Water Resource Inventory

Of the

Española Basin

Prepared for Santa Fe County

September 17, 2013

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Executive Summary

Information on water use in the Española Basin was compiled into ArcGIS for ongoing planning and assessment of water conservation potential. Utilizing this water resource inventory and comparing per capita use to potential use under a conservation scenario revealed the potential for water savings of about 17 percent of the 23,400 acre-feet per year (ac-ft/yr) diverted by public water systems and domestic wells. The water savings could be achieved through implementation of water conserving technology inside and outside without changing the total area landscaped. More savings could be realized through reduction in irrigated area. Other water use sectors had insufficient data to adequately assess the potential for water savings.

Water Use Sector	Potential water savings (ac-ft/yr)
Public water systems	1,016
Commercial self-supplied	Unknown
Domestic wells	1,872
Treated Effluent	1,013
Agricultural irrigation	Unknown

While many public water systems have dramatically reduced their per capita demand over the last decade (from an average of 99 gallons per capita per day (gpcd) to 77 gpcd, some systems have the potential to reduce demand through the implementation of water conserving technology, such as drip irrigation.

Too few self-supplied commercial systems had any recent data on water diversions to estimate potential water savings for this sector. Only 42 out of 136 of these commercial systems report their well water usage. Commercial customers on the City of Santa Fe's water system have reduced water consumption significantly (over 50 percent) from 1998-2008, suggesting that there is potential for water savings in this sector.

Domestic wells served over 43,000 people in the region, diverting an estimated 5,600 ac-ft/year. Meter readings and water right records from domestic wells were assessed to determine actual water use. The median per capita demand from domestic wells estimated to be 112 gpcd or about 50 percent more than residential demand for customers served by public water systems.

The homes connected to the metered wells were evaluated using aerial photography of the area landscaped to determine the water requirements for conserving and non-conserving approaches to water use. More than 64 percent of the 161 households served by domestic wells could reduce their water consumption just through implementing appropriate conservation technology, without changes to the type and area landscaped, saving a total of 32 percent. More savings could be achieved beyond what was calculated here (with limitations on landscaped area and types of vegetation, for instance).

Of the 1,045 acres of turf in the Española Basin, 77 percent are irrigated with effluent, raw river water or are artificial turf. The remaining 243 acres are irrigated with potable water, which requires an estimated 1,000 ac-ft of water per year. The agricultural sector diverts most of the water in the region, 61,231 ac-ft of surface water, but an estimated 35,700 ac-ft/yr returns back to the surface water and/or groundwater aquifers, thus the total consumption (depletion) is about 25,500 ac-ft/yr. Water conservation in agriculture commonly increases the depletion by making better use of the applied water, which ultimately intercepts return flow water that otherwise serves other users, thus water conservation was not pursued for this sector.

Recommendations:

1. Develop conservation plans targeted for communities with higher per capita demand. ***Data Gap: Audits for each community with high water use to determine where savings can be achieved. Monthly diversion data for each water sector within the public water systems is required for the analysis. Average landscaped area for each community should be determined to quantify the water requirements for existing landscape types.***
2. Develop conservation plans for domestic wells. ***Data Gap: Audits for self-supplied homes with high water usage to determine where savings can be achieved. Monthly data and specific information on the number people served by each home will help determine the cause of high water use.***
3. Employ more staff at OSE or county governments to track water use in the region because only a small fraction of the domestic wells are metered and very little is known about the water use from the commercial sector. ***Data Gap: Diversion data for 23 percent of public water systems, 69 percent of self-supplied commercial systems***

and 98% of domestic wells, which currently have no reported metered water usage.

4. Explore the possibility of reducing the use of potable water currently irrigating 243 acres of turf. Currently, the municipalities of Santa Fe and Los Alamos do not have excess effluent to meet the existing daily demand. ***Data Gap: Details on the options to replace with artificial turf or use other source of supply for each park or golf course currently irrigated with potable water***.
5. Implement conservation technology where turf is irrigated (regardless of the source of water) to reduce the demands on those sources of supply. ***Data Gap: Application rates on all parks, turf type, water requirements for existing turf.***

1. Introduction

This report summarizes the data collection efforts to develop a GIS-based water resource inventory of the Española Basin to support Los Alamos, Santa Fe and Rio Arriba Counties in their efforts to develop and implement water management and conservation. As stated in the grant proposal (Bureau of Reclamation WCFSP Grant R11AP40026), the objective of the water resources inventory is "to determine water uses in both incorporated and unincorporated areas, i.e., municipalities and in areas not dependent upon utility infrastructure. The diverse water uses justify the need for characterization of water resources and future planning efforts for regional water systems, land use, community and economic development purposes."

2. Plan of Action by Partners

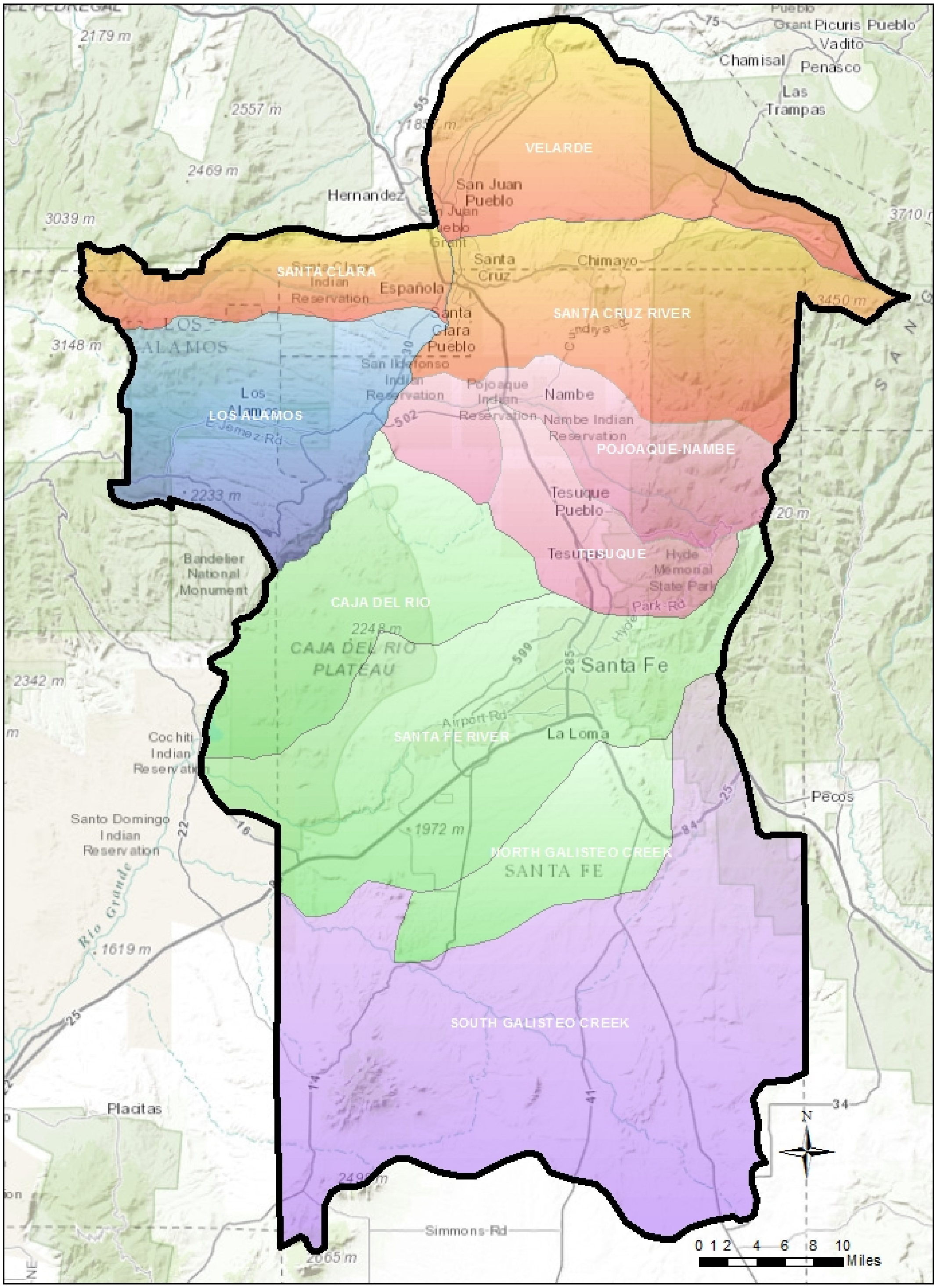
This effort was initiated by Santa Fe County, but guided by partners during a series of meetings. Collaborative partners included the Counties of Los Alamos and Rio Arriba, the City of Santa Fe, Jemez y Sangre Water Planning Council (JySWPC), and the Española Basin Regional Issues Forum (EBRIF). Partner meetings were held on October 13, 2011, April 27, 2012, August 24, 2012 and September 11, 2013 and attended by the partners listed in Appendix A1. The study area includes the Española basin (Figure 1), located in the Rio Grande watershed in northern New Mexico. While the Española basin can be defined by geologic or topographic features, we have defined the extent of the basin in this study to be consistent with the boundaries of the Jemez y Sangre Regional Water Plan area to make use of the available water demand data. Several subcommittees were formed to work on gathering data and develop a plan of action (Appendix A2) from specific sectors.

The ***Public Water System Subcommittee*** included Patricio Guerrerortiz and Craig O' Hare from Santa Fe County, Cheri Vogel from the Office of the State Engineer (OSE), Rick Carpenter from the City of Santa Fe Water Division, and Christine Chavez from Los Alamos County Water Utility.

The ***Agricultural Irrigation Subcommittee*** included Patricio Garcia and Lucia Sanchez from Rio Arriba County, Duncan Sill formerly of Santa Fe County, Laurie Trevizo from the City of Santa Fe and Molly Magnuson from the OSE.

The ***Domestic Well Subcommittee*** included Claudia Borchert, City of Santa Fe Water Division and Duncan Sill from Santa Fe County.

Figure 1. Map of Española Basin and Sub-Basins.



3. Water Supply Infrastructure Inventory

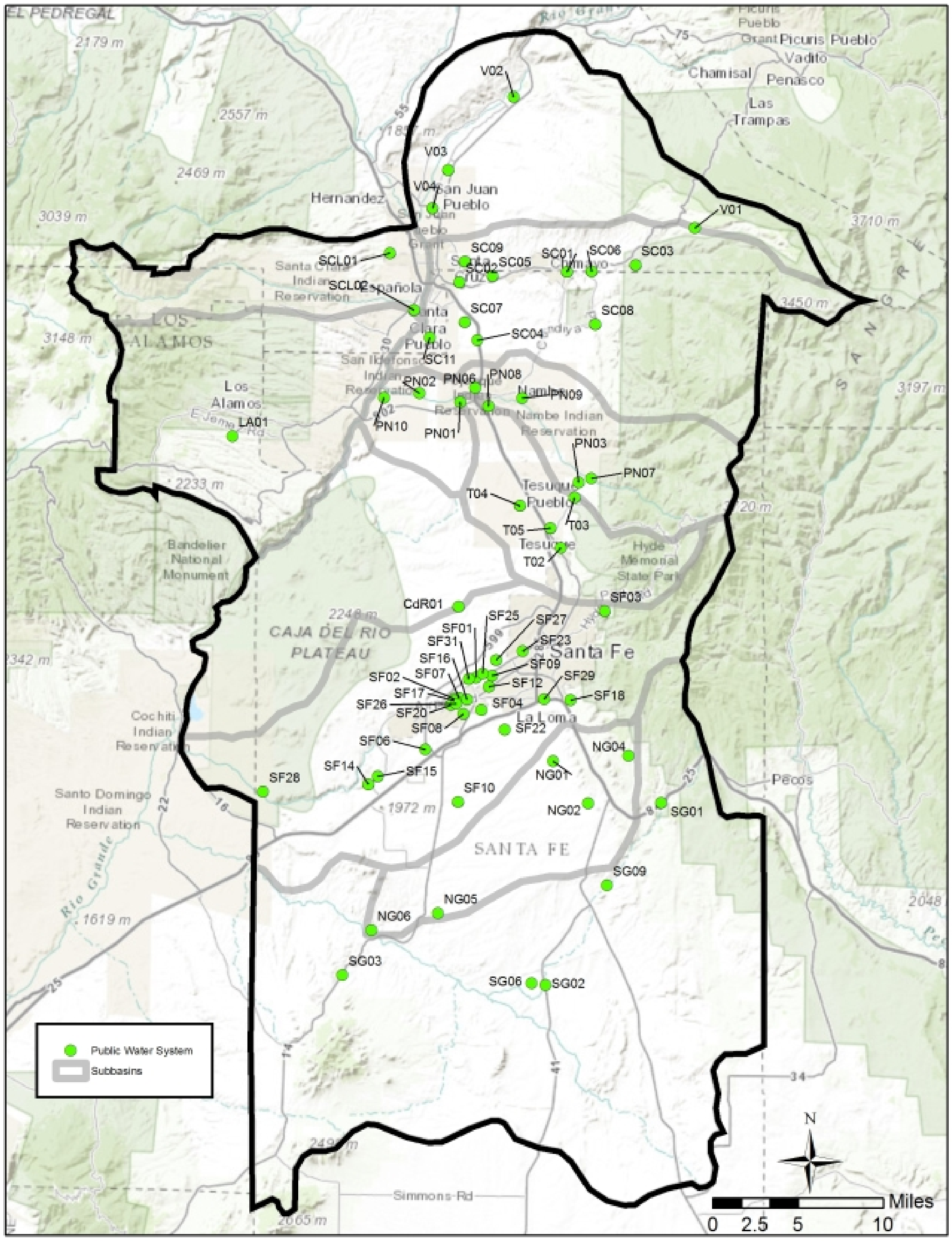
This water resource inventory recognizes all of the water demands that impact the resources in the Española Basin, but is focused on those categories where water conservation efforts could be implemented. The water budget components (inflow and outflow) for each of the sub-basins within the region were updated from the Jemez y Sangre Regional Water Plan (DBS&A & ACL, 2003). We have compiled the available data into the ArcMap GIS project for each of the water use categories, but have specifically explored in greater detail the municipal, community, and domestic water use to assist the counties in their planning efforts. Details and explanation of information contained in the GIS is provided in the Metadata accompanying project.

3.1 Public Water Systems

Data on 64 public water systems (Figure 2 and Table 1) were compiled using information collected from the New Mexico Environment Department Drinking Water Bureau (NMDWB), the OSE 2005 Water Use Report (Longworth, et al., 2008), preliminary data collected by OSE for the 2010 Water Use Report, and responses to a survey sent to the public water systems. Public water systems include municipal and county utilities, mutual domestic water consumers associations (MDWCA), mobile home parks and other private community systems. NMDWB defines Public Water Systems as those serving 25 or more people or 15 or more connections year-round. The NMOSE defines a public water supply system as community water systems that rely on a water source "other than wells permitted under 72-12-1 NMSA 1978" (Longworth, et al., 2008). Data collected included the location of the water system infrastructure, service area, population served, sources of supply and amount diverted each year. **Figure 3** shows the infrastructure data collected for all of the systems, which includes wells, storage tanks and treatment systems.

The public water system survey (Appendix B) requested feedback on the types of assistance that the water systems needed and the extent of their existing conservation efforts. Of the 64 public water systems, 16 responded to the survey. Eleven of the systems requested assistance with conservation planning, even though 14 currently have conservation plans. Fourteen requested assistance managing their infrastructure (**Figure 4**).

Figure 2. Location of Public Water Systems



Public Water Supply Systems in the Española Basin

Table 1. Public Water Systems and Arc Map Project ID

Water System ID	Public System Name
CdR01	Las Campanas Water & Sewer Coop
LA01	Los Alamos & White Rock Municipal Water System
NG01	Sunlit Hills of Santa Fe
NG02	Eldorado de Santa Fe
NG04	Canada de los Alamos
NG05	Santa Fe South Water Coop
NG06	El Vadito de Los Cerrillos MDWCA
PN01	Valley Cove Mobile Home Park (MHP)
PN02	El Rancho MHP
PN03	Chupadero Water Sewer Coop
PN06	Pojoaque Terraces MHP
PN07	Rio En Medio MDWCA
PN08	Pueblo of Pojoaque
PN09	Pueblo of Nambe
PN10	San Ildefonso Pueblo
SC01	Chimayo MDWCA
SC02	Santa Cruz MDWCA
SC03	Cordova MDWCA
SC04	Juniper Hills MHP
SC05	Cuartro Villas MDWUA
SC06	Rio Chiquito MDWCA
SC07	Solacito Homeowners Assn.
SC08	Cundiyo MDWCA
SC09	Española Water System (part)
SC11	Enchanted Mesa MHP
SCL01	Española Water System (part)
SCL02	Santa Clara Pueblo
SF01	Village MHP
SF02	Country Club Gardens MHP
SF03	Hyde Park Estates Cooperative Domestic Water Association
SF04	Juniper Hills PT Ranch
SF06	Wild and Wooley Trailer Ranch
SF07	Santa Fe Country Club Apartments
SF08	Santa Fe Mobile Home Hacienda
SF09	Santa Fe West MHP
SF10	Penitentiary of New Mexico
SF12	Trailer Ranch MHP

Water System ID	Public System Name
SF14	La Cienega Owners Associations Water System
SF15	La Cienega MDWCA
SF16	Casitas de Santa Fe
SF17	Shalom MHP
SF18	La Vista Homeowners Assn.
SF20	Country Club Estates
SF22	Santa Fe County Utilities
SF23	City of Santa Fe Water Utility
SF25	Aqua Fria Water Association
SF26	Asi La Mar Trailer Park
SF27	West Alameda
SF28	La Bajada MDWCA
SF29	Sierra Vista Retirement Community
SF31	Lone Star Trailer Ranch
SG01	Cañoncito at Apache Canyon MDWCA
SG02	Galisteo MDWCA
SG03	Madrid Water Co-Op
SG06	Ranchitos de Galisteo WUA
SG09	Lamy MDWCA
T02	Tesuque MDWCA
T03	Vista Redonda MDWCA
T04	Pueblo of Tesuque
T05	Tesuque Pueblo Trailer Village
V01	Truchas MDWCA
V02	Velarde MDWCA
V03	Alcalde MDWCA
V04	Ohkay Owingeh Pueblo

Figure 3. Infrastructure for public water systems included in the GIS coverage.

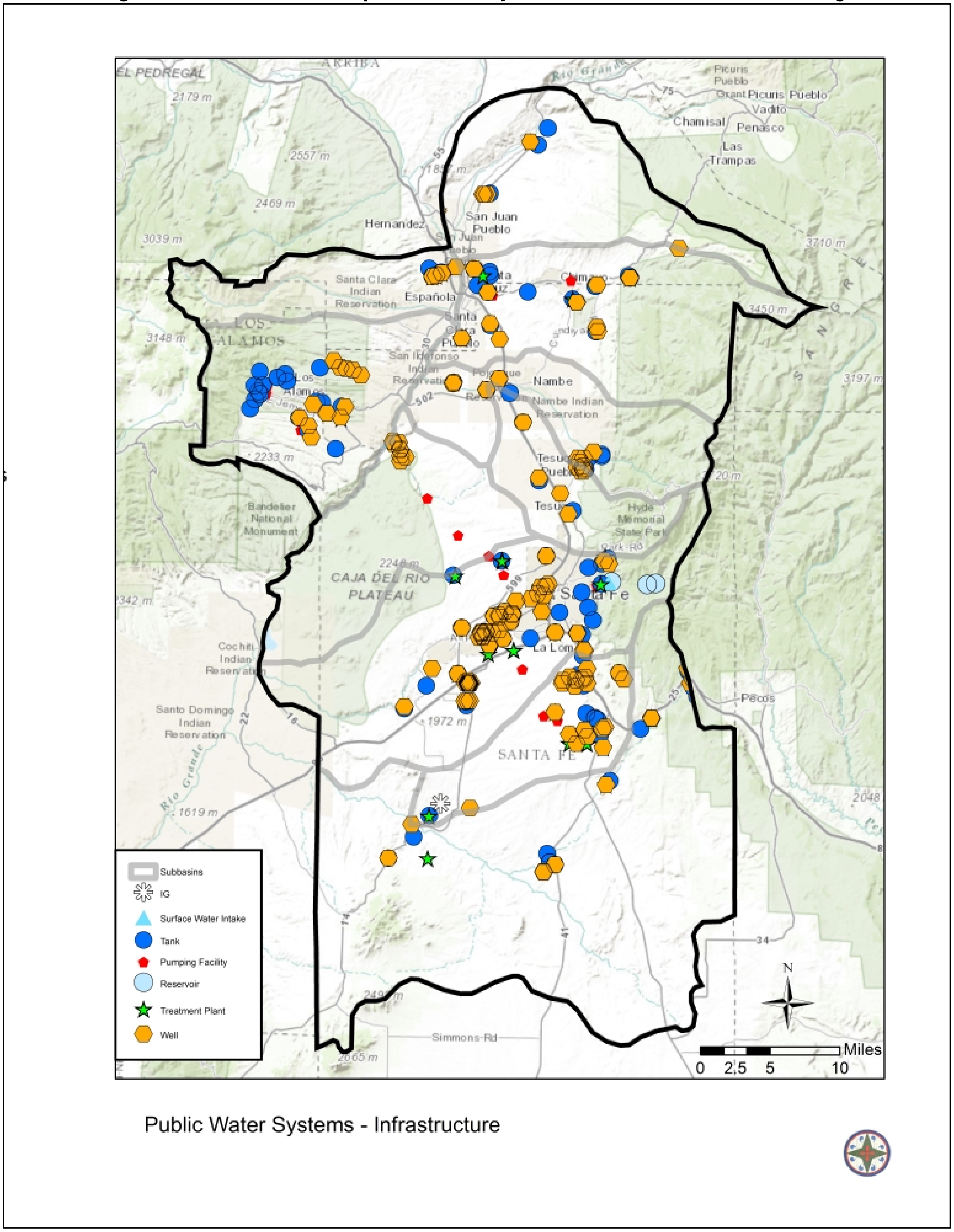
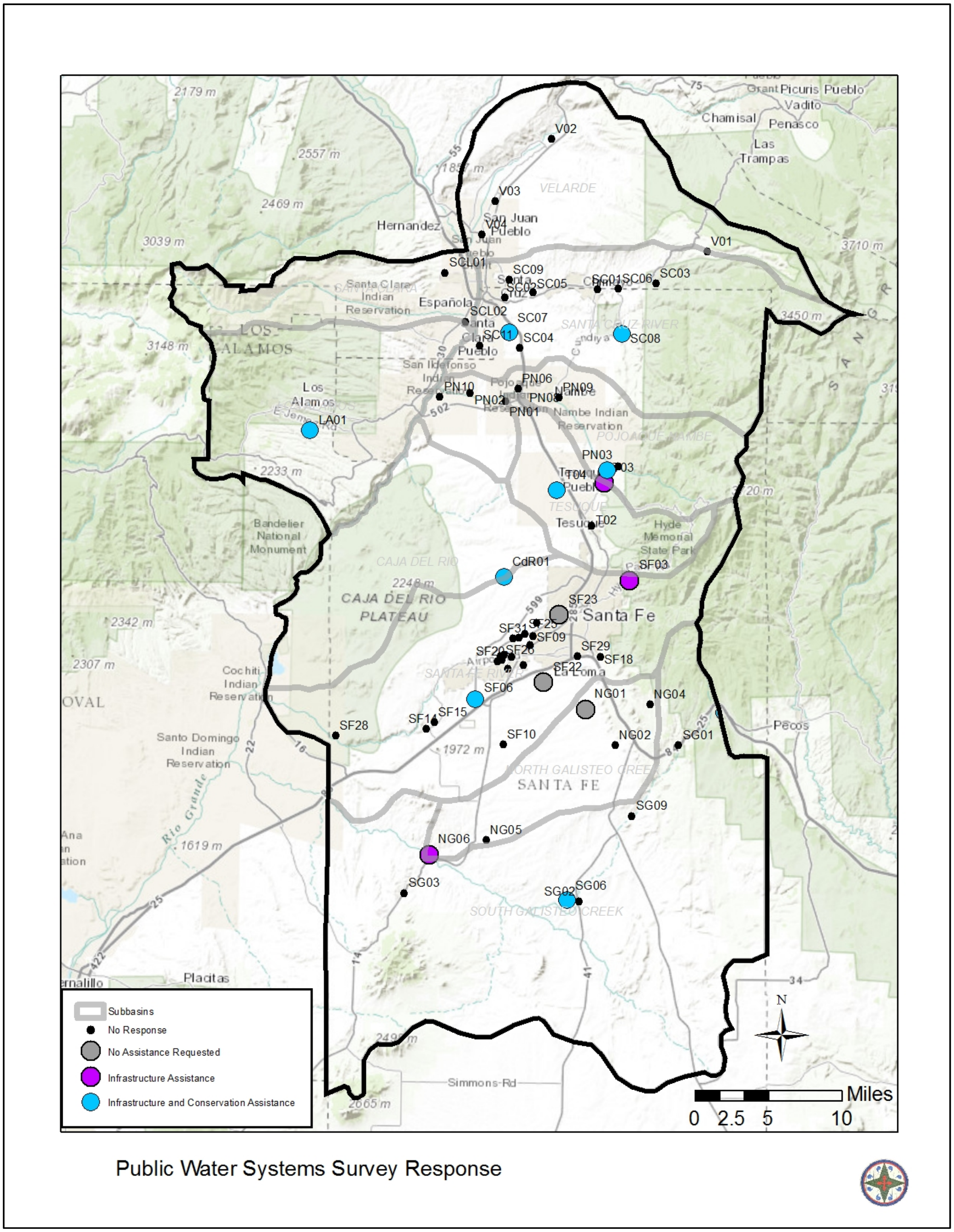


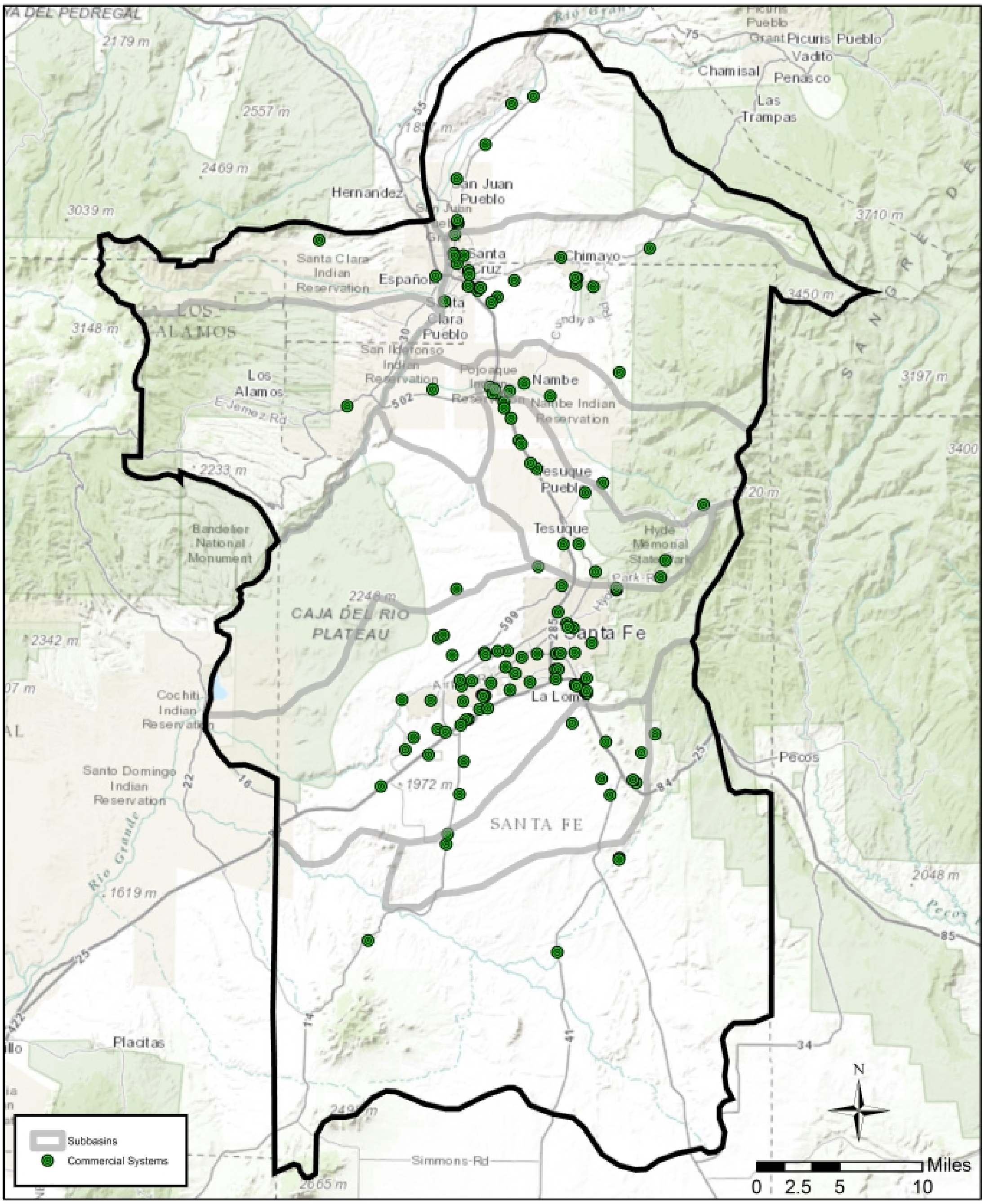
Figure 4. Response to survey of public water systems.



3.2 Self-supplied Commercial, and Industrial, Mining and Power Water Systems

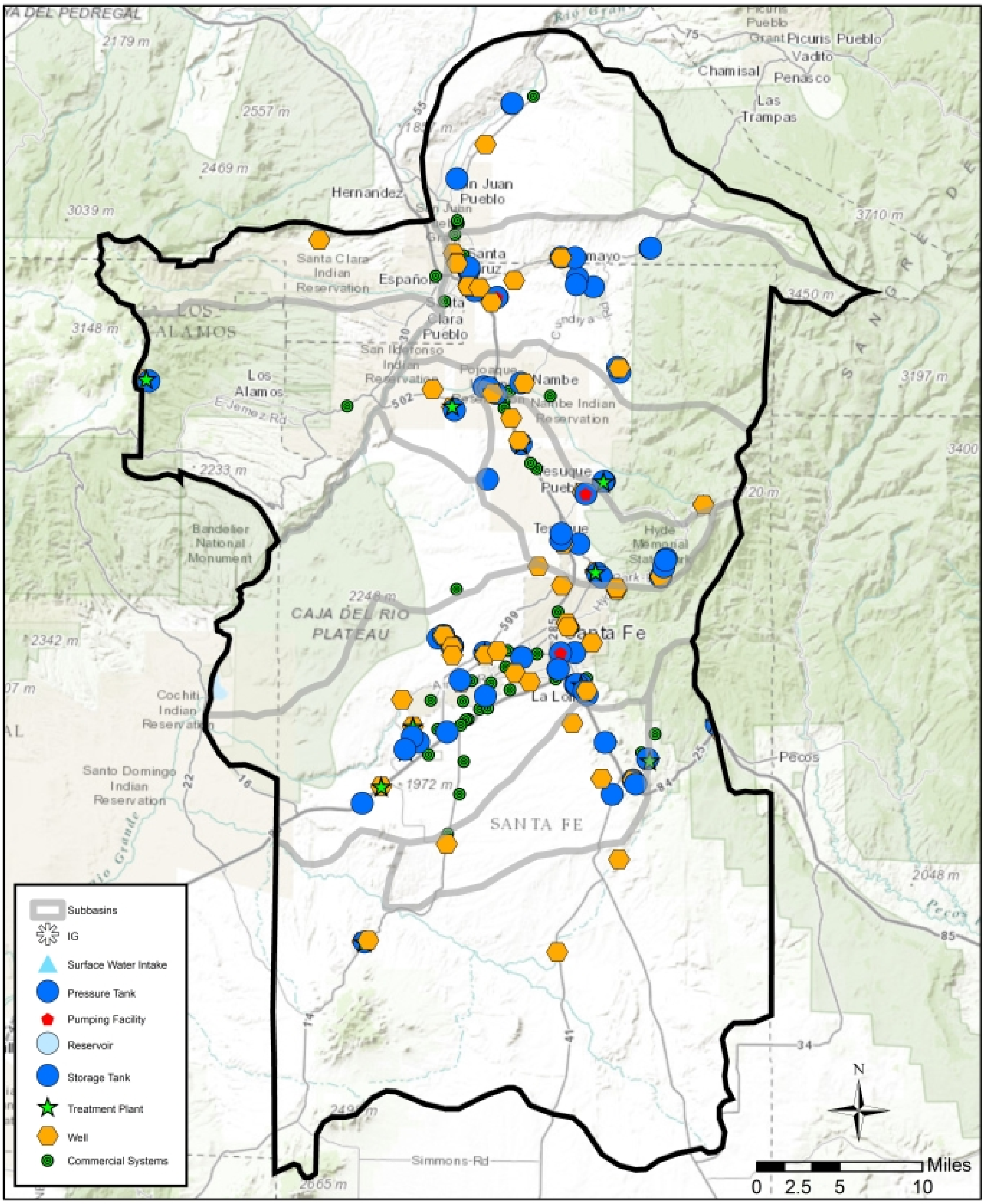
Water diversion data on 139 self-supplied commercial (including schools, resorts, restaurants, and other businesses), industrial, mining and power facilities with their own water supply systems were compiled into the GIS system. Most of the commercial, industrial, mining and power systems in the Española Basin fall under the commercial category, with the exception of mining in the Ortiz Mountains and minor gravel operations, thus this category is described as the “commercial” sector for ease of discussion. Sources included the NMDWB, OSE 2005 Water Use Report and preliminary data for OSE’s 2010 Water Use Report. **Figure 5** shows the commercial water systems and **Figure 6** shows the extent of the infrastructure data available for the commercial systems.

Figure 5. Commercial Water Systems in the Española Basin



Commercial Self-Supplied Systems

Figure 6. Infrastructure of commercial self-supplied water systems.



Commercial Water Systems - Infrastructure

3.3 Self-Supplied Domestic

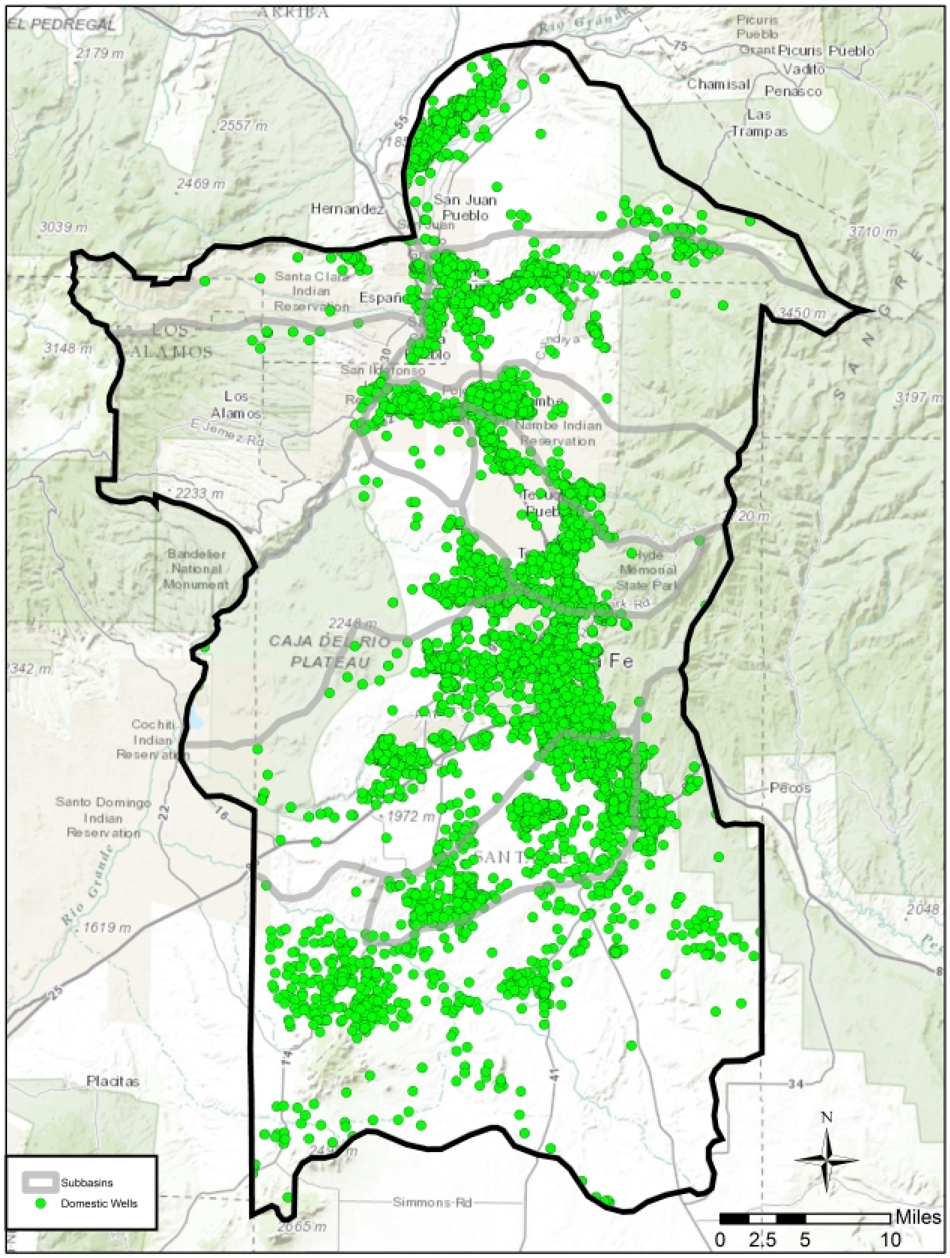
Self-supplied domestic wells are wells serving one to several households or incidental commercial uses and are permitted under the NM Statute 72-12-1. Approximately 8,200 such wells are permitted and contain information in OSE WATERS database in the Española Basin (Figure 7). Wells drilled before the groundwater basin was declared are not included in the database. Drinking and sanitary uses that are incidental to the operations of a governmental, commercial, or non-profit facility are included in this definition of domestic wells (D'Antonio, 2011), thus some of the 8,200 wells include wells serving gas stations or restaurants. Of these wells, about 500 wells are metered as shown in **Figure 8**. Wells are only metered if they serve a commercial business, serve more than one household, have other water rights transferred to the well, or are included in the Aamodt Settlement.

The water right records for the 500 metered wells were reviewed to determine the number of houses serving each well. Where possible, the homeowner was contacted to determine the number of homes or units on each well, clarify meter records and identify the address for each home served by the well. The average household size from the census was used to estimate the population served by each well, except where the owner provided actual household size. Of the total metered wells we have two levels of domestic well use data:

Group 1. A total of 141 wells and meter records stated the *number* of homes served (but not necessarily which homes). This group of 141 wells/meters serves 291 homes in Rio Arriba and Santa Fe Counties.

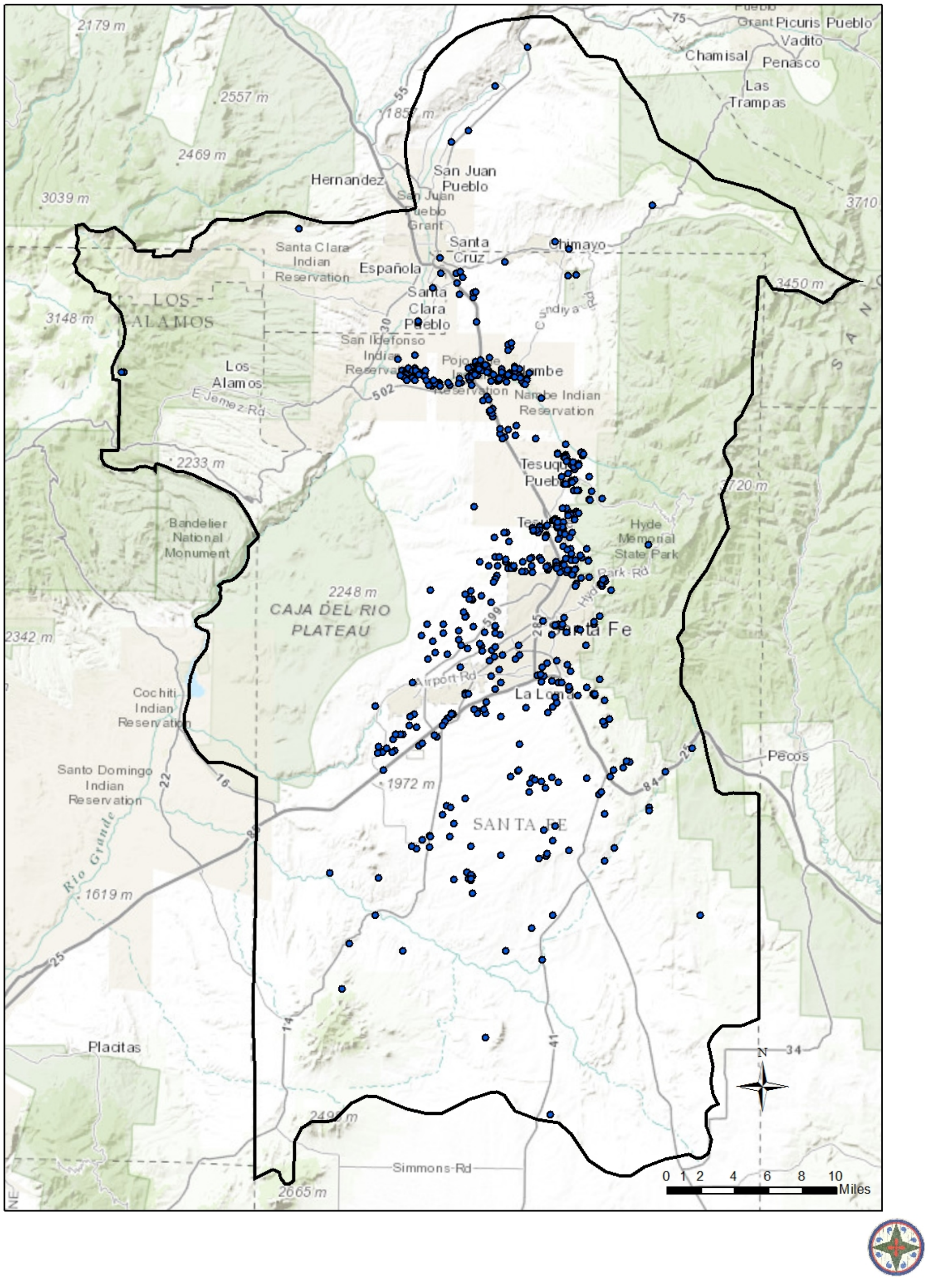
Group 2. A subset of Group 1 wells (about half) contained information on *which* homes were served by the well/meter. For the 71 wells (of which some have multiple meters), the landscaping was digitized using Bing Aerial photography and high resolution imagery for 2008 and 2011 provided by Santa Fe County. The 71 wells (with 81 meters) are connected to 161 homes, all within Santa Fe County.

Figure 7. Domestic wells in the Española Basin available on OSE WATERS database.



8,200 Domestic wells in the Española Basin

Figure 8. Metered domestic wells in the Jemez y Sangre Region



3.4 Agricultural Water Use

Data on agricultural water use was compiled into the GIS project from a variety of sources. The OSE WATERS data base has information on diversions from groundwater and surface water. GIS coverage of irrigated land was previously compiled into for the Jemez y Sangre Regional Water Plan (DBS&A and ACL, 2003 and Duke, 2001). Santa Fe County provided shape files showing the extent of the hydrographic surveys, and BOR provided details of the irrigation associated with the Aamodt Adjudication (Tesuque and Pojoaque-Nambe sub-basins). Agricultural water use is concentrated in the northern portion of the Española Basin (**Figure 9**). Information on cropping patterns was available for part of the Española Basin (Figure 10). For the area where the cropping patterns were provided, alfalfa, hay and native pasture make up 44 percent of the crops (**Table 2**). Efforts to update the water demand for the agricultural sector through conversations with the OSE and the County Extension agents (Torres, 2012 and Valdez, 2012) revealed no changes to the estimate of irrigated acreage or water use characterized in the Jemez y Sangre Regional Water Plan (DBS&A and ACL, 2003).

Surface water rights shown in Figure 10 are divided into two types: declarations and permits. Surface declarations are water rights from rivers or streams that are “grandfathered” in because they existed at time a surface water basin was declared and surface permits were issued later through a water rights permitting process.

Table 2. Crop distribution in the northern Española Basin.

CROP TYPE	Total Area	Smallest Farm	Largest Farm	%
	acres			
Alfalfa	2506.1	0.024	48.3	26%
Cotton	5.5	5.5	5.5	0.06%
Fallow	2887.2	0.5	143.7	30%
Hay (all other)	1246.3	0.8	273.2	13%
Irrigated Native Pasture	443.9	1.3	84.0	5%
Misc. Field Crops	851.3	1.5	72.3	9%
Misc. Pasture Grass	114.9	3.4	40.3	1%
Spring Small Grain	860.2	1.0	67.0	9%
Winter Small Grain	709.2	1.5	28.8	7%
Total	9624.5			100%

Figure 9. Information regarding agricultural water use in the GIS project.

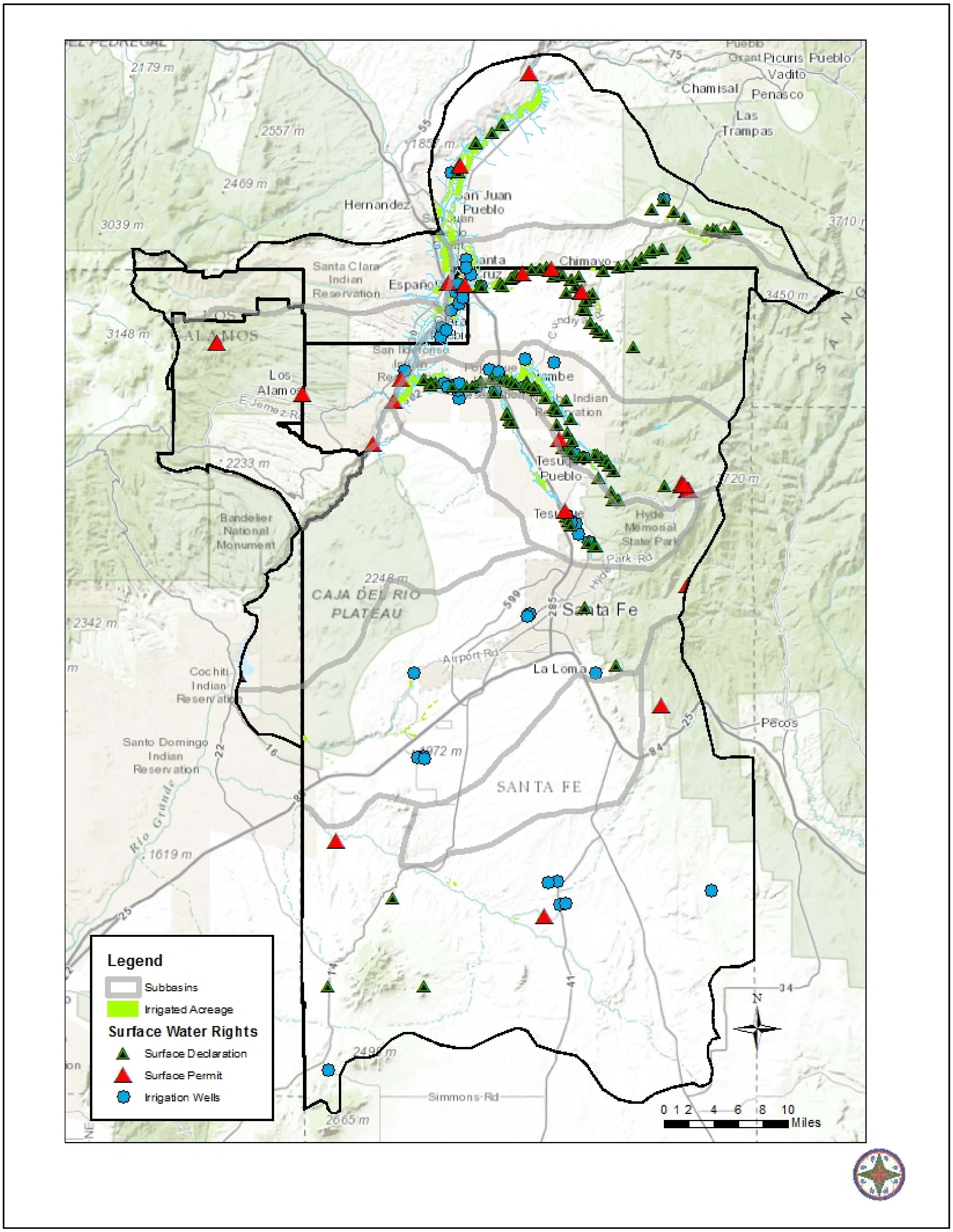
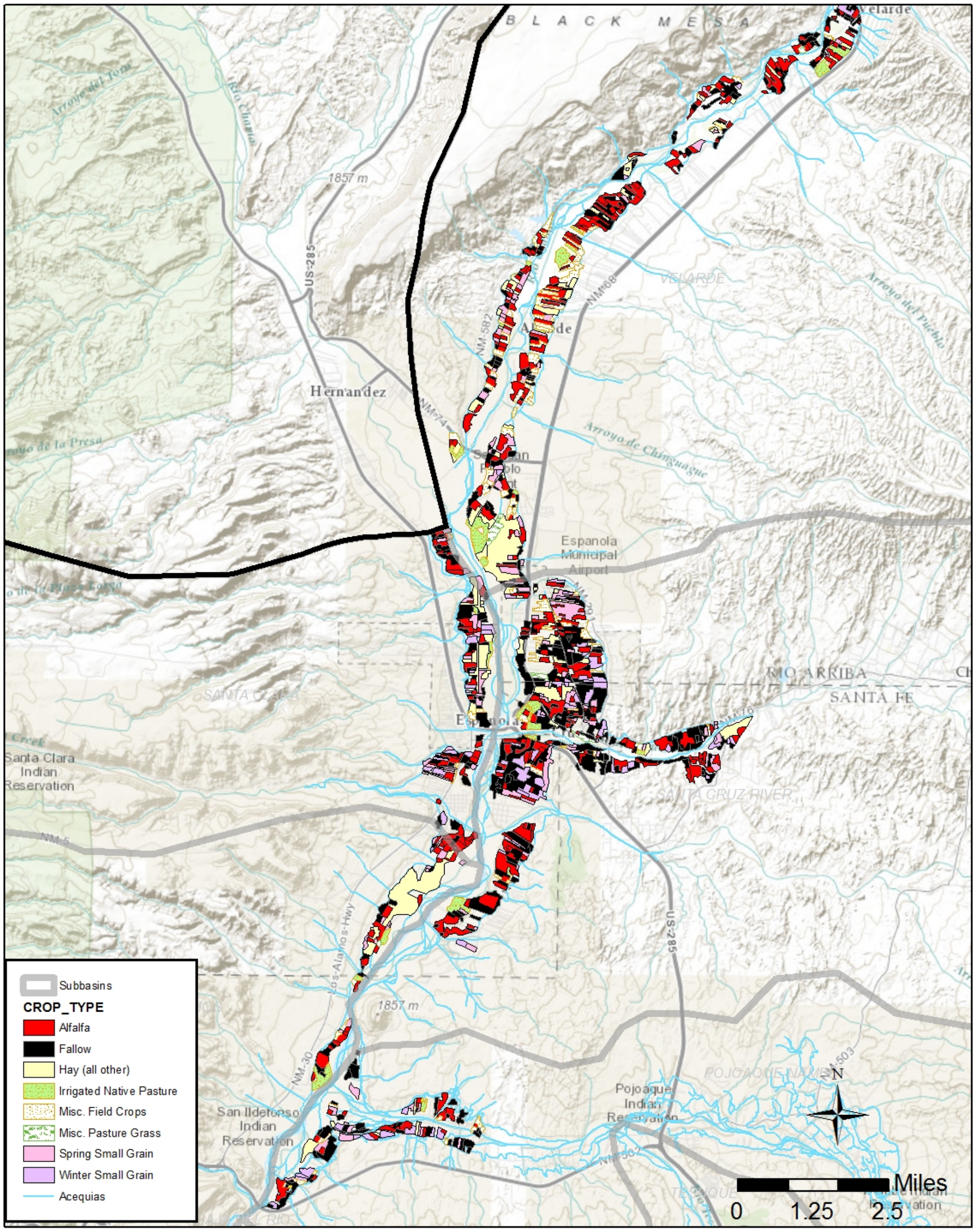


Figure 10. Crop Distribution in the Northern Española Basin.



Cropping patterns in part of the Española Basin (Source:OSE GIS)

3.5 Treated Effluent Use

Use of treated effluent in the Jemez y Sangre region has been ongoing since 1941 (CDM, 2001) for irrigating farms and turf, such as golf courses and parks. Turf that was visible from aerial photography at a scale of 1:15,000 was digitized and characterized as to the source of irrigation (Figure 11) using information from two recent studies for Los Alamos Water Utility and the City of Santa Fe. Both communities utilize treated effluent, but are limited to full utilization due to lack of storage for treated effluent produced during the winter when irrigation is minimal.

The Los Alamos Water Utility contracted to Forsgren Associates Inc., to conduct an extensive survey on the conservation potential of reclaimed wastewater (Forsgren, 2013). In this report, Forsgren examined the water diversions, type of turf, source of supply and application rates for each of the parks in the community and developed recommendations for making better use of treated effluent. Los Alamos produces an average of about 1,350 ac-ft/yr of effluent from two WWTP, which represents a return of 53 percent of the volume of water sold to Los Alamos and White Rock (not including LANL). An average of about 285 ac-ft/yr or 21 percent of the effluent is used for irrigating turf in the community. During summer months, the average monthly production is about 36.6 million gallons and the average peak use is 22 million gallons, or 60 percent of the available treated effluent.

The City of Santa Fe recently approved a Reclaimed Wastewater Resource Plan (Borchert, 2013) that is an integral part of their water resource management. The plan was expressly written to catalog the existing uses and potential future uses of treated effluent, and develop recommendations for the future use of reclaimed wastewater over the next 20 years.

The City of Santa Fe has an annual reclaimed wastewater production volume of approximately 5,600 ac-ft, which is the volume used for user allocation determinations in the revised plan. On a monthly production basis, the City of Santa Fe Wastewater Reclamation Plant produces approximately 467 ac-ft per month, or approximately 5 million gallons per day. On an annual basis, approximately 20 to 25 percent (1,278 ac-ft/yr) is routed to current reclaimed wastewater customers (for irrigating turf, construction, dust suppression, watering wildlife, etc.); the remainder is discharged into the Santa Fe River.

According to the 2013 Reclaimed Wastewater Resource Plan, 62 percent of the potable water produced by the City of Santa Fe's water customers ends up at the City's Wastewater Reclamation Plant. Approximately 38 percent of the potable water produced by the City is consumed and not returned to the WWTP for reclamation and reuse.

The source of water, amount of water diverted for each field was compiled into the GIS.

3.6 Riparian Vegetation Use

Riparian habitats occur along perennial and ephemeral stream reaches in areas beyond the channel confines where flooding occurs. Riparian habitat is vital to many species, including beaver, migratory birds, the listed endangered species southwestern willow flycatcher, and the northern leopard frog, which is designated as a sensitive species under the Endangered Species Act. Riparian habitat requires water and consumes water, which is why it is included in assessments of water resources.

Shape files of riparian vegetation were imported from recent projects for Santa Fe County: Galisteo Watershed: Wetlands for the Santa Fe Growth Management Strategy (Milford, et al 2009) and a wetlands action plan for Santa Fe County (Jansens, 2012).

3.7 Surface Water Evaporation

The rate of surface water evaporation (Figure 12) was imported from a shape file created for the Jemez y Sangre Regional Water Plan by Duke Engineering (2001). Surface water evaporation rates can be used to calculate water depletions from reservoirs, ponds and swimming pools.

Figure 11. Irrigated turf in the Jemez y Sangre Region

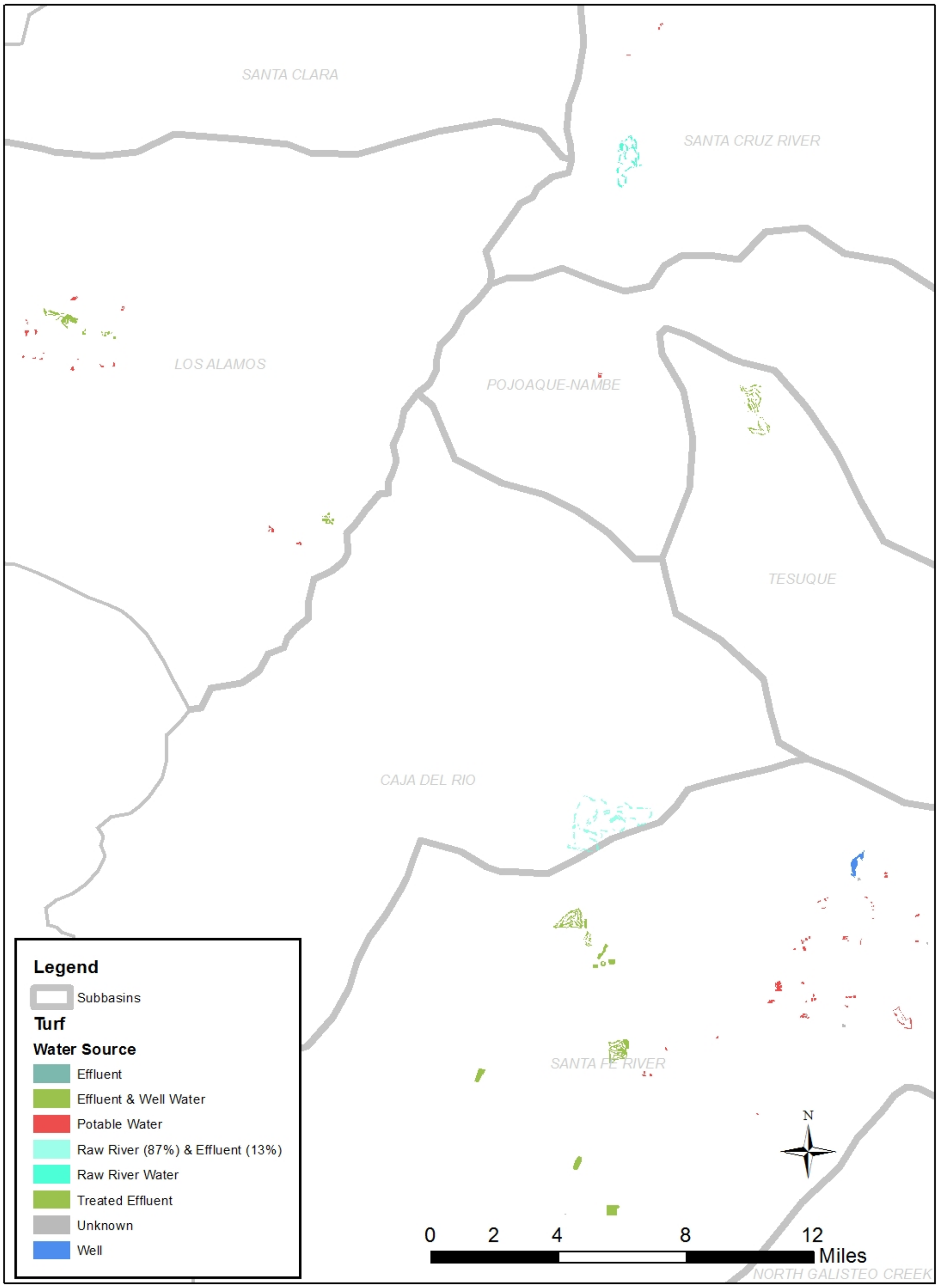
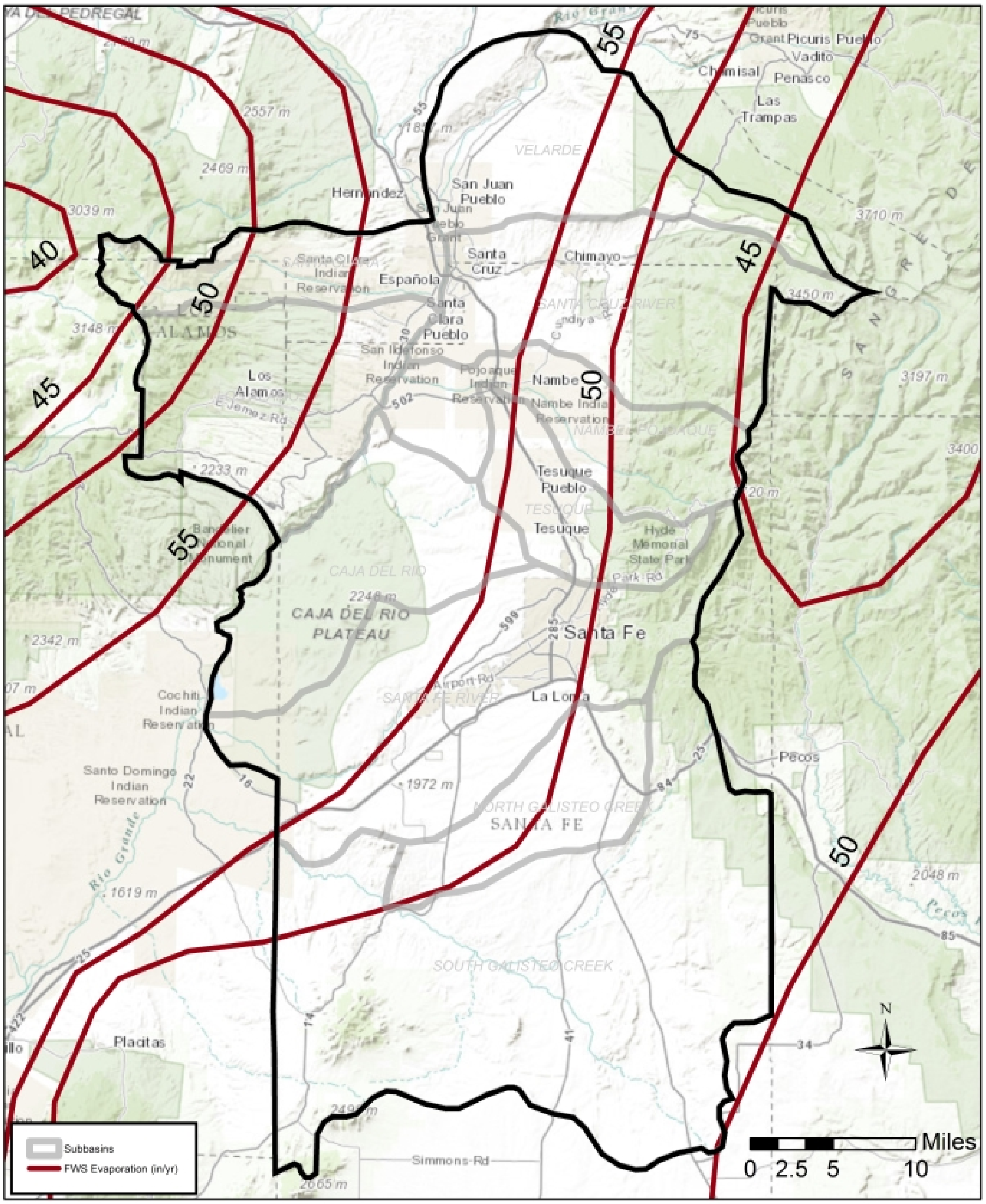


Figure 12. Free Water Surface Evaporation in the Espanola Basin.



Free water surface evaporation rate (inches/year)
in the Española Basin

4. Water Demand Characterization and Conservation Potential

Water demand for the following sectors, public water systems, commercial self-supplied systems, and domestic wells, is estimated based on meter readings for each sector. Tables C1 and C2 show the total estimated diversions from groundwater and surface water, respectively. The conservation potential for the public water systems and self-supplied domestic sectors is estimated for residential use only. The potential for water conservation for the self-supplied commercial sector is not estimated because too little data is available to quantify the water demand and thus, assess the water conservation potential for each business. Agricultural water conservation was discussed at length at an early partners meeting, but quantifying the potential remains elusive as discussed below.

The potential for water conservation was assessed by comparing the actual use to what would be needed if conservation technology were implemented. This was chosen to illustrate the savings that could be achieved without compromising lifestyle choices or aesthetics. More savings could be achieved through development of other standards (a draconian standard would be no outdoor watering, for example). Methods to implement water conservation are not discussed here, only the potential for water savings. Methods vary from education and incentives to rate structures and fines, all of which have differing levels of effectiveness.

4.1 Public Water Systems

The 64 public water systems (Table 1) serve over 136,000 people in the region and divert about 10,000 ac-ft/yr from groundwater and 8,000 ac-ft/yr from surface water (Tables C1 and C2). An acre-foot is the volume of water that covers one acre in one foot of water, or about 325,851 gallons. The per capita demand for the residential sector ranges from 40 to 242 gallons per capita per day (gpcd) with an average of 77 gpcd (Figure 13).

To estimate the potential for conservation, an “average conserving” per capita was calculated for each sub-basin using the water demand rates for indoor use (Vickers, 2001) and demand rates for landscaping developed by OSE (Wilson, 1996). The per capita rates for indoor water use for conserving and non-conserving households are shown in Table 3. Non-conserving households are those with pre-1980 fixtures such as toilets that use 5 gallons per flush instead of 1.6 gallons. The indoor per capita rate for a conserving household was the same for all areas

Figure 13. Per Capita Residential Demand for Public Water Systems.

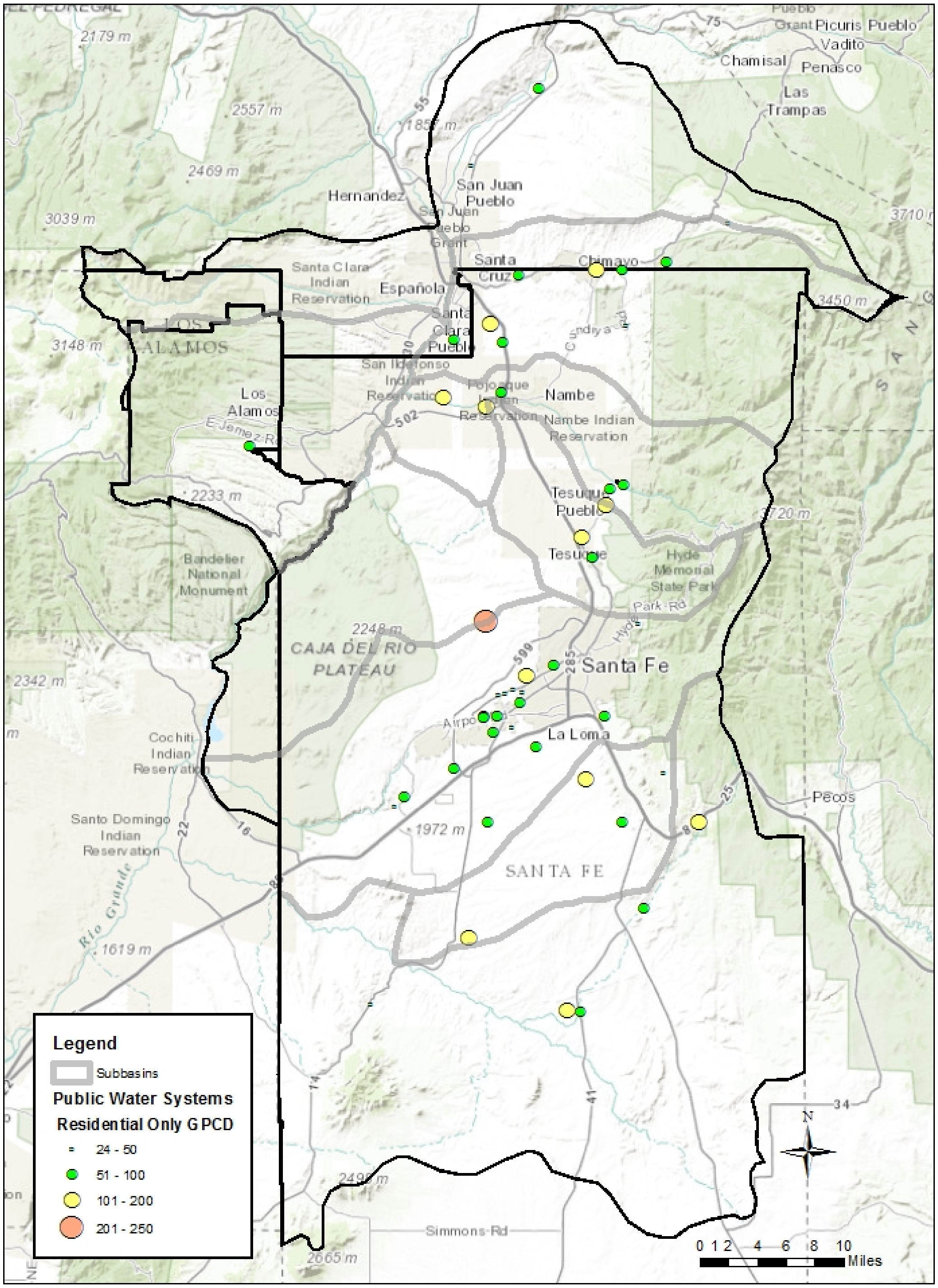


Table 3. Indoor per Capita Water Demand for Conserving and Non-Conserving Households

Indoor Water Use	Conserving Household (up-to-date plumbing fixtures and water conserving appliances)			Pre-1980s plumbing fixtures			Potential Savings per capita
	per use	uses per day per person	per capita water use	per use	uses per day per person	per capita water use	
	gallons		gpcd	gals		gpcd	gpcd
Toilet Flush	1.6	5.1	8.2	5	5.1	25.5	17.3
Toilet Leakage			4.0			9.5	5.5
Showers	11.7	0.75	8.8	30.7	0.75	23.0	14.2
Baths			1.2			1.2	0.0
Faucets			10.8			26.7	15.9
Dishwashers	7	0.10	0.7	14	0.1	1.4	0.7
Washing machines	27	0.37	10.0	56	0.37	20.7	10.7
Other domestic			1.6			NA	
Total Indoor			**45.3**			**108.1**	**62.8**

(Vickers, 2001)

of the Jemez y Sangre region. In some parts of New Mexico, swamp coolers are very common and use 20 gpcd (Wilson, 1996), but we have assumed that they are relatively uncommon in this region. A conserving household per capita indoor water demand is estimated at 45 gpcd, less than half of a non-conserving household with an estimated indoor demand of 108 gpcd. Thus if indoor fixtures are replaced, water savings could be up to 63 gpcd.

Residential outdoor water use is determined primarily by two factors: 1) the amount (area) and type of irrigated landscaping (including vegetable gardens, orchards, pasture, etc.) and 2) how efficiently the landscaping is irrigated. If conservation technology, such as drip/micro-irrigation, pop-up sprinklers with Matched Precipitation (MP) rotator heads, leveling, timing and appropriate spacing of emitters, are deployed outdoor water use can be reduced more than 40 percent (Wilson, 1996). There are, of course, other, generally more incidental, outdoor uses of water such as vehicle washing, permanent or portable swimming pools, fountains and hot tubs, etc.

It is, of course, a matter of opinion as to what is an "acceptable" or "appropriate" amount and type of irrigated landscaping for residential properties in northern New Mexico's arid climate. This report does not address, let alone resolve that issue. Individuals and communities will develop their own standard and prototype for landscapes. The City of Santa Fe, for instance, limits turf area of cool-season grasses to 1,000 square feet or 10 percent of the lot size (for single family dwellings), whichever is less (Land Development Code, Article 14.8.4E, Ord. No. 2011-37 § 10). Some pueblos do not allow any outdoor landscaping, thus their standard would be much different than the one developed here. The point of developing the "typical" area based on existing landscaping is to help guide county planners to determine the best conservative strategy. Thus, if the actual per capita is less than the amount calculated for a conserving household, planners will know that further efforts to reduce water use through conservation technology will not produce significant savings.

To calculate the outdoor water use for conserving and non-conserving households, a set area of irrigated trees, gardens and turf were assumed that represent the typical landscape for the public water systems. By making this assumption, we are calculating the water savings that could be gained by implementing water conservation technology to irrigate *existing* landscaping. More saving could be gained by reducing the area landscape or by replacing the vegetation with xeriscaping (low water use landscaping), for instance. However, it is our intent to illustrate the water gains that could be made without changing the amount or type of landscaping, but rather, just smart, efficient use of water.

The difficultly with this approach is to identify the "typical" landscape on which to base the average water demand if conservation or non-conserving technologies are applied. Ideally, we would measure every yard served by each water system and calculate an average area of turf, trees and gardens. While that is not possible within the scope of this project, we do have the average landscape area from homes that were digitized for the analysis of domestic wells discussed in Section 4.3. **Table 4** summarizes the average landscaped area of the 161 homes that was used for calculating a typical landscape. Turf includes irrigated grass, trees include non-native irrigated trees and shrubs, and gardens include vegetable and flower beds (annual and perennial).

Table 4. Average Landscaped Area of Homes.

Landscape Category	Area (ft^2)
Turf	350
Trees	2,300
Garden	340

The water demands for irrigation vary based on elevation, aspect and latitude and type of landscaping (Table 5). The type of grass used for turf greatly impacts the water demand: Kentucky bluegrass uses more than twice the amount of water that buffalo grass requires (Wilson, 1996). Native vegetation generally requires much less water and less frequent watering, once the vegetation is established.

Table 5. Irrigation Requirement for Landscape in Three Locations.

	Irrigation Requirement (gal/ft^2/day)		
Location	Santa Fe	Española	Los Alamos
Turf			
Kentucky Bluegrass with traditional sprinklers	32.7	37.99	28.76
Buffalo Grass with traditional sprinklers	14.9	19.7	11.1
Buffalo Grass with conservation technology	8.8	11.6	6.5
Bermuda Grass with conservation technology	13.7	16.8	11.4
Ornamental (non-native) Trees and Shrubs			
Trees with flood or Sprinkler	16.13	20.74	12.44
Trees with conservation technology	9.49	12.20	7.32
Herb and Vegetable Gardens			
Gardens with flood or sprinkler	15.11	18.28	12.06
Gardens with conservation technology	8.89	10.75	7.09

(Wilson, 1996)

While there are many permutations that impact the water demands of residential landscape, the “conserving” outdoor demand calculated here is based on 350 ft^2 turf of buffalo grass, 2,300 ft^2 cumulative tree canopy and shrubs and 340 ft^2 of herb and vegetable garden area and irrigation techniques that employ conservation technologies that reduces the waste from 50 percent to 15 percent. The calculation of per capita demands of conserving households outdoor water is shown in (Table 6) for three areas in the Española Basin.

Table 6. Calculation of Per Capita Outdoor water demand for conserving households.

Landscape			Santa Fe		Española		Los Alamos	
Type	Area*	Average House-hold Size	Annual Water Requirement	Per Capita Demand	Annual Water Requirement	Per Capita Demand	Annual Water Requirement	Per Capita Demand
	ft^2	2010 Census	gallons	GPCD	gallons	GPCD	gallons	GPCD
Turf	350	2.4	3,070	3.5	4,056	4.6	2289	2.6
Trees	2,300	2.4	21,827	24.9	28,060	32.0	16836	19.2
Garden	340	2.4	3,023	3.5	3,655	4.2	2411	2.8
Total	2,990	2.4	27,919	31.9	35,771	40.8	21,536	24.6

*Average landscaped area for 161 homes (see Section 4.3)

The per capita demands of conserving households for indoor and outdoor water use (Table 7) vary from a low of 69.8 gpcd for Los Alamos to 76 gpcd for Santa Fe and 86.1 for Española. The non-conserving totals vary from 166.5 to 184.8 gpcd.

Table 7. Estimated Residential Per Capita Water Demand (gpcd) for Conserving and Non-conserving Households in Three Locations for a Typical Landscaped Area.

Location	Santa Fe		Española		Los Alamos	
	Conserving	Non-conserving	Conserving	Non-conserving	Conserving	Non-conserving
Indoor	45.3	108.1	45.3	108.1	45.3	108.1
Outdoor	31.9	61.3	40.8	76.7	24.6	48.8
Total	76.6	166.5	86.1	184.8	69.8	156.9

To check the soundness of the conserving household water demand estimate, we have compared the actual water demand for the City of Santa Fe's Water System, which has reduced its per capita rate from about 106 (assuming 63 percent of 168 gpcd) in 1995 to 75 gpcd in 2012 for single family homes through a comprehensive water conservation program, including incentives, rate structure, rebates and mandatory water use restrictions. The single family residential per capita demand is based on the diversions of single family residents divided by the population of single family residents, which represents about 63 percent of the total per capita demand (all water diversion divided by the entire population) for the city in 2012. The 2012 monthly per capita demand for single family residents for the

City of Santa Fe (Figure 14) varies from a winter average of 51.4 gpcd to a high of 110 gpcd in July, with an average of 75 gpcd (Borchert, 2012), only 2 percent less than the estimated conserving household.

Comparing the actual per capita demand to the typical “conserving” house reveals that some systems have significant potential to reduce demand, while others have already reduced their demand through conservation efforts. Table 8 shows the details of the number of public water systems, the population served and the average per capita demand compared to the “conserving” per capita demand. The total potential for the region that could be gained through conservation in the public water system sector is about 1,000 ac-ft/yr, with over 500 ac-ft/yr from the Los Alamos sub-basin.

Figure 14. Monthly Water Demand for Single Family Residents in the City of Santa Fe (2012).

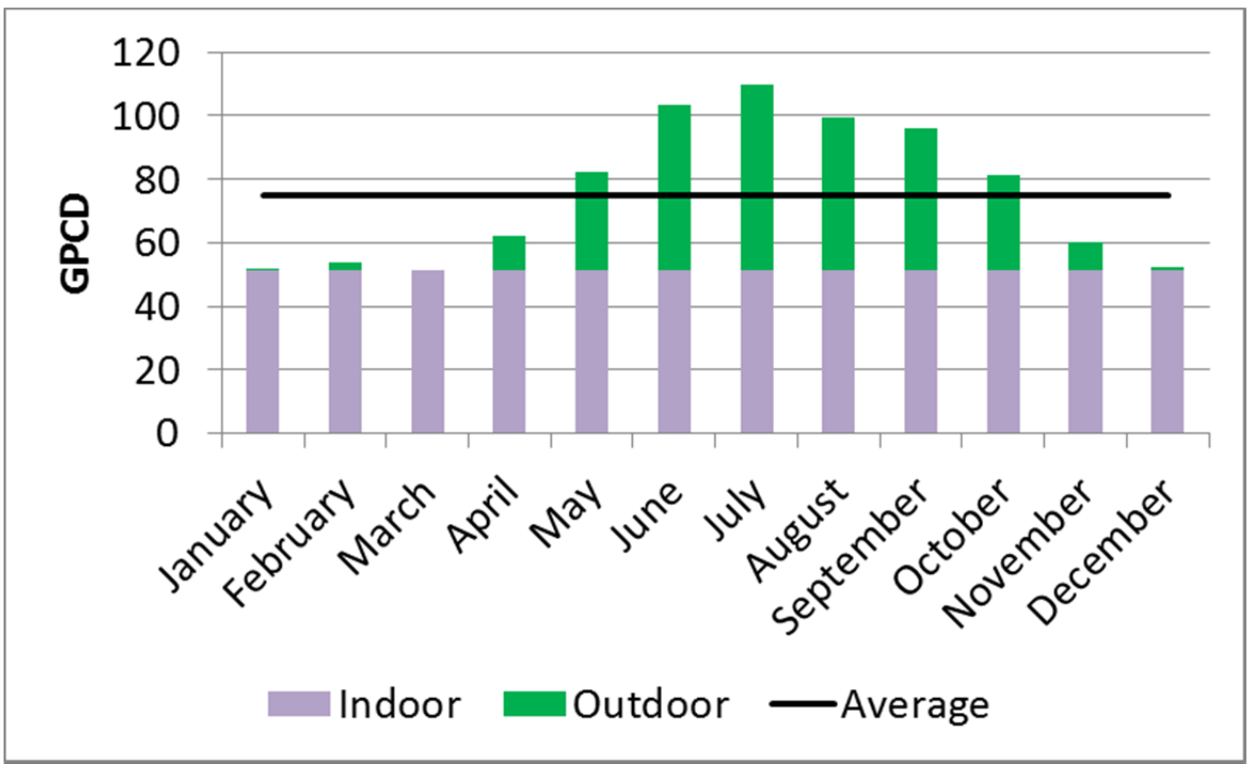


Table 8. Water Diversions by Sub-basin and Public Water Systems and the Conservation Potential.

	Velarde	Los Alamos	Santa Clara	Santa Cruz	Pojoaque-Nambe	Tesuque	Santa Fe*	Caja del Rio	North Galisteo	South Galisteo	**Total**
Total Population (2010 Census)	8,538	18,671	4,795	20,647	5,593	2,809	98,608	2,253	13,008	4,018	178,218
Average Household Size	2.60	2.22	2.54	2.51	2.36	2.22	2.31	2.41	2.20	2.17	2.33
Public Water Systems											
Number of systems	4	1	2	10	8	4	24	1	5	5	64
Number of systems with recent diversion data	3	1	1	5	3	3	16	1	5	5	43
Diverted from groundwater (ac-ft/yr)	77	4,376	998	285	49	89	1,972	1,266	680	67	9,860
Diverted from surface water (ac-ft/yr)	0	21	0	0	0	0	2,537	5,413	0	0	7,971
Population Served by PWS	1,740	17,950	2,496	8,913	3,000	966	91,963	604	7,185	611	135,427
Residential per capita Use (gpcd)	40	99	NA	111	90	116	72	242	76	90	--
Conserving per capita (gpcd)	86	69.8	86	86	86	77	77	77	77	7	79
Potential water savings from PWS (ac-ft/yr)	0	590	NA	250	12	42	0	112	0	9	1,016

*PWS in Santa Fe are served in part by water diversions from Caja del Rio. PWS in North Galisteo receive water from South Galisteo.

The summary by sub-basin in Table 8 provides a general range of what could be obtained through implementation of indoor and outdoor conservation strategies but it does not reveal what strategies should be implemented. Each public water system should conduct an audit to determine where inefficient water use and water waste may be occurring. An analysis of monthly water use will indicate the indoor and outdoor water use as a first step toward targeting the “low-hanging fruit” for achieving water conservation. Water leaks in the delivery system may also be contributing to the waste.

Table 8 shows no potential savings in the Santa Fe Watershed because the average per capita use is less than the rate calculated for the “conserving household”. Analysis of the 2012 monthly data reveals that the outdoor use is much less than our estimated average, whereas the indoor use is higher than the “ideal” conserving household. The indoor demand can be estimated from the average winter months for December through March of 51.4 gpcd, which is 14 percent higher than the indoor conserving household of 45.3 gpcd (Table 4). The average outdoor water use is 23.6 gpcd, 25 percent less than the calculated outdoor demand. Thus from this simple analysis, if the City wanted to pursue additional conservation efforts, they may want to focus on the indoor water use. Note, however, that doing so would, in turn, reduce the amount of return flow to the wastewater treatment plant and subsequent discharge to the Santa Fe River.

To understand why the single family residential water use is Los Alamos (at 166 gpcd) is about twice that of Santa Fe (at 75 gpcd), the landscape for ten homes in a variety of neighborhoods was digitized and summarized in Table 9. While the range of landscaped area is the same for the two communities, the median is more than twice as much in Los Alamos (5,300 ft^2). The estimated median water use for the ten homes in Los Alamos would be 89 gpcd if each of these homes used water conserving technology or 218 gpcd for non-conserving households based on the existing landscape for the ten homes, compared to the actual use for Los Alamos single family residents of 166 gpcd (Chavez, et al. 2013). If the ten homes are representative of the whole community of Los Alamos, it would appear that they are relatively efficient with their water use, but could achieve more savings with the implementation of water conserving technology without changing the area irrigated.

The median turf area for the ten homes on the City of Santa Fe water utility of 2,200 ft^2 is about 800 ft^2 less than the average used to calculate the "typical" landscape (Table 4) and would require 69 gpcd to meet the per capita water demands under the conserving household scenario. The homes selected included 2 homes zoned R1 (one house per acre), and 2 in R2 (2 houses per acre) and one home for R3-R7. The actual water demand for all single-family City residents is 75 gpcd, slightly more than potential conservation household median value of 69.8 gpcd, indicating that this small subset is fairly representative of the single family residents in Santa Fe.

Table 9. Select Landscape Areas and Calculated Water Demand for Single Family Residents in Los Alamos and Santa Fe.

			Outdoor Water Use		Outdoor Use Per Capita		Total Per Capita	
		Total Landscaped Area	Conserving	Not Conserving	Conserving Outdoor	Not Conserving Outdoor	Conserving *(45.3 indoor)*	Not Conserving *(108.1 indoor)*
PWS	House	ft^2	gallons per year		gpcd		gpcd	
LA01	1	4826	32,260	77,666	40.2	96.7	85.5	205.0
LA01	2	14845	100,590	231,098	125.3	287.8	170.6	396.1
LA01	3	12008	82,010	183,243	102.1	228.2	147.4	336.5
LA01	4	15152	103,098	233,417	128.4	290.7	173.7	399.0
LA01	5	561	3,980	6,769	5.0	8.4	50.3	116.7
LA01	6	4177	29,076	59,199	36.2	73.7	81.5	182.0
LA01	7	10645	72,840	161,655	90.7	201.3	136.0	309.6
LA01	8	3289	23,021	44,565	28.7	55.5	74.0	163.8
LA01	9	5852	38,282	99,009	47.7	123.3	93.0	231.6
LA01	10	2770	18,486	44,746	23.0	55.7	68.3	164.0
Average LA01		7,413	50,364	114,137	62.7	142.1	108.0	250.4
Median		**5,339**	35,271	88,337	43.9	110.0	**89.2**	**218.3**
SF23	1 (R1)	2144	17,039	35,359	20.2	41.9	65.5	150.2
SF23	2 (R2)	3049	24,079	49,813	28.6	59.1	73.9	167.4
SF23	3 (R3)	2307	21,761	36,987	25.8	43.9	71.1	152.2
SF23	4 (R4)	2028	18,850	32,039	22.4	38.0	67.7	146.3
SF23	5 (R5)	2899	26,821	45,588	31.8	54.1	77.1	162.4
SF23	6 (R6)	986	9,361	15,911	11.1	18.9	56.4	127.2
SF23	7 (R7)	1405	12,247	21,964	14.5	26.0	59.8	134.3
SF23	8 (R1)	10354	100,211	174,785	118.9	207.3	164.2	315.6
SF23	9 (R2)	14747	135,057	248,783	160.2	295.1	205.5	403.4
SF23	10 (PRC)	1080	9,599	16,316	11.4	19.4	56.7	127.7
Average SF23		4,100	37,503	67,754	44.5	80.4	89.8	188.7
Median		**2,226**	20,306	36,173	24.1	42.9	**69.4**	**151.2**

4.2 Commercial and Industrial Self-Supplied Water Use

Annual water diversions for self-supplied commercial systems total 1,400 ac-ft/yr from groundwater and 430 ac-ft/yr from surface water (Table 10). Only 42 of the 136 systems have recent diversion data, thus the actual use may be much different. The type and size of commercial systems would need to be examined to explore the possibility for water savings through conservation. Likewise the commercial use for business supplied by public water systems would also need to be examined on a case-by-case basis (i.e. for a hotel, how many rooms, what is the vacancy rate, how much water is used compared to what could be used to meet the needs of the business).

A report by the City of Santa Fe Water Division (King, et al, 2009) showed significant reductions in water use over a ten-year period (1998 to 2008) in response to the City's conservation efforts. Full service restaurants, for example, reduced water demand (per seat) by 50 percent and hotels reduced water use (per room) by 58 percent. Thus, water savings are possible but the lack of metering and reporting of water use by the self-supplied commercial sector is a challenge for developing a conservation strategy.

Table 10. Water Use by the Commercial Sector in the Española Basin.

	Velarde	Los Alamos	Santa Clara	Santa Cruz	Pojoaque-Nambe	Tesuque	Santa Fe	Caja del Rio	North Galisteo	South Galisteo	**Total**
Commercial Self-Supplied Water Systems											
Number of systems	9	1	2	25	7	17	59	1	9	6	136
Amount Diverted from Groundwater (ac-ft/yr)	64.23	1	10	418	18	450	283	132	15	12	1,402
Amount Diverted from Surface Water (ac-ft/yr)	0	0	0		18.7	0	0	413	0	0	432
Potential Water Savings	Unknown										

4.3 Domestic Well Water Use

Most domestic wells are not metered and thus, to estimate the total amount of water diverted from the domestic well sector, two major pieces of information are needed: the population and an average per capita use. To address the first data gap, we estimated the population served by domestic wells by subtracting the population served by public water systems from the total population. Secondly, we reviewed meter readings from domestic wells to determine an average per capita demand.

4.3.1 Estimation of population served by domestic wells.

The population served by domestic wells was estimated by first estimating the total population in each sub-basin and subtracting the population served by the public water systems in the sub-basin. The total population for each sub-basin was calculated by estimating the percent of the 2010 Census population within each block group that fell within each sub-basin. Table 11 shows the total population for each sub-basin, the estimated population served by public water systems and the remaining population served by domestic wells. We estimated population served by all of the public water systems using the most recent data available, which in some cases may be 10 or 15 years old. Most of those systems were small systems serving mobile home parks or other communities with a population that is small and has probably not changed significantly. The greatest uncertainty involves the population served by pueblo water systems. We do not know the percent of the population within the pueblos that are served by a community water system.

Table 11. Summary of 2010 Population by Sub-basin and Source of Supply

Sub-basin	Total Population	Population served by PWS	Population Served by Domestic wells
Velarde	8,537.6	1,740	6,798
Santa Clara	4,795	2,496	2,299
Santa Cruz	20,646.8	8,913	11,734
Los Alamos	18,671	17,950	721
Tesuque	2,809	966	1,843
Nambe-Pojoaque	5,593	3,000	2,593
Caja del Rio	2,253	604	1,649
Santa Fe	98,608	91,963	6,645
North Galisteo	13,008	7,185	5,823
South Galisteo	4,018	611	3408
Total Population	**178,218**	**135,427**	**43,512**

4.3.2 Estimating per capita demand

Of the 500 metered wells (**Figure 8**), only 141 indicated the *number* of homes served by the well and only 71 wells (with 81 meters) specified *which* homes were served by the well and meter. (Some wells had just one meter serving multiple homes and others had separate meters for each home.) The metered wells that were eliminated from the original 500 were those that did not specify the number of homes served by the well, the meter readings were incomplete or the well actually served a commercial business even though it was permitted as a domestic well.

Based on our analysis of the 141 meter records, annual water pumping ranges from 0.02 to 2.4 ac-ft per year per house and averages 0.44 ac-ft/yr and a median of 0.28 ac-ft/yr per home. Using the 2010 census for the average household size per block group to estimate the population for each house, the average per capita demand is 0.20 ac-ft/yr or 177 gpcd and the median is 0.13 ac-ft/yr (112 gpcd). The minimum per capita demand is 10 gpcd and the maximum is 1,110 gpcd as shown in Figure 15. The very low values maybe due to an error in the multiplier used for the meter reading. The very high values may also be due to meter reading errors or due to a difference in the number of individuals residing at a specific house compared to the census average. The median is less influenced by the outliers and therefore, a better value representing water use from domestic wells.

Based on the review of the 141 domestic wells and 291 homes, 36 percent of the households have a per capita consumption less than the “conserving” value of 76.6 gpcd (value for Santa Fe where the majority of the wells are located). Approximately 33 percent have a use exceeding the non-conserving household per capita demand of 167 gpcd.

A second phase of this investigation was conducted for those wells in which the homes served by the wells were specified in either the OSE WATERS database or water right applications. Of the 141 wells, 71 wells had information on the specific lots or parcels or owners served by the wells. The owner data or subdivision lot information in WATERS was matched with GIS information of parcel data in Santa Fe County to identify the specific home. These 71 wells serve 81 meters and 161 homes (Figure 16).

Figure 15. Per Capita Water Use by 141 Domestic Wells

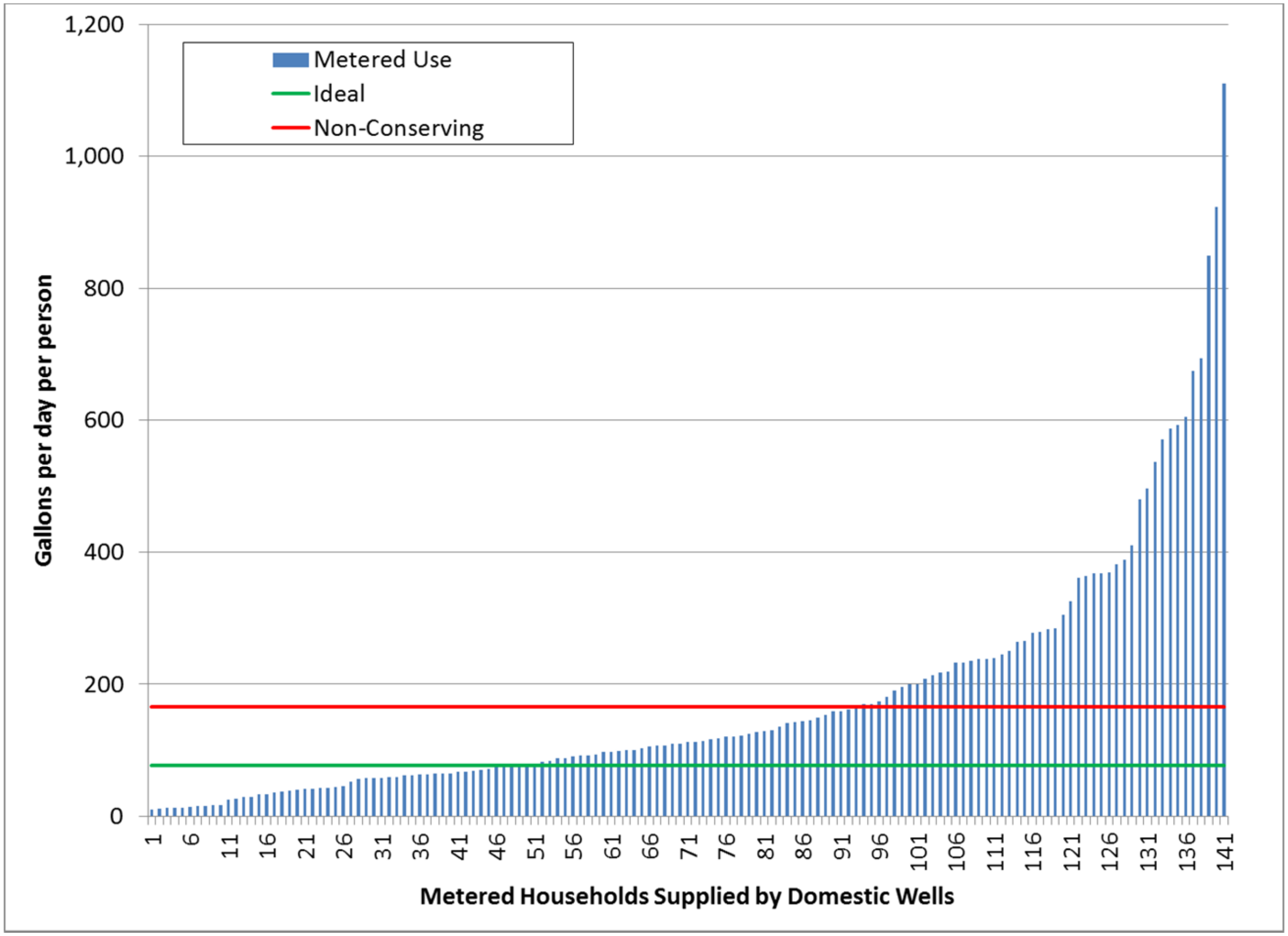
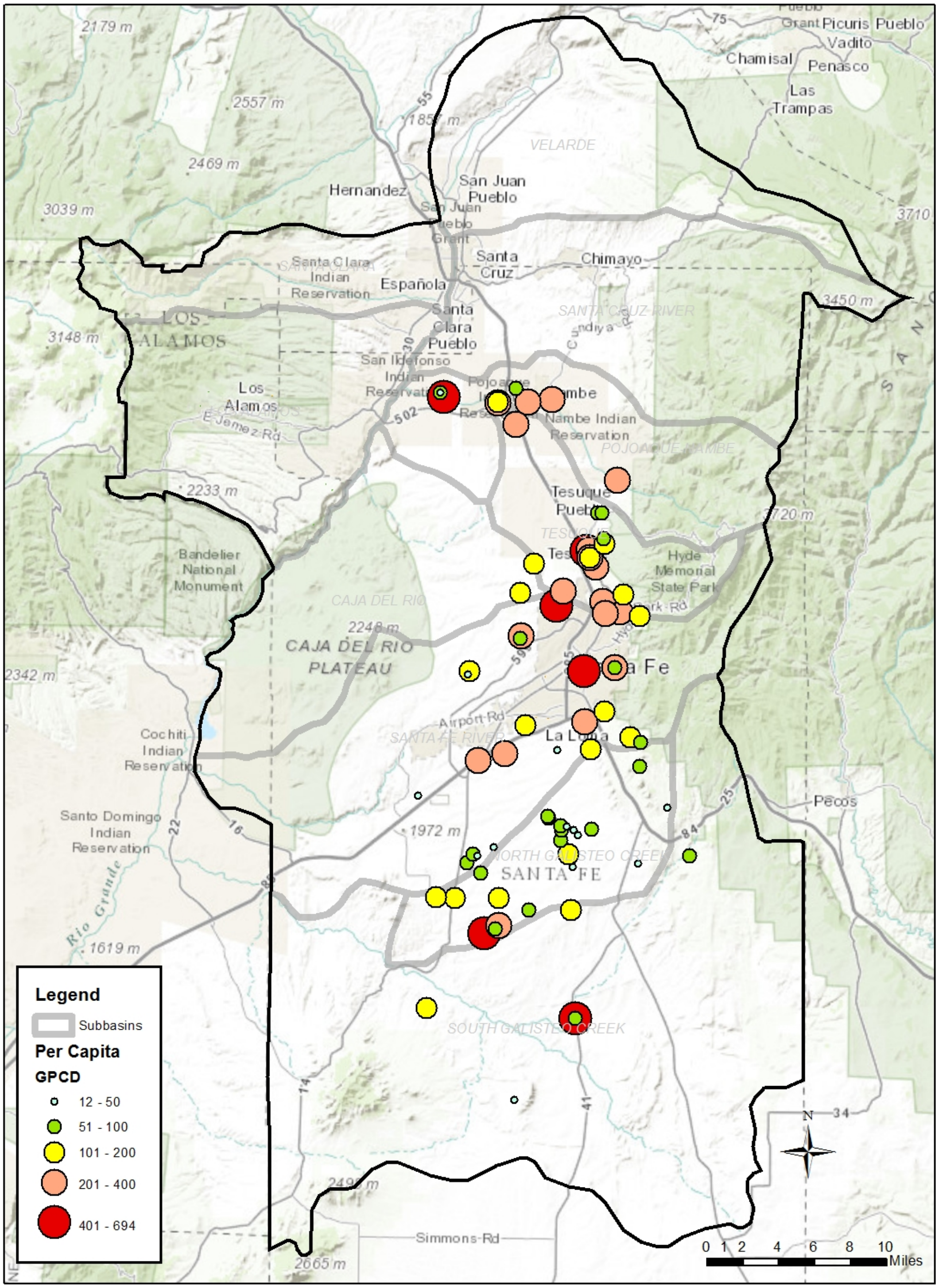


Figure 16. Per Capita Demand where Houses were Identified (71 wells/81 meters).



Using high resolution imagery provided by the county for 2008 and 2011, we examined each parcel associated with one or more domestic well. The goal of the residential irrigation analysis was to determine if the estimated water use appeared excessive for the existing landscape, and if there is potential for conservation through implementation of efficient watering methods.

Using heads-up digitizing methods (meaning on-screen analysis) and a standardized approach to identifying areas likely subjected to deliberate watering activities, we created a "Residential Irrigation" polygon dataset and populated it with attributes about the vegetation type and source data. Where we have been able to identify the houses served by the wells and meters (using parcel data and address or lot information in the water right applications), the landscape was digitized using this methodology.

Figure 17 shows an example of one house and the mapped areas of probable outdoor irrigation. The average metered water use for this home is 0.78 ac-ft/yr, which amounts to 369 gpcd for an average household size of 1.88 for the Census Block (2010 Census). The house has 2,700 ft^2 of turf, 800 ft^2 of trees and 170 ft^2 of garden area. Water requirement even with sprinklers and Kentucky bluegrass would be 0.27 ac-ft/yr or 130 gpcd for outdoor use. Combining with 45 gpcd for indoor (assuming new fixtures) the total water demand with their existing landscaping could be 175 gpcd. Thus, unless the household size (number of people living at the house) is much greater than the Census average, it appears that water demand could be significantly reduced by not over-irrigating the landscape. The water use could be further reduced to 99 gpcd by installing drip irrigation or other water conserving technology.

Water use from evaporation from swimming pools was estimated based on the pan evaporation rate for Santa Fe of 50 inches per year which equates to 31.2 gal/ft^2/year (not including any draining and refilling). Ten out of 161 homes has some type of pool, including ornamental ponds.

Where homes were adjacent to acequias (Figure 18), the irrigation of the landscape was not attributed to the well. A total of 161 homes were analyzed for their annual projected water demands based on the irrigated landscape and the household size. Table 12 summarizes the average landscaped area by category and the number of houses with each category of landscaping and Table 13 lists the summary of analysis per well meter.

The average household use is compared to the calculated potential water use based on the ***existing*** landscaping for two scenarios: a conserving and non-conserving household. The conserving household is calculated using the per capita demand for new indoor fixtures (45 gpcd) and an outside use based on buffalo grass where turf is present and all landscaping irrigated with drip irrigation or other water-conserving technology. The non-conserving house is based on an indoor use of 108 gpcd plus outdoor landscaping with sprinkler or flood irrigation and Kentucky bluegrass instead of Buffalo grass for homes with turf.

The comparison of actual use to the range of calculated use per house is shown in Figure 19 and per capita in Figure 20 (calculated by dividing by the average household size for the Census Block). Where the amount used is more than the calculated potential water use for a conserving household, but less than the amount for a non-conserving household, the blue open square will plot below the black line and the red solid diamond will plot above the line. If both plot below the line, then water may be wasted (such as fugitive water or leaking pipes) or the household size may be greater than the 2010 census average. Where the potential use estimates plot above the line, we may have overestimated the household size or the irrigated landscaping or the household may be exceptional at conserving water, such that the actual use is less than the calculated use..

The average and median water use per house for the 71 wells is 0.44 and 0.26 ac-ft/yr, respectively (very close to the values for the 141 wells where the house was not identified). The average and median per capita use for this subset of metered wells is 0.19 and 0.12 ac-ft/y, respectively. The median is likely to be more representative than the average because it is less influenced by outliers (both high and low). The median potential water use with efficient indoor plumbing and a drip irrigation system is 0.07 ac-ft/yr, resulting in a potential savings of 0.05 ac-ft/yr per person served by a domestic well. Figure 21 illustrates the difference in household water use if conservation measures were implemented.

4.3.3 Estimation of water diverted from domestic wells and potential water savings

Given the median per capita water use determined from this investigation of 0.12 ac-ft/yr, and the population of 43,512 (within the Jemez y Sangre Regional Water Planning area) not served by a community system (Table 11) we estimate that 5,640 ac-ft/yr were diverted from domestic wells in 2010. The Jemez y Sangre Regional Water Plan (DBS&A & ACL, 2003) estimated 7,700 ac-ft diverted from domestic wells. Potential water savings were calculated by sub-basin based on the median potential for the wells in each sub-basin and the "conserving" rate (described in Section 4.1). The total potential savings for a conservation effort focused on domestic wells appears to be about 1,870 ac-ft/yr.

Table 12. Summary of the number of homes and the average area of each landscape category.

Landscape Category	Number of Homes with Landscape Type	Average Landscaped Area (ft2)	Average Landscaped Area for 160 homes
Turf	43	1,295	350
Garden	58	950	340
Trees/Orchard	160	2,307	2,300
Pool	10	233	14

Table 13. Water Use and Conservation Potential for the Domestic Well Sector.

	Velarde	Los Alamos	Santa Clara	Santa Cruz	Pojoaque-Nambe	Tesuque	Santa Fe	Caja del Rio	North Galisteo	South Galisteo	**Total**
Total Population [a]	8,538	18,671	4,795	20,647	5,593	2,809	98,608	2,253	13,008	4,018	178,218
Household Size [a]	2.60	2.22	2.54	2.51	2.36	2.22	2.31	2.41	2.20	2.17	2.33
Domestic Wells											
Domestic Wells [b]	823	29	121	1149	1414	949	1591	282	1089	735	8,182
Population Served by Domestic Wells	6,798	721	2,299	11,734	2,593	1,843	6,645	1,649	5,823	3,408	43,512
Wells & meters with identified houses	0	0	0	0	7	19	21	2	26	6	81
Number of identified houses	0	0	0	0	8	32	52	5	54	10	161
Median per capita use for wells with meters and known number of homes(gpcd)	-	-	-	-	235	209	105	130	68	105	-
Median potential per capita use for conserving indoor and outdoor for given turf (gpcd)	*86*	*69.8*	*86*	*86*	*101*	*93*	*62*	*69*	*56*	*69*	-
Water diverted (ac-ft/yr)	837	89	283	1,445	682	431	784	240	443	402	5,637
Potential Water Savings (ac-ft/yr)	182	32	61	313	389	239	323	113	80	139	1,872

[a] 2010 Census, [b] OSE WATERS,

Figure 17. Example of digitized landscape.

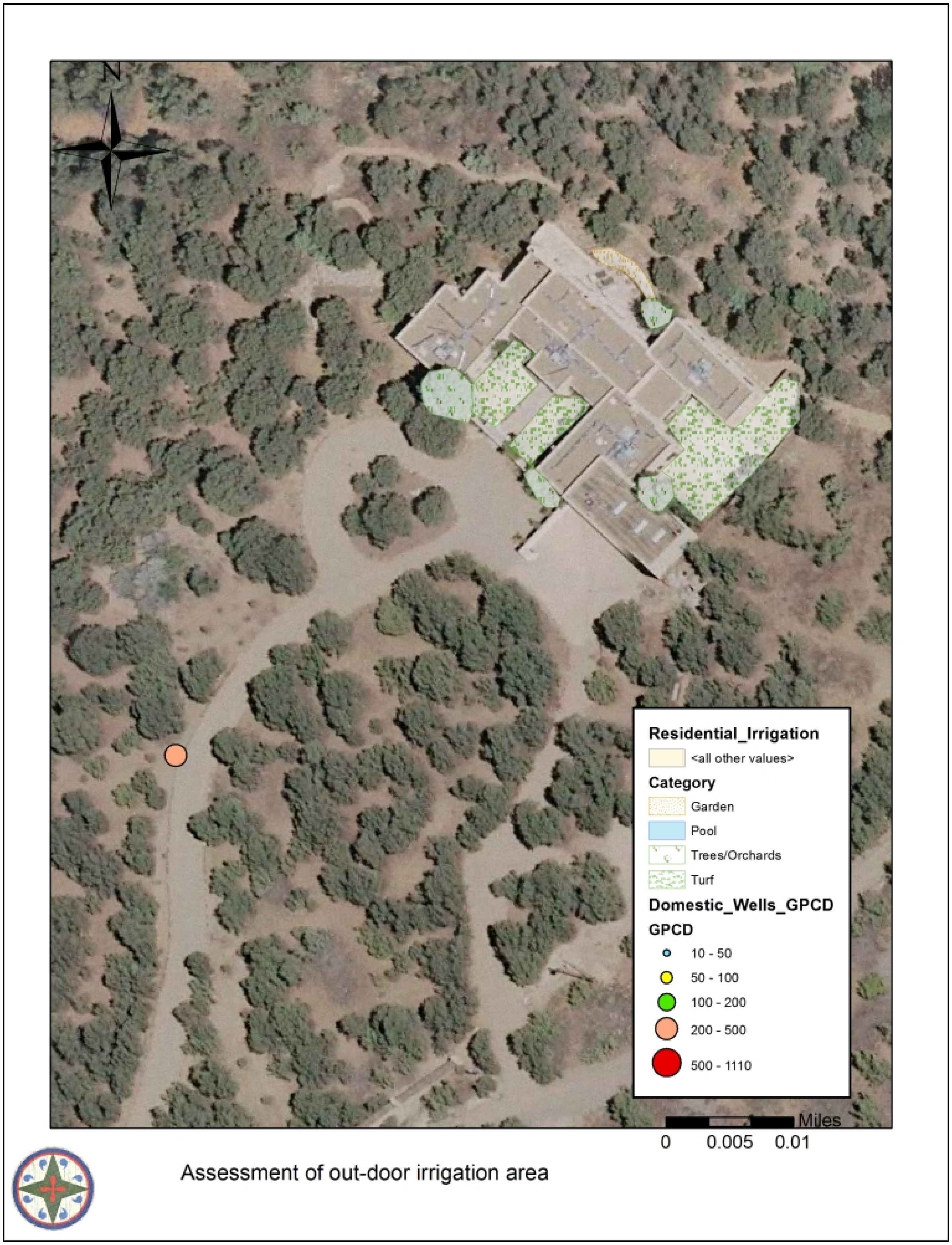
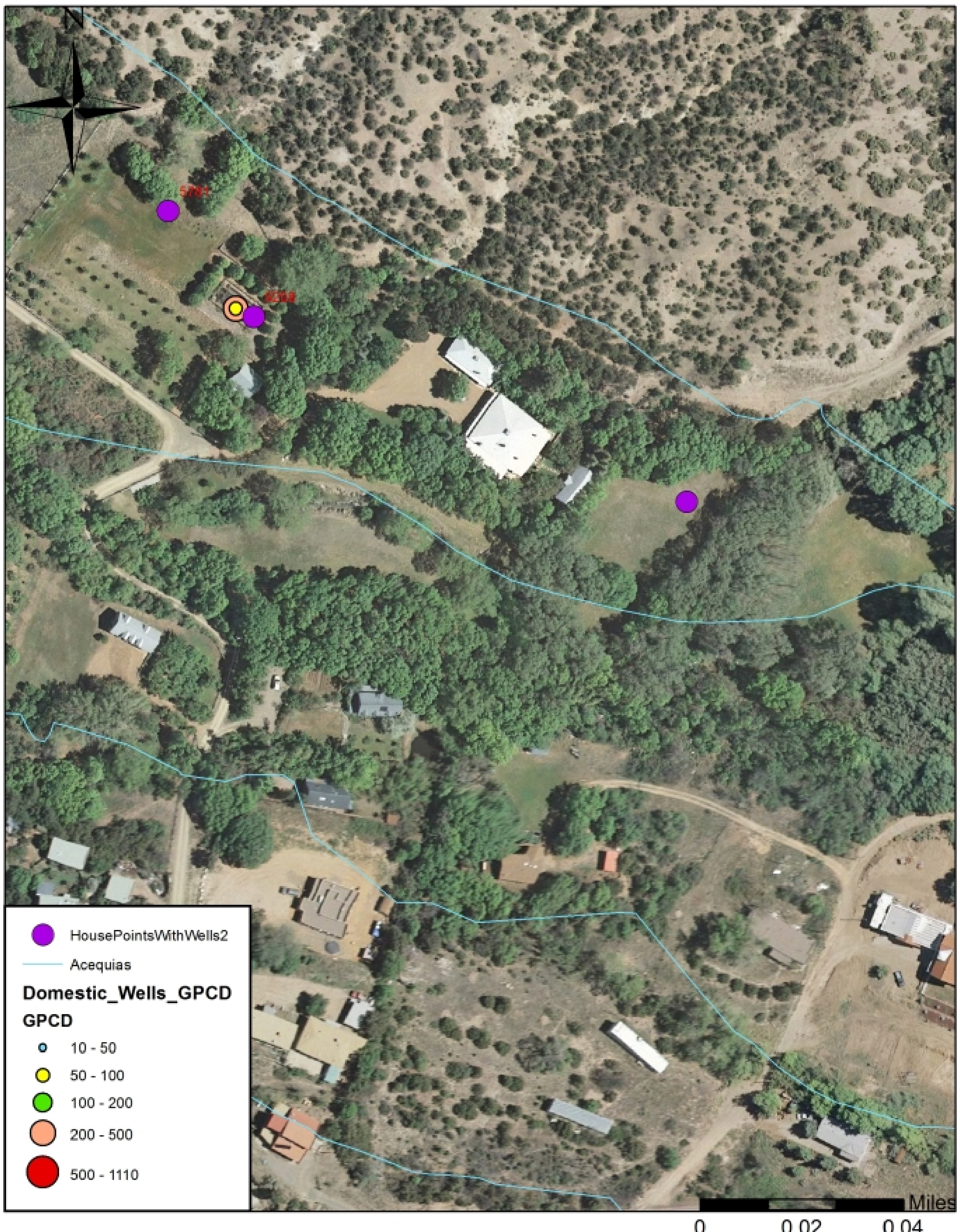


Figure 18. Landscape Area Adjacent to Acequias.



Assessment of out-door irrigation adjacent to acequias

Figure 19. Cross Plot of Metered versus Potential Use per House

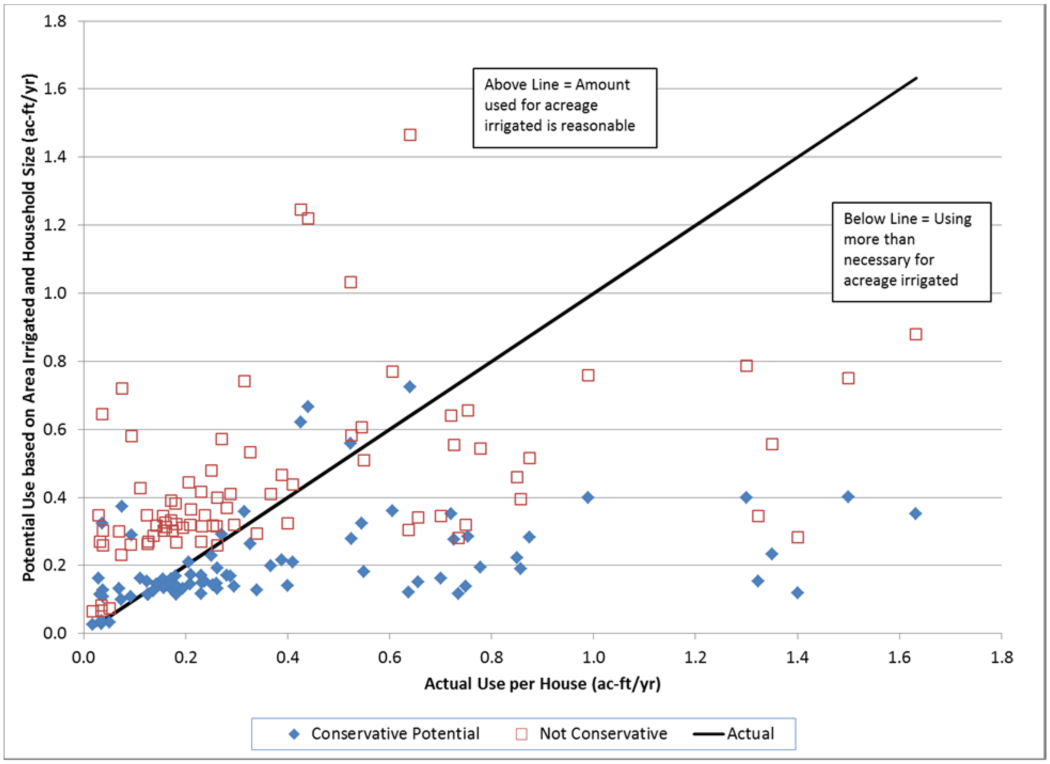


Figure 20. Cross-plot of Metered versus Potential Use per Capita

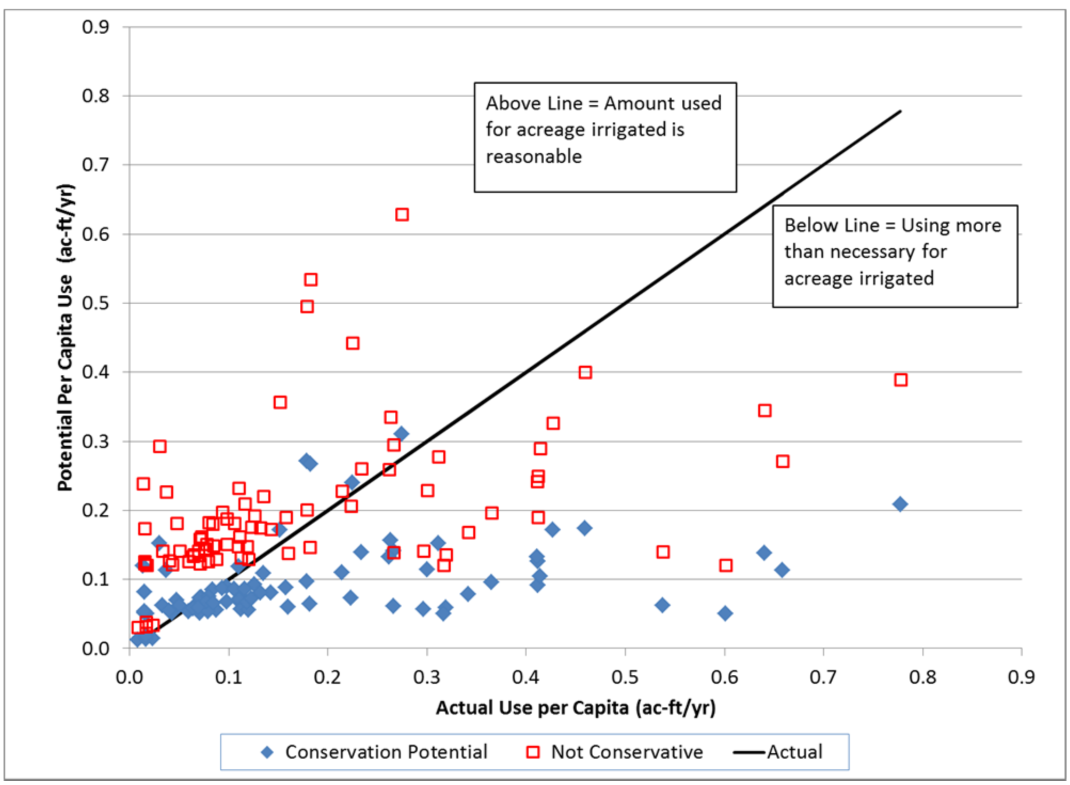


Table 14. Summary of Actual and Predicted Water Use per Domestic Well Water Meter

Summary of actual and predicted water use per meter.

		Actual					Predicted Range of Water Diversions							
					Total Annual		Outdoor		Indoor		Total Annual			
Meter Number	Water Rights POD Number	Average of Measured Water Diversion	Number of Houses	House Size	Average Water Diversion	Average Water Diversion	Diversion if Conserve	Diversion if Non-Conserve	Diversion if Conserve	Diversion if Not Conserve	Diversion if Conserve	Diversion if Not Conserve	Diversion if Conserve	Diversion if Not Conserve
		Per Meter		2010 Census	Per House	*Per Capita*	Per House						*Per Capita*	
		ac-ft/yr			ac-ft/yr		ac-ft/yr							
1750	RG 28149	0.21	1	2.46	0.21	*0.08*	0.09	0.15	0.12	0.30	0.21	0.44	*0.09*	*0.18*
1754	RG 52395	0.68	2	2.13	0.34	*0.16*	0.02	0.04	0.11	0.26	0.13	0.29	*0.06*	*0.14*
1783	RG 54601	0.18	2	2.14	0.09	*0.04*	0.00	0.00	0.11	0.26	0.11	0.26	*0.05*	*0.12*
1797	RG 57586	1.91	3	2.15	0.64	*0.30*	0.01	0.04	0.25	0.26	0.27	0.30	*0.12*	*0.14*
1838	RG 61290	0.25	1	2.55	0.25	*0.10*	0.10	0.17	0.13	0.31	0.23	0.48	*0.09*	*0.19*
1912	RG 35756	1.64	4	1.92	0.41	*0.21*	0.11	0.21	0.10	0.23	0.21	0.44	*0.11*	*0.23*
1969	RG 35216	0.47	2	2.12	0.23	*0.11*	0.04	0.06	0.11	0.26	0.15	0.31	*0.07*	*0.15*
1982	RG 66445	0.26	1	1.82	0.26	*0.14*	0.06	0.09	0.09	0.22	0.15	0.31	*0.08*	*0.17*
2014	RG 73504	0.78	2	2.46	0.39	*0.16*	0.09	0.17	0.12	0.30	0.22	0.47	*0.09*	*0.19*
2037	RG 51310	1.32	1	2.46	1.32	*0.54*	0.03	0.05	0.12	0.30	0.15	0.35	*0.06*	*0.14*
2049	RG 43709	0.35	2	2.46	0.18	*0.07*	0.00	0.00	0.12	0.30	0.13	0.30	*0.05*	*0.12*
2061	RG 55464	0.86	1	2.08	0.86	*0.41*	0.08	0.14	0.11	0.25	0.19	0.40	*0.09*	*0.19*
2064	RG 46519	0.95	4	2.14	0.24	*0.11*	0.04	0.09	0.11	0.26	0.15	0.35	*0.07*	*0.16*
2326	RG 37593	0.78	5	2.08	0.16	*0.08*	0.03	0.05	0.11	0.25	0.13	0.35	*0.06*	*0.14*
2389	RG 21166	1.12	4	2.12	0.28	*0.13*	0.06	0.11	0.11	0.26	0.17	0.37	*0.08*	*0.17*
2582	RG 57237	1.31	2	2.46	0.66	*0.27*	0.03	0.04	0.12	0.30	0.15	0.34	*0.06*	*0.14*
2766	RG 51886	0.44	1	2.46	0.44	*0.18*	0.54	0.92	0.12	0.30	0.67	1.22	*0.27*	*0.50*
2855	RG 21518	1.63	1	2.55	1.63	*0.64*	0.22	0.57	0.13	0.31	0.35	0.88	*0.14*	*0.34*
2942	RG 35752	1.09	6	2.08	0.18	*0.09*	0.01	0.02	0.11	0.25	0.12	0.27	*0.06*	*0.13*

Summary of actual and predicted water use per meter.															
		Actual					Predicted Range of Water Diversions								
					Total Annual		Outdoor		Indoor		Total Annual				
Meter Number	Water Rights POD Number	Average of Measured Water Diversion	Number of Houses	House Size	Average Water Diversion	Average Water Diversion	Diversion if Conserve	Diversion if Non-Conserve	Diversion if Conserve	Diversion if Not Conserve	Diversion if Conserve	Diversion if Not Conserve	Diversion if Conserve	Diversion if Not Conserve
		Per Meter		2010 Census	Per House	*Per Capita*	Per House						*Per Capita*	
		ac-ft/yr			ac-ft/yr		ac-ft/yr							
3469	RG 59316	1.05	2	1.97	0.53	*0.27*	0.20	0.36	0.10	0.24	0.30	0.60	*0.15*	*0.30*
3470	RG 57574	1.70	2	2.33	0.85	*0.36*	0.10	0.18	0.12	0.28	0.22	0.46	*0.10*	*0.20*
4373	RG 57851	0.46	2	2.05	0.23	*0.11*	0.01	0.02	0.10	0.25	0.12	0.27	*0.06*	*0.13*
4404	RG 32467	1.30	1	3.16	1.30	*0.41*	0.24	0.41	0.16	0.38	0.40	0.79	*0.13*	*0.25*
4478	RG 72378	3.50	4	2.13	0.88	*0.41*	0.17	0.26	0.11	0.26	0.28	0.52	*0.13*	*0.24*
4748	RG 69240	1.50	2	2.35	0.75	*0.32*	0.02	0.03	0.12	0.28	0.14	0.32	*0.06*	*0.14*
4966	RG 28917	0.32	2	2.3	0.16	*0.07*	0.03	0.05	0.12	0.28	0.14	0.33	*0.06*	*0.14*
5138	RG 75078	0.03	1	2	0.03	*0.01*	0.06	0.10	0.10	0.24	0.16	0.35	*0.08*	*0.17*
5485	RG 35870	0.75	1	1.64	0.75	*0.46*	0.20	0.46	0.08	0.20	0.28	0.66	*0.17*	*0.40*
5488	RG 51167	0.18	1	1.93	0.18	*0.09*	0.07	0.15	0.10	0.23	0.17	0.38	*0.09*	*0.20*
5781	RG 56960	0.74	1	2.32	0.74	*0.32*	0.00	0.00	0.12	0.28	0.12	0.28	*0.05*	*0.12*
5803	RG 55082	0.78	1	1.88	0.78	*0.41*	0.10	0.32	0.10	0.23	0.20	0.54	*0.10*	*0.29*
6493	RG 45966	0.70	1	2.05	0.70	*0.34*	0.06	0.10	0.10	0.25	0.16	0.35	*0.08*	*0.17*
7523	RG 39829	0.73	1	2.42	0.73	*0.12*	0.15	0.26	0.12	0.29	0.28	0.55	*0.11*	*0.23*
7524	RG 39829	0.33	1	2.42	0.33	*0.14*	0.14	0.24	0.12	0.29	0.26	0.53	*0.11*	*0.22*
7589	RG 75957	0.31	2	2.14	0.16	*0.07*	0.05	0.09	0.11	0.26	0.16	0.35	*0.07*	*0.16*
7605	RG 72505	0.32	1	2.08	0.32	*0.15*	0.25	0.49	0.11	0.25	0.36	0.74	*0.17*	*0.36*
8202	RG 61290	0.09	1	2.55	0.09	*0.04*	0.16	0.27	0.13	0.31	0.29	0.58	*0.11*	*0.23*
8209	RG 44133	0.26	1	2.08	0.26	*0.13*	0.09	0.15	0.11	0.25	0.19	0.40	*0.09*	*0.19*
8216	RG 83289	0.59	2	2.46	0.30	*0.12*	0.01	0.02	0.12	0.30	0.14	0.32	*0.06*	*0.13*
8375	RG 33963	1.92	3	2.33	0.64	*0.27*	0.61	1.18	0.12	0.28	0.72	1.47	*0.31*	*0.63*

Summary of actual and predicted water use per meter.

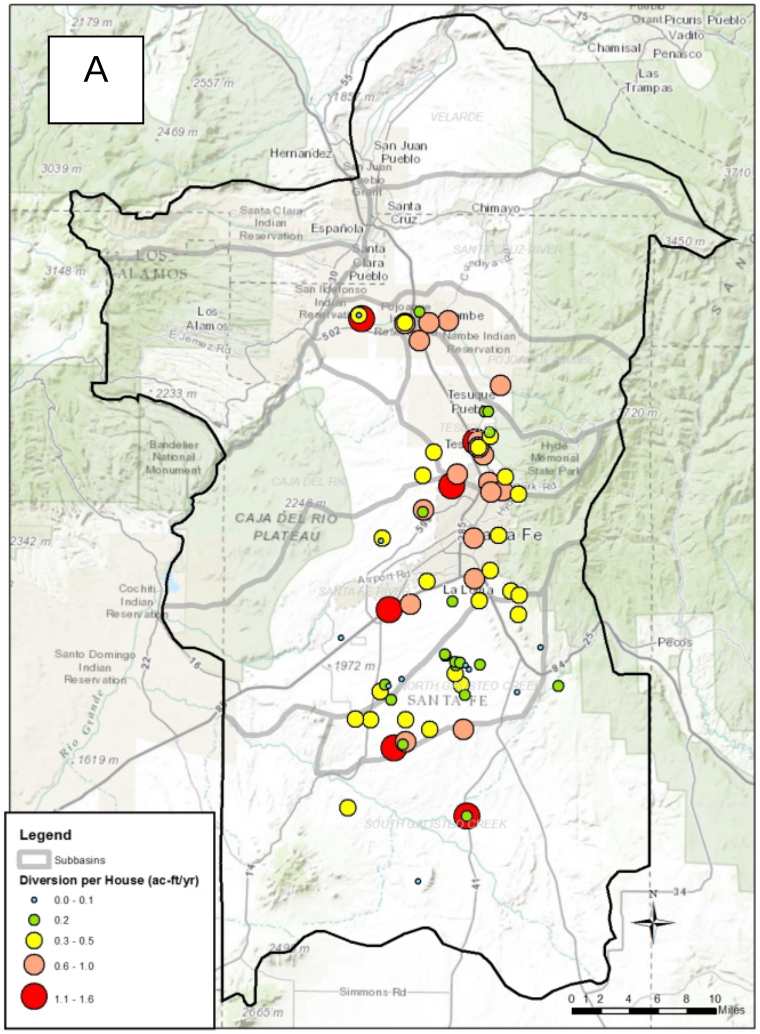
Meter Number	Water Rights POD Number	Actual: Average of Measured Water Diversion	Actual: Number of Houses	Actual: House Size	Actual Total Annual: Average Water Diversion	Actual Total Annual: Average Water Diversion	Predicted Range of Water Diversions, Outdoor: Diversion if Conserve	Outdoor: Diversion if Non-Conserve	Indoor: Diversion if Conserve	Indoor: Diversion if Not Conserve	Total Annual: Diversion if Conserve	Total Annual: Diversion if Not Conserve	Total Annual: Diversion if Conserve	Total Annual: Diversion if Not Conserve
		Per Meter		2010 Census	Per House	*Per Capita*	Per House						*Per Capita*	
		ac-ft/yr			ac-ft/yr		ac-ft/yr							
8396	RG 52317	0.38	3	2.14	0.13	*0.06*	0.01	0.01	0.11	0.26	0.12	0.27	*0.05*	*0.13*
8579	RG 50417	0.72	1	2.31	0.72	*0.31*	0.23	0.36	0.12	0.28	0.35	0.64	*0.15*	*0.28*
8581	RG 45157	0.61	1	2.3	0.61	*0.26*	0.24	0.49	0.12	0.28	0.36	0.77	*0.16*	*0.33*
9383	RG 47303	1.40	1	2.33	1.40	*0.60*	0.00	0.00	0.12	0.28	0.12	0.28	*0.05*	*0.12*
9519	RG 53887	0.99	1	2.32	0.99	*0.43*	0.28	0.48	0.12	0.28	0.40	0.76	*0.17*	*0.33*
9957	RG 42760	0.43	1	2.33	0.43	*0.18*	0.50	0.96	0.12	0.28	0.62	1.25	*0.27*	*0.53*
9958	RG 42760	0.52	1	2.33	0.52	*0.22*	0.44	0.75	0.12	0.28	0.56	1.03	*0.24*	*0.44*
10171	RG 43372	0.14	2	2.12	0.07	*0.03*	0.03	0.04	0.11	0.26	0.13	0.30	*0.06*	*0.14*
10284	RG 55665	1.60	4	2.2	0.40	*0.18*	0.03	0.06	0.11	0.27	0.14	0.32	*0.06*	*0.15*
10333	RG 23040 POD 2	0.81	3	2.46	0.27	*0.11*	0.17	0.27	0.12	0.30	0.29	0.57	*0.12*	*0.23*
10352	RG 22690	0.21	1	2	0.21	*0.11*	0.07	0.12	0.10	0.24	0.17	0.36	*0.09*	*0.18*
10353	RG 22690	0.26	1	1	0.26	*0.26*	0.08	0.14	0.05	0.12	0.13	0.26	*0.13*	*0.26*
10509	RG 48802	0.33	3	2.35	0.11	*0.05*	0.04	0.14	0.12	0.28	0.16	0.43	*0.07*	*0.18*
10757	RG 31499	0.25	2	1.93	0.13	*0.06*	0.02	0.03	0.10	0.23	0.11	0.26	*0.06*	*0.14*
10819	RG 55326	0.28	2	2	0.14	*0.07*	0.04	0.08	0.10	0.24	0.15	0.32	*0.07*	*0.16*
10843	RG 18119	0.04	1	2.15	0.04	*0.02*	0.00	0.00	0.11	0.26	0.11	0.26	*0.05*	*0.12*
10850	RG 89117 POD1	0.41	3	2.14	0.14	*0.06*	0.01	0.01	0.11	0.26	0.11	0.27	*0.05*	*0.13*
10897	RG 67598	1.10	3	2.05	0.37	*0.18*	0.10	0.16	0.10	0.25	0.20	0.41	*0.10*	*0.20*
10909	RG 11278	0.11	3	2.7	0.04	*0.01*	0.01	0.02	0.14	0.33	0.15	0.34	*0.05*	*0.13*

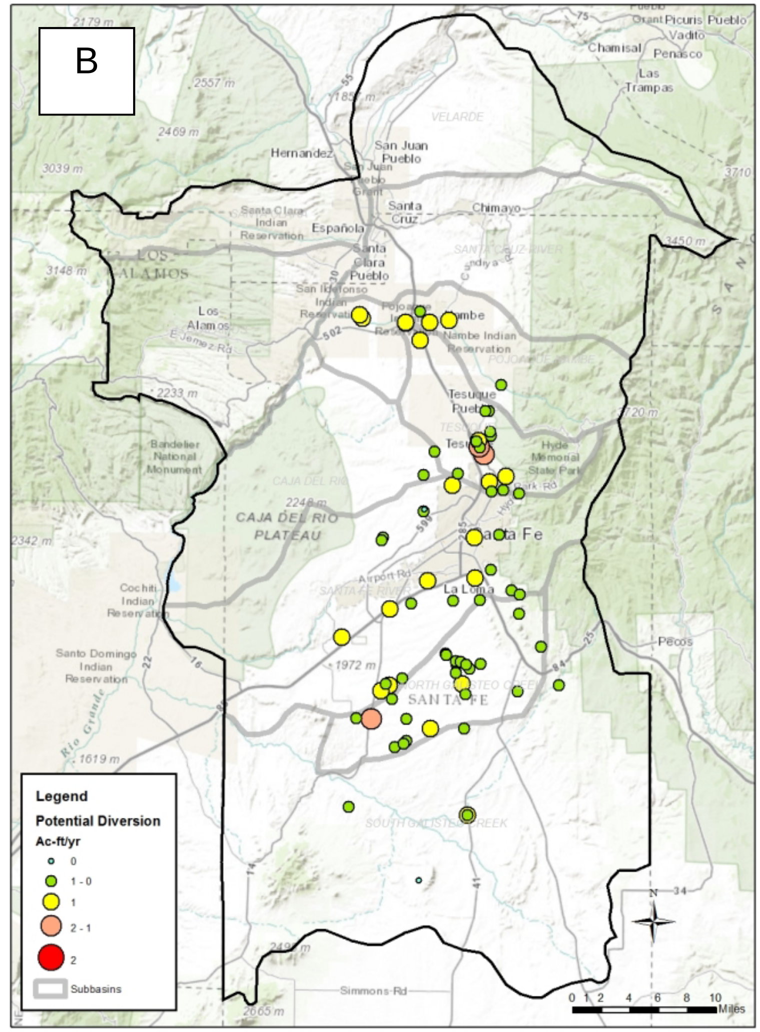
Summary of actual and predicted water use per meter.

Meter Number	Water Rights POD Number	Actual: Average of Measured Water Diversion	Actual: Number of Houses	Actual: House Size	Actual: Total Annual: Average Water Diversion	Actual: Total Annual: Average Water Diversion	Predicted Range of Water Diversions: Outdoor: Diversion if Conserve	Outdoor: Diversion if Non-Conserve	Indoor: Diversion if Conserve	Indoor: Diversion if Not Conserve	Total Annual: Diversion if Conserve	Total Annual: Diversion if Not Conserve	Total Annual: Diversion if Conserve	Total Annual: Diversion if Not Conserve
		Per Meter		2010 Census	Per House	*Per Capita*	Per House						*Per Capita*	
		ac-ft/yr			ac-ft/yr		ac-ft/yr							
10910	RG 18119	0.25	1	2.15	0.25	*0.12*	0.03	0.06	0.11	0.26	0.14	0.32	*0.07*	*0.15*
11188	RG 56326	0.20	1	2.46	0.20	*0.08*	0.01	0.01	0.12	0.30	0.13	0.31	*0.05*	*0.13*
11189	RG 56326 X	0.07	1	2.46	0.07	*0.03*	0.25	0.42	0.12	0.30	0.37	0.72	*0.15*	*0.29*
11225	RG 51167	1.50	1	1.93	1.50	*0.78*	0.30	0.52	0.10	0.23	0.40	0.75	*0.21*	*0.39*
11313	RG 79466	0.34	2	2.14	0.17	*0.08*	0.05	0.13	0.11	0.26	0.16	0.39	*0.07*	*0.18*
11331	RG 40516	0.23	1	1.98	0.23	*0.12*	0.07	0.18	0.10	0.24	0.17	0.42	*0.09*	*0.21*
11332	RG 52980	0.16	1	2.08	0.16	*0.08*	0.04	0.06	0.11	0.25	0.14	0.31	*0.07*	*0.15*
11451	RG 85097	0.50	4	2.46	0.12	*0.05*	0.03	0.05	0.12	0.30	0.15	0.35	*0.06*	*0.14*
12071	RG 31375	0.34	2	2.46	0.17	*0.07*	0.02	0.03	0.12	0.30	0.14	0.33	*0.06*	*0.14*
12582	RG 53619	0.73	4	2.15	0.18	*0.08*	0.03	0.06	0.11	0.26	0.14	0.32	*0.07*	*0.15*
12633	RG 87718	1.10	2	2.46	0.55	*0.22*	0.06	0.21	0.12	0.30	0.18	0.51	*0.07*	*0.21*
12962	RG 56503	0.58	2	2.34	0.29	*0.12*	0.05	0.13	0.12	0.28	0.17	0.41	*0.07*	*0.18*
13165	RG 72659	2.70	2	2.05	1.35	*0.66*	0.13	0.31	0.10	0.25	0.23	0.56	*0.11*	*0.27*
13169	RG 90933 POD1	0.22	3	1.82	0.07	*0.04*	0.01	0.01	0.09	0.22	0.10	0.23	*0.05*	*0.13*
13575	RG 22412	1.25	6	2.12	0.21	*0.10*	0.04	0.06	0.11	0.26	0.14	0.32	*0.07*	*0.15*
13867	RG 42962	0.07	1	2.14	0.07	0.03	0.00	0.00	0.11	0.26	0.11	0.26	0.05	0.12
13869	RG 42962	0.20	1	2.14	0.20	0.09	0.02	0.03	0.11	0.26	0.13	0.29	0.06	0.14
13871	RG 42962	0.14	1	2.14	0.14	0.07	0.01	0.01	0.11	0.26	0.12	0.27	0.05	0.13
14282	RG 33831	0.55	1	2.33	0.55	*0.23*	0.21	0.32	0.12	0.28	0.32	0.61	*0.14*	*0.26*

Summary of actual and predicted water use per meter.														
		Actual					Predicted Range of Water Diversions							
					Total Annual		Outdoor		Indoor		Total Annual			
Meter Number	Water Rights POD Number	Average of Measured Water Diversion	Number of Houses	House Size	Average Water Diversion	Average Water Diversion	Diversion if Conserve	Diversion if Non-Conserve	Diversion if Conserve	Diversion if Not Conserve	Diversion if Conserve	Diversion if Not Conserve	Diversion if Conserve	Diversion if Not Conserve
		Per Meter		2010 Census	Per House	*Per Capita*	Per House						*Per Capita*	
		ac-ft/yr			ac-ft/yr		ac-ft/yr							
14446	RG 62646	0.15	4	2.46	0.04	*0.02*	0.00	0.00	0.12	0.30	0.13	0.30	*0.05*	*0.12*
14730	RG 51702	0.13	4	2.14	0.03	*0.02*	0.01	0.01	0.11	0.26	0.11	0.27	*0.05*	*0.13*
13542	RG 42962	0.14	1	2.14	0.14	0.07	0.04	0.07	0.11	0.26	0.15	0.33	0.07	0.16
Total/Average			**161**	**2.21**	**0.41**	**0.19**	**0.10**	**0.19**	**0.11**	**0.27**	**0.21**	**0.45**	**0.10**	**0.20**
Median				**2.14**	**0.26**	**0.12**	**0.05**	**0.10**	**0.11**	**0.26**	**0.16**	**0.35**	**0.07**	**0.17**

Figure 21. Comparison of Existing (a) and Potential (b) Household Water Use from Domestic Wells if Conservation Measures were Implemented.





4.4 Agricultural Water Use

As stated in Section 3.4, the amount of irrigated acreage has not been assessed for over a decade, and very little is known about the actual water diversions, return flows, crops grown, and irrigation methods. In a partner meeting on April 27, 2012, we discussed the possibility of assessing the conservation potential for the agricultural sector given the limited amount of knowledge regarding the irrigation systems. Lining an acequia or installing drip irrigation, for instance, may improve the off-farm and on-farm efficiency for a particular farm, but it also increases the water use on that farm and may reduce water that otherwise was returning to a stream, acequia or shallow groundwater that was serving other farms. It is possible that farms at the end of an acequia or otherwise isolated from the other farms may benefit from conservation efforts without doing harm to downstream parciantes. It is also possible that laser leveling fields could improve irrigation efficiency and reduce the waste of "incidental depletions", such as evaporative losses from ponded water. Determining where this could be accomplished and the savings that could be achieved were beyond the scope of this project. Table 15 summarizes the water diversions from groundwater and surface water and estimated return flows by agriculture in each sub-basin.

4.5 Treated Effluent Use

Several communities, like Santa Fe and Los Alamos use wastewater for a variety of purposes, including irrigating parks and golf courses (Table 16). Of the 1,045 acres of turf that were digitized, 15 are artificial, 956 are irrigated with treated effluent and/or raw river water and 243 are irrigated with potable water. The average application rate for fields in Santa Fe is 3.6 ac-ft/acre/yr based on the effluent delivered to fields at the Marty Sanchez Golf Course, the Municipal Recreation Complex, Santa Fe Country Club, Santa Fe Downs, Las Campanas Golf Course and at the fields in White Rock and Los Alamos. Using this application rate for all the turf area, an overall demand of about 1,013 ac-ft of potable water is currently used that could potentially be saved if effluent were both available and transportable (necessary infrastructure) to the turf.

The application rate varies from 2.5 to over 5 ac-ft/acre/yr and could be less if conservation technology is implemented. While the price of effluent is less than potable water, it is a very valuable resource and should be used with the same efficiency as other sources of water.

Forsgren (2013) calculates the irrigation requirements for cool season turf grasses in Los Alamos to be 30-35 inches a year (or 2.5 to 2.9 ac-ft/acre/yr). Some of the fields in Los Alamos used up to 5.4 ac-ft/acre/yr. If conservation technology was implemented for all of the fields such that the application rate was reduced to 32.5 inches per year, the diversion of effluent could be reduced by about 48 ac-ft for Los Alamos and White Rock.

In Santa Fe, the Las Campanas golf course has reduced the turf area and implemented conservation technology to reduce their application rate to 39 inches per year in 2010. (As of 2012 Las Campanas no longer irrigates with treated effluent from the City of Santa Fe, but utilizes raw river water and treated effluent from Las Campanas.) The Marty Sanchez golf course applied 51 inches of water in 2010, thus if they followed the example of Las Campanas by implementing water conserving technology, the use of treated effluent could be reduced to 39 inches per year for a savings of 105 ac-ft/yr.

Table 15. Water Use and Information for the Agricultural Sector.

	Velarde	Los Alamos	Santa Clara	Santa Cruz	Pojoaque-Nambe	Tesuque	Santa Fe	Caja del Rio	North Galisteo	South Galisteo	**Total**
Agriculture											
Irrigation Wells in OSE WATERS	4	0	0	163	30	16	30	0	7	9	259
SW Declarations or Permits in OSE WATERS	12	0	0	65	71	13	4	0	0	3	
Diverted from groundwater (ac-ft/yr)	47	0	0	0	366	0	318	0	0	0	731
Diverted from surface water (ac-ft/yr)	26,400	0	1,623	19,703	8,442	2,111	2,665	0	0	287	61,231
Estimated irrigation return flow (ac-ft/yr)	16,750	0	886	10,760	4,457	1,115	1,559	0	0	168	35,695

Table 16. Treated Effluent Use, Turf Area and Potential Use of Treated Effluent.

	Velarde	Los Alamos	Santa Clara	Santa Cruz	Pojoaque-Nambe	Tesuque	Santa Fe	Caja del Rio	North Galisteo	South Galisteo	**Total**
Treated Effluent Use											
Area of Turf (acres)	0	155.6	0.0	86.0	6.0	80.9	545.2	168.5	3.1	0	1,045
Area of Artificial (acres)	0	0.0	0.0	0.0	0	0	14.1	0.0	1.4	0	15
Area of turf irrigated with treated effluent (acres)	0	104.2	0	0	0	80.9	353.4	84.3	0	0	623
Area of turf irrigated with raw river water (acres)	0	0	0	80.3	0	0	0.0	*84.3*	0	0	165
Area of turf irrigated with potable water (acres)	0.0	51.4	0.0	5.7	6.0	0.0	177.8	0.0	1.7	0.0	243
Water Diversion with Effluent for Turf (ac-ft/yr)	0	379	0	0	0	285	1,019.8	413	0	0	2,106
Water Diversion with Potable Water for Turf (ac-ft/yr)	0	187	0	21	22	0	646	132	6	0	1,013
Potential Water Savings with Treated Effluent use (ac-ft/yr)	0	187	0	21	22	0	646	132	6	0	1,013

5. Conclusions and Recommendations

Table 17 and Table 18 summarize the overall potential savings for the region for each of the water use sectors. Overall, the magnitude of potential savings is equivalent for public water systems and domestic wells. The potential for water savings with conservation measures is significant for some public water systems and an estimated 64 percent of domestic wells. The largest public water system, the City of Santa Fe's Sangre de Cristo Water Utility, serves 80,000 people (out of the 98,600 in the Santa Fe Sub-basin), nearly half of the population in the region, and with their conservation efforts have reduced the total (indoor and outdoor) residential water demand to 72 gpcd (75 gpcd for single family and 49 gpcd for multi-family units), lower than the calculated "conserving" rate. Los Alamos water users would have to cut their residential per capita demand in half to obtain the "conserving" household rate, which could result in most of the estimated potential savings for this water sector: about 590 ac-ft/yr out of the estimated total for the region of 1,000 ac-ft/yr. This potential reduction of 1,000 ac-ft/yr represents about 5 percent of the current diversions for the 64 public water systems. Recent water demand data was available for 67 percent of the public water systems, thus better information will help to accurately assess the overall potential through conservation initiatives.

Table 17. Summary of overall potential water savings by water sector.

Water Use Sector	Potential water savings (ac-ft/yr)
Public water systems	1,016
Commercial self-supplied	Unknown
Domestic wells	1,872
Treated Effluent use	1,013
Agricultural irrigation	Unknown

The self-supplied commercial sector diverts an estimated 1,500 ac-ft total based on data that is 10 to 20 years old. Better meter readings and reporting could improve the understanding of the actual use of this sector and then assess whether or not the use could be reduced through conservation. Only 30 percent of the self-supplied commercial systems had 2010 meter records.

Domestic wells divert an estimated 5,640 ac-ft/yr and the estimated potential savings is about 1,870 ac-ft or 33 percent of the total diversion from domestic wells if conservation practices were implemented for the existing landscapes. More savings could be achieved by reducing landscaped area. Only 6 percent of domestic wells report meter records to the OSE, and only about 2 percent stated how many homes are connected to the wells.

While use of treated effluent is already significant in this region, the potential exists for more savings if the infrastructure were in place and the effluent available to irrigate turf that is presently irrigated with potable water. An estimated 1,013 ac-ft/yr of potable water is applied to turf in the region. Currently, the City of Santa Fe irrigated 177.8 acres of turf with potable water, requiring an estimated 646 ac-ft of potable water, or about 6.5 percent of the 9,958 ac-ft annual diversion. The daily demand of effluent currently exceeds the availability, thus storage of effluent may be needed as part of the infrastructure. If application rates of effluent exceed the turf requirements, more effluent could be made available to irrigate other areas. Artificial turf could be used to reduce the demands on potable water where appropriate.

The agricultural sector diverts most of the water in the region, 61,231 ac-ft of surface water, but an estimated 35,700 ac-ft/yr returns back to the surface water and/or groundwater aquifers, thus the total consumption (depletion) is about 26,000 ac-ft/yr. An estimated 730 ac-ft/yr are diverted from groundwater. Water conservation in agriculture commonly increases the depletion and intercepts return flow water that otherwise serves other users, thus water conservation was not pursued for this sector.

Recommendations:

1. Develop conservation plans targeted for communities with higher per capita demand. ***Data Gap: Audits for each community with high water use to determine where savings can be achieved. Monthly diversion data for each water sector within the public water systems is required for the analysis. Average landscaped area for each community should be determined to quantify the water requirements for existing landscape types.***
2. Develop conservation plans for domestic wells. ***Data Gap: Audits for self-supplied homes with high water usage to determine where savings can be achieved. Monthly data and specific information on the number people served by each home will help determine the cause of high water use.***

3. Employ more staff at OSE or county governments to track water use in the region because only a small fraction of the domestic wells are metered and very little is known about the water use from the commercial sector. ***Data Gap: Diversion data for 23 percent of public water systems, 69 percent of self-supplied commercial systems and 98% of domestic wells, which currently have no reported metered water usage.***
4. Explore the possibility of reducing the use of potable water currently irrigating 243 acres of turf. Currently, the municipalities of Santa Fe and Los Alamos do not have excess effluent to meet the existing daily demand. ***Data Gap: Details on the options to replace with artificial turf or use other source of supply for each park or golf course currently irrigated with potable water***.
5. Implement conservation technology where turf is irrigated (regardless of the source of water) to reduce the demands on those sources of supply. ***Data Gap: Application rates on all parks, turf type, water requirements for existing turf.***

Table 18. Summary of the potential for water savings through conservation by sector and sub-basin.

	Velarde	Los Alamos	Santa Clara	Santa Cruz	Pojoaque-Nambe	Tesuque	Santa Fe	Caja del Rio	North Galisteo	South Galisteo	**Total**
	acre-feet per year										
Public Water Systems	0	590	NA	250	12	42	0	112	0	9	1,016
Commercial Self-Supplied	0	0	0	0	NA	0	0	NA	0	0	NA
Domestic Wells	182	32	61	313	389	239	323	113	80	139	1,872
Treated Effluent use	0	187	0	21	22	0	646	132	6	0	1,013
Agriculture	NA	0	NA	NA	NA	NA	NA	0	0	NA	NA
Total	182	810	61	584	423	282	859	356	86	148	3,900

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Appendix A1. Attendees of Partner Meetings.

April 27, 2012

Cheri Vogel, OSE Water Use Bureau
Molly Magnuson, OSE Water Use Bureau
Dagmar Llewellyn, Bureau of Reclamation
Joe Alderete, Bureau of Reclamation
Christine Chavez, Los Alamos County Water Conservation Coordinator
Marcha Carra, Bureau of Reclamation
Darcy Bushnell, Utton Center
Charlie Nylander, EBRIF/Jemez y Sangre/Watermatters, LLC.
Wetherbee Dorshow, Earth Analytic, Inc.
Amy C. Lewis, ACL Consulting
Craig O'Hare, SF County Public Works Dept.
Claudia Borchert, City of Santa Fe Water Division
Meredith Porter, Student Intern, Santa Fe County
Hvtce Miller, Santa Fe County
Lucia Sanchez, Rio Arriba County
Patricio Garcia, Rio Arriba County Planning Director
Duncan Sill, Santa Fe County

August 24, 2012

Erik Aaboe, Santa Fe County, Energy Specialist
Patricio Guerrerortiz, Santa Fe County Public Works Director
Molly Magnuson, OSE Water Use Bureau
Julie Valdez, OSE Water Use Bureau
Amanda Hargis, Santa Fe County
Dagmar Llewellyn, Bureau of Reclamation
Joe Alderete, Bureau of Reclamation
Todd Kirkpatrick, Bureau of Reclamation
Christine Chavez, Los Alamos County Water Conservation Coordinator
Charlie Nylander, EBRIF/Jemez y Sangre/Watermatters, LLC.
Wetherbee Dorshow, Earth Analytic, Inc.
Amy C. Lewis, ACL Consulting
Craig O'Hare, SF County Public Works Dept.
Agnes Leybo-Cruz, Santa Fe County Public Works
Laurie Trevizo, City of Santa Fe Water Conservation Division

September 11, 2013

Erik Aaboe, Santa Fe County, Energy Specialist
Molly Magnuson, OSE Water Use Bureau
Todd Kirkpatrick, Bureau of Reclamation
Christine Chavez, Los Alamos County Water Conservation Coordinator
Charlie Nylander, EBRIF/Jemez y Sangre/Watermatters, LLC.

Wetherbee Dorshow, Earth Analytic, Inc.
Amy C. Lewis, ACL Consulting
Craig O'Hare, SF County Public Works Dept.
Consuelo Bokum, Jemez y Sangre Water Planning Council
Stephen Wiman, City of Santa Fe Water Conservation Committee
Paul Casaus, Santa Fe County Public Utilities
Claudia Borchert, City of Santa Fe Water Division
Joseph Gutierrez, Santa Fe County
Lam Ho, Bureau of Reclamation
Lucia Sanchez, Rio Arriba County
Hvtce Miller, Santa Fe County
Grace Perez, City of Santa Fe Water Conservation Committee

Appendix A2. Plan of Action

INVENTORY OF WATER USE IN THE ESPAÑOLA BASIN
PARTNER PLAN OF ACTION
FOR DISCUSSION
June 16, 2012

GOAL: Develop a Plan of Action that details the sources of water diversion and depletion amounts and other data for each water use category and defines each partner's roles and responsibilities.

Water Use Sectors	Data and Sources	Gap in Supply & Demand	Responsible Partner(s)	Sub-Activities, Target Dates, and Individual Responsibilities	Possible Future Actions to quantify water use
1. Municipal and Community Public Water Systems	69 Community water systems with infrastructure data: 41 with Diversion data, JyS 2003 Plan and JyS 2007 Update NMED Drinking Water Bureau (DWB) OSE 2005 Water Use and 2010 Update OSE Aquifer Test Database and NMBMG Database Survey	28 need diversion 13 Need population or service connections	Amy Lewis Consulting (ALC) and *PWS Sub-Committee	Partners mail out PWS Surveys and Maps in June; Responses due July 11th with phone follow-ups; preliminary water utility model by July 6th (ACL);	
2. Commercial and Industrial Use	OSE 2005 Water Use OSE draft of 2010 water use and meter records JyS 2007 update	2012 estimates of diversions	ACL, JyS, and EBRIF	ACL and Charlie Nylander select targets for calls and interviews; Charlie engages JyS and EBRIF in performing calls and interviews;	

Water Use Sectors	Data and Sources	Gap in Supply & Demand	Responsible Partner(s)	Sub-Activities, Target Dates, and Individual Responsibilities	Possible Future Actions to Quantify Water Use
3. Tribal Community Water Systems	JyS 2007 Update OSE 2005 Use Report IHS, OSE, &NMED Survey and Interview	2010-2012 water diversions	Charlie Nylander and ALC	Charlie mail out survey letters to Pueblos in June, with one-on-one follow up in July;	
4. Domestic Well Use	399 wells with location and diversion data: average diversion is 0.5 ac-ft/yr OSE database JyS 2007 Update Census County Database	Population served by domestic wells and actual use by all wells	ALC and *Domestic Well Sub-Committee	Estimate use by 2010 census and average diversion from OSE meter database; Well Sub-Committee decide whether to perform selected interviews in July;	Compare water use to aerial photography to assess outdoor water use and help target conservation programs
5. Agricultural Water Use	Extension agents say water use has not changed since 2005 JyS 2009 Update OSE, NRCS Farm Service Agency Acequia Assoc. & GIS	2010-2012 irrigated acreage and diversions of water	ACL and *Irrigation Sub-Committee	Create polygon for 12 major irrigated areas (ACL and Earth Analytic) and create data table attributes in June; Meet with OSE Hydrographic Survey on June 26 on OSE GIS Schema, include SF County digitized versions of hydrographic survey maps	Populate GIS data as hydrographic surveys are completed. Estimate irrigated acreage from aerial photography

Water Use Sectors	Data and Sources	Gap in Supply & Demand	Responsible Partner(s)	Sub-Activities, Target Dates, and Individual Responsibilities	Possible Future Actions to Quantify Water Use
6. Reclaimed Wastewater Reuse	2002 data on wastewater use for a few systems NMED, OSE, IHS, EBRIF	2012 estimates on which systems use effluent and how much	ACL, EBRIF, JyS	PWS survey includes questions about wastewater reuse. Charlie coordinate data gathering with EBRIF members	
7. Riparian Vegetation Use	JyS 2003 GIS Hydric Soils MRLC, HRF, Landsat	2012 estimate of water use	ACL	ACL and Earth Analytic collaborate on data sources;	GIS analysis of aerial photography
8. Surface Water Evaporation	JyS 2003 NHD Database GIS, Calculation	2012 estimate of water use	ACL	ACL is lead for this calculation;	GIS analysis of aerial photography

*Public Water System Sub-Committee Members: Amy Lewis, Cheri Vogel, Patricio Guerrerortiz, Craig O'Hare, Christine Chavez, Rick Carpenter, Lucia Sanchez, Charlie Nylander

Irrigation Sub-Committee Members: Duncan Sill, Patricio Garcia, Lucia Sanchez, Molly Magnuson, Charlie Nylander, Laurie Trevizo,

Domestic Well Sub-Committee Members: Charlie Nylander, Claudia Borchert, Duncan Sill, and JyS members

Appendix B

Public Water System Survey

Please review the data below and make any corrections necessary. We would also like your feedback on the nature and types of water conservation actions that have been implemented and assistance that would be most useful from your county government or other agencies.

Water System			
Previous names of water system			
Name/Title			
Address			
E-mail		**Phone**	
Type of Water Treatment (if any)			
Number of wells		**Wells Metered?** Y N	
Production Capacity (gpd)			
Annual Diversions (million gallons)			
Peak Demand Summer (gpd)			
Number of service connections		**Service Connections Metered?** Y N	
Rate Structure (circle one):	**Flat monthly fee**	**Based on amount of water used**	
Wastewater collection system			
Wastewater reuse?		**Percent reused:**	

Actions to **Reduce Demand** (Please check all that apply and describe the proposed project in the space provided).

Current	Reports, Data Available	Proposed	May consider in the future	
☐	☐	☐	☐	Manage growth and land use
☐	☐	☐	☐	Water conservation focused on outdoor use
☐	☐	☐	☐	Water conservation focused on indoor use for new construction
☐	☐	☐	☐	Water conservation focused on indoor use through retrofits
☐	☐	☐	☐	Water harvesting (rooftop)
☐	☐	☐	☐	Rate structure incentive for water conservation
☐	☐	☐	☐	Graywater harvesting
☐	☐	☐	☐	Rebates or other incentives to reduce demand
☐	☐	☐	☐	Wastewater reuse
☐	☐	☐	☐	Other___________________________

Please briefly describe the proposed or completed projects or programs.

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	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
WATER CONSERVATION					
Need assistance with educating customers on reducing water waste (fugitive water, watering at appropriate times, etc)					
Need assistance with educating customers on indoor water conservation					
Need assistance with education customers on outdoor water conservation					
Would like assistance with developing appropriate rate structures to encourage water conservation					
Would like assistance with developing rebate programs for encouraging water conservation					
Would like assistance with developing mandatory requirement for encourage water conservation					
Would like to collaborate with other water systems to conduct routine leak detection surveys					

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
INFRASTRUCTURE MANAGEMENT					
The current infrastructure is in excellent condition					
Would like assistance in maintaining storage tanks, wells, pumps, water treatment equipment and other infrastructure					
Would like assistance in planning infrastructure development.					
Would like assistance in preparing an asset inventory and asset management plan.					
Would like assistance with complying with water quality regulations such as sampling and reporting					
Would like assistance in providing adequate fire protection throughout the water system boundary.					
Water System has sufficient wet water supply and water rights to meet customer needs, including peak daily demand, at all times.					
Water levels in wells are declining and we are concerned about supply					
Water system is run by volunteers and management of system is difficult					
We are members of NMRWA					
Water quality meets all water quality standards					
Additional comments:					

Appendix C. Estimated water diversions for each sector of use.

Table C1. Groundwater budget components for the Jemez y Sangre Water Planning Region.

Sub-Basin		Velarde	Los Alamos	Santa Clara	Santa Cruz	Pojoaque-Nambe	Tesuque	Santa Fe	Caja del Rio	North Galisteo	South Galisteo	Total
Inflow	ref											
Mtn Frnt Recharge	a	2,100	3,820	3,760	3,080	4,500	2,460	5,050	0	0	5,500	30,270
Stream Loss	a	1,800	400	510	5,190	5,000	2,500	1,600	1,150	770	0	18,920
Stream loss blw La Bajada	a							4,730				4,730
Flow from Adj Sub	a	4,500	0	0	1,760	3,800	3,500	1,000	3,550	1,550	1,050	20,710
Return Flow	b	489	2,188	646	1,074	375	485	1,513	819	628	242	8,459
Total Inflow		8,889	6,408	4,916	11,104	13,675	8,945	13,893	5,519	2,948	6,792	83,089
Outflow												
Public Water Systems	c	77	4,376	998	285	49	89	1,972	1,266	680	67	9,860
Other Metered Wells	d	64	0.5	10	418	18	450	283	132	132	15	1,522
Domestic Wells	e	837	0	283	1,445	682	431	772	240	443	402	5,536
Irrigation Wells	a	46	0	0	0	366	0	318	0	0	0	730
Evapotranspiration	a	1,350	300	1,250	2,400	1,850	2,400	1,200	1,100	500	1,300	13,650
Springs	a	5,800	0	0	0	4,000	1,815	2,170	0	0	890	14,675
Sub Flow out	a	800	2,300	2,740	7,130	6,960	40,00	4,120	2,550	2,050	4,600	37,250
Total Outflow		8,975	6,977	5,282	11,677	13,926	9,185	10,834	5,288	3,805	7,275	83,223
Change Storage	f	-85	-568	-366	-574	-251	-240	3,059	231	-858	-482	-134

References:
a: Duke, 2001. Water Supply Analyses for the Jemez y Sangre Water Planning Region
b: Water Supply Surveys 2012 plus OSE draft estimates Planning Region *50%
c: Water Supply Surveys 2012 plus OSE draft estimates Planning Region
d: Commercial wells only-OSE estimates
e: (2010 Census Population minus pop served by PWS) * 0.12 ac-ft/cap
f: Inflow minus Outflow

Table C2. Surface water budget components for the Jemez y Sangre Water Planning Region.

Sub-Basin		Velarde	Los Alamos	Santa Clara	Santa Cruz	Pojoaque -Nambe	Tesuque	Santa Fe	Caja del Rio	North Galisteo	South Galisteo	Total
Inflow (ac-ft/yr)	ref											
Surface Inflow	a	593,580	2,790	5,570	26,280	10,540	3,500	7,850	1350	900	6,240	658,600
Springs	a	5,800	0	0	0	4000	1,815	2,170	0	0	890	14,675
Return Flow (Ag)	a	16,750	0	886	10,760	4,457	1,115	1,559	0	0	168	35,695
Return Flow (PWS)	b	0	0	0	0	0	0	3,915	0	0	0	3,915
Outflow (ac-ft/yr)												
Irrigation	a	26,400	0	1,623	19,703	8,442	2,111	2,665	0	0	287	61,231
Public Water Systems	b	0	21	0	0	0	0	2,537	5,413	0	0	7,971
Seepage	a	1,800	400	510	5,190	5,000	2,500	8,500	1,150	770	0	25,820
Evapotranspiration	a	2,570	1,990	550	3,680	2,850	1,280	1,180	200	130	2570	17,000
Surface Outflow	a	585,360	400	3,780	8,470	2,705	540	1,110	0	0	4440	606,805

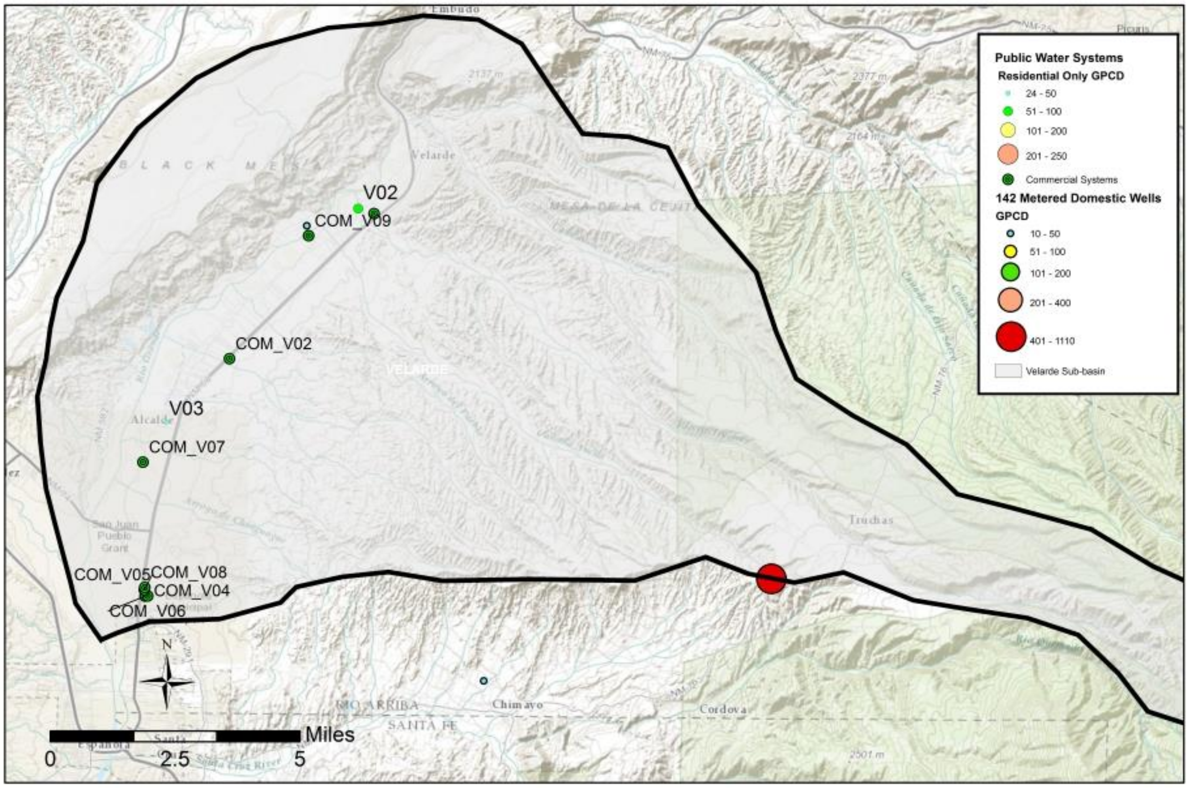
References:

a: Duke, 2001. Water Supply Analyses for the Jemez y Sangre Water Planning Region

b: Water Supply Surveys 2012 plus OSE draft estimates Planning Region

Appendix D. Sub-basin Summaries

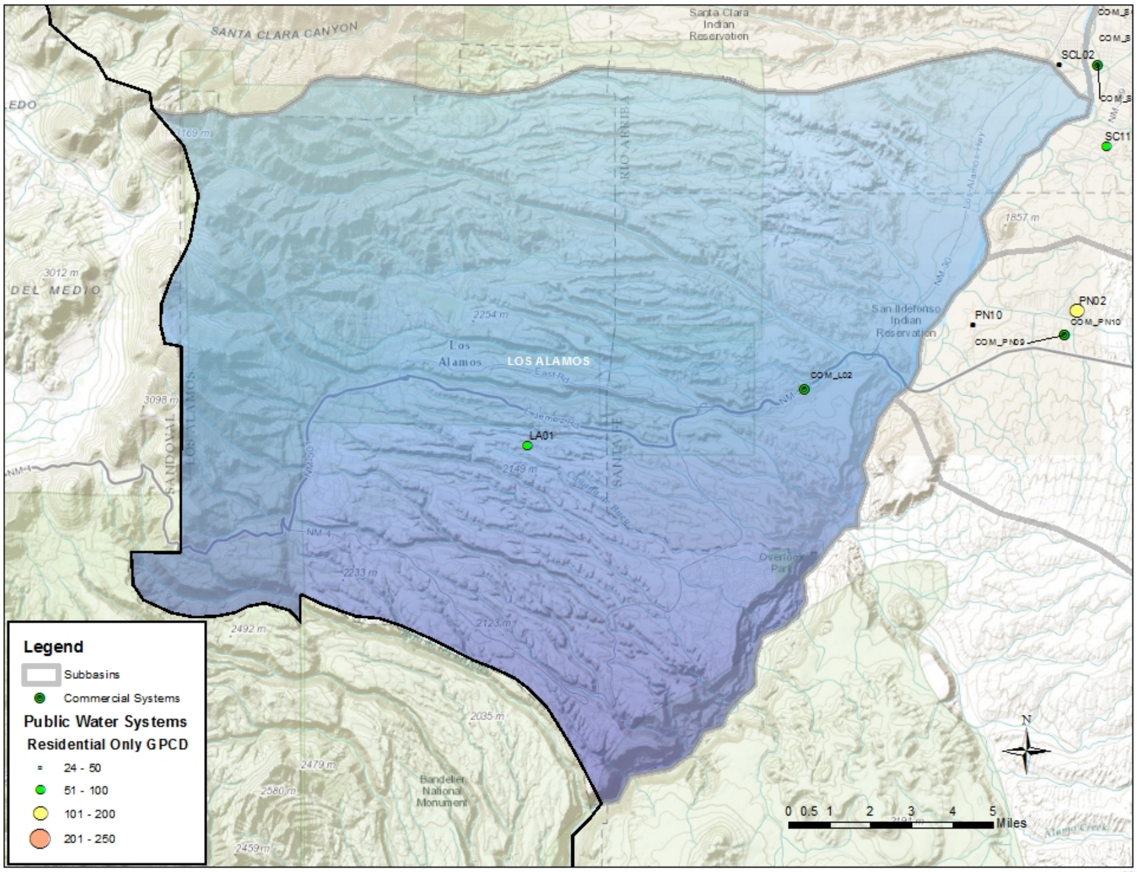
Velarde Sub-basin	
Total Population (2010 Census)	8,538
Average Household Size	2.60
Public Water Systems	
Four systems serve 1740 people. Three of the systems have diversion data showing 77 ac-ft/yr diverted from groundwater	
The average use from these systems (with no commercial use).	40 gpcd
Conserving Household (gpcd)	86 gpcd
Potential Water Savings from PWS	0
Commercial Self-Supplied Water Systems	
9 commercial self-supplied water systems. One system has diversion data of 64.2 ac-ft/yr from groundwater	
Domestic Wells	
Estimated population served by domestic wells in the Velarde sub-basin is 6,800, which with an average household size of 2.6 suggests that 2,600 active domestic wells in the sub-basin. OSE WATERS includes information on 823 domestic wells, but only 2 have meter readings. Not enough information to assess actual per capita demand from domestic wells.	
Estimated amount of water diverted from domestic wells using median of metered wells (0.12 ac-ft/yr/person)	837 ac-ft/yr
Potential water savings from domestic wells	182 ac-ft
Treated Effluent	
No turf identified from aerial photography at a scale of 1:15,000	
Agriculture	
In the Velarde sub-basin, 26,400 ac-ft/yr of surface water and 47 ac-ft/yr of groundwater are diverted for irrigation (DBS&A and ACL, 2003). OSE WATERS has information on 4 wells and 12 surface water declarations or permits.	
While the estimated irrigation return flow is 16,750 ac-ft/yr, much of that return flow goes to other farms or the Rio Grande and thus, any “conservation” practices may actually increase the amount of water depleted.	



Public Water Systems - Residential Per Capita Demand

Los Alamos

Los Alamos Sub-basin	
Total Population (2010 Census)	18,671
Average Household Size	2.22
Public Water Systems	
Of the 18,671 population of Los Alamos sub-basin, 17,950 is within Santa Fe County which is served entirely by one public water system. Los Alamos Public Utility diverted 4,376 ac-ft from groundwater and 21 ac-ft from surface water in 2011. The average per capita demand is 209 gpcd including the commercial sector and 99.2 for residential customers only for 2011.	
Conserving Household	69.8 gpcd
Potential Water Savings from PWS	590 ac-ft/yr
Commercial Self-Supplied Water Systems	
One commercial self-supplied water system in Los Alamos County diverts about 0.5 ac-ft/yr from groundwater	
Domestic Wells	
The estimated population served by domestic wells in the Los Alamos sub-basin (in areas outside of Los Alamos County) is 721, although only 29 domestic wells appear in OSE WATERS. The estimated amount of water diverted from domestic wells is 89 ac-ft/yr. Assuming the annual median domestic well use of 0.123 ac-ft/person and a conservation potential of 0.078 ac-ft/person, a savings of .045 ac-ft per person is estimated for a total of 32 ac-ft/yr.	
Potential Water Savings from Domestic Wells-AFY	32
Treated Effluent	
In Los Alamos sub-basin, 155.6 acres of turf were digitized from the aerial photography. Of this acreage 67%, or 104 acres are irrigated with treated effluent and the remaining 51 acres are irrigated with potable water. An estimated 379 ac-ft of effluent is applied to the 155.6 acres and 187 ac-ft/yr of potable water to the 51 acres.	
Estimated water diversion with potable water for turf	187 ac-ft/yr
Potential water savings with treated effluent use	187 ac-ft/yr
Agriculture	
No agricultural use occurs in the Los Alamos sub-basin	
Potential water savings for agriculture	0


Legend
Subbasins
Commercial Systems
Public Water Systems
Residential Only GPCD
24 - 50
51 - 100
101 - 200
201 - 250
SANTA CLARA CANYON
Santa Clara Indian Reservation
SCL02
SC11
PN02
PN10
COM_PN09
COM_L02
LA01
LOS ALAMOS
San Ildefonso Indian Reservation
Bandelier National Monument
DEL MEDIO
RIO ARRIBA
SANTA FE
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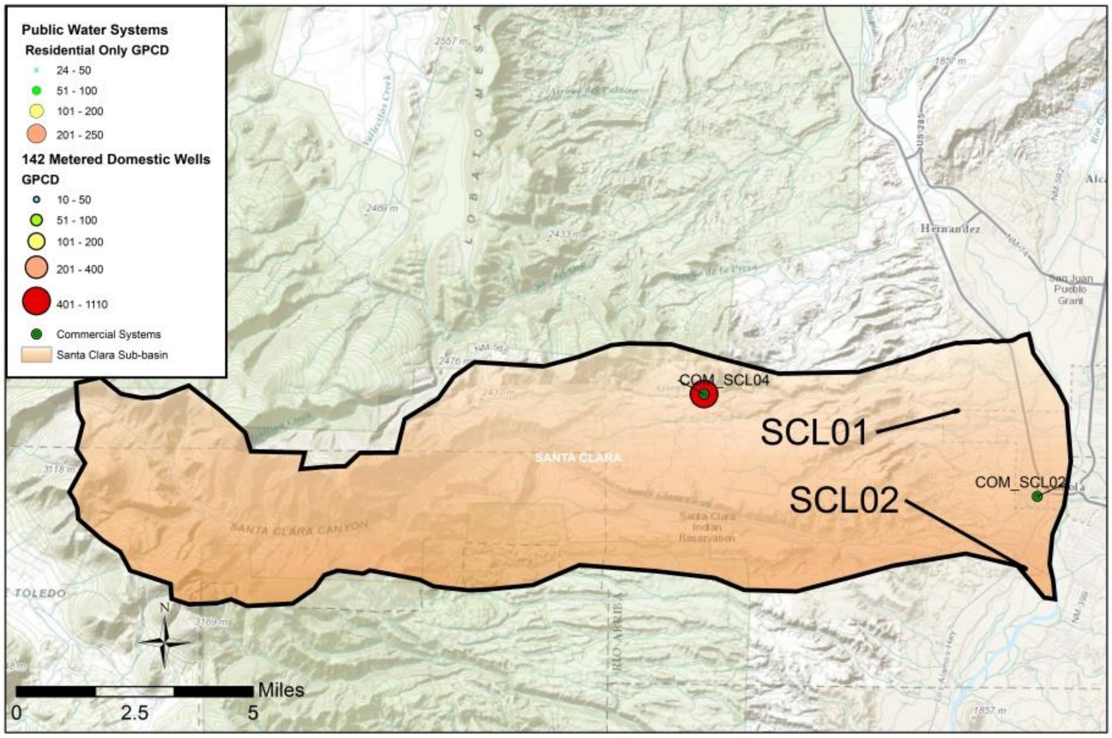
0 0.5 1 2 3 4 5
Miles

Santa Clara

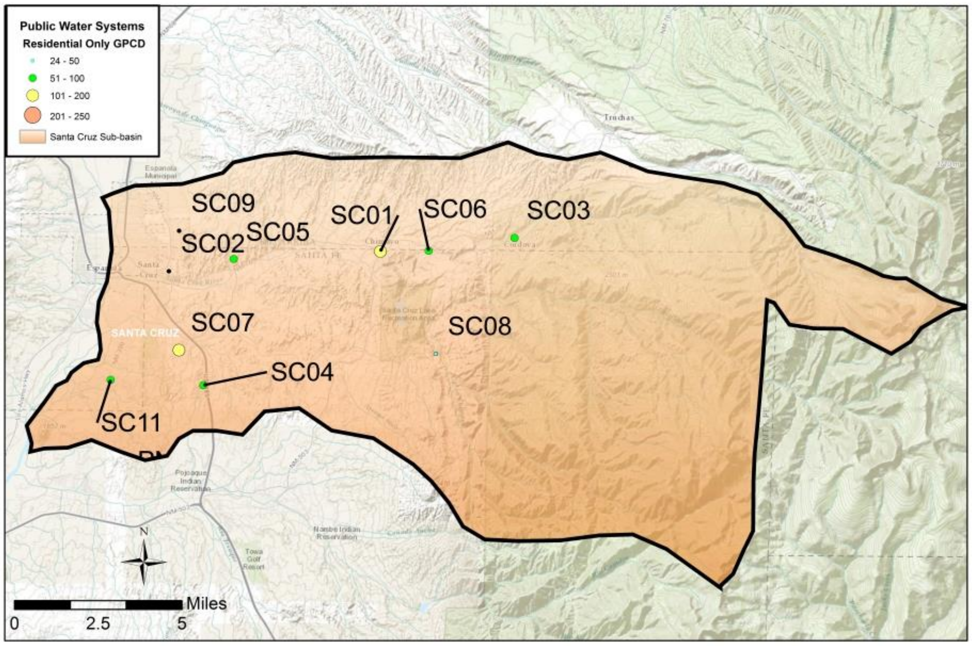
Santa Clara Sub-basin	
Total Population (2010 Census)	4,795
Average Household Size	2.54
Public Water Systems	
Two public water systems are present in the Santa Clara sub-basin. One serves Santa Clara Pueblo and the amount diverted and the population served is unknown. The other system is for the City of Española, which serves about 2500 people and diverts about 1,000 ac-ft/yr from groundwater. The average use on the City of Española system is 89 gpcd, including commercial use. Given that this in only slightly higher than the conserving per capita demand for residential only, no savings are projected for implementing a water conservation plan for Española residents.	
Conserving Household	86 gpcd
Potential Water Savings from PWS (AFY)	0
Commercial Self-Supplied Water Systems	
Two self-supplied commercial systems were identified for Santa Clara sub-basin and only one of systems had diversion data of about 10 ac-ft/yr from groundwater.	
Domestic Wells	
An estimated 2,300 people are served by domestic wells in the Santa Clara sub-basin, which is likely an over-estimate because the population served by Santa Clara's water system is not known. About 900 wells would be needed to serve all 2,300 people based on the average household size. The OSE WATERS database includes 121 domestic wells, only one of which is metered. Insufficient data are available to estimate the amount of water diverted from domestic wells and the potential savings.	
Potential Water Savings from Domestic Well	NA
Treated Effluent	
No turf was identified in the Santa Clara sub-basin from aerial photography at a scale of 1:15,000	
Potential Water Savings with treated effluent	0
Agriculture	
In Santa Clara, 1,623 ac-ft of surface water is diverted for irrigation with about 886 ac-ft/yr. estimated as return flow (DBS&A and ACL, 2003). No irrigation wells were identified. Return flow water serves other farms or the Rio Grande and thus, any "conservation" practices may actually increase the amount of water depleted.	
Potential Water Savings for Agriculture	0



Per Capita Residential Water use for Public Water Systems in the Santa Clara Sub-basin

Santa Cruz

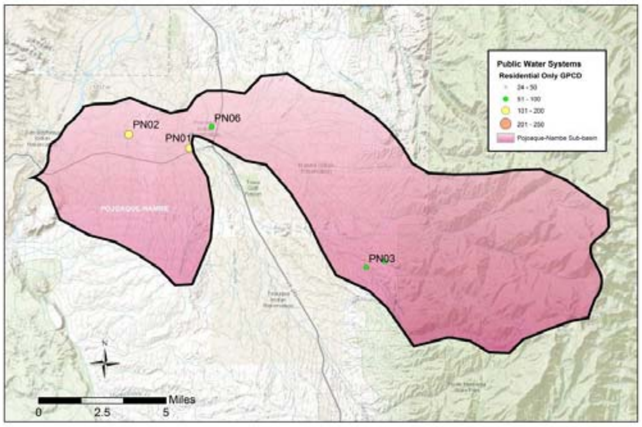
Santa Cruz Sub-basin	
Total Population (2010 Census)	20,647
Average Household Size	2.51
Public Water Systems	
Ten public water systems serve 8,913 people in the Santa Cruz sub-basin. Five of these systems have diversion information, which totals about 285 ac-ft/yr. The average per capita use for the systems with data is 111 gpcd. With a conserving per capita demand of 86 gpcd, the potential water savings for this sub-basin is 250 ac-ft/yr.	
Potential Water Savings from PWS	250 ac-ft/yr
Commercial Self-Supplied Water Systems	
Seven of the twenty-five self-supplied commercial systems in Santa Cruz sub-basin have diversion data. Of those with data, about 418 ac-ft are diverted from groundwater.	
Domestic Wells	
About 57% of the population in Santa Cruz sub-basin is served by domestic wells. Using the average household size, the estimated 11,734 people are served by 4,680 domestic wells. OSE WATERS has information on 1149 wells in their database and 1 of these is metered. If the median per capita meter demand for all of Jemez y Sangre of 0.12 ac-ft/yr is used for the diversion rate, a total of 1445 ac-ft/yr is estimated to be pumped from the groundwater. If 86 gpcd is the rate for a conserving household, then an estimated savings of 313 ac-ft are projected if the median use can be reduced through conservation.	
Potential water savings from domestic wells	313 ac-ft/yr
Treated Effluent	
Of the 86 acres of turf in the Santa Cruz sub-basin, 80 are irrigated with raw river water and 6 are irrigated with potable water. Using an average application rate of 3.6 ac-ft/yr per acre, an estimated 21 ac-ft of potable well water, which could potentially be saved if irrigated with effluent.	
Potential water savings with treated effluent	21 ac-ft/yr
Agriculture	
About 19,700 ac-ft of water are diverted from surface water for agriculture with an estimated 10,760 ac-ft of return flow (DBS&A and ACL, 2003). WATERS shows 65 surface water declaration or permits. While no groundwater diversions were identified in the Jemez y Sangre water plan, 163 irrigation wells are included in OSE WATERS. Return flow water serves other farms or the Rio Grande and thus, any “conservation” practices may actually increase the amount of water depleted.	
Potential water savings for agriculture	0



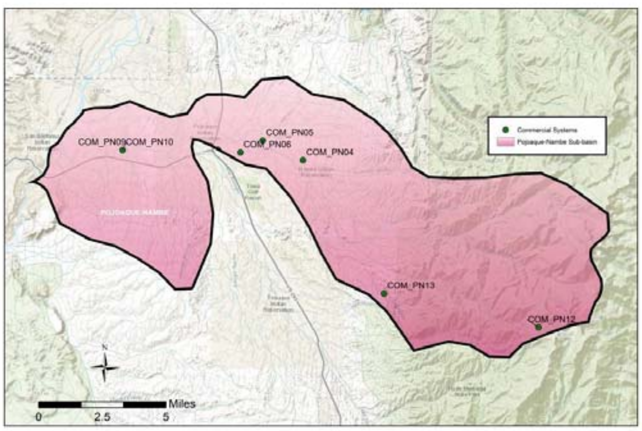
Per Capita Residential Water use for Public Water Systems in the Santa Cruz Sub-basin

Pojoaque-Nambe

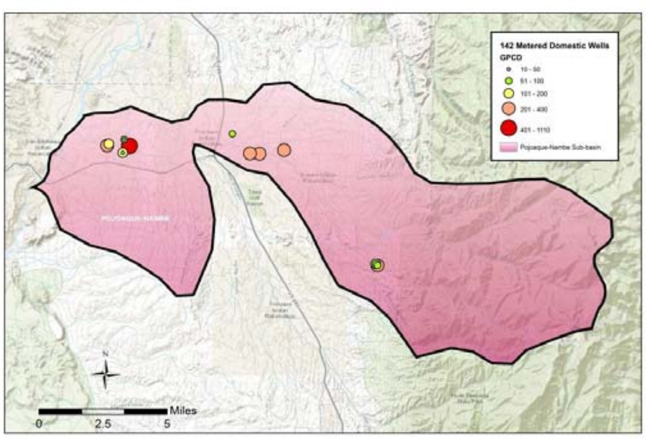
Pojoaque-Nambe Sub-basin	
Total Population (2010 Census)	5,593
Average Household Size	2.36
Public Water Systems	
Eight public water systems serve about 3,000 people in the Pojoaque-Nambe Sub-basin. Three of the systems have diversion data, which total to 49 ac-ft/yr from groundwater. The average residential per capita use is 90 gpcd, which is only slightly more than the conserving rate of 86 gpcd, thus water savings from this sector might reach about 12 ac-ft/yr.	
Potential Water Savings from PWS	12 ac-ft/yr
Commercial Self-Supplied Water Systems	
One of the seven self-supplied commercial systems has diversion data (18.4 ac-ft/yr from groundwater and 18.7 ac-ft/yr from surface water).	
Domestic Wells	
About 2,600 people are served by domestic well, which, if there is one well per house, would equal about 1,100 active domestic wells. The OSE WATERS database includes information on 1,414 wells, 17 of which are metered and state the number of homes connected. The 17 meters serve 19 households with a median per capita diversion rate of 114 gpcd. Seven of the wells specify which houses are connected to the wells. The median per capita demand from the eight houses served by the seven domestic wells is 235 gpcd. Based on the turf for these 8 homes, the median demand should be 101 gpcd if indoor and outdoor conservation is practiced. If a rate of 235 gpcd (0.2633 ac-ft/yr) is applied to all 2,600 people served by domestic wells, 680 ac-ft/yr is diverted from domestic wells. If the conservation measures were applied to the existing outdoor landscaping and low-water use fixtures were used indoors (such that the average use was reduced to 101 gpcd), a total of about 389 ac-ft/yr could be saved.	
Potential Water Savings from Domestic Wells	389 ac-ft/yr
Treated Effluent	
6 acres of turf were identified in the Pojoaque-Nambe sub-basin, all of which are irrigated with potable water. With an average application rate of about 3.6 ac-ft/y/acre, the total amount of water diverted for this turf is about 22 ac-ft.	
Potential water savings with treated effluent	22 ac-ft/yr
Agriculture	
Estimated surface and groundwater diversions for agriculture in the Pojoaque-Nambe sub-basin are 8,442 and 366 ac-ft/yr with 4457 ac-ft/yr of return flow (DBS&A and ACL, 2003).OSE WATERS includes information on 30 Irrigation Wells, and 71 surface water declarations or permits. Return flow water serves other farms or the Rio Grande and thus, any “conservation” practices may actually increase the amount of water depleted.	
Potential water savings for agriculture	0



Per Capita Residential Water use for Public Water Systems in the Pojoaque-Nambe Sub-basin



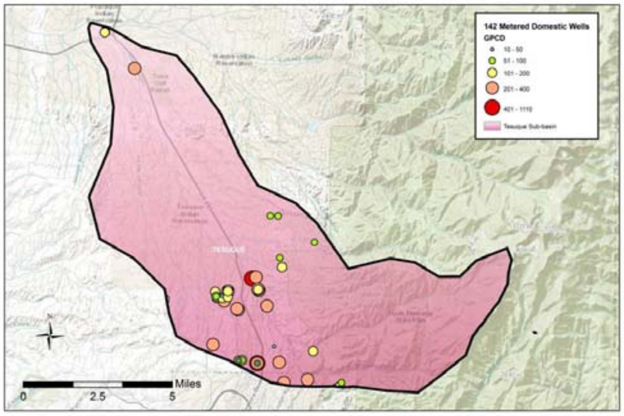
Commercial Self-Supplied Systems



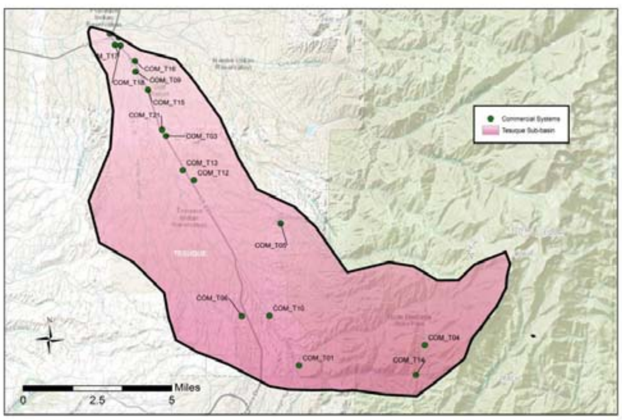
Per capita water diversion from metered domestic wells where the number of houses served is known

Tesuque

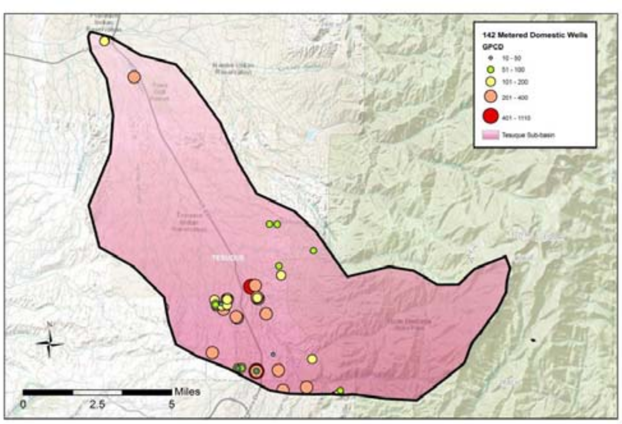
Tesuque Sub-basin	
Total Population (2010 Census)	2,809
Average Household Size	2.22
Public Water Systems	
Three out of four of the public water systems in the Tesuque sub-basin have diversion data, which totals 89 ac-ft/yr from groundwater and serves 966 people. The average per capita residential water use is 116 gpcd and the conserving per capita is 77 gpcd. Thus, the potential water savings is 42 ac-ft/yr.	
Potential water savings from PWS	42 ac-ft/yr
Commercial Self-Supplied Water Systems	
Of the 17 self-supplied commercial systems, 2 have diversion data which total 450 ac-ft/yr from groundwater.	
Domestic Wells	
The estimated population served by domestic wells is 1,843, which relates to 831 active domestic wells. OSE WATERS database shows 949 wells and 47 are metered and state the number of houses connected (108 homes). The median usage for these 47 metered wells connected to 108 homes is 135 gpcd. Details in permit applications for 19 of these wells specified the lot or street number for 32 houses connected to the wells. The median reported metered use from these 32 homes was 209 gpcd. The potential use based on the digitized turf area of these 32 homes is 93 gpcd if indoor and outdoor conservation practices are applied. Using the median rate of water use from the 32 homes for the entire population served by domestic wells, the total annual diversion is estimated to be 431 ac-ft/yr. If the rate was reduced to 93 gpcd, 239 ac-ft/yr could be saved.	
Potential water savings from domestic wells	239 ac-ft/yr
Treated Effluent	
All of the 81 acres of turf identified from aerial photography in the Tesuque sub-basin is irrigated with an estimate 294 ac-ft/yr of treated effluent.	
Potential water savings with treated effluent	0
Agriculture	
Estimated surface diversions for agriculture in the Tesuque sub-basin are 2,111 ac-ft/yr with 1,115 ac-ft/yr of return flow (DBS&A and ACL, 2003).OSE WATERS includes information on 16 Irrigation Wells, and 13 surface water declarations or permits. Return flow water serves other farms or the Rio Grande and thus, any “conservation” practices may actually increase the amount of water depleted.	
Potential water savings for agriculture	0



Per capita water diversion from metered domestic wells where the number of houses served is known



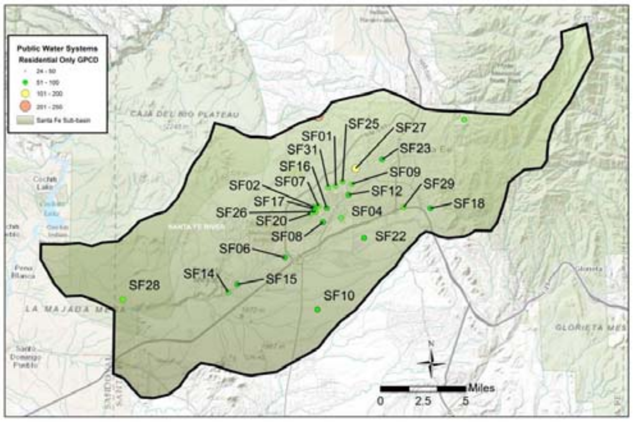
Commercial Self-Supplied Systems



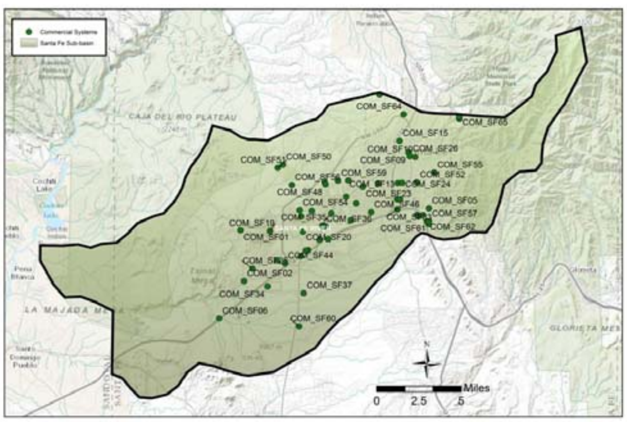
Per capita water diversion from metered domestic wells where the number of houses served is known

Santa Fe

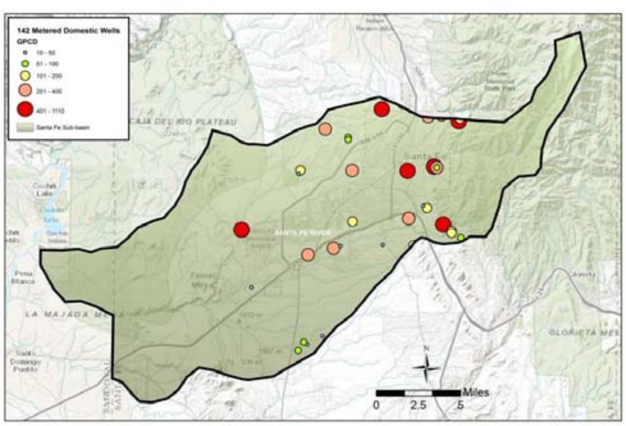
Santa Fe Sub-basin	
Total Population (2010 Census)	98,608
Average Household Size	2.31
Public Water Systems	
Over 93% of the population in the Santa Fe sub-basin is served by 24 public water systems. 16 of these systems have diversion data, showing most recently that 1,972 ac-ft diverted from groundwater and 2,537 ac-ft from surface water within the Santa Fe Sub-basin and 1,050 from groundwater and 5413 ac-ft from surface water in the Caja del Rio sub-basin. The average residential per capita use is 72 gpcd, which is less than the conserving household of 77 gpcd. The majority of this population served by public water systems (80,054 out of 91,963) are on the City of Santa Fe Water System which has had an aggressive water conservation plan in place since 1996, which accounts for the low water use and little potential for further reductions.	
Potential water savings from PWS	0
Commercial Self-Supplied Water Systems	
59 self-supplied commercial systems were identified, 24 of which have diversion data. An estimated 282.6 ac-ft/yr are diverted from groundwater for 24 of the commercial systems.	
Domestic Wells	
An estimated 7% or 6,645 of the population in the Santa Fe sub-basin is served by domestic wells, which would equate to 1,437 active domestic wells, if each well serves two homes. OSE WATERS shows information on 1,591 domestic wells in the sub-basin, 76 of which are metered. Review of water right applications show that 33 of the metered wells state how many homes are connected and 21 wells specify which lot is served. A total of 52 homes are served by these 21 wells and the median per capita use was estimated at 105 gpcd. The median potential water use for the digitized turf area of these 55 homes is 62 gpcd if indoor and outdoor conservation practices are applied. The estimated water diverted from all of the domestic wells based on the median use of 105 gpcd (0.12 ac-ft/yr per person) is 784 ac-ft/yr. If conservation practices were applied to reduce the median diversion to 62 gpcd (0.07 ac-ft/yr) then 323 ac-ft/yr could be saved.	
Potential water savings from domestic wells	323 ac-ft/yr
Treated Effluent	
In the Santa Fe sub-basin, 545 acres of turf were digitized from aerial photography. Of this acreage 65%, or 353 acres are irrigated with treated effluent, 14 acres are artificial turf and the remaining 177.8 acres are irrigated with potable water. An estimated 1,020 ac-ft of effluent is applied to the 353 acres and 676 ac-ft of potable water is applied to the 177.8 acres. If effluent lines could be extended to the various public fields throughout the city, this potable water could be saved for other uses.	
Potential water savings with treated effluent	676 ac-ft/yr
Agriculture	
Estimated surface and groundwater diversions for agriculture in the Santa Fe sub-basin are 2,665 and 318 ac-ft/yr, respectively, with 1,559 ac-ft/yr of return flow (DBS&A and ACL, 2003). OSE WATERS includes information on 30 Irrigation Wells, and 4 surface water declarations or permits. Return flow water serves other farms or the Rio Grande and thus, any “conservation” practices may actually increase the amount of water depleted.	
Potential water savings for agriculture	0



Per Capita Residential Water Use from Public Water Systems in the Santa Fe Sub-basin



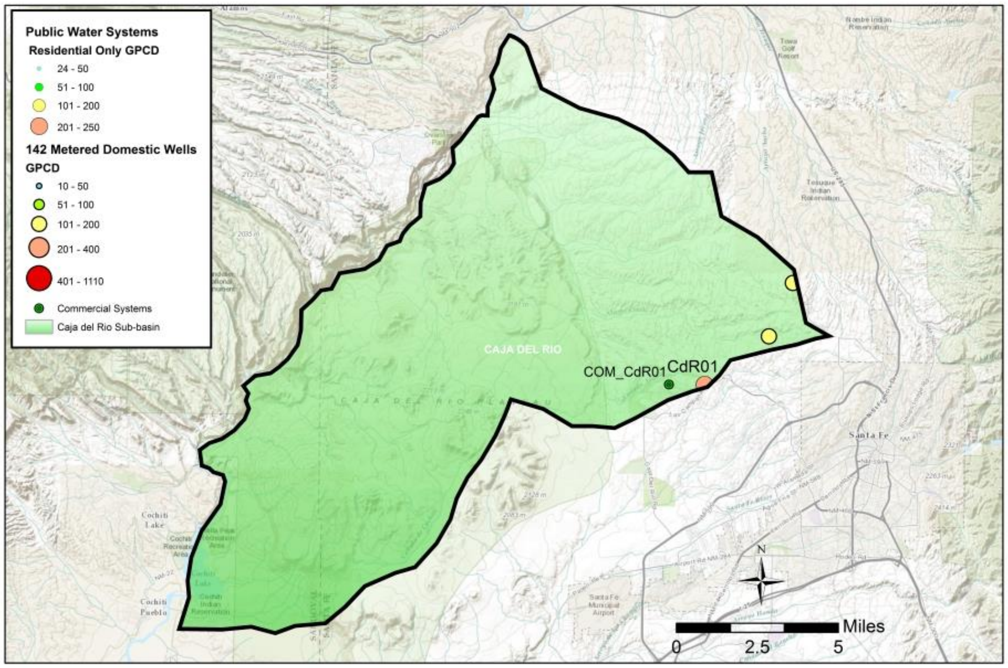
Commercial Self-Supplied Systems in the Santa Fe Sub-basin



Per Capita Water Use from Metered Domestic Wells in the Santa Fe Sub-basin

Caja del Rio

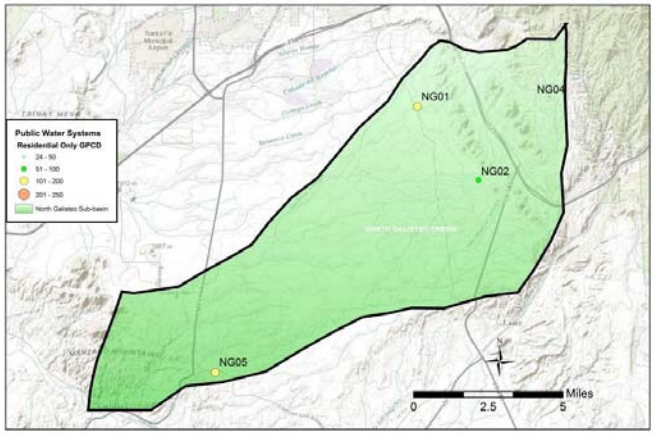
Caja del Rio Sub-basin	
Total Population (2010 Census)	2,253
Average Household Size	2.41
Public Water Systems	
One public water system, Las Campanas Water and Sewer Coop, serves a population of 604 people and some businesses, but two other systems divert water from the Caja del Rio sub-basin. A total of 5,413 ac-ft were diverted from surface water and 1,266 ac-ft were diverted from ground water in 2012 for all three systems. Las Campanas diverted about 242 ac-ft/yr for residential customers, yielding a residential per capita demand of 242 gpcd. About 132 ac-ft/yr is served to commercial customers. With an conserving per capita demand of 76.5 gpcd, the potential savings for residents on this public system is 112 ac-ft/yr.	
Potential water savings from PWS	112 ac-ft/yr
Commercial Self-Supplied Water Systems	
One commercial system diverts about 413 ac-ft of surface water to the Las Campanas Golf Course.	
Domestic Wells	
An estimated 1,646 people in Caja del Rio sub-basin are served by an estimated 274 domestic wells (assuming 2.5 homes per well). The OSE WATERS database shows information on 282 wells, 2 of which are metered and serve 5 homes. The estimated average per capita demand from these 2 metered wells is 130 gpcd and the estimated potential demand with the digitized turf for these 5 homes is 69 gpcd if water conservation techniques are applied indoor and outdoor. If all self-supplied homes in this basin are diverting at the same rate as this small sub-set, then the total diversion is estimated to be 240 ac-ft/yr and the potential water savings would be 113 ac-ft/yr.	
Potential water savings from domestic wells	113 ac-ft/yr
Treated Effluent	
All 168.5 acres of turf were irrigated with raw river water and treated effluent and potable water when BDD is shut down. Prior to 2012, the golf course received 413 ac-ft of effluent and 132 ac-ft of potable water. Las Campanas reduced the area of the golf course by 30 acres in 2012.	
Potential water savings with treated effluent	NA
Agriculture	
No water diversions were identified for agriculture in the Caja del Rio sub-basin (DBS&A and ACL, 2003), and no wells are identified as irrigation wells in OSE WATERS	
Potential water savings for agriculture	0



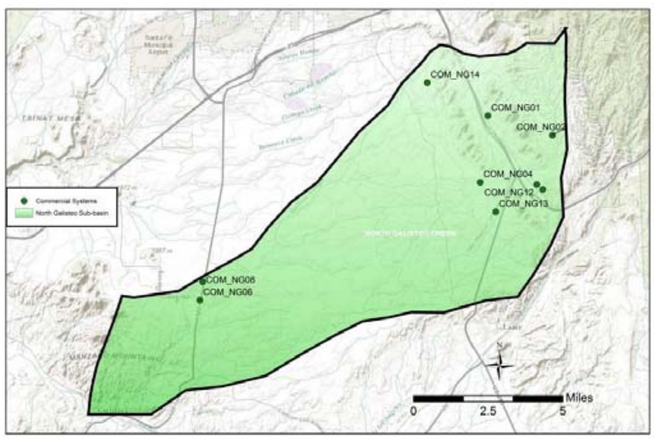
Per Capita Residential Water use in the Caja del Rio Sub-basin

North Galisteo

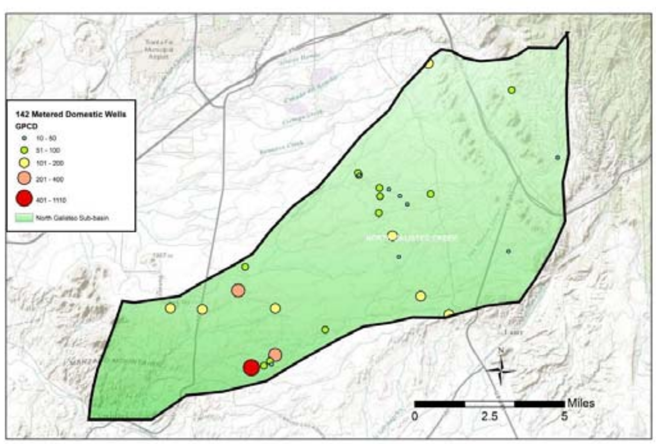
North Galisteo Sub-basin	
Total Population (2010 Census)	13,008
Average Household Size	2.20
Public Water Systems	
Five public water systems serve 7,185 people in the North Galisteo sub-basin and some businesses. All of these systems report diversion data showing an estimated 680 ac-ft diverted from groundwater each year. The average residential water use is 76 gpcd (excluding the amount diverted for commercial customers). This is very near the estimated conserving rate of 77 gpcd for conserving households.	
Potential water savings from PWS	0
Commercial Self-Supplied Water Systems	
Of the 9 self-supplied commercial systems in the North Galisteo sub-basin, only 1 has diversion data. The one system diverts about 15 ac-ft/yr.	
Domestic Wells	
An estimated 5,823 people in North Galisteo sub-basin are served by an estimated 1,324 domestic wells (assuming 2 homes per well). The OSE WATERS database shows information on 1,089 wells, 31 of which are metered and 26 of the wells identified the lot served by the homes. The median per capita demand from these 22 metered wells serving 54 homes is 68 gpcd and the estimated potential demand with the digitized turf for these 54 homes is 56 gpcd if water conservation techniques are applied indoor and outdoor. If all self-supplied homes in this basin are diverting at the same rate, then the total diversion is estimated to be 443 ac-ft/yr and the potential water savings would be 80 ac-ft/yr.	
Potential water savings from domestic wells	80 ac-ft/yr
Treated Effluent	
Wastewater in this sub-basin is discharged to septic tanks and thus, the option of reusing waste water is not available at this time. About 3 acres of turf were identified from aerial photography and 1.4 acres are artificial and 1.7 acres are irrigated with potable water. The estimated water use is 6 ac-ft/yr on the 1.7 acres of turf.	
Potential water savings with treated effluent	6 ac-ft/yr
Agriculture	
No water diversions were identified for agriculture in the North Galisteo sub-basin (DBS&A and ACL, 2003), although 7 wells are identified as irrigation wells in OSE WATERS	
Potential water savings for agriculture	0



Per Capita Residential Water use for Public Water Systems in the North Galisteo Sub-basin



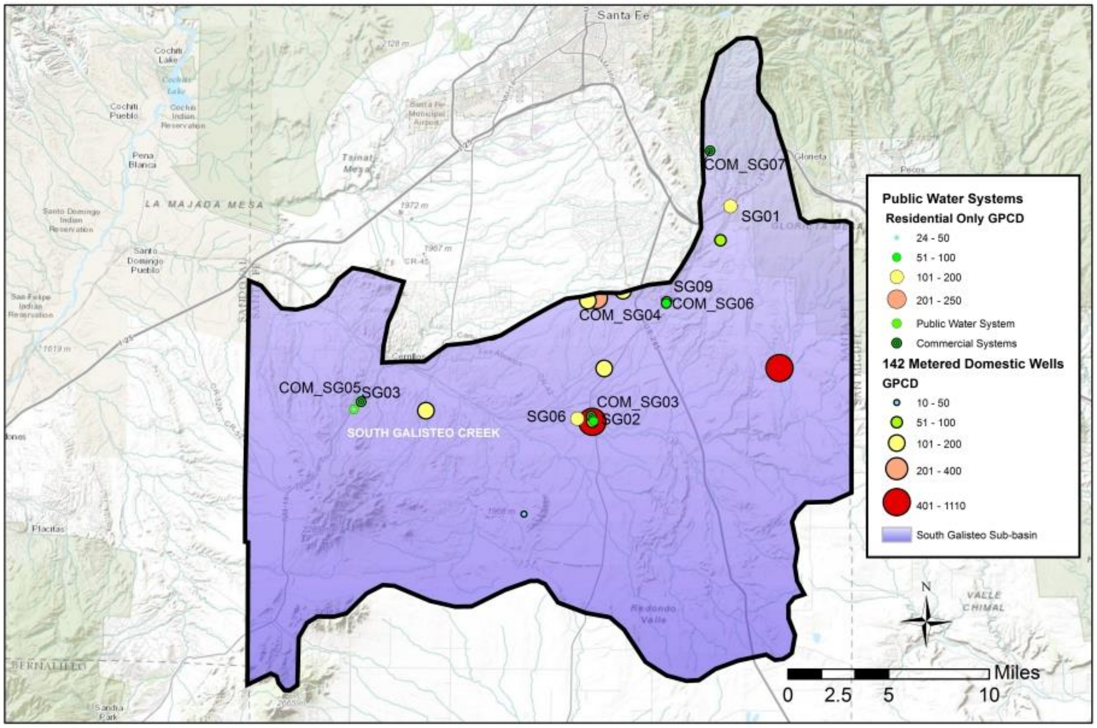
Commercial Self-Supplied Systems in the North Galisteo Sub-basin



Per capita water diversion from metered domestic wells where the number of houses served is known

South Galisteo

South Galisteo Sub-basin	
Total Population (2010 Census)	4,018
Average Household Size	2.17
Public Water Systems	
All 5 public water systems in the South Galisteo sub-basin report diversion data, which totals 67 ac-ft/yr from groundwater and serves 611 people and some businesses. The average per capita demand for the residential sector is 90 gpcd and the conserving rate is estimated at 77 gpcd. Thus, the potential water savings is 9 ac-ft/yr if conservation practices are implemented for all systems.	
Potential water savings from PWS	9 ac-ft/yr
Commercial Self-Supplied Water Systems	
Of the 6 commercial systems, 4 report diversion data, which totals about 12 ac-ft/yr from groundwater.	
Domestic Wells	
An estimated 3,408 people are served by individual domestic wells, which is 76% of the population in this sub-basin. With a household size of 2.2 people per house and an average of 1.5 houses per well, an estimated 1047 domestic wells are active in the South Galisteo sub-basin. OSE WATERS has information on 735 wells, 9 of which are metered and 6 identify the specific houses connected to the well, of which there are 10. The median per capita water diversion for these 10 homes is 105 gpcd, whereas the conserving rate given the digitized turf for these homes is 69 gpcd. If the water use from the 10 homes is representative of all domestic well use, then about 402 ac-ft/yr is estimated to be diverted from domestic wells in this sub-basin. If water conservation techniques were implemented to irrigate existing landscaping and water-conserving indoor fixtures were used, then water use could be reduced by 139 ac-ft/yr.	
Potential water savings from domestic wells-AFY	139
Treated Effluent	
No regional wastewater collection systems were identified, nor were any turf in public spaces, thus no potential for water savings exists for this sector.	
Potential water savings with treated effluent	0
Agriculture	
The Jemez y Sangre water plan (2003) shows about 300 ac-ft of water diverted from surface water for agriculture and none from groundwater. However, OSE WATERS shows 9 irrigation wells, thus some water may be diverted from groundwater for irrigation. OSE WATERS shows 3 surface water declarations or permits for irrigation with surface water. An estimated 170 ac-ft of irrigation return flow returns to surface water, and may be used by other farms or discharged to the Rio Grande, thus, any “conservation” practices may actually increase the amount of water depleted.	
Potential water savings for agriculture	0



Water Systems in the South Galisteo Sub-basin