ATTACHMENT 6

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

Blue Ridge (C.C. Cragin) Reservoir Drinking Water Source Financial Feasibility Study, Tetra Tech Inc.

Blue Ridge (C.C. Cragin) Reservoir Drinking Water Source Financial Feasibility Study

Prepared for

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ABBREVIATIONS & ACRONYMS

AAC	Arizona Administrative Code
ACC	Arizona Corporation Commission
AC-FT	Acre-feet
ADC	Arizona Department of Commerce
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
ARS	Arizona Revised Statutes
ASCE	American Society of Civil Engineers
AWS	Assured Water Supply
AWWA	American Water Works Association
BGS	Below Ground Surface
CC&N	Certificate of Convenience and Necessity
CFS	Cubic feet per second
CWA	Clean Water Act
DIP	Ductile Iron Pipe
DU	Dwelling Unit
DWID	Domestic Water Improvement District
DWRF	Drinking Water Revolving Fund
FPS	Feet per second
FR	Forest Road
GADA	Greater Arizona Development Authority
GPD	Gallons per day
GPM	Gallons per minute
HOA	Home Owners Association
HP	Horsepower
Kgal	One thousand gallons
MAG	Maricopa Association of Governments
MRWRMS	Mogollon Rim Water Resources Management Study
PWS	Public Water Supply
PVC	Polyvinyl Chloride
RPM	Revolutions per minute
SDWA	Safe Drinking Water Act
SRP	Salt River Project
TDH	Total Dynamic Head
WIFA	Water Infrastructure Finance Authority
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

This Financial Feasibility Study of the Blue Ridge (C.C. Cragin) Reservoir Drinking Water Source (Study) has been developed for Gila County, Arizona, under the Water Infrastructure and Finance Authority (WIFA) of Arizona Technical Assistance (TA) program, Grant Number TA-DW001-2007. The Study identifies the need for, and quantifies the associated financial conditions associated with the use of the C. C. Cragin Reservoir ("Reservoir") to augment local water supply in an area of Northern Gila County, below the Mogollon Rim.

The C.C. Cragin Reservoir (formerly known as the Blue Ridge Reservoir) is located near Clint's Well, on the Mogollon Rim in Coconino County, about 25 miles north of Payson, Arizona. The reservoir has a storage capacity of 15,000 acre-feet, and is physically located within the Coconino National Forest. As a part of the Arizona Water Settlement Act, the Salt River Project (SRP) acquired the C.C. Cragin Reservoir and water transfer system from Phelps Dodge Corporation in February of 2005. Ownership of the reservoir has been transferred as of 2007 to the Bureau of Reclamation, with the SRP operating the reservoir under the provisions of the Salt River Federal Project. As a part of the acquisition agreement, a portion of the water is to be delivered to the Gila River Indian Community in accordance with the Comprehensive Gila River Settlement (Tetra Tech, 2007).

In addition, the agreement also set aside 3,500 acre-feet of water per year to be used to improve water supply in northern Gila County. Of this amount, 3,000 acre-feet has been designated for use by for the Town of Payson; the remaining 500 acre-feet are planned to serve other communities in northern Gila County. Surface water from the reservoir is currently conveyed from the pump station located near the reservoir through an existing pipeline to the headwaters of the East Verde River near Washington Park where the existing electrical generator is located. A new 16-inch diameter pipeline is proposed to transfer water from Washington Park to the Payson area.

The Town of Payson will construct, own, and operate the pipeline extension and will, in its sole and absolute discretion, make all decisions related to use of the pipeline extension to deliver any Gila County allocated water to rural communities adjacent to the pipeline, or near the Town of Payson. This Study does not consider any delivery fee or connection fee that may be charged by the Town of Payson to Gila County or to other Town approved users of the pipeline extension. These Town of Payson related charges will be an additional cost to the non-Payson users of the C.C. Cragin water. This Study does not include any Salt River Project costs of allocated water that will be charged to the Gila County C.C. Cragin water users that are located in the rural areas outside the Town of Payson.

There are over 15 identified rural communities that are located near the proposed pipeline, or near the Town of Payson that may be able to use the 500 acre-feet non-Payson reservoir allotment (Tetra Tech, 2007). Gila County, under an envisioned Northern Gila County Water Authority entity, has proposed a joint use agreement with the Town of Payson to transport ("wheel") the County's allocation of water to the various rural communities that commit to purchase water needed to serve their private lands. Therefore, if any rural communities commit to access the C.C. Cragin water via the Payson pipeline, the Town will need to engineer infrastructure capacity and ultimately approve any agreements for the joint use of the pipeline by any rural communities, water improvement districts, homeowner associations, regulated water utilities, etc.

This Study is focused on assessing the financial viability of possible pipeline water use by the affected rural communities in Northern Gila County. The report is intended to be a decision-making tool for Gila County, the Town of Payson, and the affected communities to assist with establishing water supply priorities relative to the C.C. Cragin (Blue Ridge) Pipeline Project. The Study identifies which of the rural communities can readily demonstrate a need for additional water supply from the pipeline, whether water service from the pipeline is appropriate for these communities, and if the communities can reasonably assume the capital and annual operations and maintenance (O&M) costs associated with this water supply. The study is based upon population projections, and other capacity data from the Mogollon Rim Water Resources Management Study (MRWRMS), and capital and O&M costs from the recent Blue Ridge Reservoir Water Supply Pipeline and Treatment Plant study commissioned by the Town of Payson and completed by Black & Veatch (Black & Veatch, 2006).

The financial evaluation of water supply alternatives are summarized herein, including the construction cost analyses for pipeline connections and water treatment facilities, relative water treatment O&M evaluation, and identified debt repayment scenarios. The Summary of Findings (Table A on the following page) indicates that, with very few exceptions, most of the communities studied herein could benefit from additional water supply from the pipeline, and again, with few exceptions, most of the projects appear to be financially viable.

Blue Ridge (C.C. Cragin) Reservoir Drinking Water Source Financial Feasibility Study
December 21, 2007

Table A. Summary of Financial Feasibility Study Results

Community	Existing Capacity (Ac-ft)	2002 Demand (Ac-Ft)	2040 Average Demand[4] (Ac-Ft)	Average Additional Demand[5] (Ac-Ft)	Existing Capacity/ 2040 Avg Demand Ratio	Connection Cost	WTP Cost	Total Capital Cost	Construction Cost/ 2002 Connections	Annual O&M	Annual Capital Payment[6]	Total Annual Payment	Cost $/1000 gallons
Washington Park	3.2	0.2	4.5	1.3	0.7	$305,300	$4,300	$309,600	$25,800	$410	$29,200	$29,600	$70.5
Rim Trail DWID	14.5	10.7	66.0	51	0.2	$96,700	$172,000	$268,700	$2,889	$16,700	$25,400	$42,100	$2.5
Verde Glen	11.6	2.8	32.5	22	0.4	$638,100	$73,700	$711,800	$14,829	$7,160	$67,200	$74,400	$10.3
Cowan Ranch[7]	12.1	0.9	8.0	0.0	1.5	$102,800	$0	$102,800	$5,411	$0	$9,700	$9,700	$0.0
Shadow Rim Ranch GS Camp[7]	8.1	1.2	2.0	0.0	4.0	$295,600	$0	$295,600	$36,950	$0	$27,900	$27,900	$0.0
Whispering Pines[1]	32.3	17.5	98.5	66	0.3	$209,500	$221,200	$430,700	$2,519	$21,500	$40,700	$62,200	$2.9
Beaver Valley	22.6	22.0	74.5	52	0.3	$185,000	$173,400	$358,400	$2,172	$16,800	$33,800	$50,600	$3.0
Freedom Acres[3]	9.2	9.2	11.5	3.4	0.8	$176,365	$11,400	$187,700	$14,438	$1,100	$17,700	$18,800	$17.1
Wonder Valley[7]	16.9	3.0	9.5	0.0	1.8	$81,050	$0	$81,050	$6,235	$0	$7,700	$7,700	$0.0
Sunflower Mesa[3]	2.0	2.0	5.0	3.0	0.4	$75,900	$9,983	$85,900	$10,738	$970	$8,100	$9,100	$9.1
Mesa del Caballo[1]	28.2	66.0	153.0	125	0.2	$56,900	$416,700	$473,600	$1,158	$40,500	$44,700	$85,200	$2.1
East Verde Estates[1,2]	16.1	15.9	82.5	66	0.2	$1,680,300	$138,400	$1,818,700	$11,090	$3,440	$171,700	$175,100	$8.1
Flowing Springs[2]	7.3	6.1	29.0	22	0.3	$972,600	$45,300	$1,017,900	$24,236	$1,130	$96,100	$97,200	$13.7
Star Valley[2]	153.8	153.8	490.9	337	0.3	$0	$621,550	$621,600	$1,348	$15,450	$58,700	$74,200	$0.8
Round Valley[1,2,3]	77.3	77.3	113.5	36	0.7	$1,761,200	$75,500	$1,836,700	$10,319	$1,880	$173,400	$175,300	$14.9
Oxbow Estates[1,2,3]	32.2	32.2	38.0	6	0.8	$877,550	$12,100	$889,700	$12,710	$300	$84,000	$84,300	$44.4
TOTALS:	**447.4**	**420.9**	**1,218.9**	**791.2**		**$7,514,900**	**$1,975,500**	**$9,490,500**			**$896,000**	**$1,023,400**	**$199**

Table Notes:

[1] *Community with undependable or drought-sensistive aquifer per ADEQ/MRWRMS*

[2] *Could be served by the Town of Payson Water Treatment Plant*

[3] *Existing Capacity derived from privately owned wells; combined capacity unknown; Current Water Demand shown as capacity*

[4] *2040 Average Demand = Average of future estimates of low and high water consumption in gpcd as presented in the MRWRMS*

[5] *Average Additional Demand (Design Value) = Difference between actual 2002 capacity and future average demand (averaged between "low" and "high" gpcd).*

[6] *Annual Capital Payment is the annual capital recovery cost of connection and treatment amortized over a 20 year period at an interest rate of 7%. The capital recovery equation was used, where:*

A = P[i(1+i)n/(1+i)n-1], where

A = annual capital payment

P = present value of water treatment and connection costs

i = is the inflation rate in %/100% (in this case, 7%)

n = lifetime of payment schedule (in this case, 20 years)

Cost per 1,000 gal = (Annual O&M + Annual Capital Payment)/1,000 gallons treated per year

[7] *Existing capacity meets/exceeds future demand; additional water from pipeline extension may not be warranted, connection and capital costs shown for information only.*

Denotes Community with capacity/demand ratio less than 1 - this community can demonstrate a need for additional water supply

Denotes Construction Cost/Connection less than $5000; and thus "scorable" with respect to WIFA Cost-effectiveness criteria

See Footnote #7

1.0 INTRODUCTION

This Financial Feasibility Study of the Blue Ridge (C.C. Cragin) Reservoir Drinking Water Source (Study) has been developed for Gila County, Arizona, under the Water Infrastructure and Finance Authority (WIFA) of Arizona Technical Assistance (TA) program, Grant Number TA-DW001-2007. The Study identifies the need for, and quantifies the associated financial conditions associated with the County's use of the C. C. Cragin Reservoir (the "reservoir") to augment local water supply in an area of Northern Gila County, below the Mogollon Rim in conjunction with the Town of Payson.

The C.C. Cragin Reservoir (formerly known as the Blue Ridge Reservoir) is located near Clint's Well, on the Mogollon Rim in Coconino County, about 25 miles north of Payson, Arizona. **Figure 1**, the Project Location Map, shows Payson, about 80 miles north of Phoenix. The Reservoir has a storage capacity of 15,000 acre-feet, and is physically located within the Coconino National Forest. As a part of the Arizona Water Settlement Act, the Salt River Project (SRP) acquired the C.C. Cragin Reservoir and water transfer system from Phelps Dodge Corporation in February of 2005. Ownership of the reservoir has been transferred to the Bureau of Reclamation, with the SRP operating the reservoir under the provisions of the Salt River Federal Project. As a part of the acquisition agreement, a portion of the water is to be delivered to the Gila River Indian Community in accordance with the Comprehensive Gila River Settlement (MRWMRS, 2007).

In addition, the agreement also set aside 3,500 acre-feet of water to be used to improve water supply in northern Gila County. Of this amount, 3,000 acre-feet has been designated for use by for the Town of Payson; the remaining 500 acre-feet are planned to serve other communities in northern Gila County. Surface water from the reservoir is currently conveyed from the pump station located near the reservoir through an existing pipeline to the headwaters of the East Verde River near Washington Park, a small private community surrounded by the Tonto National Forest. As shown in **Figure 2**, a new 16-inch diameter pipeline is proposed to be constructed, owned and operated by the Town of Payson to transfer about one-third of the annual water supply of C. C. Cragin Reservoir from the Washington Park generator to the Town of Payson. The other two-thirds of the water will flow down the East Verde River to its confluence with the Verde River.

It is important to note that the Town of Payson will construct, own, and operate the pipeline extension and will, in its sole and absolute discretion, make all decisions related to use of the pipeline extension to deliver any Gila County allocated water to rural communities adjacent to the pipeline, or near the Town of Payson. This Study does not consider any delivery fee or connection fee that may be charged by the Town of Payson to Gila County or to other Town approved users of the pipeline extension. These Town of Payson related charges will be an additional cost to the non-Payson users of the C.C. Cragin water. This Study does not include any Salt River Project costs of allocated water that will be charged to the C.C. Cragin water users that are located in the rural areas of Gila County that are outside of the Town of Payson.

There are over 15 identified rural communities that are located near the proposed pipeline, or near the Town of Payson that may be able to use the 500 acre-feet non-Payson reservoir allotment (Tetra Tech, 2007). Gila County, under an envisioned Northern Gila County Water Authority entity, has proposed a joint use agreement with the Town of Payson to transport ("wheel") the County's allocation of water to the various rural communities that commit to purchase water needed to serve their private lands. Therefore, if any rural communities commit to access the C.C. Cragin water via the Payson pipeline, the Town will need to engineer infrastructure capacity and ultimately approve any agreements for the joint use of the pipeline by any rural communities, water improvement districts, homeowner associations, regulated water utilities, etc. Several of these communities have experienced chronic water supply shortages related to drought, and other issues. Table 1 includes a summary of the affected communities and their water suppliers included in this study as identified by County personnel.

Table 1 - Community Water Systems along/near Pipeline

Community	Water Supplier	Community	Water Supplier
• Washington Park -	Home Owners Association	• Wonder Valley -	Home Owners Association
• Rim Trail -	Rim Trail DWID	• Mesa Del Caballo -	Brooke-Payson Water Co.
• Verde Glen -	Home Owners Association	• Flowing Springs -	Brooke-Payson Water Co.
• Cowan Ranch -	Home Owners Association	• East Verde Estates -	Brooke-Payson Water Co.
• Shadow Rim Ranch – Girl Scout Camp-	Cactus Pine Council of GSA (Private wells)	• Oxbow Estates -	Private wells
• Whispering Pines -	Brooke Utilities/Payson Water Co. Div.	• Round Valley -	Private wells
• Beaver Valley -	Beaver Valley Water Company	• Star Valley -	Private Wells & Brook-Payson Water Co.
• Freedom Acres -	Private wells		

This report is intended to be a decision-making tool to Gila County in establishing water supply priorities relative to the C.C. Cragin/Blue Ridge Pipeline Project. Therefore, the purposes of this Study are to determine:

- If the above identified rural communities adjacent to or near the proposed Town of Payson/ C.C. Cragin Reservoir pipeline need, and can effectively utilize a potential new source of water from the existing C.C. Cragin Reservoir;
- The costs of constructing the pipelines, possible pumping stations, and treatment plants necessary to provide water to these communities from this potential water source; and
- If the communities can reasonably assume the capital costs and annual operations and maintenance (O&M) costs associated with the use of this water supply.

This report summarizes the findings of the financial feasibility study, includes a discussion of the potential growth in the Mogollon Rim Water Resources Management Study (MRWRMS) area, and a summary of the rural community-specific needs for water supply from the proposed pipeline. The MRWRMS regional water supply study is conducted by the United States Bureau of Reclamation, the Town of Payson and Gila County. An infrastructure needs assessment for northern Gila County is discussed and specific water supply alternatives for rural communities are identified in the MRWRMS study. The financial evaluation of water supply alternatives for the 15 rural communities are summarized herein, including the construction cost analyses for pipeline connections and water treatment facilities, relative water treatment O&M evaluation, and identified debt repayment scenarios. Lastly, this report provides an assessment of whether the identified rural communities along the pipeline alignment can demonstrate a need for additional water supply from the pipeline, whether water service from the pipeline is appropriate for those communities with demonstrated need, and if these communities can reasonably assume the capital costs and annual O&M maintenance costs associated with the use of this water supply.

1.1 Previous Work by Others

This study makes use of, and augments other ongoing planning efforts by Town of Payson, the Bureau of Reclamation, the SRP, the Coconino and Tonto National Forests, Gila County, and other stakeholders, related to the C.C. Cragin (Blue Ridge) Pipeline Project.

1.1.1 Mogollon Rim Water Resources Management Study (MRWRMS)

As a part of the ongoing Mogollon Rim Water Resources Management Study (MRWRMS), a 2006 draft section entitled, "Mogollon Rim Water Supply Study: Future "Without' Available Alternatives", was provided as background data to support this Study (Murray and Jones, 2006). The MRWRMS provides data on existing and future populations, existing system water capacity, alternative water supplies and water service demand. The MRWRMS also describes the Mogollon Rim study area's potential future water supply situation, particularly if no alternative solutions are pursued and if no federal action is taken to address the area's water shortage issues (Murray and Jones 2006). The study area includes 48 communities, many of which have already experienced water supply shortages. Drought conditions have existed in the study area since the early 1990s. Only 3 to 4 of these communities have a right to use surface water as a primary water source. The other communities, including the Town of Payson, rely solely on groundwater for water supplies. This study proposes surface water delivery from the Blue Ridge Reservoir (now called C.C. Cragin Reservoir) or development of local groundwater supplies as the best options to meet future water supply needs, with surface water delivery from the Blue Ridge Reservoir as the primary option (Murray and Jones, 2006).

If no new water resources are identified for the Town of Payson and the surrounding communities, then in the future, severe growth and conservation limitations will be necessary. The MRWRMS recommends the construction of a pipeline extension from the existing Blue Ridge Reservoir Pipeline as the best option for Payson. Tapping into this pipeline extension, with the approval of the Town of Payson is a viable approach for additional supply for the other affected area communities (Murray and Jones, 2006).

1.1.2 Blue Ridge Reservoir Water Supply Pipeline and Treatment Plant (Pipeline Study)

Most of the cost-estimating methodology, and unit costs used for the financial analyses within this Study were obtained from the "*Town of Payson, Blue Ridge Reservoir Water Supply Pipeline and Treatment Plant*", (Pipeline Study) (Black & Veatch, 2006). The Pipeline Study report discusses proposed pipelines from the Blue Ridge Reservoir (now called C.C. Cragin Reservoir) to the Town of Payson and the community of Pine, as well as proposed treatment to address requirements for surface water treatment for both areas (Black & Veatch, 2006).

The Pipeline Study includes a discussion of a proposed 14.7-mile raw water pipeline extension from the Washington Park generator to Payson, as well as a micro-filtration-type treatment plant for this water source. A second proposed pipeline trunk off the main Payson line to serve the community of Pine, Arizona, is evaluated in the report, along with plans for a corresponding micro-filtration (membrane) type water treatment plant. The initial length of the raw water main will be sized to deliver a combined design flow of 4.5 million gallons per day (mgd) (considering 0.6 mgd for the Pine Extension and 3.9 mgd for the remaining length for Payson). The optimum pipe diameter for the Payson raw water main was determined to be 16-inches; ductile iron pipe (DIP) was determined to be the best choice for pipe material. However, if more than Payson's 3,000 acre feet per year are to be transported in the Payson pipeline to communities in or near Payson, then the pipeline size may be increased to eighteen inches in diameter. The proposed Pine Extension consists of an 8-inch DIP pipeline that is 15.2 miles long, with three intermediate booster pump stations (Black & Veatch, 2006).

The proposed Payson raw water pipeline runs in a south-southwesterly direction, beginning at the Washington Park generator and mainly following the Houston Mesa Road to the proposed water treatment plant within or near the Town of Payson. The Pipeline Study introduces two possible alignments for a portion of the pipeline: one follows an existing powerline easement; the other follows the FR 199 (Houston Mesa Road) alignment. Both alignments are currently being evaluated by the Town of

Payson, as part of the Environmental Assessment process under the National Environmental Protection Act (NEPA) (Walker, 2007). Both alignments are shown on the attached Plate 1.

The proposed Pine extension (previously determined to not be feasible due to excesive cost) begins at Station 183+00 of the Payson raw water pipeline alignment at the intersection of Forest Road (FR) 32 and FR 64 (Control Road). The proposed pipeline runs west along Forest Route (FR) 64 to the intersection of State Route 87, then northwesterly along State Route 87 to the proposed Pine treatment plant (Black & Veatch, 2006).

The proposed water treatment plants for the Town of Payson and community of Pine involve microfiltration treatment followed by disinfection. At both areas, an on-site finished water reservoir and pump station are proposed to be constructed for treated water storage and distribution (Black & Veatch, 2006). Using Year 2006 unit costs, the Pipeline Study includes estimates of probable capital and O&M costs for both the Pine and Payson pipeline and water treatment plants. Table 2 provides a summary of the total costs for the proposed Payson raw water pipeline and treatment plant.

Table 2 - Cost Summary
Proposed Payson Raw Water Main and Treatment Plant

Item	Cost
16-inch raw water main	$17,211,037
Water treatment plant	$6,253,750
Total capital cost	$23,464,787
Amortized Cost per Year (20 year period)	$2,214,910
Operation & maintenance ($/year)	$168,433
Total annual cost	**$2,383,343**
Cost per 1,000 gallons ($/kgal)	**$2.44**
Table Source: Black & Veatch, 2006	

Table 3 provides a summary of the total costs for the proposed Pine raw water pipeline and treatment plant.

Table 3 - Cost Summary
Proposed Pine Raw Water Main and Treatment Plant

Item	Cost
Raw water main	$15,185,000
Water treatment plant	$1,670,000
Total capital cost	**$16,855,000**
Amortized Cost per Year (20 year period)	$1,590,993
Operation & maintenance ($/year)	$162,262
Total annual cost	**$1,753,255**
Cost per 1,000 gallons ($/kgal)	**$10.76**
Table Source: Black & Veatch, 2006	

1.2 Design Criteria

All work has been developed to be consistent with the requirements for surface water sources as set forth in Arizona Administrative Code (AAC) Title 18, Chapter 4, Article 3 (R18-4-301), and design guidance for drinking water systems as outlined in ADEQ Bulletin 10. In addition, debt repayment scenarios are evaluated using methods that are consistent with the WIFA loan evaluation guidelines as set forth in AAC Title 18, Chapter 15, Article 3. Other applicable design criteria are listed in Appendix A.

2.0 BACKGROUND AND GENERAL SITE CONDITIONS

The Study Area including the Town of Payson is located in northern Gila County, approximately 25 miles south of the C.C. Cragin Reservoir, 93 miles northeast of Phoenix and 183 miles north of Tucson. Figure 2 provides a general project vicinity map. This area is described as having a high quality of life and has retirement, construction, and tourism as its main economic focus, as well as growth in service firms and manufacturing.

2.1 Topography

The area encompassed by the Salt and Verde River Basins (which includes Gila County) contains mid-elevation mountain ranges, valleys, and areas of higher elevation along the north-central boundary. Vegetation includes semi-desert grasslands, Sonoran desert scrub, chapparal, montane and woodland conifer forests (ADWR, 2007). Most of the study area is comprised of scrub-shrub juniper and conifer forest-type cover.

The most prominent topographic feature in the study area is the Mogollon Rim, a rock escarpment which is 200 miles long and 7,000 feet high (Arizona Department of Commerce, 2007). The Mogollon Rim escarpment, which is the boundary between the Plateau uplands province and the Central highlands province, is a steeply sloping cliff that rises 1,000 to 2,000 feet above Payson to altitudes of 5,500 to 7,500 feet (National Geodetic Vertical Datum of 1929) at the upper edge of the escarpment. The rim is cut by steepened canyons, and south of the rim is a landscape of buttes and mesas. Elevations in the study area range from about 4,500 feet in and near Payson, up to over 7,000 feet at the Mogollon Rim. Slopes are generally north-to-south from the Rim, and range from flat in valley sections to over 20 percent nearer the Rim (Owen-Joyce, 2000).

2.2 Climate

The Mogollon Rim influences the climate of the area. Moisture-laden airmasses, upon encountering these topographic features, rise, cool, and precipitate moisture. Annual precipitation ranges from 18 to 26 inches near the rim and in the Plateau uplands with the highest values occur along the rim. Annual snowfall is about 40 to 85 in along the edge and top of the Mogollon Rim, and 24.1 inches in Payson (WRCC, 2007 and Owen-Joyce, 2000). Precipitation is seasonal; during the winter, storms associated with frontal systems bringing moisture from the Pacific Ocean traverse the area from west to east. These storms spread rainfall of light to moderate intensity across large parts of the southwestern United States from late October through April. Precipitation often occurs as rain at the lower elevations near Payson and as snow at higher elevations along the Mogollon Rim, and on the plateau. Winter storms have been the cause of many of the major floods in this area, particularly when warm rain falls on snow. The highest runoff during a year commonly occurs in March and April as a result of snowmelt. High flows are less common in May and early June between the winter and summer storm seasons than during any other part of the year. The second precipitation season is during the summer when moist tropical air sweeps in from the south. Precipitation at this time of year often occurs as short-duration, locally intense thunderstorms that are common from late June through early October and often cause local flash flooding.

2.3 Geology and Soils

The Mogollon Rim presents the primary geologic feature of the area. A 3,000- to 4,000-foot sequence of early to late Paleozoic sedimentary rocks forms the generally south-facing scarp of the Mogollon Rim. The area adjacent to the edge of the Mogollon Rim is an "erosional landscape of rolling, step-like terrain exposing Proterozoic metamorphic and granitic rocks. Farther south, the Sierra Ancha and Mazatzal Mountain ranges, which are composed of various Proterozoic rocks, flank an alluvial basin filled with late Cenozoic sediments and volcanic flows" (Parker, et al, 2004).

Most of the soils found at higher elevations are derived from weathered granite and basaltic rocks. Granitic soils have sandy textures surface horizons with weak soil structure and loose consistency, making them susceptible to wind, and water erosion. Soils derived from basalt have a medium to fine-textured surface horizon, and clayey-subsoils. Soils on the hills and mountains of the Verde watershed can be generally classified as having a high runoff potential, with very low infiltration rates (Woodhouse et al, 2002 and Blasch, et al, 2005).

2.4 Surface Water Hydrology and Hydraulics

For water planning purposes, the Arizona Department of Water Resources (ADWR) has grouped this portion of Gila County into the Verde River Basin (**Figure 3**). Within the Verde River basin, there are 7 large reservoirs (500 acre-feet and greater) and 6 other reservoirs (50 acre-feet and greater) (**Figure 4**) (ADWR 2007). Eight streams with perennial to intermittent to ephemeral flow drain upland regions of the Mogollon Rim and flow into the Salt River on the southern boundary or the Verde River on the western boundary. These tributaries drain the region north and east of the Verde River and flow in a southwesterly direction toward the Verde River. Perennial flow in the Verde River and its major tributaries is maintained by ground-water discharge. Stream channels are largely controlled by geologic features, such as regional joint or fault systems. Flashy runoff in the mainly bedrock stream channels is typical (Parker, 2004). There are numerous streams and washes throughout the pipeline corridor. In the upper portions of the watershed, above an elevation of 5,000 feet, most of the streams are perennial; nearer to the Town of Payson, the streams reflect intermittent flow conditions.

Springs are distributed throughout the region, typically discharging at or above the contact of variably permeable formations along the face of the Mogollon Rim with a scattering of low-discharge springs (Parker, et al, 2004 and ADWR, 2007).

2.5 Hydrogeology

The project area is located within the Mogollon Highlands, an area of 4,855 square miles of rugged, mountainous terrain at the southern edge of the Colorado Plateau. This area is characterized by a "bedrock-dominated hydrologic system that results in an incompletely integrated regional ground-water system, flashy stream flow, and various local water-bearing zones that are sensitive to drought" (Parker et al, 2004). Ground-water flow is generally controlled by large-scale fracture systems or by karst features in carbonate rocks. Precipitation, which shows considerable variability in amount and intensity, recharges the ground-water system along the crest of the Mogollon Rim and to a lesser extent along the crests and flanks of the rim and the Mazatzal Mountains and Sierra Ancha (Parker et al, 2004). Local, generally shallow aquifers of variable productivity occur in plateau and mesa-capping basalts in the sedimentary rocks of the Schnebly Hill and Supai Formations, in fractured zones of the Proterozoic Payson granite, and in the alluvium of the lower Tonto Creek Basin. These water-bearing zones are sensitive to short-term climatic fluctuations, such as the current drought (Parker, et al, 2004).

Well yields near the Payson pipeline route and the Town of Payson range from less than 1-2 gpm to over 500 gpm, with most wells yielding less than 35 gpm (ADWR, 2007). **Figure 5** depicts groundwater resources in the Verde River Basin, and areas where there has been a recent reduction in well capacity. The ADWR 55 Well Inventory was used to obtain general information on area wells, including depths, static water levels, and pumping capacity (ADWR, 2007a). This information indicates several hundred groundwater wells throughout the basin, and that many of the homes and businesses within the study area rely on individual private wells for their water supply (ADWR, 2007). Water quality is generally high; however, in Payson, several wells exceed standards for arsenic, beryllium, cadmium, lead, selenium, and volatile organic compounds (ADWR, 2007).

2.6 Land Use and Population Estimate

Throughout the MRWRMS study area, about 97% of the land is federally managed National Forest and Wilderness areas or Tribal lands; only about 3% of the land is privately owned (MRWRMS, 2007). Land uses include limited commercial and industrial properties, generally in- or near the Town of Payson, along with minimal agricultural property, limited mining property, and significant recreational land (mainly weekend cabin property that is steadily transforming to full time homes). With the proximity to Phoenix, there has been increasing pressure for growth – primarily residential growth; however, property use and growth has been significantly limited because of major concerns with water availability, with local controls on land use and growth in the form of water staging use-restrictions and moratoriums on new meters and main extensions. In 2000, Gila County reported a population of 51,335. By 2006, the population had grown to over 56,800, a growth rate of only 10 per cent over a six year period. As a part of the MRWRMS, population and associated water demands were projected from 2002 through 2040, by water service provider groups. By 2040, all developed and developable land within the study area are expected to have been built-out and occupied by full-time residents (Murray and Jones 2006). Current (2002) and projected populations for the study area are provided in **Table 4.**

Table 4 - Present and Projected Population Summaries

Water Service Provider Groups	Present Population (2002)	Projected Future Build-Out Population (2040)	Incremental Increase in Population
Town of Payson*	14,500	44,637	30,137
Private regulated water utilities**	5,650	20,550	14,900
Domestic water improvement districts	192	1,253	1,061
Cooperatives/home owner associations/non-profits***	1,986	6,696	4,710
Total All Groups	**22,328**	**73,136**	**50,808**

Data Source: Murray and Jones, 2006
* Includes Tonto Apache Tribe.
** Includes the Brooke Utilities, Inc. Star Valley A&B portions of the Town of Star Valley.
*** Includes the Diamond Point Shadows portion and the non-Brooke Utilities portion of the new Town of Star Valley.

As shown in **Table 4**, the current (2002) population of the study area is approximately 22,000. By 2040, the study area population is expected to increase to approximately 73,000. About 61 percent of this population is within Payson. The major growth outside of Payson is anticipated to occur in areas served by regulated water utilities. To date, growth has been limited by strict water conservation restrictions, including a basic lack of potable water in many areas (Murray and Jones, 2006).

3.0 INFRASTRUCTURE NEEDS ASSESSMENT

An infrastructure needs assessment has been performed to evaluate the existing and future water demands with respect to the capacity and reliability of the existing water infrastructure to meet these demands. This assessment was based upon the population planning estimates from the MRWRMS, with average per capita water use rates from communities with known water use.

The infrastructure needs assessment included a review of known and projected annual demand, (converted to acre-feet), for the affected communities located adjacent to or near the proposed Town of Payson pipeline. The needs determination has been developed using a spreadsheet that can be used to compare the demand to the capacity of the existing supply, as a way of assessing the ability of the current water sources to meet the short- and long-term water needs for the area. Communities with existing or anticipated future water supply issues are identified, along with the additional water supply requirements.

3.1 Estimates of Water Demand

Estimates of existing and future water demand were obtained from the MRWRMS, as provided for use in this Study (Murray and Jones, 2006). These estimates are based upon current water use in gallons per capita, per day (gpcd), and projected future use under two different water scenarios. The MRWRMS includes an estimate of future water use under a "low" water use rate that reflects implementation of various water conservation practices, and a "high" rate that reflects a "worse case scenario".

In order to streamline the evaluation of infrastructure needs for this Study, the "high" and "low" future demands, as calculated in the MRWRMS, were averaged to reflect an average future water use rate within this range. These water demand values reflect the Average Daily Demand, as is typical for water supply planning. However, as ADEQ Bulletin 10 recommends using the Peak Daily Demand for the design of wells, pumps, and pipelines, a peaking factor of two was used to develop an estimate for the existing and future Peak Day Demand (ADEQ, 1978).

These calculations are provided in **Appendix B**. A summary of existing and future water demands for each community is provided in **Table 5**, on the following page.

Table 5 - Table of Existing and Future Water Demand

Community	Demand				Average Additional Demand (Design Value) (ac-ft)*
	2002		2040		
	No. of connections	2002 (ac-ft)	No. of connections	2040 Avg of High & Low Estimate (ac-ft)	
Washington Park	12	0.2	12	5	1.3
Rim Trail DWID	93	10.7	137	66	51
Verde Glen	48	2.8	89	33	22
Cowan Ranch	19	0.9	21	8	0
Shadow Rim Ranch GS Camp	8	1.2	8	2	0
Whispering Pines	171	17.5	228	99	66
Beaver Valley	165	22.0	205	75	52
Freedom Acres	13	9.2	21	12	3
Wonder Valley	13	3.0	15	10	0
Sunflower Mesa	8	2	10	5	3
Mesa del Caballo	409	66.0	455	153	125
East Verde Estates	164	15.9	246	83	66
Flowing Springs	42	6.1	80	29	22
Star Valley	461	153.8	1101	491	337
Round Valley	178	77.3	242	114	36
Oxbow Estates	70	32.2	75	38	6
TOTALS:	**1,874**	**420.9**	**2,945**	**1,219**	**791**
Data Source: MRWRMS, 2007; * Reflects difference between existing capacity and average future demand					

3.2 Current Water Capacity

The current capacity of the public water systems that serve the communities identified in this Study was obtained through a review of the information provide in the MRWRMS (Murray and Jones 2006), and from well information included in the ADWR 55 Wells database (ADWR, 2007) It should be noted that the data concerning well capacities within the ADWR well database are obtained from the original well driller's reports. While these data generally reflect production capacity at the time of well development; they may or may not reflect current well capacity, thus some estimates of production capacity have been made through interviews with system operators. **Table 6** provides a summary of the existing public water system capacity for each of the communities identified in this study. (NOTE: This section deals with current supply, not with demand, and does not include private well capacities. See Section 3.1 above for estimates of demand).

Table 6– Existing Public Water System Capacity

Community	Surface Water	Distribution System	# of Public System-Wells	Total System Output (gpm)	Gpd[4]	Capacity ac- ft/year[5]
Washington Park	No	Yes	Spring	4[1]	2,880	3.2
Rim Trail DWID	Yes	Yes	1	18	12,960	14.5
Verde Glen	No	Yes	1	14	10,080	11.6
Cowan Ranch	No	Yes	1	15	10,800	12.1
Shadow Rim Ranch GS Camp	No	Yes	2	10	7,200	8.1
Whispering Pines	No	Yes	2	40	28,800	32.3
Beaver Valley	Yes	Yes	1	28	20,160	22.6
Freedom Acres	No	Yes	1	14	10,080	9.2
Wonder Valley	No	Yes	2	21	15,120	16.9
Sunflower Mesa[2]	No	No	0	0	0	2.0
Mesa del Caballo	No	Yes	10	35	25,200	28.2
East Verde Estates	No	Yes	3	20	14,400	16.1
Flowing Springs	No	Yes	1	9	6,480	7.3
Star Valley[3,6]	No	Yes	5	155	111,600	153.8
Round Valley[2]	No	No	0	0	0	77.3
Oxbow Estates[2]	No	No	0	0	0	32.2

Data Sources: MRWRMS (Preliminary Draft), system operators, and ADWR 55 Wells Database; available online at http://www.sahra.arizona.edu

[1] Spring steady 24 hours per day. [2]Served by Private Wells; [3]Parts of Star Valley served by private wells.

[4] Gpd based upon supply provided over a 12-hour day. [5] If no public wells or distribution system exist, the Ac-ft capacity is based upon the MRWRMS estimated 2002 demand.

[6] Parts of Star Valley are served by both private wells and Brooke Utilities (excludes the Diamond Point Shadows area recently incorporated into the new Town of Star Valley)

3.3 Pipeline Supply Needs Evaluation

For planning and study purposes, a preliminary ranking of initial water infrastructure priorities can be developed using a simple ratio of available supply-to-demand (e.g. a ratio of more than one is ok; less than one indicates a community that may need additional water supply). In addition, the recent draft Water Atlas for the Verde River watershed has identified several communities that do not have an adequate water supply (ADWR, 2007). These communities are annotated within this table along with those that the MRWRMS have identified as having chronic water shortages.

Table 7, on the following page, provides a summary comparison of water supply and existing system capacity, based upon the average daily demand. **Appendix B** includes these calculations, as well as the evaluation of these systems with respect to the ability to meet Peak Daily Demand.

Table 7. Comparison of Water Demand Versus Supply.

	2002					2040	
Community	Existing Supply (Ac-ft)	Average Demand (Ac-ft/Yr)	Capacity/ Demand Ratio	Peak Demand (Ac-Ft)	Capacity/ Demand Ratio	Average Demand (Ac-ft)	Capacity/ Demand Ratio
Washington Park	3.2	0.2	16.1	0.4	8.1	4.5	0.7
Rim Trail DWID	14.5	10.7	1.4	21.4	0.7	66.0	0.2
Verde Glen	11.6	2.8	4.1	5.6	2.1	32.5	0.4
Cowan Ranch	12.1	0.9	13.4	1.8	6.7	8.0	1.5
Shadow Rim Ranch GS Camp	8.1	1.2	6.7	2.4	3.4	2.0	4.0
Whispering Pines	32.3	17.5	1.8	35.0	0.9	98.5	0.3
Beaver Valley	22.6	22.0	1.0	44.0	0.5	74.5	0.3
Freedom Acres	9.2	9.2	1.0	18.5	0.6	11.5	1.0
Wonder Valley	16.9	3.0	5.6	6.0	2.8	9.5	1.8
Sunflower Mesa	2.0	1.2	1.0	4	0.5	5.0	0.3
Mesa del Caballo	28.2	66.0	0.4	132.0	0.2	153.0	0.2
East Verde Estates*	16.1	15.9	1.0	31.8	0.5	82.5	0.2
Flowing Springs*	7.3	6.1	1.2	12.2	0.6	29.0	0.3
Star Valley*	153.8	153.8	1.0	307.6	0.6	490.9	0.4
Round Valley*	77.3	77.3	1.0	154.6	0.5	113.5	0.7
Oxbow Estates*	32.2	32.2	1.0	64.4	0.5	38.0	0.9
TOTALS:	**447.4**	**420.7**		**841.7**		**1,218.9**	

** Community systems that may be served by Town of Payson Water Treatment Plant ("WTP"). The additional total demand for the Payson WTP equals 467.2 Ac-ft, which is the difference between average demand in 2040 and the 2002 existing supply for these five communities. This anticipated additional demand from these five communities would require an 11% increase in the planned Payson pipeline capacity.*

As shown in Table 7, many of the communities within the study area have constrained water resources under existing conditions, and most will require additional water supply by the Year 2040.

3.4 Alternative Water Supply

For communities with identified water supply issues, the water supply alternatives as presented in the MRWRMS study have been reviewed to identify possible non-C.C. Cragin (Blue Ridge) water supply options. As discussed in the MRWRMS report, these potential alternative water supplies include surface water, rainwater harvesting, possible wastewater reuse, and de-salination.

Most of the communities within the study area rely on groundwater and many residences rely on private wells, rather than a community water system. Only three or four of the communities within this Study rely on surface water. Because surface water requires filtration to meet the requirements of the Safe Drinking Water Act (SDWA), it is more expensive to produce; thus many of these communities use surface water only to augment groundwater supplies.

Rainwater harvesting is used in some areas of the United States as a means of augmenting water supplies. This is often relied upon on a very localized home-by-home basis to augment the water supplies used for outside washing and irrigation purposes (e.g. non-potable), and to reduce the potential for stormwater quality issues downstream. Unfortunately, the volumes and frequencies of precipitation in the study area may not be sufficient to allow rainwater harvesting to be relied upon to augment water supply.

In most communities in the study area, wastewater is not collected for treatment or disposal. Because of the distances involved, converting the existing onsite wastewater facilities (septic tanks with drainfields) to the community systems that would allow wastewater capture for reuse would be prohibitively expensive. The Town of Payson, Mesa del Caballo, and the Tonto Apache Tribe are the only communities within the project study area where wastewater is presently collected for treatment. A portion of the effluent in Payson is currently being used for groundwater recharge in the Green Valley Park (Payson, 2007). However, effluent generated by the Town and Mesa del Caballo is owned by the Northern Gila County Sanitary District. Over the next 10 to 15 years, this effluent is not anticipated to be a useable alternative water supply for the Town because this water source is presently over-committed to other end re-uses, and because currently Payson generates less effluent than expected due to low water use by Town residents. In addition, the Tonto Apache Tribe has constructed a wastewater treatment plant and will no longer use the current Northern Gila County Sanitary District treatment facility (Murray and Jones, 2006).

In reviewing the total number of connections, and the community layout with respect to potential for economic collection of wastewater for treatment and effluent reclamation and reuse, Star Valley may have enough connections in close proximity, so that that evaluation of a centralized wastewater treatment facility with water reclamation may be merited, especially in light of the ability to avoid potential contamination of groundwater resources that are currently used for potable water. As communities develop from primarily rural land uses to the higher development densities found in towns and cities, the discharge from onsite wastewater treatment systems (septic tanks and drainfields) can increase to the point where the collective discharge from these systems to groundwater becomes problematic. Thus, consideration of community wastewater treatment may be warranted, to allow capture and potential reuse of the effluent, and as a water source protection measure.

Desalination is a very effective way of treating water sources with limited water quality to allow use as a drinking water supply. This technology is gaining acceptance and use in coastal areas, and in arid areas such as the Rio Grande valley, where there are water shortages and saline ground- and surface water supplies. While this technology is proven, and is gaining more widespread use in the United States, desalination plants can be expensive to implement, and are generally considered to be more cost-effective for larger capacity systems (20 to 50 MGD) with a viable (saline) water supply (Tetravision, 2007). The communities within this study would generally be considered to be small, with concerns related to limited water supply rather than the supply's water quality. Thus, this option is not really feasible for this area.

Because of the remote nature of the majority of these communities, these alternatives may not adequately meet the requirements as "long term, uninterruptible water supplies that may be relied upon for drinking water". **Table 8,** on the following page provides a matrix that summarizes the general availability of these options to each community.

Table 8 – Alternative Water Sources.

Community	Present Source	Groundwater	Surface Water	Wastewater Reuse	Desalination
Washington Park	Spring	✓	✓		
Rim Trail DWID	1 Well &Surface Water	✓	✓		
Verde Glen	2 Wells	✓			
Cowan Ranch	1 Well	✓			
Shadow Rim Ranch GS Camp	2 Wells	✓	✓		
Whispering Pines[1]	2 Wells	✓			
Beaver Valley[2]	1 Well & Surface Water	✓	✓		
Freedom Acres	1 Well	✓			
Wonder Valley	2 Wells	✓			
Sunflower Mesa	Private Wells	✓			
Mesa del Caballo,[1,2]	10 Wells	✓			
East Verde Estates[1]	3 Wells	✓			
Flowing Springs	1 Well	✓			
Star Valley	5 public wells; private wells	✓		✓	
Round Valley	Private wells	✓			
Oxbow Estates	Private Wells	✓			

Data Source: MRWSS, 2006;

Notes: [1] Identified by MRWSS as having chronic water shortages

[2] Included in Table 5.5-10, Arizona Water Atlas for Verde Watershed as having an "Inadequate" ADWR Adequacy Determination.

✓ Possible alternative water supply

4.0 PIPELINE CONNECTIONS

For communities where there are no other viable water supply options, an estimate of probable cost for the required pipeline connection has been developed.

The Town of Payson will construct, own, and operate the pipeline extension and will, in its sole and absolute discretion, make all decisions related to use of the pipeline extension to deliver any Gila County allocated water to rural communities adjacent to the pipeline, or near the Town of Payson. This Study does not consider any delivery fee or connection fee that may be charged by the Town of Payson to Gila County or to other Town approved users of the pipeline extension. These Town of Payson related charges will be an additional cost to the non-Payson users of the C.C. Cragin water. This Study does not include any Salt

River Project costs of allocated water that will be charged to the Gila County C.C. Cragin water users that are located in the rural areas outside the Town of Payson.

4.1 Methodology and Pipeline Connection Layout

The proposed pipeline connection locations have been identified through field reconnaissance of each community facility, and a review of the Pipeline Study and MRWRMS. The field reconnaissance effort included visits to each of the affected communities, obtaining Geospatial Positioning System (GPS) coordinates and elevation data, obtaining photographs, and general system assessment concerning current system condition. A copy of the field summary is included in **Appendix B**.

A preliminary "redline" schematic map that shows the pipeline connection locations was provided to Gila County, the Town of Payson, and other stakeholders for input, to verify that the proposed layouts accurately reflect local concepts, concerns and preferences concerning optimal pipeline connection location for each community. This schematic map that incorporates the Town and Gila County comments is included in this report as Plate 1. The pipeline extension alignments as shown in Plate 1 form the basis of the estimates of probable cost as developed for this project. The pipeline design assumes waterline connection sizes will be developed in accordance with water design guidance for Gila County, Town of Payson, and Arizona Department of Environmental Quality (ADEQ) Engineering Bulletin 10. However, the minimum diameter for waterlines longer than 500 feet is 6-inches; and thus this becomes the minimum waterline diameter used for these pipeline extensions. Pipeline extensions less than 500 feet in length were sized as necessary to meet projected build out demand. The estimate of probable costs will be developed for 6-inch and 8-inch diameter ductile iron pipe (DIP) to the Town of Payson 16-inch diameter DIP Pipeline. All piping is assumed to be provided in accordance with the requirements of the American National Standards Institute (ANSI)/ American Water Works Association (AWWA) Specification C150/A21.50, which includes a standard minimum pressure rating of 350 pounds per square inch (psi).

4.3 Cost Estimates

For communities where there are no other viable water supply options, an estimate of probable cost for the required pipeline connection has been developed. Because there are few communities where there are other viable water supply options, cost estimating has been provided for all of the communities, as a tool to support local decision-making. Estimates of probable cost have been developed for each of the pipeline connections as independent projects. For consistency with prior cost estimates developed for the Blue Ridge (now C.C. Cragin) Pipeline Study, the unit costs from the Pipeline Study have been used to develop the estimates of probable cost for each pipeline extension project. Consistent with this study, these estimates are based upon Year 2006 construction costs.

These pipeline extension project costs have then been allocated to the communities proposed to be receiving service by a ratio of community demand to total water volume proposed to be delivered through that pipeline service extension. Booster pump stations have been included in locations where there is negative slope, or insufficient pipeline velocity. The costs for these pump stations have been pro-rated from the cost estimates in the Pipeline Study on the basis of pump station capacity. These estimates include costs for pipeline and bedding, booster pump stations, rock excavation, pavement replacement, wash crossings and traffic control. A 25 per cent contingency is also included to cover other general construction items such as tapping sleeves and valves, any clearing and grubbing, mobilization and demobilization, Stormwater Pollution Prevention Plans (SWPPPs), permits, labor, equipment, miscellaneous contingencies and other appurtenances required for complete installation. **Table 9**, on the following page includes a summary of the proposed pipeline service extensions, the communities served, and the associated total lengths of 6-inch and 8-inch diameter pipeline associated with these community pipeline extensions.

Table 9 - Summary of Estimates of Preliminary Cost for Water Line Extensions

Extension	Start	Terminus	Communities Served	Length	Diameter	Wash Crossings	Pump Stations			Segment Cost
							Number	Capacity (gpm)	~TDH	
Rim Trail DWID	Pipeline	Rim Trail WTP	Rim Trail DWID, Washington Park, Verde Glen, Cowan Ranch, Shadow Rim Ranch Girl Scout Camp	250	6	1	0			$ 96,700
Washington Park	Rim Trail WTP	Washington Park	Washington Park	2,500	6	2	1	1.6	235 ft	$ 305,300
Verde Glen Extension	Rim Trail WTP	Verde Glen	Verde Glen, Cowan Ranch	7,800	6	1	0			$ 638,100
Cowan Ranch Extension	Verde Glen	Cowan Ranch	Cowan Ranch	500	6	1	1	0.0	30 ft	$ 102,800
Shadow Rim Ranch Extension	Verde Glen Extension	Shadow Rim GS	Shadow Rim Ranch GS Camp	2,400	6	2	0			$ 295,600
Beaver Valley	Pipeline	Beaver Valley	Beaver Valley	1,200	6	1	0			$ 185,000
Whispering Pines	Pipeline	Whispering Pines	Whispering Pines	400	6	1	0			$ 209,500
Wonder Valley Extension	Pipeline	Wonder Valley	Freedom Acres, Wonder Valley & Sunflower Mesa	50	6	1	0			$ -
Sunflower Extension	Wonder Valley	Sunflower Mesa	Sunflower Mesa & Freedom Acres	200	6	1	0			$ 75,900
Freedom Acres Extension	Sunflower Mesa	Freedom Acres	Freedom Acres	800	6	1	0			$ 176,400
Mesa del Caballo	Pipeline	Mesa del Caballo	Mesa del Caballo	200	6	0	0			$ 56,900
E. Verde Main Pipeline Extension	Payson WTP	Split to E. Verde & Flowing Springs	East Verde Estates & Flowing Springs	14,800	8	3	0			$ 1,623,900
East Verde Estates Pipeline	E. Verde Main Pipeline	E. Verde Estates	E. Verde Estates	4,500	6	2	0			$ 457,100
Flowing Springs Pipeline	E. Verde Main Pipeline	Flowing Springs	Flowing Springs	5,000	6	1	1	27.0	80	$ 571,900
Star Valley	Payson 260 Pipeline Te	Star Valley System	Star Valley	0	8	2	1	369.5	100	$ -
Round Valley Main Pipeline Extension	Payson 260 Pipeline Te	Round Valley	Round Valley & Oxbow Estates	9,800	8	1	1	52.1	50	$ 1,292,000
Round Valley Pipeline	RV Main Pipeline @ 2	Round Valley	Round Valley	4,500	8	1	1	44.9	50	$ 647,600
Oxbow Estates Pipeline	RV Main Pipeline @ 2	Oxbow Estates	Oxbow Estates	6,650	6	2	1	7.2	50	$ 699,200
			Total Pipeline:	61,550	116	24	7			**$ 7,433,900**
			Total, 6-inch diameter waterline:	32,450						
			Total, 8-inch diameter waterline:	29,100						

5.0 WATER TREATMENT

The Federal Safe Drinking Water Act (SDWA) requires surface water treatment by filtration prior to its use as a drinking water supply. In accordance with the SDWA and AAC Section R18-4-301, water treatment plants ("WTP") are included to provide filtration, and chlorination, and necessary storage of the "finished water" prior to use by each community. This section describes the methodology used, system locations and cost estimates associated with the water treatment facilities necessary to use the C.C. Cragin Reservoir water source.

5.1 Methodology and Layout

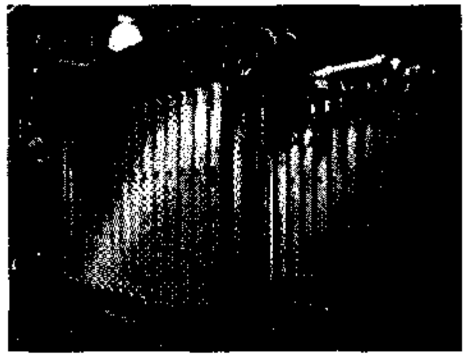
During the field reconnaissance and subsequent pipeline extension layout and map review process, a general layout was developed so that it would be possible to serve several communities within close proximity to each other by a single WTP. This allows some potential cost savings through economies of scale, particularly with respect to reducing O&M and in serving a greater number of connections to share in the annual expenses. In addition, the communities of Star Valley, Round Valley, Oxbow Estates, East Verde Estates, and Flowing Springs are located downstream of the Town of Payson Pipeline terminus and WTP. So the additional water supply necessary to serve these communities would likely be obtained through the Town of Payson WTP and water system (or through County owned or community owned water main extensions), rather than directly from the proposed Payson Pipeline extension.

The proposed location for each WTP was located centrally within the proposed treatment area, and as close to the Pipeline as practicable in order to reduce pipeline extension costs. In addition, the GPS elevation data were also used to locate each facility to reduce the overall number of required pump stations. As shown on Plate 1, a total of five WTPs (in addition to the Payson WTP) are proposed to serve the 15 communities of this study. These are generally located:

- Rim Trail DWID
- Beaver Valley
- Whispering Pines
- Wonder Valley
- Mesa del Caballo

In order to be consistent with the WTPs proposed in the Pipeline Study, it is assumed that the WTPs would also be a similar microfiltration technology as manufactured by Pall Corporation, or equal. This would allow for consistent parts, O&M requirements, and possibly shared operators between these systems. Similar to the microfiltration plants proposed in the Pipeline Study proposed for Pine and Payson, the WTPs for this study will consist of microfiltration followed by disinfection (chlorination). An onsite finished water reservoir and pump station would also be included for storage and distribution of treated water, where required.

Microfiltration membranes provide an effective barrier to particles, bacteria, cryptosporidium and giardia within a small footprint. The membranes are provided in cartridges that are housed in a pressure vessel. Feed water is delivered to the membranes at about 35 pounds per square inch (psi) pressure. The permeate is drawn from the outside into the membrane, and out, leaving the solids to accumulate within the pressure vessel. These solids are removed through periodic backwashing, air scrubbing and chemical cleaning. Some, or all, of the WTPs will require a method to dispose of the backwash materials removed from the raw water that flows in the Payson pipeline extension.



It is assumed that raw water will be delivered to each WTP when the Town of Payson Pipeline is in use, about nine months of each year. Finished water will be delivered to the storage tank, and then into the distribution systems. Each system will also include a pre-strainer to filter out larger particles, and disinfection. General specifications for the treatment equipment are:

- Pre-filter strainers: at least one per WTP site; mesh opening at 500 microns
- MF Membranes: Pall Corporation, or approved equal: Microza hollow fiber; flux rate of 55 gfd; module area of 50 meters square Outside Diameter/ 27 square meters Inside Diameter
- Membrane Rating: 0.1 micron;
- Disinfection: On-site chlorine generators or hypochlorinators will be used for disinfection.

The number of microfiltration process modules to be provided for each WTP is a function of the overall capacity required for that particular unit.

5.2 Cost Estimates

Estimates of probable cost have been developed as independent projects for each of the surface water treatment facilities necessary to meet the requirements of the SDWA, and AAC Section R18-4-301. For consistency with prior cost estimates developed for the Town of Payson Blue Ridge (now C.C. Cragin) Pipeline Study, the unit costs from the Pipeline Study have been used to develop the estimates of probable cost for each WTP project. These costs have been developed to include general requirements, site work, the microfiltration building and equipment, disinfection, a finished water reservoir (ground storage tank), disinfection, mechanical, electrical, plumbing and controls (Black and Veatch, 2006). A 25 per cent contingency is also included. Consistent with the Pipeline Study, the costs are based upon Year 2006 construction costs.

The costs for these WTP projects have then been allocated to each of the 15 communities receiving service by a ratio of community demand to total water volume treated by the water treatment plant connected to that community. The nominal cost of water treatment facilities for most of the communities has been developed as a ratio of the required average flow rate to the actual flow rates and costs associated with the Pine micro-filtration water treatment plant (WTP) rather than the Payson WTP since the proposed Pine WTP capacity is closer to the anticipated capacity of the new community WTPs considered herein. The total adjusted cost was then divided by the current plant capacity in acre-feet per year and gallons per minute (gpm) to obtain a multiplier as a function of cost per capacity unit (Acre-feet and gpm). A simple spreadsheet was then used to multiply the required pipeline delivery rate (and surface water treatment capacity) for each affected community by the adjusted unit cost for treatment. Those communities that can be served by the Town of Payson WTP (Star Valley, Round Valley, Oxbow Estates, East Verde Estates, and Flowing Springs) may ultimately incur a different formula for allocation of treatment and O&M costs.

For the other communities, because the Pine unit costs are a little higher, they reflect the decreased economies of scale associated with a smaller plant, and thus provide a level of conservativeness to these estimates. This provides a realistic relative water treatment infrastructure cost for each community. Consistent with the Pipeline Study, capital costs were amortized over a 20-year period at a seven percent interest rate in order to obtain an annual payment requirement. Costs per 1000 gallons treated, and costs per connection were also estimated to allow a basis of comparison. Detailed cost estimates are included in **Appendix C**. **Table 10** provides a summary of the WTPs proposed for the communities on or near the Pipeline.

Table 10. Summary of Proposed Water Treatment Plants

Plant #	WTP Location	Communities Served	WTP Capacity (kgal/year)	WTP Capacity (gpd)	Capital Costs
1	Rim Trail WTP	Rim Trail DWID, Washington Park, Verde Glen, Cowan Ranch, Shadow Rim Ranch Girl Scout Camp	24,400	66,800	$ 250,100
2	Whispering Pines WTP	Whispering Pines	21,600	59,100	$ 221,400
3	Beaver Valley WTP	Beaver Valley	16,900	46,300	$ 173,230
4	Freedom Acres WTP	Freedom Acres, Sunflower Mesa and Wonder Valley	2,100	5,700	$ 21,530
5	Mesa del Caballo WTP	Mesa del Caballo	40,700	111,400	$ 417,180
Payson	Payson WTP**	Town of Payson, Tonto Apache Tribe*	1,059,000	3,900,000	$ 6,253,750
		Star Valley, Oxbow Estates, Round Valley, East Verde Estates and Flowing Springs	152,237	417,089	$ 974,320
		Total, Proposed Payson Plant	1,211,237	4,317,089	$ 7,228,070

See **Appendix C** for Detailed Cost Estimates
* Currently served by Town of Payson
**Original Payson WTP capacity per Black & Veatch Report is 3.9 mgd
Estimated increase in capacity is 11%

A similar approach has been used to develop the estimate of prototypical O&M costs for the water treatment facilities. O&M estimates from the Pipeline Study for the Payson and Pine WTPs were used to estimate the required annual O&M budget. The O&M costs within the Pipeline Study include power, chemicals, membrane replacement, waste disposal and a full-time operator (Black & Veatch, 2006). The costs were adjusted to provide a multiplier for acre-feet per year, and gpm minute treated. This cost formula was then used with the required water demands associated with the affected communities, to develop the relative O&M costs associated with each facility.

As another important cost consideration, it is important to note that the Town of Payson will construct, own, and operate the pipeline extension and will, in its sole and absolute discretion, make all decisions related to use of the pipeline extension to deliver any Gila County allocated water to rural communities adjacent to the pipeline, or near the Town of Payson. This Study does not consider any delivery fee or connection fee that may be charged by the Town of Payson to Gila County or to other Town approved users of the pipeline extension. These Town of Payson related charges will be an additional cost to the non-Payson users of the C.C. Cragin water. This Study does not include any Salt River Project costs of allocated water that will be charged to the Gila County C.C. Cragin water users that are located in the rural areas outside the Town of Payson.

6.0 EVALUATION OF FINANCIAL FEASIBILITY

The evaluation of financial feasibility includes an assessment on a community-by-community basis of the ability to initially fund construction, and to support ongoing debt repayment and O&M costs.

6.1 Community Cost Assessment

Population and system demand data from the MRWRMS, were used with unit cost from the Pipeline Study to develop an estimate of preliminary cost for the pipeline extensions and WTPs necessary to augment the existing water supply for the 15 communities within this study. These costs were then prorated per community using a ratio of the individual community demand to overall WTP demand. Costs per 1000 gallons served, and cost per connection were also calculated in order to allow a basis for comparison. **Table 11**, on the next page, provides a summary of the prorated pipeline extension cost, WTP cost, and annual costs (including debt repayment and O&M) for each community within the study area.

The cost for (a) Gila County or individual rural communities to transport ("wheel") water through the Payson pipeline, (b) the cost of the raw reservoir water from Salt River Project, and (c) the cost of Gila County or individual communities to operate the WTPs, will all be determined at a later date. It is assumed herein that it is likely Gila County will ultimately form a northern Gila County Water Authority to construct the infrastructure, operate the WTPs, and possibly coordinate joint bonding, etc. to minimize the duplication of efforts and costs to the various communities that "sign-on" to the use of C.C. Cragin water.

As shown **on Table 11**, these total initial capital costs range from $81,050 for Wonder Valley to $1.8 Million for East Verde Estates and Round Valley. Total annual payments range from $7,700 for Wonder Valley to $173,400 for Round Valley. For some communities where the residents may be on limited incomes, the upper range of these annual costs, when allocated to individual water users, may be prohibitive. Generally, infrastructure costs are often easier to finance for systems with a greater number of connections. In order to evaluate whether jointly financed systems would provide cost savings with respect to annual payment requirements, the costs were also evaluated assuming a joint finance scenario.

Table 11. Summary of Financial Feasibility of C.C. Cragin Drinking Water Source

Community	Demand				Additional Capacity from Reservoir - Average Additional Demand		Cost Summary								
	2002		2040												
	No. of connections	2002 (ac-ft)	No. of connections	2040 High (ac-ft)	(kgal)	(ac-ft)**	Capital Connect Cost	WTP Cost	Total Initial Capital	Cost per Connect 2002	Amortized Annual Capital Payment	Annual O&M	Annual O&M + Capital Costs	Cost per 1,000 ($/kgal) gallons	Annual Cost per Connect 2040
Washington Park	12	0.2	12	5	420	1.3	$305,300	$4,300	$309,600	$25,800	$29,200	$410	$29,600	$70.48	$2,470
Rim Trail DWID	93	10.7	137	88	16,800	51.5	$96,700	$172,000	$268,700	$2,889	$25,400	$16,700	$42,100	$2.51	$310
Verde Glen	48	2.8	89	44	7,200	22.0	$638,100	$73,700	$711,800	$14,829	$67,200	$7,160	$74,400	$10.33	$840
Cowan Ranch	19	0.9	21.0	9	0	0.0	$102,800	$0	$102,800	$5,411	$9,700	$0	$9,700	$0.00	$460
Shadow Rim Ranch GS Camp	8	1.2	8	2	0	0.0	$295,600	$0	$295,600	$36,950	$27,900	$0	$27,900	$0.00	$3,490
Whispering Pines	171	17.5	228	123	21,600	66.2	$209,500	$221,200	$430,700	$2,519	$40,700	$21,500	$62,200	$2.88	$270
Beaver Valley	165	22.0	205	83	16,900	51.9	$185,000	$173,400	$358,400	$2,172	$33,800	$16,800	$50,600	$2.99	$250
Freedom Acres	13	9.2	21	16	1,100	3.4	$176,365	$11,356	$187,700	$14,438	$17,700	$1,100	$18,800	$17.09	$900
Wonder Valley	13	3.0	15	12	0	0.0	$81,050	$0	$81,050	$6,235	$7,700	$0	$7,700	$0.00	$510
Sunflower Mesa	8	2.0	10	7	1,000	3.0	$75,900	$9,983	$85,900	$10,738	$8,100	$970	$9,100	$9.10	$910
Mesa del Caballo	409	66.0	455	159	40,700	124.8	$56,900	$416,700	$473,600	$1,158	$44,700	$40,500	$85,200	$2.09	$190
East Verde Estates	164	15.9	246	86	21,600	66.4	$1,680,300	$138,400	$1,818,700	$11,090	$171,700	$3,440	$175,100	$8.11	$710
Flowing Springs	42	6.1	80	32	7,100	21.7	$972,600	$45,300	$1,017,900	$24,236	$96,100	$1,130	$97,200	$13.69	$1,220
Star Valley	461	153.8	1101	573	97,100	337.0	$0	$621,550	$621,600	$1,348	$58,700	$15,450	$74,200	$0.76	$70
Round Valley	178	77.3	242	149	11,800	36.2	$1,761,200	$75,500	$1,836,700	$10,319	$173,400	$1,880	$175,300	$14.86	$720
Oxbow Estates	70	32.2	75	42	1,900	5.8	$877,550	$12,100	$889,700	$12,710	$84,000	$300	$84,300	$44.37	$1,120
TOTALS:	**1,874**	**420.9**	**2,945**	**1,430**	**245,220**	**791**	**$7,514,900**	**$1,975,500**	**$9,490,500**	**$11,428**	**$896,000**	**$127,340**	**$1,023,400**	**$12**	**$903**
										(Average)				(Average)	(Average)

Table 12, on the following page, presents the joint finance scenario. Supporting calculations and documentation for the estimates of probable cost are presented in **Appendix C.**

In addition, it is important to note that these estimates of probable costs reflect a general order of magnitude based upon the anticipated costs of the pipeline extension and WTPs only, and do not include the costs for delivered raw water through the main pipeline. The costs of use of the Pipeline by communities other than Payson will be determined at a later date by the Town of Payson.

The Town of Payson will construct, own, and operate the pipeline extension and will, in its sole and absolute discretion, make all decisions related to use of the pipeline extension to deliver any Gila County allocated water to rural communities adjacent to the pipeline, or near the Town of Payson. This Study does not consider any delivery fee or connection fee that may be charged by the Town of Payson to Gila County or to other Town approved users of the pipeline extension. These Town of Payson related charges will be an additional cost to the non-Payson users of the C.C. Cragin water. This Study does not include any Salt River Project costs of allocated water that will be charged to the Gila County C.C. Cragin water users that are located in the rural areas outside the Town of Payson.

In terms of cost comparisons, the individual communities must consider that the cost for (a) Gila County or individual rural communities to transport ("wheel") water through the Payson pipeline, (b) the cost of the raw reservoir water from Salt River Project, and (c) the cost of Gila County or individual communities to operate the WTPs will all be determined at a later date. It is assumed herein that it is likely Gila County will ultimately form a northern Gila County Water Authority to construct the infrastructure, operate the WTPs, and possibly coordinate joint bonding, etc. to minimize the duplication of efforts and costs to the various communities that "sign-on" to the use of C.C. Cragin water.

Table 12. Summary of Financial Feasibility of C.C. Cragin Drinking Water Source Using Joint Financing

Community	Demand 2002 No. of connections	Demand 2002 (ac-ft)	Demand 2040 No. of connections	Demand 2040 High (ac-ft)	Additional Capacity from Reservoir - Average Additional Demand (kgal)	Additional Capacity from Reservoir - Average Additional Demand (ac-ft)**	Cost Summary: Capital Connect Cost	WTP Cost	Total Initial Capital	Cost per Connect 2002	Amortized Annual Capital Payment	Annual O&M	Annual O&M + Capital Costs	Annual Cost per 1,000 ($/kgal) gallons	Annual Cost per Connect 2040
Washington Park/Rim Trail	105	10.9	149	93	17,220	52.8	$ 402,000	$ 176,300	$ 578,300	$ 5,508	$ 54,600	$ 17,110	$ 71,700	$ 4	$ 480
Verde Glen/Cowan Ranch	67	3.7	110	53	7,200	22.0	$ 740,900	$ 73,700	$ 814,600	$ 12,158	$ 76,900	$ 7,160	$ 84,100	$ 12	$ 760
Shadow Rim Ranch GS Camp	8	1.2	8	2	-	0.0	$ 295,600	$ -	$ 295,600	$ 36,950	$ 27,900	$ -	$ 27,900	$ -	$ 3,490
Whispering Pines	171	17.5	228	123	21,600	66.2	$ 209,500	$ 221,200	$ 430,700	$ 2,519	$ 40,700	$ 21,500	$ 62,200	$ 3	$ 270
Beaver Valley	165	22.0	205	83	16,900	51.9	$ 185,000	$ 173,400	$ 358,400	$ 2,172	$ 33,800	$ 16,800	$ 50,600	$ 3	$ 250
Freedom Acres/Wonder Valley/Sunflower Mesa	34	14.3	46	35	2,100	6.4	$ 333,315	$ 21,339	$ 354,650	$ 10,431	$ 33,500	$ 2,070	$ 35,600	$ 17	$ 770
Mesa del Caballo	409	66.0	455	159	40,700	124.8	$ 56,900	$ 416,700	$ 473,600	$ 1,158	$ 44,700	$ 40,500	$ 85,200	$ 2	$ 190
East Verde Estates/Flowing Spr	206	22.0	326	118	28,700	88.1	$ 2,652,900	$ 183,700	$ 2,836,600	$ 13,770	$ 267,800	$ 4,570	$ 272,300	$ 9	$ 840
Star Valley	461	153.8	1,101	573	97,100	337.0	$ -	$ 621,550	$ 621,600	$ 1,348	$ 58,700	$ 15,450	$ 74,200	$ 1	$ 70
Round Valley/Oxbow Estates	248	109.5	317	191	13,700	42.0	$ 2,638,750	$ 87,600	$ 2,726,400	$ 10,994	$ 257,400	$ 2,180	$ 259,600	$ 19	$ 820
PROJECT TOTALS	**1,874**	**420.9**	**2,945**	**1,430**	**245,220**	**791**	**$ 7,514,900**	**$ 1,975,500**	**$ 9,490,500**	**$ 9,701**	**$ 896,000**	**$ 127,300**	**$ 1,023,400**	**$ 7**	**$ 794**
										(Average)				(Average)	(Average)

6.2 Project Finance Options

Project implementation for utility infrastructure projects is usually heavily dependent upon identifying and securing the necessary project funding. General funding methods used for public infrastructure include finance mechanisms necessary for initial project capital, and revenue sources necessary for repayment. Finance mechanisms are often used by a community to basically get the project implemented. These generally involve the initial capital expenditures for permitting, project administration, design and construction. Examples of finance mechanisms that may be considered by these communities for infrastructure improvements includes, but are not limited to:

- **General Fund**: Many communities that have an established water and wastewater utility, budget for, and use a portion of their General Fund to finance capital improvements for infrastructure. Typically, a Capital Improvements Plan is prepared every 5 years that proactively outlines these expenditures. The downside to this may be that water improvements may have to compete with other programs for a limited budget.

- **Revenue Bonds**: Cities, utility districts, and other political bodies with bonding authority may sell revenue bonds to raise necessary capital for various identified public improvements. Depending upon the total amount being bonded, revenue bonds may require public (voter) approval prior to implementation. Counsel from a municipal bonding specialist, and legal counsel is recommended. Most bond programs have an extended repayment period (20 to 30 years is typical).

- **General Obligation Bonds**: General obligation bonds are similar to revenue bonds, except that the proceeds from the bond sale are placed in the General Fund, and may not necessarily be ear-marked for a specific project.

- **Local Improvement Assessments**: Local improvement assessments can be used to levy necessary project funding from the landowners that may potentially reap the greatest benefit from a project. Local improvement assessments typically require approval of the affected property owners. While theoretically a viable source of funding, actual implementation of local improvement assessments may be challenging.

- **Local Impact Fees:** Local impact fees are a good way of leveraging revenue to support capital improvements, and are generally regarded as a good method of "growth paying for growth". These fees are typically developed through an impact fee study that evaluates both local market conditions, and the overall cost of the proposed capital improvements. Impact fees are generally viewed as a "free" revenue source, as they may be voted in without an election, usually only apply to new development, and are perceived to exclude current taxpayers. Collected impact fees must be expended within about 6 years of collection (Tischler, 2002).

- **Utility Extension Agreements:** In Arizona, many private utilities and Domestic Water Improvement Districts (DWIDs) use utility extension agreements in order to expedite system expansion. These agreements form a contract between the interested developer and the utility whereby the developer agrees to design and install the infrastructure necessary to serve their project, with future ownership and operation by the utility. The utility typically retains design approval and construction oversight authority. The utility then agrees to repay the developer, all, or a portion of the associated project costs at a certain rate over an agreed upon timeframe (usually 10 percent over ten years). This may be useful for new developments within the project area, but may not adequately address the existing situation or in-fill type development.

- **Revolving Loan Funds**: Revolving loan funds are available from state and federal sources. These funds are typically low-interest loans that may be available to support water and wastewater infrastructure needs; other revolving loan funds are established to implement the water and wastewater improvements necessary to support local economic development. Loan repayment is reinvested in the revolving loan fund to support other projects. Many of these loans require a local match of other funding, or in-kind services.

- **Federal Loan and/Grant Programs**: Federal loan and grant programs may also be available to support project development. The ability to use a loan versus a grant is typically dependent upon project need, and local demographics (median household income, % below poverty level, minority population, etc). In addition, several programs promote grants for project planning and design efforts as a means of leveraging loans for construction costs. These funds are typically low-interest loans that may be available to support water and wastewater infrastructure needs; other revolving loan funds are also available to implement water and wastewater improvements necessary to support local economic development. Many of these loans require a local match of other funding, or in-kind services.

- **State Loan and Grant Programs**: Arizona administers several state loan and grant programs through the Arizona Water Infrastructure Finance Authority (WIFA), and the Arizona Department of Economic Security (ADEC), Greater Arizona Development Authority (GADA) and others. These programs vary in the amount provided, the ability to fund infrastructure need, versus economic development needs, and in terms of repayment.

- **Rural Water Infrastructure Committee (RWIC)**: WIFA and GADA have convened a committee to coordinate Arizona and Federal infrastructure financing entities that have programs directed towards rural infrastructure finance. The RWIC may serve as a "one stop shop" for project funding. A community can make arrangements to make a presentation to the RWIC concerning the project infrastructure needs, description, and cost estimates. The funding participants can then provide the community with a road map of the best route(s) available towards obtaining necessary funding for a particular project.

Revenue sources are funding mechanisms that may be used to support ongoing system O&M, program management and administration, and to repay project financial obligations over time. Revenue sources that may be considered by these communities include, but are not limited to:

- **User charges (utility rates):** Most utilities develop monthly user charges (or utility rates) in order to obtain necessary revenues for utility operation, capital reserves, and repayment of debt obligation. Monthly utility rates for both water and wastewater use, are typically developed and billed as a function of water meter size and water use. There is publically available software that may be used by a utility to establish appropriate rate structures or a formal rate study by a trained utility economist may also be used to justify proposed utility rates.

- **System development charges (impact fees):** System development charges or impact fees are another way of leveraging revenue to support ongoing utility service. These fees are typically developed through an impact fee study that evaluates local market conditions, potential future land values, and the overall cost of the proposed capital improvements. Impact fees are generally viewed as a "free" revenue source, as they may be voted in without an election, usually only apply to new development, and are perceived to exclude current taxpayers. Collected impact fees must be expended within about 6 years of collection (Tischler, 2002).

- **Connection charges:** Many utilities charge connection charges to new development/ or new service addresses as a way of recuperating costs for the infrastructure upgrades necessary to serve the additional area. Depending on local growth, political climate concerning that growth, financial need and other factors, connection charges can range from a few hundred dollars per connection, to several thousand dollars. High connection charges may serve to slow development, and associated economic growth.

- **Inspection fees:** Inspection fees on new utility construction, or upgrades to existing construction can also be used to offset costs of utility operation. These fees are typically used with impact fees, and other primary revenue streams.

- **Property, or other taxes:** Property, and other tax assessments can be used to levy necessary project funding. Tax assessments typically require approval of the affected property owners, and while theoretically a viable source of funding, actual implementation may also be challenging.

Gila County and the affected communities may want to explore other options for developing revenue to support project implementation through a more detailed utility rate study. This rate study should be focused on the development of a municipal infrastructure financial program that addresses the anticipated infrastructure costs and implementation schedule as outlined in this report.

6.3 Debt Repayment Scenarios

As it is anticipated that these projects will likely apply to WIFA for a loan under the Capacity Development sections of the Drinking Water State Revolving Loan program. A debt repayment scenario was developed based upon using the current initial debt ratios, current loan interest rates, and appropriate discount rates. A schematic that illustrates the WIFA loan process is included in Appendix C.

In general, publicly-held community drinking water systems (excluding federal facilities) are eligible for financial assistance under WIFA's Drinking Water Revolving Fund (DWRF). A community water system is defined as a water system that serves 25 or more people (and at least 15 service connections) year round. Nonprofit, non-community water systems, such as schools and church camps, are also eligible, although they must meet all other WIFA financial assistance requirements. Systems qualified under DWRF also include cities, towns, special districts, domestic water improvement districts, co-ops and nonprofit associations. Privately-held community drinking water systems are also eligible, however loans to private systems may will be charged a higher interest rate.

Projects are evaluated by WIFA for available funding based upon priority, existing system conditions, project benefits, including consolidation and regionalization, and local fiscal capacity. Fiscal capacity includes a review of construction cost per connection: projects with costs per connection that are less than $2,500 are scored higher; projects with costs greater than $5,000 connection get no points. This would also encourage joint project development. Projects applying for funding under this WIFA DWSRF program will need to be able to demonstrate the following:

- Legal capability under AAC Section R18-15-103;
- Financial Capability under AAC Section R18-15-104;
- Technical Capability under AAC Section R18-15-105;
- Managerial and Institutional Capability under AAC Section R18-15-105;
- Completion of Environmental Review Process under R18-15-107.

In addition, the projects need to be "ready-to-implement". WIFA has the authority to establish the interest rates for these loans, and thus the interest rate may be variable; however, they are generally considered to be lower interest rate loans.

The spreadsheets developed under Tables 11 and 12 (above) provide an assessment of debt repayment scenarios over a twenty year period based upon a conservative seven (7) percent interest rate, over a twenty year period. The time frame is consistent with WIFA requirements; the interest rate may be higher than current rates, but is consistent with the prior cost estimates, and may reflect a "worse-case" future scenario with respect to project financing. These analyses will include initial construction costs, the annual O&M requirements, debt repayment and capital (debt) reserve.

7.0 CONCLUSIONS

In reviewing the infrastructure needs analyses, and the financial evaluation of the proposed pipeline extensions and WTPs necessary to serve the communities located in, or near the Pipeline, one can draw the following conclusions:

- The total difference between existing supply, and future average demand can be met by the proposed Town of Payson Pipeline;
- Most of the communities in the study have a very strong current need for additional water supply and/or for improved infrastructure necessary to treat, store, and deliver new or current water supplies.
- All communities currently need the redundancy of supply available from the Payson Pipeline to reduce the risk of single source of supply (one well, groundwater only, etc.), and to periodically rest ground water wells and aquifers for hours, days, or years, so that adequate recharge occurs.
- All communities, except the Shadow Rim Ranch Girl Scout Camp, Wonder Valley and Cowan Ranch will need additional water supply by the Year 2040.
- The Town of Payson Pipeline and WTP may provide service to Star Valley, Round Valley, Oxbow Estates, East Verde Estates, and Flowing Springs through pipeline extensions; this would require about a 11 percent increase in the Payson Pipeline and WTP capacity.
- Existing groundwater supply may not be sufficient to serve the needs of all study area communities.
- With the exception of exploring wastewater reclamation and reuse to augment non-potable water supply within Star Valley, available waste water supplies may not present a viable alternative to surface water as a means of augmenting water supplies.
- The relatively high initial and annual costs for the project for Washington Park may discourage the project consideration by these communities.
- Many of the projects may be feasible for their intended communities, and would be considered to be "cost-effective" under WIFA project guidelines (AAC R18-15-305).
- Joint project cost-sharing may provide initial and annual cost savings by decreasing the per connection charges

- The estimates of probable costs reflect a general order of magnitude based upon the anticipated costs of the pipeline extension and WTPs only, and do not include the costs for delivered raw water through the main pipeline. The costs of use of the Pipeline by communities other than Payson are to be determined at a later date by the Town of Payson.

- So, in terms of cost comparisons, the individual communities must consider that the cost for (a) Gila County or individual rural communities to transport ("wheel") water through the Payson pipeline, (b) the cost of the raw reservoir water from Salt River Project, and (c) the cost of Gila County or individual communities to operate the WTPs will all be determined at a later date.

- It is assumed herein that it is likely Gila County will ultimately form a northern Gila County Water Authority to construct the infrastructure, operate the WTPs, and possibly coordinate joint bonding, etc. to minimize the duplication of efforts and costs to the various communities that "sign-on" to the use of C.C. Cragin water.

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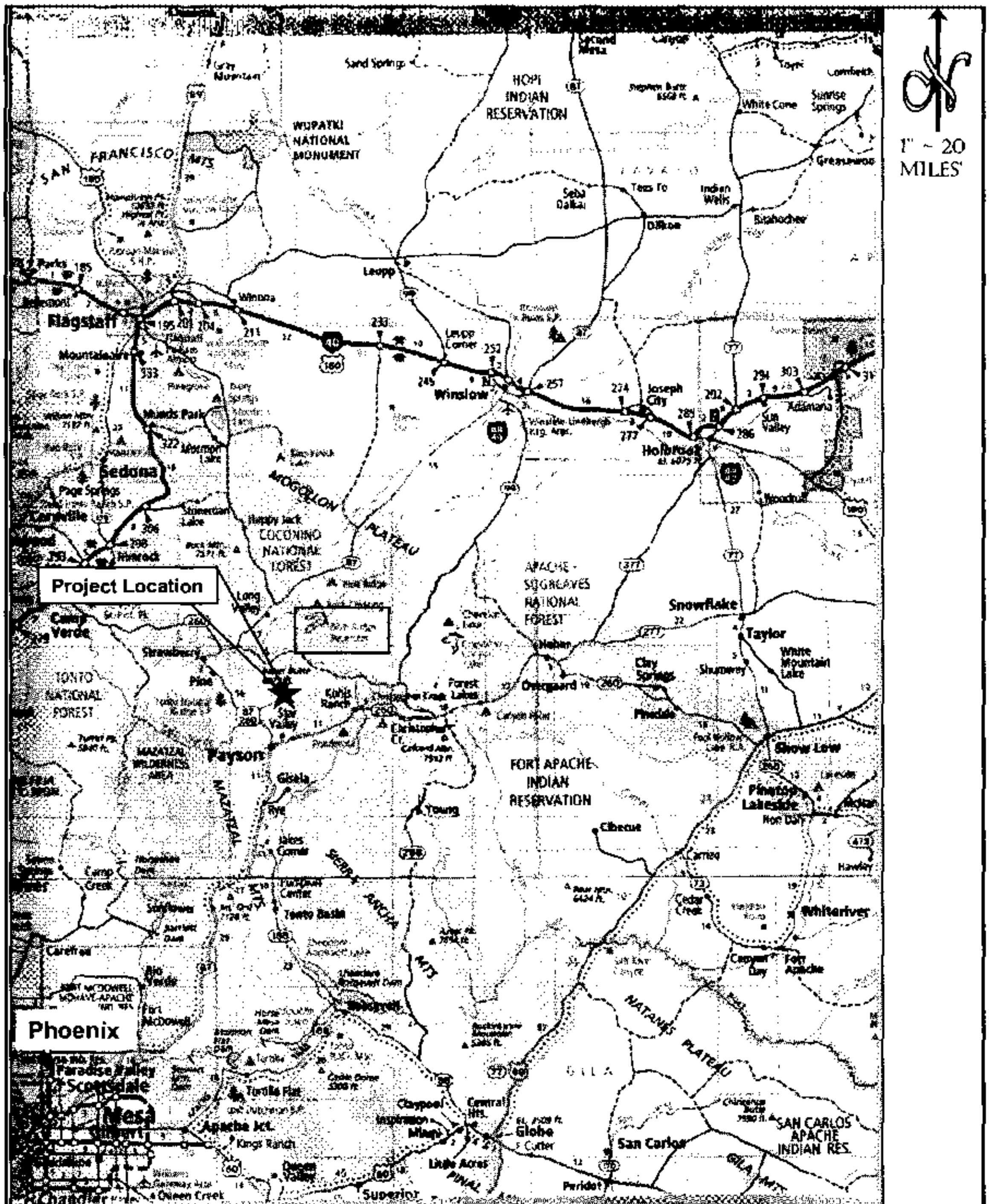
FIGURES



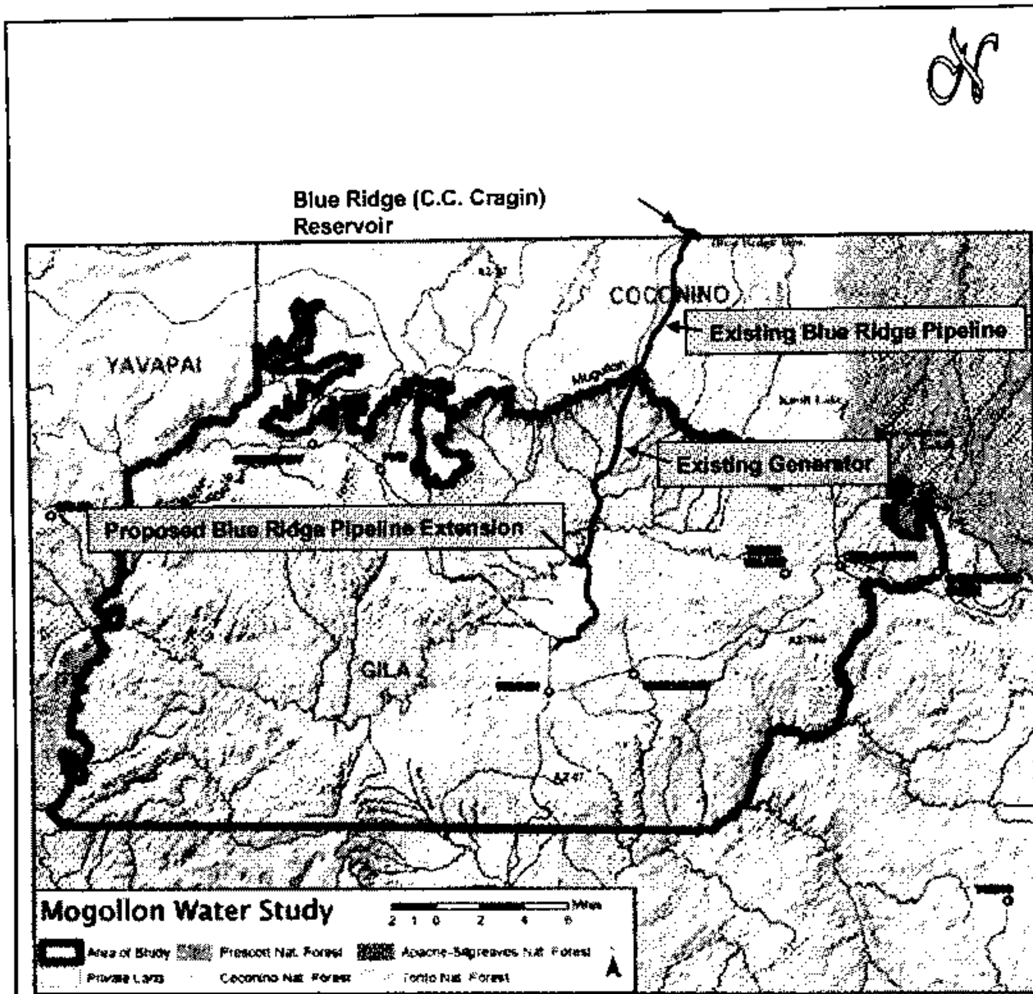
Map Source: Rand McNally, 2006

C.C. Cragin Reservoir Financial Feasibility Report

Gila County, Arizona

Figure 1 – Project Location Map

TETRA TECH



Map Source: Draft MRWRMS, 2007

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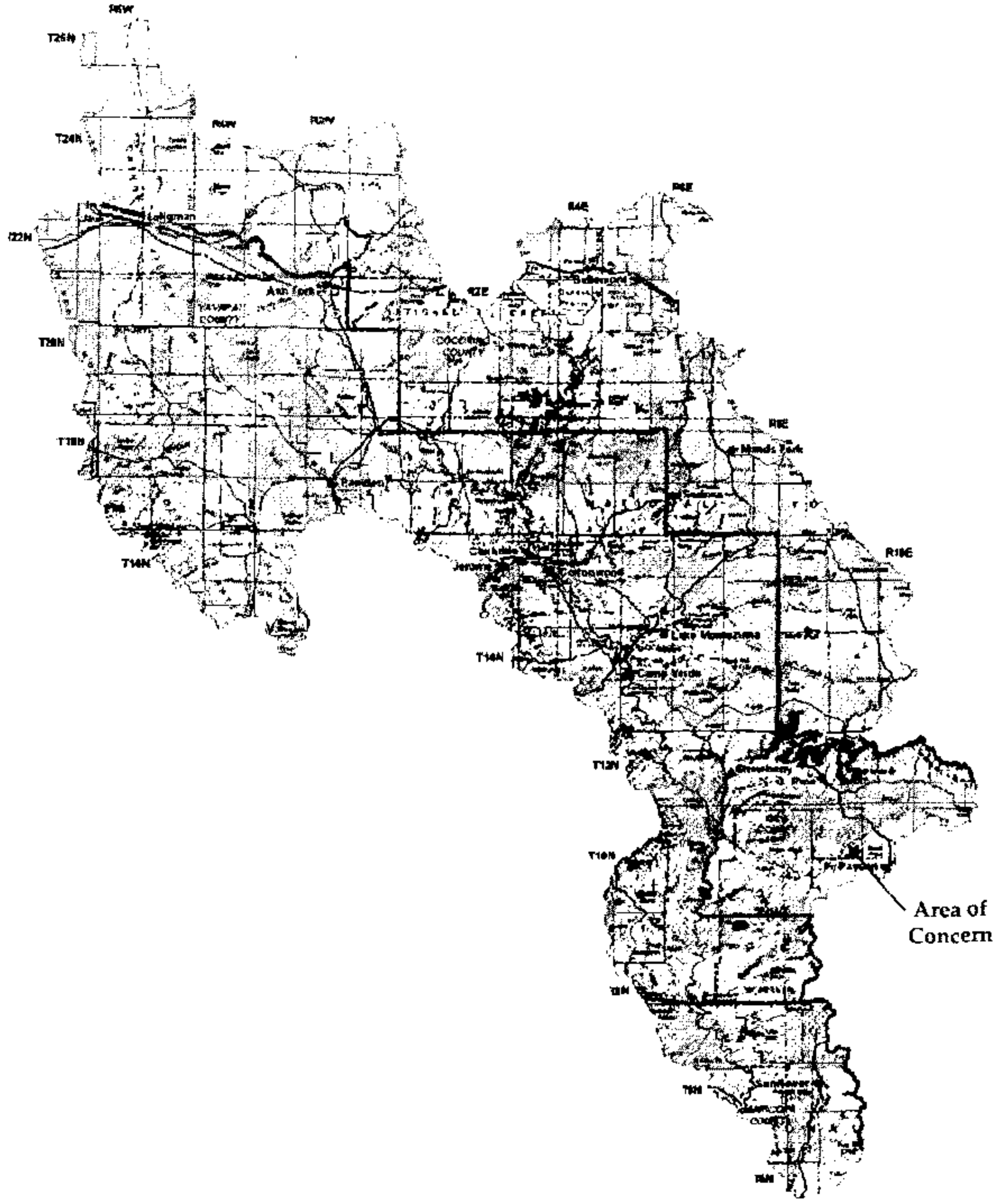
Gila County, Arizona
Figure 2 – Pipeline Location Map

TETRATECH



Map Source: ADWR 2007

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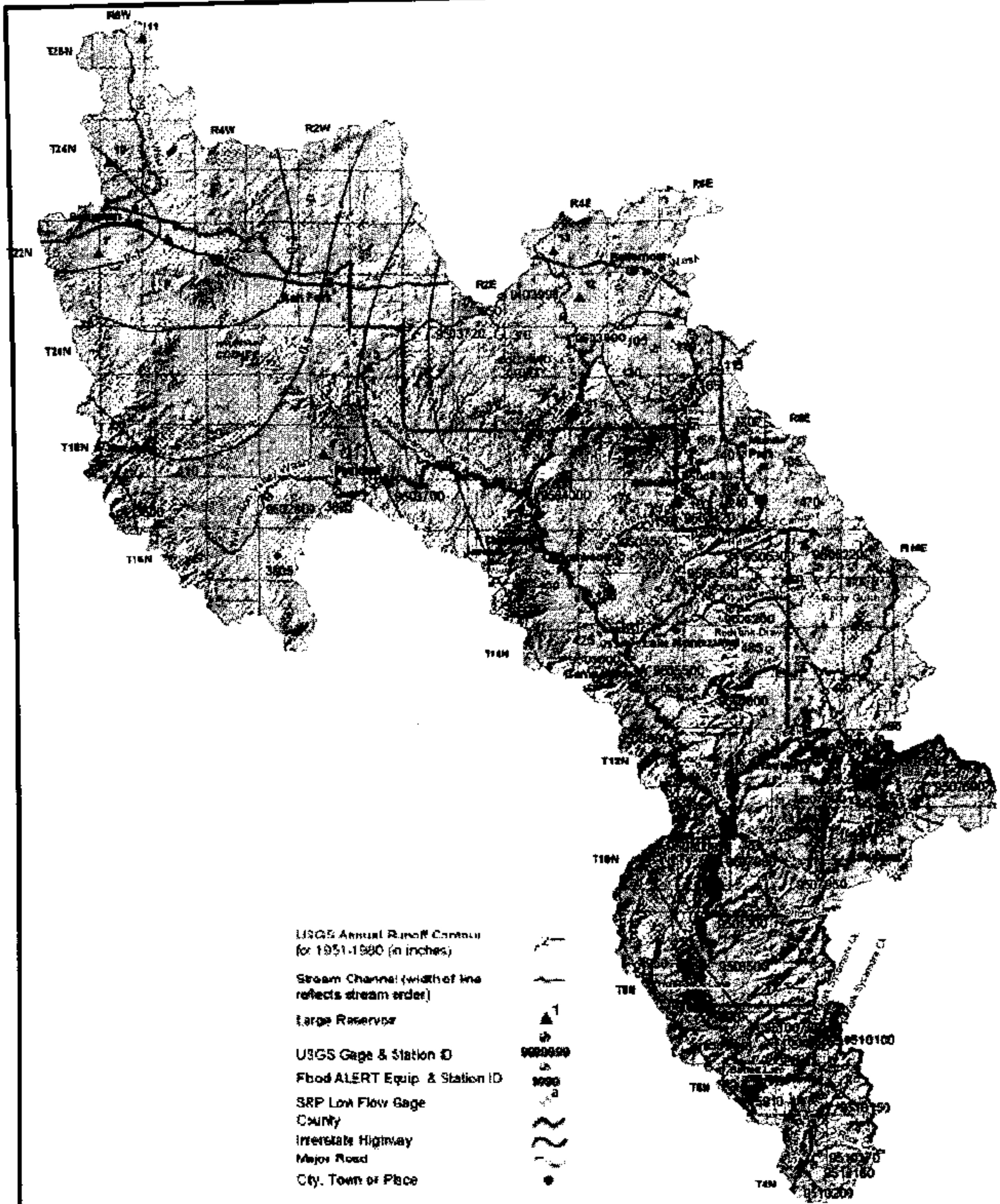
Gila County, Arizona

Figure 3– Verde River Basin Map

TETRA TECH



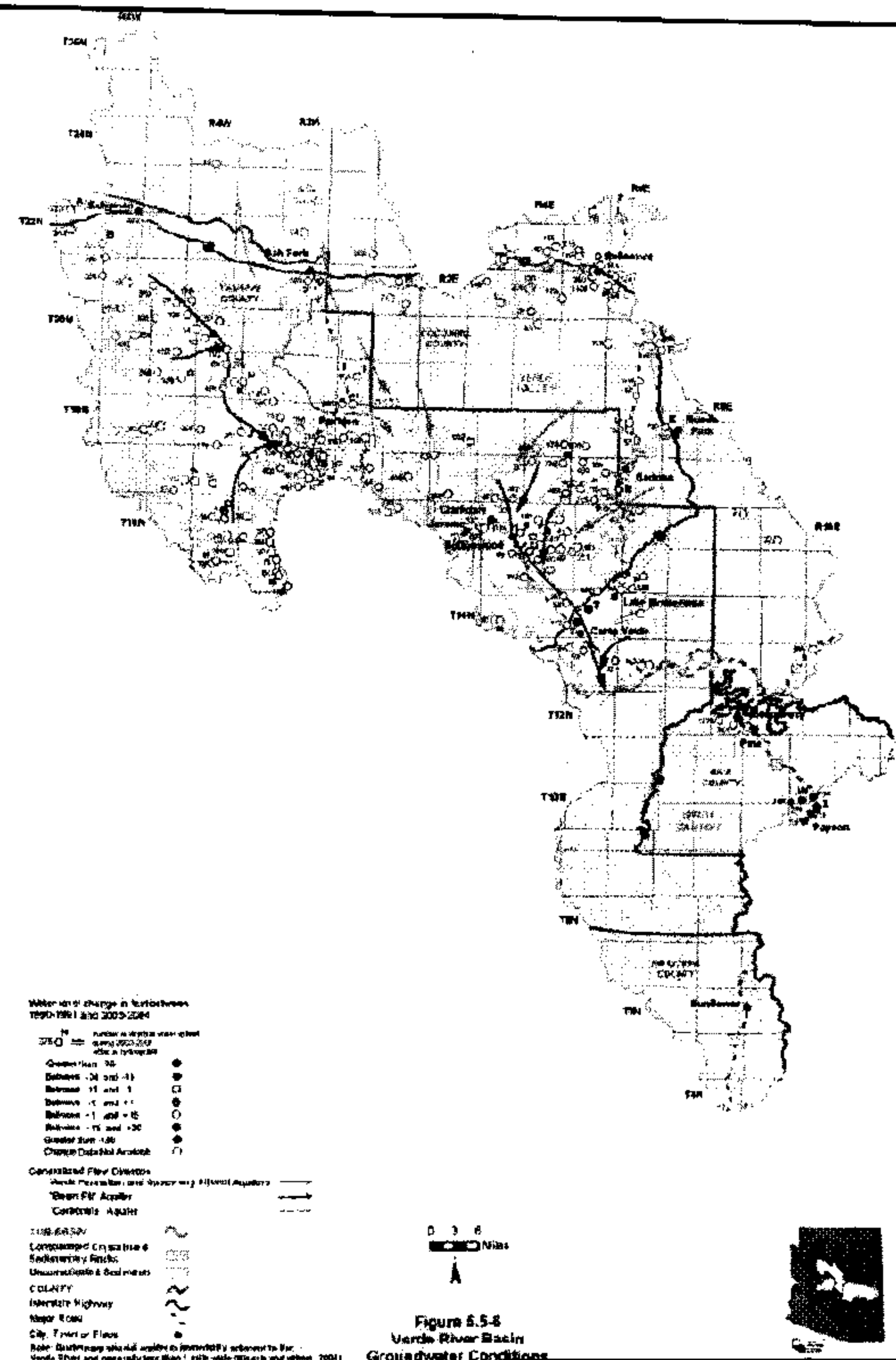
Map Source: ADWR 2007

C.C. Cragin Reservoir Financial Feasibility Report

Gila County, Arizona

Figure 4 – Verde River Basin Surface Water

TETRA TECH



Map Source: ADWR 2007

C.C. Cragin Reservoir Financial Feasibility Report

Gila County, Arizona

Figure 5– Verde River Basin Groundwater

TETRA TECH

APPENDIX A

SUMMARY OF DESIGN CRITERIA

Federal Requirements

Archaeological Resources Protection Act of 1979 (16 U.S.C. 470 aa-11; 43 CFR 7) – Requires protection for any archaeological resources uncovered during the project construction.

Clean Water Act, Section 304(a), National Recommended Water Quality Criteria – Permits for discharges to waters of the United States, including jurisdictional wetlands, must ensure that the discharges will not cause or contribute to a violation of water quality criteria or impair designated uses in the receiving water or downstream waters.

Clean Water Act, Section 401 Certification – For discharges to waters of the United States to certify that the project will not violate water quality standards; this certification must come from the State or authorized Tribe (or EPA for "unauthorized" Tribes) in whose geographic jurisdiction the discharge would occur; States or Tribes may place conditions on its certification that are intended to prevent such violation; in addition, States and Tribes may waive certification (USEPA, 2000a).

Clean Water Act, Section 402 (NPDES) – The National Pollutant Discharge Elimination System (NPDES) regulates the discharge of pollutants from point sources into waters of the United States. This may apply for either point discharge from a treatment system to waters of the United States, or for stormwater discharges during construction from projects affecting an area greater than 5 acres (USEPA, 2000a).

Clean Water Act Section 404 – Section 404 of the clean water act pertains to projects that involve the discharge of dredged or fill material to waters of the United States; This might occur if flood control measures were constructed to protect a treatment system, or if a historical wetlands location were to be converted to a treatment wetlands (generally discouraged unless the wetlands had been previously degraded) (USEPA, 2000a).

Endangered Species Act (16 U.S.C. 1531, et seq. 50 CFR 402; 40 CFR 6.302 (h)) – Projects cannot results in adverse impacts to species listed as threatened or endangered.

Fish and Wildlife Conservation Act (16 U.S.C. 2901 et seq. and 50 CFR 83) – Projects cannot results in adverse impacts to fish and wildlife habitat.

Protection of Wetlands (Executive Order 11990) – Projects cannot result in overall adverse impacts to jurisdictional wetlands.

National Historic Preservation Act (16 U.S.C. 470) – Requires appropriate documentation and if appropriate, preservation of any and all resources with historic or prehistoric significance encountered during construction.

Native American Grave Protection and Repatriation Act (Public Law 101-601) – Requires documentation, protection and appropriate repatriation of any human remains of Native American origin encountered during construction.

Safe Drinking Water Act (42 U.S.C. 300f-300j-25) – Concerns use of surface water sources for drinking water supply.

National Environmental Policy Act (NEPA) (42 U.S.C. 4321 to 4370d; 40 CFR 1500-1508) – For projects that involve a federal action with the potential to significantly affect the environment.

State Requirements

State requirements may be considered in the development of this project; however, in general, the Federal requirements are considered to be more stringent. State Regulations to be considered include, but are not limited to:

- Arizona Department of Environmental Quality (ADEQ). 2005. Arizona Administrative Code – Environmental Reviews and Certification. Title 18, Chapter 5. March 31.
- Arizona Department of Environmental Quality, 1978, Engineering Bulletin No. 10, Guidelines for the Constructionf Water Systems; Prepared by the Arizona Department of Health Services, May.
- Arizona Department of Environmental Quality, 1978a, Engineering Bulletin No. 8 Disinfection of Water Systems. Prepared by the Arizona Department of Health Services, June.

APPENDIX B

DEMAND ESTIMATIONS AND OTHER CALCULATIONS

Blue Ridge (C.C. Cragin) Reservoir Drinking Water Source Financial Feasibility Study
December 21, 2007

APPENDIX B - Infrastructure Needs Analyses

			Existing System Capacity						002 Demar	2040 Demand							
										Average Daily Demand (gpd)				Peak Daily Demand (gpd)			
WTP No.	Location	MRWRMS #	Surface Water?	Dist'n System?	# of System-Wells	Total Well Output* (gpm)	Gallons per Day****	Ac-ft/Year	Capacity/ Demand Ratio	Low	High	Average	Capacity/ Demand Ratio	Low	High	Average	Capacity/ Demand Ratio
1	**Rim Trail WTP**				5	61	44,186	49.5	1.6	76,200	132,286	104,243	0.42	152,400	264,572	208,486	0.21
	Washington Park	41	No	Yes	Spring	4	2,880	3.2	9.6	3,480	4,350	3,915	0.74	6,960	8,700	7,830	0.37
	Rim Trail DWID	26	Yes	Yes	1	18	12,960	14.5	0.7	39,480	78,631	59,056	0.22	78,960	157,262	118,111	0.11
	Verde Glen	40	No	Yes	1	14	10,080	11.3	2.4	15,240	22,225	18,733	0.54	30,480	44,450	37,465	0.27
	Verde Glen - Other**	47	No	No	0	0	268	0.3	0.3	10,320	17,200	13,760	0.02	20,640	34,400	27,520	0.01
	Cowan Ranch	8	No	Yes	1	15	10,800	12.1	6.6	6,000	8,200	7,100	1.52	12,000	16,400	14,200	0.76
	Shadow Rim Girl Scout Ranch	28	No	Yes	2	10	7,200	8.1	3.1	1,680	1,680	1,680	4.29	3,360	3,360	3,360	2.14
2	**Whispering Pines WTP**	**42**	No	Yes	2	40	28,800	32.3	0.9	65,640	109,400	87,520	0.33	131,280	218,800	175,040	0.16
3	**Beaver Valley WTP**	**3**	Yes	Yes	1	28	20,160	22.6	0.6	59,040	73,800	66,420	0.30	118,080	147,600	132,840	0.15
4	**Freedom/Wonder WTP**				3	35	26,995	28.1	7.9	14,640	30,710	22,675	0.65	29,280	61,420	45,350	0.60
	Freedom Acres	15	No	Yes	1	14	10,080	9.2	4.6	6,000	14,150	10,075	1.00	12,000	28,300	20,150	0.50
	Wonder Valley	43	No	Yes	2	21	15,120	16.9	21.0	5,760	10,800	8,280	1.83	11,520	21,600	16,560	0.91
	Sunflower Mesa**	48	No	No	0	0	1,795	2.0	3.7	2,880	5,760	4,320	0.42	5,760	11,520	8,640	0.21
5	**Mesa del Caballo WTP**	20	No	Yes	10	35	25,200	28.2	0.2	131,040	141,960	136,500	0.18	262,080	283,920	273,000	0.09
***	**Flowing Springs/East Verde WTP**				4	29	20,880	23	0.5	93,840	105,500	99,670	0.21	187,680	211,000	199,340	0.10
	Flowing Springs	14	No	Yes	1	9	6,480	7.3	0.6	23,040	28,800	25,920	0.25	46,080	57,600	51,840	0.13
	East Verde Estates	11	No	Yes	3	20	14,400	16.1	0.5	70,800	76,700	73,750	0.20	141,600	153,400	147,500	0.10
***	**Star Valley**				5	155	172,128	154	1.2	409,560	511,950	460,755	0.37	819,120	1,023,900	921,510	0.19
	Star Valley A & B	30	No	Yes	5	155	111,600	125.0	0.7	148,800	186,000	167,400	0.67	297,600	372,000	334,800	0.33
	Star Valley - Other**	46	No	No	0	0	60,528	67.8	0.5	260,760	325,950	293,355	0.21	521,520	651,900	586,710	0.10
***	**Oxbow/Round Valley**				-	-	97,755	110	0.5	99,720	171,130	135,425	0.72	199,440	342,260	270,850	0.36
	Oxbow Estates**	21	No	No	0	0	28,746	32.2	0.5	30,000	37,500	33,750	0.85	60,000	75,000	67,500	0.43
	Round Valley**	27	No	No	0	0	69,009	77.3	0.5	69,720	133,630	101,675	0.68	139,440	267,260	203,350	0.34

* Data from ADWR 55 Wells Database; available online at http://www.sahra.arizona.edu

** Served by Private Wells; capacity is assumed to meet existing demand

*** May be served through Town of Payson System

**** Assumes water replenishment over a 12-hour day

Appendix B - Demand Calculations

WTP No.	Location	WTWSMB Map Location #	2002 Population	2002 Avg Daily (gpcd)	2002 Peak Daily (gpcd)	2002 Avg Annual (ac-ft)	2002 Average Daily Demand (gpd)	2002 Peak Daily (gpd)	2040 Population	2040 Avg Daily (gpcd) Low	2040 Avg Daily (gpcd) High	2040 Peak Daily (gpcd) Low	2040 Peak Daily (gpcd) High	2040 Avg Daily (gpd) Low	2040 Avg Daily (gpd) High	2040 Peak Daily (gpd) Low	2040 Peak Daily (gpd) High	2040 Avg annual (ac-ft) Low	2040 Avg annual (ac-ft) High	2040 Avg (ac-ft)
1	[illegible]		76	[illegible]	[illegible]	15.4	14,378	28,756	275	120	175	230	349	34,700	212,110	103,400	[illegible]	[illegible]	[illegible]	11.6
	Washington Park	41	1	150	300	0.2	150	300	24	150	190	240	300	3,600	4,560	4,560	6,700	4	5	4.5
	Rim Rock [illegible]	26	45	224	470	10.7	9,500	19,121	329	120	270	240	470	39,480	38,[illegible]	78,960	157,262	44	[illegible]	[illegible]
	Verde C[illegible]	40	16	131	262	2.3	2,096	4,192	127	120	175	240	350	15,240	22,225	30,480	44,450	3	25	4.7
	Verde Glen - Other	47	2	200	400	0.5	400	800	[illegible]	120	200	240	400	10,320	17,200	20,640	34,400	12	17	65.1
	Cottage Ranch	6	3	144	120	0.5	430	1,440	50	120	164	240	329	6,000	8,200	12,000	16,402	7	9	8
	[illegible] Ranch	29	12	96	192	1.3	1,152	2,304	14	120	132	240	264	1,680	1,680	3,360	3,360	2	4	1
2	Whispering Pines	41	60	150	300	11.5	15,000	11,000	507	120	200	240	400	60,840	[illegible]	[illegible]	[illegible]	74	[illegible]	[illegible]
3	Beaver Valley	5	280	37	164	27	10,420	30,000	407	120	190	240	380	48,840	73,000	97,680	147,000	46	82	44.1
4	Freedom Acres/Wonder Valley		76	44	132	3.8	3,762	3,400	732	120	240	240	1,400	24,840	46,750	55,200	92,400	17	33	24
	Freedom Acres	15	24	36	76	9.2	1,192	2,254	30	120	283	240	566	4,000	14,190	12,000	28,320	7	16	11.5
	Wonder Valley	30	30	12	24	3.0	368	720	48	120	225	240	450	5,760	10,800	11,520	21,600	7	12	9.5
	[illegible]	16	15	16	32	3.0	240	480	24	120	240	240	480	2,880	5,760	5,760	11,520	3	7	4
5	[illegible]		[illegible]	[illegible]	154	[illegible]	[illegible]	112,950	[illegible]	120	150	240	300	131,640	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]		230	130	450	31	18,700	36,400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	131.6
	[illegible] Springs	34	40	137	274	6.3	5,480	20,960	192	120	150	240	300	23,040	28,800	46,080	57,600	26	32	30
	[illegible]	33	180	79	158	15.9	14,220	28,440	540	120	135	240	266	79,800	76,700	161,600	152,400	79	[illegible]	101.5
7	[illegible] Valley		1484	[illegible]	320	116.6	137,250	194,512	3413	240	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	378	[illegible]
	[illegible] Valley A & B	30	184	84	168	86	76,776	153,552	1240	120	190	240	300	[illegible]	156,000	297,600	372,000	116.7	204	162.30
	[illegible] Valley Other	46	750	84	168	65.1	60,480	121,960	2173	120	150	240	300	260,760	325,950	521,520	651,900	292	365	328.0
8	[illegible] Valley		540	240	700	[illegible]	47,500	196,440	331	240	320	440	700	46,720	173,220	160,440	243,200	1.5	241	151.5
	[illegible]	21	240	120	240	32.3	28,800	47,040	256	120	156	240	400	30,000	37,440	60,000	75,000	34	42	38
	[illegible] Valley	22	300	230	460	77.3	69,000	138,000	581	120	230	240	460	69,720	133,630	139,440	267,260	78	149	113.5

WTP No.	Location	Difference between 2002 existing and 2040 demand: Low (ac-ft/yr)	High (ac-ft/yr)	Average (ac-ft/yr)	Avg (gpd)	MGD: Future High	MGD: Difference High	Cost Estimate: Annual Demand (kgal)	Unit Cost basis	Unit Cost ($/kgal)	2040 High Future Cost Estimate	O&M: Unit cost ($/kgal)	O&M: Total Annual Cost
1	[illegible]	40	[illegible]	75	66,707	[illegible]	0.583	24,555	[illegible]	[illegible]	[illegible]	[illegible]	124,270
	Washington Park	0.8	1.5	3.3	1,310	0.017	0.002	495					
	Rim Rock [illegible]	29.3	73.3	51.3	45,961	0.245	0.271	16,776					
	Verde C[illegible]	0.3	13.3	6.9	6,125	0.029	0.309	2,236					
	Verde Glen - Other	11.7	11.7	15.3	13,570	0.053	0.381	4,953					
	Cottage Ranch	0.3	0.3	3	8	0.025	0.100	7					
	[illegible] Ranch	0.0	0.5	3	8	0.005	0.000	6					
2	Whispering Pines	42	59	86	66,570	[illegible]	[illegible]	23,594	Plan	[illegible]	[illegible]	[illegible]	[illegible]
3	Beaver Valley	43.4	[illegible]	52	46,526	[illegible]	[illegible]	16,917	Plan	[illegible]	[illegible]	[illegible]	[illegible]
4	Freedom Acres/Wonder Valley	8.8	13	8	3,700	[illegible]	[illegible]	1,362	Plan	[illegible]	[illegible]	[illegible]	[illegible]
	Freedom Acres	0.3	6.8	3.65	3,429	0.044	0.005	1,130					
	Wonder Valley	0.3	10.0	4.35	4	0.033	0.080	5					
	[illegible]	1.3	5.3	2.96	2,[illegible]	0.010	0.306	97[illegible]					
5	[illegible]	111.3	126.6	[illegible]	111,[illegible]	[illegible]	[illegible]	[illegible]	Plan	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	28,755	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] Springs	16.7	24.7	23.5	19,400	0.[illegible]	0.[illegible]	7,081					
	[illegible]	[illegible]	[illegible]	[illegible]	29,217	0.237	0.[illegible]	21,327					
7	[illegible] Valley	275	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	97,337	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] Valley A & B	8.3	[illegible]	37.3	33,336	[illegible]	[illegible]	12,168					
	[illegible] Valley Other	221.2	297.2	260.7	232,750	1.105	[illegible]	84,[illegible]					
8	[illegible] Valley	3.5	115	[illegible]	37,[illegible]	[illegible]	[illegible]	13,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	1.6	9.8	3.8	3,179	0.1[illegible]	0.006	1,[illegible]					
	[illegible] Valley	0.7	71.7	36.2	32,377	0.4[illegible]	0.080	11,796					

[illegible] [illegible]

Blue Ridge (C.C. Cragin) Reservoir Pipeline Financial Feasibility Study
Appendix B - Distribution System Details

Description	Length (ft)	dH (ft)	Slope	Demand (gpm)	Flow (cfs)	V (fps)	Design Q, cfs	# of Pumps	Wash Crossings	Pipe Size	Notes
Washington Park	2,500	-320	-12.8	1.58	0.004	0.02	1.42	1	2	6	Pump Required - TDH=235 ft
To Wash 1	2,500	-160	-		Pipefull V =	7.23	OK			6	Pump Required
End	0	-80	-							0	Pump Required
Rim Trail Extension	250	40	16.0	93	0.21	1.05	2.41	0	1	6	
(pipeline to RT DWID WTP)					Pipefull V =	12.30	OK				PRV required
Verde Glen Extension	7,600	151	1.9	27	0.06	0.31	0.84	0	1	6	
RT DWID to Verde Glen	8,000	151			Pipefull V =	4.28	OK				
Capacity = Verde Glen & Cowan Ranch											
Cowan Ranch Extension	500	-8	-1.6	0	0.00	0.00	0.15	1	1	6	Pump required, TDH = 30 feet
Verde Glen to Cowan Ranch					Pipefull V =	7.53	OK				
Shadow Rim Ranch Extension	2,400	125	5.21	0	0.00	0.00	1.38	0	2	6	2 wash crossings
Pipeline to Shadow Rim GS Ranch					Pipefull V =	7.02	OK				
Beaver Valley	1,200	40	3.33	64	0.14	0.73	1.10	0	1	6	
Pipeline to Beaver Valley Plant					Pipefull V =	5.61	OK				
Wonder Valley Extension	50	3	6.00	8	0.02	0.09	1.48	0	1	6	
Pipeline to Wonder Valley					Pipefull V =	7.53	OK				
(size for Sunflower Mesa, Wonder Valley & Freedom Acres)											
Sunflower Mesa	200	43	21.50	1	0.00	0.01	2.80	0	1	6	
Freedom Acres to Sunflower Mesa					Pipefull V =	14.26	OK				
(Size for Sunflower Mesa & Wonder Valley)											
Freedom Acres	800	5	0.63	0	0.00	0.00	0.48	0	1	6	
Sunflower Mesa to Freedom Acres					Pipefull V =	2.43	OK				
Whispering Pines	400	4	1.00	19	0.04	0.21	0.60	1	0	6	Pump required, TDH = 30 feet
Pipeline to Whispering Pines Plant					Pipefull V =	3.07	OK				
Mesa del Caballo	200	2	1.00	82	0.18	0.93	0.60	0	0	6	
Pipeline to MdC Plant					Pipefull V =	3.07	OK				

Blue Ridge (C.C. Cragin) Reservoir Pipeline Financial Feasibility Study
Appendix B - Distribution System Details

Description	Length (ft)	dH (ft)	Slope	Demand (gpm)	Flow (cfs)	V (fps)	Design Q, cfs	# of Pumps	Wash Crossings	Pipe Size	Notes
E. Verde Main Pipeline Extension	14,800	300	2.0	109.3	0.24	0.70	1.85	0	3	8	to split, 3 wash crossings
From pipeline to Split					Pipefull V =	5.31	OK				
To Wash 1	2,300	50	2.2						1	8	
To Wash 2	1,200	40	3.3						1	8	
To Wash 3	10,500	240	2.3						1	8	
To Split	800	80	10.0							8	
E. Verde Estates Extension	4,500	153	3.4	82.3	0.18	0.93	1.11	0	2	6	2 wash crossing
To Wash 1	2,200	160	7.3		Pipefull V =	5.67	OK		1	6	
To Wash 2	2,200	20	0.9						1	6	
To End	100	0	0.0							6	
To Flowing Springs	5,000	-27	-0.54	52.1	0.12	0.59	0.76	1	1	6	Pump Required, TDH= 80 ft
To Wash 1	3,600	120	3.3		Pipefull V =	3.89	OK				
To End	1,400	0	0.5 to 1								
Star Valley	0	266	0.0	417.9	0.93	2.67	0.00	1	2	8	2 wash crossings
Star Valley will be served from existing pipeline					Pipefull V =	0.00	OK		1	8	
								1	1	8	Pump Required, TDH=50
Round Valley Pipeline	9,800	200	2.0	52.1	0.12	0.33	1.86	1	1	8	
From Payson Pipeline @ Tonto Apache Tribe		200			Pipefull V =	5.33	OK			8	1 wash crossing
To Wash 1	4,300	0	0.0					1	1	8	Pump Required
To Split	5,500	160	2.9							8	
To Round Valley	4,500	1	Flat!	45	0.10	0.29	1.94	1	1	8	**Pump required, TDH=50'**
					Pipefull V =	5.56	OK				
To Oxbow	6,650	160	2.4	7.2	0.02	0.08	0.90	1	2	6	**2 wash crossings.**
To Wash 1	3,600	120	3.3		Pipefull V =	4.58	OK	1	1	6	Pump Required; TDH=50ft.
To Wash 2	2,400	40	1.7						1	6	Pump Required
To End	650	0	0.0							6	Pump Required

Design Assumptions: V >= 3fps **Diameter** >= 8 inches

APPENDIX C

ESTIMATES OF PROBABLE COMMUNITY COSTS

Blue Ridge (C.C. Cragin) Reservoir Pipeline Financial Feasibility Study
Appendix C - 2006 Unit Costs from
Blue Ridge Reservoir Pipeline Study

2006 Pipe Unit Construction Costs[A]		
Description	**Unit Cost**	**Unit**
Pipeline	$7.50	/in-dia/lf
Pavement Replacement	$40	/lf
Rock Excavation	$45	/cy
Water/Wash Crossings	$45,000	/crossing
Traffic Control	$170,000	/Lump Sum
Booster Pump Stations	$1,650	/station/acft/yr

2006 WTP Construction Costs[A]		
	Community	
Description	**Payson**	**Pine**
General Requirements (9%)	$288,000	$72,000
Sitework (20%)	$640,000	$160,000
MF Building (1600 sq ft)	$176,000	$88,000
MF Equipment	$1,780,000	$415,000
Disinfection	$275,000	$50,000
Finished Water Reservoir (@ $0.75/gal)	$750,000	$150,000
Pump Station	$215,000	$100,000
Electrical / I&C (20%)	$703,000	$177,000
HVAC / Plumbing (5%)	$176,000	$44,000
Subtotal	$5,003,000	$1,336,000
Contingency (25%)	$1,250,750	$334,000
Total Capital	$6,253,750	$1,670,000
Cost per 1,000 Gallons Treatment Capacity ($/kgal)	$6.40	$10.25

Cost Summary		
Item	**Payson Cost**	**Pine Cost**
Raw Water Main	$17,211,037	$15,185,000
Water Treatment Plant	$6,253,750	$1,670,000
Total Capital Cost	$23,464,787	$16,855,000
Amortized (20 years)	$2,214,910	$1,590,993
Operations & Maintenance ($/year)	$168,433	$162,262
Total Annual Cost	**$2,383,343**	**$1,753,255**
Cost per 1,000 Gallons ($/kgal)	**$2.44**	**$10.76**
O&M ($/kgal)	$0.16	$1.00
Design Capacity (mgd)	3.9	0.6
Design Capacity (ac-ft/year)	3250	500
Design Capacity (kgal/year)	1,059,017	162,926

[A] Black and Veatch. February 10, 2006. Blue Ridge Reservoir Water Supply Pipeline and Treatment Plant - Final. Town of Payson, Arizona.

December 21, 2007

Cost Assumptions: Costs are developed for each of the identified communities within this financial feasibility study. Costs for shared pipeline extensions (a pipeline that serves more than one community) are prorated to each community as a percentage of total pipeline extension capacity provided to each community. Costs for water treatment and O&M are prorated on the basis of average future volume of water treated. Costs are based upon the Unit Costs for pipeline, microfiltration, and O&M as presented in the Blue Ridge Reservoir Water Supply Pipeline and Treatment Plant (Black & Veatch, 2006). Pipeline costs include piping, pipe fitting, bedding, backfill and compaction, and may reflect a "conservative-high" estimate. Water treatment and O&M costs for most communities are based upon unit costs for Pine as presented in the Black& Veach report, as the Pine system is closer in scale to those required by these systems. Communities served by the Town of Payson (Flowing Springs, East Verde Oxbow Estates, and Round Valley) are based upon the Payson rates. Consistent with the costs presented within the prior study, costs are provided on a FY 2006 basis, and include a 25% contingency. Capital Recovery is based upon a period of 20 years, and a 7% interest rate. Present Value is based upon period of 20 years, and a 7% discount rate.

n = 20 years
i = 7%

Capital Recovery: $A = P[i(1+i)^n/(1+i)^n-1]$

WASHINGTON PARK COSTS					
Description	**Quantity**	**Unit**	**Unit Cost**	**Unit**	**Cost**
Pipeline Extension					
Pipeline - 6"	2,500	lf	$7.50	in-dia/lf	$112,500
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	625	lf	$40	lf	$25,000
Rock Excavation*	139	cy	$45	cy	$6,200
Water/Wash Crossings	2	crossing	$45,000	crossing	$90,000
Traffic Control	0.05	lump sum	$170,000	lump sum	$8,500
Booster Pump Stations	1	stations	$2,000	station	$2,000
				Subtotal, Extension Costs	$244,200
				Contingencies @25%	$61,100
				Total Extension Cost	***$305,300***
Portion of Rim Trail WTP	415	kgallons	$10.25	kgallons	$4,260
				Total Capital Costs	**$309,600**
				Amortized Capital Costs	$29,200
Annual Operations and Maintenance	415	kgallons	$1.00	$/kgal	$410
				Total Annual Costs for Washington Park	**$29,600**
Present Value of O&M over 20 years, at 7% rate					**$4,400**
TOTAL Life-Cycle Costs, Washington Park:					**$315,100**
No. of connections, 2002	12			**Cost/connection, 2002:**	**$26,260**
No. of connections, 2040	12			**Cost/connection, 2040:**	**$26,260**

RIM TRAIL DWID COSTS					
Description	**Quantity**	**Unit**	**Unit Cost**	**Unit**	**Cost**
Pipeline Extension					
Pipeline - 6"	250	lf	$7.50	in-dia/lf	$11,250
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	63	lf	$40	lf	$2,500
6-inch Diameter Pressure Reducing Valve & box	1	ea	$1,000	ea	$1,000
Rock Excavation*	14	cy	$45	cy	$600
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.1	lump sum	$170,000	lump sum	$17,000
Booster Pump Stations	0	stations	$0	station	$0
				Subtotal, Extension Costs	$77,350
				Contingencies @25%	$19,300
				Total Extension Cost	***$96,700***
Portion of Rim Trail WTP	16,776	kgallons	$10.25	kgallons	$172,000
				Total Capital Costs	**$268,700**
				Amortized Capital Costs	$25,400
Annual Operations and Maintenance	16,776	kgallons	$1.00	$/kgal	$16,700
				Total Annual Costs for Rim Trail DWID	**$42,100**
Present Value of O&M over 20 years, at 7% rate					**$177,800**
TOTAL Life-Cycle Costs, Rim Trail, DWID					**$448,200**
No. of connections, 2002	93			**Cost/connection, 2002:**	**$4,820**
No. of connections, 2040	137			**Cost/connection, 2040:**	**$3,270**

Verde Glen Water Extension - ***serves communities of Verde Glen, Verde Glen "Other" & Cowan Ranch from Rim Trail DWID WTP***					
Description	**Quantity**	**Unit**	**Unit Cost**	**Unit**	**Cost**
Pipeline Extension					
Pipeline - 6"	7,800	lf	$7.50	in-dia/lf	$351,000
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	1,950	lf	$40	lf	$78,000
Rock Excavation*	433	cy	$45	cy	$19,500
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.1	lump sum	$170,000	lump sum	$17,000
Booster Pump Stations	0	stations	$0	station	$0
			Subtotal, Verde Glen Extension Cost		$510,500
				Contingencies @25%	$127,600
				Total Extension Cost	***$638,100***
VERDE GLEN COSTS					
Annual Water Demand, kgal:	7,186				
Total Water Demand for Extension, kgal:	7,186				
Percentage per Verde Glen:	100%				
Portion of Verde Glen Extension Costs:					$ 638,100
Portion of Rim Trail WTP	7,186	kgallons	$10.25	kgallons	$73,700
				Total Capital Costs	**$711,800**
				Amortized Capital Costs	$67,200
Annual Operations and Maintenance	7,186	kgallons	$1.00	$/kgal	$7,160
				Total Annual Costs for Verde Glen	**$74,400**
Present Value of O&M over 20 years, at 7% rate					**$76,200**
TOTAL Life-Cycle Costs,Verde Glen:					**$792,000**
No. of connections, 2002	48			**Cost/connection, 2002:**	**$16,500**
No. of connections, 2040	89			**Cost/connection, 2040:**	**$8,900**

COWAN RANCH COSTS

Annual Water Demand, kgal:	0
Total Water Demand for Extension, kgal:	7,186
Percentage per Verde Glen:	0%
Portion of Verde Glen Extension Costs:	$ -

Description	Quantity	Unit	Unit Cost	Unit	Cost
Cowan Ranch Pipeline Extension from Verde Glen					
Pipeline - 6"	500	lf	$7.50	in-dia/lf	$22,500
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Surface Pavement Replacement	125	lf	$40	lf	$5,000
Rock Excavation*	28	cy	$45	cy	$1,200
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.05	lump sum	$170,000	lump sum	$8,500
Booster Pump Stations	1	stations	$0	station	$0
			Subtotal, Verde Glen Extension Cost		$82,200
				Contingencies @25%	$20,600
				Total Extension Cost	***$102,800***
			Total Costs, Extension to Cowan Ranch	$	102,800
Portion of Rim Trail WTP	-	kgallons	$10.25	kgallons	$0
				Total Capital Costs	**$102,800**
				Amortized Capital Costs	$9,700
Annual Operations and Maintenance	-	kgallons	$1.00	$/kgal	$0
			Total Annual Costs for Cowan Ranch		**$9,700**
Present Value of O&M over 20 years, at 7% rate					**$0**
TOTAL Life-Cycle Costs,Cowan Ranch					**$103,300**
No. of connections, 2002	19			**Cost/connection, 2002:**	**$5,440**
No. of connections, 2040	21			**Cost/connection, 2040:**	**$4,920**

SHADOW RIM RANCH GIRL SCOUT CAMP COSTS

Description	Quantity	Unit	Unit Cost	Unit	Cost
Pipeline Extension					
Pipeline - 6"	2,400	lf	$7.50	in-dia/lf	$108,000
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	600	lf	$40	lf	$24,000
Rock Excavation*	133	cy	$45	cy	$6,000
Water/Wash Crossings	2	crossing	$45,000	crossing	$90,000
Traffic Control	0.05	lump sum	$170,000	lump sum	$8,500
Booster Pump Stations	0	stations	$0	station	$0
				Subtotal, Extension Costs	**$236,500**
				Contingencies @25%	$59,100
				Total Extension Cost	***$295,600***
Portion of Rim Trail WTP	-	kgallons	$10.25	kgallons	$0
				Total Capital Costs	**$295,600**
				Amortized Capital Costs	$27,900
Annual Operations and Maintenance	-	kgallons	$1.00	$/kgal	$0
			Total Annual Costs for Shadow Rim		**$27,900**
Present Value of O&M over 20 years, at 7% rate					**$0**
TOTAL Life-Cycle Costs, Shadow Rim:					**$297,000**
No. of connections, 2002	1			**Cost/connection, 2002:**	**$297,000**
No. of connections, 2040	1			**Cost/connection, 2040:**	**$297,000**

BEAVER VALLEY COSTS					
Description	**Quantity**	**Unit**	**Unit Cost**	**Unit**	**Cost**
Pipeline Extension					
Pipeline - 6"	1,200	lf	$7.50	in-dia/lf	$54,000
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	300	lf	$40	lf	$12,000
Rock Excavation*	67	cy	$45	cy	$3,000
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.2	lump sum	$170,000	lump sum	$34,000
Booster Pump Stations	0	stations	$0	station	$0
				Subtotal, Extension Costs	**$148,000**
				Contingencies @25%	$37,000
				Total Extension Cost	***$185,000***
Beaver Valley WTP	16,917	kgallons	$10.25	kgallons	$173,400
				Total Capital Costs	**$358,400**
				Amortized Capital Costs	$33,800
Annual Operations and Maintenance	16,917	kgallons	$1.00	$/kgal	$16,800
				Total Annual Costs for Beaver Valley	**$50,600**
Present Value of O&M over 20 years, at 7% rate					**$178,800**
TOTAL Life-Cycle Costs, Beaver Valley					**$538,600**
No. of connections, 2002	165			**Cost/connection, 2002:**	**$3,260**
No. of connections, 2040	205			**Cost/connection, 2040:**	**$2,630**

WHISPERING PINES COSTS

Description	Quantity	Unit	Unit Cost	Unit	Cost
Pipeline Extension					
Pipeline - 6"	400	lf	$7.50	in-dia/lf	$18,000
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	100	lf	$40	lf	$4,000
Rock Excavation*	22	cy	$45	cy	$1,000
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.2	lump sum	$170,000	lump sum	$34,000
Booster Pump Stations	1	stations	$65,600	station	$65,600
				Subtotal, Extension Costs	$167,600
				Contingencies @25%	$41,900
				Total Extension Cost	*$209,500*
Whispering Pines WTP	21,584	kgallons	$10.25	kgallons	$221,200
				Total Capital Costs	**$430,700**
				Amortized Capital Costs	$40,700
Annual Operations and Maintenance	21,584	kgallons	$1.00	$/kgal	$21,500
				Total Annual Costs for Whispering Pines	**$62,200**
Present Value of O&M over 20 years, at 7% rate					**$228,900**
TOTAL Life-Cycle Costs, Whispering Pines					**$662,100**
No. of connections, 2002	171			**Cost/connection, 2002:**	**$3,870**
No. of connections, 2040	228			**Cost/connection, 2040:**	**$2,900**

Wonder Valley Main Extension - *serves communities of Freedom Acres, Sunflower Mesa and Wonder Valley from Wonder Valley WTP*

Description	Quantity	Unit	Unit Cost	Unit	Cost
Main Pipeline Extension					
Pipeline - 6"	50	lf	$7.50	in-dia/lf	$2,250
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	13	lf	$40	lf	$500
Rock Excavation*	3	cy	$45	cy	$100
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.1	lump sum	$170,000	lump sum	$17,000
Booster Pump Stations	0	stations	$0	station	$0
			Subtotal, Wonder Valley Extension Cost		$64,850
				Contingencies @25%	$16,200
				Total Extension Cost	***$81,050***
WONDER VALLEY COSTS					
Annual Water Demand, kgal:	0				
Total Water Demand for Extension, kgal:	2,082				
Percentage per Wonder Valley:	0%				
Portion of Wonder Valley Extension Costs:				**$**	-
Portion of Wonder Valley WTP	-	kgallons	$10.25	kgallons	$0
				Total Capital Costs	**$81,050**
				Amortized Capital Costs	$7,700
Annual Operations and Maintenance	-	kgallons	$1.00	$/kgal	$0
			Total Annual Costs for Wonder Valley		**$7,700**
Present Value of O&M over 20 years, at 7% rate					**$0**
TOTAL Life-Cycle Costs,Wonder Valley:					**$82,000**
No. of connections, 2002	13			**Cost/connection, 2002:**	**$6,230**
No. of connections, 2040	15			**Cost/connection, 2040:**	**$5,400**

SUNFLOWER MESA COSTS					
Annual Water Demand, kgal:	974				
Total Water Demand for Wonder Valley, kgal:	2,082				
Percentage per Sunflower Mesa:	47%				
Portion of Wonder Valley Extension Costs:					$ 37,900.00
Sunflower Mesa Pipeline Extension	(Pipeline from Freedom Acres to Sunflower Mesa, split costs with Wonder Valley)				
Pipeline - 6"	200	lf	$7.50	in-dia/lf	$9,000
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	50	lf	$40	lf	$2,000
Rock Excavation*	11	cy	$45	cy	$500
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.05	lump sum	$170,000	lump sum	$8,500
Booster Pump Stations	0	stations	$0	station	$0
			Subtotal, Sunflower Mesa Extension Cost		$65,000
			Contingencies @25%		$16,300
			Total Sunflower Extension Cost		***$81,300***
Annual Water Demand, kgal:	974				
Total Water Demand for Sunflower Extension, kgal:	2,082				
Percentage per Sunflower Mesa:	47%				
Portion of Sunflower Mesa Costs:					**$ 38,000.00**
			Total Costs, Extension to Sunflower Mesa		**$ 75,900**
Portion of Wonder Valley WTP	974	kgallons	$10.25	kgallons	$9,983
			Total Capital Costs		**$85,900**
			Amortized Capital Costs		$8,100
Annual Operations and Maintenance	974	kgallons	$1.00	$/kgal	$970
			Total Annual Costs for Sunflower Mesa		**$9,100**
Present Value of O&M over 20 years, at 7% rate					**$10,300**
TOTAL Life-Cycle Costs,Sunflower Mesa					**$96,900**
No. of connections, 2002	8		**Cost/connection, 2002:**		**$10,740**
No. of connections, 2040	10		**Cost/connection, 2040:**		**$8,590**

FREEDOM ACRES COSTS						
Annual Water Demand, kgal:	1,108					
Total Water Demand, kgal:	2,082					
Percentage per Freedom Acres:	53%					
Portion of Freedom Acres Extension Costs:					$	8,700.00
Annual Water Demand, kgal:	1,108					
Total Water Demand for Sunflower Extension, kgal:	2,082					
Percentage per Freedom Acres:	53%					
Portion of Sunflower Mesa Extension Costs:					$	43,265.12
Freedom Acres Pipeline Extension	(Pipeline from Sunflower Mesa to Freedom Acres)					
Pipeline - 6"	800	lf	$7.50	in-dia/lf		$36,000
Pipeline - 8"	0	lf	$7.50	in-dia/lf		$0
Pavement Surface Replacement	200	lf	$40	lf		$8,000
Rock Excavation*	44	cy	$45	cy		$2,000
Water/Wash Crossings	1	crossing	$45,000	crossing		$45,000
Traffic Control	0.05	lump sum	$170,000	lump sum		$8,500
Booster Pump Stations	0	stations	$0	station		$0
			Subtotal, Freedom Acres Extension Cost			$99,500
				Contingencies @25%		$24,900
			Total Freedom Acres Extension Cost			*$124,400*
			Total Costs, Extension to Freedom Acres		$	176,365
Portion of Wonder Valley WTP	1,108	kgallons	$10.25	kgallons		$11,356
				Total Capital Costs		**$187,700**
				Amortized Capital Costs		$17,700
Annual Operations and Maintenance	1,108	kgallons	$1.00	$/kgal		$1,100
			Total Annual Costs for Freedom Acres			**$18,800**
Present Value of O&M over 20 years, at 7% rate						**$11,700**
TOTAL Life-Cycle Costs,Freedom Acres						**$200,100**
No. of connections, 2002	13			**Cost/connection, 2002:**		**$14,440**
No. of connections, 2040	21			**Cost/connection, 2040:**		**$8,940**

East Verde Estates Water Extension - *serves communities of East Verde Estates and Flowing Springs*

Description	Quantity	Unit	Unit Cost	Unit	Cost
Main Pipeline Extension					
Pipeline - 6"	0	lf	$7.50	in-dia/lf	$0
Pipeline - 8"	14,800	lf	$7.50	in-dia/lf	$888,000
Pavement Surface Replacement	3,700	lf	$40	lf	$148,000
Rock Excavation*	958	cy	$45	cy	$43,100
Water/Wash Crossings	3	crossing	$45,000	crossing	$135,000
Traffic Control	0.5	lump sum	$170,000	lump sum	$85,000
Booster Pump Stations	0	stations	$0	station	$0
		Subtotal, East Verde Estates Main Extension Cost			$1,299,100
				Contingencies @25%	$324,800
				Total Extension Cost	***$1,623,900***
EAST VERDE ESTATES COSTS					
Annual Water Demand, kgal:	21,627				
Total Water Demand for Extension, kgal:	28,711				
Percentage per Verde Glen:	75%				
Portion of East Verde Main Extension Costs:					$ 1,223,200
Description	**Quantity**	**Unit**	**Unit Cost**	**Unit**	**Cost**
East Verde Pipeline Extension					
Pipeline - 6"	4,500	lf	$7.50	in-dia/lf	$202,500
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	1,125	lf	$40	lf	$45,000
Rock Excavation*	250	cy	$45	cy	$11,200
Water/Wash Crossings	2	crossing	$45,000	crossing	$90,000
Traffic Control	0.1	lump sum	$170,000	lump sum	$17,000
Booster Pump Stations	0	stations	$0	station	$0
		Subtotal, East Verde Estates Extension Cost			$365,700
				Contingencies @25%	$91,400
				Total Extension Cost	***$457,100***
				Total costs for connection to East Verde	***$1,680,300***
Portion of Payson WTP	21,627	kgallons	$6.40	kgallons	$138,410
				Total Capital Costs	**$1,818,700**
				Amortized Capital Costs	$171,700
Annual Operations and Maintenance	21,627	kgallons	$0.16	$/kgal	$3,440
		Total Annual Costs for East Verde Estates			**$175,100**
Present Value of O&M over 20 years, at 7% rate					**$36,600**
TOTAL Life-Cycle Costs,East Verde Estates					**$1,863,900**
No. of connections, 2002	164			**Cost/connection, 2002:**	**$11,090**
No. of connections, 2040	246			**Cost/connection, 2040:**	**$7,390**

FLOWING SPRINGS COSTS

Annual Water Demand, kgal:	7,084				
Total Water Demand for Extension, kgal:	28,711				
Percentage per Verde Glen:	25%				
Portion of East Verde Main Extension Costs:				$	400,700.00

Description	Quantity	Unit	Unit Cost	Unit	Cost
Flowing Springs Pipeline Extension					
Pipeline - 6"	5,000	lf	$7.50	in-dia/lf	$225,000
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	1,250	lf	$40	lf	$50,000
Rock Excavation*	278	cy	$45	cy	$12,500
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.1	lump sum	$170,000	lump sum	$17,000
Booster Pump Stations	1	stations	$108,000	station	$108,000
			Subtotal, Flowing Springs Extension Cost		$457,500
				Contingencies @25%	$114,400
				Total Extension Cost	***$571,900***
			Total Cost of Connection to Flowing Springs:		***$972,600***
Portion of Payson WTP	7,084	kgallons	$6.40	kgallons	$45,341
				Total Capital Costs	**$1,017,900**
				Amortized Capital Costs	$96,100
Annual Operations and Maintenance	7,084	kgallons	$0.16	$/kgal	$1,130
			Total Annual Costs for Flowing Springs		**$97,200**
Present Value of O&M over 20 years, at 7% rate					**$12,000**
TOTAL Life-Cycle Costs,Flowing Springs					**$1,034,700**
No. of connections, 2002	42			**Cost/connection, 2002:**	**$24,240**
No. of connections, 2040	80			**Cost/connection, 2040:**	**$12,720**

MESA DEL CABALLO COSTS

Description	Quantity	Unit	Unit Cost	Unit	Cost
Pipeline Extension					
Pipeline - 6"	200	lf	$7.50	in-dia/lf	$9,000
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	50	lf	$40	lf	$2,000
Rock Excavation*	11	cy	$45	cy	$500
Water/Wash Crossings	0	crossing	$45,000	crossing	$0
Traffic Control	0.2	lump sum	$170,000	lump sum	$34,000
Booster Pump Stations	0	stations	$0	station	$0
				Subtotal, Extension Costs	**$45,500**
				Contingencies @25%	$11,400
				Total Extension Cost	***$56,900***
Mesa del Caballo WTP	40,657	kgallons	$10.25	kgallons	$416,700
				Total Capital Costs	**$473,600**
				Amortized Capital Costs	$44,700
Annual Operations and Maintenance	40,657	kgallons	$1.00	$/kgal	$40,500
			Total Annual Costs for Mesa del Caballo:		**$85,200**
Present Value of O&M over 20 years, at 7% rate					**$431,100**
TOTAL Life-Cycle Costs, Mesa del Caballo					**$907,000**
No. of connections, 2002	409			**Cost/connection, 2002:**	**$1,160**
No. of connections, 2040	455			**Cost/connection, 2040:**	**$1,040**

STAR VALLEY COSTS - Will assume use of existing Pipeline					
Description	**Quantity**	**Unit**	**Unit Cost**	**Unit**	**Cost**
Pipeline Extension					
Pipeline - 6"	0	lf	$7.50	in-dia/lf	$0
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	0	lf	$40	lf	$0
Rock Excavation*	0	cy	$45	cy	$0
Water/Wash Crossings	0	crossing	$45,000	crossing	$0
Traffic Control	0	lump sum	$170,000	lump sum	$0
Booster Pump Stations	0	stations	$556,000	station	$0
				Subtotal, Extension Costs	$0
				Contingencies @25%	$0
				Total Extension Cost	**$0**
Portion of Payson WTP	97,117	kgallons	$6.40	kgallons	$621,550
				Total Capital Costs	**$621,600**
				Amortized Capital Costs	$58,700
Annual Operations and Maintenance	97,117	kgallons	$0.16	$/kgal	$15,450
			Total Annual Costs for Star Valley		**$74,200**
Present Value of O&M over 20 years, at 7% rate					**$164,500**
TOTAL Life-Cycle Costs, Star Valley:					**$789,900**
No. of connections, 2002	461			**Cost/connection, 2002:**	**$1,350**
No. of connections, 2040	1,101			**Cost/connection, 2040:**	**$560**

Round Valley Main Extension - *serves communities of Round Valley and Oxbow Estates from Town of Payson system*					
Description	**Quantity**	**Unit**	**Unit Cost**	**Unit**	**Cost**
Main Pipeline Extension					
Pipeline - 6"	0	lf	$7.50	in-dia/lf	$0
Pipeline - 8"	9,800	lf	$7.50	in-dia/lf	$588,000
Pavement Surface Replacement	2,450	lf	$40	lf	$98,000
Rock Excavation*	635	cy	$45	cy	$28,600
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	1	lump sum	$170,000	lump sum	$170,000
Booster Pump Stations	1	stations	$104,000	station	$104,000
			Subtotal, Round Valley Main Extension Cost		$1,033,600
				Contingencies @25%	$258,400
				Total Extension Cost	***$1,292,000***
ROUND VALLEY COSTS					
Annual Water Demand, kgal:	11,796				
Total Water Demand for Extension, kgal:	13,686				
Percentage per Verde Glen:	86%				
Portion of Round Valley Extension Costs:			$60	**$**	**1,113,600**
Description	**Quantity**	**Unit**	**Unit Cost**	**Unit**	**Cost**
Round Valley Pipeline Extension					
Pipeline - 6"	0	lf	$7.50	in-dia/lf	$0
Pipeline - 8"	4,500	lf	$7.50	in-dia/lf	$270,000
Pavement Surface Replacement	1,125	lf	$40	lf	$45,000
Rock Excavation*	291	cy	$45	cy	$13,100
Water/Wash Crossings	1	crossing	$45,000	crossing	$45,000
Traffic Control	0.5	lump sum	$170,000	lump sum	$85,000
Booster Pump Stations	1	stations	$60,000	station	$60,000
			Subtotal, Round Valley Extension Cost		$518,100
				Contingencies @25%	$129,500
				Total Extension Cost	***$647,600***
			Total cost of connection to Round Valley:		***$1,761,200***
Portion of Payson WTP	11,796	kgallons	$6.40	kgallons	$75,500
				Total Capital Costs	**$1,836,700**
				Amortized Capital Costs	$173,400
Annual Operations and Maintenance	11,796	kgallons	$0.16	$/kgal	$1,880
			Total Annual Costs for Round Valley		**$175,300**
Present Value of O&M over 20 years, at 7% rate					**$20,000**
TOTAL Life-Cycle Costs,Round Valley:					**$1,866,100**
No. of connections, 2002	178			**Cost/connection, 2002:**	**$10,320**
No. of connections, 2040	242			**Cost/connection, 2040:**	**$7,590**

OXBOW ESTATES COSTS

Annual Water Demand, kgal:	1,890				
Total Water Demand for Extension, kgal:	13,686				
Percentage per Oxbow Estates:	14%				
Portion of Round Valley Main Extension Costs:				$	178,400

Description	Quantity	Unit	Unit Cost	Unit	Cost
Oxbow Estates Pipeline Extension					
Pipeline - 6"	6,650	lf	$7.50	in-dia/lf	$299,250
Pipeline - 8"	0	lf	$7.50	in-dia/lf	$0
Pavement Surface Replacement	1,663	lf	$40	lf	$66,500
Rock Excavation*	369	cy	$45	cy	$16,600
Water/Wash Crossings	2	crossing	$45,000	crossing	$90,000
Traffic Control	0.4	lump sum	$170,000	lump sum	$68,000
Booster Pump Stations	1	stations	$19,000	station	$19,000
			Subtotal, Oxbow Estates Extension Cost		$559,350
				Contingencies @25%	$139,800
				Total Extension Cost	***$699,150***
			Total cost of connection to Oxbow estates		***$877,550***
Portion of Payson WTP	1,890	kgallons	$6.40	kgallons	$12,100
				Total Capital Costs	**$889,700**
				Amortized Capital Costs	$84,000
Annual Operations and Maintenance	1,890	kgallons	$0.16	$/kgal	$300
			Total Annual Costs for Oxbow Estates		**$84,300**
Present Value of O&M over 20 years, at 7% rate					**$3,200**
TOTAL Life-Cycle Costs,Oxbow Estates					**$897,400**
No. of connections, 2002	70			**Cost/connection, 2002:**	**$12,710**
No. of connections, 2040	75			**Cost/connection, 2040:**	**$11,860**