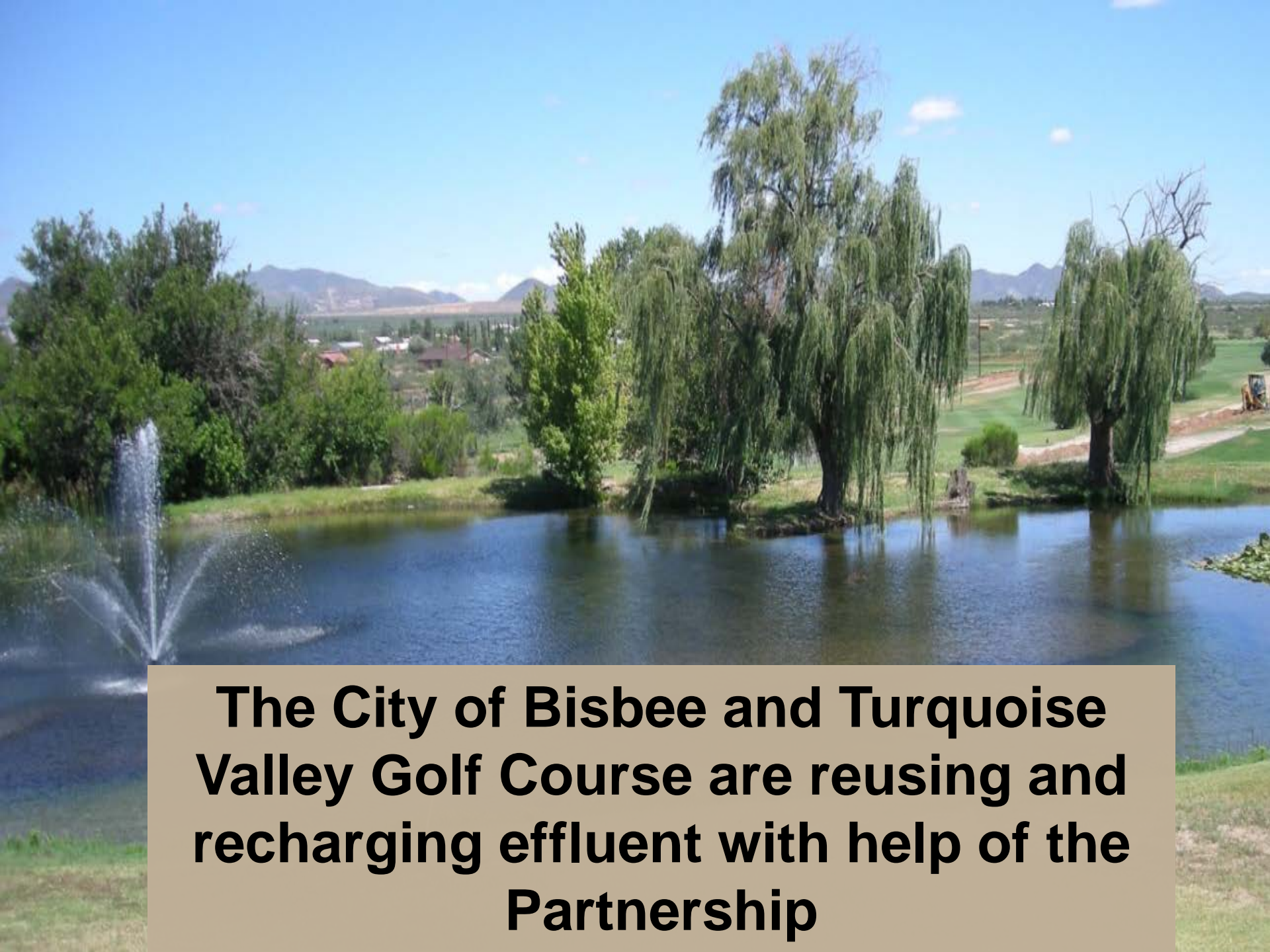
**The City of Sierra Vista recharges  
their treated effluent in these  
wetlands near the river**





**Fort Huachuca is installing dry wells to capture rainwater from rooftops**





**The City of Bisbee and Turquoise Valley Golf Course are reusing and recharging effluent with help of the Partnership**





**BLM has reintroduced beaver  
whose dams increase water  
depth in the river especially  
during dry times**

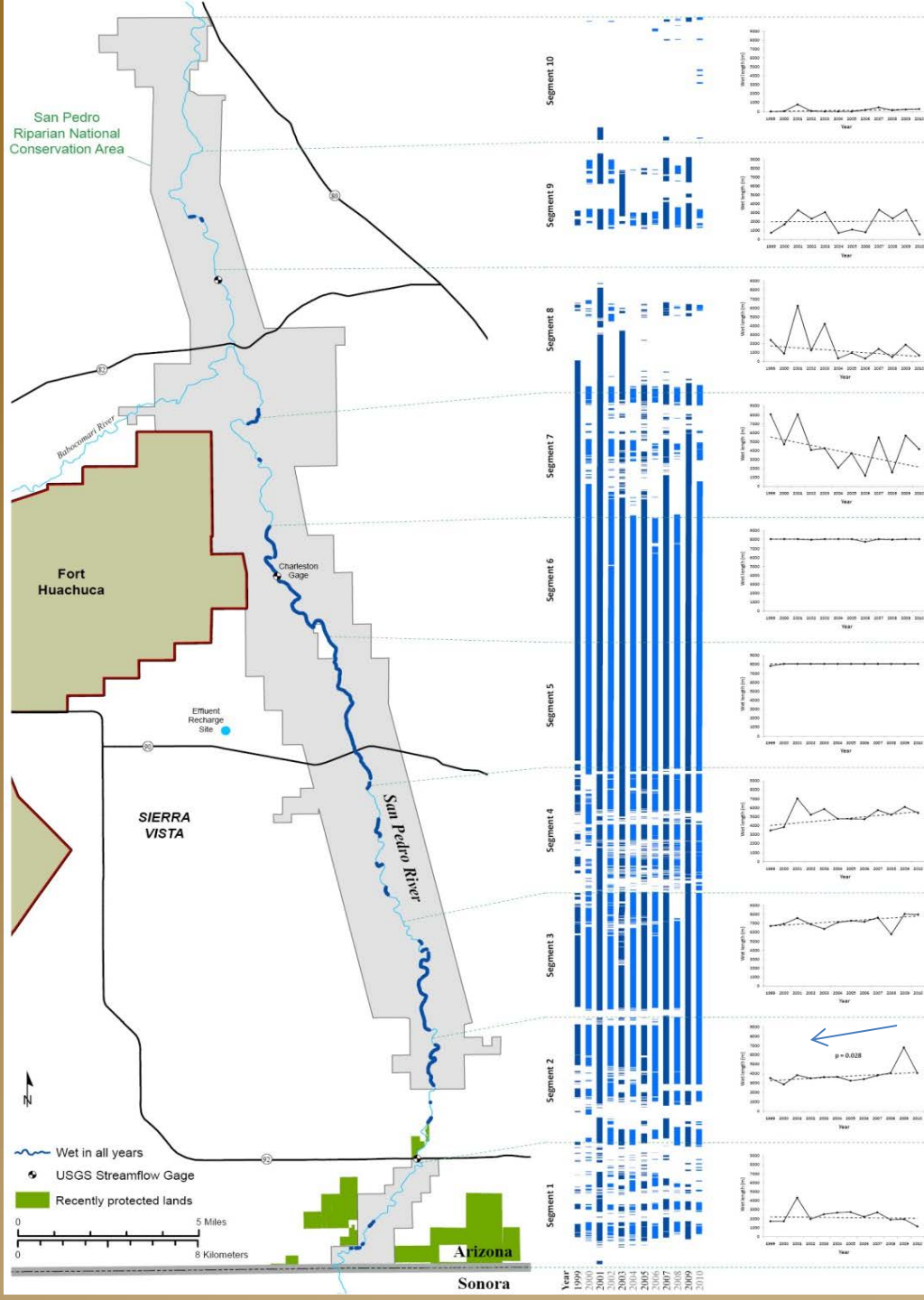


# Integrated Water Management:

## Optimize in-basin strategies

- Diversify and optimize in-basin strategies to extent possible
- Result is maximum resiliency and minimized costs over the long-term

# Wet/dry mapping 1999-2010



# Integrated Water Management:

## Utilize Spatial Water Management

- Where we pump and/or recharge can be as important to rivers as how much we pump in intermediate time scales (years to multiple decades)
- Use spatial water management to reduce risk in interim period until longer term strategies (100 + yr) are implemented

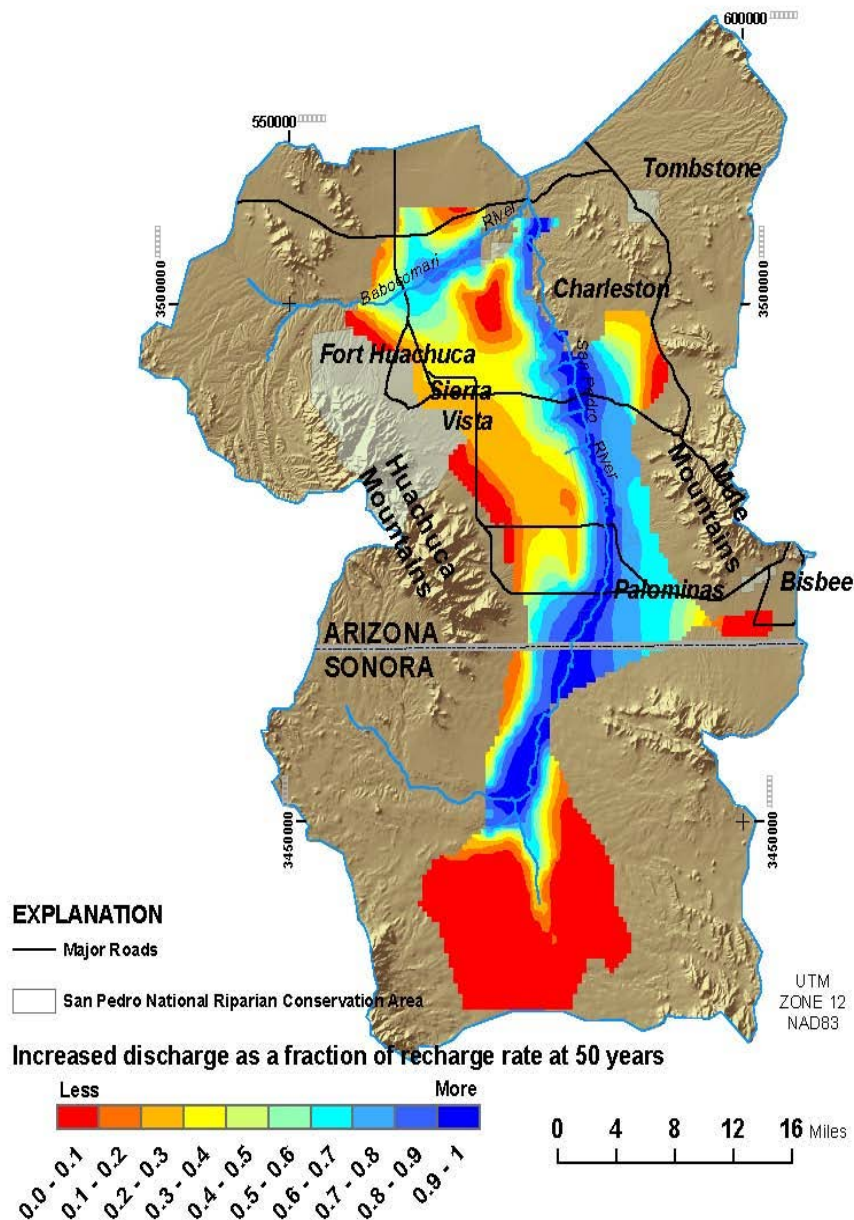


Figure 5b. Computed increase of streamflow, riparian evapotranspiration, and springflow that would result for recharge of water to the uppermost model layer at a constant rate for 50 years. The color at any location represents the fraction of the recharge rate at that location that can be accounted for as changes in outflow to model boundaries representing streams, riparian vegetation, and springs.



# Simulated aquifer recharge and benefits to river flows

model layer 2  
boundary

Hereford Rd.

2030 (0.33m)

2050 (0.33m)

King's  
Ranch

Palominas Hwy.

Mansker

Simulated  
Baseflow  
Change  
(cfs)

0.1 to 0.5  
0.5 to 1

2030

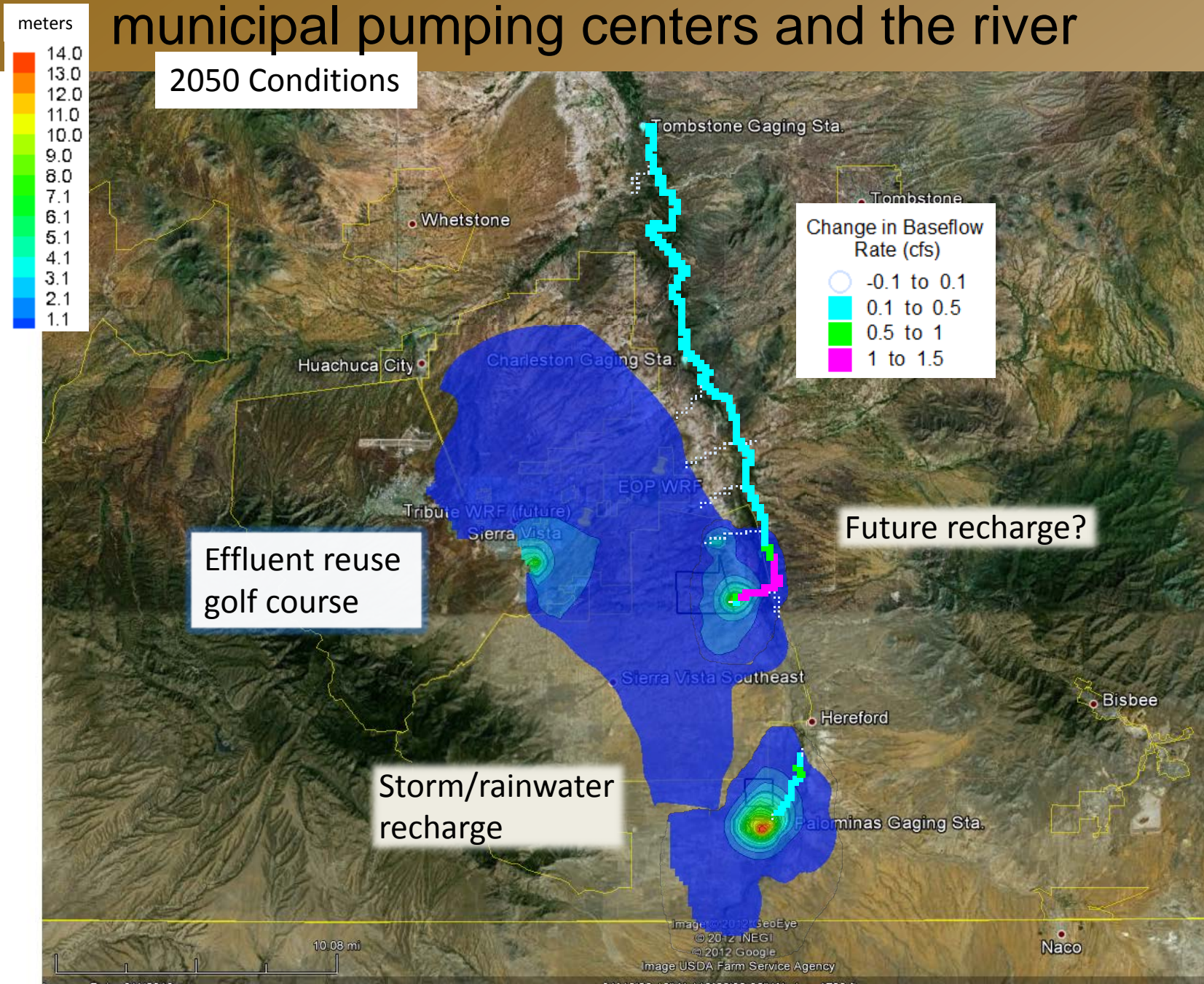
2050

Palominas  
Gaging Station





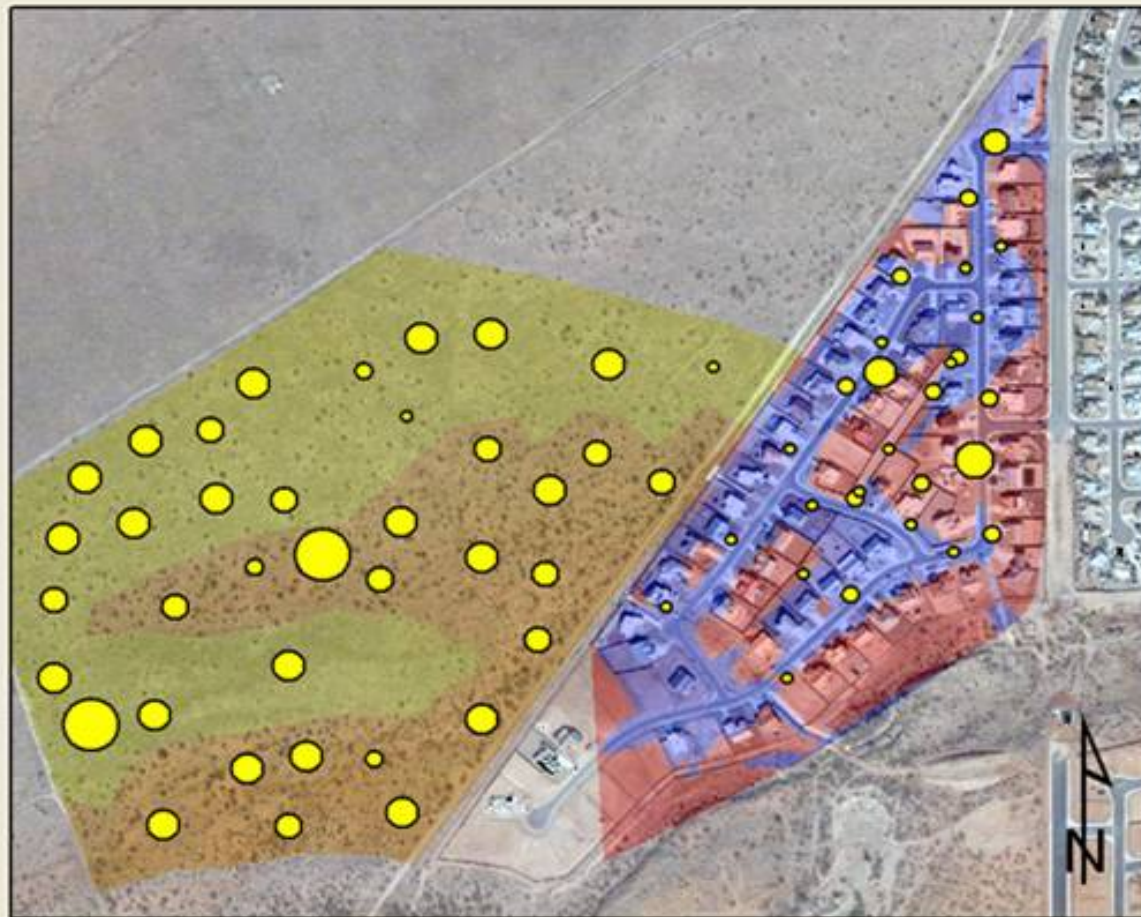
# Regional reuse and recharge to benefit both municipal pumping centers and the river





# Innovation for Stormwater /Rainwater Capture

Runoff has increased from 2 percent of rainfall to 37 percent of rainfall with urbanization at this subdivision.



**Sat. Hyd. Conductivity  
mm/hr**

- 1.4 - 2.8
- 2.9 - 4.3
- 4.4 - 5.7
- 5.8 - 7.2
- 7.3 - 8.6
- 8.7 - 10.1
- 10.2 - 11.6
- 11.7 - 13.0

# Integrated Water Management:

## Find black and white solutions (not gray)

- “Black AND white solutions” are only possible through use of strong technical tools and by building significant trust with other water users
- Can take significant time, commitment, expertise and funding



# Integrated Water Management: San Pedro River

- Develop and promote new water management policies and practices that offer flexibility to managers in meeting economic social and environmental outcomes
- Incorporate flows that support natural resources into time-sensitive and critically important water management decisions
- Accelerate public and private investment in natural infrastructure and water management that sustains healthy river flows

# Integrated Water Management:

## It's all a Matter of Time

- Initiate momentum: start with doable interim strategies that build knowledge, trust, understanding among partners
- Utilize spatial water management concepts for rapid responses, to reduce short-term risks
- Recognize additional needs for long term sustainability