SURPRISE

ARIZONA

City of Surprise
Water Resources Master Plan

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Acronyms and Abbreviations

AAC	Arizona Administrative Code
AAW	Arizona American Water
ADEQ	Arizona Department of Environmental Quality
ADF	Average Daily Flow
ADWR	Arizona Department of Water Resources
AWWA	American Water Works Association
CAGRD	Central Arizona Groundwater Replenishment District
CAP	Central Arizona Project
CAWCD	Central Arizona Water Conservation District
DU	Dwelling Units
Gal	Gallons
GPAD	Gallons Per Acre Per Day
GPCD	Gallons Per Capita Per Day
GPD	Gallons Per Day
GPM	Gallons Per Minute
LF	Linear Feet
MAG	Maricopa Association of Governments
MG	Million Gallons
MGD	Million Gallons Per Day
MPA	Municipal Planning Area
MWD	Maricopa Water District
PPH	Persons Per House
psi	Pounds Per Square Inch
SPA	Special Planning Area

Glossary of Terms

Acre-foot (AF) A volume of water equal to 325,851 gallons.

Active Management Area (AMA) An area designated by ADWR to meet specific groundwater management goals.

Average Day Demand The average demand over a specific time period over which the average is calculated. For example, the annual water consumption divided by 365 days in a year.

Aquifer A geologic formation or soils that is sufficiently saturated to transmit or yield economic quantities of water to wells or springs.

Drinking Water Water that meets or exceeds all applicable federal, state, county, city, and local requirements concerning safety. Drinking water is also called potable water.

Groundwater The water contained in the aquifer.

Incidental Recharge The irrigation of landscape or crops which results in the secondary benefit of adding water to the aquifer.

Maximum Day Demand The maximum demand over a one-day period.

Numeric Model A computer program used to design and analyze water, reclaimed, or wastewater systems.

Peak Hour Demand The maximum demand over a one-hour period.

Recharge The application of water to the land surface for the specific purpose of adding water to the aquifer.

Reclaimed System Collectively, all property involved in the production, distribution, and treatment of reclaimed water, including land, water source, water lines, reservoirs, pumps, motors, hydraulic structures, and general properties.

Reclaimed Water Wastewater that has been treated and recovered for useful purposes.

Surface Water All water on the surface, as distinguished from subsurface water or groundwater.

Wastewater The used water from a community, customer, or individual.

Wastewater System Collectively, all property involved in the collection and treatment of wastewater, including land, sanitary sewer lines, treatment plants, pumps, motors, hydraulic structures, and general properties.

Water Provider A city, town, private water company, water co-operation, or public wholesaler responsible for the direct or indirect distribution of water to its customers.

Water System Collectively, all property involved in the production, distribution, and treatment of drinking water, including land, water source, water lines, reservoirs, pumps, motors, hydraulic structures, and general properties.

1.0 INTRODUCTION

1.1. Authorization

The City of Surprise, Arizona (the City) authorized RBF Consulting to assist in the development of a Water Resources Master Plan to provide water resources planning guidance.

1.2. Purpose of Study

The City has estimated its 2002 population at 54,416 people. According to the City of Surprise General Plan 2020 (General Plan), the population is expected to increase to over 500,000 when the City reaches its ultimate build-out population. One of the key factors in sustaining growth is to ensure that adequate water resources are available to meet the future demands. In order to help evaluate the current available resources and the potential resource needs for the future, the City has developed this Water Resources Master Plan. By assessing the water demands that will be needed in the future and identifying and acquiring adequate water resources, the City will be able to plan for and meet the demands of future development.

Scope of Work

The regulatory framework that outlines water use, availability and water quality is discussed as the background of this Water Resources Master Plan. This study evaluates the future water demands for the City for five distinct planning horizons. These horizons include 2005, 2010, 2015, 2020, and the build-out scenario. The water demands will be summarized based on special planning areas and demand categories. The water supplies currently available to the City are then summarized. As part of the effort to identify available groundwater as a supply, a hydrogeologic study was completed to identify and evaluate locations with the best groundwater potential for future development. The projected demands over the different planning horizons are then compared to the available water supplies. Based on this comparison, the Plan will discuss strategies for identifying and acquiring sufficient water resources to meet these demands.

2.0 WATER LAW AND REGULATION IN ARIZONA

This section provides a summary of the laws affecting water within the State of Arizona. In 1980, the State enacted the Arizona Groundwater Management Act to protect Arizona's groundwater resources. This Act and amendments to the Act since 1980 (collectively, the "Groundwater Management Act" or "Act") provide the framework for how the City may withdraw and use groundwater. Groundwater use is further restricted by the Assured Water Supply Rules adopted by the Director of the Arizona Department of Water Resources (ADWR) in 1995. Arizona has also enacted comprehensive laws governing the manner in which the City, and others, may store water underground and the circumstances under which the City may exchange water with other users. As a member service area of the Central Arizona Groundwater Replenishment District (CAGRD), the City's rights to withdraw groundwater are expanded. In addition, maintaining adequate water quality is also a concern of the City. The laws and rules governing water quality, as well as the water quality standards that the City must maintain are described. This section summarizes these laws and how they apply to the City.

2.1. 1980 Arizona Groundwater Management Act

Arizona's major water problem has always been an imbalance between water consumption and dependable supply. The state relies heavily on groundwater, and for decades, has been mining its groundwater supplies to meet ever-increasing demands. Despite the work of several special commissions, the state failed to enact measures to meaningfully restrict groundwater uses. The development of groundwater laws fell to the courts in the context of disputes between water users and resulted in an inflexible body of law that did not recognize hydrological principles.

In 1976, the Arizona Supreme Court handed down a decision that would change the nature of groundwater use in Arizona forever. The case, *Farmers Investment Company v. Bettwy (FICO)*, 113 Ariz. 520, 558 P.2d. 14, involved a large pecan farming corporation in Pima County, the City of Tucson, and several copper mining companies. The Court prohibited Tucson and the mines from pumping groundwater and transporting it for use at a different location if the wells of the farming corporation or other water users were affected. In essence, because FICO was affected, the decision authorized a severe curtailment in groundwater pumping by Tucson and the mines.

The FICO decision spurred the legislature to establish yet another commission, the Groundwater Management Study Commission, to rewrite Arizona's groundwater laws. After two and a half years of negotiation by the Commission, including six months of closed-door meetings by representatives of the cities, mines, and agriculture, the Commission agreed upon comprehensive legislation to regulate groundwater uses. The legislation was passed by the legislature as the Groundwater Management Act in a one-day special session and signed into law by Governor Bruce Babbitt on June 12, 1980.

The Groundwater Management Act quantifies and regulates rights to withdraw groundwater in geographic areas of the state where the overdraft, or mining, of

groundwater is most severe. These areas, called Active Management Areas or AMAs, include the Phoenix AMA in which the City is located. Within the AMAs, the Act identifies and places limits on rights to withdraw groundwater, regulates the drilling of new wells, and requires groundwater users to conserve groundwater pursuant to management plans adopted by ADWR for each AMA. The Act also prohibits urban development where there is not a 100-year assured water supply.

2.1.1. Management Plans

The Groundwater Management Act requires ADWR to adopt a series of management plans for each AMA designed to achieve the AMA's management goal. For the time period of 2000 through 2010, the Third Management Plan in the series of five plans is in effect. The management goal for the Phoenix AMA is safe-yield (A.R.S. § 45-562). Safe-yield is a long-term balance between the annual amount of groundwater withdrawn in the AMA and the annual amount of natural and artificial recharge in the AMA (A.R.S. § 45-561). Each management plan must include a continuing mandatory conservation program for all persons withdrawing groundwater in the AMA (A.R.S. § 45-563)

The water service area owned by the City was categorized as a small municipal provider based on the definitions used during the development of the Third Management Plan, since they had only served an estimated 1,100 people and used 156 acre-feet of water in 1998. Small municipal providers have no per capita conservation requirements under the Third Management Plan. However, they are required to minimize waste of all water supplies, maximize efficiency in outdoor watering, encourage reuse of water supplies, and reduce total gallons per capita per day usage.

Due to growth within the City, the Surprise water service area will most likely be categorized as a large municipal provider by 2004. A new large municipal provider is one defined as using more than 250 acre-feet of non-irrigation water per year after January 1, 2000. In 2001, the City reported that 1,332 acre-feet of water were used within the service area. This would indicate that the City could be considered a large municipal provider.

Once the City has been identified as a large municipal provider, it will initially be assigned to the total Gallons Per Capita Per Day (GPCD) Program. The total GPCD requirement will be computed using the Third Management Plan component methodology. The City will then be given two full years to comply with the GPCD requirement. Most large municipal providers are regulated under the GPCD Program. The GPCD Program uses a formula, which includes existing residential population, new single and multi-family populations, and lost and unaccounted for water to determine the GPCD goal for each municipal provider.

The Management Plan for the Third Management Period for the Phoenix AMA requires large municipal providers to comply with the total GPCD Program, unless the provider is regulated under the Non-Per Capita Conservation Program (NPCCP) or the Alternative

Conservation Program (ACP). Both the NPCCP and ACP are available only through an application process. The provider must limit or reduce its use of groundwater in order to qualify for either program. Under the NPCCP, the provider must have a plan under which it will deliver no mined groundwater after January 1, 2010. Additionally, the provider must agree to implement reasonable conservation measures that ADWR determines will achieve a water-use efficiency equivalent to the GPCD requirements. Under the ACP, the provider may achieve compliance with groundwater use limitations by extinguishing grandfathered rights, serving groundwater that will be replenished by the Central Arizona Groundwater Replenishment District (CAGRD), using remediated groundwater, using non-groundwater supplies, or using groundwater withdrawn from outside the AMA.

Failure to comply with the management plan requirements could result in penalties imposed by ADWR, including daily fines, loss of recharge credits, and revocation of the City's designation of assured water supply. (ADWR, 1999) The implications of these penalties could include a moratorium on growth within the City.

2.1.2. Well Drilling Permits

The Groundwater Management Act requires a permit to drill a non-exempt well in a new location (A.R.S. § 45-599). Municipal wells are non-exempt wells. Prior to issuing a permit, ADWR must determine that the proposed well will not unreasonably increase damage to surrounding land and other water users due to the concentration of wells (A.R.S. § 45-598). Under temporary rules adopted by ADWR in 1983 (A.A.C. R12-15-830), the applicant for a permit for a new well with a design pumping capacity in excess of 500 gallons per minute must submit a hydrological study of the projected declines in water levels from the operation of the proposed well. ADWR will approve the permit application if it determines that the probable impact of the proposed well on any well of record with ADWR will not exceed ten feet of additional drawdown of the aquifer over a five-year period. If ADWR determines that the probable impact of the proposed well will exceed 25 feet of additional drawdown over a five-year period, ADWR must deny the application. If the additional drawdown from the proposed well is greater than ten but less than 25 feet, ADWR may consider several factors in determining whether to grant the application. These factors include the existing rate of decline of the aquifer water level in the area, current costs of pumping, and any efforts of the applicant to mitigate the projected damage.

The Groundwater Management Act allows the City to deepen or replace an existing well without obtaining a permit from ADWR. (A.R.S. § 45-597) ADWR's temporary rules define a replacement well as a well located no greater than 660 feet from the original well that will not withdraw an annual amount of groundwater in excess of the historical withdrawals from the original well. (A.A.C R12-15-840)

2.1.3. Service Area Rights

Under the Groundwater Management Act, cities, towns and private water companies, known as municipal providers, may withdraw groundwater pursuant to a service area right (A.R.S. § 45-492). This right allows the City to pump groundwater within its service area for the benefit of landowners and residents within its service area. The City's service area is defined as the area of land actually being served water by the City-owned water distribution system and any additions to such area that contain an operating distribution system owned by the City (A.R.S. § 45-402).

Along with the City, ten other water companies have rights to serve water within the City's municipal planning area. These companies include: Arizona-American Water Company, Beardsley Water Company, Brooke Water Company, Chaparral Water Company, the City of El Mirage, Morristown Water Company, Puesta Del Sol Water Company, Saguaro Acres, Saguaro View and West End Water Company. Both the Arizona Corporation Commission and ADWR regulate these water companies. The City's service area and the service areas for the private water companies are delineated in Figure 1.

2.2. Assured Water Supply Rules

The City of Surprise's ability to withdraw groundwater is further constrained by the Groundwater Management Act's requirement that new residential developments must have an assured water supply (A.R.S. § 45-576). An assured water supply (AWS) means that sufficient water of adequate quality will be continuously available to satisfy the needs of the development for at least 100 years, consistent with the management plans and the achievement of the management goal for the AMA. The Act requires ADWR to designate municipal providers where an assured water supply exists. ADWR has adopted rules to implement the assured water supply provisions (A.A.C. R12-15-701 et seq). These rules and the City's designation are discussed below.

Under the rules, groundwater in the Phoenix AMA is "physically available" only if it is pumped from a depth that does not exceed 1,000 feet below land surface (A.A.C. R12-15-703.B). Central Arizona Project (CAP) water is physically available if the provider has a long-term subcontract for CAP water. Other CAP water is physically available only if the provider demonstrates a back-up supply of water. Surface water other than CAP water (such as water from the Salt and Verde Rivers) is physically available under a formula provided in the rules. If a proposed source of water for an assured water supply is water to be recovered from an underground storage project, the volume of water legally available is represented by stored water credits existing on the date of the application for designation of an assured water supply. If the applicant wants to use credits for stored water that do not exist at the date of the application, ADWR will consider the physical availability of the water to be stored and the presence of an existing storage project in determining whether to include the proposed credits.

The AWS Rules limit the amount of groundwater a municipal provider may withdraw "consistent with the management goal" of the AMA. The volume of groundwater the provider may withdraw is calculated pursuant to a formula contained in the rules (A.A.C. R12-15-705.G). For the City, the calculated volume of groundwater that can be withdrawn is zero acre-feet per year. However, this amount of groundwater use allowed can be increased through several mechanisms. The first increase to the allowed groundwater use is by an incidental recharge baseline factor of 4% of water use granted through the AWS Rules. The amount of groundwater use allowed may also be increased by the amount of credits obtained for the extinguishment of irrigation grandfathered water rights.

The Act provides a mechanism for a designated provider to increase the amount of groundwater it may withdraw pursuant to the assured water supply rules. Under A.R.S. § 45-576.01, ADWR may find that a water provider's additional use of groundwater is consistent with the management goal if the provider is a member service area of the Central Arizona Groundwater Replenishment District (CAGRD) and ADWR has approved CAGRD's plan of operation. As long as the groundwater is physically available, the municipal provider may pump more groundwater than the assured water supply rules allow. However, as a member of CAGRD, the provider must pay CAGRD for the cost of recharging a like amount of water. CAGRD is discussed in more detail below.

ADWR recently amended its assured water supply rules to limit when Colorado River water leased from an Indian community is legally available for purposes of demonstrating an assured water supply (A.A.C. R12-15-703.01). Under the new rule, the lease must provide a water supply for 100 years. For the first 50 years, the lease will continue to meet the 100-year assured water requirement. After 50 years, in order to maintain its designation the municipal provider must present evidence to ADWR of ongoing negotiations with the Indian community to renew the lease. The municipal provider is allowed ten years to complete an agreement for the renewal of the lease. Additionally, the municipal provider must show that either no more than 15% of its total water supplies are obtained through leases with Indian communities, or that another source of water will be available to it to substitute for the leased water for the remainder of the 100-year period.

2.3. Underground Water Storage, Savings, and Replenishment

In 1986, Arizona enacted laws to allow and encourage the storage of water underground. These laws were substantially revised in 1994. Water may be stored underground only by an entity that has received a water storage permit from ADWR (A.R.S. § 45-831.01) and only at a storage facility that has received a permit from ADWR (A.R.S. § 45-8111.01). Recovery of stored water requires a recovery well permit issued by ADWR (A.R.S. § 45-834.01). If the water stored underground is surface water and its use is based on a decreed or appropriative water right (e.g., Salt and Verde River water), the water may be recovered only in the same calendar year in which it was stored (A.R.S. §

45-851.01). Effluent and water that could not have reasonably been used directly are eligible for long-term storage allowing these sources to be recovered in a subsequent year or years (A.R.S. § 45-852.01). Long-term storage credits may be sold, leased or exchanged (A.R.S. § 45-854.01) and may be used in demonstrating an assured water supply (A.R.S. § 45-855.01).

If the water stored is effluent or water from outside the AMA that would not have reached the AMA without the efforts of the holder of the long-term storage credits, 100 percent of the water is recoverable. Otherwise, only 95 percent of the water qualifying for long-term storage credits is considered recoverable (A.R.S. § 45-852.01). Stored water may be used or exchanged only in the manner in which it was permissible to use or exchange the water before it was stored (A.R.S. § 45-832.01). In other words, the water retains its legal characteristics even if the actual molecules recovered are groundwater.

2.4. Water Exchanges

Arizona's statutes governing exchanges of water were enacted in 1992. A "water exchange" is a trade of one water source for another. Each party to the exchange must have a right to use the water it gives in trade (A.R.S. § 45-1001). Additionally, each party to the exchange may use the water it receives only in the manner in which it had the right to use the water given in trade (A.R.S. § 45-1003). Certain water exchanges do not require a permit from ADWR. These exchanges include those in which the amount exchanged does not exceed 50 acre-feet in any twelve-month period and certain exchanges made pursuant to contract that is enrolled with ADWR (A.R.S. § 45-1002). Other water exchanges require a permit from ADWR (A.R.S. § 45-1041).

The Central Arizona Groundwater Replenishment District (CAGRD) was established by the legislature in 1993 when it required the Central Arizona Water Conservation District (CAWCD), which manages the CAP, to replenish groundwater pumped by certain landowners and municipal providers in AMAs.

2.5. Central Arizona Groundwater Replenishment District (CAGRD)

Membership in the Central Arizona Groundwater Replenishment District (CAGRD) is an alternative mechanism to help demonstrate an assured water supply. The purpose of the CAGRD is to provide a mechanism for landowners and water providers to demonstrate an AWS under the AWS Rules, which became effective in 1995. If a municipal provider or a developer can prove that groundwater is physically available to meet its needs, by joining CAGRD, it obtains the right to use more groundwater than would otherwise be allowed under the assured water supply rules. The landowner or municipal provider must pay CAGRD to replenish the excess groundwater used. CAGRD must replenish in the same AMA from which the groundwater was pumped. The City of Surprise is a member service area of the CAGRD.

2.5.1. CAGRD History

In 1993, the legislature created a groundwater replenishment authority to be operated by the Central Arizona Water Conservation District (CAWCD) throughout its three-county service area. This replenishment authority of CAWCD is known as the CAGRD. Under the 1993 CAGRD enabling legislation, membership in the CAGRD provides a means by which an AWS applicant can satisfy AWS criterion number 4, which requires that the proposed water use be consistent with the water management goals of the particular AMA. The "consistency with management goals" section of the AWS Rules limits the quantity of mined groundwater that an applicant may use to demonstrate an AWS.

The purpose of this groundwater pumping limitation is to prevent new development from relying solely on mined groundwater to serve its water demands. Development, however, is not necessarily prevented for those landowners and water providers who have no direct access to CAP water or other renewable supplies. If a water provider or a landowner has access to groundwater and desires to rely on groundwater to demonstrate a 100-year water supply, it may do so, provided it joins the CAGRD. As a member of the CAGRD, the landowner or provider must pay the CAGRD to replenish any groundwater pumped by the member that exceeds the pumping limitations imposed by the AWS Rules. In summary, under the 1995 AWS Rules, groundwater may not be the basis for any new development in the Phoenix AMA. If a development does not have CAP water or other renewable supplies, it must join the CAGRD.

In 1999, the legislature expanded CAWCD's replenishment authorities and responsibilities by passing the Water Sufficiency and Availability Act. Under this legislation, CAGRD's role in helping members prove an AWS is extended beyond the "consistency with management goal" criterion described above. The CAGRD may assist a member service area in satisfying criterion number 1, proof that a sufficient quantity of water is continuously available to satisfy the water demands within the service area for 100 years. The new legislation allows ADWR to grant a designation of assured water supply to a water provider whose service area has been enrolled as a member service area of the CAGRD and has been granted Water Availability Status by the CAWCD Board. This status commits the CAGRD to replenish water for the member service area and to have this water available for at least one hundred years. The CAGRD must submit a plan to ADWR that proves its capability to grant this water availability status. The authority of CAGRD under this legislation is limited to a total annual amount of 20,000 acre-feet. (A.R.S. § 48-3772.B(10))

2.5.2. Replenishment Obligation of the CAGRD

The CAGRD must recharge within each AMA the amount of excess groundwater pumped by or delivered to its members within each AMA. Excess groundwater is the amount of groundwater in excess of the pumping limitations imposed by the AWS Rules. The replenishment obligation incurred each year by the CAGRD must be recharged within 3 years. Recharge may be accomplished through the operation of underground storage facilities or groundwater savings facilities. The CAWCD may sell its indirect

storage and recovery credits to the CAGRD at fair value. Water used for replenishment may be CAP water or water from any other lawfully available source, except groundwater withdrawn from within an AMA. For the foreseeable future, the water that the CAGRD will use for replenishment will primarily be excess CAP water.

2.5.3. Membership

Membership in CAGRD is voluntary. Any city, town, water company, subdivision or homeowner's association located in Maricopa, Pinal, or Pima Counties may join the CAGRD. There are two types of members. The City is a Member Service Area which includes the service area of a city, town or private water company, including any additions to or extensions of the service area. Member Lands are individual subdivisions with a defined legal description.

2.5.4. Physical Access to Groundwater

Under the provisions of the 1993 CAGRD enabling legislation, membership in the CAGRD does not waive the requirement under the AWS Rules that an applicant must demonstrate the physical and legal availability of groundwater. Water providers or subdivisions which rely on the CAGRD to meet the AWS requirements must still meet the depth to groundwater criteria established in the AWS Rules and have the legal right to withdraw groundwater from the point of withdrawal.

2.5.5. Replenishment Taxes/Assessments

Costs of the CAGRD will be covered by a replenishment tax or replenishment assessment levied on CAGRD members. Water providers serving member service areas, such as the City, will pay a replenishment fee directly to the CAGRD according to the number of acre-feet of excess groundwater they deliver within their service areas during a year. For member lands, a replenishment assessment will be collected by the county assessor from each tax parcel according to the number of acre-feet of excess groundwater delivered to that parcel.

The amount of the replenishment tax/assessment will be the CAGRD's total cost per acre-foot of recharging groundwater, including the capital costs of constructing recharge facilities, water acquisition costs, operation and maintenance costs and administrative costs.

2.6. Water Treatment

2.6.1. Primary Drinking Water Regulations

In 1974, the U.S. Environmental Protection Agency (USEPA) established the Safe Drinking Water Act (SDWA). The SDWA is the main federal regulation that ensures the

safety of America's drinking waters. The SDWA has been amended in both 1986 and 1996. The SDWA has established enforceable standards for various types of contaminants. These contaminants include microorganisms, disinfection byproducts, disinfectants, inorganic chemicals, organic chemicals, and radionuclides.

The standards for the contaminants identified under the primary drinking water regulations can be identified by two categories, Maximum Contaminant Levels (MCLs) and Treatment Techniques (TT). The EPA has established MCLs as the greatest allowable quantity of a contaminant in drinking water, while TT identifies a required treatment process for a specific contaminant. At the present time 83 constituents are addressed by the MCL method, while nine constituents are addressed by the TT method. These constituents are listed in Appendix A.

2.6.2. Drinking Water Rules

In addition to the Primary Drinking Water Standards, the EPA has also established various rules regarding drinking water quality.

2.6.2.1. Surface Water Treatment Rule (SWTR)

On June 29, 1989 the EPA published the Surface Water Treatment Rule (SWTR). This rule became effective on December 31, 1990. The goal of the SWTR is to prevent diseases caused by Giardia, Legionella, and viruses sometimes found within drinking water systems utilizing surface water as a source. This rule requires that all surface water sources or groundwater under the influence of surface water be disinfected and must be filtered before being used within a drinking water system. (EPA November 2002)

The rule is based on the combined removal of the Giardia, Legionella, and viruses. The removal is accomplished through the filtration process, while the inactivation is accomplished through disinfection. The SWTR requires a minimum 3-log 99.9% combined removal and inactivation of Giardia, and a 4-log 99.99% for viruses. Compliance with this rule is requires a disinfectant residual on the system, monitored turbidity of the water, and watershed protection for unfiltered systems.

2.6.2.2. Interim Enhanced Surface Water Treatment Rule (IESWTR)

In December 1998, the Interim Enhanced Surface Water Treatment Rule (IESWTR) was finalized and the rule became effective January 1, 2002. The IESWTR was adopted to strengthen microbial protection within the SDWA. The specific requirements of this rule include: (EPA, December 1998)

- Maximum contaminant level goal (MCLG) of 0 for Cryptosporidium
- 2-log Cryptosporidium removal requirements for systems with filters
- Strengthened combined filter effluent turbidity performance standards
- Individual filter turbidity monitoring provisions

- Disinfection profiling and benchmarking provisions
- Systems using ground water under the direct influence of surface water must comply with the new Crypdosporidium rules
- Inclusion of Cryptosporidium in the watershed control requirements for unfiltered public water systems and in the definition of groundwater under the influence of surface water
- Covers on new finished water reservoirs
- Sanitary surveys, conducted by States, for all surface water systems regardless of size

2.6.2.3. Long-Term 1 Enhanced Surface Water Treatment Rule and Filter Backwash Rule (LT1FBR)

This rule was finalized June 8, 2001, with the purpose of providing better protection of finished drinking water supplies for surface water systems serving less than 10,000 people from Cryptosporidium and other microbial pathogens. The major requirements of this rule include: (EPA, March 2000)

- Filter backwash water, thickener supernatant, and liquids from dewatering processes must be recycled prior to the point where primary coagulant is added
- Direct filtration systems that recycle to the treatment process, must provide detailed recycle treatment information to the State,
- Conventional systems that practice direct recycle and have 20 or fewer filters must perform a one month, one-time recycle self assessment.

2.6.2.4. Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

The LT2ESWTR was scheduled to be finalized in May 2002 and become effective May 2005. The EPA proposed this rule to provide for increased protection against microbial pathogens in water systems utilizing surface water sources. The proposed rule focuses on Cryptosporidium however other pathogens may be addressed. The requirements for Cryptosporidium inactivation were established based on the levels of Cryptosporidium in the source water.

2.6.2.5. Stage 1 and 2 Disinfectants/Disinfection By-Products Rules (D/DBPR)

In December 2001, the Stage 1 D/DBPR became effective. This rule addresses water systems that add a disinfectant during the water treatment process. The provisions of this rule include the following water standards: (EPA, February 2003)

- Maximum residual disinfectant level goals (MRDLGs)
    - chlorine 4 mg/L
    - chloramines 4 mg/L

    - chlorine dioxide 0.8 mg/L
- Maximum contaminant level goals (MCLGs):
    - bromodichloromethane 0mg/L
    - dibromochloromethane 0.06 mg/L
    - bromoform 0mg/L
    - dichloroacetic acid 0mg/L
    - trichloroacetic acid 0.3 mg/L
    - bromate 0mg/L
    - chlorite 0.8 mg/L

In addition, the rule sets the following standards:

- Maximum contaminant levels:
    - total trihalomethane 0.080 mg/L
    - haloacetic acids (HAA5) 0.060 mg/L
    - chlorite 1.0 mg/L
    - bromate 0.010 mg/L

In addition to the Stage 1 D/DBR rule, a Stage 2 D/DBR rule was scheduled for finalization in May 2002. Under the Stage 2 rule, the disinfection byproducts (DBP) standard will be based on a Locational Running Annual Average (LRAA), and require each system to conduct an initial distribution system evaluation. The LRAA differs from the Running Annual Average utilized under the Stage 1 rule in that each sample point must now be in compliance with the standard as an annual average. (EPA, October 2001)

2.6.2.6. Radionuclides Rule

On December 7, 2002 the EPA published new standards for the Radionuclides Rule. These standards became effective on December 8, 2003. This rule also requires water systems to phase-in monitoring to ensure compliance with these standards from December 2003 to December 2007. (EPA, November 2002)

2.6.2.7. Arsenic Rule

On February 22, 2002, the Arsenic Rule proposed by the EPA became effective. This new arsenic rule modifies the drinking water standards to reduce the MCL for arsenic from 50ppb to 10ppb. The City has until January 23, 2006 to comply with this rule. Based on current data, arsenic levels in existing water production wells are relatively low; however, some of the wells may exceed the 10ppb standard. If any of the City's wells exceed this new standard, process modifications such as water supply blending or arsenic treatment will be required to reduce the arsenic concentration to below 10ppb to meet Federal and State regulations.

2.6.2.8. Lead and Copper Rule

According to the EPA, approximately 20% of human exposure to lead occurs due to the lead content in drinking water (EPA, November 2002). The Lead and Copper Rule was established in 1991 and set action levels of 0.015 mg/L for lead and 1.3 mg/L for copper. In 2001, minor revisions to the Lead and Copper Rule were established which streamline and reduce the monitoring and reporting burden of the water agencies. The rule also contains additional requirements addressing source water treatment, corrosion control, and public education.

2.6.2.9. Groundwater Disinfection Rule

In May of 2000, the EPA proposed a Groundwater Disinfection Rule (GWR). The GWR utilizes a multiple barrier approach to protect drinking water from bacteria and viruses that be found in the ground water sources. The rule will require compliance monitoring to ensure that systems that disinfect reliably achieve a 4-log (99.99 percent) inactivation or removal of viruses. (EPA, April 2002)

2.6.3. Secondary Drinking Water Regulations

Secondary Drinking Water Regulations have been established by the EPA as a set of non-mandatory water quality guidelines to assist public water systems in managing their drinking water for aesthetic considerations. These regulations address items such as color, taste, and odor. The contaminants are not considered to present a risk to human health at the Secondary Maximum Contaminant Levels (SMCLs) and public water systems only need to test for them on a voluntary basis. A summary of these regulations is provided in Table 1.

3.0 WATER DEMANDS

This section outlines the planning areas that were studied and their associated population projections and land use. This information was then utilized to project water demands within the City. The water demands were evaluated for each of the planning areas over each planning horizon.

3.1. Planning Areas

The area studied for this plan corresponds to the municipal planning area (MPA) defined in the General Plan at the time this report was written. The MPA encompasses approximately 228 square miles. As described in the General Plan, the MPA was broken down into five smaller areas known as special planning areas (SPAs). SPA 1 is the planning area where the most growth is currently occurring within the City. SPA 2 through SPA 5 are the future planning areas and were analyzed to determine the necessary water resources to satisfy the build-out infrastructure demands. It is important to note that the area studied as part of this master plan does not include the seventy-one square-mile expansion area recently added in a general plan amendment. The expansion area was not included due to the substantial completion of the master plan at the time the expansion area was proposed. The study boundaries and the Surprise municipal planning area are shown in Figure 2. The 5 SPAs are shown in Figure 3.

3.2. Population Projections

In order to effectively evaluate the future water resources requirements within the City, adequate population projections are necessary. As part of this study, the population growth and water demands were evaluated for five planning horizons. These five planning horizons include:

- 2005
- 2010
- 2015
- 2020
- Build-out

The Community and Economic Development Department computed the population projections utilized for the 2005 through 2020 planning horizons. This department has developed yearly population projections for the City through the year 2020. In addition to calculating population projections, the future population distribution was determined. The population projections were distributed over the Maricopa Association of Government's (MAG) 2000 Traffic Analysis Zones (TAZ). The 2000 Traffic Analysis Zones used in this study are shown in Figure 4. The population projections based on the TAZs are listed in Appendix B.

While the Community and Economic Development Department developed the population projections through the 2020 planning horizon, the build-out population projection was developed based on the land use map from the General Plan. The development of the build-out population projections is described in greater detail within the City of Surprise Infrastructure Master Plan. A copy of the general plan land use map can be seen in Figure 5. The population projections for each of the planning horizons are summarized in Table 2. This table breaks down the population projections for each planning horizon and for each special planning area.

While the majority of the Arizona-American Water Company is located within the City of Surprise SPA 1, a small portion of their certificated area is located within SPA 2 and SPA 3. This can be seen in Figure 6. The division between SPA 1, SPA 2, and SPA 3 is the Beardsley Canal. For the purposes of this study, and to take a conservative approach to the City's water requirements, it was assumed that the Arizona-American Water Company would only provide service within SPA1, and that the City of Surprise would provide service to the small portion of their service area located in SPA2 and SPA3. The population projections for the Arizona-American Water Company, therefore only reflect the growth occurring within SPA1. The projected population growth within the Arizona-American Water Company Service area is outlined in Table 3.

3.3. Projected Water Demands Based on Population

Once the population projections and their corresponding distribution was established, the future water demands were computed for the MPA. For the purposes of this analysis, an average water use factor of 152 gallons per capita per day (GPCD) was utilized. This factor represents the total residential and nonresidential water usage within the City's service area averaged over each resident served. 152 GPCD was used since it is the estimated 2002 average combined water use factor. Under the requirements of the Third Management Plan administered by ADWR, the City will be required to reduce their water usage to meet the conservation goals of the Phoenix AMA. The City of Surprise estimates that the combined water duty factor will be reduced to 144 GPCD by 2008. For the purposes of this study a combined water duty factor of 152 gpcd is assumed in the demand calculations. This factor is considered a conservative yet reasonable water usage factor.

Table 4 outlines the total amount of water required to satisfy the water demands for the MPA. The portion of this demand that will be provided by the Arizona-American Water Company is also identified. As discussed previously, the Arizona-American Water Company will serve a large portion of SPA1. The projected water demand for the City service area does not include the population growth anticipated within the Arizona-American service area. Although the water demand occurring from growth in their service area is identified here, it will be the responsibility of the Arizona-American Water Company to acquire the water resources for their service area. The Surprise demand is the amount of water that the City must provide under each of the planning horizons.

Water demands, included Arizona-American demands, are summarized for each of the five SPAs for each planning horizon. These water demands are shown in Table 5. Currently, water service is provided by private water companies within SPA 2 – SPA 5. For the purposes of this study, it is assumed that the City will meet the water demands associated with the population projections within the private water companies' service areas; however the decision to actually acquire private water companies will be determined in the future.

3.3.1. Distribution of Water Use by Categories

The water demand projections for the City's water service area, not including Arizona-American demands, were also summarized by demand category based on historical water use and for projected water uses. This summary provides an analysis of different water use demands. The three demand categories that were analyzed included residential interior, commercial, and irrigation.

In determining the historical water uses for each of these categories, the City of Surprise Annual Water Report was used (see Appendix C). This report gives the total gallons used per capita per day, and also the amount of water used for commercial use. Based on the 2001 water usage within the City, approximately 10 gpcd was utilized for commercial purposes. An irrigation demand factor of 68 gpcd was utilized based on the ADWR's outside land use factor of 178 gallons per housing unit per day listed in the Third Management Plan. The interior residential water use was determined by subtracting the water uses described above from the total residential gpcd. A summary of the water duties used for this analysis is provided in Table 6.

Table 7 lists estimated water demands by land use and can be used as a planning level estimate when evaluating the potential land use of an area. In Table 13, the water demands are identified by these water use types over the different planning horizons. For this summary, the irrigation demands were assumed to include residential outdoor water use. Analyzing these water demands by land use types indicates that a significant amount of the water supply within the City may be utilized as irrigation and landscape water.

3.4. Planning Demand Factors

It is important to note that if the general development characteristics of the City significantly change, such as a large amount of commercial development occurs compared with residential development, these demand values may need to be revised. As development continues to occur within the City, water trends from nearby cities suggest that newer and larger homes typically use more water. This would cause the general water usage trend within the City to increase. Additionally, if the City significantly reduces their per capita water usage as part of the conservation requirements, then these demand calculations can be reduced. In order to plan for the future, the water use demands by land type and the distribution of land uses for development will need to be evaluated frequently.

4.0 WATER SUPPLY

The water supply within the City is one of the key factors for maintaining sustainable growth and allowing the City to achieve its development goals. As a municipal water provider, the City has received entitlements to both groundwater and surface water supplies. The purpose of this section is to outline existing water resources that are currently available to the City.

As discussed previously, ten other water companies provide service within the City. For the purposes of this report it is assumed as a conservative estimate that the City will acquire each water company as development in the area necessitates. This assumption does not apply to the Arizona-American Water Company. For the purposes of this study, it was assumed that the Arizona-American Water Company would continue to provide service throughout their service area, and they would be responsible to provide sufficient water to meet the demands of those users located within their service area. Therefore, the available water supply discussed in this section identifies the water resources that will be needed to meet the demands of the City, excluding the Arizona-American Water Company service area.

4.1. Assured Water Supply Designation

On September 7, 1999, the City was designated as having an assured water supply (AWS 99-04) through an order issued by ADWR (Decision and Order No. 26-002344). In order to receive this designation, the City met the assured water supply requirements by demonstrating the ability to meet their projected and committed demand of 20,334 acre-feet for the year 2010. The order states that "Surprise has demonstrated the physical, legal and continuous availability of groundwater and effluent in an aggregate volume of 20,334 acre-feet per year for a minimum of 100 years" and that Surprise is a member service area of CAGRD. Additional information regarding ADWR's determination of an assured water supply is outlined in the summary document included with the decision and order. The summary document identifies the approved water quantities of the City's water sources and these amounts are shown also in Table 9. Both the decision and order from ADWR and the summary document can be seen in Appendix D.

4.2. Water Supplies and Water Rights

4.2.1. Grandfathered Rights

The City has received rights to groundwater through the extinguishment of irrigation grandfathered rights. As agricultural land is developed and incorporated within the City's water service area, the water rights associated with that land can be extinguished as an agricultural irrigation use and be transferred to the City as a one-time groundwater use credit. Extinguishment credits are calculated by multiplying the number of acres associated with the irrigation grandfathered right by a factor of 1.5 acre-feet per acre,

then multiplying this product by a factor of the number of years between extinguishment and 2025.

As listed in the ADWR designation of assured water supply, the City currently holds 6.22 ac-ft/year of grandfathered right extinguishment credits. These grandfathered rights are shown in Appendix E. The City has extinguished an additional 1,959.24 acre-feet of grandfathered right credits from the time that the City submitted its application for designation. Although this volume of water has been identified as a legal source of groundwater for the City, it has not been included in this water resource analysis because it is available for use for one time only and is not a perpetual, renewable resource.

4.2.2. Incidental Recharge

As water is applied to the ground through crop or turf irrigation, a portion of the water will seep back into the aquifer. This water entering into the aquifer is known as incidental recharge. ADWR has evaluated incidental recharge within the Phoenix AMA and has determined that each water provider may claim 4% of the annual water delivered to its customers as incidental recharge. While this is not a tangible source of water that can be managed, it gives the City the right to extract the incidental recharge amount from the aquifer. The incidental recharge estimated for 2005 is 256 ac-ft/year with an estimated 2,767 ac-ft/year expected at build-out.

4.2.3. CAGRD

On July 21, 1998, the City and the Central Arizona Water Conservation District entered into a Member Service Area Agreement. This agreement identifies the City as a Member Service Area and provides a mechanism for the City of Surprise to pump excess groundwater with the CAGRD recharging a like quantity of water for a fee. The City's agreement with CAGRD, shown in Appendix F, allows for the pumping of excess groundwater and the associated recharge provided by the CAGRD of up to 15,959 ac-ft/yr.

4.2.4. Central Arizona Project (CAP) Water

Central Arizona Project (CAP) water is water from the Colorado River that is a valuable renewable resource that can be used to meet future water demands. The City secured an allocation of 7,373 acre-feet/yr of CAP water by establishing an agreement with the United States Bureau of Reclamation and the CAWCD as Subcontract No. 7-07-30-W0354 provided in Appendix G. This agreement was established on November 1, 1996, and "shall remain in effect for a period of 50 years beginning with the January 1 of the Year following that in which the Secretary issues the Notice of Completion of the Water Supply System".

At the present time, the City has not identified its CAP allocation as a component of its designation of AWS. This allocation has been used for this analysis and will be included

in future amendments to the City's designation of AWS. The City is also participating in a reallocation process that is expected make an additional 2,876 acre-feet/year available to the City. This reallocation process is still ongoing and is expected to be complete around 2008. Additional water may become available to the municipal sector upon ratification of the Arizona Water Rights Settlement Act, which is currently being negotiated. Assuming that this amount of water will be allocated proportionally the same as the current reallocation process, the City could expect to receive an additional amount of water close to 4,200 acre-feet/year. Although the City does not currently receive CAP water, by contract, the City is still required to pay for the capital charges associated with the contracted amount of water.

4.2.5. Reclaimed Effluent

Another renewable source of water that the City can utilize is their reclaimed effluent from the South Wastewater Treatment Plant (WWTP). Two main options exist for using this reclaimed water source: recharge the effluent and direct use of the effluent. Reclaimed effluent will be a valuable water resource, helping to enable future growth and development within the City. The amount of projected reclaimed effluent that could be available is outlined in Table 10.

Recharging the reclaimed effluent allows the City to recover that water from a groundwater recovery well. In order to recover the water, the City must receive a permit for each of their wells as a recovery well. A recovery well permit gives the City of Surprise the ability to extract groundwater in a like quantity to the water that was recharged into the ground. The use of recovery wells has the advantage that this recovered water is not counted against the GPCD water use requirement established in ADWR's Third Management Plan and is not considered as excess groundwater. The City has constructed a water recharge facility to recharge the reclaimed effluent from the WWTP. The City has received a water storage facility permit No. 73-562521 and an underground storage permit No. 71-562521 to recharge up to 3,584 acre-feet of water each year, or 3.2 MGD, which is the current design capacity of the WWTP.

The direct use of reclaimed effluent is another way to use this valuable renewable resource. Reclaimed effluent can be used to meet water demands for non-food crops, landscape irrigation and other landscape needs such as for use in water features. The benefit of using reclaimed effluent is that this water source can be used to meet water demands without using excess groundwater and this water use also doesn't count against the GPCD water use requirements.

A conservative wastewater generation factor of 64gpcd was used to estimate the quantity of effluent available for use by the City. The build-out effluent projection was computed by subtracting the SPA 1 population receiving sewer service from the Arizona-American Water Company from the total build-out population. It is projected that the City will produce 36,787 ac-ft of effluent each year at build-out. The projected amount of effluent that could be available for each SPA over each planning horizon is identified in Table 10.

4.3. Water Supply Summary

A summary of the water supply sources, their associated quantities, and availability timing as described in this section is provided in Table 11. For the purposes of this study, the supplies identified here do not need to correspond with the City's AWS. However, the City's AWS designation should be amended as the City acquires new water resources.

5.0 WATER DEMAND AND SUPPLY ANALYSIS

Ensuring an adequate water supply within the City of Surprise is one of the key factors for maintaining sustainable growth and allowing the City to achieve their development goals. As part of planning for the City's future water resources needs, an analysis was performed comparing the projected demands with the projected water supply. This comparison is necessary to determine if and when additional water supplies must be acquired and to analyze the use of different sources of water.

For this analysis, the projected water demands were compared with the combined water resources available to the City for each of the planning horizons. The results are summarized in Table 11. These results are also displayed graphically in Figure 7. As can be seen, the City has adequate water resources to meet the projected water demands for each of the planning horizons through build-out. At build-out, the analysis indicates that the City will have a slight surplus in its water supplies compared to the projected demands. The excess will be 797 acre-feet per year. The City has the ability to acquire adequate water resources to meet their water demands for each of the planning horizons through build-out.

At the present time, the City is relying on their existing water rights, such as the grandfathered rights and incidental recharge, to help meet their demand, but the bulk of the water supply is being received through their membership in CAGRD. While this is a reliable way to meet the City's water demands, it is also a relatively expensive source of water. The City currently has a more than adequate entitlement of water to satisfy their immediate demands, as well as provide excess water that may be stored for long-term storage credits.

6.0 CONSIDERATIONS

At the present time the City is meeting its water demands through their agreement with CAGRD and the City is entitled to various other water resources that will satisfy the City's water supply through build-out. This section will outline recommendations and considerations in acquiring new water resources and in the best use of these water resources based on the analysis of the City's water demands.

6.1. Maricopa Water District

A portion of the City is located within the boundaries of the Maricopa Water District (MWD). While the majority of the MWD area is within the Arizona-American Water Company service area, approximately two and a half sections are located within the City's water service area. The boundary identifying the MWD land within the City can be seen in Figure 8.

At the present time the City does not receive any type of water allocation from the MWD. However, negotiations are occurring with MWD for a surface water allocation for the land within the MWD service area. While a potential allocation from MWD is not included within this analysis, it is an important resource to evaluate more closely in the future.

6.2. McMicken Dam Recharge Basin

In February 1999, the City entered into a lease agreement with the Flood Control District of Maricopa County to lease space within the Trilby Wash Detention Basin for the construction of a recharge cell. Under this agreement, if the City of Surprise recharges at least 10,000 ac-ft of water in any 12-month consecutive period during the first five years of the lease agreement, than the City will have the ability to lease up to four additional water recharge cells.

The Trilby Wash Detention Basin could be used as a recharge basin for CAP water or reclaimed effluent. This potential recharge site could be used to recharge the effluent generated in SPA 2 – SPA 5. This site would also serve as a reasonable location for recharging the City's CAP allocation. Consideration of this location for recharge may be necessary in the management of the City's water resources. The use of the McMicken Dam recharge basin could require agreement amendments.

6.3. CAP Water

The CAP canal crosses through the City's municipal planning area dividing SPA 4 and SPA 5 from SPA 2 and SPA 3. Currently, the City does not have the infrastructure or means to access this water. Two potential methods could be developed in order to access the CAP water. The CAP water could be conveyed to a recharge basin and then

recharged and stored underground for recovery at a later date or a surface water treatment plant could be constructed to treat the surface water.

6.3.1. CAP Water - Recharge

In order to use the McMicken Dam recharge basin, the City would be required to construct approximately 9 miles of pipeline to convey the CAP water from the canal to the recharge cells. Once the CAP water is recharged, the City could extract the water from any location within their service area using a permitted recovery well.

Another important consideration in recharging CAP water, is that under the ADWR rules, when CAP water is stored underground, 5% of this water is required to remain in the aquifer. Therefore, only 95% of the water would be available for extraction. If the City's full CAP allocation were recharged, then only 7,004 acre-ft/yr of water could be recovered. This would require the City to identify and obtain an additional 369 acre-ft per year of water at build-out to make up for this loss.

6.3.2. CAP Water – Surface Water Treatment

In order to deliver CAP water directly as a potable water source, the water would need to be treated. As described in the Water Treatment section, surface water undergoes different treatment processes and testing before it can be delivered. In addition to utilizing conventional treatment processes to treat the CAP water, it may also be necessary to treat the water for nitrate. In order to treat nitrate, an ion exchange process or a reverse osmosis process would be required. Either of these processes would add an additional cost to the plant, as well as an additional burden for disposing of the brine they generate. In addition, the City of Surprise would be required to dedicate land for the development of a brine evaporation pond in addition to the land required for the water treatment plant.

Another consideration for the use of surface water is the availability of a backup supply. This backup supply would require either an additional source of surface water or utilizing groundwater wells as backup. Infrastructure would be needed to be able to deliver water from either source to the water customers.

One of the potential advantages for a surface water treatment is that there will be a small amount of water saved as compared with a recharge and recovery program. The 5% loss of CAP water that remains in the aquifer would not be lost if the water was treated and delivered. However, there may be losses associated with surface water treatment, especially if an ion exchange or reverse osmosis method is used.

A planning estimate for a conventional surface water treatment plant is approximately $1.50 per gallon. Therefore, in order to treat the CAP water with a conventional treatment plant, costs to treat the City's original CAP allocation of 7,373 acre-feet per year would cost approximately $10,500,000 per year. The annual operation and

maintenance costs for the plant would be additional. Additional studies would need to be performed to evaluate the infrastructure needs and associated costs with providing CAP water directly.

6.3.3. CAP Water – Future Reallocations and Availability

Future reallocations of CAP water were considered as supplies available to meet the City's future demands. There is a high probability that the first reallocation will be completed within the next 5 years and will provide an additional 2,876 acre-feet per year for the City. The second reallocation will depend on the current negotiations of the Arizona Water Rights Settlement Act. The reallocation process for this second reallocation has not yet been determined. At this time, there is some uncertainty as to the results of such a reallocation since the allocation process may change and the determining factors of the other participants in the reallocation process have probably changed also. It is important for the City to remain aware of and involved in the regional water rights discussions regarding the management of CAP water.

CAP water is a surface water and is subject to the forces of nature and the variability of rainfall. In addition, CAP water users are junior in right to other water users on the Colorado River, which means that in times of shortage, CAP deliveries will be reduced. These factors emphasize the importance of the need for a backup supply of water.

6.4. CAGRD

As described previously , the City is a member service area of the CAGRD and is currently utilizing them as their main mechanism to legally use groundwater. As required under the City's agreement with the CAGRD, the City must pay a replenishment fee to cover the excess groundwater recharged on behalf of the City. It is projected that the City will be required to rely on the CAGRD to satisfy a large portion of the build-out demands.

When excess groundwater is pumped, the water provider must pay the CAGRD to replenish that water. The rate to replenish water is established on an acre-foot basis. This rate is relatively expensive, currently costing $188 per acre-foot. This rate is expected to increase significantly over time due to the costs associated with securing water rights to provide long-term assurance of its recharge capabilities. Also, this rate does not include the costs to the City for pumping and distributing the water. Based on the current year rate schedule (2003-2004), and the projected build-out demand, the City of Surprise would need to spend $3,000,292 each year in order to utilize the 15,959 ac-ft/yr of CAGRD water identified as being required at build-out. Due to the cost of this water, the City should seek other available options to satisfy the build-out demand.

6.5. Indian Lease Water

An additional option for increasing the City's water resources is to evaluate the feasibility of utilizing Indian lease water to meet their demands. There are various requirements and limitations to utilizing water leased from an Indian tribe as part of the City's assured water supply. Due to the cost of the CAGRD water and its projected usage at build-out, the City may want to evaluate Indian water lease opportunities that may be possible.

6.6. Reclaimed Water

6.6.1. Recharge

One of the keys for the City to maintain adequate water resources is the utilization of the reclaimed effluent from their wastewater treatment plants. The City is planning to continue to expand the capacity of the South WWTP. It is anticipated that at ultimate build-out, the City will generate approximately 12,300 acre-ft/yr of effluent within SPA 1. Based on these projections, the City should expand the recharge basins to meet an ultimate capacity of approximately 12,300 ac-ft/year, less any direct reuse commitments.

As development begins to expand into SPA 2 - 5, the availability of reclaimed effluent will increase and this source of water will need to be considered for sustainable growth. 24,500 acre-ft/yr of reclaimed effluent is expected to be generated within SPA 2 – 5 at build-out. Again, the recharge basins at McMicken Dam could provide an ideal location for effluent recharge based on the projected location of the SPA 3 treatment plant, as described in the City of Surprise Infrastructure Master Plan. These basins are expected to be able to recharge at least 10,000 acre-feet per year. Additional recharge basins may be necessary to handle the projected quantity of effluent available. Another option is to set aside additional land at each future WWTP site for recharge basins.

In order to fully utilize the City's effluent for recharge, additional permitting will be required. The City would be required to revise or apply for a new Underground Storage Facility permit to account for the additional quantities of water that may be recharged at the current SPA 1 recharge location. An Underground Storage Facility permit, a Water Storage Facility permit, a Recovery Well permit, and an Aquifer Protection permit will all be required for any new recharge facility. The Underground Storage Facility permit, Water Storage Facility permit, and Recovery Well permit are issued by the Arizona Department of Water Resources, while the Aquifer Protection permit is obtained through the Arizona Department of Environmental Quality.

Under the ADEQ requirements, any effluent that is recharged into the ground must be of Class B quality or better. This is a lower effluent class than would be required if the City wanted to directly reuse their reclaimed water. It is recommended that the City provide a minimum Class B effluent quality in order to be able to ensure recharge of this water resource.

An additional consideration for an effluent recharge and recovery program is the potential for some chemicals to not be completely removed from the WWTP influent during the wastewater treatment processes. Examples of some of these chemicals include: caffeine, chemotherapy drugs, endocrine disruptors, estrogen compounds, and pharmaceuticals. While additional "treatment" of these chemicals may occur following recharge, the chemicals may not be completely removed. At the present time, ADEQ is aware of these concerns, but has not yet drafted regulations.

One additional advantage to an effluent recharge program is found in the ADWR Management Plan rules. Under these rules, use of reclaimed water can offset a portion of the per capita water demand calculated by ADWR. In addition, reclaimed water can be recharged and 100% recovered. A portion of the water is not required to be left in the aquifer.

6.6.2. Direct Reuse

Another potential utilization of the City's reclaimed water is to direct reuse. In order to directly irrigate the City's parks, a minimum Class A effluent would be required. Class A effluent is achieved by utilizing secondary treatment, filtration, and disinfection at the wastewater treatment plant. Another consideration is that transmission infrastructure must also be constructed to convey the reclaimed water to the locations where it will be used.

6.6.3. Effluent Classes

The potential uses for reclaimed water vary depending on the class of effluent that is discharged from the City's WWTP's. Each class of effluent may be used for its designated potential uses and any potential uses for classes lower than itself. The potential uses for effluent are as follows:

Class A effluent is suitable for irrigation of food crops, recreational impoundments, residential landscape irrigation, school ground landscape irrigation, open access landscape irrigation, toilet and urinal flushing, fire protection systems, spray irrigation of an orchard or vineyard, commercial closed loop air conditioning systems, vehicle and equipment washing as well as those uses approved for Class B and Class C effluent.

Class B effluent is suitable for recharge, irrigation of an orchard, irrigation of golf courses, restricted access landscape irrigation, landscape impoundment, dust control, construction water, milking animal pasture irrigation and livestock watering, and street cleaning as well as those uses approved for Class C effluent.

Class C effluent can be used for pasture or livestock watering for non-dairy animals; irrigation of sod farms; irrigation of fiber, forage, seed or other similar crops and silviculture.

6.7. Water Conservation

A water conservation program can be an effective tool to help extend available water resources. According to studies performed by the EPA, residential water use in the home can be reduced by 15 to 20% without major discomfort to the homeowner. Both the City and residents will benefit from the implementation of a water conservation program with a decreased demand to meet for the City and lower payment for water services for the residents.

The foundation of most water conservation programs is its public education component. While some water conservation measures can be physically implemented into the plumbing system, many conservation methods require changes to personal habits. Lasting changes usually occur over long periods of time and require consistent messages to promote these changes. Another reason that public education is especially important for the City is that many of our residents have relocated to the City from various other climates. The Southwest desert is an extreme environment and many people are not familiar with the types of vegetation that will survive in this type of climate. Considering that over 60% of residential water demand is typically used to water landscaping, education about desert-adapted plants and efficient watering practices is one of the best methods to achieve water conservation. It is recommended that the education component be maintained at the core of the City's water conservation program with expansion of the public outreach to provide new and different ways to conserve water, but with a consistent purpose.

The City is also expanding into other components of water conservation. Technology is constantly providing new devices that can be used to conserve water, such as dual-flush toilets, low-flow showerheads, hot water recirculating systems, and realistic-looking artificial turf, to name but a few. With so many options available, the City has begun to evaluate programs to promote the use of certain devices through incentives, to require water conservation measures through City ordinance, and other methods that would further develop the water conservation program. It is important to evaluate these different options to determine how the most water can be conserved for the least program cost. It is recommended that this evaluation continue to determine the most efficient and effective water conservation measures. Once these are identified, they should be implemented according to a work plan that identifies the associated costs.

6.8. Groundwater Wells

In order to identify areas potentially favorable for locating a well, a hydrogeologic study was performed. The study is titled Potential Well Site Prioritization Matrix and Index Well Sampling and is included as Appendix I. Southwest Ground-water Consultants, Inc. was hired as a hydrogeologic consultant to analyze the available groundwater data within the City's municipal planning area, develop a well site prioritization matrix, and a well sampling program. Southwest Ground-water Consultants analyzed existing well locations, water quality data, and hydrogeologic aquifer data within the municipal planning area. A well site prioritization matrix was developed from this data, which

identifies the potentially favorable and unfavorable locations throughout the City for locating new wells. This report can be used to select the optimum locations for water supply wells and recharge facilities.

6.9. Assured Water Supply Designation Update

Under the rules set forth by the state of Arizona, a water provider must have an assured water supply designation of sufficient quantity to meet the current and projected demands of their service area. As the City actively seeks new water resources, the City should apply for amendments to their designation as new water resources are acquired. By amending the designation to include new water resources, the City will be providing for the legal continued growth and development within the municipal planning area.

6.10. Water Resources Master Plan Update

The City is expected to continue with a high growth rate over several decades. In order to plan for and accommodate this growth, this Water Resources Master Plan was developed. In order to ensure that this plan adequately reflects the needs of the City and continues to provide the most effective guidance, it is recommended that this plan be updated every five years.

Table 1
Secondary Drinking Water Regulations

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids (TDS)	500 mg/L
Zinc	5 mg/L

Table 2
Surprise Population Projections

Year	Total Population	SPA 1 Population	SPA 2 Population	SPA 3 Population	SPA 4 Population	SPA 5 Population
Current	54,416	50,656	1,046	2,061	356	297
2005	81,006	75,236	1,490	3,108	608	564
2010	124,537	108,849	8,200	6,180	743	564
2015	167,193	133,799	16,457	13,097	2,449	1,391
2020	213,951	145,839	27,519	25,150	8,508	6,936
Build-out	**517,607**	**171,750**	**70,920**	**179,550**	**43,018**	**52,369**

Table 3
Arizona-American Service Area Population Projection

Year	Arizona-American Population
Current	31,314
2005	43,406
2010	61,514
2015	79,100
2020	88,533
Build-out	**111,346**

Table 4
Water Demand Projections (ac-ft/year)

Year	Total		Arizona-American		Surprise
	Population	Demand	Population	Demand	Demand
Current	54,416	9,265	31,314	5,332	3,933
2005	81,006	13,792	43,406	7,390	6,402
2010	124,537	21,204	61,514	10,473	10,730
2015	167,193	28,467	79,100	13,468	14,999
2020	213,951	36,428	88,533	15,074	21,354
Build-out	**517,607**	**88,129**	**111,346**	**18,958**	**69,171**

Table 5
SPA Water Demands (ac-ft/year)

Year	SPA 1		SPA 2		SPA 3		SPA 4		SPA 5	
	Pop	Demand	Pop	Demand	Pop	Demand	Pop	Demand	Pop	Demand
Current	50,656	8,625	1,046	178	2,061	351	356	61	297	51
2005	75,236	12,810	1,490	254	3,108	529	608	103	564	96
2010	108,849	18,533	8,200	1,396	6,180	1,052	743	126	564	96
2015	133,799	22,781	16,457	2,802	13,097	2,230	2,449	417	1,391	237
2020	145,839	24,831	27,519	4,685	25,150	4,282	8,508	1,449	6,936	1,181
Build-out	**171,750**	**29,242**	**70,920**	**12,075**	**179,550**	**30,570**	**43,018**	**7,324**	**52,369**	**8,916**

Table 5 Includes Arizona-American Water Company Demands

Table 6
Demand Category Water Duty Factors (gpcd)

Category	Demand
Residential	74
Commercial	10
Irrigation	68

Table 7
Water Demand by Category

Category	Demand (gal/ac/day)
Rural (0.5du/ac)	300
Suburban Residential (2du/ac)	1,000
Low Density Residentail (4du/ac)	2,000
Med Density Residential (7du/ac)	3,500
High Density Residential (15du/ac)	7,000
Commercial	2,000
Irrigation	4,000

Table 8
Estimated Water Demands by Category Summary (acre-ft/yr)

	Residential	Rural	Commercial	Irrigation	Total
Current	1,915	0	259	1,760	3,933
2005	2,954	163	421	2,864	6,402
2010	4,976	249	706	4,801	10,730
2015	6,656	646	987	6,710	14,999
2020	8,441	1,956	1,405	9,554	21,354
Build-out	**28,631**	**5,046**	**4,551**	**30,947**	**69,171**

Table 9
Assured Water Supply Approved Amounts (ac-ft/yr)

Source	1999	2010
Grandfathered Rights	6.22	6.22
Incidental Recharge	183	785
CAGRD	3,291	15,959
Effluent	1,972	3,584
Total	**5,452**	**20,334**

Table 10
Effluent Generation

Year	2002	2005	2010	2015	2020	Build-out
SPA 1	3,631	5,394	7,803	9,592	10,455	12,315
SPA 2	75	107	588	1,180	1,973	5,084
SPA 3	148	223	443	939	1,803	12,550
SPA 4	26	44	53	176	610	3,084
SPA 5	21	40	40	100	497	3,754
Total	**3,901**	**5,808**	**8,927**	**11,987**	**15,338**	**36,787**

Table 11
Water Demand and Supply Analysis

acre-feet / year	2002	2005	2010	2015	2020	Buildout
Supplies						
Incidental Recharge	183	256	429	600	854	2,767
Existing CAP	7,373	7,373	7,373	7,373	7,373	7,373
1st CAP Reallocation			2,876	2,876	2,876	2,876
2nd CAP Reallocation			4,206	4,206	4,206	4,206
CAGRD	15,959	15,959	15,959	15,959	15,959	15,959
Effluent	3,000	3,955	8,928	11,986	15,338	36,787
Total Water Supply	26,515	27,543	39,771	43,000	46,606	69,968
Water Demand	3,933	6,402	10,730	14,999	21,354	69,171
Excess	22,582	21,141	29,041	28,001	25,252	797

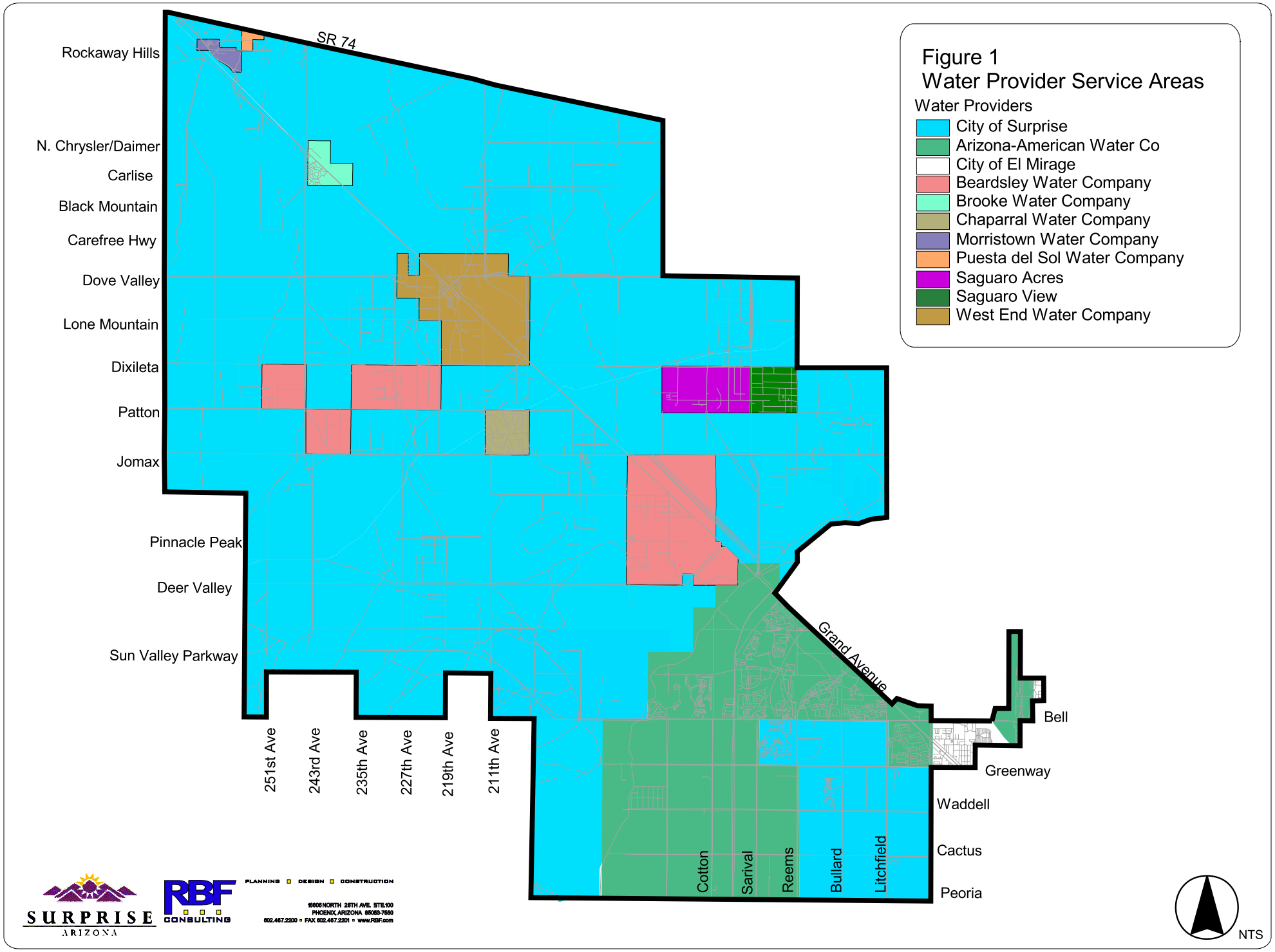
Figure 1
Water Provider Service Areas
Water Providers
City of Surprise
Arizona-American Water Co
City of El Mirage
Beardsley Water Company
Brooke Water Company
Chaparral Water Company
Morristown Water Company
Puesta del Sol Water Company
Saguaro Acres
Saguaro View
West End Water Company
SR 74
Rockaway Hills
N. Chrysler/Daimer
Carlise
Black Mountain
Carefree Hwy
Dove Valley
Lone Mountain
Dixileta
Patton
Jomax
Pinnacle Peak
Deer Valley
Sun Valley Parkway
251st Ave
243rd Ave
235th Ave
227th Ave
219th Ave
211th Ave
Grand Avenue
Bell
Greenway
Waddell
Cactus
Peoria
Cotton
Sarival
Reems
Bullard
Litchfield
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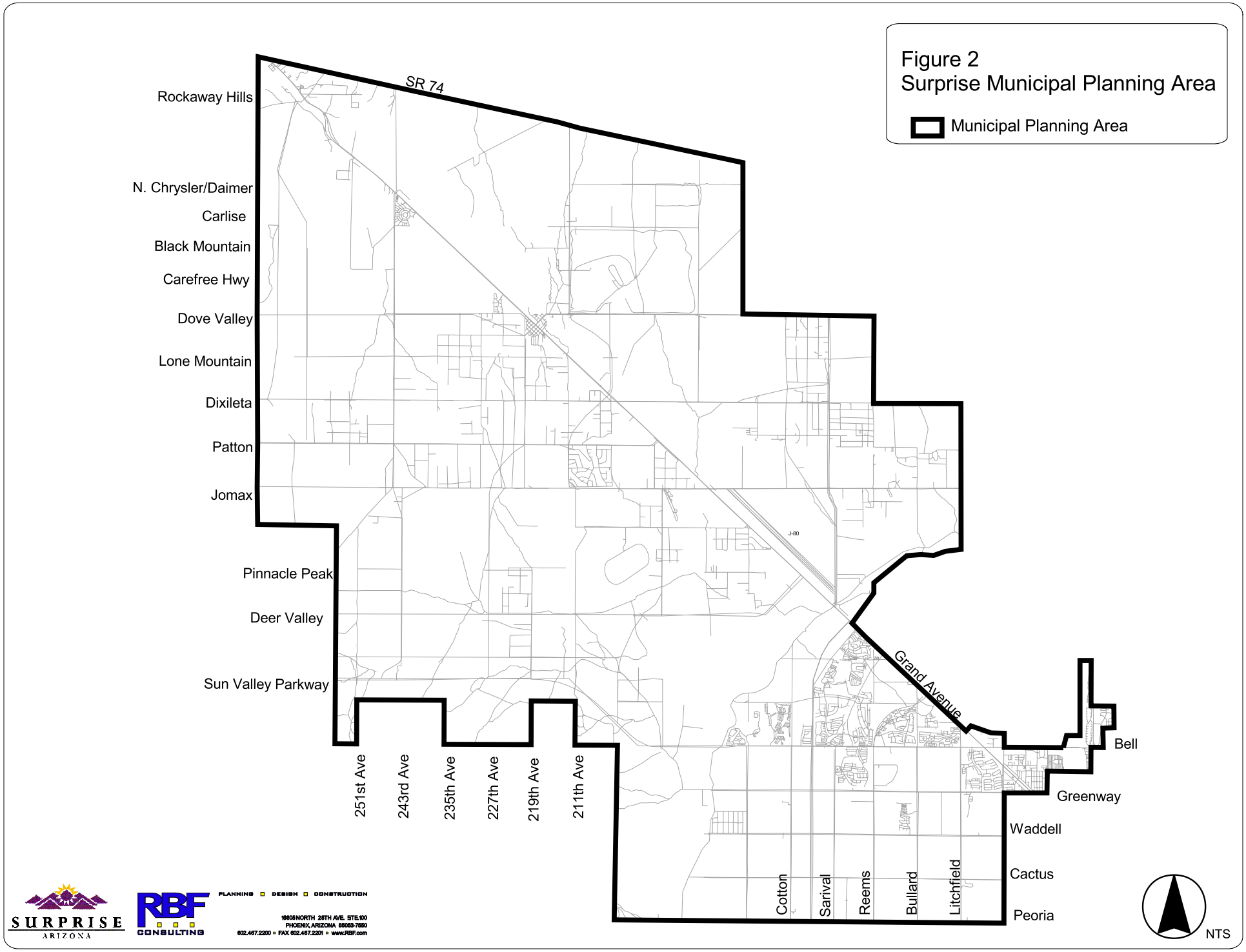
Figure 2
Surprise Municipal Planning Area
Municipal Planning Area
SR 74
Rockaway Hills
N. Chrysler/Daimer
Carlise
Black Mountain
Carefree Hwy
Dove Valley
Lone Mountain
Dixileta
Patton
Jomax
Pinnacle Peak
Deer Valley
Sun Valley Parkway
251st Ave
243rd Ave
235th Ave
227th Ave
219th Ave
211th Ave
J-80
Grand Avenue
Bell
Greenway
Waddell
Cactus
Peoria
Cotton
Sarival
Reems
Bullard
Litchfield
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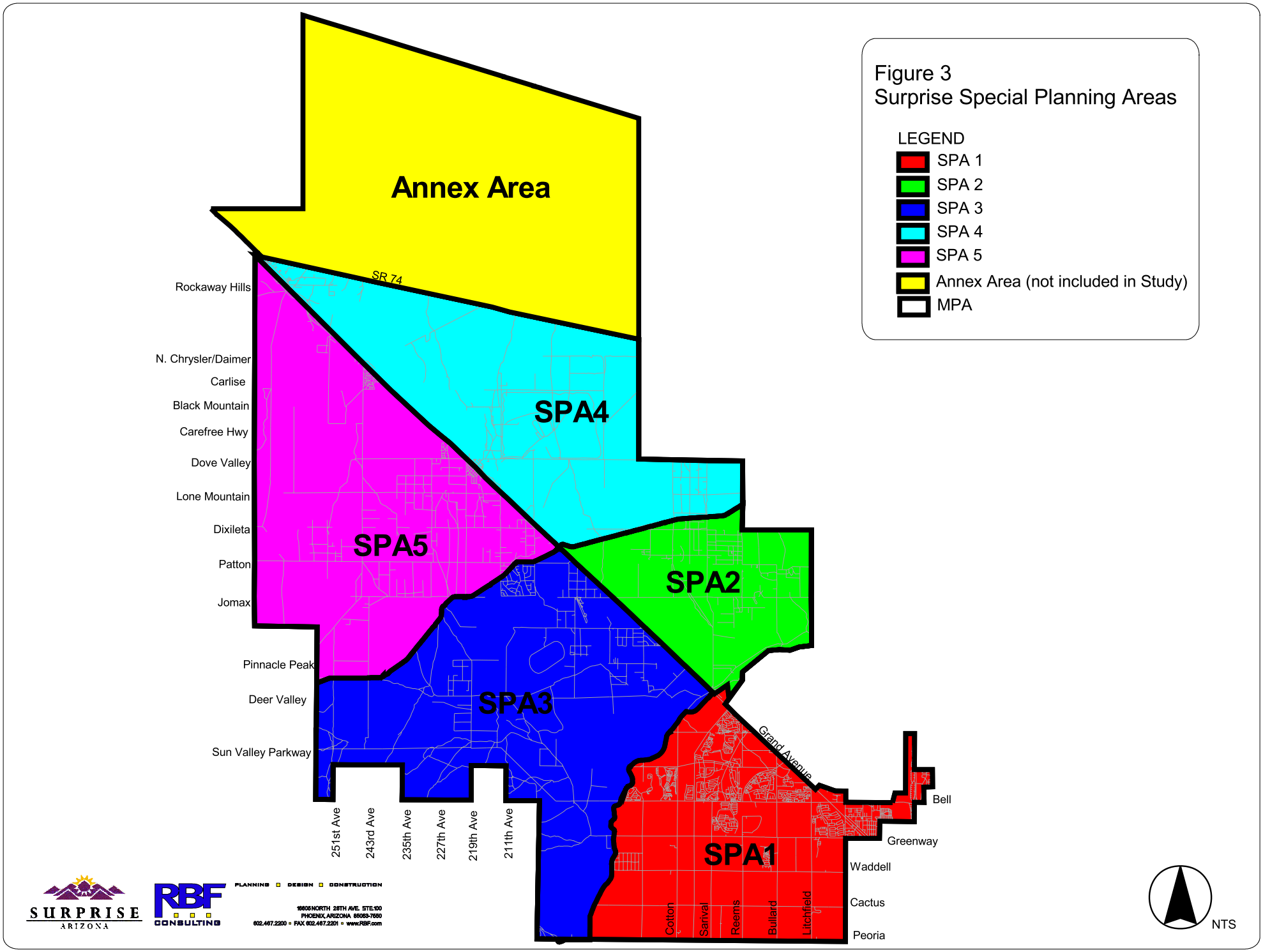
Figure 3
Surprise Special Planning Areas
LEGEND
SPA 1
SPA 2
SPA 3
SPA 4
SPA 5
Annex Area (not included in Study)
MPA
Annex Area
SPA4
SPA5
SPA2
SPA3
SPA1
SR 74
Rockaway Hills
N. Chrysler/Daimer
Carlise
Black Mountain
Carefree Hwy
Dove Valley
Lone Mountain
Dixileta
Patton
Jomax
Pinnacle Peak
Deer Valley
Sun Valley Parkway
251st Ave
243rd Ave
235th Ave
227th Ave
219th Ave
211th Ave
Grand Avenue
Bell
Greenway
Waddell
Cactus
Peoria
Cotton
Sarival
Reems
Bullard
Litchfield
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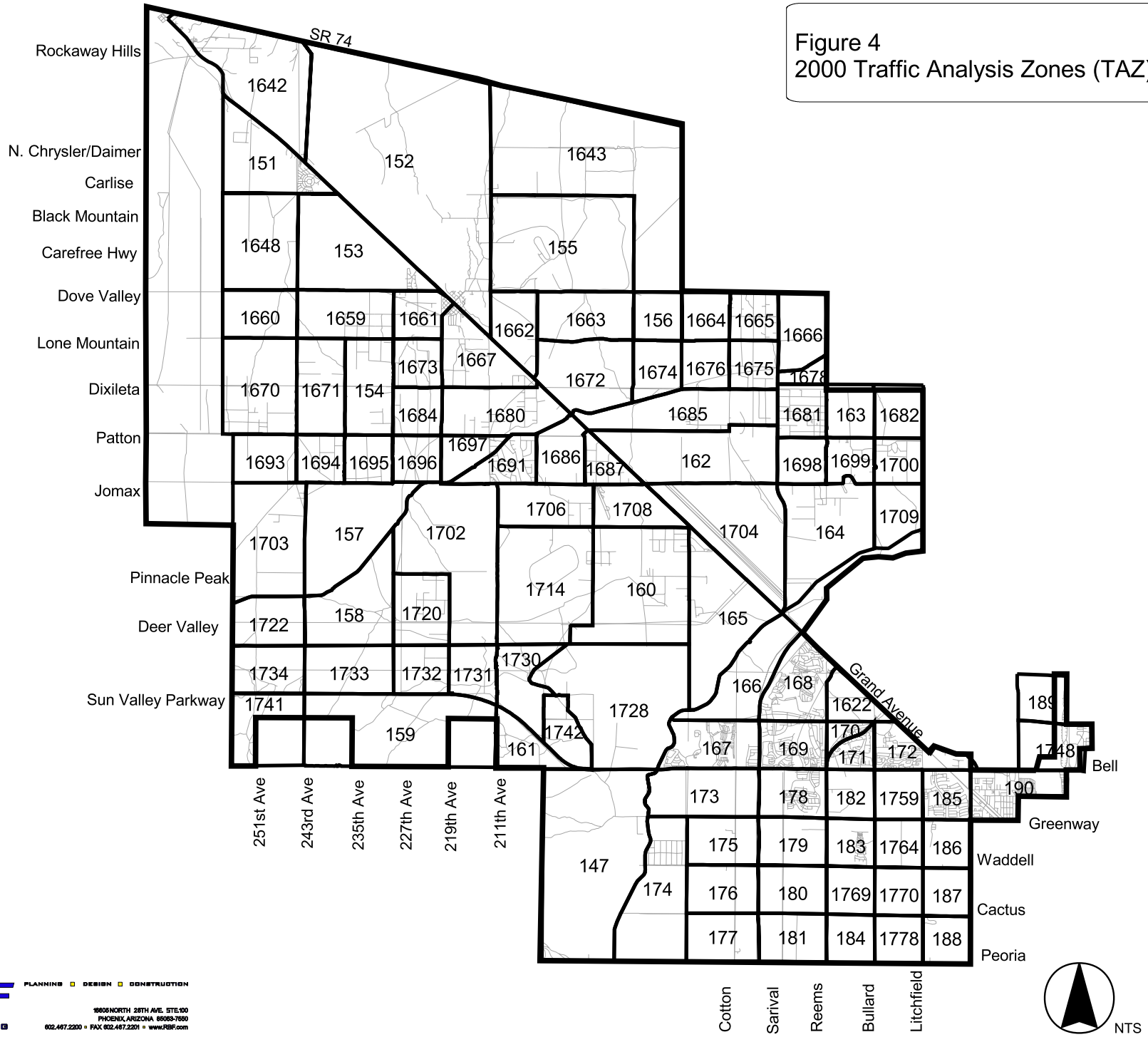

Figure 4
2000 Traffic Analysis Zones (TAZ)

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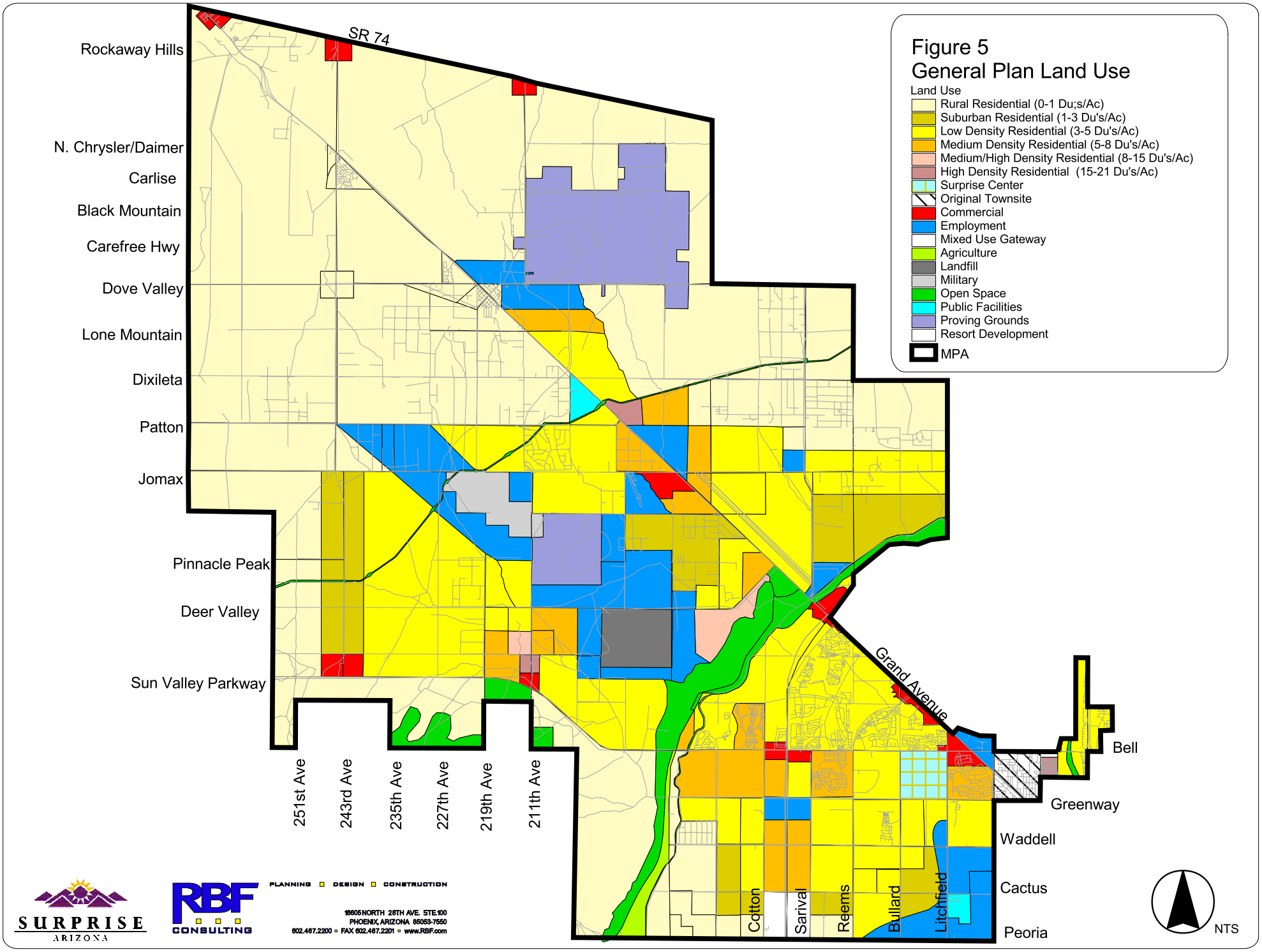
Figure 5
General Plan Land Use
Land Use
Rural Residential (0-1 Du;s/Ac)
Suburban Residential (1-3 Du's/Ac)
Low Density Residential (3-5 Du's/Ac)
Medium Density Residential (5-8 Du's/Ac)
Medium/High Density Residential (8-15 Du's/Ac)
High Density Residential (15-21 Du's/Ac)
Surprise Center
Original Townsite
Commercial
Employment
Mixed Use Gateway
Agriculture
Landfill
Military
Open Space
Public Facilities
Proving Grounds
Resort Development
MPA
Rockaway Hills
SR 74
N. Chrysler/Daimer
Carlise
Black Mountain
Carefree Hwy
Dove Valley
Lone Mountain
Dixileta
Patton
Jomax
Pinnacle Peak
Deer Valley
Sun Valley Parkway
251st Ave
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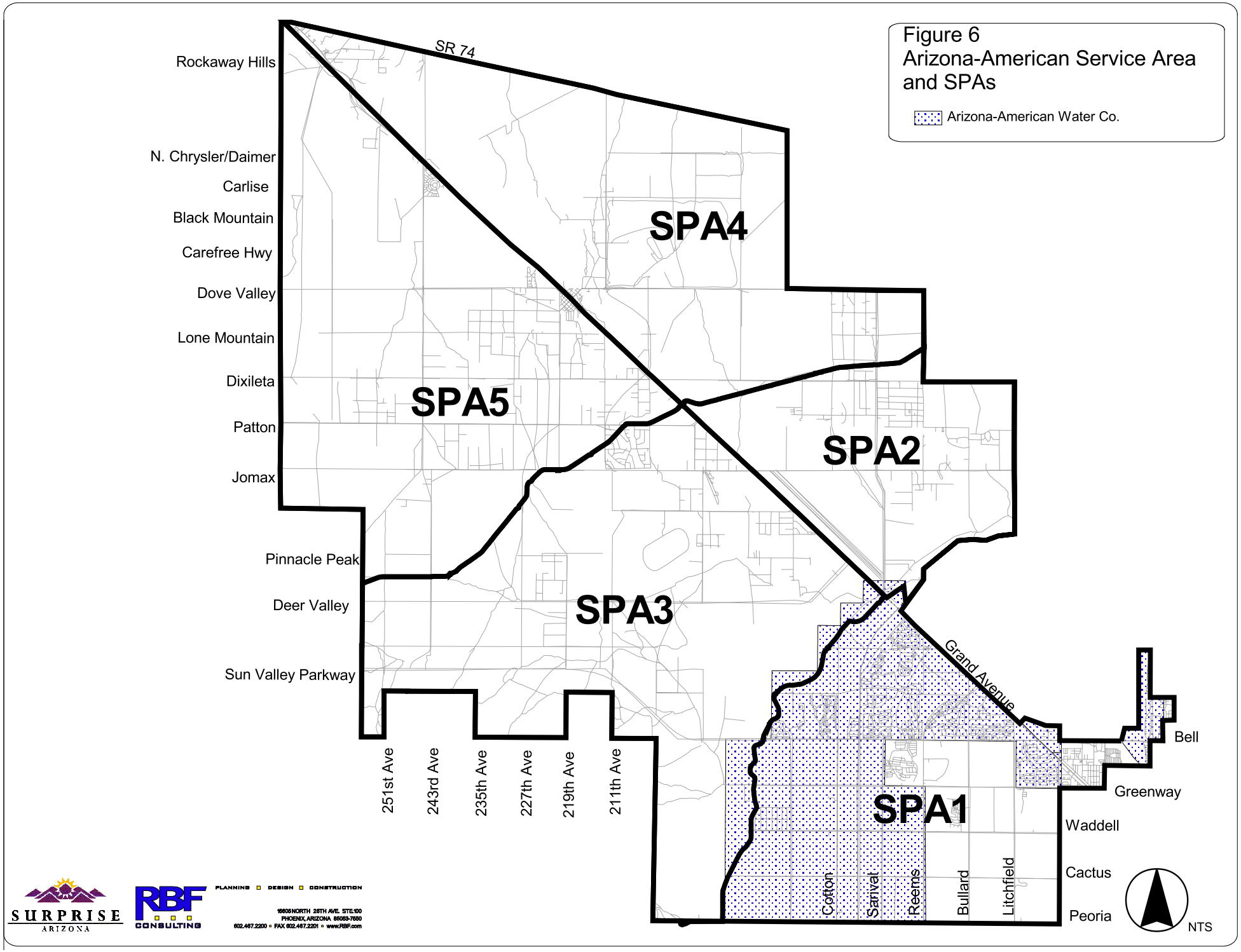
Figure 6
Arizona-American Service Area and SPAs
Arizona-American Water Co.
SR 74
Rockaway Hills
N. Chrysler/Daimer
Carlise
Black Mountain
Carefree Hwy
Dove Valley
Lone Mountain
Dixileta
Patton
Jomax
Pinnacle Peak
Deer Valley
Sun Valley Parkway
SPA4
SPA5
SPA2
SPA3
SPA1
Grand Avenue
251st Ave
243rd Ave
235th Ave
227th Ave
219th Ave
211th Ave
Bell
Greenway
Waddell
Cactus
Peoria
Cotton
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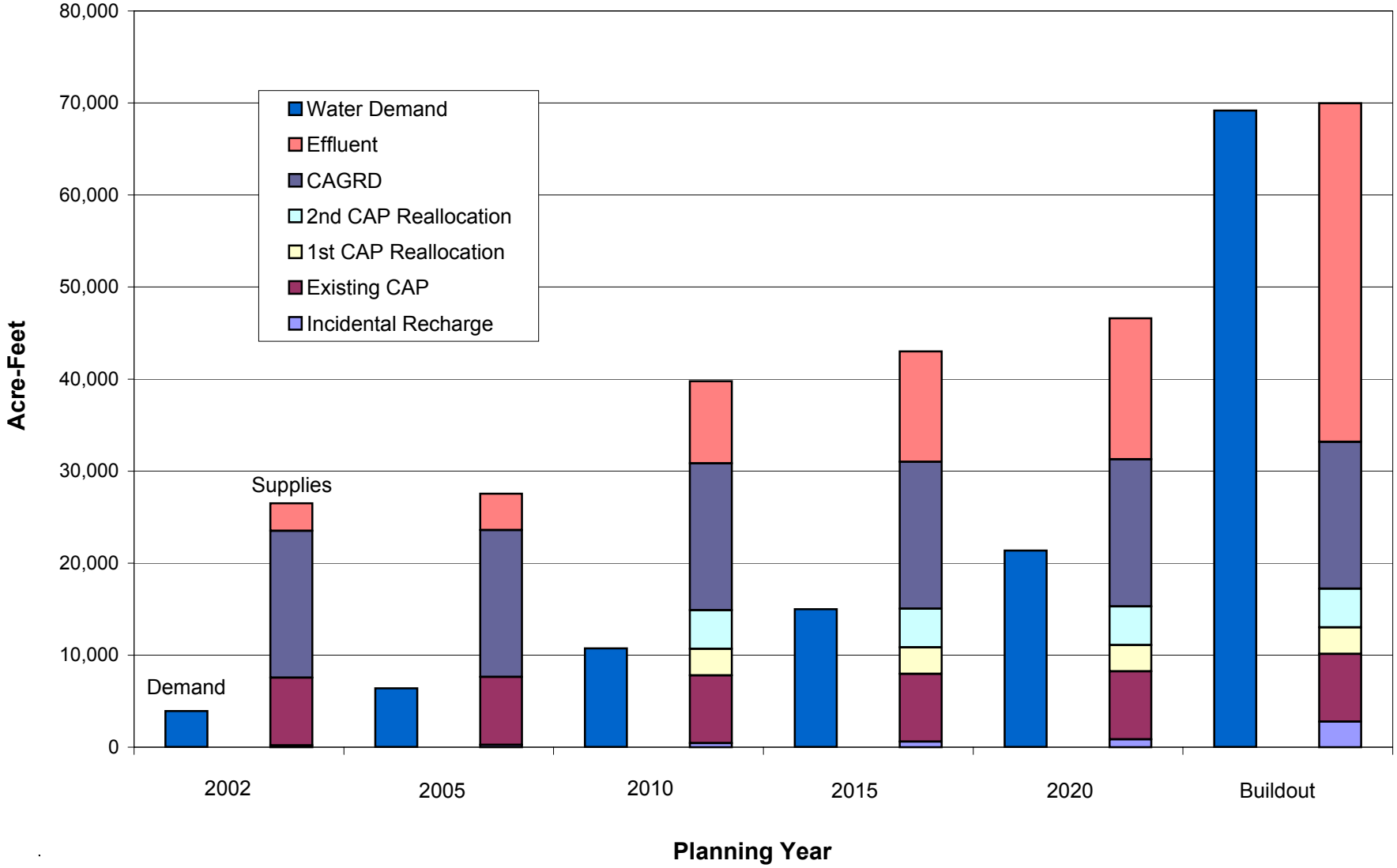
Figure 7 - Water Demand and Supply Analysis



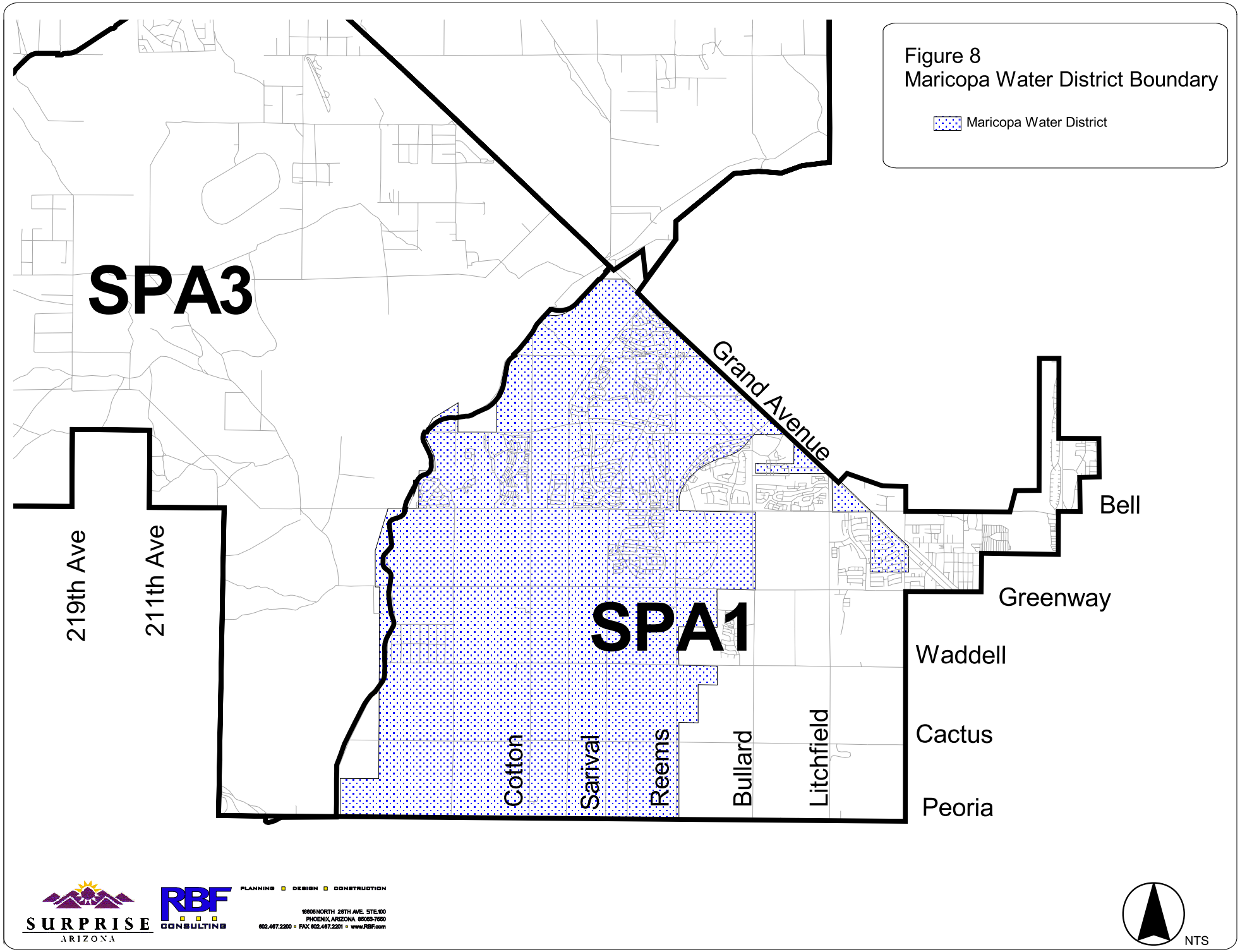


Figure 8
Maricopa Water District Boundary
Maricopa Water District
SPA3
SPA1
Grand Avenue
219th Ave
211th Ave
Cotton
Sarival
Reems
Bullard
Litchfield
Bell
Greenway
Waddell
Cactus
Peoria
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