

# **Benson Area Water Demand and Supply – Upper San Pedro AMA Review Report, 2005**



**Arizona Department of Water Resources  
August 26, 2008**



## Active Management Area (AMA) Reviews

- “The director shall periodically review all areas which are not included within an active management area to determine whether such areas meet any of the criteria for active management areas...” (A.R.S. § 45-412.C)
- AMA is a geographic area (groundwater basin) designated as requiring active management of groundwater.
- AMA Practices:
  - Grandfathered groundwater rights, conservation requirements for large water users, no agricultural land expansion, metering and reporting water pumped from large wells, Assured Water Supply Program, wells < 35 gpm are exempt
- *Upper San Pedro Basin has been reviewed twice; determinations in 2005 and 1988 not to designate*



## **2005 Designation Review included:**

- **Public outreach including newsletters, presentations and opportunity for review**
- **Analysis of hydrologic and hydrogeologic conditions and water quality information**
- **Analysis of agricultural, municipal and industrial water demand and trends\***
- **Development of a water budget\***
  - **Using best available data**

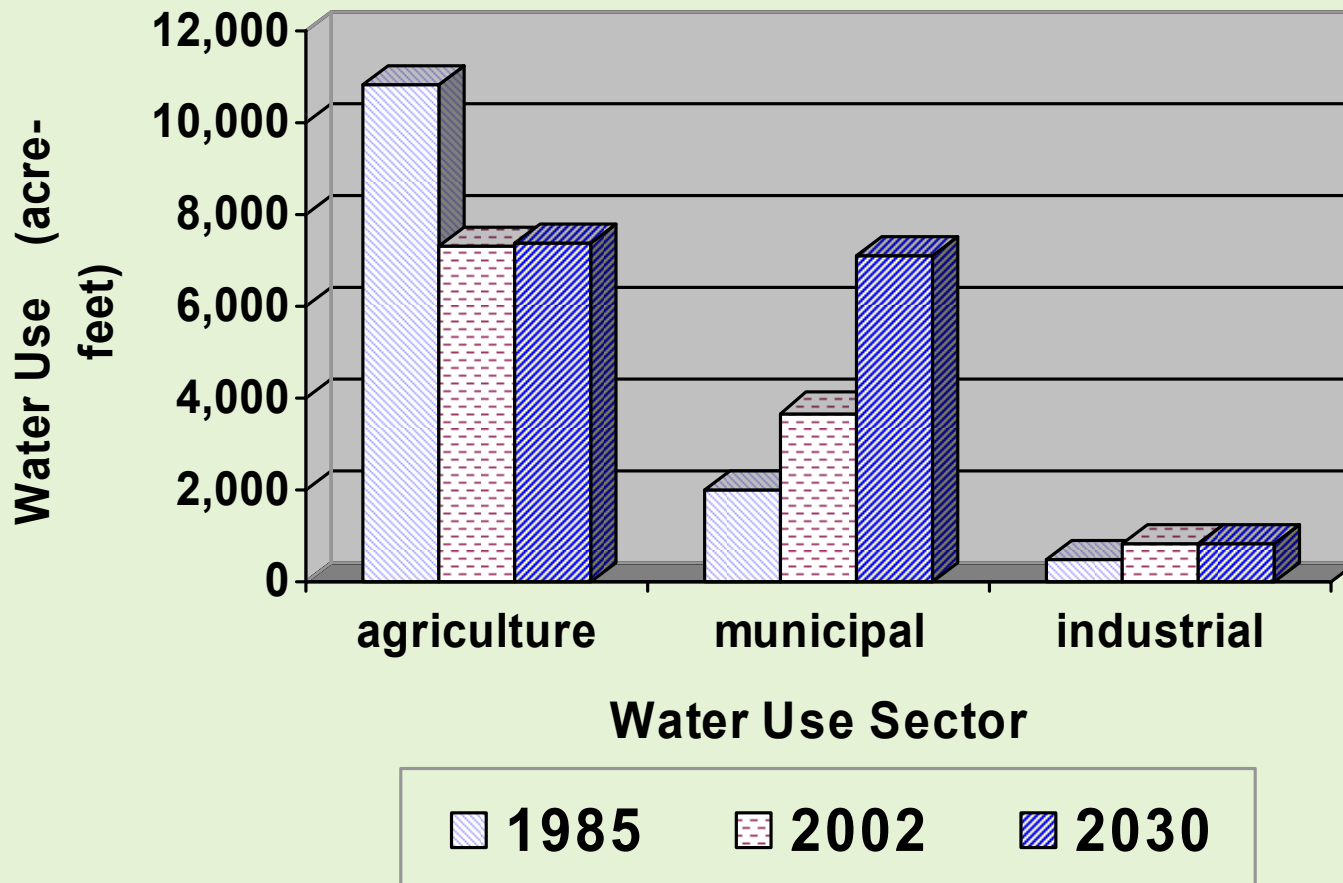
# Upper San Pedro Basin – Orientation



# **Total Demand and Supply (af) Benson sub-area**


	<b>1990</b>	<b>2002</b>	<b>2010</b>	<b>2030</b>
<b>Total Water Use</b>	<b>11,800</b>	<b>12,000</b>	<b>14,100</b>	<b>15,500</b>
<b>Total Surface Water</b>	<b>2,300</b>	<b>2,300</b>	<b>2,300</b>	<b>2,300</b>
<b>Total Effluent</b>	<b>0</b>	<b>380</b>	<b>700</b>	<b>1,200</b>
<b>Total Incidental Recharge</b>	<b>320</b>	<b>620</b>	<b>710</b>	<b>870</b>
<b>Total Groundwater (net use)</b>	<b>9,100</b>	<b>8,700</b>	<b>10,400</b>	<b>11,200</b>

# Benson Sub-area Water Demand by Sector



## Average Annual *Groundwater* Budget for the Benson sub-area (2002)

<b>Inflows to Groundwater System</b>	<b>Benson Sub-area</b>	<b>Remarks</b>
Mountain Front, Ephemeral Channel, Cross-boundary flux	10,600	Average of estimates: ADWR HSR (1991a) Jahnke (1994) Anderson and Freethy (1994)
Artificial Recharge	0	
Incidental Recharge	600	
Baseflow and Underflow into the Sub-area	440	Model underflow from Corell & others (1996)
	3,100	Baseflow data at USGS Tombstone and “The Narrows” gages
	3,050	Flood recharge est. from USGS gage data
<b>Total Inflow</b>	<b>17,790</b>	
<b>Outflows from the Groundwater System</b>		
Agricultural Demand	5,000	Excludes surface water
Municipal Demand	3,300	Excludes effluent
Industrial Demand	800	
Stock Demand	160	
Riparian Use	9,650	From ARIA (2004) and USFWS (2002); use rates from Scott and others (2004) and Dahm and others (2002)
Underflow from Sub-area	200	Underflow through “The Narrows” from flow net analysis
Baseflow Out	NA	From USGS gage records at Benson (“The Narrows”)
<b>Total GW Demand</b>	<b>19,110</b>	
<b>Change in Storage</b>	<b>-1,320</b>	



# Agricultural Demand Estimates Benson sub-area

- Actively irrigated lands > 2 acres in size
- Limited surface water diversion data (SDID)
- Acreage-based consumptive use (CU) demand estimate
  - No water use or irrigation efficiency data available
- 2002 Field Survey
  - Pomerene WUA, Saint David ID, non-district
  - 1,700 acres of non-deficit irrigation
  - 460 acres of deficit irrigation
- $(2,200 \text{ acres}) \times (\text{crop consumptive use}) = 7,300 \text{ af}$
- *2007 USGS preliminary survey found 1,000 irrigated acres-associated demand data not yet available*



# Agricultural Demand and Supply (af)

## Benson sub-area

	<b>1990</b>	<b>2002</b>	<b>2010</b>	<b>2030</b>
<b>Irrigated acres</b>	<b>2,600</b>	<b>2,200</b>	<b>2,200</b>	<b>2,200</b>
<b>Demand (CU)</b>	<b>8,800</b>	<b>7,300</b>	<b>7,400</b>	<b>7,400</b>
<b>Supply (CU)</b>	<b><i>8,800</i></b>	<b><i>7,300</i></b>	<b><i>7,400</i></b>	<b><i>7,400</i></b>
<b>Surface Water</b>	<b>2,300</b>	<b>2,300</b>	<b>2,300</b>	<b>2,300</b>
<b>Effluent</b>	<b>180</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Groundwater</b>	<b>6,300</b>	<b>5,000</b>	<b>5,100</b>	<b>5,100</b>

# Industrial Demand and Supply (af) Benson sub-area

Facility w/own well: Golf course, dairy, Apache Nitrogen

	<b>1990</b>	<b>2002</b>	<b>2010</b>	<b>2030</b>
<b>Demand</b>	<b>710</b>	<b>830</b>	<b>830</b>	<b>830</b>
<b>Supply: Groundwater</b>	<b>710</b>	<b>830</b>	<b>830</b>	<b>830</b>
<b>(Less) Incidental Recharge</b>	<b><i>(10)</i></b>	<b><i>(30)</i></b>	<b><i>(30)</i></b>	<b><i>(30)</i></b>
<b>Groundwater (net use)</b>	<b>700</b>	<b>800</b>	<b>800</b>	<b>800</b>




## Municipal Demand Estimates

### ■ Water Users

- Residential, commercial, and industrial facilities
- Public and private water systems
- Domestic wells; irrigated lands < 2 acres

### ■ Population

- Approved U.S. Census and State data used to generate sub-area population, domestic well estimates and for projections



# Municipal Demand Estimates

## Benson sub-area

- **Water Providers**
  - ACC records or direct request
  - Projections assume current per capita use rate (157 gpcd) that includes residential and non-residential demand
- **Domestic/Exempt Wells**
  - Population of sub-area not served by a provider
  - Objective to create an area-specific estimate
  - Estimated “typical” residential demand using reported water use from metered wells serving large lot, desert development in the Tucson AMA
    - 0.12 acre-feet/person/year (107 gpcd)
  - Included irrigated acreage < 2 acres in size derived from San Pedro HSR, and assumed deficit irrigation
    - 0.43 acre-feet/person/year

# Municipal Demand and Supply (af)

## Benson sub-area

	<b>1990</b>	<b>2002</b>	<b>2010</b>	<b>2030</b>
<b>Population</b>	<b>8,700</b>	<b>12,200</b>	<b>15,300</b>	<b>18,400</b>
<b>Demand</b>	<b>2,200</b>	<b>3,700</b>	<b>5,700</b>	<b>7,100</b>
<b>Water Provider</b>	<b>1,000</b>	<b>2,000</b>	<b>3,500</b>	<b>4,400</b>
<b>Domestic Well</b>	<b>1,200</b>	<b>1,800</b>	<b>2,300</b>	<b>2,700</b>
<b>Supply</b>	<b><i>2,200</i></b>	<b><i>3,700</i></b>	<b><i>5,700</i></b>	<b><i>7,100</i></b>
<b>Effluent</b>	<b>0</b>	<b>380</b>	<b>700</b>	<b>1,200</b>
<b>Groundwater</b>	<b>2,200</b>	<b>3,300</b>	<b>5,000</b>	<b>5,900</b>
<b>(Less) In. Recharge</b>	<b><i>(310)</i></b>	<b><i>(590)</i></b>	<b><i>(680)</i></b>	<b><i>(840)</i></b>
<b>Groundwater (net use)</b>	<b>1,900</b>	<b>2,700</b>	<b>4,300</b>	<b>5,100</b>




## **Domestic/exempt well estimate revisited**

- **Always uncertainty in unmeasured demand estimates**
- **Questions:**
  - **What are the components of reasonable domestic well estimates for the Benson sub-area?**
  - **How can demand be verified?**
  - **What is the relative impact of the domestic well estimate on the overall water budget?**
  - **What other components of the water budget need investigation?**

**Possible Domestic Demand Estimates (2002) for the  
Benson sub-area based on previous studies  
(assuming 877 domestic wells serving 3,227 residents)**


<b>Total af/year</b>	<b>af/person/year</b>	<b>Source</b>
<b>420</b>	<b>0.13</b>	<b>“Domestic Wells in New Mexico”; State Engineers Office, 2000</b>
<b>549</b>	<b>0.17</b>	<b>San Pedro HSR; ADWR, 1991- Suggested volume for filing domestic statement of claimant in watershed based on Phoenix AMA demand</b>
<b>877</b>	<b>(1 af/well)</b>	<b>Special Master’s <i>de Minimus</i> Report, Gila River Adjudication, 1994 (referencing Gregg Ten Eyck, 1994) – assumed 3 persons and 0.2 acres of irrigated land/well for entire basin</b>
<b>1,315</b>	<b>(1.5 af/well)</b>	<b>ADWR internal memo, 2002</b>
<b>1,032 - 1,452</b>	<b>0.32 - 0.45</b>	<b>U of A unpublished survey-Sonoita/Elgin area</b>
<b>1,800</b>	<b>0.55</b>	<b>Upper San Pedro AMA Review Report -assumed 3.68 persons and .5 acres of irrigated land/well for sub-area. Suggests wells serving more than one household</b>



## Riparian Demand Estimate Benson sub-area

- **Estimate derived from:**
  - **Riparian use data from Scott and others (preliminary report, 2004), and Dahm and others (2002) for salt cedar**
  - **USFWS (2002, National Wetlands Inventory) riparian classifications and extent**
  - **Aerial photo analysis (ARIA, 2004) used in conjunction with National Wetlands Inventory to estimate canopy cover**





## Riparian Groundwater Demand Estimate Benson sub-area

- 3,500 acre-feet of groundwater demand w/in portion of SPRNCA in Benson sub-area (Scott and others)
- 6,150 acre-feet of groundwater demand outside SPRNCA
  - Mostly mesquite; 3,096 acres, 3,967 af/yr (CU)
- *Previous estimates*
  - 8,100 acre-feet (Corell and others, 1996)
  - 7,100 acre-feet (Anderson and Freethy, 1994)



## Technical Recommendations (2005)

- Continue to measure groundwater levels
- Continue research on riparian water needs
- Studies needed to better quantify mountain front recharge, especially in the Benson sub-area
- More research focusing on hydrologic processes in the Benson sub-area
- Re-install gaging station at “The Narrows” to measure Basin outflows
- *All recommendations being implemented*



## **Primary ADWR information sources:**

- **Hydrographic Survey Report (HSR) for the San Pedro River Watershed, 1991**
- **Hydrologic Map Series Report #34, 2004**
- **Groundwater Resources of the Upper San Pedro Basin, Arizona. Technical Report to the Upper San Pedro Basin AMA Review Report, February 2005**
- **Upper San Pedro Basin Active Management Area Review Report, March 2005**
- **Arizona Water Atlas Volume 3 Southeastern Arizona Planning Area (Draft), November 2006**
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