

I. OVERSIGHT COMMITTEE'S INTRODUCTION TO THE REPORT

A. The Need for a New Paradigm

Since the 1860s, the paradigm for water resource planning in the Tucson basin has been:

"Let the people come, we guarantee to provide enough water."

Land use planning and water resource planning have been unconnected, both institutionally and conceptually. Local land use planners assumed—and water resource managers guaranteed—that there would be water available to satisfy continued growth. But, during the last century, we overwhelmed the capacity of the Santa Cruz River as a water source; we over-drafted the Santa Cruz River basin aquifer; perennial surface flows in the Santa Cruz River near Tucson ended; and our region currently depends heavily on imported water from the Colorado River.

We know now we are poised to go in another direction. Defining a sustainable water future for this community will require large scale changes and paradigm shifts in how we approach water supply management on a municipal and regional scale. It will require new financial models for operating water utilities, political will to recommend full-cost pricing of water, and considerable education and outreach to the community. It will also require unprecedented regional cooperation in management of water supplies.



Ground subsidence

In the near term our water supply portfolio is in reasonably good shape, but we want to start now to think creatively and realistically about a sustainable water future, for ourselves and for the future. Diversifying and augmenting water supplies is necessary for the current population, and will also help to serve those who will move here in the future.

We need to build a sustainable water future on three principal pillars:

- aggressive demand management
- new water supplies
- guiding the coming growth increment in terms of urban form/density and location

The new paradigm for water resource planning and management:

- recognizes scarcity and uncertainty
- puts the environment at the table where water is distributed
- balances water supply and demand management
- builds upon the crucial link between urban form and water resources
- elevates public dialogue to a central position in future planning

Water Use Sectors in the New Paradigm



How We Plan with a New Paradigm

Recognize where we are now

- We live in an arid environment
- We face an era of scarcity in water supplies and financial constraints



Envision a Sustainable Water Future

1. Water for people and for the environment, now and in the future
2. Learn from the desert and make ourselves drought resistant/tolerant
3. To the extent possible, all water supplies will be from renewable sources



The Elements of Water Resource Planning



B. Defining Sustainability


As they responded to the Scope of Work, both Committee and Staff frequently referenced “sustainability” in their discussions, and developed numerous lists of ideas and elements over the course of Phases I and II that attempted to say what a “sustainable water future” involves. Our work during Phase I documented how elusive the concept is in practice.

Historically, settlers to the Western states gradually institutionalized in laws a commodified “use it or lose it” water ethic, whereas the prevailing view among indigenous communities has been that water is more than simply a commodity. Water is a common resource that supports all life, and therefore ethical management meant conservation: One should take only what one needs.


A renewed desire for “sustainability” in the modern era implies a responsibility to assure that our water demands do not outstrip the water supplies which must support the current population of users (including the environment), newcomers, and the generations to follow. New water users and uses may emerge that we cannot now predict, and

**Working Definition of
“A Sustainable Water Future”**

Our planning and monitoring activities assure a renewable water supply sufficient to support economic vitality, community vibrancy, and environmental viability, now and in the future, by continuously adapting to changing conditions in our region.




Renewable Water Supply




Economic
Vitality

Diverse economy,
with desirable jobs
& growth potential



Social
Vibrancy

A good quality of life
for all people
of our community



Environmental
Viability

of both local and
distant ecological
systems contributing
to our water portfolio

future generations will be called upon to remake their definition of a “sustainable water future” in response to conditions emerging in their time. Thus, making plans without building in frequent monitoring of demand, supply, and ecological systems viability--in the face of changing environmental, social, climate and economic conditions--will most likely result in failure to realize sustainability goals.

“Sustainability” in the modern era also implies a regional purview. Water supplies in the Tucson basin extend across and impact a variety of jurisdictions. Moreover, our region imports a significant supply of water from the Colorado River, and as we import water from outside the Tucson basin, we impact other potential users (and vice versa) along with the environmental viability of places outside of our community.

These considerations provide the context in which we work--as the City and County, and as the Tucson basin region--to plan a sustainable water future.

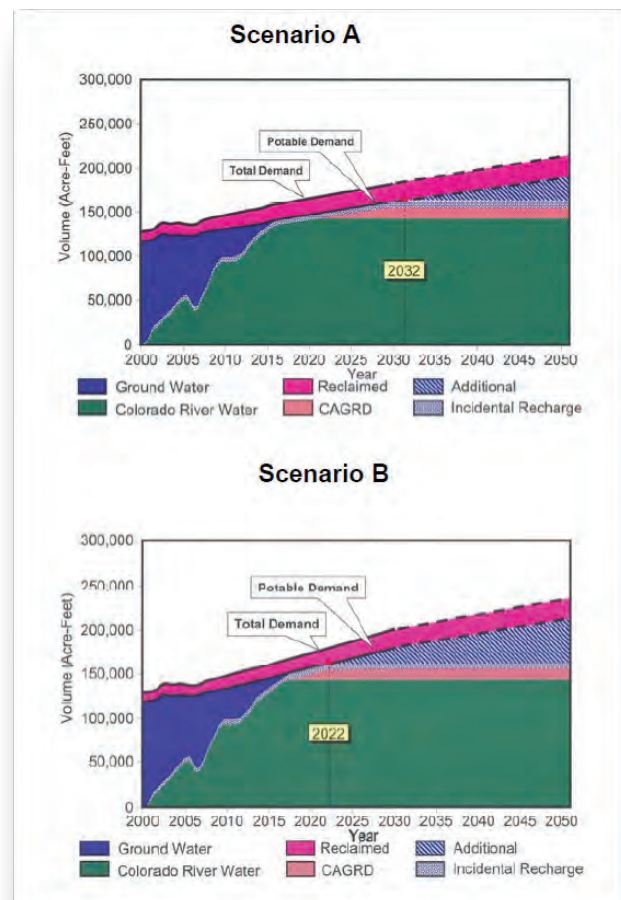
C. Addressing Uncertainty

The technical papers of Phase II detailed a multitude of uncertainties when trying to plan for the future. Prognostication is not an exact science. Therefore, our community must be prepared for many eventualities that cannot be precisely quantified, including extended local and regional drought, climate change, population fluctuation, changes to urban structure/land use, and water availability.

Since figures resulting from modeling and scenarios can vary widely (especially the further we are projecting into the future), we need to think in terms of ranges (high/low), and, update our prognostications every five years to reflect actual and new indices. City and County plans, in fact, are currently updated on such a schedule.

The technical recommendations in Section III of this report address drought and uncertainties. In addition, **the Oversight Committee offers the following specific recommendations to manage risk:**

- ✓ Scenario planning is currently undertaken by both Tucson Water and Pima County Wastewater, and should be continued. Use scenario planning as a tool to assess the changing planning environment, including the potential for extended drought or permanent climate change. Likewise, economic uncertainties, the level of water demand, and the pace/size/location of population growth can all be addressed in scenario planning. Use a sensitivity analysis method, where scenarios are built from X% plus or minus the baseline model/scenario that is likely to occur. Two major calculations to consider are probability of occurrence and potential magnitude of impacts/costs. In all cases, assumptions of each scenario should be delineated.
- ✓ When modeling, some variables to consider are:
 - the year(s) to be looked at
 - the expected water supply for that time period (high/low)
 - possible extended drought effects
 - potential new supplies resulting from better wastewater treatment, rainwater and greywater harvesting, and savings from less per capita use
- ✓ Do a regionally-coordinated drought planning effort for the public’s benefit, as it would be helpful to develop concepts and approaches that are understood by all. And pay attention to special needs of the environment during drought.



- ✓ Evaluate and consider social and financial impacts of drought on citizenry, and develop ways to address them in an equitable manner.
- ✓ Renewable supplies are more reliable than mined groundwater (which guarantees depletion), but are not fully risk-free. The availability and volume of renewable water supplies are not guaranteed in the face of changing local and extra-regional climactic conditions, and include reliance on water of distant origin that must be brought to our area through mechanical means. Future legal issues pertaining to renewable sources may also be a limiting factor.

D. Principles Intrinsic to Achieving Water Sustainability

We believe the following principles are intrinsic to achieving water sustainability. These are not new principles and, to varying extents, they are already in practice. We believe, however, that the principles should be stated as clearly as possible and widely adopted.

The principles are consistent with the new paradigm and definition of water sustainability presented above and should inform implementation of the recommended action plan. We also believe that these principles should guide and inform any regional dialogue on water and wastewater.

Principle 1: Water is an essential part of life for humans and the environment. Delivery of water and wastewater must maximize both quantity and quality.

In this report, we focused on water and wastewater quantity and the charge that the City and County acquire, develop, and deliver water and wastewater in sufficient supply to meet the social, environmental, and economics needs of the present and the future. Access to the water necessary for life is a right--not a privilege--and access to water must never be comprised for private or personal gain, or for any other reason.



Photo on right by Daniel Lobo

The human community and the environment depend utterly on the City and County delivering water and wastewater that meet or exceed all current and future federal, state and local regulatory standards. There are contaminants of known and emerging concern for which standards have not been set and might not be set for years, if at all. City of Tucson and Pima County staff will continue to monitor progress in the scientific literature and regulatory literature in measuring the risks associated with these contaminants, and will keep Mayor and Council, the Board of Supervisors, and the public fully informed on the status of the scientific literature. When in doubt, we should design management strategies that err on the side of caution.

Principle 2: The environment must be considered a user, not simply a provider, of water resources.

The environment provides the biophysical foundation for human life, and water is a critical element for the continuing functioning of all ecological systems. Impacts to the natural environment must always be considered in planning, allocation, and siting decisions such that water is reserved for maintaining a healthy environment.



Birds in Flight at Tres Rios del Norte

Principle 3: Policies affecting water and wastewater must be open to wide public discussion in a completely transparent process.

Open, inclusive, and transparent public dialogue and deliberative processes lead to better policies and decisions than does “deal-making” outside of the public eye. No interests should be excluded from deliberative processes.

Mayor and Council and the Board of Supervisors already comply with many statutes, rules and regulations on open meeting laws, notification, and due process. Indeed, this Oversight Committee was appointed to provide public input and transparency. The Oversight Committee also went to great lengths to achieve greater transparency and public participation. In retrospect, we recognize how difficult it is to catch the public’s attention in a world of so many messages, daily concerns, and distractions. Achieving openness, inclusiveness, and transparency requires we remain vigilant, especially during times when tough decisions must be made. In addition, it is essential that expert information informs the public process.

Principle 4: Water is an economically-valued resource and must be managed with due consideration to its economic value.

All costs and benefits of water and wastewater policies need to be identified and measured in order to establish baseline facts concerning the net outcomes of policy options or projects under consideration.

In addition to financial costs, the following must also be assessed:

- (A) energy costs in the physical management and transportation of water
- (B) opportunity costs (what other opportunities are being foreclosed if we decide on a given option)
- (C) environmental costs
- (D) social quality of life costs

Equity and social justice issues related to cost and quality of life must also be addressed in evaluating policy proposals and projects. We need to consider the community’s ability to pay: 20% of our population lives below poverty level. How will we afford major expenditures? How will households afford to pay for their water needs?

III. SHARED GOALS AND RECOMMENDATIONS

Part III of this report summarizes information from the 14 technical reports and identifies goals and recommendations in four categories that were co-developed by planning staff from the City of Tucson and Pima County. The following chart shows these goals and recommendations at-a-glance; a narration of issues and explanations of goals and recommendations follows the chart.

Comprehensive Integrated Planning

1 Encourage sustainable urban forms

- 1.1 Require and encourage smart growth principles

2 Direct growth to suitable growth areas

- 2.1 Encourage growth in four (4) suitable growth areas / existing built environment as highest priority
- 2.2 Link capital planning and land use planning / direct investment to desired growth areas
- 2.3 Acquire open space to define desired growth areas
- 2.4 Conduct regional growth scenario modeling

3 Integrate land use planning and water resources planning

- 3.1 Conduct comprehensive water resource planning outside of the obligated service area
- 3.2 Consider obligated service area expansion based on above analysis and additional criteria
- 3.3 Continue to track resources for new development / County Water Element, City Water Checkbook
- 3.4 Pursue wheeling and recharge agreements
- 3.5 Work toward regional solutions to address any hydrological pumping/recharge disconnect

4 Growth should pay for itself over time and be financially sustainable

- 4.1 Put mechanisms in place to ensure fiscal sustainability of new development
- 4.2 Continue to ensure “growth pays for growth” in water and wastewater financial planning

Respect for the Environment

1 Preserve existing riparian areas through coordinated regulation, policy, and outreach

- 1.1 Continue preservation through acquisition, regulation, education and outreach
- 1.2 Address non-exempt wells and surface water diversions affecting riparian areas

2 Identify needs and opportunities for future restoration

- 2.1 Develop regional policy on regulatory compliance projects
- 2.2 Collaborate regionally on riparian restoration
- 2.3 Work with ADEQ on water quality standards for habitat restoration

3 Ensure that public projects are multi-benefit, including restoration, stormwater management, recharge, and public amenity

- 3.1 Pursue multi-benefit public projects using reclaimed water
- 3.2 Pursue stormwater management opportunities in areas dominated by impervious surface

4 Ensure the future of riparian and aquatic habitat along the effluent-dependent reach of the Santa Cruz River

- 4.1 Advocate for changes to allow full recharge credit for Secretary of Interior effluent
- 4.2 Develop a “Lower Santa Cruz River Management Plan”
- 4.3 Build upon pilot restoration demonstration projects to develop a portfolio of multi-purpose projects
- 4.4 Incorporate in-channel and off-channel recharge facilities

5 Develop water supply for the environment

- 5.1 Finalize the Intergovernmental Agreement (IGA) for the Conservation Effluent Pool
- 5.2 Link water conservation to environmental preservation/restoration

Water Supply

1 Work collaboratively to acquire new water supplies for reliability

- 1.1 Maximize opportunities to acquire water supplies through regional cooperation and the “Acquire, Develop and Deliver” (ADD) water process
- 1.2 Tucson Water should acquire additional supplies to buttress its Central Arizona Project (CAP) allocation and serve growth in the obligated service area
- 1.3 Consider all costs and benefits in the acquisition of new supplies

2 Maximize and make efficient use of effluent and other locally renewable water supplies

- 2.1 Balance uses of effluent - reclaimed, environment and aquifer recharge
- 2.2 Continue to implement Regional Optimization Master Plan (ROMP) improvements
- 2.3 Stay vigilant about water quality
- 2.4 Evaluate reclaimed expansion from the perspectives of efficiency and overall water resource portfolio
- 2.5 Continue to evaluate greywater expansion
- 2.6 Continue to encourage rainwater harvesting

3 Address regulatory barriers to maximizing local supplies

- 3.1 Address groundwater credits to provide incentives to convert to reclaimed
- 3.2 Move to Class A+ water for the reclaimed system
- 3.3 Work with Arizona Department of Environmental Quality (ADEQ) and Arizona Department of Water Resources (ADWR) regarding water quality standards for riparian projects

4 Foster increased use of reclaimed water through system expansions, increased effluent allocations, and incentives

- 4.1 Expand financing options
- 4.2 Maintain private payer and explore pricing incentives to encourage conversion
- 4.3 Lower operating cost by increasing system efficiencies
- 4.4 Consider reclaimed water in new developments
- 4.5 Consider other uses of reclaimed water for municipal and environmental supply needs
- 4.6 Increase the amount of effluent dedicated to reclaimed
- 4.7 Attract additional reclaimed customers based on efficiency considerations and benefits achieved

5 Be prepared for climate change and drought

- 5.1 Continue multi-pronged planning approach
- 5.2 Use scenario planning

Demand Management

1 Increase the effectiveness of conservation programming through coordinated planning and evaluation

- 1.1 Collect uniform data on water use patterns to identify conservation potential
- 1.2 Use triple bottom line and cost/benefit analysis to improve conservation programming
- 1.3 Employ an adaptive planning approach to drought preparedness

2 Establish common water conservation goals and targeted methods

- 2.1 Establish regional, measurable water efficiency and conservation goals
- 2.2 Develop regional water conservation approaches

3 Manage demand through design of the built environment

- 3.1 Review development regulations for consistency and improved potable water conservation

4 Manage demand through changing behaviors

- 4.1 Gather public input regarding quality of life trade-offs associated with water efficiency
- 4.2 Advance a regional approach to conservation education, communication, pilot projects and training

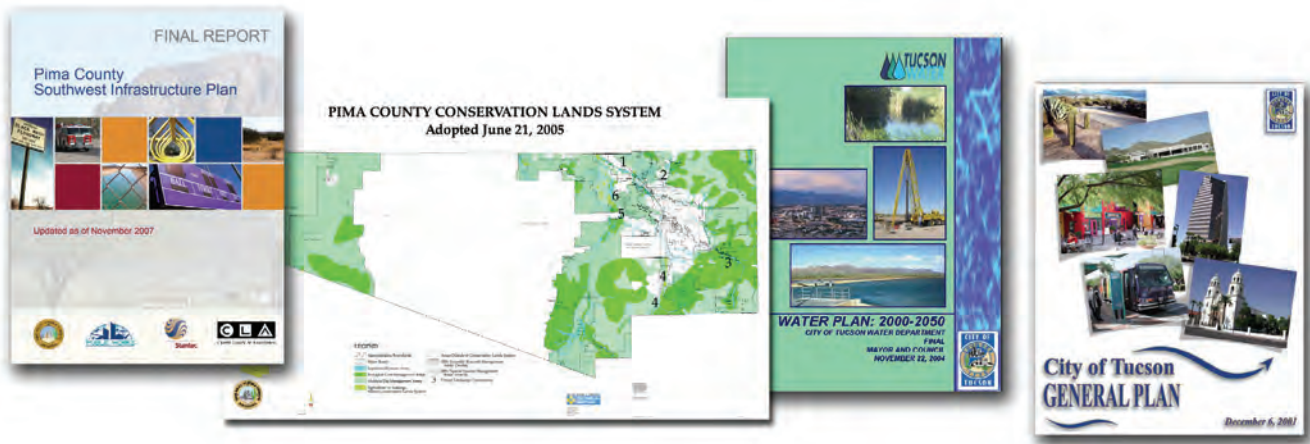
5 Increase the use of rainwater and stormwater to reduce demands on potable supplies

- 5.1 Develop design guidelines for neighborhood stormwater harvesting
- 5.2 Analyze expanded water and stormwater harvesting potential and benefits

A. Comprehensive, Integrated Planning

Water and growth are connected in a variety of ways. Extensions of water and wastewater infrastructure and the availability of water resources influence growth. On the flip side, growth influences the need for water resources and infrastructure. Water is one factor that influences and limits growth, but it is not the sole driver or single limiting factor. As other communities have demonstrated, more water can be acquired at additional cost if growth is desired. What is needed is a rational plan for growth—including the efficient allocation, distribution, and use of all available water resources along with other public infrastructure and services—that remains sustainable from environmental, financial, economic, and social perspectives.

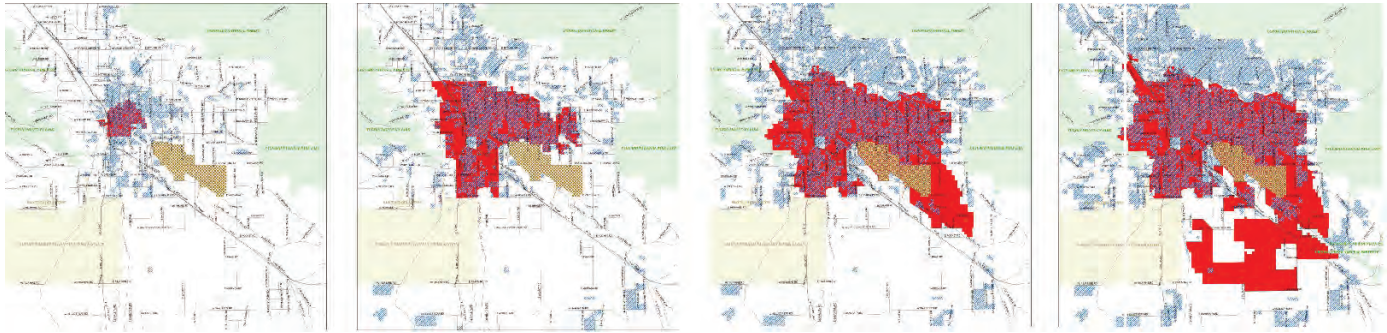
In the past, Tucson Water and Pima County Regional Wastewater Reclamation Department (RWRD) have operated in the context of a large planning area, extending service throughout the region based on demand. This approach has led to continual expansion of the service areas without regard to appropriate location or form of growth.



At the same time, our land use planning efforts have largely been jurisdictional and site-specific, rather than comprehensive and regional. We have not directed growth, instead, we have responded to demand for it. In addition, we have not connected land use and water planning efforts with planning of other services and infrastructure such as transportation, stormwater, parks, etc. Each of these services has been planned in a “silo,” and this practice has contributed to unmanaged growth, environmental problems, infrastructure and service deficits, and diminished public resources. The continuation of this disjointed and reactive planning model is not sustainable. Managing growth—both its form and location—is critical to creating a sustainable water future. We must consider in tandem (a) where we provide water and (b) where and how we want growth to occur.

The Phase II Growth and Urban Form technical paper does not attempt to predict the likelihood, timing, or scale of growth, but rather attempts to answer the question: If growth does occur, how can we accommodate it in the most sustainable manner possible? The paper addresses the forms and location of growth and makes the point that quality of growth is more important to focus on than quantity of growth. As a community, we have much more control over where growth occurs and how it is designed than we do over its likelihood, timing, or scale. Our region clearly has natural limits to growth based on available land, water, financial resources, and economic conditions. But within these constraints, there is capacity for significant growth to take place, perhaps doubling the current population. Efforts aimed at preventing or limiting growth can have negative side effects such as increasing housing cost, deterring economic growth, and pushing growth to ex-urban areas.

In addition to the form and location of growth, it is important to also consider the type of growth. Is it only rooftops and retirees? Will it include high paying jobs and young professionals? A theme from Phase I was that our local economy is overly dependent on growth and real estate development and that this is not healthy or sustainable. While our population is likely still going to grow at some rate, there is no guarantee that in the future we will grow in the same manner as we have in the past. Declining growth is not necessarily a bad thing. Diversifying our economy can help to make our community more resilient to changing growth trends.



Rapid Tucson growth – 1950, 1970, 1990, 2005

A key aspect of integrated planning is to identify opportunities to invest in and optimize use of our existing infrastructure. To achieve sustainability goals, changes to the existing infrastructure must begin by improving the efficiency and flexibility of the existing built environment, including roads, parks, public services, water, wastewater, and stormwater systems. In addition to considering the location and form of growth, integrated planning also needs to consider the efficient allocation, distribution and use of all available water resources including stormwater, effluent and potable water.

This section of the report focuses specifically on Tucson city limits and unincorporated Eastern Pima County, and does not address the other jurisdictions in the region. The goals and recommendations in this section come from the following background technical papers that were prepared as part of Phase II of the Study

1. Integrating Land Use and Water Resources Planning
2. Urban Form and Population Growth
3. Utility Cost of Growth
4. Economic Value of Water
5. Population Primer

The full technical papers are provided online as appendices to the report. They were written to address the following guiding principles provided in the for the Study:

- Urban form, water, and infrastructure planning will directly influence where future population growth will occur
- Locating future population should be done in a manner so as not to disadvantage or adversely impact existing residents
- New growth must be located where it is beneficial to the environment, economy, and conservation of our resources
- Large scale infrastructure systems to support the growth centers must be integrated with existing urban infrastructure systems that are in place
- Land use planning must be integrated with water resources and infrastructure for each jurisdiction

Goal #1: Encourage Sustainable Urban Forms

Urban form refers to the design, arrangement, appearance, and functionality of the built environment, including how compact or spread out development is and the amount and types of land uses co-located together. Urban form is most easily measured by density, however, density is but one aspect of urban form. Elements of a sustainable urban form are outlined in Recommendation 1.1 below.

The Growth technical paper takes a quantitative look at the effects of urban form and finds that small increases in density can have significant positive impacts on a whole host of factors related to sustainability and quality of life in our community, including

- Reduced car passenger miles
- Fewer miles of road per capita
- Lower water consumption per household
- Lower energy consumption and greenhouse gas emissions
- More walkable neighborhoods and urban spaces that contribute to improved public health
- More efficient delivery of public services and infrastructure
- More transit opportunities
- More types of housing choices



Examples of urban forms: office (left) and medium/high density residential (right) – graphics taken from Growth technical report

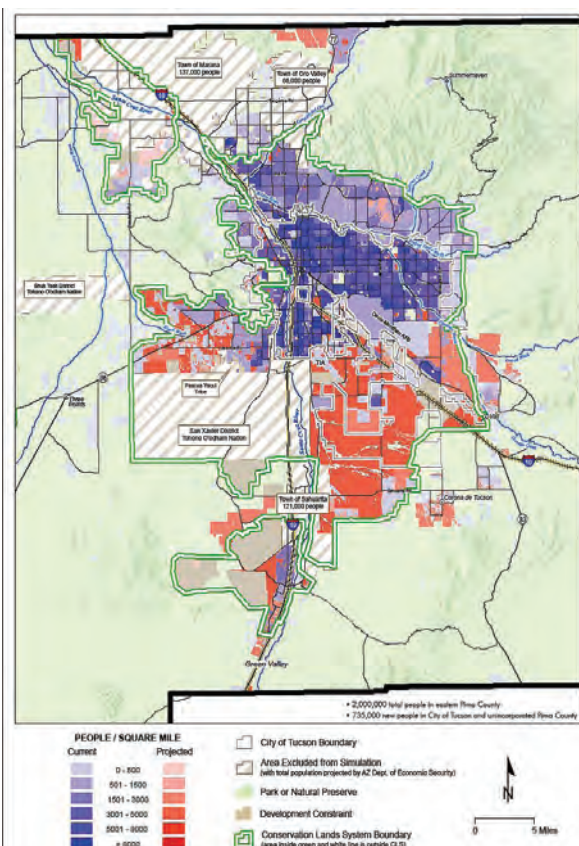
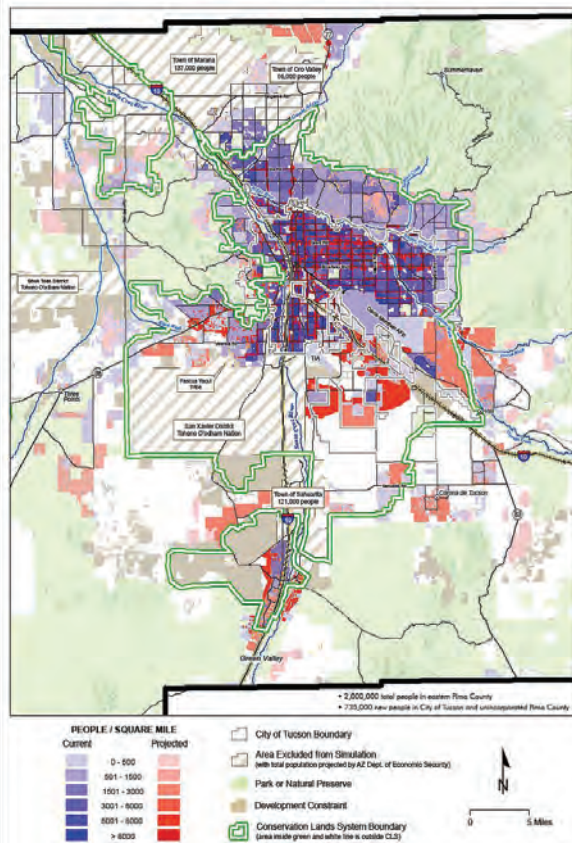
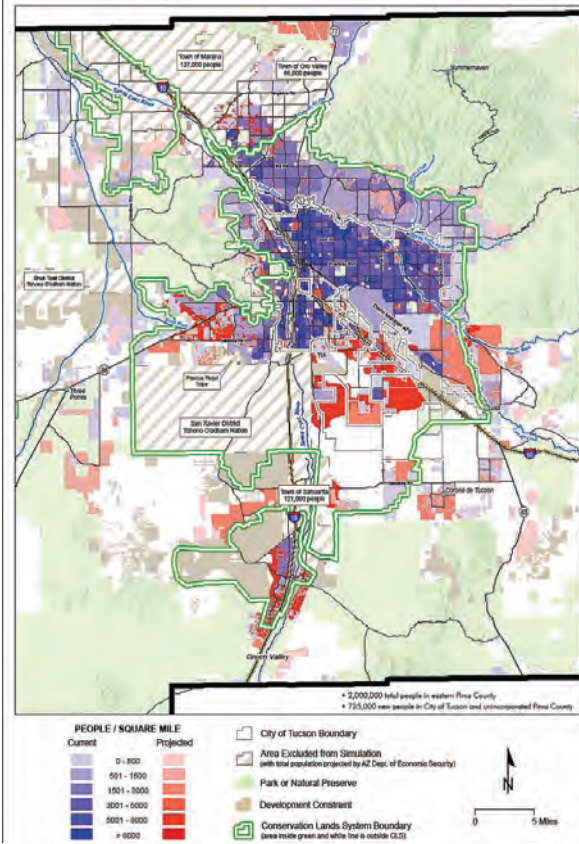
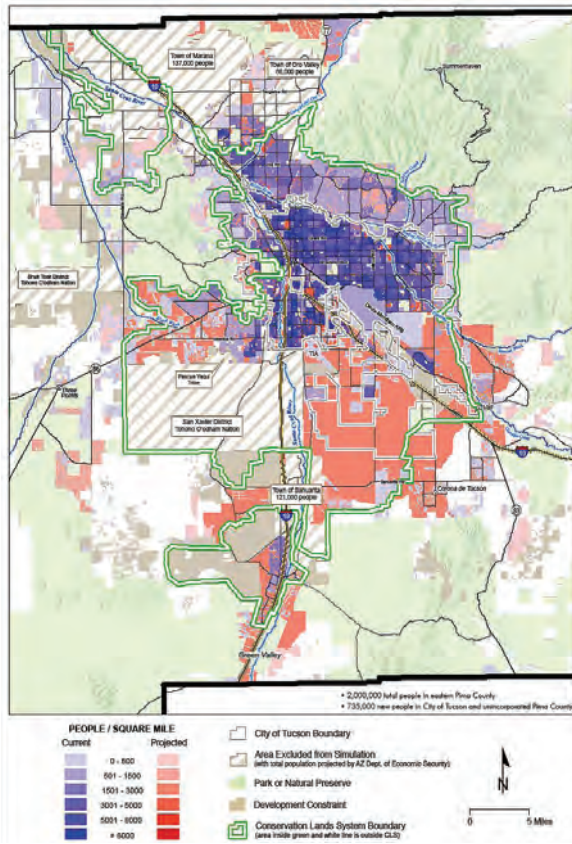
It is important to note that density does not mean uniformity: It means greater diversity in the built environment with more choices for how and where people live, work, and get around. Increases in density are typically done in nodes and select locations, not by densification of the entire community. In fact, protecting historic areas, rural areas, and single family neighborhoods are important components of a sustainable urban form.

To be functional and desirable, density must come with amenities. Our current growth pattern has meant that we have not been able to afford the necessary investments in our community, and has led to significant service and infrastructure deficits. Revenue “freed up” from better directed growth and infill should be invested in the existing built environment in order that infill and increased density can be sustainable, provide community benefits, and be accepted by residents.

In the Growth technical paper, four urban form scenarios were modeled: a status quo scenario, an enhanced habitat protection model, a taxpayer savings/infrastructure efficient model, and a transit oriented model. Both quantitative and qualitative results of each are discussed. The modeling exercise points out that as we grow, we have choices as a community and that we are not relegated to grow in the same form as we have in the past. In fact, it is clear that continuing our same pattern of growth is not a sustainable option going forward.



Tucson's urban core at night– graphics taken from Growth technical report p. 64



Four Urban Form Scenarios

Recommendations

1.1 The City and County should require and incentivize new development and redevelopment projects to implement smart growth principles and concepts, and contribute to a sustainable urban form that includes

- Mix of uses
- Open space preservation
- Higher densities/ density by design
- Housing choice
- Transportation options
- Access to jobs and services
- Reduced water and energy consumption
- Infrastructure efficiencies

A variety of policy and legislative tools should be developed to implement these concepts including:

- General and Comprehensive Plan Policies
- Land Use Code changes
- Other relevant legislative actions
- Incentives

As part of their updates to the City General Plan and County Comprehensive Plan, City and County staff should involve the public in discussions about smart growth and sustainable urban form concepts and explore implementation tools.

The City and County should support the emerging regional visioning process as a way to engage the community in a discussion of the importance of urban form. This regional visioning process can contribute to reaching a broad consensus on community values concerning urban form.

Goal #2: Direct Growth to Suitable Growth Areas

There are areas within the Tucson region that are more suitable for new development to occur than others. More suitable areas for growth are generally those that have the fewest environmental impacts and are closer to infrastructure and the existing built environment. Less suitable areas for development are located far from the existing built environment, lack services and infrastructure, and require long commutes due to lack of jobs/housing mix. Based on these criteria, infill and reinvestment in the existing built environment is identified as the highest priority and most sustainable location for future growth and development to take place.

Nevertheless, it is important to recognize there are limits on how much can be done to direct growth. Private property rights, land availability, and market forces play a significant role in where growth and development occur. Development will continue to take place in less suitable areas based on underlying zoning and as a result of lot splitting in the unincorporated area. The key point of this goal is that the City and County should do more to influence where the majority of future growth and development takes place in urban and suburban areas through where we invest public resources and build infrastructure.

Similarly, it is important that where we extend water and wastewater services matches up with where we want growth to occur. Historically, this linkage has not been made. The Phase II technical report on Growth, Urban Form and Cost of Infrastructure looked at which areas of the community are most suitable for new development based on a variety of factors (e.g. proximity to existing infrastructure and employment) and constraints (e.g. the elimination of certain lands from consideration, such as parks, federal lands, protected open spaces, hillsides). This type of growth modeling was a helpful educational tool in Phase II and would be a beneficial exercise to undertake as a region.

Four suitable growth areas emerging from this analysis are described in the recommendations below. The recommendations describe steps the City and County can take to steer growth toward these locations through policy, regulations, infrastructure investment, and open space acquisition. Timing and phasing of growth in each of these are also important to consider. In the past, market forces and the availability of vacant land have shaped where growth has occurred. While these forces will continue to be



Market forces play a significant role in growth (Photo by Daniel Lobo – must credit)

major influences, the technical paper recommends that the City and County take a more active role using the tools described above to direct growth toward suitable locations. Because of the significant State Land holdings in future growth areas, the timing of State Land disposition is a key issue that must be addressed.

Recommendations

2.1 The City and County should take steps to encourage growth and new development in areas that are within or adjacent to the existing built environment, are outside of the conservation land system, and are identified as most suitable for development. Such areas include the following:

- Infill into the existing built environment (highest priority)
- Within the Houghton corridor
- Within the Southlands area
- Within the Southwest area

In order to make use of existing infrastructure and minimize the consumption of raw land, revitalization of downtown as well as infill and reinvestment in the built-up areas of the community (inside and outside city limits) should be the highest priority for locating future growth. Infill should be done in a manner that is economically, environmentally, and socially advantageous.

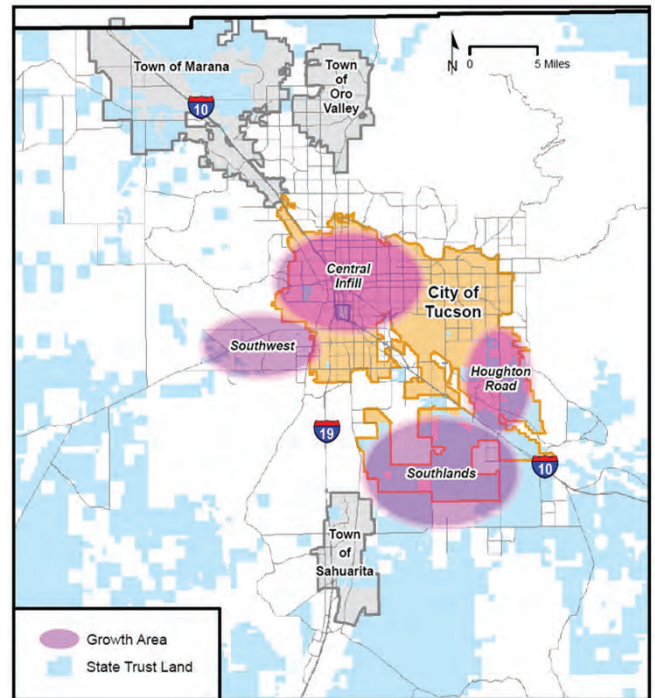
Again, a variety of policy and legislative tools should be developed to encourage growth in these locations including:

- General and Comprehensive Plan policies
- Land Use Code changes
- Other legislative actions
- Differential impact fees
- Incentives

City and County staff should involve the public in discussion about location of growth and tools to direct growth to these areas as part of their updates to the City General Plan and County Comprehensive Plan.

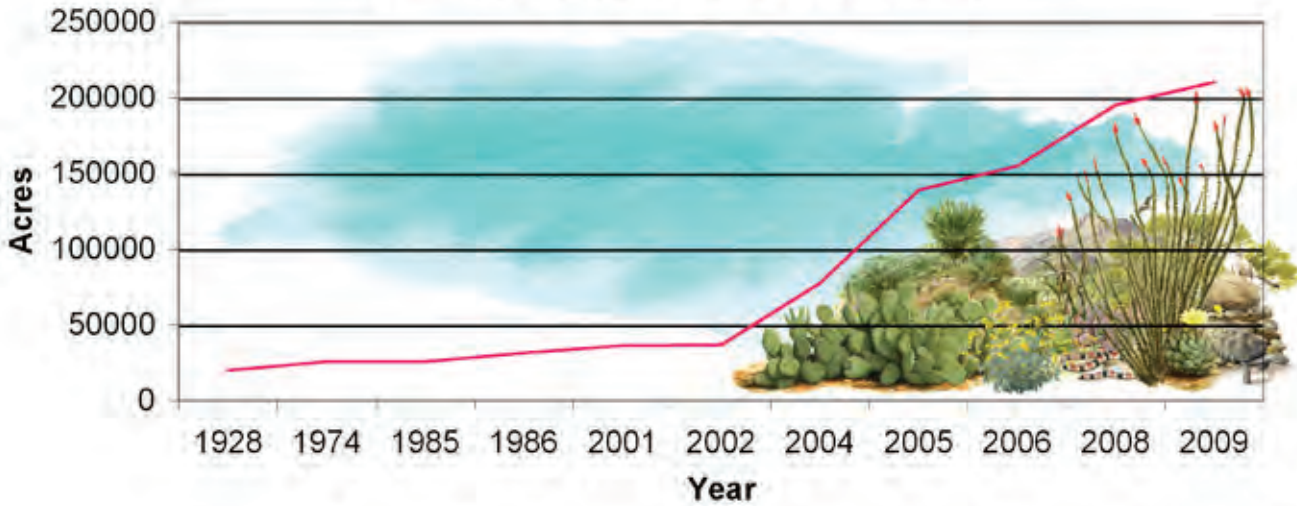
2.2 The City and County should influence the location of future growth through where infrastructure is built and public services are provided. The City and County should establish a joint land use/capital improvement planning staff team to plan for the timing, sequencing, location, and funding of infrastructure and public services to serve identified growth areas. Financial and infrastructure planning should occur ahead of development pressures. For infill areas, policies should focus on planning for and funding needed investments and improvements that must go along with higher densities and redevelopment. The County has already begun an effort to inventory the planning related activities of its various public works departments, and this could be replicated for the City prior to a joint process getting underway. Updates to the City General Plan and County Comprehensive Plan should set forth policy that requires this process take place.

2.3 The City and County should influence the location of future growth through the acquisition of open space. With the support of voters, the County will continue funding the acquisition of natural areas for conservation, recreation, and the protection of water resources. Natural preserves assist in defining the urban form, as well as providing multiple benefits such as recreational opportunities, conservation of water resources and natural floodplain functions, and protection of scenic views. In some cases, purchasing land outright or through conservation easements is the most realistic way to preserve areas not suitable for development.



Future recommended growth areas – from Growth Technical Report, p. 76

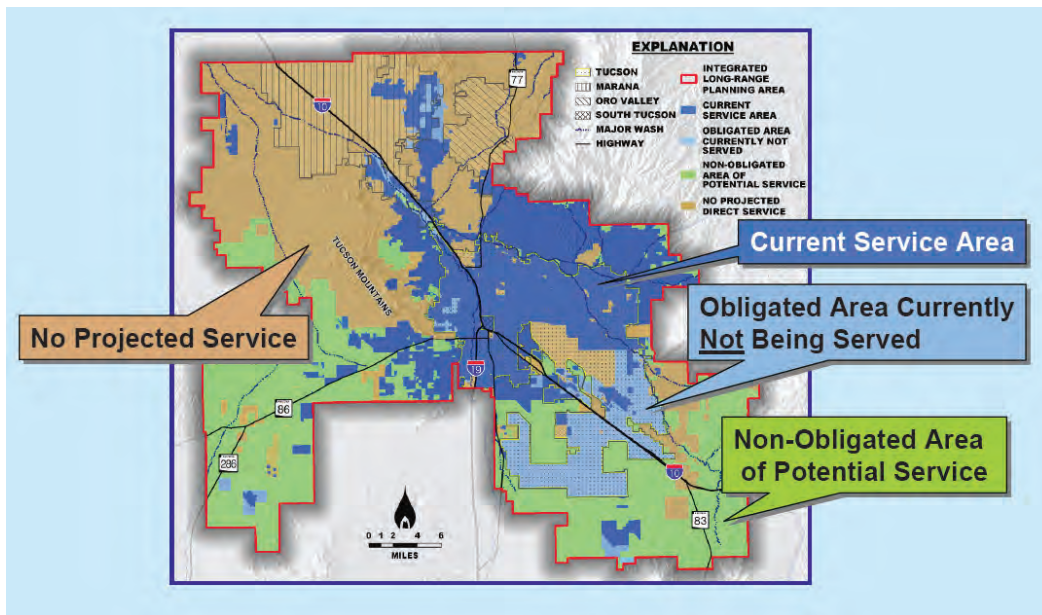
Pima County Open Space Acquisitions



2.4 The City and County should continue to work with PAG to do growth and urban-form scenario modeling on a regional level (including Marana, Oro Valley, Sahuarita, South Tucson, the Tohono O’odham Nation, the Pascua Yaqui Tribe, the San Xavier District and others) similar to the modeling done for the City/County service area in the Growth and Urban Form technical paper. This work could help inform or be done in conjunction with the emerging regional visioning process, as well as inform the City General Plan update and County Comprehensive Plan update. Ideally this analysis should also be done at the Southern Arizona and Sun Corridor scales.

Goal #3: Integrate Land Use Planning and Water Resources Planning

Historically water resource and infrastructure planning have not been considered with land use planning. Part of the difficulty stems from the fact there are numerous water providers--both public and private-- with numerous service area boundaries, and typically, these do not line up with the boundaries (and are not the same entities) of those responsible for land use planning and decision making. Tucson Water (operated by the City of Tucson) is the largest water provider in the region. Tucson Water serves a significant population outside of City limits in unincorporated Pima County and in other jurisdictions. This has made it difficult to connect land use planning and water planning even within the City



Tucson Water's Service Area

Clearly, the availability of potable water is a basic necessity for new development to occur, but there are often many options allowed by State law to obtain water for new development. Water service may be available from a municipal or private water provider, or by drilling a well and pumping groundwater, trucking in water, or relying on rainwater harvesting. On the flip side, making water service available by extending water infrastructure can help encourage growth in a particular direction (“build it and they will come”).

Wastewater is also an important consideration as well since any development exceeding one home per acre is required to connect to the public sewer system. The location and capacity of the Pima County Wastewater Reclamation Department’s (RWRD) treatment and conveyance facilities have a significant impact on the location and form of growth. Pima County RWRD’s system includes both centralized and decentralized/subregional treatment facilities, and both are important considerations when planning for growth. Advanced planning to identify a site for a future sub-regional facility in the southeast growth area is underway and represents an important step toward integrating water resources and land use planning. Planned upgrades to RWRD’s centralized facilities as part of the Regional Optimization Master Program (ROMP) program are another critical element in planning for growth. The high quality effluent that will be produced as a result of ROMP will be available for more effective and more versatile use in aquifer augmentation and riparian enhancement. It will provide additional benefits in expanding the reclaimed system, centralizing biosolids processing, improving odor control, enhancing the environment, and potentially generating solar energy.



ROMP includes a Water Reclamation Campus with solar energy and sustainability features

In the future, RWRD intends to continue identifying opportunities to achieve increased energy and wastewater treatment efficiencies within its existing and future decentralized facilities. In addition, collaborative work among effluent-rights holders can lead to optimal use of the effluent generated at these facilities through enhanced integrated planning of reclaimed water and recharge systems that best meets human, environmental and economic needs for water.

The historic disconnect between land use planning and water resource and infrastructure planning has a number of negative impacts, including (1) continued groundwater level declines in some areas of the valley impacting both existing residents, customers, businesses, and the environment; and (2) the stimulation of growth in places that lack adequate water and other types of public infrastructure and services, causing costly impacts to local governments, other service providers, and existing tax payers.

The situation is perpetuated by the Central Arizona Groundwater Replenishing District (CAGR), which was created by the State Legislature to allow development to occur in areas without access to renewable water resources, by requiring that replenishment of water occur, but not that it occur in the same location as the pumping. This is known as the “pumping/recharge disconnect.”

The City and County have made efforts in the past couple of years to better connect land use decisions with water considerations. The City instituted an interim moratorium on extending water service beyond the existing Tucson Water obligated service area until the impacts of such extensions could be fully analyzed. The interim policy brings land use considerations into water service decisions, recognizing that the past demand-based service expansion has not been sustainable from a land use planning perspective.

A concern with the current policy is that it does not prevent additional development from occurring outside of the Tucson Water service area. Developers are often able to find alternative access to water which usually means drilling wells, contributing to the pumping/recharge disconnect, and potentially contributing to continued groundwater decline and the associated adverse impacts. Recommendations 3.1 and 3.2 address (a) how Tucson Water's water service policy might be formalized by the Mayor and Council and (b) how these issues created by the policy can be addressed.

The City has also instituted a method referred to as the "water checkbook" to track and communicate with Mayor and Council as well as the public concerning how much renewable water Tucson Water has available to support proposed new developments or businesses.

The County adopted an amendment to the Water Element section of the Pima County Comprehensive Plan. This Amendment provides the Board of Supervisors (as the decision makers regarding land use changes in unincorporated Pima County) with additional information regarding water resource impacts when considering individual development proposals. The information includes whether the proposed development will have access to renewable water supplies, where pumping is proposed in relation to where recharge is proposed, and whether groundwater dependent ecosystems would be impacted. The Water Element should be revisited in the context of the full update to the Comprehensive Plan tying together land use, water, and other public infrastructure and services.

Recommendations

- 3.1 Outside of the Tucson Water Obligated Service Area in unincorporated Pima County, the City and County should work together to conduct comprehensive water resource planning in order to identify sustainable water resources to serve these areas. Water resources should be looked at in a comprehensive manner with the goal of making efficient use of water and matching up sources with needs. This planning effort should address the use of potable, reclaimed, effluent, stormwater, rainwater, and greywater. The City and County should evaluate the life-cycle cost and triple bottom line of decentralized wastewater treatment versus centralized systems in light of energy demands and efficiencies, and integration with recharge and reclaimed water systems. As an example, the City and County should work cooperatively to explore the development and operation of reclaimed water systems and recharge facilities at the County's sub-regional wastewater reclamation facilities.
- 3.2 The above described planning effort should help inform future City considerations for extending the obligated service area. Expansion decisions should be done on a sub-regional basis (rather than a parcel-by-parcel basis) in advance of specific water service requests. Any decision to expand the obligated service area should be formalized through Mayor and Council policy. The following factors should be taken into account in making policy decisions regarding expansion of the obligated service area within specific sub-regions:
- Suitability of growth area
 - Effect of extensions on future water-resource needs for the City's existing obligated service area
 - Fiscal sustainability of development and potential for future annexation
 - Appropriateness of timing/phasing of development
 - Economic impact/benefits
 - Quality and sustainability of urban form
 - Environmental implications of development
 - Environmental implications of not providing water service
 - Social equity and social-justice considerations.

Note: a discussion of the obligated service area policy was specifically undertaken by the Committee, and by vote of 9-1, The Committee supports the current interim water policy to not extend water services beyond the current obligated service area, and thinks it should remain in place, while further study and analysis contained in recommendations 3.1 and 3.2 take place. The analysis and further study should be timely, address equity, and be updated periodically.

- 3.3 In addition to the comprehensive, long range planning efforts described above, the City and County should continue to assess and track the impact of individual developments on water resources:
- The County should continue to implement the recent amendment to the Water element of the Comprehensive Plan, providing the Board of Supervisors with the necessary water resource information concerning individual development requests.
 - The City should continue to implement the “water checkbook” method of tracking and communicating to the Mayor and Council how much renewable water Tucson Water has available to support proposed new developments or businesses.
- 3.4 The City should continue to pursue discussions with other water providers regarding potential for wheeling and/or recharge agreements. As an example, Tucson Water and Metro Water/Hub should discuss the potential for wheeling of a portion of metro’s CAP allocation to Metro/Hub through Tucson Water’s integrated potable water distribution system at a cost of service price, in order to reduce Metro/Hub’s groundwater pumping in the immediate area.
- 3.5 The City and County should work together with other jurisdictions to support regional solutions to address the hydrological disconnect between where water is being pumped and where it is being replenished.

³ *Dissenting vote due to non-support continuation of current interim policy*

Goal #4: Growth Should Pay for Itself Over Time and Be Financially Sustainable

Tucson Water and Pima County Regional Wastewater Reclamation Department have financial systems in place to ensure that growth is paying for growth and is not being subsidized by existing ratepayers. Both utilities require developer contributions to expand their systems, and both have development fees in place to cover off-site improvements and centralized facilities. In addition, Tucson Water charges an impact fee for the acquisition of new water resources related to growth.

Beyond just considering cost of growth from a water and wastewater perspective, sustainability involves looking at the full cost of new development for all types of public infrastructure and services, over the long term. In addition to capturing growth related costs for water and wastewater, the City and County in recent years have instituted impact and other growth-related fees to pay the initial capital investment to serve new development (for roads and parks in the County, and for roads, parks, public safety, and general services in the City). But impact fees do not provide for the ongoing cost of serving development.

Our current pattern of development and the tax base in our community are not fiscally sustainable, as evidenced by the infrastructure deficits throughout our community. The 20-Year Regional Transportation Authority Plan, for example, is largely a “catch-up” plan and includes projects that were warranted decades ago. The situation is similar for City and County bond packages. Another example of the problem is the City’s current budget shortfall and inability to keep up with basic services like streets, parks, and public safety. Our current infrastructure deficits and budget challenges suggest we cannot afford to provide the needed services and investment for the community that we have built. As we grow, we should not continue to exacerbate or replicate this problem.

One contributor to this issue is the large unincorporated area in Pima County that does not generate the revenue that incorporated areas do (no sales tax and less state shared revenue coming in). In the past this issue has been framed as an “annexation/no annexation” debate. A sustainable water future is one in which we move beyond annexation debates and instead focus on fiscal sustainability for our entire community. Fiscal sustainability considers the life cycle cost of development, including how ongoing maintenance and the provision of public services are paid for, in addition to upfront capital costs. It also addresses the adequacy of revenues collected to provide necessary public services, fairness and



Best Financial Practices in the water and wastewater industries

equity related to who pays for services, who receives services, and the level of investment we are making throughout the community.

Recommendations

- 4.1 Future development should be evaluated in terms of fiscal sustainability from both the capital (initial construction of infrastructure) and operating (ongoing public services and maintenance of infrastructure) perspectives to ensure that new development is self-sustaining and not subsidized over the long term by current residents and businesses.
- 4.2 The Tucson Water Department and the Regional Wastewater Reclamation Department should continue managing their water/wastewater infrastructure capital improvement programs in a manner that is consistent with the latest nationally-accepted industry best practices and continue to ensure that each year's water/wastewater Financial Plan adequately and demonstrably provides mechanisms so that "growth pays for growth."

B. Respect for the Environment

Respecting the environment means that recognizing that water is not only key to our continued economic expansion, it is also essential to a vibrant and healthy environment. There must be an appropriate balance between the reservation of water for consumption and growth, and the acknowledgment that our environment is also a consumer of water resources: certain water reservations for the environment should be made and sustained.

A large percentage of the historic area of riparian habitat in southeastern Arizona has been lost to or degraded by past human activities. In addition, changing environmental circumstances further threaten remaining riparian areas, especially those already made vulnerable by human actions.



Tanque Verde Creek – from Riparian Report p. 10

The City and County share policy goals to (1) minimize additional loss of riparian habitat, (2) protect existing riparian areas against vulnerability to climate change and continuing human actions, and (3) where circumstances allow, restore degraded ecosystems back to greater functionality.

Preservation of existing natural resources and ecosystems that support native and migratory species is a higher level objective than restoration. As such, restoration must be considered in the context of efforts to preserve habitats and critical ecosystem functions before they become degraded. The objective of restoration is recovery of some components of viable ecosystem functions, such as plant communities and habitat structure. Enhancing vegetation can result in sustainable habitat that can help restore ecosystem functions of river corridors and support the wildlife species that depends for survival on the rapidly shrinking riparian areas within the County.

Ecosystems are not static or isolated systems. They are continually subject to natural trends such as drought or temperature increases associated with climate change. They are also subjected to human impacts such as changes in water quality or quantity resulting from urban runoff, pumping, upstream diversion, or invasion by non-native species. Restoration and/or preservation of habitats and ecosystems must be considered in concert with mechanisms and resources needed to maintain the long-term integrity of these areas. The most efficient and effective means of ensuring that valuable resources remain for future generations is through preservation of the remaining functional riparian ecosystems.

Restoration requires a commitment of land, water, labor, expertise, and above all, financial resources. The cost of large-scale restoration can be very expensive. There are major opportunities for restoration projects in the County. These projects are most feasible where: land is available; renewable water is available as either stream flow, rainwater, or reclaimed water; and hydro-geologic conditions are favorable. The City and County have a significant inventory of land that may be suitable for environmental restoration and enhancement.



May 2006



May 2008

Riparian stress when surface flow is unavailable – Santa Cruz River

The goals and recommendations in this section come from the following background technical papers that were prepared as part of Phase II of the Study (see appendix for the papers):

1. Stormwater Management
2. Riparian Protection
3. Water for the Environment

These technical papers were written to address the following topics identified in the for this Study, and by Oversight Committee members:

- How and where can we best use stormwater and rainwater, effluent and reclaimed water for environmental benefits and quality of life?
- What are the existing and future water demands for the environment and how should the community prioritize these needs?
- Why are environmental projects that improve ecosystem functions important?
- How and where can we best preserve and improve ecosystem functions?
- Where are future opportunities for environmental projects in proximity to existing and future water resources?
- What are the opportunities for protecting environmentally sensitive natural riparian areas, including areas of shallow groundwater and perennial and intermittent streams that support unique riparian vegetation, in Eastern Pima County?

Goal #1: Preserve Existing Riparian Areas Through Coordinated Regulation, Policy, and Outreach

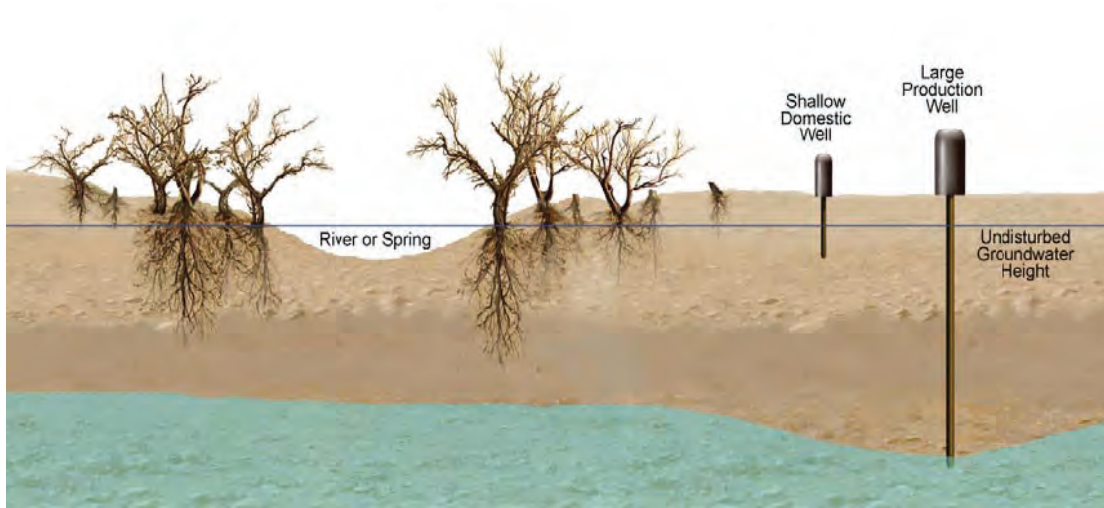
Riparian ecosystems are without question one of the most valuable natural resources in the Tucson region. Riparian areas provide habitat for a large percentage of wildlife species and also provide natural ecosystem functions related to recharge, flood management, and water quality. These areas also have significant aesthetic/amenity and economic value through providing recreational opportunities, increasing adjacent land values, and drawing large numbers of visitors to our region for ecotourism.

This first goal commits the City and County to a coordinated approach in preserving existing riparian areas to the maximum extent possible. The City and County will continue to preserve areas through the implementation of the Conservation Land System, the acquisition of existing habitat, and the refinement and continued enforcement of their respective watercourse protection regulations. Other mechanisms for preserving riparian areas should also be jointly explored, such as transfers of development rights (TDRs). However, immediate protection of riparian areas through these mechanisms may not be sufficient to ensure their long-term protection, unless water management issues are also addressed.

Increased groundwater pumping near perennial streams and shallow groundwater areas poses a threat for existing riparian areas that may only be alleviated through efforts to reduce pumping, such as switching groundwater consumers to renewable water sources. Even riparian habitats with an adequate water supply currently may require supplemental irrigation in the future during extended drought or as a result of changing water needs due to climate change.

Implementation of this goal will need to include fostering increased public awareness of the benefits of healthy ecosystems and the public's willingness to support their protection and maintenance.

Many historic hydro-riparian areas have been lost to declining groundwater tables and water diversions, yet these areas provide essential habitat for riparian-obligate species and desirable bird and wildlife watching locations. Preservation of these areas is critical to ensuring that their environmental and economic value is not lost.



Effects of groundwater over-pumping on riparian habitats, from Riparian Report, p. 4

Recommendations

- 1.1 The City and County should continue to preserve existing riparian areas to the maximum extent possible through land acquisition, regulatory land use controls that limit encroachment into floodplains and riparian habitat, and education and outreach.
- 1.2 Within their respective jurisdictional and water service areas, the City and County should evaluate the effectiveness of programs and policies addressing the protection of groundwater-dependent and hydro-riparian areas from groundwater withdrawal and surface water diversions.

The city and county should promote changes to state law regarding drilling and pumping of wells within and near shallow groundwater ecosystems.

Goal #2: Identify Needs and Opportunities for Future Restoration

So much former riparian habitat has been lost that real efforts must be made to improve degraded habitats and to restore areas no longer functioning as healthy riparian systems. Restoration of riparian areas, however, takes significant land, water, expertise, and money resources. Given the current financial environment, the vulnerability of western water sources, and the implications of climate change, restoration needs to be approached thoughtfully, systematically, and comprehensively in order to make any kind of meaningful progress.

Up to this point, restoration has mainly taken place in response to regulatory requirements or opportune circumstances favoring specific projects, such as grant funding, land availability, or related construction of other infrastructure. To build on our current portfolio, we need a regional framework for restoration that identifies needs and opportunities, the resources (land, water, expertise, etc) available and needed, and potential partners. This more strategic and regional view toward restoration will help us make the most of our future restoration efforts.

To implement a regional restoration strategy, the City and County should work with the many existing groups that have expertise, resources, and passion to offer as partners. Without including these organizations, the job of regional restoration is more difficult. Moreover, there is added value in recognizing the commitment of these organizations to protect the local environment and make the Tucson region a better place to live.

Restoration can also be viewed as a local economic and community-building opportunity. By employing local talent and community volunteers, we support the development of a local green economy.

Community involvement in restoration also builds a sense of stewardship among participants.

Children who have had limited opportunity to interact with nature, at-risk youth, and interested seniors are all populations that would enjoy benefits from volunteer opportunities for helping with riparian restoration.

Another form of stakeholder and community engagement is through the development of a mechanism to link water conservation efforts to the dedication of additional water volumes to be used for environmental purposes such as riparian restoration. A number of organizations are currently working on such an effort. This linking will also help address public concerns that water conservation ultimately just increases land development and urban sprawl.

Recommendations

- 2.1 The City and County should work with stakeholders to develop a shared regional policy for addressing those regulatory compliance projects that require water for short-term or long-term (permanent or seasonal) plant establishment.
- 2.2 The City and County should work with stakeholders to develop a regional collaboration for riparian restoration. This effort should include exploring or continuing to pursue:
 - Enhancing the value of in-lieu mitigation funds received for compliance with local watercourse protection ordinances to fund restoration activities
 - Opportunities to partner with non-governmental entities that operate mitigation banks and/or undertake restoration activities
 - Evaluation of existing County and City-owned lands for suitability for environmental conservation and restoration
 - Opportunities to secure grant funding for environmental restoration
 - Partnering with experts to identify long-term water quality implications for restoration areas, such as the impacts of higher salinity of CAP, effluent, and reclaimed water
- 2.3 The City and County should continue to work with ADEQ to develop water quality standards and designations specifically for habitat restoration.

Goal #3: Ensure that Public Projects are Multi-Benefit Including Restoration, Stormwater Management, Recharge and Public Amenity

The City and County are continually undertaking capital improvement projects that involve the development or utilization of water sources. The municipalities build and operate trails, parks, stormwater management basins, flood control projects, recharge facilities, and wastewater treatment infrastructure. In many cases, these projects have a dedicated water source and supply infrastructure, occur on municipally owned lands, and have some capital or operating budget available (usually limited).



Tres Rios del Norte Project



Stormwater and reclaimed water are used in the Kino Environmental Restoration Project

Rainwater is a free, high-quality renewable source of water available for restoration, albeit of a source of limited and variable amount. The City and County share the goal of prioritizing efforts to develop a regionally consistent approach toward utilizing rainwater harvesting for environmental restoration. While rainwater harvesting can rarely be done at a scale to support the highest water consuming habitats (i.e. meso- or hydro-riparian habitat), there are significant environmental and social benefits to creating small pockets of desert-adapted habitat (e.g..upland or xero-riparian habitat) within the fabric of the urban community.

The cost-effectiveness and methods for optimizing use of stormwater and rainwater for environmental enhancement should be further evaluated. Rainwater harvesting should also be an element of all public projects where feasible, and encouraged and/or required for private developments. In addition to the environmental and recreation/amenity value of using harvested rainwater to irrigate urban habitats, these small-scale, low-cost activities also have stormwater management and water quality benefits.

The significant public interest in rainwater and stormwater harvesting presents an opportunity for public/private partnerships to advance pilot projects and to provide meaningful ways for individuals to directly participate in improving the future of the region.

A key strategy going forward is to develop restoration standards for capital improvement projects and ensure that all opportunities to include restoration are taken. Future City and County policies and Capital Improvement Program budgets for public projects will need to be developed in a coordinated manner that supports preservation and restoration of riparian habitat

Recommendations

3.1 The City and County should pursue cost-effective, multiple-benefit, broad scale public projects that utilize reclaimed water to accomplish goals such as aquifer augmentation, riparian restoration, habitat protection, environmental enhancement, turf irrigation, and recreational opportunities in combination with flood control and stormwater management facilities, parks and trails, and water recharge and wastewater disposal activities. Some examples are:

- Incorporating ecosystem restoration adjacent to wastewater treatment facilities
- Exploring ways for recharge facilities to support restoration
- Retrofitting existing large stormwater detention basins to support riparian habitat
- Including environmental restoration opportunities as a component in all new stormwater management projects, so that optimal amounts of stormwater are retained for reuse before being discharged to the respective stormwater conveyance systems
- Incorporating, where possible, rainwater harvesting and ecological amenities into other public projects
- Development of a joint policy that incorporates rainwater harvesting, stormwater detention, non-potable water use, recreation, and ecological amenities to the extent feasible in Capital Improvement Projects budgets, especially in open space areas

3.2 The City and County should identify areas within the existing built environment characterized by an abundance of impervious surfaces, and identify opportunities for additional stormwater management in order to achieve water quality, stormwater management, and environmental benefits. To accomplish this, the City and County would need to develop a plan that identifies site-specific locations and standards for implementing stormwater management projects.

Goal #4: Ensure the Future of Riparian & Aquatic Habitat Along the Effluent-Dependent Reach of the Santa Cruz River

The significance of the effluent-dependent Santa Cruz River to wildlife has been acknowledged in various planning efforts. This habitat has developed over the past couple of decades as a result of effluent disposal from the Roger Road and Ina Road Wastewater Treatment Facilities. The riparian habitat along the Santa Cruz River is seen as vulnerable over the long-term because there is no certainty that effluent will remain available to maintain or improve the habitat.

Effluent in the river is owned by a variety of entities, but principally by the Secretary of the Interior and the City. The Secretary of the Interior is required to use the effluent indirectly to “firm” the Tohono O’odham Nation’s access to CAP water during times of shortage. Effluent rights holders maintain the option to withdraw their share of effluent from the river channel. The effluent currently being discharged into the river also includes a portion owned by the County and smaller amounts owned by other water providers. In-stream flows and in-channel recharge are compatible. Improving incentives for in-channel recharge can provide an incentive for maintaining in-channel flows.

The realities of the new economic climate, uncertainties related to future population and economic needs for water, and vulnerabilities associated with climate change all require that we evaluate the existing conditions along the effluent-dependent reach of the Santa Cruz River. Since there are no immediate plans by the Secretary of the Interior or other effluent owners to remove effluent from the river, effluent could continue to flow for some time into the future. This provides the opportunity to plan for future conditions and evaluate strategies and alternatives to maintain habitat while minimizing water demand.



Effluent-dependent habitat along the Santa Cruz River

Recommendations

- 4.1 The City and County should advocate for changes to state statutes to grant full recharge credits to the Secretary of Interior for effluent used to sustain the flows in the Santa Cruz River and the riparian corridor.
- 4.2 The City and County, along with other regional partners, should develop a “Lower Santa Cruz River Management Plan” that would identify the most effective and sustainable means for using effluent and other renewable water supplies to support and enhance valuable habitat in the Santa Cruz River corridor.
- 4.3 As part of the Management Plan and building upon the Regional Flood Control District’s current cooperative efforts, the City and County should develop partnerships with other effluent rights holders and stakeholders to use the growing collection of pilot restoration projects as demonstration of their potential to maintain and enhance aquatic and riparian

habitat along the Santa Cruz River. The City and County can then identify a portfolio of multi-purpose projects for long term implementation in the context of the Management Plan. For example, areas such as the reach between the Rillito and the Canada del Oro confluence (where stormwater flows are more concentrated) could be emphasized.

4.4 The City and County should incorporate into both in-channel and off-channel recharge facilities features which also use the water to support riparian and/or aquatic habitat.

Goal #5: Develop Water Supply for the Environment

An overarching consideration is that healthy, functioning ecosystems need water. If habitat and riparian areas are to be enhanced or restored, an adequate amount of water must be available to meet the needs of each particular ecosystem.

Water needs of riparian habitats vary depending on the ecosystem type, and density and maturity of vegetation. Upland and most xero-riparian systems can be supported solely on natural rainfall and stormflows within watercourses. Some xero-riparian and all meso- and hydro-riparian require more than just natural rainfall and stormflows, either through perennial watercourse flows, shallow groundwater, concentration of stormwater, or artificial sources such as effluent or pumped groundwater. In addition, ecosystem water needs can vary seasonally, annually, and over periods of years. A permanent supply of water may only be needed for some aquatic ecosystems. The water needs of ecosystems are likely to increase over time as a result of the higher predicted temperature and lower effective precipitation resulting from climate change.

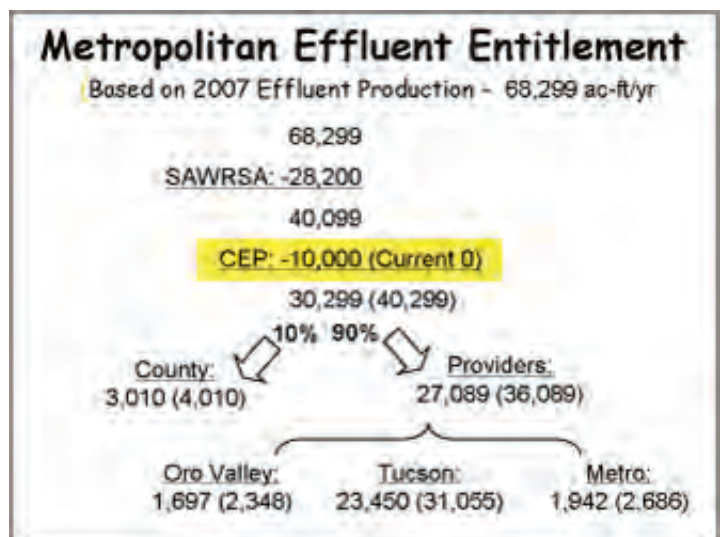


Restoring or enhancing ecosystems requires that the seasonal water needs of a system that cannot be met through rainfall and natural stream flow be addressed through artificially supplemented sources. Often additional water is needed only for supplemental irrigation during plant establishment or during extended drought; accordingly, a permanent supply of water may only be needed for some aquatic ecosystems.

The provision of water for restoration purposes is not a simple issue. In order to balance the water needs for individual restoration projects with the ability to commit appropriate water supplies, it is important to match each restoration project with the least expensive water supply of suitable quality that is physically available for use at the restoration site. Cost, competing demands, variations in quality, and complexity of capture or delivery variously affect the primary water resources in the City/County area (which include groundwater, CEP water, reclaimed water, secondary effluent, stormwater and harvested rainwater).

The only existing commitment of water to be used for environmental purposes is the Conservation Effluent Pool (CEP), consisting of up to 10,000 acre feet of effluent per year. The CEP could be derived from the Roger, Ina and Randolph treatment facilities. Uses for this pool related to Endangered Species Act (ESA) compliance have preference.

The City and County need to finalize and adopt the implementing agreement for the use of CEP. By developing restoration projects that only need supplemental water for a short establishment period (3-5 years), more projects can be completed over time. In so doing, the CEP would be used like an “investment pool” to support a myriad of restoration opportunities instead of a few. Such an agreement should



reflect shared goals regarding the use, including an emphasis on short term use rather than permanent commitment of water, and, a priority for restoration projects associated with Habitat Conservation Plans (HCPs), but with flexibility to be used wherever there would be a benefit (whether associated with HCP or not).

Successful outcomes of this goal would include (1) finalization of the CEP implementing agreement; (2) initiation of the “Tucson Environmental Water Banking Program” and (3) acquisition of water rights through the County’s Open Space Bond Program dedicated to preservation or enhancement of existing riparian areas connected to those land acquisitions.

Recommendations

- 5.1 The City and County will finalize the IGA for the Conservation Effluent Pool (CEP), which will annually provide up to 10,000 acre feet of effluent for environmental enhancements. This agreement will be delivered to the City Mayor and Council and the County Board of Supervisors for review and approval.
- 5.2 The City and County will work with stakeholders and other resource experts to link water conservation to the protection of future supplies and to environment preservation/restoration by identifying mechanisms to reserve water saved through conservation programs for specific environmental uses/projects. This will allow community members to directly contribute to environmental protection and enhancement as a result of their individual actions to reduce their use of potable water. It would also provide a mechanism to develop a water source, beyond the CEP, that can be dedicated to projects with an environmental benefit.

C. Water Supply

Key elements of a sustainable water future include: appropriately managing current water resources to protect public health and safety; assuring that water resources are renewable, sustainable, reliable, and efficiently used; and looking to additional water supplies in the future. Phase I of the Study documented Tucson Water’s currently available water supplies and found that the utility has a reliable and renewable water supply for the near term. Over the past decade, Tucson Water has made significant investments in infrastructure to recharge and deliver Colorado River water, moving from a dependence on groundwater to reliance on this renewable supply. The following table from the Phase 1 Executive Summary provides a snapshot of Tucson Water’s annual water resource portfolio.

Water Resource Type	Annual Water Supply (AF)
CAP	144,191
CAGR	12,500
Incidental Recharge	5,500
Local Groundwater	24,750
Effluent	30,500
Total	217,441

The Phase I report estimated that approximately 1.1 million people can be served by Tucson Water with this supply portfolio--approximately 360,000 more customers than are currently being served by Tucson Water. The numbers are based on assumptions about per person water consumption rates and are subject to uncertainties associated with future reliability of water resources, but these numbers provide a ballpark estimate.

The modeling done in the Phase II Growth and Urban Form technical paper found that in the future, Tucson Water may be obligated to serve somewhere between 330,000 and just over 500,000 additional people within its obligated service area. Without expanding its obligated service area further, Tucson Water may or may not need new resources in the future for the purposes of serving new growth and development: it will depend on the actual build-out numbers and per capita water use.

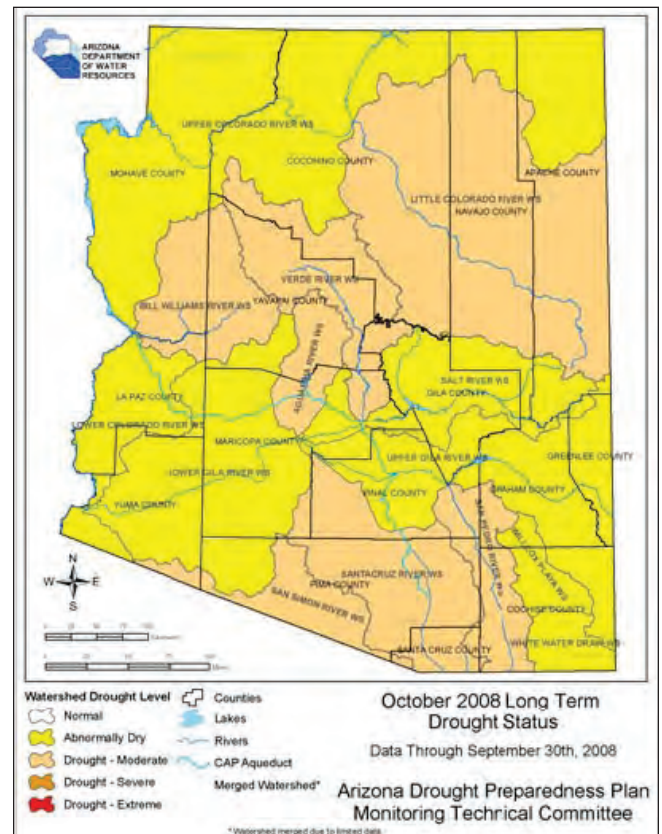


Tucson Water's CAVSARP Facility (photo by Lance and Erin Willet – must credit)

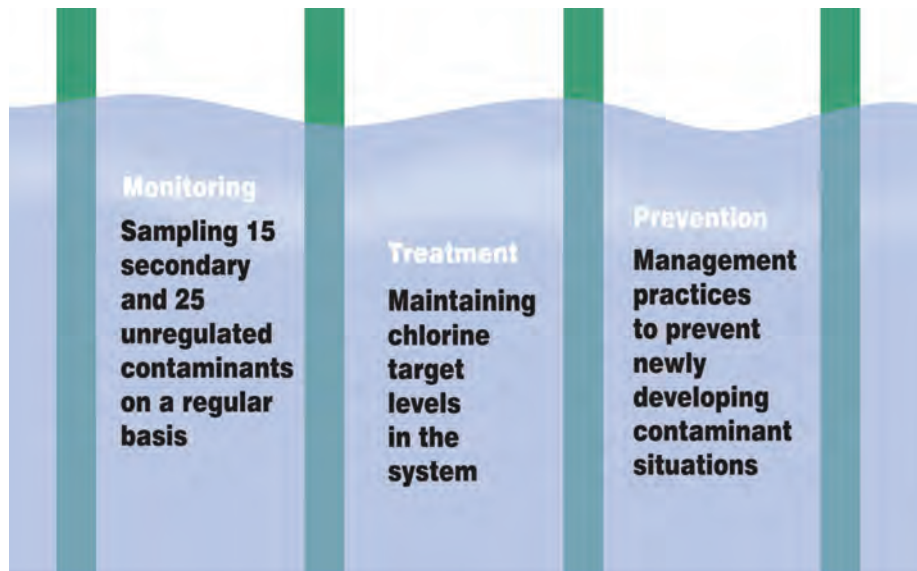
However, we are in a time of uncertainty with climate change and drought potentially affecting local water demand, local rainfall, and future flows of the Colorado River. In this context, we need to act conservatively and responsibly when it comes to managing our water resources and build in a buffer. We should further diversify our water resource portfolio so that we are not overly dependent on imported water that is vulnerable to shortage. We should increase conservation and maximize our use and re-use of renewable locally-generated water sources such as rainwater harvesting, stormwater capture and recharge, greywater systems, and use of effluent and reclaimed water.

A comprehensive approach to sustainability must also recognize that protecting, preserving, and ultimately improving water quality is a principal objective. Otherwise, water quality may limit the use of available water resources in the regional portfolio and detract from sustainability. Pima County Regional Wastewater Reclamation Department (RWRD) and Tucson Water must maintain their operations in compliance with current water quality standards and must also anticipate future regulations that may identify new pollutants (emerging contaminants) or new water treatment technologies.

While effluent is a significant component of the region's renewable supply, it is also a source of discharge of trace levels of emerging contaminants, including endocrine disrupting compounds, pharmaceuticals, and personal care products for which no regulatory standards have been set. Tucson Water protects drinking water sources with a "multiple barrier approach" for certain identified emerging contaminants such as 1,4-dioxane, uranium, radon, perchlorate, and the range of trace organics detected in effluent. Through planned ROMP improvements, RWRD is acting to increase removal of organic compounds and reduce concentrations of many emerging contaminants by achieving improved solids retention and de-nitrification. Studies have shown that this approach to nutrient removal can result in removal rates greater than 90% for many endocrine disrupting compounds. Higher quality effluent renders it a more flexible resource that strengthens sustainability. ROMP upgrades allow effluent use to be more effective and more versatile for aquifer augmentation and riparian enhancement. Furthermore, it allows Tucson Water's reclaimed system to qualify as A+, the highest quality category recognized.



From drought appendix



Tucson Water's multiple barrier approach

The information in this section comes from the following background technical papers that were prepared as part of Phase II of the Study (see appendix):

1. Additional Water
2. Reclaimed Water
3. Drought
4. Water Quality

This section addresses the following guiding principles listed in the for the Study:

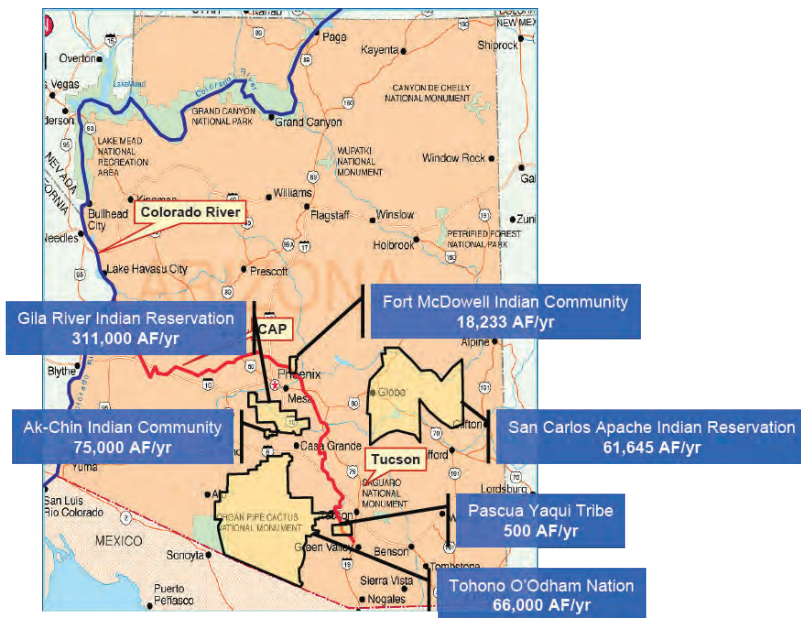
- Long-term water supply cannot occur at the expense of our existing residents or the environment
- Increase the use of reclaimed or recycled water on turf irrigation to substitute for groundwater use
- Enhance regional collaboration efforts to acquire new, renewable water supplies, such as long-term CAP leases

Goal #1: Work Collaboratively to Acquire New Water Supplies for Reliability

While Tucson Water does not have an immediate supply issue, it is prudent that Tucson Water secure new, renewable water resources in order to assure future reliability of our current water resource portfolio. Increasing the amount of water and diversifying the types of supplies in our portfolio will improve reliability. This is particularly important in the face of potential extended drought and climate change and the impact this could have on the Colorado Rivershed and local conditions.

The most promising available avenue for securing new water resources is the “ADD Water” (Acquire, Develop, Deliver) process being conducted by the Central Arizona Water Conservation District. The ADD Water process (explained in more detail in the Phase II technical paper on Additional Water Resources) is evaluating options for acquiring, developing and distributing water to enhance reliability by diversifying currently available water sources of CAP customers to meet future demands. Tucson Water has been an active participant in this process since its inception.

The most likely sources of additional water that could be acquired through the ADD process are excess CAP water, leasing contracted CAP Indian water, main stem Colorado River Water, and imported groundwater. Additional sources of water would be delivered through the existing CAP infrastructure, will be much more expensive than current CAP water, and will require interested entities to made purchases or reserve allotments well in advance of actual need.



(Left) Indian CAP allotments are potential water sources; (Right) The Central Arizona Project (photo by Link576 – must credit)

Recommendations

- 1.1 As the ADD Water stakeholder process proceeds, local water providers and users should maximize opportunities to acquire ADD water supplies and explore options to finance these additional supplies when they become available.
- 1.2 All Municipal and Industrial priority CAP allocations will be vulnerable in times of severe shortage on the Colorado River. Therefore, Tucson Water should take the necessary steps to have additional, more reliable water resources to reinforce and buttress its CAP water allocation to serve growth in the existing built environment and the yet-undeveloped areas of Tucson Water's Obligated Service Area.
- 1.3 The City and County should continue to jointly plan for the acquisition of additional supplies to maximize shared system efficiencies and to achieve their respective sustainability goals. These goals should collectively take into account social, economic, and environmental factors to ensure that all costs and benefits are considered.

Goal #2: Maximize and Make Efficient Use of Effluent and Other Locally Renewable Water Supplies

A sustainable water future is one in which we continue to broaden our view of water resources and place a greater priority on locally-renewable resources (effluent and rainwater). Effluent is typically put to use in the reclaimed system and for aquifer augmentation, while rainwater is put to use through stormwater capture and rainwater harvesting. Greater emphasis should be placed on maximizing the use of these resources and, going forward, they should be considered an important component of our community's water resource portfolio.

While the reclaimed system is an important tool for putting effluent to use, there are multiple valued uses for effluent and these uses should be maintained over time (the reclaimed system, environmental purposes, and aquifer augmentation). Use of reclaimed water does not make sense everywhere because the reclaimed system is expensive to construct and requires energy to move water through it. The use of reclaimed water should be evaluated in the overall context of maximizing the community's water resource portfolio. The key is matching up the most effective and resource-efficient water source with the needs of a particular site.

Greywater is another recycled water resource used in a similar manner as the reclaimed system, typically replacing potable water for outdoor watering but with the added benefit of being used on-site, and thereby eliminating energy and infrastructural costs of transport.