ATTACHMENT 2

(Supplemental Documentation to the: Mogollon Rim Water Resource Management Study Report of Findings)

Mogollon Rim Water Resources Management Study-Demand Analysis, Bureau of Reclamation, Phoenix Area Office

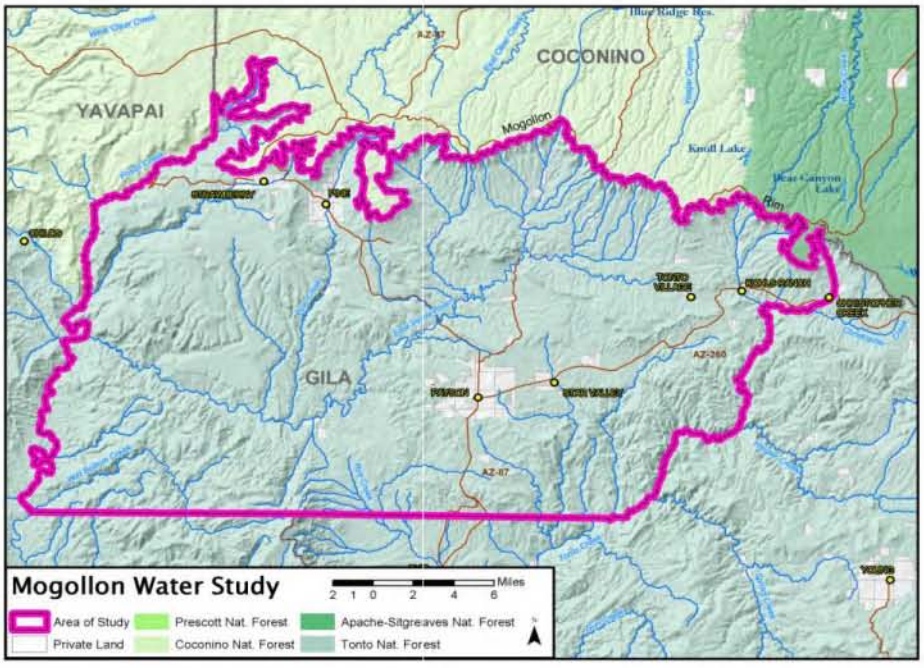
Mogollon Rim Water Resources Management Study Demand Analysis

I. Introduction

The Mogollon Rim Water Resources Management Study (MRWRMS) is an appraisal level assessment of the present water use and future water needs of the communities in northern Gila County, Arizona. The major emphasis of the study will be the development of water supply alternatives to meet the identified future demands. In order to evaluate needs, this Demand Analysis (Analysis) has been developed to identify stakeholders and present population and water use in the study area. The Analysis will use the present data and project it to the year 2040. The resultant information will be used as the basis for the development of water supply strategies and alternatives.

A. Background

The MRWRMS is located in northern Gila County. The study area is bordered on the west by the Gila County boundary and on the north by the county boundary and the Mogollon Rim. The eastern boundary is Christopher and Tonto Creeks and the southern boundary is at Latitude N34^{o} 09'.



The study partners are the town of Payson, Gila County, and the Bureau of Reclamation. Gila County represents the unincorporated communities within the study area. Other participating agencies include the Arizona Department of Water Resources, the U.S. Forest Service, the Salt River Project, the Tonto Apache Tribe, and Brooke Utilities, a private water company in the study area.

B. Water Supplies

Ground water. Currently, most of the water provided to users in the study area is ground water. Wells produce water from the underlying geology or aquifer, which is composed of fractured bedrock. The water storage capacity of this type of aquifer is dependent on fractures and weathered zones located within the bedrock.

Surface Water. Surface water in the study area is regulated under the doctrine of prior appropriation, and for many years, has been appropriated by senior water rights holders. Those water rights holders include shareholders of the Salt River Project, the city of Phoenix, the Salt River Pima-Maricopa Indian Community, and the Fort McDowell Indian Community, and others. Few entities within the study area have surface water rights and thus legal access to surface water supplies to meet the water demands on their lands.

Effluent. The Northern Gila County Sanitary District that serves parts of Payson and Mesa Del Caballo operates the only significant wastewater treatment plant in the study area. The effluent provided is used to irrigate golf courses and parks and to supply the town of Payson Green Valley Park Lake and recharge project.

Drought. The southwestern United States is considered to be in the midst of a prolonged and severe drought period. Eight of the past ten years have been unusually dry, and Arizona experienced its sixth consecutive dry winter in 2003-04. The area has experienced severe deficits in precipitation since 1989 and has observed consecutive declines in the local aquifer levels. The long-term forecast is for continued drought conditions. Although an issue, the Analysis does not take into account drought as a factor when determining future water demands.

C. Objectives and Methodology

The objective of this Analysis is to establish long-term water demands for the communities within the study area. The Analysis examines the time period 2002 to 2040, i.e. 38 years. It is expected that the study area will be fully built out by 2040.

The analysis will:

- Identify current population levels within each service area within the study area.
- Identify current water demand within each service area on a per capita basis.
- Forecast future populations for each service area within the study area over the time period 2002 - 2040.
- Project future water demands, on a per capita and “build-out” basis, over the time period 2002 – 2040 for each service area within the study area.

- Consolidate all service area water demands into a combined study area water demand forecast for the year 2040.

Determining Present Population - Present population is based on the 2000 census data obtained from Gila County, recorded by voting precinct.

Determining Present Water Demand, Seasonal Use, and Water Losses – Present water demand for the town of Payson is based on actual water use and was provided by the town's Water Department. Specific data for the major private regulated water providers: 1. Pine Water Company; 2. Strawberry Water Company; and 3. Payson Water Company (East Verde Park, Flowing Springs, Geronimo Estates, Mead Ranch, Mesa Del Caballo, Star Valley A & B, and Whispering Pines) is interpreted from the 2002 Arizona Corporation Commission Annual Reports. Data for all other water systems was collected through personal interviews with system operators.

Present values for gallons per capita per day (GPCD) are based on historical usages that vary significantly from service area to service area depending on horse population, rapid swings in temporary residency (summer camps, etc.), various levels of perceived or actual water availability, and differences in water conservation practices or conservation enforceability. Rapid changes in demand (weekend and/or seasonal use) is accounted for by consolidating those demand spikes into annual totals that are then divided by the total permanent population to determine per capita use. In the summary section of this report, all demand estimates (based on sales of water) are adjusted for an estimated water loss percentage to reflect estimated supply requirements.

Land Use – The total number of land parcels, both developed and undeveloped, are based on Gila County Assessor's tax rolls.

Methodology for Projected Population and Water Demands - Future water demands are calculated using estimated future populations assuming water use of 120 – 300 GPCD. The GPCD numbers are estimates that encompass all types of water use expected by each service area, e.g., residential, commercial, industrial, institutional, or government.

Future population projections are calculated using a build-out scenario. The land expected to be built out is the undeveloped subdivided and unsubdivided lands remaining within the study area. This method, known as the housing unit method, calculates the expected population associated with each parcel remaining to be fully developed. Land Exchanges between the U.S. Forest Service and the unincorporated communities that create more private land tracts are expected to net zero new developable acres. Any anticipated exchanges between the Forest Service and the Town of Payson are included in the Town's general plan and reflected in the future population estimates.

The housing unit method is based upon the following concept: A dwelling unit count is used to make population estimates. (In this study, parcels remaining to be built out will be substituted for a housing unit.) The future population is estimated by multiplying the expected number of

occupied households by the average number persons per household (assumed to be 2.4 unless noted).

In summary, the primary method for projecting water demand is a per capita value established for each water service area within the study area. The per capita model simply calculates the estimated consumption per capita at a specified point in time, multiplied times the estimated population at the same point in time.

D. Assumptions

- No estimates of private well water use were used to determine the 2002 demand, other than private wells that are used to directly supply the included systems (i.e. private wells that supply water direct to Pine Water Co. or Strawberry Water Co.)
- Estimates are for residential and commercial potable water only. No nonpotable irrigation water used for golf courses, pastures, orchards, etc. is included.
- No evaluations of the legality of water use or ownership of water are included. Virtually all water included is ground water; however, minor amounts of surface water is included.
- Water demands are based on estimated sales and do not reflect water pumped from supply sources. Appropriate amounts for water losses need to be added to estimated sales of water reported.
- Future population estimates assume a shift from part-time to full-time residency for communities within the study area.
- The number of estimated new parcels was from interviews with water operators, U.S. Forest Service personnel, real estate developers, and from land use studies and zoning maps, including the 2003 Comprehensive Master Plan and the 2002 Inventory and Analysis Reports prepared by Gila County.
- The estimates of gallons used per capita per day were based on current demand levels, sometimes adjusted for the fact that past water use restrictions were or were not in place, and from trends of full-time versus part-time residency.
- All un-metered water users within service areas are assumed to become metered water users by 2040.
- The volume of water taken from private wells that serve individual or commercial consumers (not sold or supplied to the utility) has not been completely estimated; however it has been accounted for when multiplying future population estimates times average water usage per capita for the service area.

E. Water Service Providers and Consumption

Table 1 lists the water source for each provider in the study area.

Table 1. List of Water Service Providers			
	System Owned And Operated Wells	Private Wells Not Tied To System	Surface Water Used (Acre-ft) And Source
Public – Municipal			
Town of Payson (includes the Tonto Apache Tribe)	37	300	-
Public - Domestic Water Improvement Districts			
Pine: Solitude Trails DWID	2	-	-
Pine: Strawberry Hollow DWID	2	-	-
Pine: Pine Water Association DWID	-	?	10.7 - A
Pine: Pine Creek Canyon DWID (Portals 4)	2	-	-
Rim Trail DWID	1	1	7.1 - B
Private – Unregulated Cooperatives/Homeowners Associations, etc.			
Arrowhead Ranch	-	5	-
Bear Flat	-	20	-
Bonita Creek	-	-	3.7 - D
Camp Geronimo Boy Scout Camp	-	-	6.4 - C
Collins Ranch	2	6	-
Cowan Ranch	1	2	-
Diamond Point Recreation	1	-	-
Diamond Point Shadows	-	260	-
Ellison Creek Estates	-	?	-
Ellison Creek Recreation	-	-	-
Freedom Acres	1	10	-
Hunter Creek	2	-	-
Kohl's Ranch	3	-	-
Oxbow Estates	-	?	-
Pine Meadows	5	-	-
R-C Boy Scout Camp	2	-	-
Round Valley	-	?	-
Shadow Rim Girl Scout Camp	2	-	-
Summit Springs	-	-	-
Thompson Draw I & II	2	-	-
Verde Glen	2	1	-
Washington Park	-	-	.3 - E
Wonder Valley	2	12	-
Zane Grey Meadows	-	5	-
Private – Regulated Utility Firms – Brooke Utilities			
East Verde Park - Payson Water Co.	3	11	-
Flowing Springs – Payson Water Co.	1	-	-
Geronimo Estates – Payson Water Co.	2	13	-

Table 1. List of Water Service Providers			
	System Owned And Operated Wells	Private Wells Not Tied To System	Surface Water Used (Acre-ft) And Source
Mead Ranch – Payson Water Co.	1	-	-
Mesa Del Caballo – Payson Water Co.	7	-	-
Pine Water Co.	21	105	-
Star Valley A&B - Payson Water Co.	2	?	-
Strawberry Water Co.	9	25	-
Whispering Pines – Payson Water Co.	2	10	-
Private – Regulated Utility Firms – Other			
Beaver Valley Water Co.	1	2	22.1 - B
Christopher Creek Haven Water Co.	4	?	-
Strawberry Water Co. (Lufkin Hunt Water Co.)	?	?	-
Tonto Creek Estates Water Co.	3	?	-
Tonto Village Water Co.	1	-	-

A – Pine Creek
B – East Verde River
C – Poison Spring and Herron Spring (on Tonto)
D – Bonita Creek
E – Mail Creek Spring

F. Present Water Demand and Population

The town of Payson's annual ground-water consumption in 2002 was 588,100,000 gallons or 1,805 acre-feet. The Town has established an estimate of aquifer Safe Yield (Safe Yield – Attain and thereafter maintain a long-term balance between the annual amount of ground water withdrawn, ground water discharged, and the annual amount of natural and artificial recharge) based upon recent hydrogeologic studies of the local aquifer underlying the incorporated boundaries of the town. Safe Yield for Payson is estimated to be 1,826 acre-feet/year. In 2002, the Town's ground-water usage was at 99 percent of Safe Yield. Table 2 presents Payson's 2002 ground water consumption in tabular form.

Table 2. Actual Ground-Water Consumption – Town of Payson – Gila County – 2002.		
Incorporated Area – Gila County	Million Gallons Per Year	Acre-Feet per Annum
Town of Payson	588.1	1,805

A safe yield value has not been determined for those communities that are unincorporated within the study area. Table 3 summarizes 2002 water use for the unincorporated communities within the study area.

Table 3. Estimated Potable Water Consumption – Unincorporated Areas – Gila County – Study Area, 2002.

Unincorporated Communities – Gila County	Million Gallons Per Year	Acre-Feet per Year
Pine (Pine Water Co., Solitude Trails DWID, Strawberry Hollow DWID, Pine Water Assoc. DWID, Pine Creek Canyon/Portal IV DWID)	60	183
Strawberry (Strawberry Water Co. and Lufkin Hunt)	37	115
Other Unincorporated Areas	163	494
Total	260	792

G. Future Water Demand and Population

Table 4 summarizes total estimated potable water consumption for all communities in the study area.

Table 4. Estimated Potable Water Consumption – All Areas Within Study Area – Gila County – 2002 to 2040, Acre-Feet per Annum.

Community	2002		2040	
	Population	Acre-Feet per Year	Population	Acre-Feet per Year
Town of Payson	14,500	1,805	44,637	6,000
Pine (Pine Water Co., Solitude Trails DWID, Strawberry Hollow DWID, Pine Water Assoc. DWID, Pine Creek Canyon/Portal IV DWID)	1,981	183	9,317	1,346
Strawberry (Strawberry Water Co. and Lufkin Hunt)	1,062	115	5,170	878
Other Unincorporated Areas of Study Area	3,798	494	14,061	2,428
Total	21,341	2,597	73,185	10,652

H. Summary

Based on 10 percent estimated losses for the town of Payson and 15 percent estimated losses for all other water service providers, the total acre-feet of water required to supply the study area at build out, as shown in Table 5, is estimated to be 11,949 acre-feet per year.

Table 5. Future Water Demand, 2040 Including Losses

Community	Estimated Losses (%)	Total Annual Water Demand (AF)
Payson	10	6,600
Pine (Pine Water Co., Solitude Trails DWID, Strawberry Hollow DWID, Pine Water Assoc. DWID, Pine Creek Canyon/Portal IV DWID)	15	1,548
Strawberry (Strawberry Water Co. and Lufkin Hunt)	15	1010
Other Unincorporated Areas of Study Area	15	2,792
Total		11,950

Table 6. Mogollon Rim Water Resources Management – Population and Water Demands – 2002 & 2040																	
			2002						2040								
											Low Demand			High Demand			
Map No.	Grp.	Location	Population	Developed Parcels	Total Parcel	Gallons per Capita per Day	Million Gallons per Year	Acre-Feet per Year	Population	Total Parcels (Developed)	Gallons per Capita per Day	Million Gallons per Year	Acre-Feet per Year	Gallons per Capita per Day	Million Gallons per Year	Acre-Feet per Year
		Public - Municipal														
39	1-1	Town of Payson (includes Tonto Apache Tribe)	14,500	7,254	9747	111	588	1805	44637	19594	120	1955	6000	120	1955	6000
		Public – Domestic Water Improvement District														
29	2-1	Pine: Solitude Trails DWID	22	34	78	149	1	4	187	78	120	8	25	150	10	31
31	2-2	Pine: Strawberry Hollow DWID	0	12	41	0	0	1	173	72	120	8	23	150	9	29
23	2-3	Pine: Pine Water Association DWID[1]	50	47	55	192	4	11	132	55	120	6	18	250	12	37
22	2-4	Pine: Pine Creek Canyon DWID (Portals4)	20	70	170	342	3	8	432	180	120	19	58	250	39	121
26	1-3	Rim Trail Estates DWID	44	108	149	218	4	11	358	149	120	16	48	218	28	87
		Private Unregulated Cooperatives/Homeowners Associations, etc.														
1	5-7	Arrowhead Canyon	10	5	8	100	0	1	19	8	120	1	3	140	1	3
2	3-1	Bear Flat	12	61	144	250	1	3	346	144	120	15	46	200	25	77
4	5-2	Bonita Creek [1]	30	30	84	110	1	4	202	84	120	9	27	150	11	34
5	5-6	Camp Geronimo Boy Scout Camp [3]	60	1	1	96	2	6	68	1	120	3	9	120	3	9
7	3-2	Collins Ranch	11	35	38	199	1	2	84	38	120	4	11	150	5	14
8	1-20	Cowan Ranch	5	19	21	164	0	1	50	21	120	2	7	164	3	9
9	5-3	Diamond Point Recreation	4	45	45	137	0	1	108	45	120	5	15	150	6	18
10	1-14	Diamond Point Shadows	140	181	197	250	13	39	473	197	120	21	64	250	43	132
12	5-4	Ellison Creek Estates	30	50	80	130	1	4	192	80	120	8	26	150	11	32
13	5-5	Ellison Creek Recreation	10	60	60	137	1	2	144	60	120	6	19	140	7	23
15	1-19	Freedom Acres	29	21	21	283	3	9	50	21	120	2	7	283	5	16
17	4-2	Hunter Creek	35	75	166	571	7	22	398	166	120	17	54	300	44	134
18	3-3	Kohl's Ranch [1]	270	134	192	70	7	21	461	192	120	20	62	120	20	62
21	1-16	Oxbow Estates [2]	240	70	75	120	11	32	250	75	120	11	34	150	14	42
25	4-3	R-C Boy Scout Camp [3]	20	1	1	96	1	2	23	1	120	1	3	120	1	3
27	1-15	Round Valley	300	178	202	230	25	77	581	242	120	25	78	230	49	150
28	1-17	Shadow Rim Ranch Girl Scout Camp [3]	12	1	1	96	0	1	14	1	120	1	2	120	1	2
34	1-10	Summit Springs	0	0	27	0	0	0	65	27	120	3	9	150	4	11
35	3-6	Thompson Draw I & II	5	85	85	657	1	4	204	85	120	9	27	200	15	46
40	1-5	Verde Glen	16	66	108	137	1	2	274	114	120	12	37	175	17	54
41	1-18	Washington Park	1	14	14	150	0 (0.1)	0 (0.3)	34	14	120	1	5	150	2	6
43	1-8	Wonder Valley	40	20	23	69	1	3	58	24	120	3	8	225	5	15
44	3-5	Wood Canyon Ranch	0	0	260	0	0	0	624	260	120	27	84	150	34	105
45	3-9	Zane Grey Meadows	4	5	20	180	0	1	48	20	120	2	6	180	3	10
		Sub-total	**15,920**				**677**	**2077**	**50689**			**2220**	**6815**		**2382**	**7312**

Table 6. Mogollon Rim Water Resources Management – Population and Water Demands – 2002 & 2040																
			2002						2040							
											Low Demand			High Demand		
		Private – Regulated Utility Firms														
11	1-11	Payson Water Co. East Verde Estates (Brooke Utilities)	180	164	246	79	5	16	590	246	120	26	79	130	28	86
14	1-12	Payson Water Co. Flowing Springs (Brooke Utilities)	40	42	73	137	2	6	192	80	120	8	26	150	11	32
16	5-1	Payson Water Co. Geronimo Estates (Brooke Utilities)	35	109	252	141	2	6	624	260	120	27	84	150	34	105
19	3-4	Payson Water Co. Mead Ranch (Brooke Utilities)	25	85	126	99	1	3	302	126	120	13	41	130	14	44
20	1-9	Payson Water Co. Mesa Del Caballo (Brooke Utilities)	640	409	455	92	22	66	1092	455	120	48	147	130	52	159
24	2-5	Pine Water Co. (Brooke Utilities)	1,889	2,111	2798	75	52	159	8393	3497	120	368	1128	120	368	1128
30	1-13	Payson Water Co. Star Valley A&B (Brooke Utilities)	700	461	708	84	22	66	2378	991	120	104	320	120	104	320
33	2-6	Strawberry Water Co. (Brooke Utilities)	1,002	1,199	1667	90	33	101	5002	2084	120	219	672	150	274	840
42	1-6	Payson Water Co. Whispering Pines (Brooke Utilities)	80	171	228	195	6	17	547	228	120	24	74	200	40	123
3	1-7	Beaver Valley Water Co. [1]	240	231	351	82	7	22	842	351	120	37	113	150	46	142
6	4-1	Christopher Creek Haven Water Co.	150	342	528	73	4	12	1363	568	120	60	183	120	60	183
32	2-7	Strawberry Water Co. (Hunt Water)	60	49	60	200	4	14	168	70	120	7	23	200	12	38
37	3-7	Tonto Creek Estates Water Co.	30	65	65	137	2	5	156	65	120	7	21	150	9	26
38	3-8	Tonto Village Water Co.	350	303	353	68	9	27	847	353	120	37	114	120	37	114
		Sub-total	**5,421**				**171**	**520**	**22496**			**985**	**3025**		**1089**	**3340**
		Total	**21,341**				**848**	**2597**	**73185**			**3205**	**9840**		**3471**	**10652**

[1] Uses a combination of surface and ground water.
[2] Oxbow Estates present population density exceeds the assumed future density of 2.4; therefore, the future population is based on an assumed density of 3.4 people per parcel.
[3] Population for seasonal camps represents a full time equivalent.